CORRELATES OF CHILDHOOD MORTALITY IN NIGERIA:

EVIDENCE FROM NDHS 2013

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DEDICATION

This project is dedicated to the Lord God Almighty.

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LIST OF ABBREVIATIONS

NDHS- Nigerian Demographic Health Survey

UNICEF- United Nations Children's Education Fund

WHO- World Health Organization

UN-IGME- United Nation Inter-agency Group for child Mortality Estimation

U5D- Under-five death

PRRINN-MNCH- Partnership for Reviving Routine Immunization in Northern Nigeria-Maternal Newborn and Child Health Initiative on child mortality

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ABSTRACT

Prevalence of childhood mortality is still high in Nigeria reported at 41 per 1000 live births in 2013. The Concentration of Childhood among some women in certain communities in the country has been an issue of public health importance most especially in the developing world. The aim of this study was to describe the correlates of childhood mortality clustering in Nigeria.

Multilevel logistic regression analysis was performed on the most recent NDHS 2013 data on 31,482 live births whether dead (9.2%) or alive (90.8%) for five years before the survey nested within 893 communities. Bivariate and Ordinary logistic regression analysis was used to explore the effects of selected individual and community variables on childhood death. The odds Ratio (OR) and its 95% Confidence Interval (CI) were estimated. Frequency table was also employed for data cleaning.

Childhood death was found to cluster within some families and communities than others most especially in the Northern part of the country and in rural areas. This results showed that both individual-level factors (such as child's sex, birth interval, multiple birth, parity, parental education, maternal age and maternal birth cohort) and community-level (including water source, toilet facility, place and region of residence) variables are both correlates of death clustering. For instance, the result showed higher risk of death in male children (OR=0.890, P-value < 0.01, CI=0.774- 0.905), children born with short birth interval less than 24months (OR=0.32, P-value < 0.01, CI=0.355-1.059), with higher parity (CI=3.683-5.798), children of multiple births (CI=2.991-4.090), those from older mothers (OR=0.775, P-value = 0.01, CI=.674-0.892) and parent with no education. At the community-level, access to improved toilet facility (OR=1.10, P-value < 0.05, CI=0.831-0.988) and living in urban areas are protective of U5D.

The study consistently showed that individual and community characteristics are important correlates of childhood mortality clustering in Nigeria. The findings shows that there is death clustering in the northern part of the country than the southern part and also highlight the need to implement public health intervention strategies at both levels (the household level and the community level) most especially in those regions where childhood death is more pronounced.

Word count: 350

Keywords: Childhood mortality, Correlates, Individual-level factors, Community level characteristics.

CHAPTER ONE

1.0 INTRODUCTION

1.1 BACKGROUND

Childhood mortality rates are component of indices used to measure socio-economic status and quality of life of a country. Globally, According to the state of the world's children 223 million children died worldwide between 1990 and 2013 before their fifth birthday. U5M rate has been estimated to be 43 deaths per 1,000 live births in 2015 making a total of 16,000 child death per day and 5.9 million per year showing that progresses have been made in improving child survival. The total number of under-five deaths fall by 49% i.e. from 12.6million in 1990 to 5.9million in 2015 of which 45% die in the first 28 days of life (UNICEF, 2015). Despite all the efforts made to reduce child death, the toll of under-five deaths over the past twenty-five years is still overwhelming.

Under-five mortality rate in Africa (per 1,000 live births) has declined from 163 in 1990 to 100 in 2011(UN-IGME, 2012). Notwithstanding, child mortality still remain a huge challenge in Africa as about half of global U5D in 2013 occurred in Africa (UNICEF, 2014). So also, Sub-Saharan Africa and South Asia remain the regions with the greatest numbers of child deaths as they both account for 4 out of 5 under-five deaths globally (UN-IGME, 2011). Although, Sub-Saharan Africa has cut under-five mortality rates by 48% since 1990 but still has the world's highest rate of 92 deaths per 1000 live births that is 1out of 12 children dies before his or her fifth birthday which is nearly 15 times the average in developed countries where death experienced is one out of every 159 births (UNICEF, 2014).

Childhood mortality is a major cause of concern in Nigeria despite progress made in reducing child mortality rate from 191deaths per 1000 live births in 2000 to 89 deaths per 1000 live births in 2014, Nigeria is still fall short of the MDG 2015 target of 64deaths per 1000 live births by 28%. While her infant mortality rate of 58 deaths per 1000 live births is short of 30% deaths per 1000 live births (Nigeria MDGs, 2015). This means childhood mortality rates are still high in Nigeria like many other developing countries. Half of infant and child deaths in 2008 occurred in India, Nigeria, Democratic Republic of Congo, Pakistan and China. India (22%) and Nigeria (13%) together account for more than a third of all under-five deaths worldwide (UNICEF, 2014).

The surveys conducted by Partnership for Reviving Routine Immunization in Northern Nigeria-Maternal Newborn and Child Health Initiative on child mortality (PRRINN-MNCH) between 2009 and 2010 showed that the incidence of death in Nigeria is not randomly distributed across families and regions but rather clustered among a small proportion of women in communities. Child death clustering can be defined based on the concentration of deaths within some families or on the number of women who have lost more than one child, called the high-risk mothers (Edvinsson and Janssens, 2012). It is viewed as a situation in which majority of deaths come from a minority of sources or the concentration of child death in certain family, locality or region (Omariba, 2005). Mortality clustering was also defined by Omariba (2008) as the direct consequence of children sharing same mortality risks both measurable and immeasurable.

Data from different environments have shown that the incidence of death is not randomly distributed across families but rather, cluster among siblings. Reason for this clustering may be due to observed or unobservable differences across families, that is families in which child deaths are concentrated are poorer or share genetic or environmental risk factors that predispose all of their children to higher death risks. (Arulampalam and Bhalotra, 2005; 2006). Other studies on mortality clustering includes Madise et.al, 2003; Omariba, 2004; 2005; 2008; Kamara, 2008; Handa et.al, 2008; Aigbe and Zannu, 2012; Vandezande et.al, 2013; Hassen, 2014 and so on.

A few studies have investigated causes of childhood mortality in Nigeria with most of them using data from the NDHS. It is creditable that many of these studies identified some of the socio-economic, bio-demographic, household and environmental factors associated with childhood mortality. These studies utilized analytical models that assumed child deaths to be independent and randomly distributed across families, households and communities. However, recent studies in other settings have shown that child deaths can concentrate or cluster in some family, households, community and region (Kuate-Defo and Diallo, 2002; Omariba, 2004; 2005).

NDHS data used in this study is a large scale surveys often nested in structure (i.e. individuals are nested within households, households are nested within EAs, EAs are nested within LGAs and LGAs are also nested within states.) and based on multistage stratified cluster sampling, the appropriate approach to analyzing such survey data should be based on the nested sources of variability which come from different levels of hierarchy. Traditional logistic regression would not be appropriate to analyze this kind of data because using a single level logistic regression analysis technique violates the assumption of independence among individuals within the same group and the assumption of equal variance across groups (Abadura et.al, 2015; Babalola and Fatusi, 2009). So also, the variance of the residuals errors is correlated between individual observations as a result of the hierarchical structures of the data (Akinrefon et.al, 2015). Thus, a two-level multilevel logistic regression was used in this study in which individual-level determinants were nested within the community-level determinants.

1.2 STATEMENT OF THE PROBLEM

Under-five mortality rate has been reported by UNICEF to be high as about 16,000 children under the age of 5 still die every day. This number was considered to be overwhelming despite all effort and progress made in reducing child death. Disparities have been found in child survival among nations, communities and households which suggest clustering of death in some parts of every nation of the world. Four in every five child deaths occur in Sub-Saharan Africa and South Asia with sub-Saharan Africa bearing the highest death (UNICEF, 2015).

Despite substantial gains made in increasing child survival, progress still remains insufficient to reach MDG 4 of reducing child mortality by two third between 1990 and 2015 globally and in many regions, particularly in Caucasus and Central Asia, Oceania, Southern Asia and sub-Saharan Africa (UN-IGME, 2015).

Data from different environments have shown that the incidence of childhood death is not randomly distributed across families but, rather cluster among siblings (Arulampalam and Bhalotra, 2006). Studies have also shown that ecological structure, political and poor socioeconomic situation in many countries in sub-Saharan Africa is responsible for geographical variations in childhood mortality

Maternal and child health survey conducted in the year 2013 reveal that Nigeria loses about 2300 children making it the second largest contributor to under-five mortality rate in the world. There is also evidence of death clustering in Nigeria as there is wide will be of help to those who work on reducing inequalities in health. So also, interventions and policies on child survival can be appropriately applied to those geographical locations zones and communities with the highest childhood mortality risks in other to achieve lower and more uniform decline in infant and child mortality in the country.

1.4 OBJECTIVE OF THE STUDY

Main objective

The aim of this study is to describe the patterns and correlates of childhood mortality clustering in Nigeria.

Specific objectives

1.To describe the pattern of household childhood death clustering in Nigeria and its six geo-political regions.

2.To assess the correlates i.e. the individual level and community-level factors associated with childhood death clustering in Nigeria.

3.To compare binary logistic regression and multilevel logistic regression

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

Childhood mortality describes death between birth and the fifth birthday. Within this period, death can be sub-grouped into neonatal death which is death before the first birthday and child death that is death between first and fifth birthday. Childhood mortality Clustering is the concentration of these deaths in some household, certain community, or some parts of the country. In 2013, 2300 children died in Nigeria (UNICEF, 2013) and the incidence was noted to be more in the Northern part of the country than the southern part (Madise et. al, 2003).

The demographic characteristics of both mothers and children were found to be a important determinants of child survival. Children from wealthier families, urban households or mothers with at least secondary education stand a far better chance of surviving their early years than children from poorer families, rural households or mothers without education. Children from the poorest households are, are 1.9 times more likely to die before the age of 5 than children from the richest households. Children from rural areas are 1.7 times more likely to die before the age of 5 than children from urban areas. Children of mothers who lack education are 2.8 times as likely to die before the age of 5 as children whose mothers have secondary or higher education. In developing countries like Nigeria, 1 child in 12 dies before his or her fifth birthday where as the ratio is 1 in 147 in developed countries (UNICEF, 2013).

Worldwide, infectious diseases, prematurity, and complications during labour and delivery have been found to be the major causes of death among children under the age of 5years of which infectious diseases (that are preventable or treatable) account for about half of the deaths and nearly half of these deaths are attributable to under- nutrition. The leading causes of under-five deaths vary between high- and low-mortality groupings and among high-mortality regions. In low-mortality countries where under-five mortality is less than 10 death per 1,000 live births, infectious diseases may not be the main causes of under-five death but diseases like pneumonia, diarrhea, malaria, sepsis, whooping cough, tetanus and meningitis, measles and AIDS which together only account for 10 per cent of all under-five deaths.

Sub-Saharan Africa and South Asia account for more than 80 per cent of global under-five deaths. In higher-mortality regions, however, these key infectious diseases still kill many children under age 5, accounting for 39 per cent, 54 per cent and 47 per cent of all under-five deaths in South Asia, West and Central Africa, and Eastern and Southern Africa, respectively. Pneumonia and diarrhoea remain leading causes of death in the three regions with the highest under-five mortality in the world — West and Central Africa (accounting for 17 per cent and 10 per cent of all under-five deaths, respectively), Eastern and Southern Africa (17 per cent and 10 per cent, respectively) and South Asia (15 per cent and 9 per cent, respectively).

Malaria remains a major killer in sub-Saharan Africa, especially in West and Central Africa, where it accounts for 13 per cent of under-five deaths; and 5 per cent in Eastern and Southern Africa. It is also one of the most geographically concentrated causes of child mortality i.e. 96 per cent of all malaria deaths occur in sub-Saharan Africa.

2.2 UNDER-FIVE MORTALITY CLUSTERING OVERVIEW.

Childhood mortality rate is still high in Nigeria as in many developing countries despite all the effort made to improve child survival globally. Nigeria account for 12% of child deaths worldwide making it the 6th country with high under-5 mortality rate (UNICEF 2010). According to 2013 NDHS, the country's infant mortality rate and under-5 mortality rate are 69 and 128 respectively. Many studies have found that death cluster within some families and communities and suggested that certain risk factors responsible for death clustering include environmental factors, socioeconomic status, biological characteristics, socio-demographic, cultural factor, parity and so on (NPC 2014).

Households from lower socioeconomic status and education level are found to experience death clustering more significantly than those from higher socioeconomic status and higher education level as they may experience adverse conditions like poor access to medical care, and overstretch family resources. Also significant clustering occur more among uneducated women than among educated ones (Das Gupta, 1997; Madise et al, 2003; Omariba 2005). In addition, Ogunjuyigbe (2004) in his work found lack of education as one of the causes of childhood mortality which explains why less enlightened people attribute a dead child to be an Abiku (children from the spirit world who dies at will). Also, siblings living in the same household will invariably experience the same environmental condition. Adedini and Odimegwu in their study of the effect of neighbourhood contexts on under-five mortality in Nigeria found that children born or raised in poor neighbourhoods, rural communities and North-Eastern region of the country experience higher risk of death which by implication indicates concentration of death in those locations.

Longer birth spacing has been suggested in literatures to be significantly associated with lower child mortality (for instance see, Zenger 1993; Omariba, 2005). Short birth interval is found to be associated with material depletion, pregnancy complications, preterm and low birth-weight babiess especially when parents intend to replace a lost child immediately. Whereas longer birth space on the other way round helps the mother to recover physiological status and be more prepared to give adequate parental care for both the index child and the new arrival. Child death can also lead to maternal depression which may adversely affect the health of the unborn child and later in early infancy. It has also been established that number of siblings in an household has significant effect on under-five mortality. Oyefara (2013) confirmed that the higher the level of parity of a woman in Osun State Nigeria, the higher the possibility of childhood mortality among she experience.

Cultural practices in some community lead to death concentration of less preferred sex in that community, for instance in male oriented societies, death clustering could be as a result of an attempt to remove girls through improper childcare and the reverse is the case were female children are more preferred. Child death clustering can also result from lack of maternal competence in childcare as women who experience multiple child deaths were often less organized and inefficient in caring for children and proper household keeping Omariba (2005). Since most illnesses are treated at home, less resourceful women may not be able to diagnosing children's illness symptoms and first aid treatment to be given before taking the child to hospital as the condition arises.

Death clustering in some family is be attributed to biological factors that are genetic but some researchers concluded that the roles of these factors are limited as those that may be risky to child survival are been controlled by natural selection, which ensures that those who die young cannot pass their unsafe gene to their offspring. Biological factors that are also associated with death clustering include tendency of some mothers to experience difficult deliveries and lactation failure.

2.3 TRENDS AND PATTERNS OF CHILDHOOD MORTALITY, 1990-2015: SUB-SAHARAN AFRICA.

Death clustering was found to be higher and more pronounced in Africa than neighbouring continents (Madise et.al 2003). Despite the progress made in reducing under-five mortality in sub-Saharan Africa with annual reduction rate increase from 1.6 per cent in 1990-2000 to 4.1 per cent between 2000-2015, Sub-Saharan Africa regions still experience one death out of every 12 children compare to 1 in every 147 children experienced in developed countries. Sub--Saharan Africa and South Asia account for more than 80 per cent of the global under-five deaths indicating concentration of child death in these regions of the world.

Large disparities in U5M rates continue to separate countries and regions as children born in the highest under-five mortality country faces about 80 times the risk of dying before age 5 compare to his counterpart in the lowest mortality country. These deaths are heavily concentrated in sub-Saharan Africa South Asia and lower-income countries which emphasize the fact that a child's place of birth has an impressive effect on his or her chances of survival.

2.4 TRENDS AND PATTERNS IN CHILDHOOD MORTALITY, 2003–2014: NIGERIA

The aim of fourth Millennium Development Goals (MDG4) is to reduce under-5 mortality to 64 deaths per 1,000 live births and infant mortality to 30 deaths per 1,000 live births by 2015 (Federal Republic of Nigeria, 2010a), but the improvement made so far is still not up to this expectation (see Table 1). However, NDHS 2013 report caution that there is heaping at age 12 months which can lead to biassedness in the mortality rates reported, as this is likely to result in underestimation of infant mortality and overestimation of child mortality.

In the 2003 Nigeria Demographic Health Survey (NDHS), infant mortality and under-five mortality rates were 100 and 201 deaths per 1000 live births respectively (NPC 2004) but has reduced to 69 for infant mortality and 128 for under-5 mortality (2013 NDHS). The rate of decline is slow when compared to other developing nations that were at similar level as Nigeria in the 1990s. An example is Rwanda where the infant mortality was 85 deaths per 1000 births before but now 62 in 2002-2007 (Rathavuth et al, 2009).

Nigeria's efforts aimed at reducing avoidable child deaths have been met with gradual and sustained progress. The under-five mortality rate (U5MR) has improved remarkably from 201 deaths per 1000 live births in 2003 to 157 deaths per 1000 live births in 2008 and 128 deaths per 1000 live births in 2013. Considering the end-point status of U5MR, Nigeria is still falls short of the 2015 target of 64 deaths per 1000 live births by 28%. In 2003 the infant mortality rate (IMR) was estimated at 100 deaths per 1000 live births, which decreased to 75 deaths per 1000 live births in 2008 and to 61 deaths per1000 live births in 2013.

Table 2.1: Comparison of Mortality Rates in 2003, 2008 and 2013 NDHS

Mortality Rates	2003	2008	2013
Infant MR	100	75	69
U5MR	201	157	128

Source: Final report NDHS 2013.

2.5 CORRELATES OF UNDER-FIVE DEATH CLUSTERING.

Correlates of under-five death clustering are those factors or determinants of childhood mortality considered to be the root causes of concentration of death in some families, communities or particular geographical location. For the purpose of this study, the correlates of under-five death are grouped into two factors i.e. individual-level factors (sex of child, birth order, preceding birth Internal, multiple birth, Parity, place of residence, maternal education, paternal education, maternal age at birth of child and maternal birth cohort) and community-level factors (source of water supply, availability of improved toilet, religion and region of residence).

2.5.1 Maternal and Paternal Education.

Children of mothers who lack education are 2.8 times as likely to die before the age of 5 as children whose mothers have secondary or higher education (UNICEF, 2015). Maternal education is an important tool for reducing infant and Child mortality (Opara, 2015). In the literature, maternal education has been found to be highly associated with some factors which directly affect under-five mortality. Some of these factors are: Attitude towards health care service utilization; socio-economic status; reproductive behaviours of women and maternal employment status. Maternal education level has direct impact on mother's attitude towards the use of modern health facilities as they easily get informed and appreciate the use of modern medicine and prevents fatal child diseases thereby improve child survival status.

Evidence has shown that educated mothers have the ability to control the size of their families according to their capacities and are more likely to provide better care for their children as they can be buoyant enough to cater for their needs (Veneman, 2007).

Mother's education was found to be inversely related to a child's risk of dying as mothers with no education experience more death than mothers with secondary education or above (2013 NDHS).

Most educated mothers usually get married to a more educated husband leading to better socio- economic status and as thus, improving child survival. Decisions related to fertility levels, age at first birth, and birth spacing are also factors that can be directly influenced by paternal education level. A positive and significant association has been found between maternal and paternal education (Ikeako et. al., 2006; Gakidou, et al. 2010). According to UNICEF (2015) children from the poorest households are 1.9 times more likely to die before the age of 5 than children from the richest households. More educated women also have better reproductive health outcomes due to the fact that they have access to quality antenatal and post-natal services as well as giving birth in a qualified health facility than less educated women (NPC, 2009: 2014) other studies.

2.5.2 Preceding birth Interval and Sex of child

Longer birth interval was found to be one of the factors that improve the survival chances of succeeding children. Children born after a short birth interval are found to experience higher risk of death, especially those conceived within six months of birth of the preceding child (Tymicki, 2009). A short preceding birth interval can lead to maternal physiological depletion which may possibly affect the succeeding children at first year of life. This may be as a result of death of a child which leads to a shorter birth interval when the mother ceasing to breastfeed and thereby conceive sooner or when parents planned to conceive sooner in other to replace the lost child (Arulampalam and Bhalotra, 2006). A mother experiencing child death may be depressed, which is injurious to her subsequent child's health right from the womb or in early infancy (Rahman et al. 2004), therefore resulting in many deaths in such family.

The sex of a newborn baby is an important correlates of child survival. Girls generally experience lower infant mortality than boys (Ettarh & Kimani, 2012), but this difference loses its statistical significance in later childhood after the first birthday. Ssewanyana and Younger (2007) reported that male children usually experience higher mortality rates at all ages of childhood than their female counterpart. According to United Nation Population Fund, in all human populations, males children usually survive more at birth while females have higher life expectancies at all ages than males (UNFPA, 2012). Boco (2010) in his study on individual and community effects on childhood mortality in 27 countries out of 28 in sub-Saharan African found higher mortality among male children compared to females. The higher survival chances for one of the sexes may be attributed to the socio-cultural and physiological mechanisms. Higher male mortality can be due to greater immaturity as a result of shorter gestation period, and differential effect of estrogens and androgens on the immune system (Tymicki, 2009). However, parental investments are frequently sex-biased in some society thus resulting in lower survival of the less preferred sex. So also, males children are more vulnerable to diseases than there female counterpart which result in the latter surviving more than the former

In other way round, some society experience higher mortality rate among girls as a result of discrimination in child care in favour of boys, taking into account the future expected income from male children. Also, discriminations against girls in intra-household allocations of resources could be attributed to differences in parents' socio-economic position (Krishnan et. al., 2012). It was posited that preference for sons and discrimination against daughters in parental care cannot be completely ruled out in sub-Saharan Africa where patriarchal values predominate (Adedini et.al, 2014). While Mika (2007) establish that income growth stimulate reduction of anti-female bias in under five deaths in most of developing country.

2.4.3 Maternal age at birth of child and maternal birth cohort

There is a U-shaped relationship between childhood mortality and mother's age at birth (Uthman et al. 2008), that is young mother (less than 20 years of age cohort) and old mothers (35years and above age cohort) experience more death The relationship between childhood mortality and maternal age at child's birth is similar to that between the childhood mortality and birth order because maternal age and birth order are usually correlated. This is because the physiology of both old and young mother's bodies may not be selective enough to prepare for pregnancy and gestation resulting to malformed fetuses, stillbirths and hypothrophic births, and thus higher number of U5D. . Tymicki (2009) posited that in comparison with very young mothers (aged 15-18), children born to mothers aged 19-25 and 26-35 experience lower mortality, although he declares that there is no clear effect of the mother's age on child survival.

2.3.4 Multiple birth, Birth order and Parity

Multiple births is an important factor of infant mortality as its effect is associated with lower birth weight of the babies, which in turn is one of the factors affecting neo-natal survival as the arrival of more than one child demand for extra food consumption. Multiple births might lead to lower calorie intake as breast feeding, the main sources of nutrition during the early stages of infancy may not be sufficient and thus leads to lower survival chances. Mortality was found to be higher among children from multiple births (twins, triplets, etc.), especially during the neonatal period (Kembo and Van Ginneken, 2009; Luke and Brown, 2006; Uthmanetal. 2008). Kryzysztof Tymicki (2009) in his study on a Parish in Poland established that Twins have almost double the mortality rates of singletons. Uthmanet al. (2008) also found that multiple birth children in Nigeria were twice as likely to die at infant as singleton.

Birth order and the parity are usually used in the studies that aimed at modeling infant or late-childhood mortality and has always been established that mortality is positively correlated to the birth rank of an individual (Modin, 2002). The birth order cannot by itself be related to the risk of mortality but the multi-parity could be related to socio-economical conditions that lead to an increase in the risk of mortality. For example, as a family grows, the parental resources is stretched and may be insufficient to maintain the same level of nutrition for a larger number of children, and thus those born earlier might enjoy better nutritional status than the latter once.

However, shortage of resources is not the only problem that arises when the family grows. It has also been discovered that children with higher birth order in a large family have higher risk of experiencing accidents during early childhood as a result of less parental attention. So also, the presence of many siblings might expose a newborn baby to the risk of infectious diseases through older siblings in the household. In addition, children of higher birth order are born to an overcrowded house thereby, have higher risk of catching life-threatening infections during the first critical weeks and months of life than children with fewer or no older siblings (Burnett, 1991; Madise et al, 2014).

2.3.5 Region and Religion

Another environment-related factor that has been found to exhibit pronounced variations in child survival is region (geographical location of residence) and ethnicity. Neighbourhood characteristics can aggravate or alleviate mortality risks of individuals depending on the neighbourhood contexts where individuals reside. The environmental condition in which a child is born or exposed to have an influence on his health status and mortality. Some families are not buoyant enough to access health services therefore depend on available community health services (WHO 2005). Whereas some rural communities lack portable water and electricity supply, good sanitation, toilet facilities, proper waste disposal system, personal hygiene which can improve the survival chances of young children, thus results in concentration of death in such environment (Boco, 2010).

The proximate determinants of childhood mortality in Nigeria are found to be closely associated with neighbourhood which is the environmental risk factors and infections children are exposure to and household level characteristics (Iyun, 2000). The urban advantage partly reduced whenever socioeconomic and other demographic variables at individual, household and community levels are been controlled (Bocquier et al. 2011).

Some of the regional differences found were claimed to be due to differences in climate/weather, household environmental factors, socio-economic and cultural factors (Adebayo and Fahrmeir, 2005). Using NDHS 2003 data, Antai and Antai (2008) reported that religious differentials in Nigerian childhood mortality were explained by differences in community usage of hospital delivery services. Infant and childhood mortality rates in the urban areas in Nigeria is much higher than in the rural areas. There is also relatively high U5MR in the North East and North West zones suggesting a spatial expression of inequalities in health demographics (MDGs 2013).

2.6 PREVIOUS METHODS OF ESTIMATING CHILDHOOD MORTALITY CLUSTERING

Previous studies on the concept of Child Death Clustering use different approaches that need to be readdress for clarity of evidence on clustering and its correlates. In the literature, some studies express child death clustering as a difference between the observed deaths and the expected death using Count Models to estimate the expected distribution of death from the observed child deaths in families (Michael Murphy et al, 2001). Count models do not allow for the examination of the relationship between inter-familiar variation in mortality and death experience by close siblings and assume that the probability of child death for all families in the same group are the same (Omariba, 2005).

So also, the number of children in many families is small to give significant variance which is used by some studies to estimate death clustering. Another approach use in multilevel modeling which account for the correlation of mortality risks by observing the death of an index child as a consequence of the survival status of the previous children (i.e. the state dependent). This approach used in this study is based on the facts that the survival status of younger children is conditioned on the survival status of the older children.

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CHAPTER THREE

3.0 METHODOLOGY

3.1 STUDY AREA

Nigeria is located in Sub-Sahara of West Africa with a total land area of 140,923768 square kilometer making it the 32nd largest in the whole world the most populous country in Africa. She is surrounded by Niger in the North, Chad in the North east, Cameroon in the East, Benin in the west and Atlantic Ocean in the South. The Nation's population was 140,431,790 in the year 2006 according to population and housing census with an estimated national growth rate of 3.2% yearly and population density of 193.3 people per square kilometer. In the year 2011, Nigeria population was put to be 178million by the United Nation Population found (UNFPA) making it the 7th most populous in the world. Nigeria is made up of 36 states, with the federal capital territory in Abuja; six geo-political zone: North-West, North-East North-Central, South-East, South-West and South-South; and 774 LGAs. Nigeria is a multi-ethnic country with three major ethnic groups: Yoruba, Hausa and Igbo and three major religious namely Christianity, Islam and traditional religion. The country has one of the world's highest urbanization rate estimates of 5.3% annually with urbanization of about 45%. Since 2003 her fertility rate is still high at Total fertility rate (TFR) of 5.7%.

3.2 STUDY DESIGN

The study design was a cross–sectional and population based study using a secondary data extracted from the Nigeria Demography and health survey (NDHS 2013). In other to answer the study objectives, data analysis was conducted.

3.3 STUDY POPULATION

The study population in the NDHS was women of reproductive age between 15 - 49 years and men of age 15-49 years. The target population for this study was women of reproductive age between 15-49 who has given birth to children and the sampling units was children of age zero up to five years

3.4 SAMPLING FRAME AND TECHNIQUE

The data collection method used in the study is as described in Nigeria Demographic and Health survey 2013. According to National Population Commission (NPC) Nigeria and ICF international (2014), a stratified three stage cluster sampling design consisting of 893 localities, 904 clusters of primary sampling units (PSU) and 40,680 household was used in Nigeria Demographic and Health survey 2013.The sample was a national representative covering the entire population residing in non-institutional dwelling units in the country. The sample was designed to provide population and health indicator estimate at the national, zonal and state levels therefore the sample design allowed for specific indicator to be calculated for each level and the Federal Capital Territory Abuja.

Nigeria is divided in terms of administration into six zones and 36 states, each state is subdivided into local government areas (LGAs) and each LGA is divided into (Urban and rural) localities and each locality was divided into census Enumeration Areas (EAs) referred to as clusters in the 2013 NDHS. The sampling frame consist of the list of this EAs prepared by the NPC for the 2006 population census.

The stratified sample for 2013 NDHS was independently selected in three stages from the sampling frame. In the first stage each state was stratified into urban and rural, and then from each stratum, independent selection with probability proportional to size was made. The second stage involves random selection of one EA from most of the localities with an equal probabilities in which more than one EA was selected from a few larger localities making a total of 904EAs.

Household listing of the selected EAs was then carried out, drawing of location map and detailed sketch map as well as recording the household list on the household listing forms were done. This list of households served as the sampling frame for the selection of household in the third stage. In the third and the last stage, 45 households were selection from every urban and rural cluster using equal probability systematic sampling.

3.5 DATA EXTRACTION

Data for the study was extracted from NDHS 2013obtained freely on Nigeria Population Commission website. The NDHS is a national representative survey of women of reproductive age (15 – 49 years) and have relevant information for under-five mortality studies. Data was extracted from the children data (child recode data file). Questions include child bearing experience such as total number of sons and daughters alive or death. For all children who had dead, the age at death was asked.

3.6. STUDY VARIABLES

The following are the independent and outcome variables used for the analysis of childhood death clustering in Nigeria;

3.6.1 THE OUTCOME (DEPENDENT) VARIABLE.

The outcome variable was under-five death which includes death of children of age 0 to 5years of life.

3.6.2 THE INDEPENDENT VARIABLES OF THE STUDY.

The independent variables in this study were sub-divided into two groups:

Individual level factors

Sex of child

Preceding birth Internal

Birth order

Multiple births

Total children ever born (parity)

Maternal age at birth of child

Maternal birth cohort

Maternal marital status

Maternal education

Paternal education

Community level factor

Source of drinking water

Type of toilet facility

Religion

Place of residence

Region

TABLE 1: DESCRIPTION AND CATEGORIZATION OF THE VARIABLES USED IN THE ANALYSIS

Individual-level factors

Variable	Definitions and categorization
Child sex	Sex of the child (1=male 2=female)
Birth order	Birth order in which children were born(first order=1, order 2–3=2, order 4and above=3)
Preceding birth interval	Interval in months before birth (first birth=1, <24=2, >24=3)
Multiple birth	Multiple births (single birth=0, multiple birth=1)
Parity	Total number of children born by a woman (1=1, 2-4=2, 5or more=3)
Maternal age	Maternal age at first birth in years (<20=1, 20–35=2, 36 years and older=3)
Maternal birth Cohort	Maternal year of birth (1963-1969=1, 1970-1979=2, 1980-1989=3, 1990-1998=4)
Maternal education	Maternal years of schooling (as continuous variable)
Marital status	Marital status of the mother (1=currently married; 2=not currently married)
Paternal education	Paternal years of schooling (as continuous variable)

Community level factor

Source of drinking water

Type of toilet facility

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Maternal education	Maternal years of schooling (as continuous variable)
Marital status	Marital status of the mother (1=currently married; 2=not currently married)
Paternal education	Paternal years of schooling (as continuous variable)

Community-level factors

Variable	Definitions and categorization
Water Source	Major source of drinking water (unimproved=1, improved=2)
Toilet facility	Type of toilet facility
Religion	Maternal religion (1=Christian; 1=Moslem; 3=other)
Place of residence	Place of residence (1=urban; 2=rural)
Region	Region of place of residence (1=North Central; 2=North East; 3=Nort West; 4-South East; 5=South South, 6=South West)

3.7 OPERATIONAL DEFINITIONS OF VARIABLES

Outcome variable

The primary outcome was under-five death, which is the death of a child between age 0-5years. In these analyses, the outcome is under-five deaths taken as a binary variable.

Individual-level characteristics:

The important individual-level characteristics considered in this study are as follows: (1) child's sex, defined as sex of the child and categorized as (i) male, and (ii) female; (2) birth order, defined as the order in which children were born starting from the last born to the first born and categorized as (i) first birth order, (ii) 2–3birth order, and (iii) birth order 4 and above; (3) preceding birth interval, defined as interval in months between the current birth and the previous birth categorized as (i) first birth (ii) <= 24 months, and (iii) > 24 months; (4) multiple births, categorized as (i) single birth, and (ii) multiple birth; (5) parity, defined as the total number of children ever giving birth to by a woman grouped as (i) a child, (ii) 2-4 children, and (iii)>= 5 children; (6) maternal age, grouped as (i) <20 years, (ii) 20–35 years, and (iii) 36 years and older; (7) maternal birth cohort, defined as maternal year of birth grouped as (i) 1963-1969, (ii) 1970-1979, (iii) 1980-1989, and (iv) 1990-1998; (8) maternal education, defined as maternal highest level of education attended categorized as (i) no education, (ii) primary, (iii) secondary and

(iv) higher education; (9) maternal marital status, categorized as (i) not currently married and (ii) Currently Married; (10) paternal education, defined as paternal highest education level attended categorized as (i) no education, (ii) primary, (iii) secondary and (iv) higher.

Community level variables

The community-level variables considered for the purpose of this study are: (1) Water source, defined as major source of drinking water for members of the household categorized as (i)unimproved, (ii) improved; (2) Toilet facility, defined as type of toilet facility in the household categorized as (i)unimproved, (ii) improved; (3) maternal religion, categorized as (i) Christianity, (ii) Islam and (iii) others; (4) Place of Residence, defined as locality where household lives and categorized as (i) urban and (ii) rural; (5)Region, define as region of place of residence, categorized as (i) North Central, (ii) North East, (iii) North West, (iv) South East, (v) South South, (vi) South West.

3.8 DATA ANALYSIS AND INTERPRETATION

Exploratory data analysis used include frequency table to describe percentage of death based on the selected variables and bar chart to describe childhood death clustering in each geopolitical zone of the country, followed by bivariate analysis, logistic regression analysis and multilevel (two-level) logistic regression analysis..

3.8.1 Logistic regression model

Logistic regression models is a family of generalized linear model (GLM) or more generalized framework for regression models called General regression model which include any parametric regression model. It was first proposed in the 1970s as an alternative technique to overcome limitations of ordinary least square (OLS) regression in handling dichotomous outcomes and became available in statistical packages in the early 1980s. It is widely used as an analytical tool in epidemiology research where the outcome variable is often presence or absence of disease state. It is used to measure relationship between explanatory variable(s) and response variable(s) that are dichotomous and categorical by estimating the probability of falling into a certain level of the categorical response given a set of predictors i.e. it determines the impact of independent variables present in predicting membership of one or other of the two dependent variable categories. The explanatory variable(s) can be categorical or a mixture of continuous and categorical. Logistic regression employs binomial probability theory in which there are only two values to be predicted that probability (p) is 1 rather than 0, i.e. the event/ person belongs to one group rather than the other. Logistic regression forms a best fitting equation or function using the maximum likelihood method, which maximizes the probability of classifying the observed data into the appropriate category given the regression coefficients.

Logistic regression has two main uses: it can predict group membership (the probability of success over the probability of failure, presenting the result in the form of an odds ratio) and also provides knowledge of the relationships and strengths among the variables. It requires fewer assumptions and is more statistically robust but it includes non-normal error terms, non constant error variance and constraints on the response function which is dichotomous (i.e. the response function is bounded between 0 and 1).

As a member of GLM, it has a link function called the logit function $g(\mu_i) = \eta_i$ also known as canonical link function which implies that its parameter estimates are efficient, and tests on the parameters behaves well for small samples.

Assumptions of logistic regression

1) The dependent variable must be a dichotomy (must have 2 categories).

2) The categories must be mutually exhaustive and exhaustive i.e. a case can only be in one group and every case must be a member of one of the groups.

3) It does not assume a linear relationship between the outcome variable and the explanatory variable.

4) The explanatory variable need not be mutually exclusive and exhaustive

5) The explanatory variables need not be interval, nor normally distributed, nor linearly related, nor of equal variance within each group.

6) Assumptions of chi-square test must be satisfied.

7) Larger samples are needed than for linear regression because maximum likelihood coefficients are large sample estimates. A minimum of 50 cases per predictor is recommended.

3.8.2 Description of the model

Logistic regression model can be written as:

$$y_j = \ln(p \,|1-p) = \beta_o + \beta_1 x_{1j} + \dots + \beta_p x_{pj} + \varepsilon_j$$

$y_j = x'\beta$ (in matrix form)

Where;

y_j = value of the response variable in the j^{th}observation.

β_o = the intercept parameter.

$\beta_1 - \beta_p$ = the slope parameter with the p^{th} variable.

x_{pj} = the p^{th} observation associated with the j^{th} observation.

ε_j= the random error term which is normally and independently distributed with mean zero and variance δ^2 [$e_i \sim$ NID $(0, \delta^2)$].

Logit link function is used to transform the output of a linear regression to make it fit for probabilities. Therefore y can be expressed as $logit(p)$ where p is the probability of an event occurring. For the purpose of this study, the event of interest is child death.

The logit transformation is then written as the log odds:

$$odds = \frac{p}{1-p} = \frac{probability\ that\ a\ child\ dies}{probability\ that\ a\ child\ survives}$$

Odds varies on a scale of (0, ∞), which makes the *log odds* to vary on a scale of (-∞, ∞). This means a unit additive change in the value of an explanatory variable induces a change in the odds by a constant multiplicative value

$$logit\ [p(x)] = \log odds = log\left[\frac{p(x)}{1-p(x)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_n X_n$$

finding the exponent of both sides, the model now becomes

$$e^{logit\ p} = e^{\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_n X_n}$$

Logistic function is the inverse of the logit function.

If $logit(p) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_n X_n = z$, then

$$p = \frac{e^z}{1+e^z}$$

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$$logit\ [p(x)] = \log odds = log\left[\frac{p(x)}{1-p(x)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_n X_n$$

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$$p = \frac{e^z}{1+e^z}$$

3.9 MULTILEVEL MODEL OVERVIEW

Multilevel analysis started in the mid-1980s in educational measurement and sociology. The analysis has been defined in the literature as the combination of contextual analysis and traditional statistical mixed model theory. The general concept of multilevel analysis is that individuals interact with social group they belong and the properties of those groups are in turn influenced by the individual who make up the group, which means individual observations are not completely independent. According to Hox (2002) a multilevel model is concerned with the analysis of the relationship between variables that are measured at different hierarchical levels. The model assumes hierarchical data structure with one response variable measured at the lowest level nested within the higher levels of explanatory variables at all levels (Akinrefon, 2015; Kim and Kawachi 2007).

Multilevel models also known as random effects models, or mixed linear models or random coefficient models, or hierarchical models are applied to analyse: clustered data nested within aggregate unit, survey data, repeated measures, twin study data, meta-analysis, multivariate data, and so on. This kind of data do arise in various fields like education research, economic research, clinical and public health research in which individuals/ patients are nested in hospital, hospital in community/ state, and state in the country.

These models can be used as an alternative to ANCOVA (Analysis of Covariance) but is not strict about assumption of homogeneity of regression slope as required by ANCOVA. Repeated measurement of individual can also be examined in multilevel model, therefore it can be used as an alternative type of analysis for univariate or multivariate analysis of repeated measures. The do not assume that individual observations are independent, but that observations within cluster are dependent to some extent i.e. data are more homogeneous within cluster. Although the degree of this dependency is estimated along with the usual model parameters

Considering under-five death clustering at a multilevel analysis implies that the individual death outcome within the same state are independent where as the outcome may be dependent if the children are from the same household nested in the same community which is also in the state. Since assumption of independent errors has been violated this result to error in the estimation of results. The estimated coefficients are unbiased but not efficient because the standard errors are negatively biased which results in misleading significance effects. In the literature, the approach used to regress a predictor at the individual level on a set of predictors at other levels is by disaggregating all higher level variables to the individual level. This is done by assigning each individual in the same community the same value of the community variable and this also leads to the problem of inefficient estimation results.

In this study, analysis is done on clustered household surveys to show whether child death cluster due to individual and households level characteristics that are vary from community to community within the country is the effect of households and community variables on death outcome and how much of the between community variation that can be explained by these explanatory variables. The aim of using multilevel modeling is to take this hierarchical data structure explicitly into account and to determine the direct effect of the individual and the community explanatory variables. Many methodological works on analyzing multilevel models has been done, for instance, by Hox (2002) on illustrative introduction in multilevel models with an application to educational data and Gelman and Hill (2007) andGoldstein (2008).

3.10 Multilevel Logistic Regression

In this study, two level models are considered for analyzing dichotomous outcome variable with a single explanatory variable using the NDHS data. Information was collected from individuals (level one) which was grouped into clusters (level two). In this case the assumption of continuous variable and normality as well as homoscedastic assumption of errors is violated. Let y_{jk} be a binary response on childhood mortality for the jth women in cluster k and x_{jk} be the explanatory variable at individual level.

Let proportion of women of reproductive age experiencing child death be π_{jk} i.e. the observed proportion of this women in category 1 of group k,[$\pi_{jk} = pr\ (y_{jk}=1)$] while probability of not experiencing death equals to zero [$p_{jk} = pr\ (y_{jk}=0)$]. Let p_{jk} be modeled using a logit link function based on the assumption that y_{jk} follow a binomial distribution, logit (p_{jk}) has a distribution that is approximately normal. The intercept-only model is given by

$$\ln\left(\frac{\pi_{jk}}{1-\pi_{jk}}\right) = \beta_{0k} \qquad \text{...........(1)}$$

The individual level error term e_{jk} is not in (1) above because in binomial distribution, the variance of the observed proportion depends only on the population proportion therefore, the individual level variance is determined by the predicted value for the p_{jk} and is no put into the model as a separate term (Akinrefon, 2015).

Adding a predictor of the individual level, the model (1) becomes

$$\ln\left(\frac{\pi_{jk}}{1-\pi_{jk}}\right) = \beta_{0k} + \beta_{1k}x_{jk} \quad \text{..........(2)}$$

The regression coefficient is assumed to vary across the group as modeled by the predictor of the group level.

$$= \beta_{00} + \beta_{01}z_k + \mu_{0k} \quad \text{..........(3)}$$

$$= \beta_{10} + \beta_{11}z_k + \mu_{jk} \quad \text{..........(4)}$$

Substituting β_{0k} and β_{1k} in (2), we have the combine equation

$$\ln\left(\frac{\pi_{jk}}{1-\pi_{jk}}\right) = \beta_{00} + \beta_{10}x_{jk} + \beta_{01}z_k + \beta_{11}x_{jk}z_k + \mu_{jk}x_{jk} + \mu_{0k} \quad \text{..........(5)}$$

Where μ_{0k} and μ_{jk} are the random effect at level two.

Without random effect, equation (2) would be a standard logistic regression model. In the case of multilevel μ_{0k} and μ_{1k} are assumed to be independent, $\mu_{jk} \sim N(0, \sigma_\mu^2)$.

The probability can be written as:

$$\pi_{jk} = \frac{exp(\beta_{00} + \beta_{01}z_k + \beta_{10}x_{jk} + \mu_{0k})}{1 + exp(\beta_{00} + \beta_{01}z_k + \beta_{10}x_{jk} + \mu_{0k})}$$

Intra-class Correlation

The intra-class Correlation ρ is the estimate of the proportion of the total variance explained by the grouping structure of the entire population i. e. the proportion of group level variance compared to the total variance. Intercept only models at both levels are used to estimate the ρ, so that the intra-class correlation is given by:

$$\rho = \frac{\sigma_{uo}^2}{\sigma_{uo}^2 + \sigma_e^2}$$

Where:

σ_{uo}^2 is the variance of the second level error and

σ_e^2 is the variance of the first level error.

Akaike's Information Criterion and Bayesian Information Criterion

Akaike's Information Criteria (AIC) was first developed by Hirotugu Akaike in the year 1973 as a tool for comparing different models on a particular outcome. It is a powerful method that can be used to choose a model that best capture the true relationship between the variable of interest and still not losing generality from over fitting the data i.e. "parsimonious model" (Snipes and Taylor, 2014) It also deals with the trade-off between the goodness of fit of the model and complexity of the model. Bayesian Information Criterion (BIC) also known as Schwarz Information Criterion introduced by Schwarz in the year 1978 is another method for comparing models. It can be used to choose model that are more parsimonious because it incorporates both estimation uncertainty and parameters uncertainty. They are both penalized log-likelihood criteria but BIC penalty term is more stringent and tends to favour smaller models than AIC. In the literature AIC is best useful when the aim of modeling application is predictive (that is to build a model that will effectively predict new outcome) while BIC can best be used when the aim is descriptive (that is to build a model that will feature the most meaningful factors influencing the outcome, based on assessment of relative importance).

The computation of both AIC and BIC are based on the empirical log-likelihood. The AIC an BIC for a model is usually written in the form [-2log$L$ + kp], where L is the likelihood function, p is the number of parameters in the model, and k is 2 for AIC and $\log(n)$ for BIC.AIC is an estimate of a constant plus the relative distance between the unknown true likelihood function of the data and the fitted likelihood function of the model. The model with a smaller value in of both AIC and BIC is considered to be closer to the truth or the best for the data. Therefore, in the course of this analysis AIC and BIC were used to choose the best fitting model that incorporate all the variables influencing childhood mortality clustering in Nigeria.

3.11 SOFTWARE CONSIDERATION

Descriptive and exploratory data analysis were done using Microsoft Office Excel 22 (Microsoft Corporation, 2013) while bivarite analysis, logistic regression analysis and multilevel logistic analysis were done using Stata Statistics Version 12 (Stata Corporation, 2011).

CHAPTER FOUR

4.0 RESULTS

4.1 DISTRIBUTION OF BACKGROUND CHARACTERISTICS

The individual and community factors causing U5D clustering considered for the purpose of this study are summarised in Table 4.1 below. Out of 31,482 total number of children recorded in the NDHS 2013, about 2886 i.e. 9% of them were dead. The proportion of male to female in the sample was almost equal. The highest number of births was recorded in birth order four and above (48.6%). About 20% of all births were first born while 59% of the children were born after 24months of the preceding child. Mothers of age interval 20-35 years had the highest number of births (73.5%), older mothers (>=36 years) and young mothers (<20 years) had 14.34% and 12% respectively.

So also, almost all the children (96.5%) were singletons, about half of the children were born to mothers who had giving birth to between two and four children and 51% of the children were born to mothers in birth cohort 1980-1989. Almost half of them (46.9%) were born to mothers with no formal education while 20.4%, 26.6% and 6.1% were born to mothers with primary, secondary and tertiary education respectively. Almost all the children (92.5%) were born to mothers who were currently married and fathers with no education had the highest proportion of children (38%) followed by those with secondary education (29.5%).

Furthermore, Households who have access to improved toilet and water facilities was 48.2% and 57.9% respectively. More births were recorded among the Muslims (58.6%) compared to other religions, about two-thirds of the children (67.1%) were living in the rural areas while the highest proportion of children (31.5%) was found in the North West region.

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TABLE 2: PERCENTAGE DISTRIBUTION OF SELECTED INDIVIDUAL- AND COMMUNITY- LEVEL CHARACTERISTICS OF CHILDHOOD MORTALITY IN NIGERIA, NDHS 2013.

VARIABLES	FREQUENCY(%)
Individual level	(n=31482)
Child Mortality	
Alive	28596(90.83)
Dead	2886(9.17)
Child Sex	
Male	15965(50.71)
Female	15517(49.29)
Birth Order	
1	6109)(19.4)
2-3	10074(32.0)
4+	15299(48.6)
Birth Interval	
First Birth	6181(19.63)
<=24months	6668(21.18)
>24months	18633(59.19)
Maternal Age	
< 20 years	3840(12.2)
20 - 35 years	23129(73.47)
>=36 years	4513(14.34)
Multiple Birth	
Single birth	30384(96.51)
Multiple birth	1098(3.49)
Parity	
1	3624(11.51)
2-4	14966(47.54)
5+	12892(40.95)
Maternal Birth Cohort	
1963-1969	1225(3.89)
1970-1979	8268(26.26)
1980-1989	15931(50.6)
1990-1998	6058(19.24)

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1970-1979	8268(26.26)
1980-1989	15931(50.6)
1990-1998	6058(19.24)

TABLE 2 CONT'D: PERCENTAGE DITRIBUTION OF SELECTED INDIVIDUAL- AND COMMU-NI TY -LEVEL CHARACTERISTICS OF CHILDHOOD MORTALITY IN NIGERIA, NDHS 2013.

Variables	Frequency(%)
Community level	
Maternal Education	
No education	14762(46.89)
Primary	6432(20.43)
Secondary	8365(26.57)
Higher	1923(6.11)
Marital Status	
Not Currently Married	2366(7.52)
Currently Married	29116(92.48)
Paternal Education	
No education	11610(37.96)
Primary	5985(19.57)
Secondary	9009(29.46)
Higher	3981(13.02)
Water Source	
Unimproved	13257(42.11)
Improved	18225(57.89)
Toilet Facility	
Unimproved	16312(51.81)
Improved	15170(48.19)
Religion	
Christianity	12654(40.4)
Islam	18354(58.6)
Others	314(1)
Place of Residence	
Urban	10351(32.88)
Rural	21131(67.12)
Region	
North Central	4614(14.66)
North East	6517(20.7)
North West	9906(31.47)
South East	2816(8.94)
South South	3747(11.9)
South West	3882(12.33)

4.2 CLUSTERIMG OF CHILDHOOD MORTALITY ACROSS GEOPOLITICAL ZONES

The table below shows the descriptive analyses of the childhood mortality rate, defined as the number of child deaths per 1000 live births. Highest childhood mortality rate was recorded in the North West region followed by the North East and South East which means there is death clustering in some regions of the country than others.

TABLE 3: CHILDHOOD MORTALITY RATE ACROSS GEOPOLITICAL ZONES IN NIGERIA, NDHS 2013

Region	CMR
North Central	76.53
North East	112.88
North West	130.82
South East	103.02
South South	71.18
South West	65.61

4.2 CLUSTERIMG OF CHILDHOOD MORTALITY ACROSS GEOPOLITICAL ZONES

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South East	103.02
South South	71.18
South West	65.61

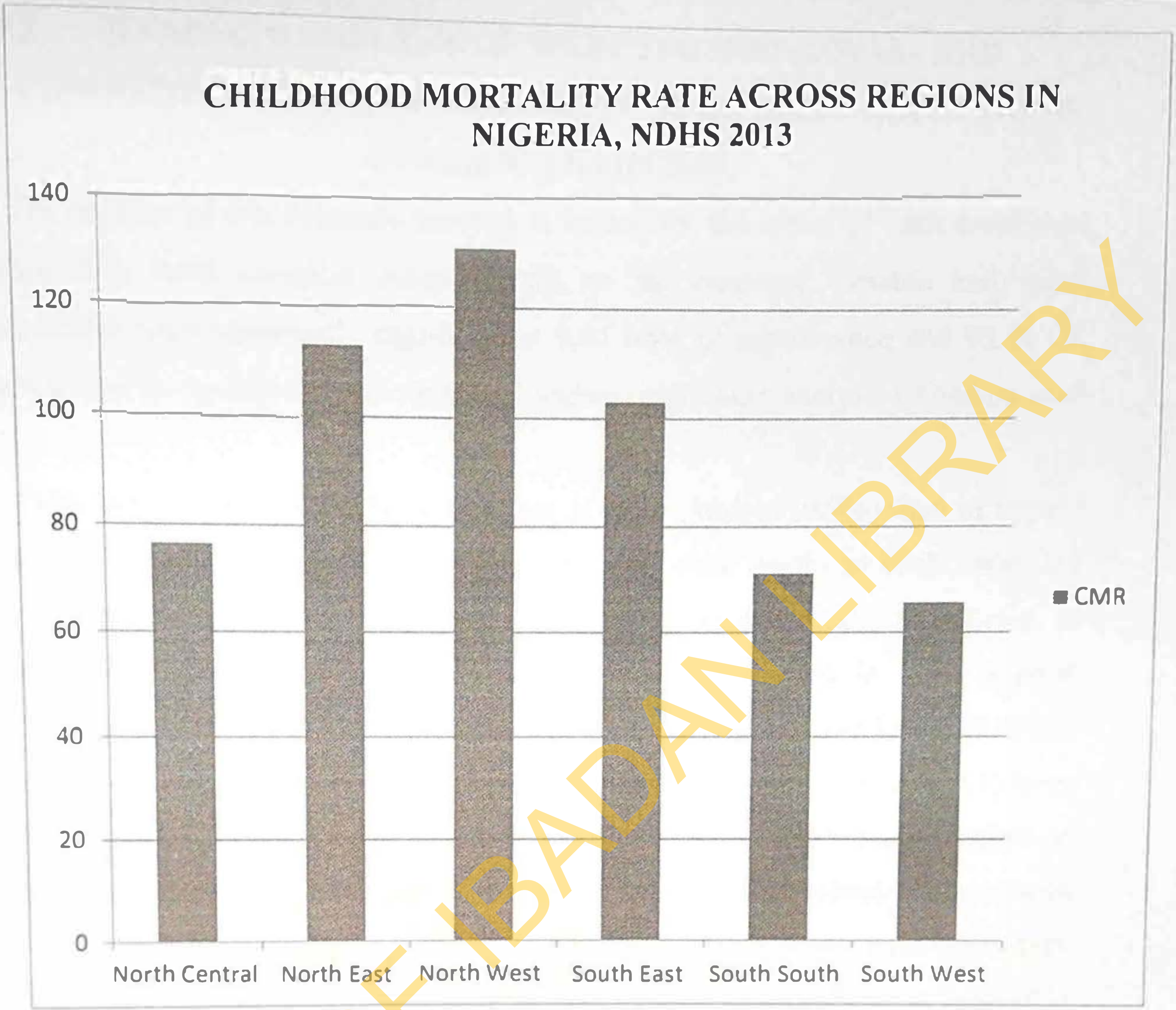

Figure 1: Chart showing childhood mortality rate across regions in Nigeria using 2013 NDHS data.

4.3 BIVARIATE ANALYSIS OF SELECTED INDIVIDUAL- AND COMMUNITY -LEVEL OF CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS 2013.

The essence of this bivariate analysis is to test for the effect of each individual and community level variables independently on the outcome variable and those variables which were statistically significant at 0.05 level of significance and 95 % CI, were considered in the logistic and multilevel logistic regression analysis (Abadura et.al 2015)

Table below shows that U5D was higher in male children (9.9%) than in female ones which is significant at (p<0.001). There were less child deaths in birth order 2-4 (7.9%) compare to other birth order and is found to be statistically significant at (p<0.001). The higher proportion of childhood mortality occurred in birth interval 24months and below (13.4%) and low in mothers within age group 20-35years (8.48%), this is significant at (p<0.001). UD5 mortality experienced in multiple birth (25.1) is as thrice as experienced in singleton birth and is significant at (p<0.001%) and mothers in cohort 1963-1969 experienced more death than mothers in the other cohort. Mothers with higher education experienced lesser death (4.5%) compare to those with secondary (6.54%), primary (9.27%) and no education (11.22%) which is significant at (p<0.001) also more educated fathers experienced less child death. Currently married women experience more U5D than those not married although the association was not significant.

Furthermore, households that have access to improved toilet and water facility experienced less childhood mortality than those who do not have the access at (p<0.001%). So also, Muslim children die more (10.3%) than other religions which is significant at (p<0.001%). Children living in the rural area die more (4.1%) compared to those in the urban area(3.1%) and this was significant at (p<0.001) while the highest childhood mortality occurred in the North- west region of the country (11.6%) than in other regions significant at (p<0.001%).

TABLE 4: BIVARIATE OFSELECTED INDIVIDUAL- AND COMMUNI -TY - LEVEL OF CHILDHOOD MORTALITY CLUSTERING IN NIGERIA ANALYSIS NDHS 2013.

Variables	Alive	Dead	Chi-square	P-value
Individual level				
Child Sex				
Male	14387 (90.12)	1578 (9.88)	19.99	<0.001*
Female	14209 (91.57)	1308 (8.43)		
Birth Order				
1	5528 (90.49)	581 (9.51)		
2-3	9283 (92.15)	791 (7.85)	31.56	<0.001*
4+	13785 (90.10)	1514 (9.90)		
Birth Interval				
First Birth	5574 (90.18)	607 (9.82)		
<=24months	5777 (86.64)	891 (13.36)	210.15	<0.001*
>24months	17245 (92.55)	1388 (7.45)		
Maternal Age				
< 20 years	3373 (87.84)	467 (12.16)		
20 - 35 years	21167 (91.52)	1962 (8.48)	59.34	<0.001*
>=36 years	4056 (89.87)	457 (10.13)		
Multiple Birth				
Single birth	27774 (91.41)	2610 (8.59)	348.44	<0.001*
Multiple birth	822 (74.86)	822 (25.14)		
Parity				
1	3393 (93.63)	231 (6.37)		
2 - 4	13731 (91.75)	1235 (8.25)	101.84	<0.001*
5+	11472 (88.99)	1420 (11.01)		
Maternal Birth Cohort				
1963-1969	1068 (87.18)	157 (12.82)		
1970-1979	7515 (90.89)	753 (9.11)	36.97	<0.001*
1980-1989	14577 (91.5)	1354 (8.50)		
1990-1998	5436 (89.73)	622 (10.27)		
Maternal Education				
No education	13105 (88.78)	1657 (11.22)		
Primary	5836 (90.73)	596 (9.27)	195.42	<0.001*
Secondary	7818 (93.46)	547 (6.54)		
Higher	1837 (95.53)	86 (4.47)		

TABLE 4: BIVARIATE OFSELECTED INDIVIDUAL- AND COMMUNI -TY - LEVEL OF CHILDHOOD MORTALITY CLUSTERING IN NIGERIA ANALYSIS NDHS 2013.

Variables	Alive	Dead	Chi-square	P-value
Individual level				
Child Sex				
Male	14387 (90.12)	1578 (9.88)	19.99	<0.001*
Female	14209 (91.57)	1308 (8.43)		
Birth Order				
1	5528 (90.49)	581 (9.51)		
2-3	9283 (92.15)	791 (7.85)	31.56	<0.001*
4+	13785 (90.10)	1514 (9.90)		
Birth Interval				
First Birth	5574 (90.18)	607 (9.82)		
<=24months	5777 (86.64)	891 (13.36)	210.15	<0.001*
>24months	17245 (92.55)	1388 (7.45)		
Maternal Age				
< 20 years	3373 (87.84)	467 (12.16)		
20 - 35 years	21167 (91.52)	1962 (8.48)	59.34	<0.001*
>=36 years	4056 (89.87)	457 (10.13)		
Multiple Birth				
Single birth	27774 (91.41)	2610 (8.59)	348.44	<0.001*
Multiple birth	822 (74.86)	822 (25.14)		
Parity				
1	3393 (93.63)	231 (6.37)		
2 - 4	13731 (91.75)	1235 (8.25)	101.84	<0.001*
5+	11472 (88.99)	1420 (11.01)		
Maternal Birth Cohort				
1963-1969	1068 (87.18)	157 (12.82)		
1970-1979	7515 (90.89)	753 (9.11)	36.97	<0.001*
1980-1989	14577 (91.5)	1354 (8.50)		
1990-1998	5436 (89.73)	622 (10.27)		
Maternal Education				
No education	13105 (88.78)	1657 (11.22)		
Primary	5836 (90.73)	596 (9.27)	195.42	<0.001*
Secondary	7818 (93.46)	547 (6.54)		
Higher	1837 (95.53)	86 (4.47)		

TABLE 4 CONT'D: BIVARIATE ANALYSIS OF SELECTED INDIVIDUAL- AND COMMUNITY -LEVEL OF CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS 2013.

Variables	Alive	Dead	Chi-square	P-value
Marital Status				
Not Currently Married	2153 (91.00)	213 (9.00)	0.0832	0.773
Currently Married	26443 (90.82)	2673 (9.18)		
Paternal Education				
No education	10275 (88.50)	1335 (11.50)		
Primary	5408(90.36)	577 (9.64)	175.20	<0.001*
Secondary	8345 (92.63)	664 (7.37)		
Higher	3760 (94.45)	221 (5.55)		
Community level				
Water Source				
Unimproved	11880 (89.61)	1377 (10.39)	40.92	<0.001*
Improved	16716 (91.72)	1509 (8.28)		
Toilet Facility				
Unimproved	14658 (89.86)	1654 (10.14)	38.46	<0.001*
Improved	13938 (91.88)	1232 (8.12)		
Religion				
Christianity	11697 (92.44)	957 (7.56)		
Islam	16467 (89.72)	1887 (10.28)	66.47	<0.001*
Others	284 (90.45)	30 (9.55)		
Place of Residence				
Urban	9685 (93.57)	666 (6.43)	138.33	<0.001*
Rural	18911 (89.49)	2220 (10.51)		
Region				
North-Central	4286 (92.89)	328 (7.11)		
North-East	5856 (89.86)	661 (10.14)		
North-West	8760 (88.43)	1146 (11.57)	170.51	<0.001*
South-East	2553 (90.66)	263 (9.34)		
South-South	3498 (93.35)	249 (6.65)		
South-West	3643 (93.84)	239 (6.16)		

*p<0.05(Statistically significant)

4.4 LOGISTIC REGRESSION ANALYSIS OF CHILDHOOD MORTALITY CLUSTERING ON SELECTED INDIVIDUAL- AND COMMUNITY –LEVEL VARIABLES IN NIGERIA, NDHS 2013

From Table 4.3 below, it was deduced that there is statistically significant association between child sex and survival status as male children are 1.2times more likely to die than their female counterparts (CI=0.760-0.892) and children of higher order are less likely to die than those of lower birth order (CI=0.519-1.64) although the association was not significant. Children born with preceding birth interval over 24months are as twice as likely to survive as those born with lower preceding birth interval and the association was significant (OR=0.32, CI=0.187-0.553). Mothers in the age group 20-35year are 1.4times less likely to experience under five deaths (CI= 0.583-0.871) compared to those in lower age group and the association is statistically significant. The association between multiplicity of birth and childhood mortality is statistically significant as children of multiple birth are 3.5times more likely to die than their singletons counterparts (CI= 3.023 - 4.135).

Furthermore, there is a significant association between parity and U5D as mothers with higher parity are likely to lose more children than those of lower parity (CI=3.161-5.262). Mothers in birth cohort 1990-1998 are more likely to experience child survival than those (CI= 0.441 - 0.803) than mothers from other cohort. Parental education is protective of childhood mortality as the more educated the parents the more likely the child survives, although this is not statistically significant at primary but significant at secondary and higher education level.

More so, mothers that have access to improved toilet facility are less likely to experience child death compared with mothers with no access (CI=0.827-0.987) but there is not statistically significant association between childhood mortality and source of drinking water. There is no significant association between survival status of children below five years of age and religion practiced. Place of residence is a constant predictor of U5D as children born in rural area are 1.4times more likely to die compared to those born in the urban areas (CI=1.231-1.535).

TABLE 5: LOGISTIC REGRESSION ANALYSES OF CHILDHOOD MORTALITY CLUSTERING ON SELECTEDINDIVIDUAL- AND COMMUNITY-LEVEL IN NIGERIA NDHS, 2013.

Variable	R	95% C.I of OR	P-value
Individual level			
Child Sex			
Male(ref)			
Female	0.824	0.760 - 0.892	0.000*
Birth Order			
1(ref)			
2-3	1.314	0.758 - 2.277	0.970
4+	0.925	0.519 - 1.646	-0.260
Birth Interval			
First Birth(ref)			
<=24months	0.620	0.359 - 1.070	0.086
>24months	0.321	0.187 - 0.553	0.000*
Maternal Age			
< 20 years(ref)			
20 - 35 years	0.715	0.583 - 0.871	0.001*
>=36 years	0.688	0.535 - 0.886	0.004*
Multiple Birth			
Single birth(ref)			
Multiple birth	3.536	3.023 - 4.135	0.000*
Parity			
1(ref)			
2 - 4	2.317	1.916 - 2.802	0.000*
5+	4.078	3.161 - 5.262	0.000*
Matdrnal Birth Cohort			
1963-1969(ref)			
1970-1979	0.694	0.562 - 0.856	0.001*
1980-1989	0.659	0.516 - 0.841	0.001*
1990-1998	0.595	0.441- -0.803	0.001*
Maternal Education			
No education(ref)			
Primary	0.983	0.866 - 1.116	0.792
Secondary	0.776	0.664 - 0.907	0.001*
Higher	0.633	0.477 - 0.840	0.002*

TABLE 5: LOGISTIC REGRESSION ANALYSES OF CHILDHOOD MORTALITY CLUSTERING ON SELECTEDINDIVIDUAL- AND COMMUNITY-LEVEL IN NIGERIA NDHS, 2013.

Variable	R	95% C.I of OR	P-value
Individual level			
Child Sex			
Male(ref)			
Female	0.824	0.760 - 0.892	0.000*
Birth Order			
1(ref)			
2-3	1.314	0.758 - 2.277	0.970
4+	0.925	0.519 - 1.646	-0.260
Birth Interval			
First Birth(ref)			
<=24months	0.620	0.359 - 1.070	0.086
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Maternal Age			
< 20 years(ref)			
20 - 35 years	0.715	0.583 - 0.871	0.001*
>=36 years	0.688	0.535 - 0.886	0.004*
Multiple Birth			
Single birth(ref)			
Multiple birth	3.536	3.023 - 4.135	0.000*
Parity			
1(ref)			
2 - 4	2.317	1.916 - 2.802	0.000*
5+	4.078	3.161 - 5.262	0.000*
MatTrnal Birth Cohort			
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1980-1989	0.659	0.516 - 0.841	0.001*
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Maternal Education			
No education(ref)			
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Secondary	0.776	0.664 - 0.907	0.001*
Higher	0.633	0.477 - 0.840	0.002*

TABLE 5: LOGISTIC REGRESSION ANALYSES OF CHILDHOOD MORTALITY CLUSTERING ON SELECTEDINDIVIDUAL- AND COMMUNITY-LEVEL IN NIGERIA NDHS, 2013.

Variable	R	95% C.I of OR	P-value
Individual level			
Child Sex			
Male(ref)			
Female	0.824	0.760 - 0.892	0.000*
Birth Order			
1(ref)			
2-3	1.314	0.758 - 2.277	0.970
4+	0.925	0.519 - 1.646	-0.260
Birth Interval			
First Birth(ref)			
<=24months	0.620	0.359 - 1.070	0.086
>24months	0.321	0.187 - 0.553	0.000*
Maternal Age			
< 20 years(ref)			
20 - 35 years	0.715	0.583 - 0.871	0.001*
>=36 years	0.688	0.535 - 0.886	0.004*
Multiple Birth			
Single birth(ref)			
Multiple birth	3.536	3.023 - 4.135	0.000*
Parity			
1(ref)			
2 - 4	2.317	1.916 - 2.802	0.000*
5+	4.078	3.161 - 5.262	0.000*
Maternal Birth Cohort			
1963-1969(ref)			
1970-1979	0.694	0.562 - 0.856	0.001*
1980-1989	0.659	0.516 - 0.841	0.001*
1990-1998	0.595	0.441 - -0.803	0.001*
Maternal Education			
No education(ref)			
Primary	0.983	0.866 - 1.116	0.792
Secondary	0.776	0.664 - 0.907	0.001*
Higher	0.633	0.477 - 0.840	0.002*

TABLE 5 CONT'D: LOGISTIC REGRESSION ANALYSES OF CHILDHOOD MORTALITY CLUSTERING ON SELECTED INDIVIDUAL- AND COMMUNITY-LEVEL IN NIGERIA NDHS 2013

Variable	R	95% C.I of OR	P-value
Paternal Education			
No education(ref)			
Primary	0.967	0.857 - 1.092	0.586
Secondary	0.886	0.778 - 1.009	0.069
Higher	0.804	0.670 - 0.965	0.019*
Community level			
Water Source			
Unimproved(ref)			
Improved	1.002	0.918 - 1.093	0.964
Toilet Facility			
Unimproved(ref)			
Improved	0.904	0.827 - 0.987	0.024*
Religion			
Christianity(ref)			
Islam	0.918	0.789 - 1.055	0.226
Others	0.792	0.524 - 1.196	0.267
Place of Residence			
Urban(ref)			
Rural	1.375	1.231 - 1.535	0.000*
Region			
North Central(ref)			
North East	1.331	1.142 - 1.551	0.000*
North West	1.501	1.290 - 1.747	0.000*
South East	1.505	1.236 - 1.833	0.000*
South South	0.910	0.750 - 1.103	0.335
South West	1.090	0.905 - 1.314	0.365

Random effect parameter: Region

Estimate intercept variance(standard error): 0.033(0.022)

Loglikelihood = -8807.444

AIC = 17676.89

BIC = 17934.91

ICC = 0.109

*p<0.05(Statistically significant)

4.5 NULL MODEL OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS ON CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS 2013.

Table below shows the results of the null, empty or variance component model of the multilevel logistic regression fitted with no explanatory variable. The purpose of fitting this model is to decompose the total variance between individual and community level, to test random variability in the intercept and to estimate the intra class correlation coefficient (ICC). This model shows that the normally distributed random intercept of childhood mortality has a variance of 0.06 which indicate that when no independent variable was included in the model, the between cluster variation in this model may be due to observed or unobserved bio-demographic and socio-economic characteristics of the population. This model was applied in other to estimate the total variance in child death that can be attributed to community-level in which the households were located to justify the reason for application of multivariate multilevel regression analysis. The intra class correlation (ICC) estimated at 0.02 indicate that 2% of the total variance in childhood mortality in Nigeria can be attributed to the communities in which the mothers were residing. This also implies that the correlation between mothers living in the same community/region have the likelihood of experiencing child death was 0.02.

4.5 NULL MODEL OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS ON CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS 2013.

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TABLE 6: NULL MODEL OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS ON CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS2013.

VARIABLES	R	S.E	95% C.I OF OR	P VALUE
	0.091	0.010	0.074 - 0.111	0.000

Random effect parameter: Region

Estimate intercept variance(standard error): 0.06(0.04)

Intra-class correlation:

Loglikelihood: -9572.624

AIC: 19149.25

BIC: 19164.96

TABLE 6: NULL MODEL OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS ON CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS2013.

VARIABLES	R	S.E	95% C.I OF OR	P VALUE
	0.091	0.010	0.074 - 0.111	0.000

Random effect parameter: Region

Estimate intercept variance(standard error): 0.06(0.04)

Intra-class correlation:

Loglikelihood: -9572.624

AIC: 19149.25

BIC: 19164.96

4.6 MODEL TWO OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS OF CHILDHOOD MORTALITY CLUSTERING ON INDIVIDUAL-LEVEL FACTORS IN NIGERIA, NDHS 2013.

In model 2 below, only individual level (socio-demographic) variables were included in the multilevel logistic regression model. The inclusion of individual level variable reduced the random intercept variance to 0.05 which implies that despite the fact that between regions/ community variation exist, some of the differences within region are attributed to individual characteristics and unexplained variation within region. The intra class correlation (ICC) estimated at 0.02 indicate that 2% of the total variance in childhood mortality in Nigeria can be attributed to the socio-demographic characteristics of individual mothers in the household. After individual level variable were been controlled for, Female children are more likely to survive compared their male counterpart (OR=0.890, CI=0.6701-0.992). A child of order 2 to 3 is 1.3times more likely to die than those of higher order (CI=0.755-2.268), but the association is not statistically significant. Children born in preceding birth interval above 24months are more likely to survive compared to other birth interval (OR=0.32, CI=0.355-1.059). Mothers in the age group 20-35year are less likely to experience under five deaths (OR=0.775,CI=.674-0.892) compared to mothers in the other age group and the association is statistically significant. There is a significant association between parity (i.e. number of children ever born) and childhood mortality as mothers of higher parity are more 4times more likely to lose more children than those of lower parity (CI=3.683-5.798) and children of multiple births are 3times more likely to die than singleton (CI=2.991-4.090). Also, mothers in other birth cohorts are more likely to experience child survival than those in 1963-1969 maternal birth cohorts and the association is statistically significant. Parental education is protective of U5D.

4.6 MODEL TWO OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS OF CHILDHOOD MORTALITY CLUSTERING ON INDIVIDUAL-LEVEL FACTORS IN NIGERIA, NDHS 2013.

In model 2 below, only individual level (socio-demographic) variables were included in the multilevel logistic regression model. The inclusion of individual level variable reduced the random intercept variance to 0.05 which implies that despite the fact that between regions/ community variation exist, some of the differences within region are attributed to individual characteristics and unexplained variation within region. The intra class correlation (ICC) estimated at 0.02 indicate that 2% of the total variance in childhood mortality in Nigeria can be attributed to the socio-demographic characteristics of individual mothers in the household. After individual level variable were been controlled for, Female children are more likely to survive compared their male counterpart (OR=0.890, CI=0.6701-0.992). A child of order 2 to 3 is 1.3times more likely to die than those of higher order (CI=0.755-2.268), but the association is not statistically significant. Children born in preceding birth interval above 24months are more likely to survive compared to other birth interval (OR=0.32, CI=0.355-1.059). Mothers in the age group 20-35year are less likely to experience under five deaths (OR=0.775,CI=.674-0.892) compared to mothers in the other age group and the association is statistically significant. There is a significant association between parity (i.e. number of children ever born) and childhood mortality as mothers of higher parity are more 4times more likely to lose more children than those of lower parity (CI=3.683-5.798) and children of multiple births are 3times more likely to die than singleton (CI=2.991-4.090). Also, mothers in other birth cohorts are more likely to experience child survival than those in 1963-1969 maternal birth cohorts and the association is statistically significant. Parental education is protective of U5D.

TABLE 7: MODEL TWO OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS OF CHILDHOOD MORTALITY CLUSTERING ON INDIVIDUAL-LEVEL FACTORS IN NIGERIA NDHS, 2013.

VARIABLES	OR	95% C.I OF OR	P VALUE
Child Sex			
Male(ref)			
Female	0.837	0.774 - 0.905	0.000
Birth Order			
1(ref)			
2-3	1.288	0.764 - 2.172	0.342
4+	0.936	0.540 - 1.622	0.814
Preceding Birth Interval			
First Birth(ref)			
<=24months	0.668	0.398 - 1.121	0.127
>24months	0.668	0.210 - 0.590	0.000
Marternal Age			
< 20 years(ref)			
20 - 35 years	0.673	0.558 - 0.812	0.000
>=36 years	0.662	0.519 - 0.845	0.001
Multiple Birth			
Single birth(ref)			
Multiple birth	3.464	2.971 - 4.038	0.000
Parity			
1(ref)			
2 - 4	2.261	1.892 - 2.701	0.000
5+	4.325	3.383 - 5.527	0.000
Marternal Birth Cohort			
1963-1969(ref)			
1970-1979	0.687	0.558 - 0.847	0.000
1980-1989	0.679	0.533 - 0,864	0.002
1990-1998	0.669	0.499 - 0.896	0.007
Maternal Education			
No education(ref)			
Primary	0.981	0.866 - 1.112	0.768
Secondary	0.764	0.657 - 0.889	0.000
Higher	0.640	0.486 - 0.842	0.000

Paternal Education			
No education(ref)			
Primary	0.958	0.850 - 1.079	0.476
Secondary	0.870	0.766 - 0.989	0.033
Higher	0.750	0.626 - 0.898	0.002
Random effect parameter: Region			
Estimate intercept variance(standard error): 0.047(0.029)			
Intra-class correlation:			
Loglikelihood: -9215.089			
AIC: 18460.18			
BIC: 18585.54			

4.7 MODEL THREE OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS OF CHILDHOOD MORTALITY CLUSTERING ON COMMUNITY-LEVEL FACTORS IN NIGERIA NDHS, 2013.

Table 4.6 below shows model 3 of the multilevel logistic regression model where only the community- level variables based on region were included in the analysis. The model shows that after adding the community level variable to the null model, the variance of random intercept reduced to 0.4which account for some of the differences between regions. The intra-community correlation (ICC) estimated at 0.02 indicate that 2% of the total variance in childhood mortality in Nigeria can be attributed to the region (community) in which the household resides. The ICC of 0.02 indicates that the intra-correlation of childhood mortality among mothers living in different region after controlling for community level variable is 7%.

After adjusting for community variables, mothers who have access to improved water facility are less likely to experience child death compared with mothers with no access (CI=0.913-1.803) although, there is no statistically significant association between childhood mortality and source of drinking water. So also, there is a significant association between child death and access to toilet facility households that have access to improved toilet facility are more likely to experience child survival compared with those that do not have the access (CI=0.831-0.988) Children from other religions are 1.3 more likely to die than those from Christianity and Islam (CI= 0.571 - 1.278) although the association is not statistically significant. Place of residence is a constant predictor of U5D as children born in rural area are 1.4times more likely to die compared to those born in the urban areas (CI=1.224-1.519) which remains statistically significant.

TABLE 8: MODEL THREE OF MULTILEVEL LOGISTIC REGRESSION OF CHILDHOOD MORTALITY CLUSTERING ANALYSIS ON COMMUNITY-LEVEL FACTORS IN NIGERIA NDHS 2013.

VARIABLES	OR	95% C.I OF OR	P-VALUE
Water Source			
Unimproved(ref)			
Improved	0.994	0.913 - 1.803	0.895
Toilet Facility			
Unimproved(ref)			
Improved	0.906	0.831 - 0.988	0.026
Religion			
Christianity(ref)			
Islam	0.945	0.827 - 1.08	0.408
Others	0.854	0.571 - 1.278	0.443
Place of Residence			
Urban(ref)			
Rural	1.363	1.224 - 1.519	0.000

Random effect parameter: Region

Estimate intercept variance(standard error): 0.379(0.243)

Intra-class correlation:

Loglikelihood: -9158.0017

AIC: 18344.00

BIC: 18460.53

4.8 MODEL FOUR OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS ON INDIVIDUAL- AND COMMUNITY-LEVEL FACTORS OF CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS, 2013.

Table below shows model 4 of the multi-level logistic regression model where both the individual- and community- level variables were included in the analysis. After accounting for variables at both levels the variance of random intercept reduced to 0.03 which shows heterogeneity across region and that there are some unobserved community and individual characteristics that are associated with childhood mortality.

TABLE 9: MODEL FOUR OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS ON INDIVIDUAL- AND COMMUNITY-LEVEL FACTORS OF CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS 2013.

VARIABLES	OR	95% C.I OF OR	P VALUE
Individual-level			
Child Sex			
Male(ref)			
Female	0.823	0.760 - 0.892	0.000
Birth Order			
1(ref)			
2-3	1.306	0.734 - 2.264	0.341
4+	0.920	0.517 - 1.637	0.777
Preceding Birth Interval			
First Birth(ref)			
<=24months	0.624	0.362 - 1.077	0.090
>24months	0.323	0.188 - 0.556	0.000
Maternal Age			
< 20 years(ref)			
20 - 35 years	0.715	0.587 - 0.871	0.001
>=36 years	0.688	0.534 - 0.885	0.004
Multiple Birth			
Single birth(ref)			
Multiple birth	3.529	3.0184 - 4.127	0.000
Parity			
1(ref)			
2 - 4	2.318	1.917 - 2.803	0.000
5+	4.086	3.167 - 5.273	0.000
Maternal Birth Cohort			
1963-1969(ref)			
1970-197	0.693	0.562 - 0.856	0.001
1980-1989	0.659	0.516 - 0.841	0.001
1990-1998	0.596	0.442 - 0.804	0.001
Maternal Education			
No education(ref)			
Primary	0.978	0.861 - 1.110	0.729
Secondary	0.773	0.662 - 0.902	0.001
Higher	0.631	0.476 - 0.832	0.001

TABLE 9 CONT'D: MODEL FOUR OF MULTILEVEL LOGISTIC REGRESSION ANALYSIS ON INDIVIDUAL- AND COMMUNITY-LEVEL (REGION) FACTORS OF CHILDHOOD MORTALITY CLUSTERING IN NIGERIA NDHS 2013.

VARIABLES	OR	95% C.I OF OR	P VALUE
Paternal Education			
No education(ref)			
Primary	0.965	0.855 - 0.089	0.559
Secondary	0.880	0.772 - 1.003	0.055
Higher	0.797	0.664 - 0.957	0.015
Community-level			
Water Source			
Unimproved(ref)			
Improved	1.001	0.917 - 1.092	0.985
Toilet Facility			
Unimproved(ref)			
Improved	0.907	0.830 - 0.990	0.030
Religion			
Christianity(ref)			
Islam	0.932	0.813 - 1.068	0.309
Others	0.800	0.530 - 1.207	0.287
Pace of residence			
Urban(ref)			
Rural	1.371	1.229 - 1.524	0.000

Random effect parameter: Region
Estimate intercept variance(standard error): 0.033(0.022)
Intra-class correlation:
Loglikelihood: -8819.987
AIC: 7693.97
BIC: 17918.70

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.0 INTRODUCTION

This chapter presents the discussion, conclusion and recommendations on correlates of death clustering among children less than five years in age in an attempt to investigate factors responsible for the under-five death concentration in certain setup like family or community based on findings from descriptive as well as inferential statistical techniques used for the analysis.

5.1 DISCUSSION

This study examined patterns and correlates of childhood mortality clustering in Nigeria using exploratory analysis, bivariate analysis, binary logistic regression and multivariate logistic regression analysis. The exploratory analysis showed that childhood mortality rate is higher in the Northern region (with Northwest region bearing the highest) which implies that deaths cluster in that region more than the Southern region of the country. In the bivariate analysis, all the independent variables considered were significant at 0.05 level of significance except maternal marital status therefore this variable was excluded from subsequence analysis.

The ordinary logistic regression analysis outcome showed that there is significant association between childhood death and lower maternal education, higher maternal age at birth of child, maternal birth cohort, multi-parity, sex of the child, short birth Interval, multiple births and use of unimproved toilet facility, those living in rural areas and region. Paternal education was also protective of U5M. However, death also clusters in children of high birth order, those who lack access to improved drinking water and religion, but there associations are not statistically significant.

Similar to the findings from this studies, other previous studies found a significant association between childhood mortality and lower educational level (Abadura et.al 2015), adolescent mothers and higher maternal age at birth of child (Veneman, 2007; Tymicki, 2009; Oyefara, 2013; Vandezande et.al,2013), multi-parity (Arulampalam &

Bhalotral, 2005; Tymicki, 2009), sex of the child (Ettarh & Kimani, 2012; Boco, 2010; Mugarura, 2011), short birth Interval (Aigbe & Zannu, 2012; Arulampalam & Bhalotral, 2005), multiple births (Tymicki, 2009; Arulampalam & Bhalotral, 2005), unimproved toilet facility (Fayehun, 2010; Mugarura, 2011), living in rural areas (Akinrefon et.al, 2015; Fayehun, 2010) and region of residence (Boco, 2010). Paternal education was also protective of U5M (Hassen, 2014; Mekonnen, 2015)

Multilevel logistic regress analysis was used to assess the effects of individual- and community level characteristics associated with childhood mortality clustering after controlling for region of residence. The results showed that individual and community level variables were the major predictors of U5D concentration in a particular region. At both individual and community level, statistically significant were all the variables that were significant in the ordinary regression analysis even after controlling for region of residence. Model 4 of Multilevel logistic regress analysis is more parsimonious than other models as it has the smallest ICC and BIC which indicate both individual and community level variables are crucial in explaining death clustering in some families and geopolitical locations in Nigeria.

Similar to other previous findings, death was found to cluster more among male under age five than female (Boco, 2010) which may be due to the fact that male children are more vulnerable to diseases (UNFPA, 2012) or prone to greater immaturity at birth (Tymicki, 2009). Death was found to cluster among children with short birth intervals, high Parity as recoded by previous studies (Omariba et. al, 2005; Arulampalam and Bhalotra, 2004). Possible explanation for this is that Short birth intervals increase the number of children of almost the same age group in the family thereby leading to over stretching of available family resources, poor growth due to poor nutrition, exposure to diseases and eventually death. Short birth interval can also lead to the maternal depletion syndrome as the body of the mother might not have replenish the essential vitamins and nutrients needed for normal fetal growth and development which can lead to pre-term and low birth weight birth babies (Lawoyin, 2001), fetal death or still births and infection transmission among closely spaced siblings (Omariba et. al, 2005).

Mothers with multiple births are likely to experience more death as which results in lower birth weight babies with lower survival chances. Lower maternal age at birth of child significantly associated with child death as younger mothers are most time lack financial resources to seek proper medical care for their children and a times due to social stigma of giving birth at younger age may not seek prenatal care as a result, complications related to the pregnancy may not be detected until it is too late (Omariba et. al, 2005). Antai in his study found that children of older mothers (34 years and older) had higher risks of deaths.

Also similar to the findings from this study, other studies reported significant associations between higher maternal and paternal education and lower concentration of childhood death (Opara, 2015; Adedini et.al, 2014; Hassen, 2014; Aigbe & Zannu, 2012; Veneman, 2007). This is as a result of some factors like positive attitude of educated parents towards utilization of health care service, high socio-economic status as a result of education and majority of them reside in urban areas where are availability of social amenities and modern health services which helps in improving child survival. Access to and use of modern health services has been found to be positively associated with child survival in southwest Nigeria (NPC, 2009). More educated women were also found to have better reproductive health outcomes due to the fact that they have access to quality antenatal and post-natal services as well as giving birth in a qualified health facility than less educated women (NPC 2014).

At the community level significant are toilet facility, place of residence in agreement with previous findings while water source and Religion are not significant. The possible explanation for this is that households living in rural areas are likely to be more exposed to household health hazards due to lack of basic infrastructure and amenities like pipe borne water, good toilet facility, proper waste disposal, standard health care center and so on. Those living in urban areas are less likely to have health hazards in their household environment (Fayehun, 2010) as a result of good sanitation and available community health services, excreta disposal which an important determinant of child health in developing countries. (Omariba et. al, 2005;). Children under age five living in households with an unimproved toilet, such as open pit, bucket, hanging toilet, pit latrine without a slab, or with no facility are significantly more likely to have diseases that can lead to morbidity and mortality than others with an improved toilet facility (Fayehun, 2010).So also, households relying on open well or surface water child significantly associated with child death as younger mothers are most time lack financial resources to seek proper medical care for their children and a times due to social stigma of giving birth at younger age may not seek prenatal care as a result, complications related to the pregnancy may not be detected until it is too late (Omariba et. al, 2005). Antai in his study found that children of older mothers (34 years and older) had higher risks of deaths.

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The effect of religion on childhood mortality in this study was insignificant, unlike in other studies like Omariba et. al (2005) and Ogunjuyigbe (2004) were religious differences influence the risk of childhood mortality.

This study showed that under-five mortality was significantly associated with region of residence, with the risks of under-five deaths being high in the North- west region of the country followed by North-East, North-Central, South-East, South-South and South-West consecutively which means deaths cluster more in the northern part of the country than the southern part similar to previous studies on childhood mortality clustering (e.g. Madise et al, 2003; PRRINN-MNCH survey 2009 & 2010) in the country. This study confirms that both individual- and community-level variables were found to be significantly associated with childhood death clustering in the country.

5.2 STRENGTHS AND LIMITATIONS OF THE STUDY

The findings from this study were not without limitations which should be borne in mind. The analysis was conducted using secondary data (NDHS 2013) and adequate information on child ever died in the family was being provided retrospectively by the mother which may be subjected to under reporting of death for children who are not living at the time of the survey (i.e. recall bias). There is also bound to be non sampling errors depending on completeness of information obtained as death incidents are recalled and reported. Despite the limitations however, the study has its own strengths. The NDHS 2013 used is a nationally representative and large sample of population based survey which covers the entire country hence, the finding could be generalized internationally. In addition, using multilevel modeling analysis to determine correlates of childhood mortality enabled to us to identify those factors that influence deaths clustering at household level as well as at community level.

5.3 CONCLUSION

This study showed that there is clustering of under-five death in some households, communities and regions in Nigeria due to some individual- and community-level factors associated with increasing risks of under-five deaths most especially in the northern part of the country. The results of this study underscore the need for public health interventions to focus more on both individual- and community-level factors responsible for concentration of U5D in the affected areas.

5.4 RECOMMENDATIONS

This study has demonstrated the significant impact of both individual and community characteristics in explaining clustering of childhood death in some households/families and regions in Nigeria. In order to ensure ample reduction in concentration of under-five death, it is therefore recommended that a comprehensive approach should be taken in reducing childhood mortality through provision of free basic education (to improve health-seeking behavior and utilization of health care services). Educational programmes to create public awareness education on the importance of a healthy living environment child survival, poverty alleviation programmes, as well as women empowerment programs should be put in place. Family planning programmes in the Northern part of the country where there is high birth rate and death rate can also be of help in reducing concentration of death in those regions.

Also Government should develop policies that will abridge the inequality in provision of basic amenities and primary health care services between rural and urban areas; community-level interventions aimed at improving child survival in the socially and economically deprived areas should be provided; Interventions aimed at promoting child health and wellbeing need to be intensified in disadvantaged and inaccessible communities within the disadvantaged regions. There is also need for policy makers to promote family planning in other to avoid large families and invariably reduce child mortality.

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