2016

# History of Pregnancy-Loss and Maternal Socioeconomic Factors as Predictors of Under-Five Child Mortality

Henry Chukwunonso Debem
*Walden University*

# Walden University

College of Health Sciences

This is to certify that the doctoral dissertation by

Henry Debem

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Amany Refaat, Committee Chairperson, Public Health Faculty
Dr. Tolulope Osoba, Committee Member, Public Health Faculty
Dr. Manoj Sharma, University Reviewer, Public Health Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2016

Abstract

History of Pregnancy-Loss and Maternal Socioeconomic Factors as Predictors of Under-Five Child Mortality

by

Henry C. Debem

MSc, Usmanu Danfodiyo University, 2006

BS, Nnamdi Azikiwe University, 2000

Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

August 2016

Abstract

Nigeria is one of the countries with the highest Under-5 Mortality rates (U5M) estimated at 117 deaths/1000 live births. Despite public health control initiatives, no significant improvement in U5M has been demonstrated. The purpose of the study was to determine whether history of Adverse Pregnancy Outcomes (APO) and maternal socioeconomic factors could predict the death of children before their fifth birthday, using the life course health development and fetal programming theories. The study population was women in their reproductive age (15- 49 years). The study was a secondary data analysis of the datasets obtained from three Nigeria Demographic and Health Surveys (2003, 2008, and 2013). Complex samples multivariate logistic regression was used to determine the associations among variables. The results showed that lower education level ($p < 0.001$), lower income level ($p < 0.05$), rural residential setting ($p < 0.01$), and lower socioeconomic status index ($p < 0.001$) of women were statistically significant predictors of U5M. APO was not statistically associated with U5M ($p > 0.05$). This concludes that children of women with low socioeconomic factors and status index could be at higher risk of death within the first 5 years of their lives, and women with history of APO stand no greater risk of losing their under-5 children. The study would contribute to positive social change among women in Nigeria through early identification of women whose children may be at risk of U5M and provision of evidence-based advocacy to urge increased government and public attention to women and child welfare.

# History of Pregnancy-Loss and Maternal Socioeconomic Factors as Predictors of Under-Five Child Mortality

by

Henry C. Debem

MSc, Usmanu Danfodiyo University, 2006

BS, Nnamdi Azikiwe University, 2000

Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

August 2016

## Dedication

Hmmm…this section is obviously the most emotional and exciting for me to write. I had never believed in the power of morale support and motivation than in time prior to and throughout this program. I am yet to realize it is time to dedicate this achievement to someone. Who else than my father, Mr. Williams Chidebem Mbonu, who had provided the greatest moral support/motivation of all time in my life, to pursue my doctorate degree. He once told me, "I had labored all my life to obtain a doctorate degree but circumstances of life never gave me the opportunity; however, the dream is not yet lost. I would still pursue it through my children. My son, it would be one of my greatest joy to see you obtain your PhD in your career. Believe me, the benefits are unlimited. You would give me nothing else, no other fortune than a PhD, and you will be successful and fulfilled for the rest of your life". I dedicate this degree to Mr. William Chidebem Mbonu (Nma Emelu na Ndu 1 of Enugwu-Ukwu). My dream and hope is that during my commencement, that Walden University would grant me a 3 minutes media opportunity to recognize him as a surprise package for him.

Acknowledgments

This is another opportunity to recognize the power and resilience of a woman. This is the story of no other person but Mrs. Susan Chinwe Levi-Debem, my most lovely wife. Without her, I could not have gone this far in this program. She accepted her solitude and sacrificed my companionship to this course; she had accepted an extreme humble life and gave in her material comfort to my tuition fees; she turned her tears of pains to joy in hope for this day; and she surrounded me with sufficient love and prayers to certainly complete this process. Other family members are not left out as their contributions in many ways, morale support, prayers, and gifts are not forgotten. I thank my beloved children, Donzel Elochukwu Debem, Jaden Chizigam Debem, and Vida Kamsi Debem, whom I often denied my time in sacrifice for this program. My mother, Mrs Catherine Chigolum Debem, your motherly and tender love and prayers are not forgotten. My brothers and sisters (Chikelu Debem, Dexter Debem, Laurel Debem, and Ogochukwu Debem) who had prided so much in my pursuit of this dream, thank you, all. My supervisory committee members, Prof. Refaat Amany (Chair), Dr. Tolulope Osoba (Committee member) and Dr. Manoj Sharma (URR), were so awesome. There is no doubt that the academic support and kind guidance I have received from you are extremely instrumental to this degree, thank you so much. I also acknowledge my academic advisor, Dr. Joseph Stevens, he has been of huge support to me. In all, I bless Him of which without His presence, there would not have been a life to in the first place to count this success today. Thank you Lord Jesus Christ, thank you God for your faithfulness.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

## Introduction

The study was developed to determine the extent the socioeconomic conditions of women and their records of previous adverse pregnancy outcomes (APO) could be useful in predicting the mortality of their children within the first 5 years of their children's life in Nigeria. The study was important because of its potential to inspire effective public health strategies toward the control of under-five mortality (U5M) in subSaharan Africa; thus, the potential positive social change implications of the study was that if the research hypotheses were found true, it might lead to the improvement of socioeconomic conditions of women as well as early focused intervention to children of high risk women to increase their survival chances. Ultimately, the life conditions of women in Africa might improve and the African children might live longer and happier.

Under-five child mortality is a major global and public health concern because children represent the future of every nation and child health reflects significant measure of the population health status of every nation (The United Nations Children's Fund [UNICEF], 2011). Sadly, Africa constitutes 86% of the worst 35 countries with reports on infant mortality (Central Intelligence Agency, 2014), and 76% of the worst 54 countries with results ranging from 50 – 167 deaths per 1000 live births among countries with reports on U5M (The World Bank [TWB], 2015). These countries constitute 28% (192) of countries with reports on the indicator and Nigeria comfortably occupies the 9$^{th}$ position with estimated 117 deaths in 1000 live births in 2013 (TWB, 2015) while Nigerian National Population Commission (NPC) estimated 128 deaths in 2012 (NPC,

2013). Over 2,300 under-five children lose their lives every day in Nigeria and this places Nigeria among the countries the worst  records of U5M rate (citation). The country has demonstrated quite a slow improvement over 3 years, moving from 131 to 117 deaths per 1000 live births from 2010 to 2013 (TWB, 2015). Accordingly, huge limited donor and considerable national resources have been expended in improving both maternal and child health in Nigeria through relevant initiatives and programs to aid the country in meeting the 4th Millennium Development Goal (Ekwonu, 2012; Federal Republic of Nigeria, 2014), which is "to reduce by two thirds, between 1990 and 2015, the mortality rate of children under five" (United State Agency for International Development [USAID], 2010, pg.1).

In this chapter, I discussed the main background and problem statement of the study to provide the overview of the circumstances that inspired the rationale for the research. I also discussed the purpose for conducting the study which was clearly delineated in the research questions and hypotheses. I reviewed the study theories to provide the conceptual framework that guided the study. The study designs, the variables, and the overall methodology were briefly described as the nature of the study. The definitions of some key terms within the context of the study were provided, and the assumptions, the scope, limitations of the work were discussed. I discussed the importance of this work in the context of the significance and potential social positive change associated with it.

## Background

U5M is a global health concern that has gained considerable attention from many countries in the bid to achieve the 4th Millennium Development Goal (MDG). Globally, over eight million children did not live to see their fifth year in the year 2008 (Black et al, 2010) and over six million in 2013 (WHO, 2014). U5M rate had informed the 4th goal of the Millennium Development plan which is "to reduce the by two third, between 1990 and 2015, the mortality rate of children under five" (USAID, 2010, pg.1). Credible global efforts through focused and innovative public health and socioeconomic interventions have been developed and channeled toward meeting the MDG and many countries have keyed into these efforts (Alkema & New, 2012). It is of encouraging note that, over time, the U5Mhas shown a universal substantial improvement from 1990 to 2013 (WHO, 2014). As of 1990, the U5M rate was 90 deaths per 1000 live; this had reduced to 46 deaths per 1000 live birth in 2013 (WHO, 2014). However, the improvement in the global under-five child health does not seem to be sufficient to meet the MDG of 67% reduction of 1990 U5M by 2015 (UNICEF, 2011).

Asia and subSaharan Africa alone accounts for the majority (over 50%) of the global U5M despite poor record and documentation (WHO, 2014). Countries that are currently among the worst records of U5M are shown in Table 1 below (TWB, 2015).

Table 1

*Countries with the Worst Records of U5M in the Increasing Order*

| | |
|---|---|
| Liberia | 70 |
| Burundi | 82 |
| Cameroon | 88 |
| Burkina Faso | 89 |
| Afghanistan | 91 |
| Benin | 100 |
| India | 109 |
| Nigeria | 117 |
| Sierra Leone | 120 |
| Somalia | 137 |
| Chad | 139 |
| Angola | 157 |

The table shows that developing countries are worst challenged with meeting this target with an overall drop from 100 to 72 deaths per 1000 live births (The Demographic and Health Survey [DHS] Program, 2010). Africa constitutes 86% of the worst 35 countries that report data on infant mortality (Central Intelligence Agency [CIA], 2014), and 76% of the worst 54 countries among countries with reports on U5M. The results of these worst countries range from 50 – 167 deaths per 1000 live births (TWB, 2015). These countries constitute 28% of the total countries (192) with reports on the U5M indicator, and Nigeria has comfortably occupied the 9$^{th}$ position with 117 deaths per 1000 live births in 2013. WHO (2014) noted that under-five children in the subSaharan Africa are 15 times more at risk of death before their fifth year than their counterparts in the developed regions; however, studies have not clearly shown if such risk are associated with residency in Africa or nativity in Africa.

One out of five children born alive in Nigeria does not reach the age of five, meaning that the U5Mratio is 200 children per 1000 live births, with infant mortality accounting for more than half of the deaths (WHO, 2011) . Nigeria has also demonstrated quite a slow improvement from 131 deaths per 1000 live births in 2010 to 117 in 2013 (TWB, 2015) and with no reciprocal improvement/move in the global ranking. This recent improvement seemed to be a relief from the worsening trend between 1990 and 2003 during which the country experienced U5Mrate increase from 87 deaths per 1000 live births in 1990 to 100 deaths in 2003 (WHO, 2014). Issues of child health focus most on the health challenges facing children between birth and 5 years old when they are thought to be most vulnerable to their environment (UNICEF, 2011). Infections, most noted to be the leading causes of deaths among this population are malaria, pneumonia, measles, diarrhea, human immune-deficiency virus (HIV), severe anemia, and malnutrition (USAID, 2010; Muoneke, Ibekwe, Nebe-Agumadu, & Ibe, 2012).

Over 30% of the deaths are attributed to malnutrition with majority of the deaths traced to the African region (UNICEF, 2011). Besides the direct causes of U5M, a number of economic and social risk factors have been suggested to predispose or expose a certain proportion of this vulnerable population to worse conditions that could render them more susceptible to their killers; thus, leading to more deaths. Factors such as poor maternal access to antenatal and quality delivery services, poverty, transportation difficulties, poor immunization history, and scarcity of trained personnel in the health facilities have been identified by WHO (2012).

Several scholars have also identified other risk factors associated with the U5M. Nattey, Masanja, and Klipstein-Grobusch (2013) noted that U5M could be associated with poor households and education level of the mother. The authors observed that households with better socioeconomic conditions could reduce the risk of U5M by 52% while attainment of secondary education could reduce the risk by 70% (Nattey et al., 2013). Household economic condition (poor) and mother's education (no formal education) has been identified as common risk factors of U5M in many other studies both in the African region and beyond (Al-Hosani, Brebner, Bener, & Norman, 2003; Ayiko, Antai, & Kulane, 2009; Ezeh, Agho, Dibley, Hall, & Page, 2015); however, Asling-Monemi, Tabassum & Persson, (2008) suggested otherwise, that is, no increased mortality risk with low or no education . Other suggested risk factors of U5M include sex of the child (Ayiko, Antai, & Kulane, 2009; Muoneke et al, 2012), and birth interval or child spacing (*low or less than 24 months from the previous birth*) (Ayiko et al., 2009; Kayode, Adekanmbi, & Uthman, 2012).

APO, which include miscarriage, induced abortion, fetal loss, or still births, are commonly observed in society in relation to high U5M rate (Abiola et al., 2013). Though no or limited population-based robust work has been done on the prevalence and incidence of the pregnancy loss in Nigeria, Abiola et al. (2013) suggested a miscarriage prevalence as high as about 49% among women of reproduction age who had ever gotten pregnant and receiving obstetrics and gynecology (O&G) services in a tertiary institution in Nigeria, suggesting that approximately 1 in 3.7 pregnancies were lost to miscarriage. This indicated that one third of the pregnancies among half of the women who have

gotten pregnant may have been miscarried. Another similar study reported miscarriage prevalence of 31% in Australia inferring that pregnancy loss could be a common event but for varying reasons or factors across countries (Zubrick, 2008). Common risk factors of adverse pregnancy loss before pregnancy identified were age at conception and weight, while risk factors during pregnancy were alcohol abuse, lifting of 20kg or more, and night duty (Feodor-Nilsson, Andersen, Strandberg-Larsen, and Nybo Andersen, 2014).

Researchers have also noted important socioeconomic factors linked with early (prepregnancy) maternal health. These factors are capable of influencing a woman's future life conditions including her future generations (children). These include income level, education level (Kahn, Wilson, & Wise, 2005; Wilkinson & Pickett, 2010), parental background/resources (Low et al, 2012), and the condition of the working environment (Benova, Cumming, & Campbell, 2014). Other factors are psychosocial factors such as environmental stress, psychological and mental health, lower maternal efficacy (Arnold-Kerri & Sperlich, 2010), adolescent depressive symptoms (Gavin, Thompson, Rue, & Guo, 2012), and single motherhood (Caragata & Liegghio, 2013). Researchers also identified risk behaviors such as tobacco smoking, alcohol abuse, and illicit substance abuse (Caragata & Liegghio, 2013).

However, researchers have not provided sufficient evidences on the predictive strength of socioeconomic conditions of women on the mortality of their children within the first 5 years in the African context, particularly in Nigeria. Thus, this study provided deeper evidence on the identification of certain socioeconomic factors of women as

possible risk factors and predictors of U5M. In addition, the prevalence of APO in Nigeria was estimated to be high at almost 50% (Abiola, et al., 2013); however, there are limited or no work on determining the possible association between the APO and U5M in the current literature; thus, the exploration of potential early warning indicators from historical events such previous APO in the mitigation of U5M remains a gap in the literature and seems a potential public health control approach.

Some common risk factors of APO and U5M include household socioeconomic condition, socioeconomic conditions of women, and maternal substance abuse, particularly during pregnancy (Feodor-Nilsson et al., 2014). However, there is still some obscurity in determining the extent of the association between the history of APO such as miscarriage, still birth, and abortion, and U5M from the literature (Kochar, Dandona, Kumar, & Dandona, 2014). Researchers have not clearly suggested the life course and/ or fetal programming context of connecting the two outcomes. In addition, simple correlation and computation sense could easily infer that age of the mother, as noted above for miscarriage, could be associated with U5M; however, such finding have indicated contrary opinions from Al- Hosani et al. (2003) and Feodor-Nilsson et al. (2014). Though these seemingly conflicting findings were observed, it is pertinent to mention that they are recorded in different settings and times.

My study is important in this context to provide to the literature additional and unique evidences on the relationship between socioeconomic conditions of women, history of APO, and U5M in the African cultural and social context. Such studies are needed to provoke more creative ways of tackling the U5M in the subSaharan Africa.

## Problem Statement

U5M has consistently become a global health threat particularly in Africa and other poor developed nations (CIA, 2014). Over 80% of the worst top quarter of the countries that has records of U5M are African countries (see table 1). WHO (2011) stated that one in five children who were born alive and healthy dies in Nigeria dies before his/her 5$^{th}$ year of life; this suggests about 20% mortality among under-five. Despite the observable improvement in reducing U5M rate in Nigeria between 2010, at 131 deaths per 100 lives, and 2013, at 117 deaths per 1000 live births, the country's global ranking has not improved (TWB, 2015). Common deaths among this population are attributed to infections such as pneumonia, human immune deficiency virus (HIV), measles, diarrhea, malnutrition, and severe anemia (USAID, 2010).

However, malnutrition is identified to be the underlying cause of 30% of deaths among under-five (UNICEF, 2011). Despite the direct causal agents of U5M, certain socioeconomic risk factors have been identified to be associated with the health outcome (WHO, 2012). These conditions, such as poor households and educational status of the parents, are thought to predispose the children to greater risk or make them less resistant to diseases and other killing agents; thus, early mortality (Nattey et al., 2013).

Few available studies have also suggested high prevalence of APO such as miscarriage, induced abortion, and fetal loss or still births in the society in positive relation to the U5M (Abiola et al., 2013 and Feodor-Nilson et al., 2014). Prevalence of miscarriage may be as high as 49% among reproductive women, suggesting about 1 in 4 pregnancy losses to miscarriage (Abiola et al., 2013). Abiola et al. (2014) and Feodor-

Nilson noted that the threat of APO in the limited resource countries may be significantly downplayed due to poor or under-reporting.

Despite the wide recognition of the global burden indicated by U5M, particularly in Nigeria, there have not been adequate evidences to support the predictive association between socioeconomic conditions of women and U5M in the country; and the exploration of APO as an early warning proxy to U5M. Better understanding of these associations could help identify women at risk earlier and promote the living conditions of the African women as a long-term public health solution to U5M.

## Purpose of the Study

The purpose of this quantitative study was to test the life course health development (LCHD) model in determining whether the use of history of APO (*miscarriage, abortion, still birth*) and maternal socioeconomic factors (*income, occupation, and education level*) could predict the death of their children before the children's fifth birthday, controlling for other potential confounding variables such as age, ethnicity, marital status, domestic violence, access to health care, and immunization. The study population was women within the reproductive age between 15 to 49 years . The first independent variable was history of APO which include miscarriage, abortion, and still birth. The variable was defined as the participant's past experience of any of the pregnancy outcomes earlier than the past 5 years before the survey, and presented in a binary response of Yes or No . Miscarriage was defined as natural or undeliberate loss of a fetus within the first 24 weeks of pregnancy. Abortion was defined as the loss/death of the fetus at any stage of the pregnancy due to an intentional effort of the women to

remove the fetus. Still birth was defined as the natural death of a baby after 24 weeks of pregnancy but before childbirth. The second independent variable was socioeconomic conditions of women described as their type of occupation, level of their income/earnings, and education level attained in the last 12 months preceding the survey. The dependent variable was defined as a participant's loss of a child born alive within the last 5 years preceding the survey. The variable was structured as dichotomous categorical variable with Yes or No options. The potential confounding variables were identified as the age of the participant at marriage, sex of the dead child, nature of the residential environment (urban or rural), domestic violence, access to health care, and vaccination history of the child.

## Research Questions and Hypotheses

The main research question of the study was:

**RQ1 -** To what extent does history of APO and socioeconomic factors among women of reproductive age predict mortality among children under 5 years old in Nigeria?

Null Hypothesis 1 ($H_0$1): There are no statistically significant associations between the APO, socioeconomic factors among women of reproductive age, and U5M in Nigeria.

Alternate Hypothesis 2 ($H_a$1): There are statistically significant associations between the APO, socioeconomic factors among women of reproductive age, and U5M in Nigeria.

Subresearch questions are:

**RQ 2 -** To what extent do socioeconomic factors predict U5M in Nigeria?

- Level of education
- Income level

- Occupational / work status
- Residential setting (urban/rural)

Null Hypothesis 2 ($H_0$2): There are no statistically significant associations between age, educational level, income level, employment /work status, and type of residential environment of women, and U5M after controlling for other demographic factors (*age of the woman, ethnicity, marital status, domestic violence*) , access to health care, and vaccination history.

Alternative Hypothesis 2 ($H_a$2): There are statistically significant associations between age, educational level, income level, employment /work status, and type of residential environment of women, and U5M after controlling for other demographic factors (*age of the woman, ethnicity, marital status, domestic violence*) , access to health care, and vaccination history.

**RQ3 -** To what extent does history of APO (*miscarriage, induced abortion, or still birth*) predict U5M in Nigeria?

Null Hypothesis 3 ($H_0$3): There is no statistically significant relationship between history of pregnancy outcomes and U5M after controlling for age at marriage, sex of the dead child, type of the residential environment, access to health care, and vaccination history

Alternative Hypothesis 3 ($H_a$3): There is statistically significant relationship between history of pregnancy outcomes and U5M after controlling for age at marriage, sex of the dead child, type of residential environment, access to health care, and vaccination history

**RQ 4 -** How consistent, in direction and statistical significance, is the association between APO and U5M across 3 years between 2003 and 2013 in Nigeria?

Null Hypothesis 4 ($H_0$4): There is no consistency in the direction (positive or negative) and statistical significance of the association between the APO and U5M across the 3 survey years (2003, 2008, and 2013) after controlling for age at marriage, sex of the dead child, type of the residential environment, access to health care, and vaccination history.

Alternative Hypothesis 4 ($H_a$4): There is consistency in the direction (positive or negative) and statistical significance of the association between the APO and U5M across the 3 survey years (2003, 2008, and 2013) after controlling for age at marriage, sex of the dead child, type of the residential environment, and access to health care, and vaccination history.

Consistency in the context of RQ4 means that the direction of the association between the APO and U5M (that is whether the two variables relate in the positive or negative direction and statistical significance) will be similar if the associations are tested differently across the 3 years, that is, tested in the year 2003, 2008, and 2013 separately.

## Theoretical and conceptual Framework for the Study

The LCHD and Fetal Programming (FP) theories were the theories that would provide the conceptual or theoretical framework to the study. They formed the underlying principles and constructs supporting the understanding the associations among the variables of interest (Creswell, 2009).

The pioneering longitudinal studies of child development conceived the theory of life course development in the early 20$^{th}$ century between the 1920s and 1930s by

Thomas and Znaniecki; nonetheless, the clear development of the theory in the 1960s led to the first known public appreciation of the theory (Elder, 1998.). This provoked several programmatic attempts to understand the conception that the condition of present life is actually determined by earlier lifestyles and events, possibly owing to cultural and social status (Elder, 1998; Elder, Johnson, & Crosnoe, 2003; Kuh, 2002; Kuh & Ben-Shlomo, 1997). The theory postulated that one's future health conditions and outcomes were determined by the historical events occasioned by interplay of social circumstances and behavioral factors that occurred in the period; and this factors may include certain decisions spurred by circumstances in the past (Elder, Johnson, & Crosnoe, 2003; Karl, 2009) . Studies have suggested that key outcomes associated with these past events included social choices (Alwin, 2012) and disease outcomes (Karl, 2009).

Baker, a professor of clinical epidemiology, propounded FP in the early 1990s (citation). Baker suggested that the adverse events that occur during pregnancy period could be the leading conditions that predispose the baby to low birth weight, and both conditions constitute increased risk of developing chronic diseases such as cardiovascular diseases later in the adult stage (Barker, 1990). The theory provided deeper understanding of the role of environmental factors during the course of pregnancy (citation). Through certain stressors and unclear communication mechanisms with the fetus, the environment could influence the development and outcome of the offspring as well as the chronic health status of the individual as an adult (Nicoletto, 2011). It had inspired several tests and wide applications in epidemiology, social sciences, and biomedicine (Ellison, 2012). The FP theory essentially has a similar principle with the LCHD. However, while LCHD

presents a broader perspective with respect to longer-term effects of physical and social exposures as far as intergenerational era (which includes the periods of gestations during pregnancies) on chronic disease outcomes in future life stages and generations; the FP focusses more on the effect of similar exposures but limited to the fetal development process along the gestational period and the chronic health outcomes on the child (Elisson, 2010; Kuh 2002).

The theories applied to my study considering the socioeconomic conditions (the independent variables) that described the environment in which a woman lived all through her life, including during her pregnancy. The complex interactions or interplays that could lead to certain APO, as well as defining the health outcomes of the children at their most vulnerable period of their life (within the first 5 years) were also explained by the theories. So, the LCHD and FP theories provided solid theoretical combination that conceptualizes the possible associations between those long term and short term maternal socioeconomic factors and other social risk factors that predate the conception of a child, the resultant APO, and child developmental process to adulthood.

## Nature of the Study

**Quantitative** – Literature supported various study methodologies, but provided sufficient preference for cross-sectional study design . Thus, I conducted a quantitative secondary study of a dataset generated through a cross-sectional survey design. This was the appropriate methodology that could best answer the research questions within the framework of the available data and logistic resources. Cross-sectional design is a popular observational study methodology that is commonly used to determine the

characteristics of a study population at a specific point in time or within a short period of time (Levin, 2006). The methodology had also been explored by many studies to measure associations between two or more variables of interest (risk factors/exposure variables and health status/outcomes) (Arffin et al., 2012; Ayiko et al., 2009; Ezeh et al., 2015; Kayode et al., 2012; Nattey et al., 2013). However, in the search for a suitable and feasible study design for my study, I noted and reviewed the goal and objectives of the Demographic Health Survey (DHS) programs supported in about 90 developing countries globally, including Nigeria. I discovered that maternal and child health were among its key program / health areas of interest and the surveys are conducted in these countries periodically (citation). I, then, observed that program had used cross-sectional methods in the surveys, had conducted DHS in Nigeria in the 3 years of interest to my study, the questionnaires had covered the major thematic areas of interest to my study, and most importantly, could grant data access to researchers for secondary data reviews. Hence, these findings made it most appropriate to conduct a secondary data analysis on a pooled dataset from the Nigerian Demographic and Health Survey (NDHS) of 2003, 2008, and 2013. The choice this methodology would avoid repetition of efforts, maximize the resources already expended in conducting those surveys, and be more efficient in working with such large datasets within the time provision of my degree program.

The NDHS was a periodic population and household based survey that obtained information from every member of the household selected through a multistage cluster sampling (USAID, 2015a). The survey collected information through a face-to-face interview using three questionnaire types designed specifically to elicit relevant

information from women, men, and household (USAID, 2015a). Information was also elicited retrospectively, about the under-five children who died within the last 5 years preceding the survey, using the women's questionnaire (USAID, 2015a). Hence, my study was interested in the data collected with the women's questionnaire. All women within the reproductive age in each of the household were meant to be interviewed; however, I considered all women within the reproductive age of between 15 to 49 years who had a history of pregnancy and had given birth in the last 5 years preceding the survey. To be certain that the number of participants included met or exceeded the required sample size for the study, the actual sample size of the study was determined using the G*Power sample size determination software following the stipulated procedures of Buchner, Faul, and Erdfelder, (2010). I excluded women with any record of family or genetic illness. I compared the U5M outcome of women with history of APO (miscarriage, induced abortion, and still birth) with those who had no history of the pregnancy outcomes, and developed a predictive model for U5M while controlling for other covariates. Similar design model was developed for the socioeconomic factors (education, income, and occupation) and U5M but in different group levels as obtainable in the survey.

Secondary data sets present some strengths and limitations to its utility in research. The strengths include the efficiency in time and cost effectiveness in resource limiting settings. Secondary datasets would save the time of going through the process of data collection, tools development, tools/questionnaire validation, recruiting/selecting the participants, ethical considerations, and the actual data collection from the participants. It

would also save the cost applicable to the aforementioned data processes, making it a relatively affordable and efficient process (Smith et al., 2011). The limitation was that the data quality, in terms of data collection process and data completeness itself, could not be assured. Despite the improved access to secondary dataset courtesy of the communication technological advancements, identifying datasets that could answer specific research questions of interest is often challenging (Smith et al., 2011).

## Definition of Terms

*Adverse Pregnancy Outcomes (APO)*: Natural or unnatural events or outcomes that terminate the course of a pregnancy and leading to the loss or death of the fetus before normal birth. These outcomes include miscarriage, abortion, and still birth (NPC, 2013).

*Employment or work status*: The condition in which the participant considered herself as formally engaged in at least one paid job that earned her income on regular basis. (NPC, 2013)

*Income level*: the estimated measure of the amount of money that a participant earned or controlled in the time of the survey (NPC, 2013). However, the wealth status index of the women was used as a proxy to reflect their income level (USAID, 2015b

*Nature of Residence*: The infrastructural developmental setting of the environment where the participant lived in the last 12 months prior to the NDHS (NPC, 2013).

*Socioeconomic Factors*: Social conditions and attributes that determine a woman's differential privileges to resources in a society, thus, determining her

socioeconomic status or position in the society (citation). Common socioeconomic factors that were commonly associated to women status include education, occupation, and income level (Kahn et al, 2005; Williams, 2005). *Under-Five Mortality (U5M) Rate*: The probability that a child, out of 1000 live births, would die before his/her fifth birthday within a specified time period, usually in years (Kayode et al, 2012; UNICEF, 2011).

## Assumptions

My study was a secondary data analysis of datasets collected from Nigeria Demographic Health Surveys; hence, I had no control over the entire process of the design and data collection. Therefore, I assumed that the quality of the study process, including the participants selection and data management process (data collection, data entries, data cleaning, data storage, and data presentations), was sufficiently high to support the findings and conclusions of my dissertation. I also assumed that the responses of the participants were accurate and sufficient reflection of their life experiences. In addition, since, I would be working with datasets from three different surveys; I assumed that dynamic factors and conditions (limitations and delimitations) that were capable of influencing the outcomes of the surveys were similar in all three surveys.

## Scope and Delimitations

The study was based on datasets of surveys among women within their reproductive age (15 – 49 years) in Nigeria; thus, the study conclusions may not be generalized to similar population beyond the study geographical region or age group; however, the findings could be implied for or provide insights to the population in Africa.

## Limitations

The study was a secondary data analysis; hence the limitations and short comings that applied to the primary survey processes also applied to this study. The limitations included possible selection and information bias associated with the data collection method. The study datasets were obtained through cross sectional design; hence, the short time-frame of the study which might be referred to as time bias was a significant limitation of the methodology. The design might not be appropriate for time-dependent variables. This means that the result of the study might change if conducted another time/period; thus, the reliability might be of concern, and the result might be misinterpreted in general sense. In addition, the findings of the study should not imply causality; however, it could provide insight into further investigations of causality among the study variables.

## Significance

The goal to reduce the U5M has become a global interest, having enlisted it among the Millennium Development indicators and goals,attracting a unified approach in achieving the set goal particularly in the developing countries (USAID, 2010). The importance of this study would be appreciated more in the formation and development of government and private sector policies toward the promotion of public health best practices in the prevention of U5M in Nigeria. The interdisciplinary stakeholders may need local evidences to take informed decisions that directly affect the country's future population by simply paying attention to the prevailing health and socioeconomic conditions of women. The health and life of children today defines the health and life of

the population tomorrow; thus, emphasizing on a robust public health preventive and proactive interventions to safeguard the health of the children under-five for a longer, quality, and healthy life in the country (USAID, 2010).

In essence, the study could provoke LCHD conception approach to reducing U5M in Nigeria. For instance, the study could initiate the exploration and identification of possible early warning indicators of U5M; thus, create and provoke early preventive initiatives toward reducing U5M in Nigeria. These initiatives would be anchored on timely identification of women at risk of having children who may not live to their fifth year. These initiatives may call for special health programs that could attend to the women at risk and help them increase the chances of their children's survival beyond their fifth year.

The research implication is that study may provoke further studies in the Maternal and Child Health (MCH) field to further consolidate and strengthen the empirical evidences supporting the role and development of LCHD model and FP in predicting and tackling anticipated important public health issues such as U5M, as well as initiating early warning preventive and control measures. An example of such studies is to assess the population based country estimates of prevalence of APO and U5M and determine the pattern of their relationship across many countries.

**Implications for Social Change**

Besides the effective program innovation potential of the study, the findings could inspire a general LCHD agenda in the country's long-term population health towards prioritizing maternal and child's health in the bid to improving general health of the

nation. As a result of the findings, the government and other public health stakeholders in Nigeria could commit to improving the welfare of women and children through the promotion of more community based and nation-wide advocacy and awareness programs to sensitize on the role of women, initiation of more women oriented programs toward improved livelihood of the women, increase in budget allocation to maternal health and women affairs, and as far as promoting the role of women in participating in decision making on issues that concerns them . Hence, there could be a significant change in the social and economic welfare of women and children.

In essence, the study could contribute appreciable evidence and inspiration in changing the social conditions of women and children, and promoting their quality of life in Nigeria and Africa as whole. This could be achieved by generating or supporting knowledge that could serve as useful advocacy tool to pursue the living right of women as well as become the essential component of long-term strategic planning for improving the quality and longevity of under-five children. This way, the quality of life of the African child may also improve.

## Summary

U5M is an outcome and measure of a population health. It is a global public health concern with Africa being the worst hit in terms of countries that present the worst condition and status of U5M. The purpose of the study was to determine the associations among the history of APO and socioeconomic factors of women, and the mortality of their children fewer than 5 years. The background of the study showed that the three

variables were of important concerns and might share interwoven risk factors that could link the variables.

The conceptual frame work was based on the theory of LCHD and FP. The overarching research question was to what extent do a history of APO and socioeconomic factors among women predict the mortality of their children under-5 years? The study was a quantitative secondary data analysis on a cross-sectional survey design. The date source was the Nigerian DHS from three separate but consecutive surveys in Nigeria – 2003, 2008, and 2013. In Chapter 2, I discussed in details what and how the literature described the relevant study variables and the general concept applied in the past similar studies to provide an exhaustive insight and frame guide to my study.

# Chapter 2: Literature Review

## Introduction

The death of children under the age of 5 years in Nigeria is problematic and represents a huge health burden to the Nigerian population. Hence, maternal and child health in Nigeria has become a global public health concern, considering the weight of the burden it contributes to the U5M rate in the world, deterring the global efforts from achieving the 4$^{th}$ MDG (WHO, 2014). As much as public health stakeholders in Nigerian have identified several direct and indirect factors that may have led to the overwhelming mortality rate of children under five (Onwujekwu et al, 2011; UNICEF 2011), evidences in the literature did not provide a life course context of this high mortality rate in Nigeria. Evidences were not sufficient to determine the possible role of historical adverse pregnancy exposures or outcomes and socioeconomic conditions of women in predicting the risk of mortality of their children before the age of five. Thus, the purpose of the study is to determine whether the use of history of APO (miscarriage, abortion, still birth) and maternal socioeconomic factors (age of women, income level, occupation, education level, and nature of residence) could predict the death of children before their (children) fifth birthday, controlling for other potential confounding variables.

Globally, over eight million children did not live to see their fifth year in 2008 (Black et al, 2010) and over six million died in 2013 (WHO, 2014) . More than 2,300 under-five children lose their lives every day in Nigeria and this makes Nigeria among the world largest contributors to U5M rate (WHO, 2012)..

## Literature Search Strategy

The search strategy used in this chapter was a combination of methods that I considered appropriate for identifying the relevant literature to my dissertation topic . Fundamentally, I used the Walden University Library search to locate articles by topic through the important databases under health sciences. The databases I explored included the MEDLINE, CINAHL Plus, ProQuest Nursing & Allied Health Source, CINAHL & MEDLINE Simultaneous Search (to avoid duplication of articles), ScienceDirect and PsycINFO. I searched for the related articles using both the single and combined key search terms method In minimal occasions, I used Google Scholar and web search for literature on current public health trend that added broad global picture and views to my topic. The LCHD and FP theories provided the core theoretical foundation and conceptual framework for the study. .

The key search terms were informed by the key study variables and covariates. The single key search terms were *socioeconomic status, socioeconomic factors, under-five mortality, pregnancy loss, adverse pregnancy outcomes, miscarriage, still birth, abortion, education level, income level,* and *occupational status*. Combined search terms were *women socioeconomic status in Nigeria; under-five mortality in Nigeria; under-five mortality in Africa; still birth in Nigeria; women and under-five child mortality; women, education level, income level, and occupation; life course health development (LCHD) theory/model;* and *Nigeria Demographic and Health Survey*.

Majority of the literature search were bound by time period within the last 5 years; this was important in order to focus on and understand the current contextual

background of the problem being addressed by my study and the current work that were done to address the problem (American Psychology Association, 2010). Thus, this helped me in identifying the problem as most recent and current gap in the literature . I searched mainly for full-text, peer-reviewed literatures and other scholarly publications with stronger related contexts.

## Theoretical Foundation

This study was based on the theory of the LCHD and FP. The theories provided the conceptual framework that formed the bases of understanding the interplays of the variables of interest. The LCHD theory postulated that one's future health conditions and outcomes are determined by the historical events occasioned by social circumstances and behavioral factors that played in the period; and this factors may include certain decisions and outcomes occasioned by circumstances in the past (Elder, Johnson, & Crosnoe, 2003; Karl, 2009; Kuh, 2002) . The FP theory postulated that the environmental conditions of a women during pregnancy wass capable of influencing the fetal developmental process which could manifest as a chronic disease later in the adulthood of the child (Barker, 1990; Nicoletto & Rinaldi, 2011).

The history of the LCHD theory began with the pioneering longitudinal studies of child development. The study, later on, conceived the theory of life course development in the early 20$^{th}$ century between the 1920s and 1930s by Thomas and Znaniecki (Elder, 1998). However, the development of the theory became clearer and more appreciable in the 1960s and led to the first known public appreciation of the LCHD theory (Elder, Johnson, & Crosnoe, 2003). This development provoked several programmatic attempts

to understand the conception that the condition of present life is actually determined by earlier lifestyles and events, possibly owing to cultural and social status (Elder, 1998; Elder, Johnson, & Crosnoe, 2003). The history of the FP started over 2 decades ago. The theory was propounded in 1990 by Baker (Baker, 1990) . Baker (1990) suggested that the adverse events that occur during pregnancy period could be the leading factor condition that predisposes the baby to low birth weight, and both conditions constitute increased risk of developing chronic diseases such as cardiovascular diseases later in the adult stage. However, in recent years, the theory has been widely accepted and the spectrum of diseases have increased and included obesity, diabetes, allergies and osteoporosis (Nicoletto & Rinaldi, 2011).

The principles of the LCHD and FP theories are technically similar. While the LCHD provided conceptual basis for understanding that the socioeconomic condition of the woman may include the long-term status right from her past generations through her childhood, adolescence, to her adulthood and motherhood; the FP provided the deeper understanding of the social and environmental conditions that surround the period of her pregnancy and the development of the fetus (Kurl, 2009). All these were a complex interactions of events, conditions, and time that all sum up to define the life of the child (Colman, Ataullahjan, Naicker, & Van Lieshout, 2012; Kuh, 2002; Karl, 2009) . So, the theories formed the underlying principle supporting the understanding of the association of my study variables. Researchers have suggested that the key outcomes associated with past events include social orientation (Alwin, 2012) and disease outcomes (Karl, 2009). The LCHD and FP theories were useful in providing a conceptual framework in

appreciating the constructs and associations among the maternal socioeconomic factors, other social risk factors associated with APO, and U5M .

Several scholars have applied these theories in similar or related studies in the past in an attempt to understand the likely origin of health and social inequality among different populations, particularly in population health indicators such as life expectancy at birth and under-five or infant mortality rates (Wilkinson & Pickett, 2010). For instance Kahn, Wilson, and Wise (2005) explored the LCHD theory to investigate the association between the health shortcomings of adult life and the social and health conditions of their mothers when they (mothers) were adolescents or younger . Arnold-Kerri and Sperlich (2010) noted that the quality of life we enjoy in later years could be influenced by prevailing family conditions and socioeconomic status (SES). Colman, et al (2012) tested the evidence of FP in assessing the association between conditions that resulted to low birth weight (LBW) and symptoms of depression and anxiety in adolescence . The authors indicated that children who were born at LBW were at higher risk of suffering depression when they develop a chronic disease (Colman et al., 2012). Gavin, Thompson, Rue, and Guo (2012) suggested that intergenerational factors sourcing from the maternal resources could provide significant mediation between the one's SES and health outcomes, meaning that maternal resources could determine the strength of the association between SES and health outcomes. Gavin et al. (2012) conducted the study using the LCHD theory as the conceptual framework. Ellison (2010) used the FP as the conceptual framework in studying the relationship between the risk behaviors of pregnant women and cognitive stability and mental health of their children in adolescence. Other

scholars used the same theory to examine and understand other socioeconomic factors affecting maternal to child health (Arnold-Kerri & Sperlich, 2010; Dickute et al, 2002; Kahn et al., 2005; and Wilkinson & Pickett, 2010). The factors include lower income and education of women (Kahn, Wislon, & Wise, 2005; Wilkinson, & Pickett, 2010), working conditions of women, parental foundation of women (Dickute et al, 2002), environmental stress, poor psychological health, and low maternal efficacy (Arnold-Kerri & Sperlich, 2010).

The theories applied to my study considering the socioeconomic conditions (the independent variables) that describe the environment in which the woman lives all through her life, including during her pregnancy. The complex interactions or interplays that could lead to certain APO, as well as defining the health outcomes of the children at their most vulnerable period of their life (within the first 5 years) were supported by the theory. So, the LCHD and FP theories provide solid theoretical combination that conceptualizes the possible associations between the long term and short term maternal socioeconomic factors and other social risk factors that could predate the conception of a child, the resultant APO, or child birth. The rational for applying the theories in this study originated from their application in similar studies in the literature and in providing the most suitable conceptual framework in answering the research questions. I attempted to elucidate the association among maternal socioeconomic conditions, historical maternal health outcomes such as past cases or occurrence of natural or unnatural pregnancy termination, and the risk of U5M. Hence, the research questions are developed to build or challenge the LCHD and FP models.

## Literature Review Related to Key Variables

Based on the topic of my study, the key dependent variable was U5M, while the independent variables were socioeconomic factors (income level, education level, employment/work status, age, and nature residence) affecting maternal health, and history of APO. The review provided the current context of the problem and the known and unknown within the context of the topic and the study variables.

### Global and African Status of U5M

U5M rate within a population s defined as the probability that a child would die before his/her fifth birthday within a specified period of time (UNICEF, 2011). It is commonly measured as the number of deaths of children under-five that occurred out of 1000 live births within a specified period (National Population Commission [NPC], 2013). U5M rate is a global leading indicator used to rate the level of child health in a particular population as well as the general health status of a country (UNICEF, 2011). U5M rate informs the 4$^{th}$ goal of the Millennium Development plan which is "to reduce by two third, between 1990 and 2015, the mortality rate of children under five" (USAID, 2010, pg.1). Developing countries are worst challenged in meeting this target with an overall drop from 100 to 72 deaths per 1000 live births (The Demographic and Health Survey [DHS] Program, 2010). Africa constitutes 86% of the worst 35 countries with reports on infant mortality (Central Intelligence Agency, 2014), and 76% of the worst 54 countries among countries with reports on U5M. The results of these worst countries range from 50 – 167 deaths per 1000 live births (TWB, 2015). African countries constitute 28% of the countries (192) with reports on the U5M indicator, and Nigeria has

comfortably occupied the 9th position with 117 deaths per 1000 live births in 2013. Nigeria has also demonstrated quite a slow improvement from 131 deaths per 1000 live births in 2010 to 117 in 2013 (TWB, 2015) and with no reciprocal improvement /move in the global ranking.

Issues of child health focus most on the health challenges facing children between birth and 5 years old when they are thought to be most vulnerable to their environment. Infections, most noted to be the leading causes of deaths among this population are malaria, pneumonia, measles, diarrhea, human immune-deficiency virus (HIV), severe anemia, and malnutrition (DHS program, 2010; Muoneke, Ibekwe, Nebe-Agumadu, & Ibe, 2012). Over 30% of the deaths are attributed to malnutrition with majority of the deaths traced to African region (UNICEF, 2011).

**Risk Factors of U5M**

Household economic condition (poor) and mother's education (no formal education) has been identified as common risk factors of U5M in many other studies in the African region and beyond (Al-Hosani, Brebner, Bener, & Norman, 2003; Ayiko, Antai, & Kulane, 2009; Ezeh, Agho, Dibley, Hall, & Page, 2015); however, Asling-Monemi, Tabassum & Persson, (2008) suggested otherwise, that the U5M risk did not necessarily increase with low or no education among women . Other suggested risk factors of U5M included sex of the child (Ayiko, Antai, & Kulane, 2009; Muoneke et al, 2012), birth interval or child spacing (*low or less than 24 months from the previous birth*) (Ayiko et al., 2009; Kayode, Adekanmbi, & Uthman, 2012), multiple births, area of residency (Ayiko, et al., 2009), nature of residence (*rural areas*) (Ezeh et al., 2015;

Kayode et al., 2012), monthly income (*low*), consanguinity, and preterm-birth (*less than 37 weeks*) (Al-Hosani et al., 2003). Li, Yan, Zeng, Dibley, and Wang (2015) suggested that nearly all the neonatal deaths in the world occurred in poor countries with low and middle income status; thus, indicting poor socioeconomic condition.

Other identified risk factors were severe physical violence and intense behavioral control in marriage among educated women (Asling-Monemi, Tabassum Naved, & Persson, 2008), age of first marriage (*before 15 years old*) which demonstrated reduced risk of U5M by between 20% – 30% if married above 20 years old, poor health seeking habits, breastfeeding for less than 18 months, large family sizes, polygamy, low birth weight, and poor sanitation (Kayode, et al., 2012). Most of these findings have informed some practical applications in reducing U5M in the target populations (Nattey, Masanja, and Klipstein-Grobusch, 2013; Ezeh et al., 2015; Kayode et al., 2012); thus showing demonstrated agreement and generalizations in the fight against U5M.

**Socioeconomic and Behavioral Risk Factors of Maternal Health**

Nigeria suffers hardship despite the continued government economic efforts and huge natural resources (Oduwole and Fadeyi, 2013; United Nations Development Program, 2015). Nigerian women are worst affected, estimating that over 68% of them might be living below poverty level of $1 a day (Oduwole and Fadeyi, 2013). Researchers have also noted important socioeconomic factors linked with early (prepregnancy) maternal health that are capable of influencing a woman's future life conditions including her future generations (children) (Ezeh et al., 2015; Kayode et al., 2012; and Luyckx, et al., 2014). These factors include income level, education level

(Kahn, Wilson, & Wise, 2005; Wilkinson & Pickett, 2010), parental background/resources (Luyckx, et al., 2014), and the condition of the work and residential environment (Ezeh et al., 2015; Kayode et al., 2012). Other factors were psychosocial factors such as environmental stress, psychological and mental health, lower maternal efficacy (Arnold-Kerri & Sperlich, 2010), depressive symptoms (Gavin, Thompson, Rue, & Guo, 2012), and single motherhood (Dickute et al., 2002). Scholars have also identified risk behaviors such as tobacco smoking, alcohol abuse, and illicit substance abuse (Dickute et al., 2002; Feodor-Nilsson, Andersen, Strandberg-Larsen, and Nybo Andersen, 2014). Shih et al. (2011) suggested that the socioeconomic condition of the neighborhood in which a woman lives could influence her mental health.

**Adverse Pregnancy Outcomes**

APO, which include miscarriage, induced abortion, fetal loss or still births, are commonly observed in population with relatively high under-fiveMortality rates (U5MR) (Kochar, Dandona, Kumar, , & Dandona, 2014). Though no or limited population-based robust work has been done on the prevalence and incidence of the pregnancy loss in Nigeria, Abiola et al. (2013) suggested a miscarriage prevalence as high as 49% among women of reproductive age who had ever gotten pregnant and receiving Obstetrics and Gynecology (O&G) services in a tertiary institution in Nigeria, suggesting that approximately 1 in 3.7 pregnancies were lost to miscarriage. This indicated that one third of the pregnancies among half of the women who had gotten pregnant might have suffered miscarriage. Another similar study reported miscarriage prevalence of 31% in Australia inferring that pregnancy loss could be a common event

but for varying reasons or factors across countries (Zubrick, 2008). Hure, Powers, Mishra, Herbert, Byles, and Loxton (2012) further noted that the rate of miscarriage among Australian women could range from 11.3 to as high as 86.5 miscarriage incidences per 100 live births . This translates to 11% to approximately 87% of live births . Bailey and Sokol (2011) indicated that majority of natural pregnancy losses occurred before the women knew they were pregnant and such may not be detected or recorded clinically; however, they estimated that only about 20% of miscarriages were detected by clinicians. Bailey and Sokol (2011) also noted that 6 out of 1000 pregnancies in the United States are threatened by still birth. Due to poor documentations and accounts of APO, such prevalence records are not common in many countries, particularly in the developing countries (Bailey & Sokol, 2011). This may not be unrelated to the nature of incidence which may not be easily detected by inexperienced women.

Common risk factors of adverse pregnancy loss before pregnancy identified were age at conception, and weight, while risk factors during pregnancy were alcohol abuse, weight lifting of 20kg or more, and night duty (Feodor-Nilsson et al., 2014); however, Arffin, Al-Bayaty, and Hassan (2012) found no association between exposure to environmental tobacco smoke, stress, and APO (*miscarriage and preterm birth*). Other risk factors include maternal mental illness from substance abuse (Zubrick, 2008). Greenwood et al. (2010) noted that caffeine intake during the first trimester of pregnancy could increase the risk of miscarriage and stillbirth at the late stage of the pregnancy. Bicking-Kinsey, Baptiste-Roberts, Zhu, and Kjerulff, (2013) noted that the history of miscarriage does not predict the maternal psychological birth experience with respect to

fear of adverse outcome of the baby or the mother, though mothers who had previous experience of miscarriage insignificantly demonstrated more frequent fears on birth experience than those who never had any adverse pregnancy outcome. In support of the findings by Feodor-Nilsson et al. (2014), Bailey and Sokol (2011) strongly attributed miscarriage, stillbirth, preterm delivery, and sudden infant death syndrome to exposure to alcohol during the course of pregnancy.

**Common Risk Factors of APO and U5M**

Scholars have demonstrated some common risk factors of APO and U5M such as socioeconomic condition of household (Ezeh et al., 2015; Kochar, Dandona, Kumar, & Dandona, 2014) and maternal substance abuse, particularly during pregnancy (Feodor-Nilsson et al., 2014). Hure et al. (2012) demonstrated an association between miscarriage and still birth, though certain variations related to socioeconomic factors among a cohort of women in Australia were noted. In a prospective longitudinal study, the researchers observed that women with high prevalence of miscarriage engaged more in tobacco smoking and eventually had fewer live births. They also noted that women who gave their first births at younger ages (14 – 20) experienced more still births (40 / 1000 live births) than their older counterparts (Hure et al., 2012).

However, there is still some obscurity in linking the history of adverse pregnancy loss such as miscarriage with the U5M from the literature. For example, in simple correlation and computation sense, one could easily infer that age of the mother, as noted above for miscarriage, could be associated with U5M; however, such finding have indicated contrary opinions (Al-Hosani et al., 2003). While Feodor-Nilsson et al. (2014)

noted that at conception, age of 30 years and above is an important risk factor of miscarriage, Al – Hosani et al. (2003), in his study in Abu Dhabi, suggested that older ages of 40 years and above and history of fetal loss are not associated with U5M. In addition, Kochar et al. (2014) indicated that higher rate of induced abortion may be linked with reduced neonatal mortality rate in Bihar State of India . Though these seemingly conflicting findings are observed, it is pertinent to mention that they are recorded in different settings and times; however, my study may set to provide additional appreciation of the evidence on the relationship between history of pregnancy loss and U5M in the Nigerian setting.

**Key Measures of Associations and Study Designs Reported in the Study Reviews**

The different measures of associations and study designs in different settings were reviewed and noted to inform careful interpretations of my findings and further researches that may improve on these . The authors demonstrated their measures of associations in several technical and cultural contexts which may suppose that the findings and interpretations should actually be approached a bit more carefully and differently; therefore, it is pertinent to note that these differences and similarities on the statistical measures and study designs.

Ayiko, Antai, and Kulane (2009) determined the levels and risk factors of U5M through a cross - sectional study design and measured the associations among the risk factors and the U5M using the hazard ratio (HR) from a cox regression model. Their findings were from the cultural context of Uganda. Ezeh, et al. (2015) explored similar study design and measures of associations as done by Ayiko, et al. (2009) but conducted

in Nigeria which is a West African country like Uganda. Hence, the two surveys shared both common strengths and limitations. The sample sizes (9,006 and 63,844 respectively) were sufficiently large and the robustness of the statistical analysis was adequate to elicit the true study effects and minimize type 1 error (Field, 2013). However, the study design is subject to recall bias which may introduce error in the information generated, and the results of the associations from a cross-sectional design would not imply casualty (Creswell, 2009).

On the other end, Asling-Monemi (2008) assessed violence against women as a risk factor of U5M. The author performed a secondary analysis of a longitudinal data in Bangladesh, and measured the association using the hazard ratio from a conditional logistic regression. He/she also noted recall bias as a major limitation of the study and feared that the rate of violence against women may actually be under-reported . Nattey et al. (2013) used the Incidence Rate Ratio (IRR) from Kaplan – Meier Survival incidence to measure the associations of interest and estimated the mortality rate in Tanzania. The limitations of the study were not noted.

Kochar et al. (2014) estimated the magnitude of miscarriage, still birth, and abortion in Bihar, India. The authors conducted a population based survey and measured the associations of interest using odds ratio (OR). They also noted recall bias and the peculiar nature of some residential areas that restricted access to some people as the major limitations of the study. Arffin, Al-Bayaty, and Hassan (2012) assessed environmental tobacco smoke and stress as risk factors of APO in Malaysia. The statistical measures of association was the Mann-Whitney test which was a non-

parametric test, used due to non-normality of the distribution of the observations. The key major limitation in the study was that the sample size was small (33); thus, the use of non – parametric test to address the normal distribution limitation. In the addition to that, the cross-sectional study design may further limit the robustness and reliability of the study.

Bailey and Sokol (2011) determined the association between prenatal alcohol exposure and APO using a meta – analysis of published articles on the subject. Major limitations noted was the diversity of methodologies and measures of associations used in the primary work. This might have introduced some technical and analytical errors and finding a common term for generalizing the findings (Bailey and Sokol, 2011). Zubrick (2008) measured the associations between pre-existing maternal health disorder and pregnancy loss in Australia using OR in a retrospective cohort analysis, though the limitations of the study were not noted by the author, recall bias is observed to be the major limiting factor with the study design (Song & Chung, 2010).

The common limitations noted in the studies were fundamental weaknesses that I may also encounter in my study and may not be able to address them beyond the limits of my methodology. However, I addressed the limitations and challenges in the work by Arffin, Al-Bayaty, and Hassan (2012) due to small sample size and use of non-parametric test. I ensured that my sample size was sufficiently large to increase the analytical power of my study and reduce the chances of committing type 1 error (Trochim, 2006).

**Potential Confounders**

Confounders are variables that may be associated with the independent or predictor variables of study interest, as well as yield some level of influence on the

dependent or outcome variable (Creswell, 2009). Confounding influences are generally avoided in any study because of their ability to distort the size of the study effect or associations between the two study variable; therefore, bias the results. This unwanted effect is also considered in this study. Besides the numerous demographic covariates that have been identified in this study; the major confounders among them that were identified in literature are "*access to healthcare*" and "*vaccination history of the child*".

Access to health care is defined as the availability of, affordability of, and reachability to health care services by the target population (Gulliford et al., 2002). This means that access is not just the availability or adequacy of services, but it should be easily obtained or reached by the population they are provided for. Gulliford et al. (2002) in their review of healthcare access noted the three other core components of access to healthcare in addition to adequacy of supply: affordability, physical accessibility, and acceptability. Affordability is the financial or economic aspect of accessing care, physical accessibility is the location of the services (distance or mode of transportation affordability), and acceptability is the social and cultural context of access to healthcare which describes how much the services are accepted or trusted by the people as their own and for their own good (Gulliford et al., 2002).

The DHS program obtained and reviewed a measure of maternal healthcare access using "*the number of antenatal care (ANC) and postnatal care (PNC) visits*" as suitable indicators for the variable (USAID, 2015c). Similar factors noted by Gulliford were also observed by other authors as limiting women's access to ANC and PNC . Tesfahun, Worku, Mazengiya, and Kifle (2014) in a cross-sectional study of women of

reproductive age (15 – 49 years) in Ethiopia, noted that location of the health care facility, distance to the facility, having obtained antenatal care services, and having the authority to take decisions concerning health care utilization were major significant factors associated with post-natal care access . This associations were measured using the adjusted OR.

Similarly, Joshi, Chandni Siranda, Hodgson, and Hayen (2014) suggested that age, parity, education levels, and household economic status of the women were significant predictors of completion of ANC visits and uptake of quality ANC services. The authors also noted that quality ANC services were associated with reduced maternal and neonatal mortality, and that these were particularly observed in low income countries. In another cross sectional study in Uganda, Mangwi et al. (2014) assessed if adherence or uptake of ANC services could predict good post-natal care practices among lactating woman. The authors found relatively high awareness of PNC practices among women who adhered to ANC services but no significant associations were observed in PNC practices. The authors, however, recommended focus mobilization programs for PNC adherence among lactating mothers. Islam and Odland (2011) noted cultural issues, distance to health care facilities, and socioeconomic status of women as major determinants of maternal healthcare access.

Immunization had been noted as the major service component that that is obtained by or attracted majority of women who access PNC in Uganda (Nankabirwa, Tumwine, Mugaba, Tylleskär, & Sommerfelt, 2015). The authors, from the findings of their study of the effects of BCG vaccines, noted that vaccination could reduce child BCG related

mortality by 50%. Kitamura, Komada, Xeuatvongsa, and Hachiya, (2013) noted that vaccines are one of the greatest breakthroughs of public health in controlling child mortality, and one of the most commendable vaccination programs was the Extended Program on Immunization (EPI).

In my review, I was able to identify factors limiting effective immunization programs and mothers' access to vaccination of their children as household occupation, maternal age, distance to the facilities, means of transportation, medical qualification of the birth attendant, regular notification of vaccination schedules (Kitamura et al., 2013), socioeconomic condition of the women, inconvenient timing, time constraints, and cultural unacceptability of vaccines (Babirye, et al., 2011). Stockwell, Irigoyen, Andres Martinez, and Findley, (2014), recommended that improved and open communications between providers and the mothers, increased decision-making authority of women on their health issues, flexible appointments, and improved education at both the individual and community levels could greatly improve uptake of vaccination services.

**Methodologies Consistent with my Scope of Study**

I considered the study of life course events and predictors as one that involved observation of events in the natural settings. Hence, this calls for a paradigm research methods that could provide sufficient time for the health outcomes or exposures of interest to be elicited for proper observations. Longitudinal or cohort prospective studies have been the standard methodology of choice by many authors of life course investigations (Barakat-Haddad, Elliott, & Pengelly, 2012; Brown, 2010; De Genna et al., 2006; Gavin, Thompson, Rue, & Guo, 2012; Kahn, Wilson, & Wise, 2005). Other related

studies include identification of modifiable and attributable risk factors of miscarriage in Denmark (Feodor et al., 2014), association between caffeine intake and APO (Greenwood et al, 2010) and a secondary analysis of longitudinal study dataset to determine the association between violence against women and U5M in Bangledash (Asling-Monemi, 2008). The longitudinal studies for life course events could sample huge number of participants and cover a number of years with associated expensive resources.

The major weakness associated with this design was that it might not be suitable in a resource limited settings because it demands consistent follow-up of the participants over a relatively long period of time and this requires huge human, time, and financial resources (Barakat-Haddad, Elliott, & Pengelly, 2012). The robustness of longitudinal method is also threatened my high chances of Loss-to-follow-up (LTFU) which may result to selection bias and loss of statistical power to detect the effect or association of interest, thus, requires large sample size (Crosby, DiClemente, & Salazar, 2013). However, the longitudinal studies, if managed well are more robust to the purpose of the study, inclined to collect accurate information, and provide opportunities for study/design mediation (Cosby et al, 2013).

Several studies have also explored other research methods in the context of risk factors and exposures associated with miscarriage and U5M in order to throw more light on related conditions and circumstances that lead to the health outcomes. Majority of the researchers considered cross –sectional design more appropriate. For example, cross-sectional design was used to determine the awareness, prevalence, and the psychological

effects of sudden pregnancy loss among women of reproductive age in Nigeria (Abiola et al, 2013). Cross-sectional design was further explored to study the associated between environmental tobacco smoke, stress, and miscarriage in Malaysia (Arffin et al, 2012); household socioeconomic status and U5M (Ezeh et al., 2015); the risk factors associated with U5M in Tanzania (Natteey et al., 2013); trend determination of childhood mortality from 1990 to 2006, and other determinants of U5M in Uganda (Ayiko, 2009). Other related studies included the determination of risk factors associated with postneonatal, infant, and U5 mortalities in Nigeria (Ezeh et al., 2015); risk factiors for U5M in Abu Dhabi (Al-Hosani et al., 2003); risk factors associated with deaths among children under-five with severe anemia (Mouneke et al., 2012); and identification of maternal, child, and family risk factors associated with mortality among under-five children in Nigeria (Kayode et al., 2012).

The cross-sectional approach is popularly preferred for its convenience, relatively considerate in cost, and efficiency which demonstrates its timeliness in completion (Arffin et al., 2012; Crosby et al., 2013; Kayode et al 2012). However, the cross-sectional study by Arffin et al., 2012 was limited by the small sample size and the conclusion was obscured. Ezeh et al (2015) also noted that the design was not robust to determine causality; therefore, one needs to be careful in interpreting the conclusions from cross-sectional study about causality. The approach is also vulnerable to recall bias (Crosby et al., 2013; Kochar et al., 2014).

Zubrick (2008) explored retrospective cohort analysis in investigating the association between maternal mental illness and pregnancy loss. Asling-Monemi,

Tabassum Naved, and Persson (2008) used the secondary analysis of longitudinal data. This study methodology also attracted many preferences due to its convenience and better cost effective than prospective longitudinal cohort study; however, the method is limited by the lack of control of the data management process and recall bias, just like the cross-sectional study (Asling-Monemi et al., 2008; Crosby et al., 2013). Bailey and Sokol explored the advantage of meta-analysis and literature review to validate the claims on the association between prenatal alcohol consumption and adverse pregnancy events.

## Summary and Conclusions

The search strategy used in this chapter was a combination of key terms search in several databases from the Walden University Library and the use of google search engines for renowned public health websites. The LCHD theory provided the core theoretical foundation and conceptual framework for the study. The literature provided detailed current context of the key study variables of the study. The dependent variable was U5M, and the independent variables were socioeconomic factors affecting maternal health and APO. Household economic conditions, maternal education, family planning, nature of residence, and the women's psychological stability were suggested to be risk factors of U5M. Methods most applicable in the literature in relation to the scope of my study were cohort longitudinal method, cross-sectional study, retrospective cohort analysis, and secondary analyses of longitudinal study archived dataset. Besides all the known risk factors for the U5M identified and discussed in the literature review, evidences were still limited on the predictive measure of collective and individual direct socioeconomic conditions of women on the U5M of their children; and the life-course

association between the history of APO of women and the U5M of their children in Nigeria; hence, the purpose of the study. I investigated these gaps by reviewing a cross-sectional datasets generated by Nigeria Demographic and Health Surveys (NDHS) from women of reproductive age (of age 15 – 49). The methodology and many more relevant details were explored in studying these gaps are discussed in the next chapter (Chapter 3).

# Chapter 3: Research Method

## Introduction

The purpose of this quantitative study was to test the LCHD model in determining whether the use of history of APO (miscarriage, abortion, still birth) and maternal socioeconomic factors (age, income, occupation, and education level) of women could predict the death of their children before their (children) fifth birthday, controlling for other potential confounding variables. Chapter 1 elaborated on the research problem which demonstrated that U5M is a significant global health concern (CIA, 2014).

Chapter 1 also identified African countries as contributing the highest burden of U5M in the world and Nigeria was among the top countries contributing to this indicator in Africa and the world (WHO, 2012). Socioeconomic conditions of women was suspected to be a major risk factor of maternal and child health, and history of pregnancy outcomes are observed to share common risk factors with U5M; hence both factors (socioeconomic factors and history of pregnancy outcomes) could predict the mortality among children under-5 years of age. The overarching research question of the study was "to what extent does history of APO and socioeconomic factors among women of reproductive age predict mortality among children under 5 years old in Nigeria?" The subresearch questions were, "to what extent do socioeconomic factors predict U5M in Nigeria?, to what extent does history of APO (miscarriage, induced abortion, or still birth) predict U5M in Nigeria, and how consistent is the association between APO and

U5M from across three surveys between 2003 and 2013 in Nigeria?" The conceptual framework for the study is built from the life-course development theory (LCHD).

In this chapter, I discuss the research design that was appropriate for answering my research question, which was essentially a secondary analysis of a population-based cross-sectional survey and the rationale for choosing the design. I discussed the target population and the sampling procedures given the requirements of my study power and the elements obtainable in the NDHS datasets accessed. I also reviewed the recruitment, participation, and data collection procedures applicable in the primary study that generated the datasets of interest to my study, as well as procedures for gaining access to the appropriate datasets. The relevant instrumentation (questionnaires) used in the main study was briefly reviewed to buttress its validity and relevance to my study in the context of my research questions. I also discussed the operationalization of the study variables and presented suitable statistical tests for answering each of the research questions, all in a data analysis plan (in table format and discussion). I mentioned some threats to the validity of the study, and the ethical considerations including possible ethical threats and solutions to minimize ethical threats.

## Research Design and Rationale

The study investigated a couple of independent variables and a dependent variable under the controlled influence of some covariates. The independent variables were socioeconomic factors with major considerations for age of women at marriage, level of education, income level, employment/work status, and nature of residence. The covariates were other possibly interacting variables that could weigh significant influence

on the outcome(s) of interest but not considered as the variables of interest in the study (Creswell, 2009), and they were identified from the literature reviewed in Chapter 2. The covariates identified for this study were age of the women (age at last birthday before the survey), marital status, ethnicity, and domestic violence. The dependent variable was U5M which was operationally defined as the number of children under the age of 5 years who have died as at the time of the survey.

This study was a secondary data analysis of a cross-sectional survey which explored a cross-sectional design to obtain relevant information from the participants within the last 5 years preceding the survey. The secondary data was obtained from the Nigerian Demographic and Health Survey (NDHS). The Demographic Health Surveys (DHS) are nationally representative household based surveys designed to estimate the relevant characteristics of the participating country's population. The surveys are used to provide periodic (every 5 years) monitoring and evaluation data / information about the country's population with respect to basic demography, socioeconomic conditions, health, and nutrition. Cross-sectional design are commonly utilized based on three questionnaire types (men, women, and household) to elicit desired information from the participants. The survey participants for the three desired surveys were eligible adults identified from stratified randomly sampled households (USAID, 2015). The NDHS was similarly a population-based and nationally representative survey conducted across the six geopolitical regions of Nigeria (NPC, 2013). The related variables are appropriate to answer the research questions that are developed to ascertain and estimate the

associations among the socioeconomic factors of women, history pregnancy loss, and U5M in Nigeria within the last 5 years.

The key benefit of this cross-sectional design is its relative efficiency with time and financial resources. Information is collected once from a participant and within a short period of time from all the participants depending on the size of the sample, and the cost of obtaining information is relatively low. Hence, no time and cost constraint was envisaged (Crosby et al., 2013). In addition, besides the research design, most beneficial for secondary data analysis is that the method is even more time and financially efficient which makes it more convenient and appropriate for my dissertation process. However, one of the limitations of cross-sectional design is that the design on its own is not robust enough to suggest or infer causality between two variables/factors; yet, it is capable of estimating reliable population characteristics, and identifying or suggesting valid relationships that could provoke the use of other relatively robust designs like cohort longitudinal studies and experimental designs to elicit causality (Crosby et al., 2013). That is to say that cross-sectional designs could provide scientific clues that could lead to advanced discoveries in the course of time and other scientific investigations; thus, this makes it more consistent and appropriate for use in similar studies like this.

## Methodology

Secondary data analysis was conducted using the women datasets generated from the NDHS in 2003, 2008, and 2013 surveys in response to the individual research questions. In addition to the description of my study methodology, this section would provide sufficient description of the methods and procedures used in the main study.

**Population**

The NDHS is a national population-based study that targeted all the residents (men, women, and children) in Nigeria with an objective to obtain reliable national estimates of certain population characteristics (USAID, 2015). However, only men between the reproductive ages of 15 to 59 years and women between the reproductive ages of 15 to 49 years were interviewed across selected eligible households (NPC, 2013). Information about the children was obtained from the eligible household adults (occupants) (NPC, 2013). Therefore, the eligible study participants were all men and women within the stipulated ages of 15 to 59 years and 15 to 49 years, respectively, who were available as the acclaimed rightful members or residents of the household. These population included guests who have stayed in the house for at least a night before the survey (NPC, 2013). In overall, the NDHS interviewed a total of 38,948 out of 39,902 eligible women (98% response rate), and 17,359 men out of 18,229 eligible men (95%) in 2013(NPC, 2013). Similarly, in 2008 survey, 33,385 out of 34,596 eligible women and 15,486 out of 16,722 eligible men were interviewed; while 7,620 out of 7,985 eligible women and 2,346 out of 2,572 eligible men were interviewed in 2003 (NPC, 2013) .

Nonetheless, my target population was only women within the reproductive age of 15 – 49 years; thus, I considered reviewing and analyzing data from the 38,948; 33,385; and 7,620 women in 2013, 2008, and 2003 respectively to adequately answer my research questions.

**Sampling and Sampling Procedures**

The sampling of the NDHS (main study) was essentially *a three-stage cluster stratified sampling* strategy, designed to be nationally representative of the country's population. The country was administratively divided into four levels: First level was the States (36 + Federal Capital Territory - FCT). The states were divided into 774 Local Government Areas (LGAs) at the second level. The LGAs were further divided into localities at the third level, and the localities divided into smaller convenient units known as the census enumeration areas (EAs) which constituted an average of 40 households (about 211 people) in each EA. The EA was the primary sampling unit (PSU) designed and used by NPC during the 2006 population census; however, the PSU for the 2008 and 2013 NDHS were clusters which were formed on the basis of EAs used for the 2006 population census (NPC, 2013). A minimum cluster size was constituted by 80 households and housed a population of about 400 people; hence, some EAs were combined to form a cluster while some EAs were large enough to constitute a cluster (NPC, 2013).

Based on the administrative structure of the country, the three-stage stratification sampling method was considered most appropriate, and the stratification was based on the splitting of the states into two developmental areas: rural and urban (NPC, 2013). The first stage was at the level of locality. The researchers used probability proportional to size (PPS) to randomly select 893 localities across all the states. In the second stage, one EA was randomly selected from one locality with equal probability selection; however, for localities with larger sizes, the researchers selected more than one EA resulting to a

total of 904 EAs at this stage. In the last stage, the survey team conducted a complete household enumeration and mapping of all the 904 selected EAs through the NPC enumeration teams and all the households in each of the selected localities were listed with all the household residents accounted for. The household listing then formed the sampling frame for the household selection in the third stage (NDHS, 2013).

In the third stage, using an equal probability systematic sampling (EPSS), an equal number of households (45) were then selected from each of the rural and urban clusters/EAs across the selected localities of the states; however, little adjustments were made to accommodate the larger sizes of states of Kano and Lagos which were allocated 40 clusters each while other 34 states and FCT had 23 to 24 clusters each. In all, among the 904 clusters (40,680 households), 372 (16,740 households) and 532 (23,940 households) clusters were from urban and rural areas respectively. All eligible adults or occupants (men and women) based on the target population criteria discussed above, in each of the selected households, were potential study interviewees.

Hence, I reviewed data from the 38,948 women interviewed in 2013, 33,385 women interviewed in 2008, and 7,620 women interviewed in 2003.

The inclusion criteria were women who had given birth in the last 5 years preceding the surveys or at least gotten pregnant once within the period .The exclusion criteria were women who indicated any form of hereditary disorder or whose ages are missing. The rationale for the eligibility (inclusion and exclusion) criteria was that the study was interested in APOs and U5M, and since pregnancy leads to or precedes both outcomes (any pregnancy outcome and U5M), it became an excellent choice of

participating eligibility. So any participant who was not pregnant within the period of consideration would not be fit to provide any relevant information in response to the research questions. Again, age (15 – 49) was a key element in the study both as a selection criterion and study factor; thus, it was assumed that missing age could distort the selection of eligible participants; hence, corrupt the study results. For example, a participant with a missing age is 53 years old, but because her age was missing, the survey might have assumed she was within the reproductive age bracket and interviewed her and indicated a missing age for her. I understood that the instance of including a person with a missing age in the main surveys was very rarely; however, such instance would not be entirely out of place. All participants who met the eligibility criteria were selected and their total numbers become my final sample sizes for my study across the survey years (2003, 2008, and 2013). The idea was to protect the integrity and validity of the original sampling design in maintaining the nationally representativeness of the survey as well as creating sufficient statistical power for my study.

However, to determine and ensure that the observed sample sizes were sufficient to detect the desired effect in my study, I used the G*Power software 3.1.9.2 to determine the appropriate sample size following the guidance from Buchner and Erdfelder (n.d) . I set the power at 0.80 (which is the probability of finding a true effect, if it exists) and the alpha level at 0.05 (which is the probability that I would reject the null hypotheses wrongly – type 1 error) (Trochim, 2006). Using the G*Power determination and depending on my statistical analyses described in the later section, I chose the estimated effect size at medium (Gravetter, & Wallnau, 2004) and my sample size per survey year

period was determined at 2,652 participants The least sample size among the surveys was that from 2003 but it met the minimum threshold size as determined using the G*Power .

**Recruitment, Participation, and Data Collection**

This was a secondary data analysis of the datasets generated by the NDHS; thus, I did not engage any primary recruitment, participation, and data collection process. However, the related processes and procedures explored in the primary survey is located in the 2013 NDHS (NPC, 2013).

**Access to Dataset**

The DHS datasets were available and accessible online. However, the data was not directly accessible; I requested for access to Nigeria Survey datasets by first registering to be recognized as user of the website. I created a research project user request in which I provided some personal identification details such as contact information; as well described the intended use of the datasets. The project description included the project title and the purpose of the study I wanted to use the datasets for. My request was granted and I was given full access to all DHS datasets for Nigeria. The permission letter was submitted to the university Institutional Review Board (IRB) for review and clearance during the ethical validation process of my study. Nonetheless, if my access was not granted, the notification could be for disapproval or a request for additional information needed; and I might need to provide additional information for further reviews and considerations.

**Survey Instruments**

The NDHS survey instruments (instruments in the main study/survey) were adopted to align with the model questionnaires developed by the MEASURE DHS program but modified to suit the Nigerian context. I reviewed and finalized the country modification in collaboration with all relevant country stakeholders including the government ministries, government agencies, nongovernmental organizations (NGOs), and international public health partners and donors. The instrument was reviewed to reflect all the relevant and contextual population issues such as maternal and child health, family planning, HIV/AIDS, domestic violence, and household socioeconomic conditions. The instruments were finally translated and pretested to confirm the reliability and validity (NPC, 2013). The original study obtained individual based information from women, men and household-based information; however, my study is interested in the information from women which contained relevant variables to answer my research questions. Information were collected in the following applicable topics: background statistics such as age, education, literacy, nature of residence, etc; reproductive history and childhood mortality; marriage and sexual activity; women's work and their decision making; and domestic violence (NPC, 2013).

**Operationalization of the Variables**

The independent variables were *socioeconomic factors* affecting women and *history of adverse pregnancy outcome*. The socioeconomic factors of a woman are described as those social and economic attributes or factors affecting or influencing a woman's living condition, value and recognition in the society and these include *level of*

*education, income level, employment/work status,* and *nature of residence* (Kahn et al, 2005; Williams, 2005). The socioeconomic status or condition of the woman could be measured as an index value of the socioeconomic factors afore-listed; hence, the socioeconomic condition/status of a participant was calculated by a simple sum of all the scores of all the relevant socioeconomic factors associated with the participant (Williams, 2005). The higher values would denote higher socioeconomic conditions/status while the lower values will denote lower socioeconomic conditions/status.

*The level of education* was defined as the measure of education attained by the woman before the survey, and would be measured and coded in four levels (0 = No Education, 1 = Primary Education, 2= Secondary Education, and 3 = Higher/Tertiary Education). The *income level* was defined as the amount of money or measure of resources of economic importance received or owned by the woman. The variable was meant to indicate woman's economic level; however, the NDHS did not clearly capture this variable in a way that could be reliably or quantitatively measured in values, but computed closely similar variable as the household wealth index which is a composite variable that measures the participants' household level ownership of and access to certain assets (USAID, 2015b). This could be used as a proxy to reflect a woman's income level as well as economic status as USAID (2015b) indicated that the variable was more valuable for use in situations where income and expenditure level data could not be reliably, captured; hence, the wealth index status of the woman's household was used in this study to reflect the woman's income level. The wealth index was a quintile score captured as a categorical variable and would be captured as such (1 = Poorest, 2 =

Poor, 3 = Middle, 4 = Richer, and 5 = Richest). *Employment/Work status* was defined as the woman's formal or informal engagement in any form of work or employment that earned her any form of economic remuneration in money or kind services in the last 12 months following the survey. This was measured in a dichotomous category defined by the woman's engagement in any paid work or not recoded as 1 = YES/employed and 0 = NO/unemployed. *Nature of residence* is defined as the level of development indicated by relative population size of the area in which the women resided at the time of the survey. This was stated as dichotomous variables and recoded as 1 for rural area, and 2 for urban area.

The *history of adverse pregnancy* was described as any experience of miscarriage, abortion, or stillbirth. This is another dichotomous variable captured and recoded as 1 = YES and 0 = NO.

The dependent variable is *under- five mortality* (U5M) which is operationally defined as the number of children under the age of 5 years lost to death by the woman as at the time of the survey . This was an ordinal variable that accounted for the number of deaths lost by a participant which ranged from 0 to infinity; however, it would be recreated to a dichotomous/categorical variable in response to having experienced U5M or not, and recoded as 1 = YES, and 0 = NO.

The covariates identified for this study were *age, marital status, ethnicity domestic violence, access to health care, and vaccination history of the child*. The *age of the woman* as at the survey was defined as her age as at her last birthday before the survey, quantified as continuous variables by the absolute numbers reported (15 to 49).

*Marital status* was defined as the living situation in which the woman lives/stays together with another partner or not; this is nominal variable categorized and coded as 0 = Not married or living with a man, 2 = Widowed / Divorced, 3 = Living with a Man but Not Married, 4 = Married. *Ethnicity* was defined as the tribal affiliations of the participant; this is a nominal variable and coded as 1 = Hausa, 2 = Igbo, 3 = Yoruba, and 4 = others, with no ranking or relative values attached to the categories. *Domestic violence* was the woman's record of past experience of violence by her spouse or partner coded as 1 = YES, and 0 = NO. *Access to health care* was defined as the woman's successful uptake of antenatal and postnatal care during the period of her pregnancies and deliveries in the last 5 years of preceding the survey; and coded as 0 = No access to both services in all the pregnancies, 1 = Access to one of the services in any of the pregnancies, and 2 = access to both of the services in all the pregnancies. History of measles vaccination of the child was defined as the successful completion of child vaccination doses of measles mumps and rubella (MMR)in the last 5 years preceding the survey; and coded as 0 = no complete measles vaccination of child, 1 = complete measles vaccination of child

**Data Analysis Plan**

The summarized data analysis plan is presented clearly in table 2 below.

Table 2

*Inferential Data Analyses Summary by Research Questions and Variables*

| Research Questions | Independent variable (Type of Variable) | Variable coding | Dependent Variable | Variable Coding | Statistical Analysis | Statistical Results to Test Hypotheses |
|---|---|---|---|---|---|---|
| 1. To what extent do socioeconomic factors predict U5M in Nigeria? | Level of Education of the woman (Ordinal) | 0 = None<br>1 = Primary<br>2 = Secondary<br>3 = Higher/Tertiary | Under-Five Mortality (binary variable data) | 0 = NO<br>1 = YES | Binary Logistic Regression | Odds Ratio<br>Predicting Strength (β)<br>Contributing Account for variation (Wald's test) |
| | Level of income of the woman – Household Wealth Index (ordinal) | 1 = Poorest<br>2 = Poor<br>3 = Middle<br>4 = Rich<br>5 = Richest | | | | |
| | Employment/Work Status of the woman (dichotomous) | 0 = None<br>1 = Employed | | | | |
| | Nature of Residential Environment (dichotomous) | 1 = Rural<br>2 = Urban | | | | |
| | Socioeconomic condition/status Index (continuous) | Not Applicable | Under-Five Mortality (binary variable data) | 0 = NO<br>1 = YES | Binary Logistic Regression | |
| 2. To what extent does history of adverse pregnancy outcomes (*miscarriage, induced abortion, or still birth*) predict U5M in Nigeria? | History of Adverse Pregnancy Outcomes (dichotomous) | 0 = None<br>1 = Yes | Under-Five Mortality (binary variable data) | 0 = NO<br>1 = YES | Binary Logistic Regression | Odds ratio Predicting Strength (β) |
| 3. How consistent is the association between adverse pregnancy outcomes and U5M from 2003 to 2013 in Nigeria? | History of Adverse Pregnancy Outcomes (dichotomous) for 2003, 2008, and 2013 | 0 = None<br>1 = Yes | Under-Five Mortality (binary variable data) | 0 = NO<br>1 = YES | Binary Logistic Regression | Odds ratio Predicting Strength (β) |

All relevant statistical results were set and interpreted at 95% confidence interval and 5% alpha level.

The data analyses were performed using the Statistical Package for Social Sciences (SPSS) 20.1. The NDHS datasets had already been subjected to rigorous data cleaning and editing processes to achieve the best quality datasets possible. The data NDHS processes included supervisor-reviews of questionnaires, identifying and rectifying data-collection errors, data coding, double data entries, identifying and editing computer-classified errors, and data completion into datasets and databases. The data entry and cleaning were performed with the CSPro software (NPC, 2013).

However, I noted that the purpose of my study was not considered in the primary study; thus, I may need to review the questionnaires (Women's questionnaire) and explore the datasets relevant to my study to clearly understand the details and components of the datasets. The components of the datasets reviewed were the variables definitions, raw data, data context and the data coding manual. Afterwards, I used the information I obtained in manipulating and recoding the data to suit the context of my study. For example, for the socioeconomic status (SES)/condition, I needed to compute socioeconomic index from the various socioeconomic factors captured in the dataset. Again, the proposed calculation of the SES index was aligned in such a way that higher values denote higher status and vice versa, so, I needed to recode the socioeconomic factors in such that it is ranked/scored to reflect the ranked values and pattern of interest

as obtainable in the society; for example highest education level having the highest score and no education at all having the least score which is zero.

In survey researches such as the DHS, It is common to observe some non-responses and incomplete information in the form of missing data on certain variables particularly on case wise (Creswell, 2009). This means that some respondents may not answer some questions they are not comfortable with and this leaves some pockets of missing data on different variables across cases, making them difficult to analyze if it affects the key variables. This could constitute a huge source of selection bias if it entails removing cases that miss important data and it threatens the external validity of the study if not handled properly (Field, 2013). These variations may further introduce sample variations of the three surveys in the representativeness of the target populations. These variations would be resolved or minimized significantly by weighting the individual samples according to the guidance of the DHS sampling and weighting procedures (USAID, 2015).

In order to ensure completeness of my analyses, all cases with missing data on the key study variables (independent variables, dependent variables, and major potential confounders) were removed from the analyses but accounted for by weighting. However, if the proportion of the missing data was above 10% of the complete sample size, then, the demographic characteristics (on the important covariates) of the cases with missing data would be determined and compared statistically with the study cases. I would estimate any significant difference and the degree of possible bias they may introduce in the study results (Field, 2013; Creswell, 2009; Trochim, 2006).

The DHS does not use a simple random sampling (SRS) for the selection of the participants, rather a stratified probability proportional to size cluster sampling design. This is a complex sampling design which may introduce some systematic bias that could flaw inferences made from the statistical results. To control for this design effect, the complex samples logistic regression was explored which would run a more conservative model to adjust for the design effect (Field, 2013).

**Research Questions and Hypotheses**

The main research question of the study was:

**RQ1:** To what extent does history of APO and socioeconomic factors among women of reproductive age predict mortality among children under 5 years old in Nigeria?

Null Hypothesis 1 ($H1_0$): There are no statistically significant associations between the APO, socioeconomic factors among women of reproductive age, and U5M in Nigeria.

Alternate Hypothesis 2 ($H1_A$): There are statistically significant associations between the APO, socioeconomic factors among women of reproductive age, and U5M in Nigeria.

Sub – research questions are:

**RQ2-** To what extent do socioeconomic factors predict U5M in Nigeria?

a. Level of education
b. Income level (wealth index)
c. Employment (work status)
d. Residence (urban/rural)

Null Hypothesis 2 ($H2_0$): There are no statistically significant associations between age, educational level, income level, employment /work status, and type of residential

environment of women, and U5M after controlling for other demographic factors (age of the woman, ethnicity, marital status, domestic violence) , access to health care, and vaccination history.

Alternative Hypothesis 2 ($H2_A$): There are statistically significant associations between age, educational level, income level, employment /work status, and type of residential environment of women, and U5M after controlling for other demographic factors (age of the woman, ethnicity, marital status, domestic violence) , access to health care, and vaccination history.

**RQ3**- To what extent does history of APO (miscarriage, induced abortion, or still birth) predict U5M in Nigeria?

Null Hypothesis 3 ($H3_0$): There is no statistically significant relationship between history of pregnancy outcomes and U5M after controlling for age at marriage, sex of the dead child, type of the residential environment, access to health care, and vaccination history

Alternative Hypothesis 3 ($H3_A$): There is statistically significant relationship between history of pregnancy outcomes and U5M after controlling for age at marriage, sex of the dead child, type of residential environment, access to health care, and vaccination history

**RQ 4** - How consistent is the association between APO and U5M from 2003 to 2013 in Nigeria?

Null Hypothesis 4 ($H4_0$): There is no consistency in the direction (positive or negative) of the association between the APO and U5M across the three survey years (2003, 2008, and 2013) after controlling for age at marriage, sex of the dead child, type of the residential environment, access to health care, and vaccination history. Alternative

Hypothesis 4 ($H4_A$): There is consistency in the direction (positive or negative) of the association between the APO and U5M across the three survey years (2003, 2008, and 2013) after controlling for age at marriage, sex of the dead child, type of the residential environment, and access to health care, and vaccination history.

The data analyses involved both descriptive and inferential statistics. The descriptive statistics were essentially used to describe the demographic characteristics of the sampled population. Frequency tables were used to present all categorical variables across the relevant datasets while central tendency measures (mean and median), dispersion measures (standard deviations, range, minimum, and maximum), distribution measures (skewness and kurtos), and relevant charts where explored for relevant continuous variables. The descriptive statistics would also be used to compare the population distributions across the three datasets of interest and decipher the trend across the 10 year period.

Multivariate logistic regression was the primary inferential statistical tests that were applied to understand the predictive associations among the study variables. However, as noted earlier, because the DHS did not use a simple random sampling (SRS) for the selection of the survey participants, rather a two-stage stratified probability proportional to size cluster sampling design, this was a complex design that could introduce some systematic flaws if certain inferences are made from the statistical results. Hence, to control for this design effect, the complex samples multivariate logistic regression was explored.

Multivariate logistic regression is more applicable to the study because it is more suitable for determining the predictive effects and values of combined and multiple continuous and categorical predictors on a binomial or multinomial outcome variable (Field, 2013). It is appropriate for developing models for individual and interactive predictor effects on the outcome variable using a hierarchical model approach to determine and assess the build-up improvement of the models; hence, I used it to determine the collective and individual predictive effects of the independent variables as well as controlling for other covariates identified for possible unaccounted influence on the models The covariates are possibly interacting variables that could weigh significant influence on the outcome(s) of interest but they are not considered as the variables of interest in the study (Creswell, 2009). They were identified as potential covariates and confounding variables based on the literature reviewed in chapter 2 which identified the variables as possible common risk factors associated with the study variables. Using the binary and multinomial logistic regression dialogue function of the SPSS, the approach would employ block hierarchical method to compare models using the "enter" variable entry function at each model stage.

**Statistical Assumptions of Multiple Logistic Regressions**

One of the key advantages of logistic regression model is that it does not run on many key assumptions as observed with the linear regression model. Unlike the latter, the assumption of linearity does not apply since the logistic regression deals with both metric and categorical data on the independent variable against a dichotomous dependent variable, so the relationship between the variables of interest need not be linear in nature.

Similarly, other assumptions such as normality, and homoscedasticity do not apply in multiple logistic model (Field, 2013; Trochim, 2006).

However, in its principle, a couple assumptions must be noted and conformed with. First, for binary logistic regression, the dependent variable must be binary while for ordinal logistic regression, the dependent variable must be ordinal; this I would ensure by using or converting my dependent variable to binary and ordinary as applicable (Field, 2013).

Secondly, the logistic regression assumes P(Y=1), which means that it assumes that the probability of an event occurrence is one; thus, I would code my binary dependent variable as 1 and 0, while 1 is the desired outcome (Field, 2013).

Lastly, multiple logistic regression assumes that the sample sizes are large enough to ensure sufficient number of cases for individual independent variables to provide sufficient power for the maximum likelihood estimation principle (Field, 2013). This I would take into consideration and ensure that each independent variable has more than 30 cases as suggested by Trochim (2006).

**Variable Selection Method for the Statistical Analysis**

The method of selection proposed for this analysis was the "Entry Method". This is the standard method of entry in which all the predictor variables are entered into the model or equation at once and their individual predictive values on the dependent variable or variance accountabilities on the dependent variable are reviewed simultaneously. However, each predictor was reviewed and assessed by the predictive effect it yields in the presence of others. This method is considered appropriate when

dealing with a small set of predictor variables that are not more than six predictors (Field, 2013). Secondly, since the interest of the study was not to construct an optimal regression equation or deeper investigation into specific models, rather, I was interested in the small set of predictors that answers each of the research questions, the entry method was considered suitable for the regression method (Statistics Solutions, 2016).

## Threats to Validity

The common threats to cross-sectional and secondary study validity are usually threats to the external and internal validity. Common threats to the external validity are the rigor of the study design which only considers the study effect or population characteristics at that point in time and may not truly reflect the situation over a longer period or range of time. This means that the findings may not be confidently generalized over a period of time beyond the inclusive year(s) and causality cannot be inferred due to time-based interferences. These are fundamental threats to external validity from cross-sectional studies; however, the main study elicited some historical information which were used in the secondary study and I considered a large sample size pooled from multiple research surveys 2003, 2008, and 2013 to increase the scope of time and population; thus improve the external validity.

The threats to internal validity are essentially factors limiting the extent at which the observed effects reflects the true effect among the study population and this refers more to measurement errors (Frankfort-Nachmias & Nachmias, 2008). The primary threats to internal validity in this study are self-reported and recall bias. The information reported by the participants may not accurately reflect the true occurrence of the events

due to possible recall failures; however, efforts such as adequate training of the interviewers, pre-test of the instruments, and translation of the questions to suit the local context/language of the participants were recorded to improve the internal validity of in the main study (NPC, 2013). In addition, the large sample size envisaged in the secondary study would improve the internal validity (Frankfort-Nachmias & Nachmias, 2008).

**Ethical Procedures**

Women and children are special population in the field of public health; hence, are given special ethical considerations in studies involving them. However, my research posed very minimal ethical concerns as I used secondary datasets that were collected, de-identified, and stored through closely supervised stringent ethical procedures (NPC, 2013); thus, I did not involve or contacted any of the participants for any further study processes. In addition, I formally requested for access to the datasets from the authority that owned and hosted the DHS datasets. My request was reviewed by the DHS team and I received a notification that my access request was granted. The primary local survey obtained local ethical clearance from the local national ethical body known as the National Health Research Ethics Committee (NHREC) in accordance with the DHS program ethical standards (NPC, 2013). The DHS program conforms to very high standards for maintaining confidentiality and protecting the privacy of the members of the households and other related members during the survey. The DHS upholds two levels of ethical review and approvals: the international lRB and the host country IRB (United States Agency for International Development [USAID], 2012). The international

ethical review is obtained through the ICF IRB which ensures that the survey complies with the U.S. HHS regulations for the protection of the human subjects according to the 45 CFR 46 act (USAID, 2012). The host country level IRB clearance was provided by the NHREC with a specific assigned number, NHREC/01/01/2007, to ensure that the survey complies with the ethical laws and norms of Nigeria (NPC, 2013). I was also aware of Nigerian ethical requirements and have been certified by the NHREC in this regard with NRHEC certified number: NHREC/TR/02/06/2007a. I also obtained the Walden University IRB with the approval number: 03-25-16-0331537.

In practice, the NDHS researchers duly informed the participants of the essence, purpose, and possible consequences or implications of the study. The participants provided documented informed consent to participate in the study and the data obtained were further de-identified for public use. In my study, I did not involve any direct human contact and I further reviewed the data to identify any sensitive information that might need additional protection by exclusion, encryption, or obscuring the information during reporting, to maintain the confidentiality status intended for participation (Frankfort-Nachmias & Nachmias, 2008).

## Summary

The study explored a cross-sectional design using a three-staged stratified probably sample selection to obtain a nationally representative sample. The study population was women of reproductive age, between the ages of 15 and 49 years who have had at least one birth or pregnancy experience during the last 5 years preceding the surveys. Datasets from NDHS across three consecutive surveys (2003, 2008, and 2013)

were obtained and analyzed using logistic regression to answer the research questions as stated above. The results of the statistical analyses were generated and presented in the next chapter, Chapter 4.

# Chapter 4: Results

## Introduction

In this study, I determined whether the use of history of APO (miscarriage, abortion, still birth) and maternal socioeconomic factors (income, occupation, and education level) could be possible predictors of death of children within their first 5 years of age, among women of reproductive age in Nigeria. The likely unwanted effects of certain potential confounding variables or covariates such as age, ethnicity, marital status, domestic violence, access to health care, and history of child immunization (measles) were controlled for. The overarching research question was:

RQ1 - To what extent does history of APO and socioeconomic factors among women of reproductive age predict mortality among children under 5 years old in Nigeria? The null Hypothesis 1 ($H_0$1): There are no statistically significant associations between the APO, socioeconomic factors among women of reproductive age, and U5M in Nigeria. The alternate Hypothesis 1 ($H_a$1): There are statistically significant associations between the APO, socioeconomic factors among women of reproductive age, and U5M in Nigeria.

The subresearch questions and their hypotheses are as follows:

**RQ 2-** To what extent do socioeconomic factors (level of education, income level, employment/work status, and type of residential setting) predict U5M in Nigeria?
The null hypothesis ($H_0$2) is there are no statistically significant association between, educational level, income level, employment /work status, and type of residential setting of women, and U5M after controlling for demographic factors (age of the woman at first

marriage, ethnicity, marital status, and domestic violence) , access to healthcare, and child vaccination history. The alternative hypothesis ($H_a2$) is that there are statistically significant association between, educational level, income level, employment /work status, and type of residential setting of women, andU5M, after controlling for demographic factors (age of the woman at first marriage, ethnicity, marital status, and domestic violence) , access to healthcare, and child vaccination history.

**RQ 3 -** To what extent does history of APO (miscarriage, induced abortion, or still birth) predict U5M in Nigeria? The null hypothesis ($H_0 3$) is there is no statistically significant relationship between history of pregnancy outcomes andU5M, after controlling for age at first marriage, sex of the child, type of the residential setting, mother's educational level, access to health care, and vaccination history. Alternative hypothesis ($H_a 3$) is there is statistically significant relationship between history of pregnancy outcomes andU5M, after controlling for age at first marriage, sex of the child, type of the residential setting, mother's educational level, access to health care, and vaccination history.

**RQ 4 -** How consistent in the direction and statistical significance is the association between APO and U5M from 2003 to 2013 in Nigeria? The null hypothesis ($H_0 4$) is there is no consistency in the direction (positive or negative) and statistical significance of the association between the APO and U5M across the three survey years (2003, 2008, and 2013) after controlling for age at marriage, sex of the child, mother's educational level, type of the residential environment, access to health care, and vaccination history; while the alternative hypothesis 4 ($H_a 4$) is that there is consistency in

the direction (positive or negative) and statistical significance of the association between the APO and U5M across the three survey years (2003, 2008, and 2013) after controlling for age at marriage, sex of the child, mother's educational level, type of the residential environment, and access to health care, and vaccination.

In this chapter, I reviewed the compliance of the data collection process as planned and described the results of the statistical analyses that responded to the study purpose and research questions. The first section of the chapter describes the demographic characteristics of the study population sample as relevant to the three research questions, using relevant descriptive statistics. The later section reviews the bivariate analyses to test the various hypotheses across the three research questions mentioned above. The primary inferential analysis was binary logistic regression / logit model used to determine the statistical predictive strengths of the study predictors on the outcome variable. The demographics (age, educational level, ethnicity, wealth index, residential setting, employment status, and socioeconomic status index) were essentially presented in charts (for categorical variables) and tables (for continuous variables) while the inferential statistical results were presented in tables.

## Data Collection

The study was a secondary data analysis which did not involve actual recruitment of participants and collection of data; however, I downloaded the datasets used for the study from the data host website with written permission and allowed access to the datasets. The datasets were downloaded as planned as noted in Chapter 3 with no challenges of any sort. After reviewing the datasets with the inclusion and exclusion

criteria, and pooling the two survey datasets of interest (2008 and 2013), for Research Questions 1 and 2, a total sample size of 38,220 was generated. For Question 3, the total sample sizes generated for the individual years (2003, 2008, and 2013) were 3775, 18028, and 20192, respectively. The baseline demographic characteristics were described in details in the result section below. The sample is believed to be a fair representation of the larger study population as the selection in the primary study was based on a probability sampling method, demonstrating high external validity.

## Results

### Descriptive Statistics for the Respective Surveys

This section of the results describes some common demographic characteristics/patterns of the various study samples across the 3 survey years (2003, 2008, and 2013) of interest. While the 2008 and 2013 datasets where pooled to provide large sample size with sufficient study power for RQ 1 and 2, all three survey datasets were explored in RQ 3 to determine the comparative analyses of the association of interest across the individual surveys. Table 3 below shows that the current ages of the participants are closely similar except for the sample sizes. The unweighted sample size for 2003 is relatively low (3,775) while those of 2008 and 2013 are quite large (18,028 and 20,192 respectively). However, the individual samples were weighted to account for sample and response rate variations, as well as, improve their representativeness of the target populations; the weighted sizes were 3911, 17,635, and 20467 (table 3).

Table 3

| *Samples Description by Current age of participants* | | | |
|---|---|---|---|
| | 2003 | 2008 | 2013 |
| Mean | 28.52 | 29.44 | 29.42 |
| Median | 28.00 | 29.00 | 29.00 |
| Std. Dev | 7.33 | 7.36 | 7.32 |
| Minimum | 15 | 15 | 15 |
| Maximum | 49 | 49 | 49 |
| Weighted Sum (n) | 3,911 | 17,635 | 20,467 |

*Unweighted sample size (n): 2003 =3755; 2008 = 18028; 2013 = 20192*

The demographic patterns across the three surveys were very similar. Table 4 shows that, in 2003, majority (27%) of the participants were between the ages of 25 to 29 years old, while the least represented were 45 – 49 years of age. Majority (51%) had no educational background and only 3.7% had higher education. Most (64%) of the participants reported to had been engaged in any form of work that earned them any form of income (in cash or kind). Despite the relatively high work status, majority (42%) earned income within the poor category while the richest among them were the least at 17% of the population. The tribe composition of the study population was captured in the year but a large portion (71%) of the population resided in the rural area. A large majority (91%) of them were married.

In the 2008 survey, the table shows that the demographic distribution of the study population was very similar to that of 2003. Majority of the population (27%) were 25 to 29 years old and the least population were the eldest among them, between 45 to 49 years. A majority (46%) were not educated and the least (6%) obtained higher education. Though most of the participants were engaged in one form of work that earned them

some benefits, the majority (45%) yet earned income within the poor category. As also observed in 2003, they commonly (70%) lived in the rural area and over 90% of them were married. The Hausa were the largest single tribe found among the participants (29%) followed by the Yoruba (15%) and Igbo (12%). Other tribes, together, constituted 45% of the population.

The demographic distribution of the study sample in 2013 survey does not seem to be significantly different from the previous surveys. The common age group was still 25 to 29 years (26%) and the least represented, 45 to 49 years. Many (48%) of them were not educated while minority (6.3%) were those with higher education. Many (69%) were working, yet majority (45%) still earned poor income. Many of them (64%) lived in rural areas and many (92%) were married.

Table 4

*Key Demographic Descriptions of the Samples - Frequencies and Percentages*

| Demographic Characteristics | 2003 | | 2008 | | 2013 | |
|---|---|---|---|---|---|---|
| | Freq. | Percentage | Freq. | Percentage | Freq. | Percentage |
| **Age Groups** | | | | | | |
| 15-19 | 356 | 9.1 | 1168 | 6.6 | 1323 | 6.5 |
| 20-24 | 850 | 21.7 | 3399 | 19.3 | 4009 | 19.6 |
| 25-29 | 1055 | 27.0 | 4694 | 26.6 | 5376 | 26.3 |
| 30-34 | 713 | 18.2 | 3617 | 20.5 | 4247 | 20.7 |
| 35-39 | 541 | 13.8 | 2671 | 15.1 | 3172 | 15.5 |
| 40-44 | 308 | 7.9 | 1416 | 8.0 | 1656 | 8.1 |
| 45-49 | 88 | 2.2 | 671 | 3.8 | 684 | 3.3 |
| Weighted Total (n) | 3911 | 100.0 | 17635 | 100 | 20467 | 100.0 |

(*table continues*)

| Demographic Characteristics | 2003 | | 2008 | | 2013 | |
|---|---|---|---|---|---|---|
| | Freq. | Percentage | Freq. | Percentage | Freq. | Percentage |
| **Highest Educational Level** | | | | | | |
| No education | 1989 | 50.8 | 8017 | 45.5 | 9794 | 47.9 |
| Primary | 918 | 23.5 | 4012 | 22.8 | 3915 | 19.1 |
| Secondary | 861 | 22.0 | 4557 | 25.8 | 5475 | 26.7 |
| Higher | 142 | 3.7 | 1050 | 6.0 | 1283 | 6.3 |
| Weighted Total (n) | 3911 | 100.0 | 17635 | 100.0 | 20467 | 100.0 |
| **Occupational Status** | | | | | | |
| No | 1421 | 36.4 | 5967 | 34.1 | 6365 | 31.2 |
| Yes | 2481 | 63.6 | 11544 | 65.9 | 14008 | 68.8 |
| Weighted Total (n) | 3902 | 100.0 | 17511 | 100.0 | 20373 | 100.0 |
| **Income Level** | | | | | | |
| Poorest | 852 | 21.8 | 4074 | 23.1 | 4699 | 23.0 |
| Poorer | 846 | 21.6 | 3916 | 22.2 | 4588 | 22.4 |
| Middle | 808 | 20.7 | 3350 | 19.0 | 3902 | 19.1 |
| Richer | 735 | 18.8 | 3204 | 18.2 | 3674 | 18.0 |
| Richest | 670 | 17.1 | 3091 | 17.5 | 3604 | 17.6 |
| Weighted Total (n) | 3911 | 100.0 | 17635 | 100.0 | 20467 | 100.0 |
| **Type of Residence** | | | | | | |
| Urban | 1144 | 29.3 | 5330 | 30.2 | 7278 | 35.6 |
| Rural | 2767 | 70.7 | 12305 | 69.8 | 13189 | 64.4 |
| Weighted Total (n) | 3911 | 100.0 | 17635 | 100.0 | 20467 | 100.0 |
| **Ethnicity** | | | | | | |
| Hausa | - | - | 5113 | 29.0 | 6991 | 34.2 |
| Igbo | - | - | 2039 | 11.6 | 2213 | 10.8 |
| Yoruba | - | - | 2638 | 15.0 | 2487 | 12.2 |
| Others | - | - | 7845 | 44.5 | 8776 | 42.9 |
| Weighted Total (n) | - | - | 17635 | 100.0 | 20467 | 100.0 |
| **Marital Status** | | | | | | |
| Never married | 117 | 3.0 | 422 | 2.4 | 452 | 2.2 |
| Married | 3546 | 90.7 | 16355 | 92.7 | 18860 | 92.1 |
| Living together | 104 | 2.6 | 321 | 1.8 | 537 | 2.6 |
| Widowed | 34 | 0.9 | 227 | 1.3 | 252 | 1.2 |
| Divorced | 66 | 1.7 | 136 | 0.8 | 201 | 1.0 |
| Not living together | 43 | 1.1 | 173 | 1.0 | 165 | 0.8 |
| Weighted Total (n) | 3911 | 100.0 | 17634 | 100.0 | 20467 | 100.0 |

**Comparative and Pattern Analyses of Key Demographic Characteristics and Health Outcomes**

Despite the similarity observed across the three survey years, some of the demographic characteristics of interest suggested some remarkable trend over the years. A review of the educational levels of the samples suggested that the population are further gaining more education over the years (see Figure 1). While the majority who have obtained no formal education and those with only a primary education seemed to be on the decline, more women seem to be obtaining secondary and higher education.

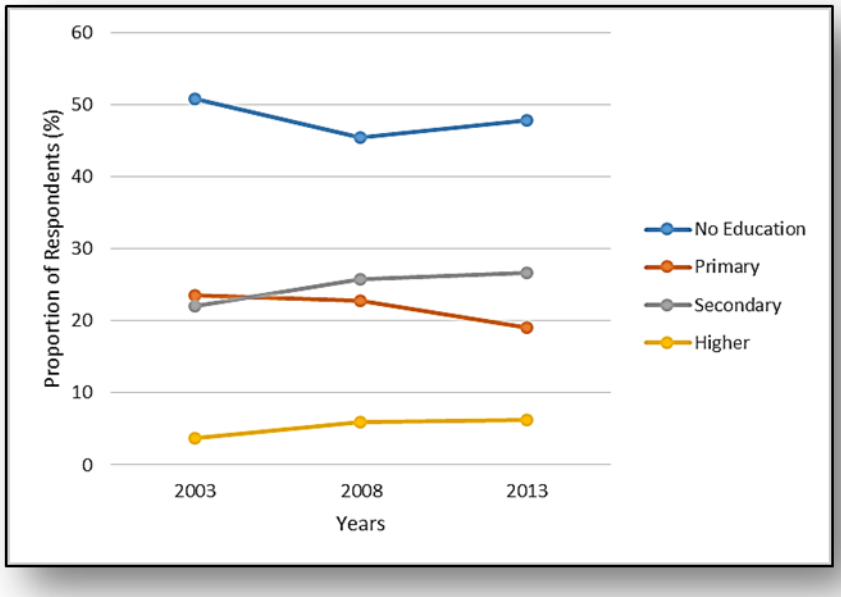


*Figure 1: Weighted pattern of educational level of the respondents across the three surveys*

Figure 2 shows that the proportion of women who were getting engaged in any form of work to earn a living may be on the increase as against joblessness.

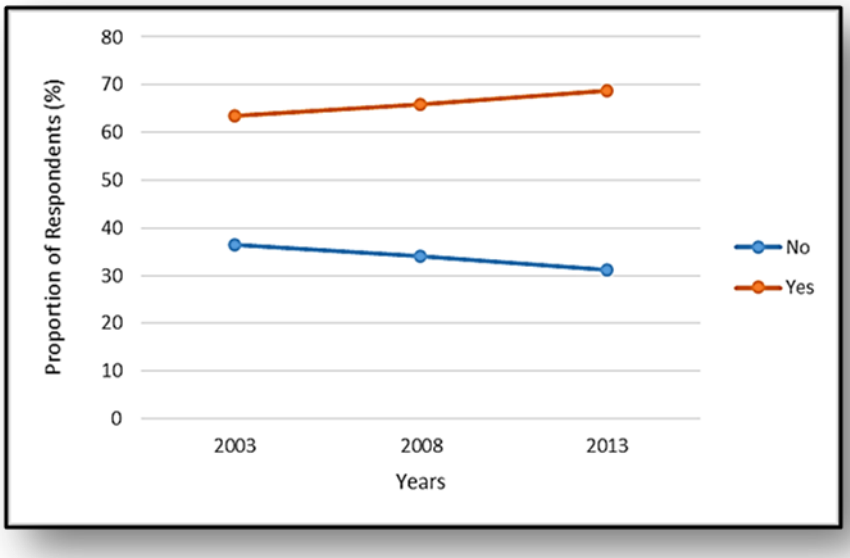


*Figure 2: Weighted pattern of occupational status of the respondents across the three surveys*

However, this does not translate to better living with respect to income, as the population of women who are earning poor income seem to be on the increasing while the middle and rich income earners showed depreciation over the years (Figure 3).

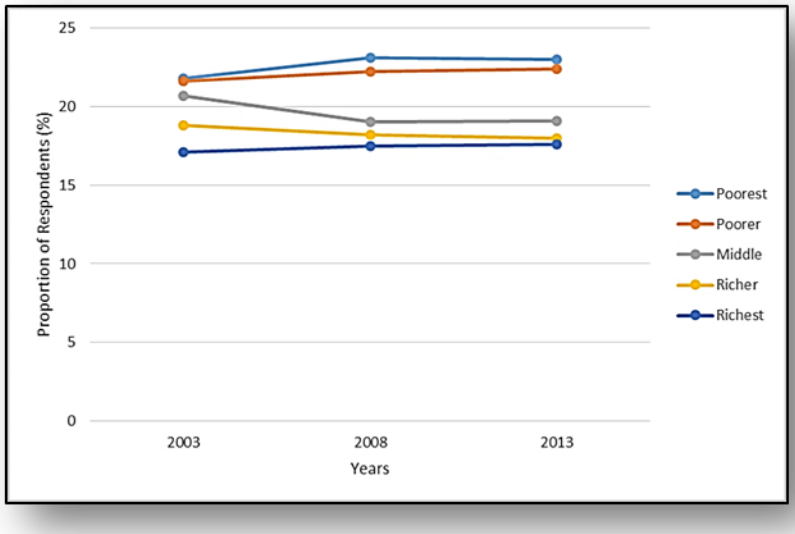


*Figure 3: Weighted pattern of income level of the respondents across the three surveys*

Comparison across the three surveys suggested a continuous migration of women from the rural to the urban areas over the 10 year period (see Figure 4)

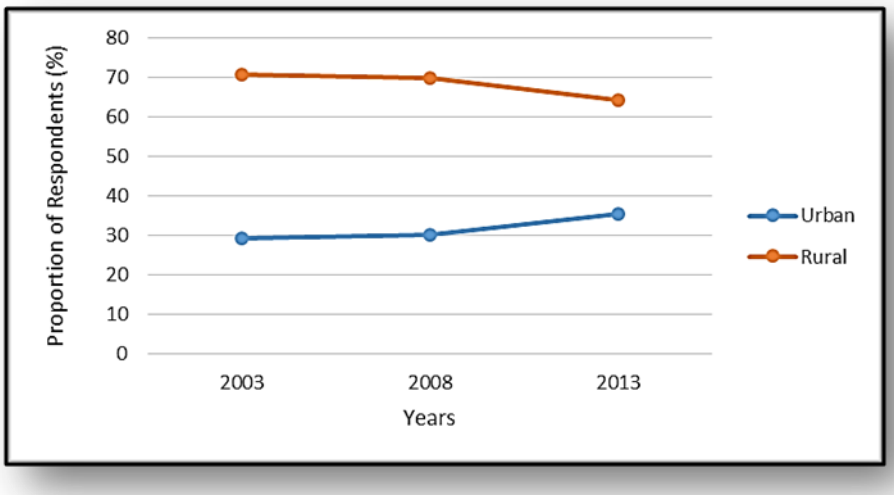


*Figure 4: Weighted pattern of the residential settings of the respondents across the three surveys*

The prevalence of U5M and APO in Nigeria may be on the decreasing trend (see Figure 5), however, in a slow pace. The proportion of women who had experienced U5M within the last 5 years preceding 2003 was 19.3%. This outcome dropped to 15.4% in 2008 and further to 12.7% in 2013, suggesting an overall approximately 34% (6.5) reduction in 10 years. This improvement shows that the proportion of women whose children die within their first 5 years is gradually reducing; thus, suggesting gradual reduction in the U5M rate and prevalence in the country. It is pertinent to note that the results in Figure 5 is only an indication of the trend of U5M prevalence in the country and could serve as a good proxy for U5M prevalence, but not the actual U5M prevalence or rate; therefore, caution should be applied in the interpretation of the results.

In a similar pattern, the proportion of women with an event of APO in 5 years preceding 2003 was 17% which dropped to 13% in 2008 and finally 11.6% in 2013. This pattern also suggested an ultimate likely reduction of prevalence of APO by 32% in 10 years. However slow this development may seem, it could depict a commendable improvement in the country.

The figure also presented the development of women's access to prenatal healthcare and vaccination of their children over the years. It demonstrated a higher prevalence in terms of access to prenatal care and measles vaccination overtime, during the three years studied (see Figure 5).

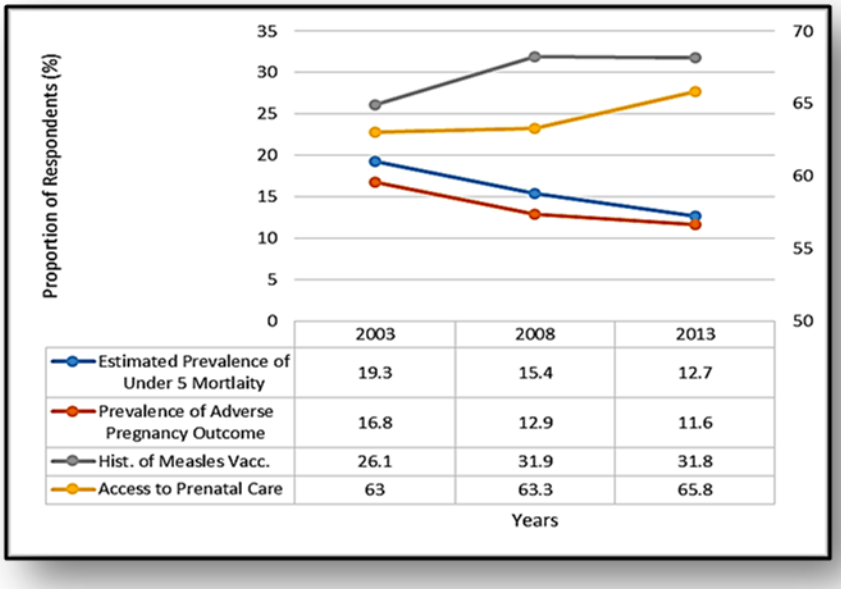


*Figure 5: Weighted pattern in the prevalence of women with U5M and APO*

**Demographic Characteristics of the Pooled Samples (2008 and 2013 Surveys)**

This section describes the descriptive characteristics of the pooled datasets (2008 and 2013) used to answer research questions 1 and 2. The weighted total sample size of

the combined participants was 38,108. The average age of the participants was 29 years old with minimum and maximum ages at 15 and 49 years respectively (Table 5). The table shows that majority (26%) of the women were between the age of 25 to 29 years old. Most of them (46.7%) had no formal education. While many (67%) of the women were engaged in some jobs, majority (45%) still earned poorly. Majority (67%) also lived in the rural areas and dominated by Hausas (32%) as a single largest tribe constitution.

Table 5

*Key Demographic Descriptions of the Samples - Frequencies and Percentages*

| Demographic Characteristics | 2008/2013 | |
|---|---|---|
| **Age Groups** | | |
| 15-19 | 2491 | 6.5 |
| 20-24 | 7407 | 19.4 |
| 25-29 | 10069 | 26.4 |
| 30-34 | 7864 | 20.6 |
| 35-39 | 5844 | 15.3 |
| 40-44 | 3071 | 8.1 |
| 45-49 | 1355 | 3.6 |
| Weighted Total (n) | 38102 | 100.0 |
| **Highest Educational Level** | | |
| No education | 17811 | 46.7 |
| Primary | 7927 | 20.8 |
| Secondary | 10031 | 26.3 |
| Higher | 2333 | 6.1 |
| Weighted Total (n) | 38102 | 100.0 |
| **Occupational Status** | | |
| No | 12332 | 32.6 |
| Yes | 25553 | 67.4 |
| Weighted Total (n) | 37885 | 100.0 |

(*table continues*)

| Demographic Characteristics | 2008/2013 | |
|---|---|---|
| **Income Level** | | |
| Poorest | 8772 | 23.0 |
| Poorer | 8504 | 22.3 |
| Middle | 7252 | 19.0 |
| Richer | 6878 | 18.1 |
| Richest | 6696 | 17.6 |
| Weighted Total (n) | 38102 | 100.0 |
| **Type of Residence** | | |
| Urban | 12608 | 33.1 |
| Rural | 25494 | 66.9 |
| Weighted Total (n) | 38102 | 100.0 |
| **Ethnicity** | | |
| Hausa | 12104 | 31.8 |
| Igbo | 4252 | 11.2 |
| Yoruba | 5126 | 13.5 |
| Others | 16621 | 43.6 |
| Weighted Total (n) | 38102 | 100.0 |

*Current age = 29, n = 38102, Std. dev. = 7.3, Min = 15, Max = 49, Std. err = 0.038;*
*Age at first cohabitation = 17.6, N = 37228, Std. dev. = 4.5, Min = 15, Max = 49, Std. err = 0.024;*

## Test of Hypotheses by Research Questions

### Research question 2

Research Question 2 attempted to determine "*to what extent do socioeconomic factors (level of education, income level, employment/work status, and type of residential setting) predict U5M in Nigeria?*" Table 6 shows that the four main predictors with their interactive effect were considered at once in the model and the model demonstrated a high statistical significance $X^2(21) = 293.41$, $p < 0.001$. The model shows that education level, income level, and residence setting are statistically significant predictors of U5 mortality at $\beta(3) = 41.4$, $p < 0.001$; $\beta(4) = 40.04$, $p < 0.001$; and $\beta(1) = 7.83$, $p < 0.01$

respectively, while the occupational engagement in which the women had was not statistically significant predictors of U5M. Considering the respective highest levels of the predictors against their reference levels of the categories, their odds ratios in similar order were OR = 1.84, CI (1.48, 2.29); OR = 1.61, CI (1.35, 1.21); OR = 0.86, CI (0.77, 0.96).

Table 6

*Model of Education Level, Occupational Status, Income Level, and Residential Setting on Under-Five Mortality,*

| Parameter Estimates | B | Std. Error | Wald. | Exp(B) | 95% Confidence Interval for Exp(B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| **(Intercept)** | -2.601 | .108 | 3792.54*** | .074 | .060 | .092 |
| **Educational Level** | | | 41.41*** | 1.000 | | |
| No Education | 0.608 | 0.112 | | 1.837 | 1.475 | 2.289 |
| Primary | 0.536 | 0.112 | | 1.709 | 1.372 | 2.128 |
| Secondary | 0.320 | 0.107 | | 1.377 | 1.116 | 1.699 |
| **Residence Setting** | | | 7.83** | 1.000 | | |
| Urban | -0.153 | 0.055 | | .858 | .771 | .955 |
| **Occupational Status** | | | 1.68 | 1.000 | | |
| No | -0.049 | .037 | | .953 | .885 | 1.025 |
| **Income Level** | | | 40.04*** | 1.000 | | |
| Poorest | 0.475 | 0.090 | | 1.609 | 1.350 | 1.917 |
| Poor | 0.505 | 0.086 | | 1.657 | 1.399 | 1.963 |
| Middle | 0.278 | 0.084 | | 1.320 | 1.119 | 1.557 |
| Richer | 0.256 | 0.076 | | 1.292 | 1.114 | 1.500 |

*n = 37884; * = p < 0.05, ** = P < 0.01, *** = p < 0.001; Model Chi Sq = 293.41; Cox & Snell R-Sq = 0.013; Negelkerke R Sq = 0.023; classification % correct = 86.1%; α = 0.05;*

*Dependent Variable: Under 5 Mortality (reference category = No)*
*Unadjusted Model: (Intercept), Educational Level, Residency Setting, Occup_Status, Income level*
*Reference categories: higher education, rural, yes, richest*

On further analyses to ascertain the predictive strengths of the statistical significant predictors, the model was further adjusted for other covariates such as marital status, age at first cohabitation, ethnicity, current age, severe domestic violence, access to prenatal healthcare, and child measles vaccination history. Table 7 demonstrated that the predictive strength of education level, income level, and residential setting remained statistically significant; however, there were significant decreased moderations in the Wald values of education level ($\beta(3) = 17.52$, $p < 0.001$) and income level ($\beta(3) = 14.00$, $p < 0.01$), while a significant improvement on the Wald value and statistical significance of occupational status ($\beta(1) = 10.25$, $p < 0.05$). However, occupational status remained statistically insignificant. This suggests that some of the covariates could be effect modifiers/moderators and confounders of the effects of the independent variables over the dependent variable.

Table 7

*Model of Education Level, Occupational Status, Income Level, and Residential Setting on Under-Five Mortality,*

| Parameter Estimates | B | Std. Error | Wald. (df) | Exp(B) | 95% Confidence Interval for Exp(B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| **(Intercept)** | -3.24 | 0.507 | I34.25*** (1) | .039 | 0.014 | 0.106 |
| **Educational Level** | | 0.195 | 17.50*** (3) | 2.075 | 1.417 | 3.040 |
| No Education | 0.73 | 0.189 | | 2.141 | 1.478 | 3.101 |
| Primary | 0.76 | 0.178 | | 1.735 | 1.225 | 2.458 |
| Secondary | 0.55 | | | 1.000 | | |
| **Residence Setting** | | 0.076 | 4.30* (1) | 0.854 | 0.736 | 0.992 |
| Urban | -0.16 | | | 1.000 | | |
| **Occupational Status** | | 0.057 | 2.23 (1) | 0.919 | 0.822 | 1.027 |
| No | -0.09 | | | 1.000 | | |
| **Income Level** | | 0.137 | 14.00** (4) | 1.400 | 1.069 | 1.833 |
| Poorest | 0.34 | 0.133 | | 1.419 | 1.093 | 1.842 |
| Poor | 0.35 | 0.125 | | 1.128 | .882 | 1.442 |
| Middle | 0.12 | 0.113 | | 1.052 | .843 | 1.314 |
| Richer | 0.05 | | | 1.000 | | |

*n = 27005; * = p < 0.05, ** = P < 0.01, *** = p < 0.001; Model Chi.sq = 278.31***; df = 20; Cox & Snell R-Sq = 0.017; Negelkerke R Sq = 0.039; classification % correct = 91.9%; α = 0.05;*

*Dependent Variable: Under 5 Mortality (reference category = No)*

*Adjusted Model: (Intercept), Educational_Level, Residency_Setting, Occup_Status, Income_Level, Marital_Status, Ethnicity_2***, Access_Prenatal_Care**, Measles_Vacc***, Severe_Dom_Violence*, Age, Age_Cohabitation*

The predictive strength of the socioeconomic status index (SES) on the U5M was determined in a model adjusted for other covariates (see Table 8). The table showed that SES index of women could be a strong predictor of U5M at $\beta(2) = 42.72$, $p < 0.001$.

Table 8

*Model of SES Index on Under-five Mortality*

| | B | S.E. | Wald (df) | Exp(B) | 95% C.I.for EXP(B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| **(intercept)** | -2.78 | 0.466 | 116.13*** (1) | | .025 | .154 |
| **SES_Index_Group** | | | 42.70*** (2) | | | |
| Low | 0.66 | 0.10 | | 1.93 | 1.589 | 2.354 |
| Medium | 0.41 | .0.09 | | 1.51 | 1.263 | 1.803 |

*n = 27005; * = p < 0.05, ** = P < 0.01, *** = p < 0.001; Model Chi.sq = 260.32***; df = 13; Cox & Snell R-Sq = 0.015; Negelkerke R Sq = 0.04; classification % correct = 91.9%; α = 0.05;*
*Dependent Variable: Under 5 Mortality (reference category = No)*
*Adjusted Model: (Intercept), SES_Index_Group, Marital_Status, Ethnicity_***2, Access_Prenatal_Care**, Measles_Vacc***, Severe_Dom_Violence*, Age, Age_Cohabitation*

The results suggested that socioeconomic factors (*education* level, income level, and residential setting) are statistical significant predictors of U5M. This implies that women with low socioeconomic factors or socioeconomic index could be at greater risk of losing their children early, within the first 5 years of their (children) lives. By these findings, the null hypotheses that there is no statistically significant association between, educational level, income level, employment /work status, and type of residential setting of women, and U5M after controlling for demographic factors (age of the woman at first

marriage, ethnicity, marital status, and domestic violence) , access to healthcare, and child vaccination history would be rejected.

It is pertinent to note that maternal access to health care and history of child measles vaccination, as a proxy of vaccination in my study, demonstrated statistically significant associations with U5M. Child measles vaccination history in particular, was statistically significant at $X^2 = 55.13$, Exp = 1.65, $p < 0.001$ (Table 7 and 8). This suggests that women who had vaccinated their children i.e. a history of measles vaccine may be at higher risk of losing their children in their (children) first 5 years of life..

**Research question 3**

Research question 3 attempted to determine "*To what extent does history of APO (miscarriage, induced abortion, or still birth) predict U5M in Nigeria?*" The first test model considered the predictor "*Ever_Term_Pregnancy*", which depicts if the respondent has ever experienced terminated pregnancy in any adverse outcome (miscarriage, abortion, and still birth), and the outcome variable "*Under- five mortality*" while controlling for the covariates: educational _level, residency setting, sex of child, access to prenatal care, severe domestic violence, and age at first cohabitation. The predictive strength of the model was very statistically significant at $X^2(9) = 20.43$, $p < 0.001$ as well as the predictive strength of history of adverse pregnancy outcomes at $\beta(1) = 24.98$, $p < 0.001$, OR = 0.74 (see Table 9). However, the model above was further controlled for the history of child measles immunization. Though the predictive strength of the entire model improved to $X^2(10) = 21.28$, $p < 0.001$, the history of APO drastically lost its predictive

effect and statistical significance on the U5M from $\beta(1) = 24.98$, $p < 0.001$ to $\beta(1) = 1.42$, $p > 0.05$ (Table 9).

Table 9

*Model of Averse Pregnancy Outcome on Under-five Mortality, Controlling for the Covariates*

| a | Parameters | B | S.E. | Wald (df) | Exp(B) | 95% C.I.for EXP(B) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| | (intercept) | -1.83 | 0.20 | 188.7*** (1) | 0.16 | .011 | 0.24 |
| | **Adverse Preg. Outcome** | | | 24.98*** (1) | | | |
| | No | -0.30 | 0.06 | | 0.74 | 0.66 | 0.83 |

| b | | B | S.E. | Wald (df) | Exp(B) | 95% C.I.for EXP(B) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| | (intercept) | -2.91 | 0.27 | 232.7*** (1) | 0.05 | .032 | 0.092 |
| | **Adverse Preg. Outcome** | | | 1.42 (1) | | | |
| | No | -0.97 | 0.08 | | 0.91 | 0.77 | 1.06 |

** = p < 0.05, ** = P < 0.01, *** = p < 0.001; Dependent Variable: Under 5 Mortality (reference category = No) a = controlled model without Measles_Vacc; b = controlled model with Measles_Vacc.*
*[a]Adjusted Model Chi.sq = 20.43***; df = 9; Cox & Snell R-Sq = 0.012; Negelkerke R Sq = 0.022; classification % correct = 86.4%; α = 0.05; n = 29070; Model: (Intercept), Adverse_Preg_Outcome***, Educational_Level***, Residency_Setting**, Sex_Child, Access_Prenatal_Care*, Age_Cohabitation***
*[b]Adjusted Model Chi.sq = 21.28; df = 10; Cox & Snell R-Sq = 0.013; Negelkerke R Sq = 0.03; classification % correct = 91.9%; α = 0.05;n = 27112;Model: (Intercept), Adverse_Preg_Outcome, Educational_Level***, Residency_Setting***, Sex_Child, Access_Prenatal_Care*, Measles_Vacc***, Age_Cohabitation***

The results from table 7 ultimately indicated that history of APO is not associated with U5M. This could also indicate that a child from a woman who had experienced any form of APO is not at higher risk of death within his/her first 5 years of life. However, the woman with APO history may be more likely to vaccinate her children, perhaps, such adverse experience could spur them into taking more caution and care of their children. This suggested that vaccination history of a child may be a strong confounder of the effect of APO on U5M. With these findings, the null hypothesis that there is no statistically significant relationship between history of pregnancy outcomes andU5M, after controlling for age at first marriage, sex of the child, type of the residential setting, mother's educational level, access to health care, and vaccination history would not be rejected.

Similar to the results to RQ2, access to prenatal care and child vaccination history had also demonstrated statistical significant associations with U5M, with the child vaccination history making a stronger statement on its association with U5M at $X^2 = 92.3$, $p < 0.001$ over access to prenatal care at $X^2 = 4.17$, $p < 0.05$. Other covariates demonstrating statistical significant associations in the model include maternal educational level, residential setting, and age at first cohabitation.

**Research question 4**

Research question 4 determines how consistent in the direction and statistical significance is the association between APO and U5M from 2003 to 2013 in Nigeria? The first section of the results describes some common demographic characteristics/patterns of the various study samples across the 3 years of interest (2003,

2008, and 2013) within the space of 10 years (see Table 3 above). The results demonstrated that samples were very similar in characteristics and sufficiently reliable to meet the assumptions of homogeneity of the samples to test this hypothesis. The sample size is statistically sufficiently large to detect considerable study effect.

Table 10 demonstrates that the direction and the statistical significance of the association between history of APO and U5M are consistent /similar over 3 survey years (2003, 2008, and 2013). In 2003, the result showed a positive statistically non-significant association at $\beta(1) = 0.052$, $p > 0.05$; OR = 1.05, CI(0.74, 1.49) between the two variables, after controlling for other covariates. Similarly, in 2008, the association was positive and statistically non-significant at $\beta(1) = 0.02$, $p > 0.05$; OR = 1.02, CI(0.85, 1.23). In 2013, the association was determined at $\beta(1) = 1.35$, $p > 0.05$; OR = 1.15, CI (0.93, 1.39).

Table 10

*Model of Adverse Pregnancy Outcome on Under-five Mortality, Controlling for the Covariates, across the 3 Survey Years*

| 2003 | Parameters | B | S.E. | Wald (df) | Exp(B) | 95% C.I.for EXP(B) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| | (intercept) | 3.079 | 0.73 | 29.47*** (1) | 21.74 | 5.21 | 90.67 |
| | Adverse Preg. Outcome | | | 0.087 (1) | | | |
| | No | 0.052 | 0.18 | | 1.05 | 0.74 | 1.49 |

(*table continues*)

| 2008 | | B | S.E. | Wald (df) | Exp(B) | 95% C.I.for EXP(B) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| | (intercept) | 3.08 | 0.32 | 164.7*** (1) | 21.79 | 11.69 | 40.611 |
| | Adverse Preg. Outcome | | | 0.07 (1) | | | |
| | No | 0.02 | 0.09 | | 1.02 | 0.85 | 1.23 |
| 2013 | | B | S.E. | Wald (df) | Exp(B) | 95% C.I.for EXP(B) | |
| | | | | | | Lower | Upper |
| | (intercept) | 3.05 | 0.32 | 168.4*** (1) | 21.03 | 11.26 | 39.30 |
| | Adverse Preg. Outcome | | | 1.79 (1) | | | |
| | No | 1.35 | 0.10 | | 1.15 | 0.93 | 1.39 |

** = p < 0.05, ** = P < 0.01, *** = p < 0.001; Dependent Variable: Under 5 Mortality (reference category = No) a = 2003, b = 2008, c = 2013.*

*[a] n=3420; Model Chi.sq = 48.30***; df = 9; Cox & Snell R-Sq = 0.03; Negelkerke R Sq = 0.05; classification % correct = 88.1%; α = 0.05; Adjusted Model: (Intercept), Adverse_Preg_Outcome, Educational_Level, Residency_Setting, Sex_Child, Access_Prenatal_Care, Severe_dom_Violence, Age_Cohabitation*

*[b] n=15738; Model Chi.sq = 142.23***; df = 9; Cox & Snell R-Sq = 0.014; Negelkerke R Sq = 0.03; classification % correct = 90.8%; α = 0.05; Adjusted Model: (Intercept), Adverse_Preg_Outcome, Educational_Level, Residency_Setting, Sex_Child, Access_Prenatal_Care, Measles_Vacc, Age_Cohabitation*

*[c] n=18726; Model Chi.sq = 135.8***; df = 9; Cox & Snell R-Sq = 0.012; Negelkerke R Sq = 0.03; classification % correct = 92.6%; α = 0.05; Adjusted Model: (Intercept), Adverse_Preg_Outcome, Educational_Level, Residency_Setting, Sex_Child, Access_Prenatal_Care, Measles_Vacc, Age_Cohabitation*

These results demonstrate the consistency of interest in the tests across the three surveys; thus, the null hypothesis ($H3_0$) that there is no consistency in the direction (positive or negative) and statistical significance of the association between the APO and U5M across the three survey years (2003, 2008, and 2013) after controlling for mother's educational level, age at marriage, sex of the dead child, , type of the residential environment, access to health care, and vaccination history would be rejected. This results has also strengthened the reliability of the findings in research question 2 on the association between the APO and U5M. It suggests that women who have had incidence or cases of APO may actually not be at risk of losing their children within the first 5 years of birth relative to the women who had no past experience of APO. It had also suggested that those who had experienced APO may have been motivated to take extra caution and care of their children for fear of losing them, by up-taking immunization services.

**Summary**

The findings from the statistical tests successfully responded to the three RQs. Results to the first question demonstrated that the socioeconomic status index and factors such as education, income, and the type of place of residence are statistically significant predictors of U5M; thus, the null hypothesis is rejected. This implies that women with low socioeconomic factors or socioeconomic index could be at higher risk of losing their children early, within the first 5 years of their (children) lives. In the second question, the results indicated that history of APO is not statistically associated with U5M; thus, the result failed to reject the null hypothesis. This could also indicate that the children of women who have experienced any form of APO are not at risk of death within their

(children) first 5 years of life; however, the women with APO history may be more likely to immunize their children, perhaps, such experience could spur them into taking more caution and care of their children. Lastly, the tests to the third question demonstrated and further strengthened the consistency of interest in the RQ2 on the association between the APO and U5M across the 3 survey years; thus, the null hypothesis was rejected.

The results demonstrated interesting findings that are capable of spurring laudable practical applications and further studies to improve the findings; however, it is pertinent to review these findings against the literature reviewed in chapter 2 to determine consistencies and differences, as well as limitations of the study. These would be discussed in the next chapter, chapter 5 in which the findings would be interpreted in the context of the literature, and the limitations and implications of the study would be discussed.

# Chapter 5: Discussion, Conclusions, and Recommendations

## Introduction

The purpose of the study is to determine whether the use of history of APO (miscarriage, abortion, still birth) and maternal socioeconomic factors (income, occupation, education level, and residential area) could possibly predict the death of children under-5 years of age, among women of reproductive age in Nigeria. The study is essentially a secondary data analysis of primary datasets obtained from the Nigeria Demographic and Health Surveys (NDHS) which used cross-sectional method and a face-to-face questionnaire administration technique to elicit data from the respondents. The study was considered necessary in the prevailing burden of U5M in Nigeria and in Africa as a continent.

Using complex samples logistic regressions, the relevant univariate and multivariate analyses to test the study hypotheses were conducted. The results showed that the socioeconomic factors such as education level of a woman, her income level, and the developmental setting of where she lives were statistically significant predictors of U5M, after controlling for the relevant covariates; thus, the first null hypothesis was rejected. The results indicated that history of APO was not statistically associated with U5M; thus, the second null hypothesis could not be rejected. The study further demonstrated that the direction and statistical significance of the association between APO and U5M are similar across the three surveys (2003, 2008, 2013) of interest, and this finding further strengthen the reliability of the identified association in Research Question 2; thus, the third null hypothesis was rejected.

## Interpretation and Findings

### Descriptive Statistics

The descriptive statistics demonstrated that the respective samples from three surveys used in my analyses were very similar in all core demographic characteristics; thus, suggesting that the homogeneity and consistency of the samples. This is a positive finding in support of the other inferential statistics. The composition of the samples on the relevant demographic characteristics such as age, type of residential settings, ethnicity, marital status and a number of socioeconomic characteristics were essentially the same across the three surveys. The consistency in the samples as observed is sufficient to rule out the fact that certain sampling errors or selection biases in the samples are significantly minimized; however, the samples were weighted to reflect a reliable representativeness of the true populations considering the selections on three different occasions in a space of 10 years. This supports the assumption that any observed changes in the populations sets could be as a result of true changes in the factors observed in the population.

However, it was observed that the weighted sample size in 2003 was relatively very low (3,911). With others having over 17,000 participants, one may argue that that individual study powers could be different and may obscure certain effects in the comparative analyses of the surveys. This means that the inability to detect certain effects in 2003 survey as against that of 2008 and 2013 may be attributed to the different study powers reflected in the sample sizes.

The study observed some significant trends in some of the core demographic characteristics. There seemed to be an increasing pattern in the proportion of women who were engaged in some form of formal education and furthered their education to higher levels (secondary and tertiary levels). This pattern also demonstrated a reverse trend in the proportion who attained only primary education level. The results also showed that proportion of women who were engaged in some form of paid jobs (occupational status) increased over time, from 64% in 2003 to 69% in 2013; however, this did not translate well with the earning power of the women. The income trend shows that more women may be getting poorer and the rich among them getting fewer. The SES index reflected a likely overall improvement in the socioeconomic status of the women. There was slight decline in the size of the subpopulation with low SES, a significant decline in size of those at the medium status and a slight increase of those on the high status; however, in overall, majority of the women (over 40%) belonged to the low SES, across the years.

**Patterns in the prevalence of U5M, Adverse Pregnancy Outcomes and other Related Health Behaviors.**

U5M is commonly measured in rates. It is described as the number of deaths of children under-five that occurred out of 1000 live births within a specified period (NPC, 2013). This could also be interpreted as the probability that a baby newly born in that specific year will die before reaching his or her fifth year of life. On this note, this measure is not the same with the prevalence of such cases which is the number of such cases existing among the exposed population at a specific time (point prevalence) or

specific period of time (cumulative prevalence) (Frankfort-Nachmias, & Nachmias, 2008).

In the study, the estimation of U5M rate in Nigeria was outside the proposed scope of my study; however, I attempted to estimate the prevalence of U5M using the reported history of the incidence by the respondents who were actually women within their reproductive age (15 – 49 years). The estimate counted a woman who reported having lost a child under-5 years of age as just one dead child; hence, did not include other possible multiple deaths or experiences she might have; that is to say multiple child deaths per woman was noted considered in the estimate; just as other multiple births alive over the 5 years of consideration. So this estimate is used as a very close proxy for U5M as reported by the respondents. Besides, information bias and recall errors, the prevalence of APO presented in the study could be a more accurate estimate as this is a direct outcome from the participants.

The study demonstrated a likely improvement trend on U5M and APO in Nigeria. This outcome dropped by 34% from 2003 to 2013. This improvement shows that the proportion of women whose children die within their first 5 years is gradually reducing; thus, suggesting gradual reduction in the U5M rate and prevalence in the country. This finding tend to agree with report by TWB (2015) which showed that Nigeria demonstrated a slight improvement in the U5M rate from 131 deaths per 1000 live births in 2010 to 117 in 2013, that is in a space of 3 years. This supports that the U5M prevalence measurement in the study could serve as a good proxy for U5M rate; however, caution should be applied in the interpretation of the results.

In a similar pattern, the proportion of women with an event of APO in 2003 was 17% which dropped to 11.6% in 2013; showing a reduction of prevalence of APO by 32% in 10 years. The results have also showed that the women attitudes to accessing healthcare during pregnancy and vaccinating their children may have improved over time. When these trends are carefully reviewed, that is, the demographic and health behavioral developments over time with the pattern of U5M and APO, one could logically argue that the demographic factors and the uptake of health care services could be associated with the health outcomes.

**Socioeconomic Factors as Predictors of U5M**

As already indicated in my descriptive statistical findings, my study suggested that that educational level, income level, and occupational status of women are reliable predictors of U5M in multivariate analyses. This further suggested that women with low socioeconomic factors or socioeconomic status index could be at higher risk of losing their children within the first 5 years of age . These findings are in concurrence with several studies in the literature. In a similar work in Abu-Dhabi et al. (2003) reported that lack of education and low monthly income among women are significantly associated withU5M. In a cross-sectional trend study in 3 years in Uganda, Ayiko, Antai, and Kulane (2009) demonstrated that a mother's educational level posed significant risk to the death of her child in the first 5 years of life. Ezeh et al, (2015) noted significant associations among no formal education, and household level poverty with child mortality. Li et al. (2015) in their work in Northwestern China noted that low / poor income status could be associated with neonatal deaths . In other similar work Nigerian

women in Abia State, Danawi and Ogbonna, (2014) reported an inverse association between socioeconomic status of parents and infant mortality rate.

The literature has shown that the finding is no longer strange globally considering the geographical coverage within the context and scope of the research. However, it may be useful to note that my finding is in contrary to the report from Asling-Monemi et al. (2008) that mother's lack of education was not necessary associated with U5M but suggesting other undisclosed and concealed elements that may be confounding the effect of low education among women. Without ignoring the report from Asling-Monemi, there are majority voice in the literature that supported the inverse association between both household and women socioeconomic factors and child mortality.

The influence of residential setting is not yet clear or rather not yet convincing. The finding does not agree with literature in this context but may agree in another context. In the context SES factors with U5M, the study demonstrated that type of residential setting of a women (rural or urban) does not agree with that of Ezeh et al. (2015). They noted that residence in the rural areas could pose some level of risk to the survival of U5; however, their findings were not clear as to whose residential status was the study referring to, the mother or the child. Again, period of residence could matter and should be considered. For example, there might be sudden or regular migration issues in which people (participants) could migrate from rural to urban and vice versa at will. Then development or urbanization is a constant process and may have many definitions. It was not clear which definitions or classifications factors that were used by the authors for urban and rural . So, lack of standardized definition may be contributing to this

disagreement. In another study, Ayiko et al (2009) suggested that region of residence could be associated with U5M, however, by its definition of region, the authors referred to geographical region of residence different from the developmental region of residence meant in my study.

As noted in the literature, the maternal access to prenatal care and child vaccination history were important health care factors that could be associated with postnatal health outcomes. Joshi et al (2014) suggested that ANC visits were associated with decreasing level of maternal and neonatal deaths. This was similar to my side findings in the RQ2 result section that prenatal care access was statistically significantly associated with U5M; however, the direction of the association was not clear as that was not the focus of my study objectives. Mangwi et al (2014) suggested that ANC services may not predict good postnatal practices among the women.

**APO as Predictor of U5M**

The hypothesis that APO could be associated with U5M stemmed from the fact that these two outcomes share similar factors and circumstances. For example, Ezeh et al. (2015), Ayiko et al. (2009), and several others noted earlier, demonstrated that SES of a woman or household is associated with U5M; in another study, Kochar et al. (2014) also noted the significant impact of SES on APO among women of reproductive age in India. Similar common findings were made of maternal illicit substance abuse with APO (Feodor-Nilsson et al, 2014) and neonatal death (Bailey & Sokol , 2011; Greenwood et al, 2010). It becomes logical to hypothesize that these two health outcomes could be associated in direct positive proportions and could have useful practical implication due

to the temporality that exists among the outcomes, i.e. APO occurring before U5M by chronological process. However, the study demonstrated that there was initial statistical significant association between the two outcomes after controlling for all other potential confounders and covariates, except for history of measles vaccination of the child.

The inclusion of the child vaccination history in the model completely modified the statistical significance and the predictive value of APO (Wald and OR) were drastically reduced, and the statistical significance of the association was completely lost. This interesting finding goes to suggest that potential confounding effect of child vaccination on history of APO and this could inspire further researches on the likely relationship between APO and child vaccination. Ultimately, APO was not a statistical significant predictor of U5M and the null hypothesis still holds. Interestingly, though the knowledge on this association in the literature is still limited, a couple of related studies in the literature found support from this finding. Bicking et al. (2013) noted that history of APO was not associated with maternal birth experience or adverse birth outcomes which included neonatal death. In the contrary to the study finding, Kochar et al. (2014) suggested that induced abortion rate was inversely associated with neonatal mortality rate, which implies that higher rate of induced abortion could be associated to lower rate of neonatal mortality.

The third finding in Research Question 3 was not different from that in Research Question 2. The result was intended to affirm the association between APO and U5M in three survey samples from three different survey years 2003, 2008, and 2013. The results demonstrated no association between the two variables. The similarity from the three

samples was a sufficient affirmation of no statistical significant relationship between APO and U5M. The interesting finding on the strong confounding effect of child vaccination was still observed here. Though the confounder was not a variable of interest in the study, but its role became very important as it attempts to explain why the statistical significant association between APO and U5M suddenly disappeared in the last confirmatory model for APO and U5M. This, to an extent, may describe the similar weird finding by Kochar et al. (2014). The author observed an inverse significant association between abortion (a component of APO) and neonatal mortality (a subset of U5M). Although, subject to further more robust studies, the study finding suggested that women who had experienced any form of APO may have been spurred by such experience to provide more safety measures in caring for the children; thus, ameliorate the risk of U5M including neonatal mortality. Such precautions may include uptake of early and adequate immunization of the child and strict compliance to other medical / health instructions.

**Limitations of the Study**

The study limitations are likened to a typical secondary data analysis in which the author lacked control over the design effect and quality of the data management processes of the primary study; hence, study errors from the main study (NDHS) could be transferable to this study.

Secondly, in order to increase the accuracy of the computations of outcome variable of interest (U5M) from the original datasets, only women who had at least a birth event within the last 5 years preceding the survey were included the study and this informed the study sample sizes for both the combined dataset (2008 and 2013) and the

datasets for the individual years (2003, 2008, 2013) . With this exclusion criterion, the sample integrity with respect to the representativeness /external validity may have been slightly distorted and the level of distortion could not be ascertained within the scope of the study. However, the weighting of the of the demographic characteristics across the three surveys and the application of the complex samples tests, as shown in the results, demonstrated high compliance to sampling and design integrity. This procedure is among the major strengths of this study.

The U5M and APO measurements were estimated from the reported experience of the women and not a direct count from a reliable record; thus, the reports may lack some accuracies due to information bias and recall errors. It is also noted that most women were not experienced to detect or recognize minor and mild APOs except for those detected clinically and made known to them (Abiola et al., 2013); thus, a good measure of this outcome could be lost and the true prevalence of the outcome in the populations under-reported in the surveys.

The result trends presented in this paper should be interpreted with caution as the results presented for the 10-year period did not cover the individual years from 2003 to 2013, rather it reports only the three survey years (2003, 2008, and 2013) typically covered and studied by the NDHS and those were the only datasets available for the country in the 10 year period . However, it is important to mention that the individual surveys essentially elicited data and information from the events and occurrences that happened in the last 5 years preceding the survey. In this way, outcomes of events in the 5 year period were estimated (USAID, 2015a)

As typical with the cross-sectional methods, the identified associations among the variables do not imply causality. As much as the theoretical context of the study was based on the LCHD theory and FP, the temporality of the independent events or the predicting factors and the U5M was not ascertained in the datasets. For example, a participant's socioeconomic information as elicited by the questionnaire did not include the element of time of occurrence. For the APO, an attempt to include temporality reduced the sample sizes drastically and the study power would be affected; hence, such element was ignored. This is to say that it is possible that a participant could report an APO event occurring for the first time after her births within the 5 year period under consideration.

The 2003 survey did not collect data on some covariates of interest such as ethnicity and domestic violence. Hence, this presented some challenges in pooling the three data sources for all the research questions (RQ 1 and 2), so the survey dataset was not included in responding to RQ 1 and 2. However, this limitation did not pose any significant threat to the validity of the results in RQ1 and 2 because sufficient sample sizes (at least more than 26,000 participants) were generated for any of the statistical tests. The limitation may only suffice in the effect / association trend analysis in RQ 3 in which no or low effect detection may be attributed to relatively low sample size.

Lastly, my study observed that no occupation or lack of any job engagement by a woman may not pose significant threat to the lives of her children; however, this should be interpreted with care because it was not clear from the main study how this variable is defined. I could not ascertain how the respondents understood the job engagement as.

The DHS recode manual described this variable as "whether the respondent is currently working" and this could be assumed as having engaged in any form of job that one earned money or any form of benefits or remuneration. However, people may perform or engage in certain work to simply claim work status or survive at the minimum, but such jobs may not be paying regularly or not even constant. So, the description is vague and could be misinterpreted and pose huge self-reported bias. This classification or assumption may be different from other studies and this may hinder accurate comparison of findings.

## Recommendations

Based on the strengths and weaknesses of this study, the following recommendations are needful to strengthen the outcomes and findings of this study in the future studies, particularly in the light of the aforementioned limitations.

- If resources permit, a more robust methodological design such as longitudinal or cohort primary study should be conducted to control the quality and specifications of data collection, description of variables, ensure temporality among the predictors and the outcome variable which would provide a true life course and FP contexts. With this, temporality could be monitored and tracked.
- The confounding effect of child vaccination history or the true association between child vaccination history and APO as related to the U5M should be further investigated. This should be a laudable attempt to investigate and clarify the implied association and the likely social and psychological circumstances surrounding the association.

- The interpretations of my study in the context of the underlying theories - life course development model and FP theory - should be done more carefully. The multi-factorial nature and/or the social factorial diversities associated with the theories need more demystification in both empirical and qualitative contexts. More mixed studies to ascertain the mechanisms of actions/associations and understanding the many social contexts over a life course and periods of pregnancy is needful to improve the interpretations of researches around them.

## Implications

The findings in this study possess solid potentials for positive social change in Nigeria. In general, at the national political level, it could inspire a LCHD agenda in the country's long-term population health towards prioritizing maternal health agenda in the bid to improving the health of the nation. The study had indicated strong dependence of child health on women social and economic welfare; which means that programs or policies that could improve the welfare of women, could as well improve the welfare of children, and this chain of improvement is tied to the future and entire welfare of the nation.

In the notion and persistence of U5M endemic in Nigeria, and with the recent wake of sensitization on women empowerment, this finding could strengthen the empirical evidence and promote more campaign on girl education and equal opportunity employment policy across all levels of the society. This would boost the awareness of the need to promote SES of women toward saving the children and the future. At the individual levels, women are motivated to go to school and be educated; at the family

level, parents will be sensitized, motivated, and committed to sending their female wards to school while men could encourage their wives to attain higher educational levels, organizations could adopt the equal employment policies to encourage more women to attain lucrative positions and associated better income levels, and finally at the societal / policy levels, government could enact more laws and policies to create enabling environments for women to be better empowered such as creating more girls schools at all levels, subsidizing tuition fees for girls/women who are in school, and provide better employment opportunities for women .

The government and other public health stakeholders in Nigeria could commit to improving the welfare of women and children through the promotion of more community based and nation-wide advocacy and awareness programs to sensitize on the role of women, initiation of more women oriented programs toward improved livelihood of the women, increase in budget allocation to maternal health and women affairs, and as far as promoting the role of women in participating in decision making on issues that concerns them . Hence, there could be a significant change in the social and economic welfare of women and children. This change could erupt a strong call wave for women empowerment and which is capable of going beyond Nigeria to other African nations.

The methodological implication of the research is the potential to encourage more time-series cross-sectional studies which is a combination of the merits of cross-sectional and time – factor repetitive methodology used in responding to the third research question. This method could be an intuitive technique for affirming or confirming some initial empirical clues supported through cross-sectional methods without running

through the duration and resource disadvantages associated with longitudinal studies in awkward circumstances .

For practice, I recommend that long-term programs geared toward contributing to reducing U5M in Nigeria and Africa should be encouraged. Such programs should consider including certain strategies driven by women empowerment components for a lasting solution to U5M. By considering the benefits of the reduced risk of U5M, more awareness programs and advocacy to sensitize the families and decision makers should be created and existing ones strengthened for more productive campaigns . Clinicians and physicians should include sensitization briefs on this association to patients. Clinicians may not consider women with history of APO as potential victims of U5M but could also be encouraged to adopt or sustain any healthy habits to could provide additional support to their children.

## Conclusions

The study demonstrated that education level, income level, residential setting, and socioeconomic status index of women are statistically significant predictors of U5M. This implies that children of women with low socioeconomic factors or socioeconomic index could be at higher risk of death within the first 5 years of their lives. The study also indicated that history of APO is not statistically associated with U5M. This could also indicate that the children of women who have experienced any form of APO are not at risk of death within their (children) first 5 years of life compared to children of women who have never had the APO experience. The study was able to demonstrated consistency or reliability of this association between APO and U5M across the 3 survey

years; thus, APO rate may not be a reliable early warning indicator for U5M rate . National attention to women's socioeconomic empowerment agenda may be the only lasting solution to eliminating or drastically reducing U5M in Nigeria.

References

Abiola, A. O., Ajayi, A., Umeh, C. S., Adegbesan-Omilabu, M. O., Olufunlayo, T. F., & Akodu, B. A. (2013). Knowledge, prevalence and psychological effect of miscarriage among women of reproductive age group attending obstetrics and gynaecology clinics of Lagos University Teaching Hospital, Nigeria. *The Nigerian Postgraduate Medical Journal*, *20*(4), 319-324.

Al-Hosani, H. A., Brebner, J., Bener, A. B., & Norman, J. N. (2003). Study of mortality risk factors for children under age 5 in Abu Dhabi. *Eastern Mediterranean Health Journal 9*(3), 333-343.

Alkema, L., & New, J. (2012). Progress toward Global Reduction in Under-Five Mortality: A Bootstrap Analysis of Uncertainty in Millennium Development Goal 4 Estimates. *Plos Medicine*, *9*(12), e1001355-e1001355 1p. doi:10.1371/journal.pmed.1001355

Alwin, D. (2012). Integrating varieties of life course concepts. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *67*(2), 206-220.

Arffin, F., Al-Bayaty, F. H., & Hassan, J. (2012). Environmental tobacco smoke and stress as risk factors for miscarriage and preterm births. *Archives of Gynecology and Obstetrics*, *286*(5), 1187-1191. doi:10.1007/s00404-012-2417-0

Arnhold-Kerri, S., & Sperlich, S. (2010). Do parental resources mediate between social inequality and health-related quality of life of children?. *Gesundheitswesen*, *72*(2), 77-87. doi:10.1055/s-0029-1214398

Asling-Monemi, K., Tabassum Naved, R., & Persson, L. A. (2008). Violence against women and the risk of under-five mortality: analysis of community-based data from rural Bangladesh. *Acta Paediatrica 97*(2), 226-232. doi:10.1111/j.1651-2227.2007.00597.

Ayiko, R., Antai, D., & Kulane, A. (2009). Trends and determinants of under-five mortality in Uganda. *East African Journal of Public Health*, *6*(2), 136-140.

Babirye, J. N., Rutebemberwa, E., Kiguli, J., Wamani, H., Nuwaha, F., & Engebretsen, I. M. (2011). More support for mothers: a qualitative study on factors affecting immunisation behaviour in Kampala, Uganda. *BMC Public Health, 11723*. doi:10.1186/1471-2458-11-723

Bailey, B. A., & Sokol, R. J. (2011). Prenatal alcohol exposure and miscarriage, stillbirth, preterm delivery, and sudden infant death syndrome. *Alcohol Research & Health: The Journal of the National Institute on Alcohol Abuse and Alcoholism*, *34*(1), 86-91.

Barker D. J. (1990). The fetal and infant origins of adult disease. *BMJ 301*: 1111

Barker D. (2007). The origins of the developmental origins theory. *Journal of Internal Medicine. 261*(5):412-417.

Benova, L., Cumming, O., & Campbell, O. R. (2014). Systematic review and meta-analysis: association between water and sanitation environment and maternal mortality. *Tropical Medicine & International Health*, *19*(4), 368-387. doi:10.1111/tmi.12275

Bicking Kinsey, C., Baptiste-Roberts, K., Zhu, J., & Kjerulff, K. H. (2013). Effect of previous miscarriage on the maternal birth experience in the First Baby Study. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*: JOGNN / NAACOG, *42*(4), 442-450. doi:10.1111/1552-6909.12216

Black, R. E., Cousens, S., Johnson, H. L., Lawn, J. E., Rudan, I., Bassani, D. G., & ... Mathers, C. (2010). Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet (London, England)*, *375*(9730), 1969-1987. doi:10.1016/S0140-6736(10)60549-1

Buchner, A., Faul, F., & Erdfelder, E. (2010) *G*Power*. Retrieved from: http://www.gpower.hhu.de

Caragata, L., & Liegghio, M. (2013). Mental Health, Welfare Reliance, and Lone Motherhood. *Canadian Journal of Community Mental Health*, *32*(1), 95-107.doi:10.7870/cjcmh-2013-008

Centers for disease Control and Prevention (2013). Global health – Nigeria. Retrieved from: http://www.cdc.gov/globalhealth/countries/ Nigeria/why/ default.htm

Central Intelligence Agency. (2014). Country comparison: life expectancy at birth. Retrieved from: https://www.cia.gov/library/publications/the-world-factbook /rankorder/ 2102rank.html

Colman, I., Ataullahjan, A., Naicker, K., & Van Lieshout, R. (2012). Birth weight, stress, and symptoms of depression in adolescence: evidence of fetal programming in a national Canadian cohort. *Canadian Journal of Psychiatry*, *57*(7), 422-428 7p.

Creswell, J. W. (2009). Research design: *Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Danawi, H., & Ogbonna, F. (2014). Impact of Socioeconomic Status and Household Structure on Infant Mortality Rate in Abia State of Nigeria. *International Journal of Childbirth Education, 29*(4), 88-94 7p.

Ekwonu, T. (2012). The problem with Nigeria's Health Sector. ANPA - USAID. Retrieved from http://anpa.org/blog/category/usaid/

Elder, G. H., Johnson, M.K. & Crosnoe, R. (2003). The Emergence and Development of Life Course Theory. In: Jeylan T. Mortimer and Michael J. Shanahan (ed.). *Handbook of the Life Course. Springer*, pp. 3–19. New York, NY: Kluwer Academic/Plenum Publishers.

Elder, G.H.,Jnr (1998). The life course as developmental theory. *Child Development, 69*(1), 1-12

Ellison, P. (2010). Fetal programming and fetal psychology. *Infant & Child Development, 19*(1), 6-20. doi:10.1002/icd.649

Ezeh, O. K., Agho, K. E., Dibley, M. J., Hall, J. J., & Page, A. N. (2015). Risk factors for postneonatal, infant, child and under-5 mortality in Nigeria: a pooled cross-sectional analysis. *BMJ Open, 5*(3), e006779. doi:10.1136/bmjopen-2014-006779

Federal Republic of Nigeria (2014). *Global AIDS response country progress report*. Abuja, Nigeria: Federal Ministry of Health.Feodor Nilsson, S., Andersen, P. K., Strandberg-Larsen, K., & Nybo Andersen, A. (2014). Risk factors for miscarriage from a prevention perspective: a nationwide follow-up study. BJOG: *An*

*International Journal of Obstetrics and Gynaecology*, *121*(11), 1375-1384. doi:10.1111/1471-0528.12694

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics* (4th ed.). London, England: Sage.

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences* (7th ed.). New York, NY: Worth.

Gavin, A., Thompson, E., Rue, T., & Guo, Y. (2012). Maternal early life risk factors for offspring birth weight: findings from the add health study. Prevention Science: *The Official Journal of the Society For Prevention Research*, *13*(2), 162-172. doi:10.1007/s11121-011-0253

Gravetter, F. J., & Wallnau, L. B. (2004). *Statistics for the behavioral sciences* (6th ed.). Belmont, CA: Thompson-Wadsworth.

Greenwood, D. C., Alwan, N., Boylan, S., Cade, J. E., Charvill, J., Chipps, K. C., & ... Wild, C. P. (2010). Caffeine intake during pregnancy, late miscarriage and stillbirth. *European Journal of Epidemiology*, *25*(4), 275-280. doi:10.1007/s10654-010-9443-7

Gulliford, M., Figueroa-Munoz, J., Morgan, M., Hughes, D., Gibson, B., Beech, R., & Hudson, M. (2002). What does 'access to health care' mean?. *Journal of Health Services Research & Policy*, *7*(3), 186-188.

Hure, A. J., Powers, J. R., Mishra, G. D., Herbert, D. L., Byles, J. E., & Loxton, D. (2012). Miscarriage, preterm delivery, and stillbirth: large variations in rates

within a cohort of Australian women. *Plos One*, 7(5), e37109. doi:10.1371/journal.pone.0037109.

Islam, M. R., & Odland, J. O. (2011). Determinants of antenatal and postnatal care visits among Indigenous people in Bangladesh: a study of the Mru community. *Rural and Remote Health*, 11(2), 1672.

Joshi, Chandni, Siranda Torvaldsen, Ray Hodgson, and Andrew Hayen. 2014. "Factors associated with the use and quality of antenatal care in Nepal: a population-based study using the demographic and health survey data." *BMC Pregnancy and Childbirth* 14, 94. MEDLINE with Full Text, EBSCOhost (accessed January 16, 2016).

Kahn, R., Wilson, K., & Wise, P. (2005). Intergenerational health disparities: socioeconomic status, women's health conditions, and child behavior problems. *Public Health Reports* (Washington, D.C.: 1974), 120(4), 399-408.

Karl, M. U. (2009). New Directions in Life Course Research. *Annual Review of Sociology* 35: 423–424.

Kayode, G. A., Adekanmbi, V. T., & Uthman, O. A. (2012). Risk factors and a predictive model for under-five mortality in Nigeria: evidence from Nigeria demographic and health survey. *BMC Pregnancy and Childbirth*, 1210. doi:10.1186/1471-2393-12-10

Kitamura, T., Komada, K., Xeuatvongsa, A., & Hachiya, M. (2013). Factors affecting childhood immunization in Lao People's Democratic Republic: a cross-sectional

study from nationwide, population-based, multistage cluster sampling. *Bioscience Trends*, 7(4), 178-185.

Kochar, P. S., Dandona, R., Kumar, G. A., & Dandona, L. (2014). Population-based estimates of still birth, induced abortion and miscarriage in the Indian state of Bihar. *BMC Pregnancy and Childbirth*, 14413. doi:10.1186/s12884-014-0413-z

Levin, K.A. (2006). Study design III: cross-sectional studies. Evidence-Based Dentistry, 7, 24 – 25. Retrieved from: http://www.nature.com/ebd/journal/v7 /n1/full/6400375a.html

Li, C., Yan, H., Zeng, L., Dibley, M. J., & Wang, D. (2015). Predictors for neonatal death in the rural areas of Shaanxi Province of Northwestern China: a cross-sectional study. *BMC Public Health*, 15387. doi:10.1186/s12889-015-1738-x

Low, N. P., Dugas, E., Constantin, E., Karp, I., Rodriguez, D., & O'Loughlin, J. (2012). The association between parental history of diagnosed mood/anxiety disorders and psychiatric symptoms and disorders in young adult offspring. *BMC Psychiatry*, 12188. doi:10.1186/1471-244X-12-188

Luyckx, K., Goossens, E., Rassart, J., Apers, S., Vanhalst, J., & Moons, P. (2014). Parental support, internalizing symptoms, perceived health status, and quality of life in adolescents with congenital heart disease: influences and reciprocal effects. *Journal of Behavioral Medicine*, 37(1), 145-155 11p. doi:10.1007/s10865-012-9474-5

Lynch, S.M. (2008). Race, Socioeconomic status, and health in life-course perspective – Introduction to the special issue, *Research on Aging* 30, 127 – 136.

Mangwi Ayiasi, R., Kasasa, S., Criel, B., Garimoi Orach, C., & Kolsteren, P. (2014). Is antenatal care preparing mothers to care for their newborns? A community-based cross-sectional study among lactating women in Masindi, Uganda. *BMC Pregnancy And Childbirth*, 14114. doi:10.1186/1471-2393-14-114

Mann, C. (2003). Observational research methods. Research design II: cohort, cross sectional, and case-control studies. *Emergency Medicine Journal*, 20(1), 54-60.

Muoneke, V. U., Ibekwe, R. C., Nebe-Agumadu, H. U., & Ibe, B. C. (2012). Factors associated with mortality in under-five children with severe anemia in Ebonyi, Nigeria. *Indian Pediatrics*, 49(2), 119-123.

Nankabirwa, V., Tumwine, J. K., Mugaba, P. M., Tylleskär, T., & Sommerfelt, H. (2015). Child survival and BCG vaccination: a community based prospective cohort study in Uganda. *BMC Public Health*, 15(1), 175-175 1p. doi:10.1186/s12889-015-1497-8

National Population Commission [NPC] (2013). *Nigeria Demographic and Health Survey - 2012.* Abuja, Nigeria: National Population Commission and ICF Macro.

Nattey, C., Masanja, H., & Klipstein-Grobusch, K. (2013). Relationship between household socioeconomic status and under-five mortality in Rufiji DSS, Tanzania. *Global Health Action*, 619278. doi:10.3402/gha.v6i0.19278

Nicoletto, S. F., & Rinaldi, A. (2011). In the womb's shadow. The theory of prenatal programming as the fetal origin of various adult diseases is increasingly supported by a wealth of evidence. *EMBO Reports*, 12(1), 30-34. doi:10.1038/embor.2010.199

Oduwole, T.A., and Fadei, A. O (2013). Gender, economic activities and Poverty in Nigeria. *Journ. Of Res. In Peace, Gender and Dev*. 2(7), 106 - 125

Onwujekwe, O., Hanson, K., & Uzochukwu, B. (2011). Do poor people use poor quality providers? Evidence from the treatment of presumptive malaria in Nigeria. *Tropical Medicine & International Health*: TM & IH, 16(9), 1087-1098.

Shih, Regina A., Bonnie, Ghosh-Dastidar., Karen., L. Margo.,lis, Mary, E., Slaughter, Adria Jewell, Chloe, E. Bird, and Mark A. Espeland, et al. 2011. "Neighborhood Socioeconomic Status and Cognitive Function in Women." *American Journal of Public Health* 101, no. 9: 1721-1728 8p. CINAHL Plus with Full Text, EBSCOhost (accessed November 14, 2015).

Smith, A. K., Ayanian, J. Z., Covinsky, K. E., Landon, B. E., McCarthy, E. P., Wee C. C., & Steinman, M. A. (2011). Conducting high-value secondary dataset analysis: An introductory guide and resources. *J Gen Intern Med*, *26*(8), 920–929.

Song, J., & Chung, K. (2010). Observational studies: cohort and case-control studies. *Plastic and Reconstructive Surgery*, *126*(6), 2234-2242.

Statistics Solutions (2016). Selection process for multiple regression. Retrieved from: http://www.statisticssolutions.com/selection-process-for-multiple-regression/

Stockwell, M. S., Irigoyen, M., Andres Martinez, R., & Findley, S. E. (2014). Failure to Return: Parental, Practice, and Social Factors Affecting Missed Immunization Visits for Urban Children. *Clinical Pediatrics*, 53(5), 420-427 8p. doi:10.1177/0009922814527497

The World Bank (2015). Mortality rate, under-5 (per 1,000 live births). Retrieved from: http://data.worldbank.org/indicator/SH.DYN.MORT

Tesfahun, F., Worku, W., Mazengiya, F., & Kifle, M. (2014). Knowledge, Perception and Utilization of Postnatal Care of Mothers in Gondar Zuria District, Ethiopia: A Cross-Sectional Study. *Maternal & Child Health Journal,* 18(10), 2341-2351 11p. doi:10.1007/s10995-014-1474-3

Trochim, W.M.K. (2006). Statistical power. Retrieved from http://www.socialresearch methods.net/kb/power.php

United Nations Development Program (2015). Nigeria Annual Report 2014. Retrieved from: http://www.ng.undp.org/content/nigeria/en/home /library/human_development/undp-nigeria-annual-report-2014.html

United Nations Children's Fund (2011). Maternal and child health. Retrieved from: http://www.unicef.org/ nigeria/children_1926.html

United States Agency for International Development (2010). Infant and Child Mortality. Retrieved from: http://dhsprogram.com /Topics/Infant-and-Child-Mortality.cfm

United States Agency for International Development (2016). Sampling and weighting with DHS data. Retrieved from: http://blog.dhsprogram.com/sampling-weighting-at-dhs/

United States Agency for International Development (2015a). What we do: DHS overview. Retrieved from: https://dhsprogram.com/What-We-Do/Survey-Types/DHS.cfm

United States Agency for International Development (2015b). Topics: Wealth index. Retrieved from:http://www.dhsprogram.com/topics/ wealth-index/Index.cfm

United States Agency for International Development (2015c). Maternal health. Retrieved from: http://dhsprogram.com/Topics/Maternal-Health.cfm

United States Agency for International Development (2013). Recode6 DHS Manual. Retrieved from: www.dhsprogram.com/pubs/pdf/DHSG4/ Recode6_DHS_22March2013_DHSG4.pdf+recode+manual+dhs

Williams, D. (2002). Racial/ethnic variations in women's health: The social embeddedness of health. *American Journal of Public Health*, 92(4), 588-597.

World Health Organization (2014) Children: reducing mortality. Retrieved from: http://www.who.int/mediacentre/factsheets/fs178/en/

World Health Organization (2012). Maternal, newborn and child health in Nigeria. Retrieved from: http://www.who.int/pmnch/activities/countries /nigeria/en/index3.html

Zubrick, S. (2008). Maternal affective or substance disorders are risk factors for subsequent pregnancy loss. Evidence *Based Mental Health*, 11(1), 29.

Appendix A: Sampling tables from the main study

TableA1

*Sample allocation of clusters and households by state and by residence*

Table B.2 Sample allocation of clusters and households by state and by residence

| | | Number of clusters | | | Number of households | | |
|---|---|---|---|---|---|---|---|
| Geographical zone | State | Urban | Rural | Total | Urban | Rural | Total |
| North Central | Sokoto | 5 | 19 | 24 | 225 | 855 | 1,080 |
| | Zamfara | 4 | 19 | 23 | 180 | 855 | 1,035 |
| | Katsina | 5 | 19 | 24 | 225 | 855 | 1,080 |
| | Jigawa | 2 | 22 | 24 | 90 | 990 | 1,080 |
| | Yobe | 6 | 17 | 23 | 270 | 765 | 1,035 |
| | Borno | 9 | 15 | 24 | 405 | 675 | 1,080 |
| | Adamawa | 6 | 17 | 23 | 270 | 765 | 1,035 |
| North East | Gombe | 5 | 18 | 23 | 225 | 810 | 1,035 |
| | Bauchi | 3 | 21 | 24 | 135 | 945 | 1,080 |
| | Kano | 15 | 25 | 40 | 675 | 1,125 | 1,800 |
| | Kaduna | 11 | 13 | 24 | 495 | 585 | 1,080 |
| | Kebbi | 4 | 19 | 23 | 180 | 855 | 1,035 |
| | Niger | 6 | 18 | 24 | 270 | 810 | 1,080 |
| North West | FCT Abuja | 15 | 8 | 23 | 675 | 360 | 1,035 |
| | Nasarawa | 5 | 18 | 23 | 225 | 810 | 1,035 |
| | Plateau | 7 | 17 | 24 | 315 | 765 | 1,080 |
| | Taraba | 4 | 19 | 23 | 180 | 855 | 1,035 |
| | Benue | 4 | 20 | 24 | 180 | 900 | 1,080 |
| | Kogi | 8 | 16 | 24 | 360 | 720 | 1,080 |
| | Kwara | 16 | 7 | 23 | 720 | 315 | 1,035 |
| South East | Oyo | 17 | 7 | 24 | 765 | 315 | 1,080 |
| | Osun | 18 | 6 | 24 | 810 | 270 | 1,080 |
| | Ekiti | 17 | 6 | 23 | 765 | 270 | 1,035 |
| | Ondo | 11 | 13 | 24 | 495 | 585 | 1,080 |
| | Edo | 13 | 10 | 23 | 585 | 450 | 1,035 |
| South South | Anambra | 19 | 4 | 23 | 855 | 180 | 1,035 |
| | Enugu | 17 | 7 | 24 | 765 | 315 | 1,080 |
| | Ebonyi | 19 | 4 | 23 | 855 | 180 | 1,035 |
| | Cross River | 3 | 20 | 23 | 135 | 900 | 1,035 |
| | Akwa Ibom | 1 | 23 | 24 | 45 | 1035 | 1,080 |
| | Abia | 6 | 17 | 23 | 270 | 765 | 1,035 |
| South West | Imo | 11 | 13 | 24 | 495 | 585 | 1,080 |
| | Rivers | 11 | 13 | 24 | 495 | 585 | 1,080 |
| | Bayelsa | 6 | 17 | 23 | 270 | 765 | 1,035 |
| | Delta | 11 | 13 | 24 | 495 | 585 | 1,080 |
| | Lagos | 40 | 0 | 40 | 1,800 | 0 | 1,800 |
| | Ogun | 12 | 12 | 24 | 540 | 540 | 1,080 |
| Nigeria | | 372 | 532 | 904 | 16,740 | 23,940 | 40,680 |

*Table lifted from the NDHS (2013) pg. 379*

Table A2

*Expected number of female and male interviews by state and by residence*

Table B.3 Expected number of female and male interviews by state and by residence

| | | Women age 15-49 | | | Men age 15-49 | | |
|---|---|---|---|---|---|---|---|
| Geographical zone | State | Urban | Rural | Total | Urban | Rural | Total |
| North Central | Sokoto | 210 | 797 | 1,007 | 93 | 352 | 445 |
| | Zamfara | 168 | 797 | 965 | 74 | 352 | 426 |
| | Katsina | 210 | 797 | 1,007 | 93 | 352 | 445 |
| | Jigawa | 84 | 923 | 1,007 | 37 | 408 | 445 |
| | Yobe | 252 | 713 | 965 | 111 | 315 | 426 |
| | Borno | 378 | 629 | 1,007 | 167 | 278 | 445 |
| | Adamawa | 252 | 713 | 965 | 111 | 315 | 426 |
| North East | Gombe | 210 | 755 | 965 | 93 | 333 | 426 |
| | Bauchi | 126 | 881 | 1,007 | 56 | 389 | 445 |
| | Kano | 629 | 1049 | 1,678 | 278 | 463 | 741 |
| | Kaduna | 462 | 545 | 1,007 | 204 | 241 | 445 |
| | Kebbi | 168 | 797 | 965 | 74 | 352 | 426 |
| | Niger | 252 | 755 | 1,007 | 111 | 333 | 444 |
| North West | FCT Abuja | 629 | 336 | 965 | 278 | 148 | 426 |
| | Nasarawa | 210 | 755 | 965 | 93 | 333 | 426 |
| | Plateau | 294 | 713 | 1,007 | 130 | 315 | 445 |
| | Taraba | 168 | 797 | 965 | 74 | 352 | 426 |
| | Benue | 168 | 839 | 1,007 | 74 | 371 | 445 |
| | Kogi | 336 | 671 | 1,007 | 148 | 296 | 444 |
| | Kwara | 671 | 294 | 965 | 296 | 130 | 426 |
| South East | Oyo | 713 | 294 | 1,007 | 315 | 130 | 445 |
| | Osun | 755 | 252 | 1,007 | 333 | 111 | 444 |
| | Ekiti | 713 | 252 | 965 | 315 | 111 | 426 |
| | Ondo | 462 | 545 | 1,007 | 204 | 241 | 445 |
| | Edo | 545 | 420 | 965 | 241 | 185 | 426 |
| South South | Anambra | 797 | 168 | 965 | 352 | 74 | 426 |
| | Enugu | 713 | 294 | 1,007 | 315 | 130 | 445 |
| | Ebonyi | 797 | 168 | 965 | 352 | 74 | 426 |
| | Cross River | 126 | 839 | 965 | 56 | 371 | 427 |
| | Akwa Ibom | 42 | 965 | 1,007 | 19 | 426 | 445 |
| | Abia | 252 | 713 | 965 | 111 | 315 | 426 |
| South West | Imo | 462 | 545 | 1,007 | 204 | 241 | 445 |
| | Rivers | 462 | 545 | 1,007 | 204 | 241 | 445 |
| | Bayelsa | 252 | 713 | 965 | 111 | 315 | 426 |
| | Delta | 462 | 545 | 1,007 | 204 | 241 | 445 |
| | Lagos | 1,678 | 0 | 1,678 | 741 | 0 | 741 |
| | Ogun | 503 | 503 | 1,006 | 222 | 222 | 444 |
| Nigeria | | 15,611 | 22,317 | 37,928 | 6,892 | 9,856 | 16,748 |

*Table culled from the NDHS (2013) pg. 380*