RISK FACTORS FOR PERINATAL MORTALITY IN NIGERIA: THE ROLE OF PLACE OF DELIVERY AND DELIVERY ASSISTANTS

BY

OTI SAMUEL OJI

STUDENT NUMBER: 0702350N

A RESEARCH REPORT SUBMITTED TO THE FACULTY OF HEALTH SCIENCES, UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (MEDICINE) IN EPIDEMIOLOGY AND BIOSTATISTICS

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DECLARATION

I, **OTI, Samuel Oji** declare that this research report is my own work. It is being submitted for the degree of Master of Science in Medicine in the field of Epidemiology and Biostatistics in the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

……………………………. [Signature of candidate]

………………… day of …………………, 200….

DEDICATION

This work is dedicated to the memory of every new born child whose sojourn on earth lasted less than the first 7 days of life…

Dr. Samuel Oji Oti

July 2008

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First of all, I would like to thank my Heavenly Father and Lord Jesus Christ as well as the precious Holy Spirit for their grace, blessings and leading in my life. I give God all the glory for the possibility and success of this work.

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And to my late classmate and friend, Dan Ogola, may your soul rest in perfect peace with the Lord, Amen.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odds Ratio
CHW	Community Health Worker
DHS	Demographic and Health Survey
ENMR	Early Neonatal Mortality Rate
HIV	Human Immunodeficiency Virus
NDHS	Nigerian Demographic and Health Survey
MDG	Millennium Development Goals
NPC	National Population Commission (Nigeria)
NMR	Neonatal Mortality Rate
PNMR	Perinatal Mortality Rate
SBR	Still Birth Rate
TBA	Traditional Birth Attendant
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
Un-OR	Unadjusted Odds Ratio

ABSTRACT

Background: This study examines the association between place of delivery, delivery assistants and perinatal mortality in Nigeria. Previous studies have found these factors to be associated with the risk of perinatal mortality. This study therefore aims to determine the extent to which these two factors predict perinatal mortality in the Nigerian context as this information will be useful in informing health policy decisions and actions in so far as a desirable reduction in childhood mortality in Nigeria is concerned. **Methods:** This study uses cross sectional design through secondary analysis of the 2003 Nigerian Demographic and Health Survey (NDHS). The variables representing place of delivery and delivery assistants have been fitted into logistic regression models to determine their association with perinatal mortality. Several other known risk factors for perinatal mortality such as maternal education and birth weight, to mention a few, have also been investigated using the logistic regression analysis. **Results:** 5783 live singleton births were analyzed with 194 newborns dying within the first seven days of life giving an early neonatal mortality rate (ENMR) of 33.5 per 1000 and an estimated perinatal mortality rate (PNMR) of 72.4 per 1000 live births. The results also show that place of delivery [p=0.8777] and delivery assistants [p=0.3812] are not significantly associated with perinatal mortality even after disaggregating the analysis by rural and urban areas. However being small in size at birth [AOR= 2.13, CI=1.41 – 3.21], female [AOR=0.57, CI= 0.42 – 0.77] and having a mother who practiced traditional religion [AOR= 4.37, CI= 2.31 – 8.26], were all significantly associated with perinatal mortality. **Conclusions:** Place of delivery and delivery assistants are not good predictors of perinatal mortality in the Nigerian context. However various limitations of the study design used such as the issue of uncontrolled confounding may have affected the findings. Nonetheless, the increased risk of perinatal deaths in small babies and the decreased risk of death among female babies are consistent with other studies and have both been attributed elsewhere to biologic mechanisms.

CHAPTER ONE

GENERAL INTRODUCTION

1.1 INTRODUCTION

Perinatal mortality rate (PNMR) is a key health status indicator of a community (Wilkinson, 1997). Specifically it is an important indicator of maternal care, maternal health and nutrition. It also reflects the quality of obstetric and pediatric care available (WHO, 2006a). Overall it plays an important role in providing the information needed to improve the health status of pregnant women, new mothers and newborns. This information allows decision-makers to identify problems, track temporal and geographical trends and disparities and assess changes in public health policy and practice (WHO, 2006a).

There are considerable differences in PNMR between developed and developing countries (WHO, 2006a). The worldwide estimate of PNMR is about 47 per 1000 live births in the year 2000. However for more developed regions of the world, the figure is about 10 per 1000 live births compared with 50 per 1000 live births in less developed regions of the world (WHO, 2006a). These differences in PNMR have been associated with the varying levels of socioeconomic development and availability/quality of health care between countries and Regions (Mavalankar et al., 1991). For instance, Cote d'Ivoire is a low income country and has a very high PNMR of 96 per 1000 live births in the year 2000. Whereas a high income country like Sweden has a PNMR as low as 5 per 1000 live births in the year 2000 (WHO, 2006a).

One of the most vital Millennium Development Goals (MDG) set by the United Nations (UN) is to reduce child mortality by two-thirds by the year 2015; MDG-4 (UN, 2006). However, neonatal mortality (death of a newborn within the first 4 weeks of life) accounts for more than half of all infant deaths (WHO, 2006a). And, three-quarters of all neonatal deaths occur in the first week of life –the perinatal period (Lawn et al., 2005). Therefore, achieving MDG-4 will certainly require a substantial reduction in PNMRs in high mortality countries and reducing deaths in the first week of life will be essential to progress (Lawn et al., 2005; Jose et al., 2005).

Furthermore, the proportion of births that take place at a health facility and the coverage of skilled attendance at birth have been associated with the level of perinatal mortality in a community. Countries where skilled attendance and institutional delivery rates are low usually have a high PNMR (Lawn et al., 2005). For instance, in Nigeria, only 35.2% of live births are delivered with the supervision of a trained health professional (NPC et al., 2004) and Nigeria has a very high PNMR of 86 per 1000 live births in the year 2000 (WHO, 2006a). Whereas in the United States, 99.3% of live births are assisted by a trained health professional (WHO, 2006b) and the PNMR is only 7 per 1000 live births in the year 2000 (WHO, 2006a). Therefore according to the WHO, improving the skilled attendance and institutional delivery rates in countries where PNMR is high may lead to better perinatal health outcomes and ultimately reduce childhood mortality in line with the MDG's.

This study therefore aims to examine the role of skilled attendants and place of delivery in determining perinatal health outcome in the Nigerian context as there is a dearth of information to this regard. And, the results of this study could potentially inform health policy direction as far as Nigeria's child health issues are concerned.

1.2 BACKGROUND AND INFORMATION ON STUDY POPULATION

Nigeria is located in the West African sub region between 4º16' and 13º53' north latitude and between 2º40' and 14º41' east longitude. It is bordered by Niger in the north, Chad in the northeast, Cameroon in the east, and Benin in the west. To the south, Nigeria is bordered by approximately 800 kilometers of the Atlantic Ocean, stretching from Badagry in the west to the Rio del Rey in the east. With a total land area of 923,768 square kilometers, the country is the fourth largest in Africa (NPC et al., 2004).

Nigeria is made up of 36 States and the Federal Capital territory (Abuja), which are grouped into six geopolitical regions: North-Central, North-East, North-West, South-East, South-South, and South-West. There are about 374 identifiable ethnic groups, but the Igbo, Hausa, and Yoruba are the major groups. English is the official language of the country and the main religions practiced are Islam, Christianity and traditional religion. In terms of economy, Nigeria is the 6th largest crude oil producer in the world and oil exports alone account for two-third of the country's Gross Domestic Product (NPC et al., 2004).

Demographically, Nigeria is the most populous nation in Africa and the tenth most populous in the world. The most recent census in Nigeria was conducted in 2006 and the total population was estimated to be 140,003,542 with annual growth rate of 3.2% (Federal Republic of Nigeria, 2007). This is an increase of almost 36% in comparison with the 1991 census figure of 88,992,220. The population of Nigeria is predominantly rural and approximately one-third of the population lives in urban areas. Some key demographic indicators include a total fertility rate of 5.7 in 2003 compared to 5.2 in 1999; a national infant mortality rate of 100 deaths per 1,000 live births in 2003 compared to 78 per 1000 live births in 1999; and an under-five mortality rate of 203 deaths per 1,000 live births in 2003 compared to 140.1 in 1999 (NPC et al., 2004).

In terms of health, Nigeria like most developing countries of the world has a significant burden of preventable diseases. Three of the world most prevalent infectious diseases –Tuberculosis, HIV/AIDS and Malaria, are common in Nigeria. There were an estimated 373,682 new cases of Tuberculosis (TB) in Nigeria in 2004. Globally, only India had more new cases of TB than Nigeria in 2004 (WHO 2006c). An estimated 2.4 million Nigerians were said to be living with HIV and the HIV/AIDS prevalence in Nigeria was 3.9% in 2005 increasing marginally from 3.7% in 2003 (UNAIDS, 2006). Malaria, which kills about 1 million people annually world wide, is endemic in every part of Nigeria (WHO, 2006c).The current priorities in the health sector are in the area of childhood immunization, malaria treatment and prevention of HIV/AIDS. And, several initiatives such as mass immunization campaigns and the Roll Back Malaria initiative are enjoying full government backing (NPC et al., 2004).

1.3 PROBLEM STATEMENT

Between 1980 and 2000, childhood mortality after the first month of life –i.e. from 2 months to age 5 years fell by over 35% worldwide, whereas the neonatal mortality rate declined by less than 25%. Hence an increasing proportion of child deaths are now in the neonatal period; estimates for 2000 show that 38% of all deaths in children younger than 5 years happen in the first month of life. Deaths in the perinatal period have shown the least progress. In 1980, only 25% of deaths arose in the first week of life; by the year 2000 this figure had risen to 28% –an estimated 6.3 million deaths (Lawn et al., 2005; WHO, 2006a). Furthermore, almost all (99%) perinatal (and neonatal) deaths occur in low-income and middle-income countries. Nigeria has been no exception to the above trends. Earliest available estimates of perinatal deaths in Nigeria were estimated to be around 30 per 1000 live births in 1990 (WHO, 1996). More recent estimates show that this figure has almost tripled to 86 per 1000 live births in 2000 (WHO, 20006a). Currently, Nigeria accounts for 6% of all global perinatal deaths; only India (27%), China (10%) and Pakistan (7%) account for more deaths in this period of life (Lawn et al., 2005).

Several risk factors have been associated with perinatal mortality (Richardus et al., 1998). These include low birth weight, maternal health and intra-partum complications, gender of the child, poverty and health care coverage –i.e. skilled attendance at birth and proportion of births that take place at a health facility (Lawn et al., 2005). Studies have shown that births at health facilities and those delivered by skilled attendants are less likely to result in perinatal deaths. Unfortunately, in sub-Saharan Africa, less than 40% of women deliver with skilled care and 50% of neonatal and perinatal deaths occurred after a home birth with no skilled care (Lawn et al., 2005). In Nigeria, both the proportions of live births that occurred at a health facility and skilled attendance at birth showed marginal improvements between 1990 and 2003 (NPC et al, 2004). The percentage of live births delivered at a health facility increased from 32.4% in 1990 to 32.6% in 2003. And, the skilled care at delivery increased from 33% to 36.2% (NPC et al., 2004). Despite these albeit marginal improvements in health care coverage at birth, Nigeria PNMR has more than tripled over the last 2 decades.

Therefore two important questions that need to be answered are —to what extent do place of delivery and delivery attendants predict perinatal deaths in the Nigerian context? And which of these two factors is more critical than the other in predicting perinatal deaths? This information will be useful in prioritizing health interventions and streamlining health policy towards achieving the much desired reduction in child deaths by two-thirds by the year 2015.

1.4 JUSTIFICATION

Although in developed countries numerous risk factors for perinatal death have been identified, in developing countries only limited information is available (Mavalankar et al., 1991; Richardus et al., 1998). Furthermore, most of these studies in developing countries are hospital based and therefore cannot give a correct assessment of the magnitude of the problem of perinatal mortality especially in relation to place of delivery and delivery assistants. Studies on this topic in Nigeria are particularly limited in scope. For example Akpala (1993) studied the maternal and social determinants of perinatal mortality relevant to rural northern Nigeria using data from two neighboring villages in Sokoto State, Northern Nigeria. This study was therefore not representative of the Nigerian entirety. Other existing studies (Aisen et al., 2000 & Kuti et al., 2003) focus more on the clinical causes of perinatal mortality. They were therefore also neither generalisable nor did they address the role of place of delivery and delivery assistants in determining perinatal health outcome. Therefore whereas some studies (Kaunitz., et al 1984; Walraven., et al 1995) have shown significant association between place of delivery and perinatal deaths no such study has been conducted in Nigeria. Furthemore some interventional studies (Kwast., 1996 and Gloyd et al., 2001) have shown that PNMR reduces if the skill of delivery assistants is improved.

Therefore this study intends to investigate the extent to which place of delivery and delivery assistants predict perinatal mortality in the Nigerian context. This will provide baseline information that will enable stakeholders such as the Nigerian Ministry of Health to make vital decisions pertaining to maternal and child health issues such as scaling up perinatal health care delivery and training and or retraining of TBAs, midwives and CHW in safe birth practices. Furthermore, since this study will be using data from a nationally representative survey –Nigerian Demographic and Health Survey dataset 2003, findings of this study will fill a very gaping void in a nationally representative community based research on perinatal mortality in the Nigerian context –this has never been done in Nigeria before. Finally the results of this study may be useful in guiding health policy direction as far as Nigeria's child health issues are concerned.

1.5 OBJECTIVES

General

- To determine the association between place of delivery, delivery assistants and perinatal mortality in Nigeria in 2003

Specific

- To estimate the level of perinatal mortality in Nigeria in 2003
- To examine the association between place of delivery, delivery assistants and perinatal mortality in Nigeria in 2003

1.6 LITERATURE REVIEW

Despite a large amount of published data, the relative safety of home and hospital births is still the subject of debate in the developed world (Alberman., 1986). There is also no consensus as to whether or not a universal policy of delivery in a hospital is safer than delivery at home assisted by a skilled attendant -for example a midwife or a doctor (Campbell et al., 1986). Subsequently, in the developed world, while most studies have conclusively showed that unsupervised home delivery is associated with an increased risk of perinatal mortality (Campbell et al., 1979; & Schramm et al., 1987), this is no longer a source of concern since more than 99% of births (WHO, 2007) occur either in an institution or at least under the supervision of a trained birth attendant even if the delivery occurs at home. Thus the debate in developed countries has shifted to whether or not hospital deliveries are safer than planned home deliveries attended to by a skilled health professional.

However, in developing countries such as Nigeria where non-institutionalized or unsupervised home delivery is the rule rather than the exception, few studies have aimed to determine the association between place of delivery and or delivery assistants and perinatal mortality. And where these studies are available they show some contrasting results. For instance, in the study by Voorhoeve et al (1985) in Kenya, the risk of perinatal mortality was found to be slightly lower in home births compared with institutional births. Whereas, the study by Walraven et al (1995) in Tanzania found the risk of perinatal mortality to be 3 times higher in home births compared to hospital births.

Regarding the association between home births and perinatal mortality, the study by Campbell et al (1979) was one of the earliest studies to report the risk of perinatal mortality associated with unsupervised home births, births attended by skilled attendants and hospital births. They carried out a survey of 8856 births occurring in England and Wales in 1979. Their results showed that perinatal mortality rate was highest (196.6 per 1000 live births) in unbooked and unsupervised home deliveries. However for births that were booked to occur at home under the supervision of a skilled attendant, the PNMR was very low, 4.1 per 1000 live births and was even lower than PNMR for hospital births which was 12.8 per 1000 live births at a general practitioners' clinic or hospital. The explanation for this lower PNMR in supervised home deliveries compared to those occurring at a hospital was that women who planned to have supervised home deliveries were a select group of women in high social classes, aged 25-34 and whose pregnancies were adjudged to be low risk by their doctors. All these 3 characteristics are associated with a favorable perinatal outcome. Other factors that were associated with a favorable perinatal outcome in this study were multiparity (women with more than 2 previous childbirths) and birth weight greater than 2500 grams.

Another study done in Italy (Parazzini et al., 1980) using vital records of 640 401 live births from the Central Institute of Statistics showed that the PNMR was highest in home births (27.7 per 1000) compared to births at public (17.3 per 1000) and private hospitals (14.9 per 1000) respectively. However this study did not take into account baseline distribution of obstetric risk factors for perinatal mortality such as maternal age, parity and birth weight and therefore the mortality data must be interpreted with caution. Also, a study of 4,054 home births occurring in Missouri (U.S.A) between 1978 and 1984 (Schramm et al, 1987) showed a substantial excess mortality for unplanned/unsupervised home births and planned births with inadequately trained assistants, but no increased mortality for home birth attended by physicians or trained midwives.

One very interesting study by Kaunitz et al (1984) reported perinatal deaths from 1975 to 1982 among the Faith Assembly group of women in Indiana, USA. This religious group deliberately avoided any form of obstetric care whenever they were pregnant and gave birth at home without any skilled attendants. Of the 344 live births that occurred during the period under study, 21 resulted in perinatal deaths giving a PNMR of 45 per 1000 live births. The researchers report that this figure was almost three times higher than the PNMR of the entire state of Indiana at the time, 18 per 1000 live births. These findings were supported by another interesting study conducted by Walraven et al (1995) in rural Tanzania. Unlike other studies previously mentioned this study was a prospective community based study in five villages in north-western Tanzania during 1990 and involved 222 women delivering at home and 199 in a dispensary or hospital. This study is the closest researchers have come to conducting a randomized control trial studying the association of place of delivery and perinatal mortality –ethical considerations make a Randomized Control Trial unfeasible in this case. There was no statistically significant difference in the socio-demographic characteristics of those who delivered at home and those who did so at a health facility. The results showed that PNMR was 98 per 1000 live births for home deliveries compared to 35 per 1000 births for institutional births. The only identified counterintuitive result on the association between home birth and perinatal mortality was brought by Voorhoeve et al (1985) who used mortality data from the demographic surveillance site in Machakos, a rural district in Kenya. This study surprisingly found lower perinatal mortality in home births compared to hospitals. The explanation given by the researchers was that in this part of Kenya, health facilities were readily available and accessible and the women and children in this district had comparatively good nutrition. Also there was little interference by who attended home deliveries.

Several studies have been conducted around the world to investigate the impact of skilled deliveries on perinatal mortality. One of such studies involved a survey conducted in North Carolina (U.S.A) between 1974 and 1976 (Burnett et al., 1980). The results from this study showed that planned home deliveries by lay-midwives resulted in 3 deaths per 1,000 live births; planned home deliveries without a lay-midwife, 30 deaths per 1,000 live births; and unplanned and unsupervised home deliveries, 120 deaths per 1,000 live births. The mortality rates for this study however included deaths up to 28 days of life and thus will be overestimates of the PNMR. Also, hospital births were not included in this study. Nonetheless the results highlight the relative safety of supervised deliveries compared to unsupervised ones.

Some other studies have gone a step further by examining whether or not training TBAs, midwives and relatives has had any impact on improving perinatal mortality. One of such studies reported by Kwast (1996) describes 4 interventional studies involving birth attendants in

Bolivia, Guatemala, Indonesia and Nigeria. These interventions involved training TBAs, midwives or relatives in safe birth practices and in the case of Tanjungsani in Indonesia, safe 'Birth Homes' were introduced. These studies were conducted between 1989 and 1993. The results showed that in Inquivisi (Bolivia) PNMR reduced from 105 to 38 per 1000 in the 2 years following the intervention. The study in Guatemala which involved the training of 400 TBA showed a reduced risk of perinatal deaths from 22.2% to 11.8% and that in Tanjungsani showed a decrease in PNMR from 47.7 to 35.8 per 1000 in the 18 months following the study. The study in Nigeria involved life saving skills training for midwives at a specialist hospital in Bauchi State. However this study only reported a reduction in risk of still birth rates (SBR) from 5.5% to 1.8% in the 1 year period after the training. The main limitations with these 4 studies are that there were no control groups and so confounding and biases can not be ruled out.

Also, a meta-analysis of 60 studies from 60 countries by Sibley et al (2004) between 1971 and 1999 showed that training TBA was associated with a small (8%) but significant reduced risk of PNMR. However meta-analytical studies like this one are very limited in that they rely heavily on the completeness and accuracy of data in the individual studies. On the other hand, a study by Gloyd et al (2001) in Mozambique compared PNMR in 40 rural zones in Mozambique where trained TBAs practiced compared with 25 randomly selected rural zones which had untrained TBAs. The results showed no difference in PNMR between the 2 groups. The authors attribute this finding to an unexpectedly high level of births that occurred at a health facility which significantly reduced the number of births which were attended by both trained and untrained TBAs and this may have reduced the power of the study to detect differences between the 2 groups.

On the local aspects –that is Nigeria, no study was encountered which specifically investigated the role of place of delivery and delivery assistants in determining perinatal mortality. Most of the available studies had different focus as regards perinatal mortality. For example, Adetunji (1994) used data from the 1981/1982 World Fertility Survey of Nigeria to examine factors related to infant mortality. This study found that mortality rates were highest among children delivered at home. However, the endpoint of this study was infant mortality (deaths occurring in all children less than one year of age) and not specifically perinatal mortality. Therefore although infant mortality included perinatal deaths we can not make specific conclusions about the PNMR as it relates to place of birth based on the findings of this study. Another study by Akpala (1993) however aimed at identifying the maternal and social indicators of perinatal mortality relevant to northern Nigeria. This study was based on data obtained from Danchadi and Dabaga villages in Sokoto state, Nigeria. Out of 1484 births which occurred during the period of study, there were 98 perinatal deaths leading to a PNMR of 58.6 per 1000 live births. Low birth weight, maternal age less than 16 years, low parity and decreasing maternal educational status were all found to be significantly associated with perinatal mortality. However, this study did not examine the effects of place of delivery and delivery assistants on perinatal mortality.

In addition to place of delivery and skilled attendance at birth, several studies have revealed a large number of risk factors with respect to perinatal mortality, and have been able to quantify the effect of some of them. Some of these risk factors are related to the mother, others to the child. Well known maternal risk factors are age, marital status (especially single motherhood), pregnancy history, socioeconomic status, maternal education, height, ethnic origin, smoking and drinking, fertility treatment, chronic disease and complications during pregnancy and childbirth.

For the baby, risk factors include pregnancy duration and weight at birth, multiple births, sex, position at birth and congenital abnormalities (A comprehensive summary of these risk factors can be found in Richardus et al., 1998). Specific clinical causes of perinatal mortality have also been well described elsewhere but these are beyond the scope of this report. The remaining section of this chapter will be dedicated to critically discussing studies that have examined those risk factors for perinatal mortality that will be included in the analysis stage of this report.

As regards maternal education, several studies have found a significant inverse relationship between maternal education and perinatal mortality in both developed and developing countries. For instance a study by Wang et al (1999) involved the conduct of a case-controlled study using data obtained for women attending family planning services in Taipei between July 1991 and December 1992. The results showed that a relatively higher maternal education status was protective in so far as perinatal mortality is concerned. A more recent study by Devlieger et al (2005) used data from the Study Centre of Perinatal Epidemiology to investigate the social inequalities in perinatal mortality in northern Belgium. There were a total of 50 796 live births to women aged greater than 25 years in 1999 in this region in Belgium. The researchers concluded that based on the logistic regression model, fetal death, perinatal death and infantile deaths were strongly correlated with educational level of the mother.

Within the African continent, Ibrahim et al (1994) in a community-based prospective study of 6275 deliveries monitored from 1985 to 1988 in a rural community in Sudan found that perinatal mortality rates decreased as the number of years of full-time maternal education increased. These results were also reflected in an earlier study by Aisen et al (2000) in a two years prospective study involving 4135 babies delivered at the Jos University Teaching Hospital in

Nigeria between 1992 and 1993. The results showed that perinatal mortality for mothers with no formal education was the highest compared to those with higher levels of education.

On the other hand, one study was identified which showed contradictory results. This was a community based survey in Zimbabwe (Kambarami et al., 1997) using data from 640 women aged 15 – 50 years in Murewa and Madziwa rural districts. Their results showed that women who had attained primary level of education or higher had a significant risk of poorer perinatal health outcome relative to those with no formal education. The authors suggest that the reason for this was the lack of proper control for confounding in this study.

Maternal age has also been associated with perinatal mortality. A study by Forssas et al (1999) used data on 199 291 births and 1461 perinatal deaths from the Medical Birth Register in Finland to investigate the maternal predictors of perinatal mortality between 1991 and 1993. The results showed that the risk of perinatal mortality was highest in mothers who were 40 years or more. Another study by Golding et al (1994) using data from the Jamaican Perinatal Mortality Survey, found that risk of perinatal deaths were highest for women aged 35 years or more but also women aged 17 years or less. This pattern was also found in the previously cited study by Ibrahim et al (1994) in Sudan and Aisen et al (2000) in Nigeria: maternal age above 35 years and below 20 years of age were both significantly associated with an increased risk of perinatal deaths in these two studies. Several other studies however showed a more unidirectional result –that is younger maternal age associated with a higher risk of perinatal deaths. For instance, a study by Alisjahbana et al (1990) in rural West Java found a PNMR of 44.5 per 1000 live births and this was significantly associated with a maternal age of less than 20 years. The previously cited studies by Akpala (1993) in Nigeria, Kavoo-linge et al (1992) in Kenya and Wang et al (1999) in Taiwan also found similar results.

Several studies have demonstrated the association between parity and perinatal mortality. A study by Dasgupta et al (1997) of 575 perinatal deaths out of 8488 live births occurring at the HRS Medical College, India in 1993 showed that both ends of parity were associated with a significant increase in perinatal deaths –that is, first time pregnancies and parity greater than 3. Again previously cited studies like Akpala et al (1993), Ibrahim et al (1994), Wang et al (1999) & Aisen et al (2000) also showed similar results. Conversely, one study was identified which showed different results. This study was a retrospective cohort by Wu et al (2003) using data on 3697 births from routine Family Planning records in 20 rural districts in eastern China. This study found a PNMR of 69 per 1000 and a risk of perinatal death that was higher in women with 2 children compared to women with first time pregnancies. The explanation for this is quite intriguing. In China at the time, governments' childbearing restrictions permitted each family to have only one child. However if the first child was female, then the family was permitted to have a second child in the hope that it would be male. So the researchers suggested that the search for a son in the second pregnancy may have contributed to the higher perinatal mortality especially among girls born to mothers whose previous child birth was also a female child.

Another risk factor for perinatal mortality which has shown up frequently in the literature is marital status. A study by Gaizauskiene et al (2003) used data from the 1997-98 Medical Birth Registry in Lithuania to examine 75 178 live births, 786 of which resulted in perinatal deaths. In the words of the authors "It should be pointed out that the impact of marital status on perinatal mortality was very high (Population Attributable Risk Factor, PARF ~6.4 percent), even higher than that of some clinical factors, though its odds ratio, OR was among the lowest, 1.5 [95% CI: 1.2 – 1.7].” Another study by Manderbacka et al (1992) examined data on 56 595 singleton births in Finland in 1987 using data from the National registers. After adjusting for maternal age, education, geographical area and degree of urbanization, the results showed that perinatal deaths were more common among single mothers [OR=1.59, 95%CI; 1.32-1.92] than married ones. Other studies also previously cited by Forsass et al (1999), Kavoo-linge et al (1992) and Golding et al (1994) also showed similar results. On the other hand, the earlier cited study in Zimbabwe by Kambarami et al (1997) found that single, separated, widowed and divorced women had better perinatal health outcomes than married women (in both monogamous and polygamous unions). Again the authors attribute this unusual finding to lack of proper control for confounding in the study.

As regards socio-economic status, several studies have shown an inverse relationship to perinatal mortality –that is, lower socio-economic status is related with higher risks of perinatal deaths. For instance the previously cited study by Forssas et al (1999) found that socio-economic status was inversely related to perinatal mortality. In this study, the mothers were subdivided based on their employment status into four groups: upper white collar employees; lower white collar employees; blue collar workers; and others (farmers, students, housewives, unemployed and indeterminate). The results showed that risk of perinatal mortality was highest in the ‘others’ category and least in the upper-white collar employees. However, the results also showed that when the birth weight of the babies was included in the analysis, the risk of perinatal mortality attributable to socio-economic status and indeed all other significant maternal risk factors decreased significantly. The authors argue that any excess risk in perinatal mortality caused by these maternal risk factors is often attributable to the tendency of these factors to first cause low birth weight and thence predispose the child to perinatal death. This is a similar argument to that given in the study by Borrel et al (2002). Nonetheless some other studies like some of those previously cited (Kavoo-linge et al., 1992; Golding et al., 1994 & Aisen et al., 2000) also found significant inverse relationship between socio-economic status and perinatal mortality.

The impact of smoking on perinatal mortality has been of interest to researchers as far back as the late 1950s. Butler et al (1972) used data from the British Perinatal Mortality Survey of 1958 to demonstrate that the risk of perinatal deaths increased by 28% if the mother of the child smoked cigarettes during pregnancy and in fact the perinatal mortality rates increased as the number of cigarettes smoke per day increased. A relatively more recent study in Wales (Tuthill et al., 1999) using data on 16631 births found that the risk of perinatal deaths was 27% higher [95%CI=9%-49%] in children born to smokers compared to non-smokers. The authors in their discussion wrote that smoking in pregnancy leads to poor intrauterine growth via a series of pathophysiological changes which ultimately increases the risk of perinatal deaths. This is also supported by Wilcox (1993) who suggested that smoking acts by lowering birth weight and hence increasing the risk of perinatal death –an effect he called the reproductive toxicity of cigarette smoking.

Thus far literature relating to maternal risk factors for perinatal mortality has been reviewed. However as mentioned previously there are also child risk factors for perinatal mortality one of which has appeared in several studies –gender of the child. Some studies have shown a significant association between gender of the child and perinatal mortality. One of such studies (Nielsen et al., 1997) was a community based, cross sectional study of 30 randomly selected areas in rural parts of Tamil Nadu, India. The results showed that girls had an excess perinatal mortality compared to boys [rate ratio= 3.42; 95% CI= 1.68; 6.98]; this was most pronounced among girls born to *multiparous* women with no living sons. The authors link this excess mortality to a preference for sons among the women. This conclusion is similar to the findings of an earlier cited study in China by Wu et al (2003).

Conversely, a study in Cape Verde by Wessel et al (1998) found that male children had an odds of perinatal deaths that was 2.1 [95%CI=1.2-3.3] times female children. The researchers believed that the slower rate of lung maturity in male fetuses predisposed them to increased incidence of acute respiratory distress syndrome and thence higher perinatal mortality rates than female children. They also argued that male children weigh generally more than females and so birth weight could not be a confounder for the excess risk in males. Furthermore, gender preference was alien to the Capeverdian society and no evidence on female infanticide was found.

Low birth weight has also been associated with perinatal mortality by several studies. For instance, the case control study by Borrel et al (2002) using 423 cases and 1032 controls in Barcelona between 1993 and 1997 found that low birth weight (birth weight less than 2500 grams) was associated with a very high risk of perinatal mortality [OR=44.1, 95%CI=30.6 – 63.7]. Similar results were found in studies by Silins et al (1985) in Canada and Forssas et al (1999) in Finland. However the general consensus among the researchers in these studies is that most other risk factors predispose to perinatal mortality by first of all affecting the birth weight of the child. That is, birth weight is an intermediate step in the overall pathway between causal factors and perinatal mortality. Nonetheless it is an important factor that ought to be considered when investigating risk factors for perinatal mortality.

In conclusion, the studies reviewed above have highlighted the importance of place of delivery, delivery assistants, maternal and child risk factors in determining perinatal health outcome. However none of these studies have clearly and specifically determined the effect of place of delivery and delivery assistants on perinatal mortality in the Nigerian context. This study aims to investigate the effect of these 2 explanatory variables having taken other important risk factors into consideration.

1.7 Conceptual framework for variable selection

The conceptual framework within which risk factors for perinatal mortality are conceived in this study is shown in figure 2.1 below. This framework is similar (but not identical) to that used by Shah et al (2000) in their study on the socioeconomic risk factors for perinatal mortality in Kuwait. Their model is conceptually identical to that proposed by Mosley & Chen (1984) which is regarded widely by epidemiologists and social scientists to be the classical (and still relevant) framework for studying child survival (Hill., 2003). As mentioned previously, Mosley & Chen's framework is based on the premise that background social, economic, cultural, and health system variables influence a parsimonious but exhaustive set of proximate determinants which in turn directly influence child mortality (Mosley & Chen., 1984).

Hence, the study by Shah et al utilizes a similar framework to Mosley & Chen in that socioeconomic variables are considered as distal determinants of perinatal mortality while maternal risk factors are considered to be proximate determinants. However, the main difference between Mosley & Chen's model and that used by Shah et al is the categorization of the variables birth weight and length of gestation as 'most proximate determinants' of perinatal death in the study in Kuwait. These two variables are widely recognized as major proximate determinants of perinatal mortality (Edouard., 1985) but neither is included in Mosley & Chen's framework.

The conceptual framework for this study on the risk factors for perinatal mortality in Nigeria is similar to that used in the Kuwait study by Shah et al. As depicted in figure 1.1, three major types of variable influences on perinatal mortality were considered. The first include socioeconomic variables (maternal education, wealth index, residence, religion, and marital status). The second set includes maternal factors (age at birth, parity, antenatal visits, place of delivery, delivery assistants and smoking status). Finally, the variable birth size is included in the framework as the most proximate determinant of perinatal mortality. Unlike the framework used by Shah et al, length of gestation however is not included in our framework simply because information on this variable is not available in the primary data set used for this study (see section 2.7 on study limitations).

The conceptual framework in figure 1.1 below highlights the complex hierarchical inter-relationships between the variables considered in this study. It will be observed that in line with Mosley and Chen's classical framework, socioeconomic factors are located most distal to perinatal mortality. These factors are connected via a series of pathways (arrows) to other more proximal factors (maternal factors and birth size) which in turn are linked to perinatal mortality. Socio-economic factors rarely cause ill health or mortality directly hence most of their influence on perinatal mortality is largely exerted through associations with more proximal factors.

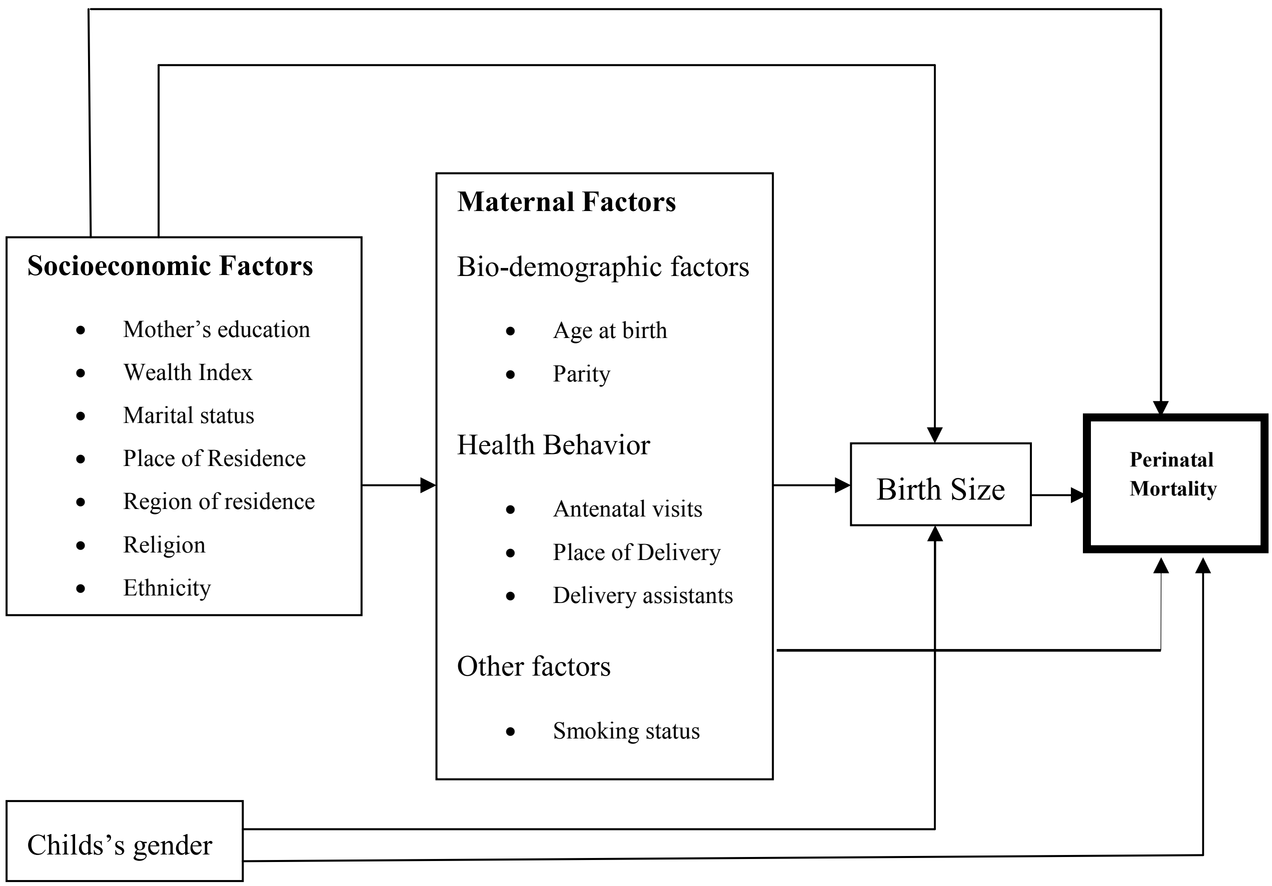

Fig.1.1. Conceptual framework showing interrelationships between risk factors for perinatal mortality

For example, in many societies cigarette smoking is partly determined by socioeconomic status. Cigarette smoking is then associated with low birth weight which in turn is a known determinant of perinatal mortality (Cesar et al., 1997; Tuthill et al., 1999; and Borrel et al., 2002). Note that gender of the child is placed independently in the framework since it is not determined by the other risk factors but may be associated either directly or indirectly with perinatal mortality.

As regards the two main explanatory variables of interest in this study —place of delivery and delivery assistants, their position in this framework is quite clear. They are categorized as maternal health seeking behavior which like other maternal factors may be influenced by socioeconomic factors (Mosley & Waters., 1995). For example, an uneducated and poor mother may have no choice other than to deliver at home under the supervision of an unskilled relative or friend and thus place her newborns life at risk. However the effect of place of delivery and delivery assistants on perinatal mortality is not so clear. It is unlikely that place of delivery or delivery assistants have any effect on the most proximate determinant in the framework —birth size. This is because birth size would have mostly been determined before process of labour/delivery begins. Therefore, the place of delivery and the type of assistance available at delivery are very unlikely to change the size. It may be that these two factors either exert a direct effect on perinatal deaths or act through some other unmeasured proximate determinant. It is against this backdrop of complex interrelationship between variables that the statistical methods utilized in this study are described below.

CHAPTER TWO

METHODOLOGY

2.1 STUDY DESIGN

This study is an analytical cross-sectional study through secondary data analysis of the 2003 Nigerian Demographic and Health Survey (NDHS) dataset.

2.1.1 ABOUT THE 2003 NDHS

The 2003 Nigeria Demographic and Health Survey (2003 NDHS) is the latest in a series of Nationally representative population and health surveys conducted in Nigeria –the previous two were in 1990 and 1999. The 2003 NDHS was conducted by the National Population Commission (NPC); all activities were coordinated by a 12-member committee. The survey was funded by USAID-Nigeria, while ORC Macro provided technical support through MEASURE *DHS+,* a project sponsored by the U.S Agency for International Development (USAID) to assist countries worldwide in conducting surveys to obtain information on key population and health indicators. Other development partners, including the Department for International Development (DFID), the United Nations Population Fund (UNFPA), and the United Nations Children's Fund (UNICEF), also provided support for the survey (NPC et al., 2004).

The aim of the 2003 NDHS was to provide estimates for key indicators such as fertility, contraceptive use, infant and child mortality, immunization levels, use of family planning, maternal and child health, breastfeeding practices, nutritional status of mothers and young children, use of mosquito nets, female genital cutting, marriage, sexual activity, and awareness and behavior regarding AIDS and other sexually transmitted infections in Nigeria (NPC et al., 2004).

The following sections will summarize the methodology used in the 2003 NDHS as given in the final report of the survey (NPC et al., 2004).

2.1.2 SAMPLE DESIGN OF THE 2003 NDHS

The sample for the 2003 NDHS was designed to provide estimates of population and health indicators (including fertility and mortality rates) for Nigeria as a whole, the 6 geo-political zones and urban and rural areas. A representative probability sample of 7,864 households was selected for the 2003 NDHS sample. The sample was selected in two stages. In the first stage, 365 clusters were randomly selected from a list of 212 080 enumeration areas (EA) developed from the 1991 population census. In the second stage, a complete listing of households was carried out in each selected cluster. Households were then systematically selected for participation in the survey (NPC et al., 2004).

2.1.3 SAMPLE SIZE

All women age 15-49 who were either permanent residents of the households in the 2003 NDHS sample or visitors present in the household on the night before the survey were eligible to be interviewed. In addition, in a subsample of one-third of all households selected for the survey, all men age 15-59 were eligible to be interviewed if they were either permanent residents or visitors present in the household on the night before the survey. The total number of eligible women for the survey was 7985, of which 7620 were successfully interviewed during the 2003 NDHS. The interview process achieved a response rate of 95.4% among all eligible women in the households surveyed. And there was very little difference in the response rates in rural and urban areas; 95% and 96.1% respectively. The total number of births during the 5 years preceding the survey was 6029, out of which 5783 were eligible for this study after excluding 246 multiple births (NPC et al., 2004).

2.1.4 QUESTIONNAIRE DESIGN

There were three questionnaires used for the 2003 NDHS: the Household Questionnaire, the Women's Questionnaire, and the Men's Questionnaire. The content of these questionnaires was based on the model questionnaires developed by the MEASURE *DHS*+ program for use in countries with low levels of contraceptive use. The questionnaires were adapted during a technical workshop organized by the National Population Commission to reflect relevant issues in population and health in Nigeria. The workshop was attended by experts from the government, NGOs, and international donors. The adapted questionnaires were translated from English into the three major languages (Hausa, Igbo, and Yoruba) and pretested during November 2002 (NPC et al., 2004)

2.1.5 DATA COLLECTION

The NPC recruited over a 100 interviewers from the 36 states and the FCT to ensure appropriate linguistic and cultural diversity. These personnel then attended a training workshop between 17 February and 8 March 2003. The actual fieldwork for the 2003 NDHS took place over a five-month period, from March to August 2003 and twelve interviewing teams carried out data collection. Each team consisted of one team supervisor, one field editor, four female interviewers, one male interviewer, and one driver. Special care was taken to monitor the quality of data collection. First, the field editor was responsible for reviewing all questionnaires for quality and consistency before the team's departure from the cluster. The field editor and supervisor would also sit in on interviews periodically. Twelve staff assigned from the NPC coordinated fieldwork activities and visited the teams at regular intervals to monitor the work. In addition, quality control personnel independently re-interviewed selected households after the departure of the teams. These checks were performed periodically through the duration of the fieldwork. ORC Macro also participated in field supervision (NPC et al., 2004).

2.1.6 DATA PROCESSING & QUALITY CONTROL

The processing of the 2003 NDHS results began soon after the fieldwork commenced. The completed questionnaires were returned periodically from the field to NPC headquarters in Abuja, where they were entered and edited by data processing personnel who were specially trained for this task. The data processing personnel included two supervisors, a questionnaire administrator (who ensured that the expected numbers of questionnaires from all clusters were received), three office editors, 12 data entry operators, and a secondary editor. The concurrent processing of the data was an advantage since the NPC was able to advise field teams of problems detected during the data entry. In particular, tables were generated to check various data quality parameters. As a result, specific feedback was given to the teams to improve performance. The data entry and editing phase of the survey was completed in September 2003.

2.2 STUDY POPULATION

The study population included all Nigerian babies:

- Who were born in the 5 years preceding the 2003 NDHS; and
- Who were the outcome of singleton deliveries

Also included in the study population are the mothers of such babies who were in the reproductive ages (15-49) and had been personally interviewed in the 2003 NDHS. Hence the 2003 NDHS only contains information on babies whose mothers who were alive at the time of the interview.

2.3 KEY WORDS

- ***Perinatal Mortality;*** includes both deaths in the first week of life & stillbirths –babies born dead (WHO, 2006a).
- ***Neonatal Mortality;*** deaths occurring during the first four weeks after birth (WHO, 2006a).
- ***Early Neonatal Mortality;*** includes all deaths occurring in the first week of life excluding still births (WHO, 2006a).
- ***Place of Delivery;*** This means places where women give birth and include home, institutional (public or private hospitals/clinics) and others.
- ***Delivery Assistants;*** This refers to any person(s) who primarily attended to the delivery process and could either be a trained health professional (Doctor, Nurse/midwife, Auxiliary midwife, Community Health Worker) or unskilled persons (Traditional Birth Attendant, Relative/friend).

2.4 EXPLANATORY VARIABLES

This study used variables which were available in the 2003 NDHS data set. The main explanatory variables are place of delivery and delivery assistants. Maternal socio-economic and bio-demographic variables used in the study include: maternal age at birth, highest level of education, geo-political location, type of place of residence (rural/urban), ethnicity, religion, marital status, wealth index (quintile), parity, number of antenatal visits and cigarette smoking status. Variables related to the child include birth size and gender of child See Table 2.1.

Table 2.1: Variables of interest and definitions

No.	Variable	Definition
Main variables		
1.	Place of delivery	Home (1), Government Health facility (2), Private Health facility (3)
2.	Delivery assistants	Doctor (1), Nurse/Midwife/*CHW (2), *TBA Relative/friend/other (3)
Maternal socio-economic & bio-demographic variables		
3.	Age at birth	Mothers age as at time of child birth
4.	Highest level of education	None (0), Primary (1), Secondary or Higher (2)
5.	Region of residence	North (1), South (2)
6.	Ethnicity	Hausa (1), Yoruba (2), Ibo (3), Other (4)
7.	Religion	Christian (1), Islam (2), Traditional/Other (3)
8.	Marital Status	Never married (0), Currently married (1), formerly married (2)
9.	Parity (number of child births)	One child (1), 2-4 children (2), 5 or more children (3)
10.	Number of antenatal visits	None (0), 1 – 3 visits (1), 4 or more visits (2)
11.	♦Wealth Index	Poor (1), Middle (2), Rich (3)
12.	Cigarette smoking	No (1), Yes (2)
13.	Type of place of residence	Urban (1), Rural (2)
Variables related to child		
14.	Gender of child	Male (1), Female (2)
15.	§Birth size	Large (1), Average (2), Small(3)

***CHW= Community health extension worker; TBA= Traditional birth attendant**

♦Wealth Index was developed as a measure of socio-economic status by Macro International and World Bank. Using principal component analysis, respondents' household assets and amenities such as source of water, house roofing material, floor type etc are integrated into a ranked score that characterizes the respondents' status from poorest to richest (NPC et al, 2004).

§ Birth size is a proxy measure for birth weight. Women who were interviewed in the NDHS 2003 were simply asked to say in their own opinions whether their children appeared unusually small, large or just average in size at birth.

2.5 OUTCOME VARIABLE

The outcome variable used was the log odds of death in the fist week of life. Each of the babies born to the interviewed women were categorized as alive or dead depending on whether or not the newborn survived the first seven days of life. Those babies who died within this period were compared to those who survived the same period. Note that this variable does not include information on still births which is not available in the primary dataset. Hence all analysis performed using this variable excludes still births.

2.6 HYPOTHESES

1. **H_0;** The odds of perinatal deaths are the same for children born to women who deliver at home compared to those who deliver at a health facility.

   H_A; The odds of perinatal deaths are different for children born to women who deliver at home compared to those who deliver at a health facility.

2. **H_0;** The odds of perinatal deaths are the same for children born to women whose delivery is attended by an unskilled delivery assistant compared to those attended by a trained health professional.

   H_A; The odds of perinatal deaths are different for children born to women whose delivery is attended by an unskilled delivery assistant compared to those attended by a trained health professional.

2.7 SCOPE AND LIMITATIONS

a) The NDHS study design is a cross sectional study and therefore the information on the explanatory and the outcome variables are collected at the same point in time. Therefore temporality can not be truly assessed.

b) Various information biases are also likely. Considering the low literacy levels in many parts of Nigeria, the reporting of age and other time bound events may be inaccurate.

c) Only variables present in the dataset can be analyzed. Therefore some important explanatory variables like distance from health facility and birth weight were assessed using proxies which themselves are inadequate. Other important information like detailed history of labour complications and length of gestation were not captured by the NDHS 2003, therefore such variables could not be included in the analysis. This raises issues of potential uncontrolled confounding by such unmeasured variables which may affect the results of this study.

d) Information on Still Births is unclear (no distinction was made in the primary data set as to whether those pregnancies which did not result in live births were due to abortions, miscarriages or still births). Therefore the Still Birth Rate (SBR) in this study was estimated using a methodology developed by the World Health Organization. This involved the use of regional estimates of the SBR/PNMR ratio to calculate the SBR in countries where no data on still births are available (WHO, 2006a).

e) The quality of DHS data depends on the completeness with which births and deaths are reported. Deaths in the first week of life are often anonymous in that the new born die and are quickly buried before they are even named. This often blurs information on these deaths and the circumstances surrounding some of them. Hence the possibility of selective under-reporting of perinatal deaths is a real threat to the data quality of this study. In order to assess if there has been selective under-reporting, the DHS uses the ratio of deaths under 7 days to all neonatal deaths as an indicator. If this ratio (expressed as a percentage) is abnormally low, then it is very likely that selective under-reporting of perinatal deaths has occurred. In the case of the NDHS 2003, this ratio was quite high

—74% for the period 0-4 years preceding the study. Hence we can conclude that selective under-reporting of perinatal deaths did not occur during data collection of the NDHS 2003.

f) The use of Principal Component Analysis to determine wealth index of respondents is limited by the fact that principal components are artificially and arbitrarily constructed indices. The empirical basis for the technique rests on whether the first principal component can accurately predict socioeconomic status. This is entirely dependent on the nature of the data, the relationships between variables that are being considered and the validity and reliability of the variables included. However, while PCA based indices can not give absolute levels of poverty in a community, it will yield a reasonably accurate measure of wealth inequality across households and settings such as rural/urban and therefore it is appropriate for this household based study (Vyas et al., 2006).

2.8 ETHICAL CONSIDERATIONS

This study involved secondary analysis of a public domain data set, NDHS 2003. Permission to use this data set was obtained in writing from Macro International Incorporation via the DHS website. The interview process via which the survey was conducted included the documentation of informed consent which was given by the respondents. Respondent confidentiality is in tact as no names are included in the data set and therefore the respondents can not be traced by the researcher. Finally, the research protocol was submitted for review by the University of the Witwatersrand Ethics Committee and ethical clearance was obtained before the research began.

2.9 PLANS FOR DISSEMINATION AND UTILIZATION OF RESULTS

When the final report is approved, the results will be submitted to a peer review health or demographic journal for publishing. Copies of the report findings will be forwarded to the Ministry of Health in Nigeria as a potential tool for informing policy direction.

2.10 DATA MANAGEMENT

The 2003 NDHS was downloaded with permission from the Macro International website. Various forms of the data set were available and the researcher selected the children data subset which was available in STATA format. This format was selected because it can be analyzed using the Intercooled STATA 9.2 statistical software and the researcher is competent in using this software.

Once the dataset was opened in STATA, a total of 32 variables including those listed in table 2.1 were selected for further analysis. There were a total of 6029 observations in the dataset representing the total number of live births born to the interviewed mothers in the 5 years preceding the 2003 NDHS. Out of this number, 246 live births were excluded because they were outcomes of non-singleton births. Therefore a total of 5783 live births were analyzed in this study out of which 194 were deaths occurred within the first seven days of life (these deaths do not include still births as this information was unavailable in the dataset). This gave an Early Neonatal Mortality Rate (ENMR) of 33.5 per 1000 live births. To calculate the perinatal mortality rate (PNMR) the methodology used was based on formulae adopted by the WHO (2006a) for countries where information on still birth rate (SBR) is lacking.

The formulae used were given by:

SBR/ENMR= K…………………………..……………………………………………………...(1)

Where K in equation 1 above is a constant value unique to each of the 6 world regions: Africa, Americas, South-East Asia, Europe, East Mediterranean and Western Pacific.

For Africa, WHO estimates K to be 1.2

Thus SBR/ENMR = 1.2

Therefore the SBR for countries in Africa without data on still births is given by

SBR = 1.2 * ENMR.

In this study, the ENMR of Nigeria was found to be 33.5 per 1000 live births.

Hence, SBR of Nigeria is given by,

SBR=1.2*33.5 = 40.2

The number of still births is given by,

$$\textbf{Number of Still Births, SBN} = \frac{\textbf{SBR*Live Births}}{\textbf{1000-SBR}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textbf{(2)}$$

Therefore substituting SBR=40.2 in equation 2 above gives,

$$\textbf{SBN} = \frac{\textbf{40.2*5783}}{\textbf{1000-40.2}}$$

$$= \textbf{242}$$

Therefore an estimated 242 still births occurred in Nigeria during the study period.

Again the total number of births, TNB is given by,

TNB= SBN + LB……….…………...……………………..(3)

Where LB is total number of **live** births, which is 5783 in this study,

Thus the total number of births in Nigeria during the study period is given by,

TNB= 242+5783 = 6025

Furthermore, the Perinatal Mortality Rate is given by,

$$\text{PNMR} = \frac{\text{(Number of Still Births + Number of Early Neonatal deaths)}}{\text{Total Number of Births}} \quad \ldots\ldots\ldots\ldots\ldots(4)$$

In this study there were 194 early neonatal deaths, 242 still births & 6025 births therefore,

$$\text{PNMR} = \frac{242 + 194}{6025}$$

$$= 436/6025 = 0.0724 = 72.4 \text{ per 1000 births}$$

Thus the PNMR of Nigeria based on this study was found to be 72.4 per 1000 births. This figure is 16% less than the estimate by WHO of 86 per 1000 live births in the year 2000. This estimated PNMR reported by WHO was based on NDHS 1999. Whereas as previously mentioned, the estimated PNMR in this study is based on the NDHS 2003 which is said to be of much better data quality than the NDHS 1999 used by WHO (NPC et al., 2004). This may explain the 16% difference in PNMR cited above.

As regards the completeness of information in the dataset, several variables had missing entries. The percentage completeness of those variables are as follows; Ethnicity (98.20%), Religion (99.90%), Birth size (99.03%), Place of delivery (99.05%), Delivery assistants (98.79%), Antenatal visits (62%) and Cigarette smoking (99.79%).

2.11 DATA PROCESSING

As earlier mentioned the data analysis was done using Intercooled STATA 9.2 statistical software package.

The first stage of the analysis involved recoding some variables into categories that would make analysis and interpretation of the results more meaningful. That is, some variables were re-categorized by merging groups which were similar but had very small numbers of observations within them. For instance *mother's education* which initially had 4 categories (1-No education, 2-Primary, 3-Secondary, 4-Higher) was recoded into 3 categories (1-No education, 2-Primary, 3-Secondary or more). The same procedure was applied to the *Religion* variable where 'Catholic, Protestant and other Christian' was merged into a single 'Christian' group; for the *Birth size* variable, 'Smaller than average' and 'Very small' were merged into one group 'Small' and 'Larger than average' and 'Very large' merged into a single 'Large' group; for the *Place of delivery* variable, 'Government hospital, health center and health post' were merged into 'Government Health Facility'; and for *Delivery Assistants* variable, 'Nurse/Midwife, Auxiliary Nurse and CHW' were merged into one group while TBA, relatives, friends and other where merged into a single group. Continuous variables like *maternal age at birth* were also categorized into 3 groups; less than 20 years, 20 to less than 35 years and 35 years or more. So also was *parity* categorized into 3 groups; one child, 2-4 children and 5 or more children. The Number of *antenatal visits* was also categorized into No visits, 1-3 visits and 4 or more visits. This is in line with W.H.O technical report on antenatal care which recommends at least 4 visits for each low risk pregnancy (WHO, 2002). This in itself is a limitation because the data available for this study does not provide sufficient information to determine which pregnancies in the 5 years preceding this study could be classified as low risk or high risk.

2.12 DATA ANALYSIS

2.12.1 Statistical methods

There were three stages in the analysis of our data. These include descriptive statistics, bivariate analysis, and multiple logistic regression. These stages are described below:

The first stage in analysis involved the use of descriptive statistics to examine the distribution of the study participants in terms of the variables of interest in this study. Frequency tables and charts were used to summarize the study participants' characteristics and proportion of live births across selected variable categories. This was followed by a bivariate analysis to examine the relationship between each variable of interest and the outcome variable –perinatal mortality (coded as zero if child survived the perinatal period and one if child died within this period). This relationship was examined by running a bivariate logistic regression of perinatal mortality over each of the variables of interest one after the other.

The next stage involved the use of stepwise multiple regression modeling. This approach is useful in assessing the effect of our main explanatory factors (place of delivery and delivery assistants) on perinatal mortality, having controlled for the significant socioeconomic and maternal factors as well as one important proximate determinant. This approach is similar to that used by Shah et al (2000) in determining the effect of socioeconomic status on perinatal mortality in Kuwait having controlled for maternal influences and two major proximate determinants in their study.

In this multivariate analysis, variables which were significantly associated with perinatal deaths after the bivariate analysis were then fitted into a final multiple logistic regression model. The multiple logistic regression model is given by:

$$\log_e [p/1-p] = \alpha + \beta_1 x_1 + \beta_2 x_2 \ldots\ldots \beta_i x_i$$

Where p= the probability of a newborn dying within the first seven days of life; x_1 to x_i are the explanatory variables which were fitted into the model; α is the intercept term (constant) and $\beta_1 \ldots \beta_i$ represent the regression coefficient related to the explanatory variables.

It should be noted that the two main explanatory variables of interest, place of delivery and delivery assistants were retained in the final models regardless of whether or not they were significant at the 5% level.

A total of 6 models where fitted in the multivariate analysis. In the first model (Model 1), using stepwise backward selection, variables that were not significant at the 5% level where dropped from a full model containing all the explanatory variables. The final model which was fitted included the following variables; gender of the child, mother's religion and residence (rural/urban) and birth size of the child. Place of delivery and delivery assistants where retained in the model even though they were not significant at the 5%level because they are our main explanatory variables of interest.

In the second model (Model 2), the interaction between delivery assistants and place of delivery was investigated by adding an interaction term to Model 1. This interaction term was added because the relationship between one of these two variables and perinatal mortality may vary across different levels of the other variable. For instance, home deliveries may be positively associated with perinatal deaths if there is no skilled attendance at delivery. However, if there is skilled attendance present at home delivery, then any positive association of the latter with perinatal deaths may disappear. Nonetheless, this interaction term was not found to be significant at the 5% level. However, a likelihood ratio test was conducted to see if adding the interaction term improved the fit of the model (see Results section).

The data was then disaggregated by place of residence (rural and urban) and separate modeling was conducted for each area using the same procedure explained above. Thus, Model 3 and 4 in the results section represent variables found to be significantly associated with perinatal death in urban areas including interaction terms (Model 4). Model 5 and 6 represent analysis of data for rural areas. Again, likelihood ratio tests where conducted to determine if the models including the interaction terms had better fit than the models without them.

It is noteworthy that in order to avoid the problem of correlated errors in the models described above, the 'pweight' and 'robust cluster' options in STATA were included in the logistic regression process. These options correct for the clustering effects of multiple observations associated with survey dataset such as the NDHS 2003 used in this study.

CHAPTER THREE

RESULTS

3.1 CHARACTERISTICS OF RESPONDENTS

The main objectives of this study were to estimate the level of perinatal mortality in Nigeria and to examine the association between place of delivery, delivery assistants and perinatal mortality using data from the NDHS 2003. Out of 5783singleton live births that occurred in the five years preceding the survey, there were 194 deaths before the 7th day of life giving ENMR of 33.5 per 1000 live births and an estimated PNMR of 72.4 per 1000 live births (see section 2.10). This figure is 14% less than the WHO estimate of 86 per 1000 live births in 2000.

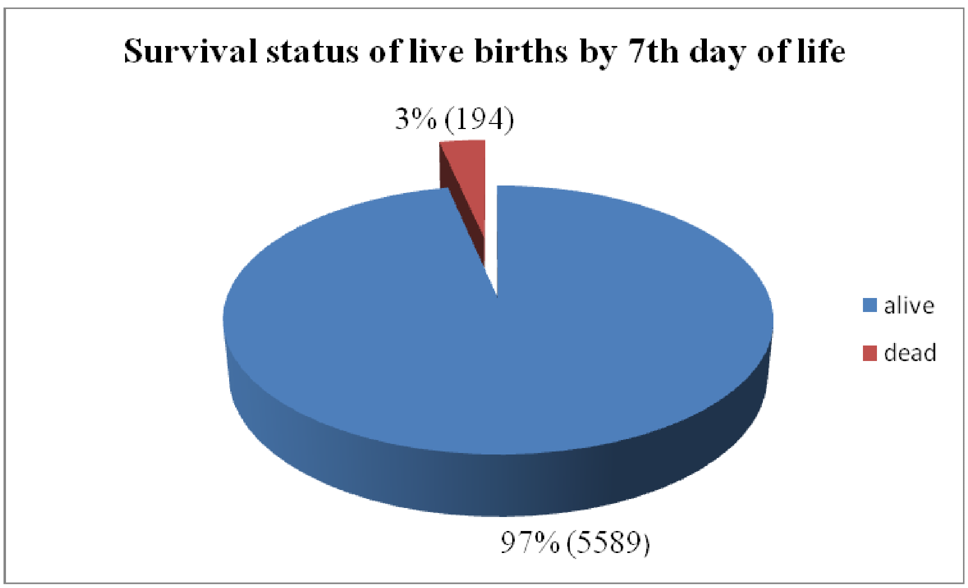

Fig. 3.1 Survival status of 5783 live births by the 7th day of life

Table 3.1: Distribution of live births by selected explanatory factors/variables (NDHS,2003)

No.	Variable	Category	Frequency	(%)
a.	**Mother's age at birth**	Less than 20 years	381	(6.59)
		20-34.9 years	4084	(70.62)
		35 years or more	1318	(22.79)
		Total	**5783**	**(100)**
b.	**Mother's highest level of education**	no education	2918	(50.46)
		primary	1405	(24.3)
		secondary or higher	1460	(25.25)
		total	**5783**	**(100)**
c.	**Number of Antenatal visits**	None	1239	(21.4)
		1 - 3	525	(9.1)
		4 or more	1828	(31.6)
		Missing	2191	(37.9)
		total	**5783**	**(100)**
d.	**Mother's marital status**	never married	109	(1.88)
		currently married	5468	(94.55)
		formerly married	206	(22.79)
		total	**5783**	**(100)**
e.	**Wealth Index**	poor	2614	(45.21)
		middle	2239	(38.72)
		rich	929	(16.07)
		total	**5783**	**(100)**
f.	**Place of residence**	urban	2024	(35)
		rural	3759	(65)
		total	**5783**	**(100)**
g.	**Religion**	Christianity	2212	(38.28)
		Islam	3453	(59.76)
		Traditional/other	113	(1.96)
		total	**5783**	**(100)**
h.	**Parity**	1 child	734	(12.69)
		2-4 children	2712	(46.9)
		5 or more children	2339	(40.41)
		total	**5783**	**(100)**
i.	**Smoker**	no	5751	(99.65)
		yes	20	(0.35)
		total	**5771**	**(100)**
h.	**Child's gender**	male	2940	(50.84)
		female	2843	(49.16)
		total	**5783**	**(100)**
i.	**Size of child at birth**	large	2412	(42.43)
		Average	2457	(43.23)
		Small	815	(14.34)
		total	**5685**	**(100)**

The socioeconomic and bio-demographic characteristics of the 5783 respondents are summarized in table 3.1. From this table we can see that the percentage of teenage deliveries among the respondents is 6.6%, while 22.8% reported age at birth to be 35 years or more.
About half of the respondents (50.5%) had no formal education while the others attained primary school education or higher. Most of the respondents were currently married (95%). Also majority (45%) of the respondents were ranked as 'poor' while only 16% of them were in the 'rich' category according to the NDHS 2003 wealth index ranking.

Also in table 3.1 it can be seen that most of the respondents (65%) resided in rural areas. The main religion among the respondents is Islam (60%), followed by Christianity (38%) and traditional religion (2%). Majority of the respondents (87%) had at least 2 or more living children. About a third of the respondents (32%) had at least 4 antenatal visits when they where pregnant while 21% had no antenatal care at all. Very few of the respondents (<1%) were reported to be current cigarette smokers. There were slightly more live male births (50.8%) than females. Most of the respondents (43%) reported that the size of their baby at birth was average, while 14% believed that their baby was smaller than average at birth.

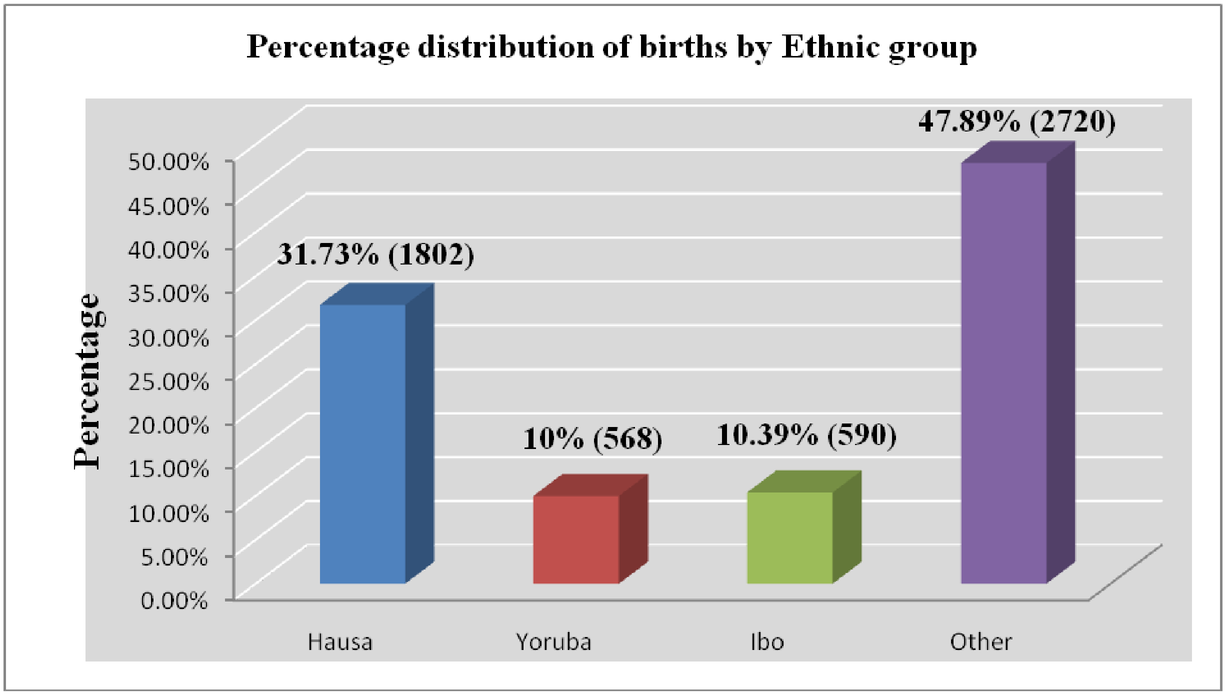

Fig. 3.2 Percentage distribution of live births by ethnicity

Figure 3.2 shows the distribution of respondents by ethnicity. About thirty two percent (32%) the respondents were of the Hausa tribe (32%) while just about 10% were either Yoruba or Ibo respectively – the 3 main tribes in Nigeria. However, almost 50% of the other respondents were from over 75 minority tribes such as the Nupe, Tiv, Ijaw etc (NPC et al 2004).

The percentage distribution of births by place of delivery and delivery assistants are shown in Figure 3.4 and 3.5 respectively. Majority of the live births (65%) reported in the survey occurred at home while the remainder occurred at a health facility.

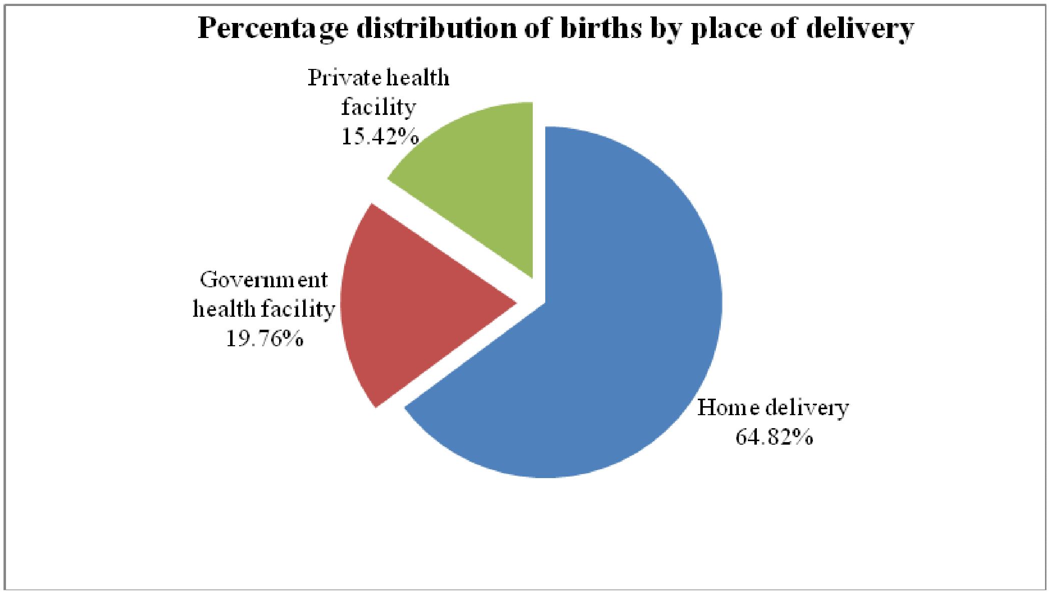

Fig. 3.3 Percentage distribution of births by place of delivery

Also, most of the live births (62%) were attended by an unskilled person (a relative, friend or untrained traditional birth attendant, TBA) while 31% were delivered by a Nurse, Midwife or CHW.

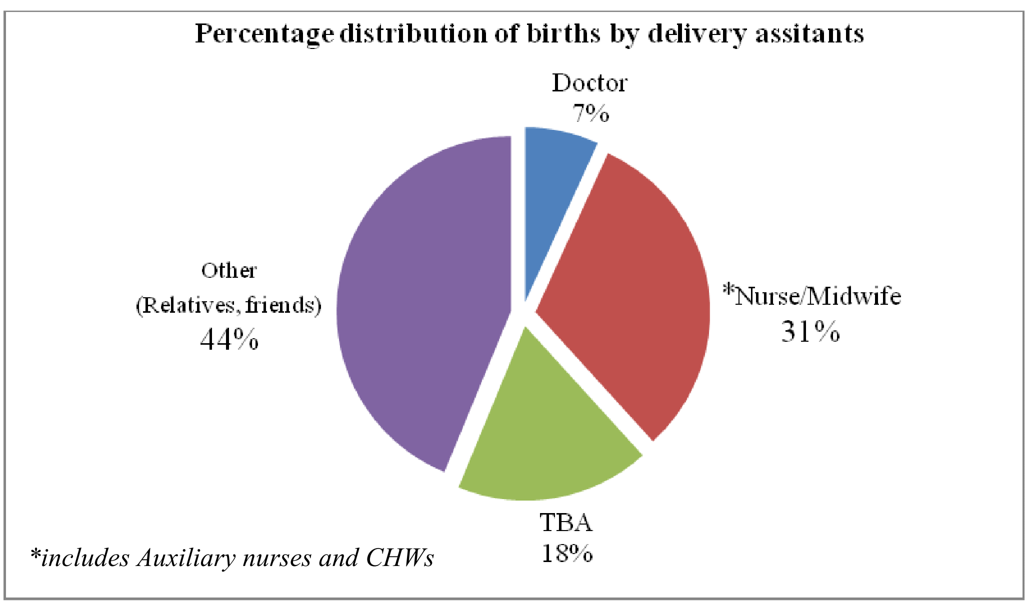

Fig.3.4 Percentage distribution of births by delivery assistants

Table 3.2 below shows the distribution of births by place of delivery according to selected variables. We find that across all maternal age categories, majority of the births in the five years preceding the study occurred at home. In urban areas, more than 50% of all births occurred in a health facility either public or privately owned, whereas 75% of births in the rural areas occurred at home. Majority (87%) of the women with no formal education delivered at home whereas about 74% of women with secondary education or higher delivered at a health facility. Similarly, most 'poor' women gave birth at home while more than half of the 'rich' women delivered in a health facility. In terms of religion, most births (60%) to Christian women occurred in a health facility. Conversely, most births (80%) to Muslim women and Traditionalists respectively, occurred at home. Also, of those women who had no antenatal care, 95% of them eventually delivered at home. By contrast, 60% of women who had at least 4 antenatal hospital visits delivered in a health facility.

Table 3.2: Percentage distribution of births in the 5 years preceding the study by place of delivery according to selected variables(NDHS,2003)

No.	Variable	Place of Delivery (%) Home	Government Hospital	Private Hospital
a.	**Mother's age at birth**			
	Less than 20 years	75.2	17.9	6.9
	20-34.9 years	64.5	19.6	15.9
	35 years or more	62.9	20.9	16.2
b.	**Mother's highest level of education**			
	no education	87.5	7.9	4.6
	primary	57.6	23.8	18.7
	secondary or higher	26.5	39.6	33.9
c.	**Place of residence**			
	urban	46.9	30.1	22.9
	rural	74.5	14.2	11.4
d.	**Geo-political zone**			
	North	78	15.4	6.6
	South	30.9	30.9	58.2
e.	**Delivery Assistants**			
	Doctor	5.4	39.4	55.2
	Nurse/Midwife/CHW	12.9	53.3	33.8
	TBA/Other	97.8	0.5	1.7
f.	**Religion**			
	Christianity	39.2	30.3	30.6
	Islam	80.6	13.4	6.1
	Traditional/other	81.6	11.8	6.4
g.	**Parity**			
	1 child	51.3	26.3	22.4
	2-4 children	61.9	20.7	17.5
	5 or more children	72.6	16.6	10.8
h.	**Childs Gender**			
	Male	63.8	20.3	15.9
	Female	65.9	19.3	14.8
i.	**Size of child at birth**			
	larger than average	61.9	21.7	16.4
	average	65.5	18.6	15.9
	smaller than average	70.3	18.2	11.5
j.	**Wealth Index**			
	Poor	82.7	10	7.3
	Middle	91.7	16.6	11.7
	Rich	38.1	34	27.9
k.	**Antenatal Care**			
	None	95.9	2.2	1.9
	1-3 visits	71.1	17.1	11.8
	4 or more visits	38.9	34.4	26.7

Table 3.3: Percentage distribution of births in the 5 years preceding the study by type of assistance present at delivery according to selected variables(NDHS,2003)

No.	Variable	Delivery Assistants (%) Doctor	Nurse/Midwife/ CHW	TBA/Other
a.	**Mother's age at birth**			
	Less than 20 years	6.1	24.1	69.8
	20-34.9 years	6.4	31.6	62
	35 years or more	8.1	33.3	58.6
b.	**Mother's highest level of education**			
	no education	2.4	12.9	84.7
	primary	5.7	40.4	53.9
	secondary or higher	16.7	60.1	23.2
c.	**Place of residence**			
	urban	12.8	44.1	43.1
	rural	3.5	24.7	71.8
d.	**Geo-political zone**			
	North	3.5	21.7	74.8
	South	15.2	56.6	28.2
e.	**Place of Delivery**			
	Home	0.6	6.2	93.2
	Govt. Hospital	13.6	84.7	1.7
	Private Hospital	24.4	69.1	6.5
f.	**Religion**			
	Christianity	11.4	52.6	36
	Islam	4	18.5	77.5
	Traditional/other	0.9	19.1	80
g.	**Parity**			
	1 child	12.4	41.3	46.3
	2-4 children	6.9	33.4	59.7
	5 or more children	4.8	26.1	69.1
h.	**Childs Gender**			
	Male	7.3	31.6	61.1
	Female	6.3	31.3	62.4
i.	**Size of child at birth**			
	larger than average	7.8	32.7	59.5
	average	6.2	31.3	62.5
	smaller than average	5.8	29	65.2
j.	**Wealth Index**			
	Poor	1.8	17.3	80.9
	Middle	4.4	27.7	67.9
	Rich	14.5	51.7	33.8
k.	**Antenatal Care**			
	None	0.7	4.2	95.1
	1-3 visits	2.9	29.8	67.3
	4 or more visits	13.5	52.4	34.1

Table 3.3 shows the distribution of birth by type of assistance present at delivery according to selected characteristics. We see that regardless of the mother's age, majority of the deliveries were assisted by a TBA, relative or friend. In the urban areas, majority (57%) of births were attended by a trained health professional while 43% were attended by unskilled persons such as a TBA, relative, or friend. By contrast, in rural areas, 72% of births were attended by an unskilled person. Specifically, 4% of births in the rural areas were attended by doctors compared to 13% in the urban areas. For women who were either uneducated or poor, about 80% of births were attended by unskilled persons. On the other hand, almost 70% of births to women who were rich or had at least secondary education were attended by a skilled person.

Tables 1 - 3 in the Appendices section of this report show distribution of births attended to by place of delivery according to selected characteristics for each of the 3 categories of delivery assistants, that is doctors, nurses/midwives and TBA/others. Of important note in these tables are 3 peculiar trends. Firstly, across all selected variables, we see that more than 85% of births attended to by doctors occurred in a health facility. Of these births attended to by doctors in health facilities, slightly more birth occurred at a private facility except among births to poor women which were attended to more commonly in government hospitals. A similar but slightly different trend is seen among births attended by Nurses/Midwives/CHW. While almost 75% of birth attended to by this group of persons occurred in a health facility, more of these births occurred in a government health facility. For deliveries attended by unskilled persons however we see a reverse trend across all the selected characteristics; at least 80% of such births were attended to at home.

3.2 LEVELS AND DIFFERENTIALS

The levels and differentials of perinatal mortality by selected socioeconomic and bio-demographic factors are shown in Table 3.2. Home deliveries have a slightly higher PNMR than deliveries which occur at a government health facility, while deliveries at a private health facility show the least PNMR. Deliveries assisted by doctors paradoxically show the highest level of PNMR whereas those deliveries assisted by Nurses/Midwives show the lowest PNMR. Teenage mothers have the highest PNMR while mothers aged 20 to less than 35 years show the least. Interestingly women with primary education have a higher PNMR than those with no education while those women with secondary education or higher have the lowest PNMR. Women from ‘poor’ households have the highest PNMR whereas those from ‘rich’ households have the least PNMR.

Also, the PNMR is higher in rural areas compared to urban areas. The PNMR is also highest among the Ibo babies but is lowest among Yoruba babies. Births to women who practice Traditional religion show a very high PNMR, almost 6 times the rates among babies from Christian and Muslim homes. Women who had ever been pregnant only once before (*primiparous*) had births that resulted in the highest PNMR compared to women with 2 to 4 previous pregnancies whose births showed the least PNMR. Women who had 4 or more antenatal visits when they were pregnant had the lowest PNMR compared to those who had less than 4 visits or no visits at all. Male babies had a higher PNMR than female babies. Also, babies that were smaller than average in size had the highest PNMR of all birth size categories.

Table 3.4:Levels and differentials of perinatal mortality by selected explanatory factors (NDHS,2003)

No.	Variable	Category	*PNMR (per 1000)
a.	place of delivery	Home	**33.97**
		Government health facility	33.79
		Private health facility	32.75
b.	delivery assistant	Doctor	**45.7**
		Nurse/Midwife/CHW	30.38
		TBA/Others	34.3
c.	Mother's age at birth	Less than 20 years	**52.49**
		20-34.9 years	32.36
		35 years or more	36.98
d.	Mother's highest level of education	no education	36.22
		Primary	**39.97**
		secondary or higher	26.72
e.	Wealth Index	Poor	**41.34**
		Middle	30.82
		Rich	18.29
f.	Place of residence	Urban	25.33
		Rural	**39.83**
g.	Geo-political zone	North	33.87
		South	**36.9**
h.	Number of antenatal visits	None	**25.8**
		1 – 3 visits	25.6
		4 or more visits	19.7
h.	Ethnicity	Hausa	29.71
		Yoruba	25.27
		Ibo	**47.96**
		Other	36.98
i.	Religion	Christianity	34.61
		Islam	30.75
		Traditional/other	**177.08**
j.	Parity	1 child	**44.1**
		2-4 children	29.22
		5 or more children	38.22
k.	Child's gender	Male	**44.4**
		Female	24.87
l.	Size of child at birth	large	25.95
		average	34.09
		small	**52.97**
	Total		33.55

* excludes still births

3.3 BIVARIATE ANALYSIS

To examine the individual effects of place of delivery, delivery assistants and other selected explanatory factors on perinatal mortality, a logistic regression of perinatal deaths was run over each variable of interest separately. The results are shown in Table 3.5. Place of delivery and delivery assistants were not significantly associated with perinatal deaths. Also maternal age at birth, mother's educational attainment, maternal marital status, parity, number of antenatal visits, ethnicity, geo-political zone and smoking status were not significantly associated with perinatal deaths.

The factors that were found to be significantly associated with **increased** risk of perinatal deaths include residing in rural areas, practicing traditional religion and being smaller than average in size at birth. On the other hand factors which were significantly associated with a **decreased** risk (protective effect) of perinatal deaths include being a female child and being in the 'rich' wealth category.

Table 3.5:Results of Bivariate logistic regression of perinatal mortality and selected explanatory factors (NDHS,2003)

No.	Variable	Category	OR	95%CI	p-value
a.	place of delivery	Home	1	-	-
		Government health facility	0.99	0.68 - 1.45	0.977
		Private health facility	0.96	0.64 - 1.46	0.863
b.	delivery assistant	Doctor	1	-	-
		Nurse/Midwife/CHW	0.66	0.38 - 1.16	0.149
		TBA/Other	0.75	0.45 - 1.26	0.275
c.	Mother's age at birth	Less than 20 years	1	-	-
		20-34.9 years	0.62	0.38 - 1.01	0.055
		35 years or more	0.71	0.41 - 1.22	0.21
d.	Mother's highest level of education	no education	1	-	-
		primary	1.1	0.79 - 1.54	0.566
		secondary or higher	0.74	0.51 - 1.08	0.115
e.	Number of antenatal visits	None	1	-	-
		1 – 3 visits	1.11	0.60 – 2.07	0.744
		4 or more visits	0.76	0.47 – 1.23	0.259
f.	Mother's marital status	never married	1	-	-
		currently married	1.87	0.46 - 7.65	0.382
		formerly married	1.88	0.38 - 9.21	0.435
g.	Wealth Index	Poor	1	-	-
		Middle	0.78	0.53 - 1.14	0.193
		Rich*	**0.56**	**0.41 – 0.81**	**0.002**
h.	Place of residence	urban	1	-	-
		rural*	**1.57**	**1.13 - 2.18**	**0.007**
i.	Religion	Christianity	1	-	-
		Islam	0.89	0.66 - 1.20	0.444
		Traditional/other*	**5.12**	**2.91 - 9.01**	**<0.0001**
j.	Parity	1 child	1	-	-
		2-4 children	0.66	0.43 - 1.01	0.058
		5 or more children	0.87	0.57 - 1.31	0.503
l.	Smoker	yes	1	-	-
		no	3.22	0.74 - 13.96	0.119
m.	Child's gender	male	1	-	-
		female*	**0.56**	**0.42 - 0.76**	**<0.0001**
n.	Size of child at birth	large	1	-	-
		Average	1.31	0.94 - 1.84	0.112
		Small*	**2.04**	**1.3 - 3.06**	**0.001**
o.	Ethnicity	Hausa	1	-	-
		Yoruba	0.85	0.47 - 1.55	0.595
		Ibo	1.61	1.00 - 2.59	0.048
		Other	1.24	0.88 - 1.75	0.21
p.	Geo-political zone	North	1	-	-
		South	1.09	0.80 - 1.49	0.595

***significant association (p-value<0.05)**

3.4 MULTIVARIATE ANALYSIS

The specific objective of this study was to primarily examine the association between place of delivery, delivery assistants and perinatal mortality; and secondarily to determine the extent to which selected explanatory factors predict perinatal health outcome. Tables 3.4 to 3.11 below show the output of various multivariate logistic regression models fitted for perinatal mortality in Nigeria in general, and for urban and rural areas separately. With the exception of delivery assistant and place of delivery which where included in all models, only factors found to be significantly associated with perinatal mortality ($p<0.05$) are presented in the tables. The adjusted odds ratios (AOR), 95% confidence interval (CI), p-value and Wald's test statistic of each factor fitted into the models are shown in these tables. Interaction terms are also included in the tables where found to be significant.

Table 3.6 (Model 1) shows the fitted model of significant determinants of perinatal mortality in Nigeria as a whole (both rural and urban). The results show the 2 main explanatory variables (delivery assistants and place of delivery) and 4 variables which were found to be significant predictors of perinatal mortality. These include gender of the child, religion, birth size and place of residence. In terms of place of delivery, births which occurred at a private health facility had 6% increased risk [AOR=1.06, CI=0.51-2.19] of perinatal deaths compared to home births. Also births at a government health facility had an 18% increased risk [AOR=1.18, CI=0.58-2.41] of perinatal deaths compared to home births. However, the Wald's test statistic for this variable is highly insignificant ($p=0.8777$) and the 95% confidence interval includes unity. Thus we can say that place of delivery is not a good predictor of perinatal deaths in this instance.

Table 3.6: Results of multivariate analysis for factors found to be associated with perinatal mortality, NDHS 2003: MODEL 1 *(interaction terms not included)*

No.	Variable	Category	AOR	95%CI	p-value	Wald's test (p-value)
a.	Delivery Assistants					0.3812
		Doctor	1	-	-	
		Nurse/Midwife/CHW	0.65	0.36-1.19	0.165	
		TBA/Other	0.71	0.31-1.63	0.414	
b.	Place of delivery	Home	1	-	-	0.8777
		Public Hospital	1.18	0.58-2.41	0.657	
		Private/Other	1.06	0.51- 2.19	0.873	
c.	Child's gender					0.0003
		male	1	-	-	
		female*	**0.57**	**0.42-0.77**	**<.0001**	
d.	Religion					<0.00001
		Christianity	1	-	-	
		Islam	0.92	0.65-1.30	0.627	
		Traditional/other*	**4.37**	**2.31-8.26**	**<0.0001**	
e.	Size of child at birth					0.0015
		Large	1	-	-	
		Average	1.36	0.97-1.91	0.079	
		Small*	**2.13**	**1.41-3.21**	**0.0001**	
f.	Residence					0.0003
		Urban	1	-	-	
		rural*	**1.73**	**1.2-2.49**	**0.003**	

*Significant at p<0.05

Also, births attended to by Nurses/Midwives/CHW and TBA/Others have a 35% [AOR=0.65, CI=0.36-1.19] and 29% [AOR=0.71, CI=0.31-1.63] reduced risks of perinatal deaths respectively, when compared to those attended by doctors. However the Wald's test statistic of this variable is also highly insignificant (p=0.3812) and the 95% confidence interval also includes unity. Hence, delivery assistants is not a good predictor of perinatal mortality in this instance. On the other hand, female babies had a 43% reduced risk [AOR=0.57, CI=0.42 – 0.77] of dying compared to male babies and this was significant at the 5% level. Also, children born to mothers who practiced traditional religion had a significant risk of perinatal deaths that was highest [AOR=4.45, CI=2.38 – 8.33] compared to mothers who were Christians (the reference group). Furthermore the risk of perinatal deaths was significantly highest [AOR=2.26, CI=1.36

– 3.67] among babies whose birth size was smaller than average relative to those who were average or more. Finally, the risk of perinatal deaths was 71% higher [AOR=1.71, CI=1.2 – 2.43] in babies born in rural areas relative to those born in urban areas and this was significant at the 5% level.

Table 3.7: Results of multivariate analysis for factors found to be associated with perinatal mortality, NDHS 2003: MODEL 2 *(interaction term included)*

No.	Variable	Category	AOR	95%CI	p-value	Wald's test (p-value)
a.	Delivery Assistants (DA)					0.595
		Doctor	1	-	-	
		Nurse/Midwife/CHW	0.61	0.22-1.67	0.334	
		TBA/Other	0.65	0.17-2.38	0.511	
b.	Place of delivery (POD)	Home	1	-	-	0.874
		Public Hospital	1.10	0.38-3.15		
		Private/Other	0.95	0.22-4.07		
c.	Child's gender					0.0003
		male	1	-	-	
		female*	**0.57**	**0.42-0.77**	**<.0001**	
d.	Religion					<0.00001
		Christianity	1	-	-	
		Islam	0.91	0.642-1.30	0.616	
		Traditional/other*	**4.42**	**2.34-8.35**	**<0.0001**	
e.	Size of child at birth					0.0014
		large	1	-	-	
		Average	1.36	0.97-1.91	0.078	
		Small*	**2.13**	**1.41-3.21**	**0.001**	
f.	Residence					0.0028
		Urban	1	-	-	
		rural*	**1.74**	**1.21-2.50**	**0.003**	
g.	Delivery Assistants x Place of Delivery	Interaction term	1.05	0.60-1.84	0.861	

*Significant at p<0.05

Table 3.7 (Model 2) shows the effects of the introduction of an interaction term between delivery assistants and place of delivery in Model 1. We see that place of delivery and delivery assistants remain insignificant at the 5% level while birth size, gender, religion and residence remain significant with only slight differences in values. Furthermore the Wald test statistic of the interaction term is insignificant (p=0.861). Also when we run a likelihood ratio test to determine if the addition of an interaction term improves the fit of the model we find that it does not. That is, the p-value of the likelihood ratio test is insignificant (p=0.8621). Hence we conclude that the model without the interaction term is sufficient and gender, birth size, religion and residence are good predictors of perinatal deaths in Nigeria as a whole.

Table 3.8: Results of multivariate analysis for factors found to be associated with perinatal mortality in Urban areas, NDHS 2003: MODEL 3 *(interaction terms not included)*

No.	Variable	Category	AOR	95%CI	p-value	Wald's test (p-value)
a.	Delivery Assistants (DA)					0.1873
		Doctor	1	-	-	
		Nurse/Midwife/CHW	0.60	0.26-1.39	0.232	
		TBA/Other	1.72	0.43-6.94	0.44	
b.	Place of delivery (POD)	Home	1	-	-	0.1377
		Public Hospital	3.82	0.98-14.83	0.053	
		Private/Other	3.52	0.94-13.18	0.062	
c.	Child's gender					0.0003
		male	1	-	-	
		female*	**0.49**	**0.26-0.93**	**0.03**	
d.	Size of child at birth					0.003
		large	1	-	-	
		Average	1.56	0.76-3.16	0.223	
		Small*	**3.99**	**1.79-8.91**	**0.001**	

*Significant at p<0.05

Table 3.8 (Model 3) shows the results of multivariate logistic regression of factors associated with perinatal mortality in the **urban** areas of Nigeria. Just like in the general model, delivery assistants and place of delivery are not significantly associated with perinatal deaths but birth size and gender are. The risk of perinatal deaths is 51% less [AOR=0.49, CI=0.26 – 0.93] for female children compared to males. Also babies reported as small in size had an increased risk of perinatal deaths [AOR=3.99, CI=1.79 – 8.91] in comparison to children who were average or more in size. The inclusion of an interaction term between place of delivery and delivery assistants (Model 4) does not improve the model as the likelihood ratio test is insignificant (p=0.4707). Besides the interaction term itself is not significant at the 5% level (p=0.493). Hence we conclude that in urban areas, gender of the child and birth size are the best predictors of perinatal mortality.

Table 3.9: Results of multivariate analysis for factors found to be associated with perinatal mortality in Urban areas, NDHS 2003: MODEL 4 *(interaction term included)*

No.	Variable	Category	AOR	95%CI	p-value	Wald's test (p-value)
a.	**Delivery Assistants (DA)**					0.224
		Doctor	1	-	-	
		Nurse/Midwife/CHW	1.08	0.16-7.26	0.935	
		TBA/Other	4.82	0.17-140.7	0.361	
b.	**Place of delivery (POD)**	Home	1	-	-	0.2980
		Public Hospital	8.90	0.50-158.9	0.137	
		Private/Other	10.96	0.30-401.5	0.493	
c.	**Child's gender**					0.03
		male	1	-	-	
		female*	0.49	0.26-0.93	0.03	
d.	**Size of child at birth**					0.003
		large	1	-	-	
		Average	1.55	0.76-3.15	0.229	
		Small*	**3.99**	**1.79-8.88**	**0.001**	
e.	**Delivery Assistants x Place of Delivery**	Interaction term	0.68	0.23-2.03	0.493	

*Significant at p<0.05

In table 3.9 (Model 5), we see the results of multivariate logistic regression of factors associated with perinatal mortality in the **rural** areas of Nigeria. The results of this model are quite similar to Model 1 –that is gender of the child, religion and birth size of the child remain significantly associated with perinatal deaths while place of delivery and delivery assistants are not significant at the 5% level. The effects of female gender, traditional religion and being small in birth size on perinatal mortality remains significant and are almost the same as in Model 1. Also, the inclusion of an interaction term between place of delivery and delivery assistants in the model for rural areas does not improve the fit of the model. That is the likelihood ratio test is insignificant (p=0.6573) and the p-value of the interaction term is also not significant at the 5% level (p=0.613).

Table 3.10: Results of multivariate analysis for factors found to be associated with perinatal mortality in Rural areas, NDHS,2003: MODEL 5 ***(interaction terms not included)***

No.	Variable	Category	AOR	95%CI	p-value	Wald's test (p-value)
a.	Delivery Assistants					0.6327
		Doctor	1	-	-	
		Nurse/Midwife/CHW	0.77	0.32-1.9	0.577	
		TBA/Other	0.60	0.20-1.77	0.349	
b.	Place of delivery	Home	1	-	-	0.7618
		Public Hospital	0.79	0.35-1.82	0.382	
		Private/Other	0.73	0.31-1.71	0.464	
c.	Child's gender					0.0004
		male	1	-	-	
		female*	**0.60**	**0.42-0.85**	**0.004**	
d.	Religion					<0.00001
		Christianity	1	-	-	
		Islam	0.95	0.63-1.43	0.802	
		Traditional/other*	**5.03**	**2.55-9.96**	**<0.0001**	
e.	Size of child at birth					0.058
		Large	1	-	-	
		Average	1.31	0.89-1.93	0.176	
		Small*	**1.78**	**1.11-2.88**	**0.018**	

*Significant at p<0.05

On the other hand, the main difference in the model for rural areas compared with the general model is that there is now a statistically significant interaction term which is fitted into model 6. This interaction is between religion and gender of the child. This implies that the relationship between mother's religion and perinatal deaths is affected by the level of a third factor (effect modifier) which in this case is gender of the child. That is, the strength of association between mother's religion and perinatal mortality depends on whether the child is male or female. To adjust for and quantify the effect of this interaction, we stratified the model for rural areas by gender of the child (see Table 3.12) and we found a very interesting result. That is, although the association between traditional religion and perinatal deaths remain significant among both genders, the strength of this association differs considerably. For males, the risk of perinatal deaths if their mothers practiced traditional religion was 2.67 [95%CI=1.06 - 6.72] times that of male children whose mothers practiced Christianity. Whereas, for female children whose mothers practiced traditional religion, the risk of perinatal deaths rises to 12.2 [95%CI=4.56 – 32.59] times that of female children whose mothers practice Christianity

Table 3.11: Results of multivariate analysis for factors found to be associated with perinatal mortality in Rural areas, NDHS,2003: MODEL 6 *(interaction terms included)*

No.	Variable	Category	AOR	95%CI	p-value	Wald's test (p-value)
a.	Delivery Assistants					0.5433
		Doctor	1	-	-	
		Nurse/Midwife/CHW	0.62	0.17-2.23	0.467	
		TBA/Other	0.45	0.04-2.04	0.299	
b.	Place of delivery	Home	1	-	-	0.7016
		Public Hospital	0.62	0.19-2.02	0.424	
		Private/Other	0.48	0.82-2.80	0.413	
c.	Child's gender					0.0003
		male	1	-	-	
		female*	**0.36**	**0.19-0.61**	**<0.0001**	
d.	Religion					<0.00001
		Christianity	1	-	-	
		Islam	0.82	0.55-1.21	0.318	
		Traditional/other*	**5.24**	**2.68-10.24**	**<0.0001**	
e.	Size of child at birth					0.051
		Large	1	-	-	
		Average	1.30	0.88-1.92	0.18	
		Small*	**1.81**	**1.12-2.93**	**0.015**	
f.	Delivery Assistants x Place of Delivery	Interaction term	1.20	0.59-2.46	0.613	
h.	Gender* Religion	**Interaction term***	**2.16**	**1.18-3.96**	**0.013**	

*Significant at p<0.05

Table 3.12: Results of multivariate analysis for factors found to be associated with perinatal mortality in rural areas stratified by gender of child (NDHS,2003)

No.	Variable	Category	OR	95%CI	p-value	Wald's test (p-value)
1. MALES						
	Religion					0.0147
		Christianity	1	-	-	
		Islam	0.73	0.46-1.14	0.162	
		Traditional/other*	**2.67**	**1.06-6.72**	**0.038**	
2. FEMALES						
	Religion					<0.00001
		Christianity	1	-	-	
		Islam	1.45	0.77-2.73	0.243	
		Traditional/other*	**12.2**	**4.56-32.59**	**<0.0001**	

*Significant at p<0.05

CHAPTER FOUR

DISCUSSION

The main objective of this study was to determine the association between place of delivery, delivery assistants and perinatal mortality in Nigeria. Specifically, this study purposed to estimate the level of perinatal mortality in Nigeria and to examine the role of place of delivery and delivery assistants in determining perinatal mortality; while taking other selected risk factors into consideration. This study used logistic regression modelling to quantify the effect of these risk factors on perinatal mortality. This analysis was performed first at a general level and then disaggregated by urban and rural settings. The results showed that the level of perinatal mortality in Nigeria was 72.4 per 1000 live births. Place of delivery and delivery assistants were found not to be significantly associated with perinatal mortality even after disaggregating the analysis by rural/urban settings. However, gender of the child, religion, size of the child and type of place of residence were found to be significantly associated with perinatal mortality.

4.1 PREDICTORS OF PERINATAL MORTALITY

4.1.1 Place of Delivery and Delivery Assistants

The results of this study show very little difference in the level of PNMR between home deliveries and institutional deliveries in Nigeria. This result is inconsistent with most studies (for example Kaunitz et al 1984 and Walraven et al 1995) and is especially surprising for a developing country like Nigeria where most home deliveries are not supervised by a trained professional (WHO, 2007). In the developed world where most home deliveries are attended by skilled health personnel, the above results will not be unusual (Schramm et al 1987). One speculative explanation for this result may be that majority of those who deliver at a health facility only to do so if there are complications in labour by which time the health of the foetus has been seriously compromised. If this is combined with a lack of high quality perinatal care units in most hospitals in Nigeria, the result would be a level of PNMR in hospital deliveries that is as high if not higher than home delivery rates.

As regards delivery assistants, another puzzling result is seen in the levels of perinatal mortality. That is, deliveries attended by doctors have a higher level of PNMR than all other categories of delivery assistants including untrained persons such as TBAs, relatives and friends. Again it may very well be that doctors have the worst level of PNMR because they mostly get to attend to complicated labour at very late stages by which time not much can be done to rescue the newborn. Further investigation into the conditions surrounding labour and delivery and the effect on perinatal outcome may be necessary in the Nigerian context. However the results also show that deliveries attended by Nurses/Midwives/CHW have the least PNMR of all compared to TBA and relatives/friends. This is expected as they are better trained to handle deliveries and complications that may arise when compared to unskilled persons. This finding is consistent with the study by Burnett et al (1980).

Furthermore, when we investigate the association between place of delivery, delivery assistants and perinatal mortality, we find that the bivariate analysis showed no significant association between these factors and perinatal deaths. Not only are the p-values of the odds ratios for these factors very high, the 95% confidence intervals all include unity. These facts rule out the presence of not only a weak association but also imply that chance can not be ruled had any such association even existed. The reason for this lack of association is unclear and is inconsistent with most studies like Kaunitz et al (1984) and Walraven et al (1995).

One possible explanation for this lack of assocation may be due to the effect of uncontrolled confounding. On one hand our conceptual framework (see figure 2.1) shows the possible influence of socioeconomic factors on place of delivery and delivery assistants. For example, an uneducated and poor mother may have no choice other than to deliver at home under the supervision of an unskilled relative or friend and thus place her newborns life at risk. On the other hand, the precise mechanism by which place of delivery and delivery assistants cause perinatal deaths is less straightfoward. It may be possible that some other unmeasured proximate determinant lies in the pathway between these two variables and perinatal mortality hence masking their effect. For example, labour complications are a strong confounder for perinatal deaths (Weiner et al., 2003) Home deliveries and those assisted by unskilled persons are associated with a high risk of labour complications. And labour complications, which are a risk with every pregnancy, may be associated with increased risk of perinatal death. However, full and accurate accounts labour complications are not available in the NDHS 2003 and thus this potential confounder could not be measured.

Another possibility may be that perhaps a good number of the 'untrained' persons such as TBAs who attend to majority of births in Nigeria are in fact really good at what they do and have succeeded in avoiding differences in their perinatal death rates that may have led to statistically significant association. A study by Imogie et al (2002) in Nigeria revealed that one of the reasons why women in Nigeria patronized TBA was simply due to their positive experiences – they have had successful deliveries in the hands of TBA. This finding is also supported by the study in Nigeria by Salako & Daniel (2007). However, both studies emphasize that the training, retraining and monitoring of TBA is crucial to ensure that the quality of services they offer are at an acceptable standard of safe birth practices.

Finally, having adjusted for all explanatory factors in a multivariate analysis, we find that there is still no significant association between place of delivery, delivery assistants and perinatal mortality even after disaggregating the results by rural and urban settings. We therefore fail to reject our null hypotheses as far as this study is concerned. That is, the risk of perinatal deaths is the same regardless of where the children in this study are delivered or the type of assistance that was present at delivery. The significant predictors of perinatal mortality in this study include childs gender, religion, birth size and residence and are discussed below.

4.1.2 Gender of the child

Gender of the child was found to be significanlty associated with perinatal deaths. That is, female children had a lower risk of dying in the perinatal period compared to males. This is supported by Wessel et al (1998). Male children are said to be more prone to perinatal deaths than females for biological reasons. Those studies that found higher risk of perinatal deaths in females than males (for example, Nielsen et al., 1997) jusitfied their findings by arguing that gender preference was practiced in their study populations. While there is no evidence nationally to suggest that gender preference or infantide is practiced in Nigeria, in smaller subsections of the rural population this may not be the case as discussed in section 4.1.5 . However at a general level we can conclude that natural selection which gives female children the survival edge over males at this early stage of life is allowed to prevail in the Nigerian context.

4.1.3 Religion of child's mother

While being born to a mother who practiced traditional religion was found to be significantly associated with increased risk of perinatal deaths, neither being muslim or christian was found to be significanlty associated with an increased risk of perinatal mortality. The peculiarity of those who practice traditional religion may be found in the beliefs and myths they may have concerning child birth. Just as was the case with the Faith Assembly people (Kaunitz et al., 1984) who believed that child bearing was an act of God not to be interefered with, it is likely that similarly misplaced convictions may reflect the high risk of perinatal deaths mong traditional religion pracitioners in this study.

4.1.4 Birth Size

Children who were said to be smaller than average in size at birth had a significantly higher risk of perinatal death than those who were average or more. This may reflect the increased risk of perinatal deaths attributable to being Low birth weight as found in studies like Silins et al (1985) and Borrel et al (2003). The prevailing argument is that low birth weight is an intermediate pathway between causal risk factors and perinatal mortality (Silins et al., 1985, Forsass et al., 1999). While this may be true in this study as well, there remains questions as to how good of a proxy birth size is for actual birth weight. Certainly the accuracy with which birth size as reported by respondents predicts the true birth weight will determine the validity of the results related to the former. Nonetheless the finding of increased risk of perinatal deaths in smaller than average newborn is for all intent and purposes consistent with existing scientific knowledge.

4.1.5 Place of Residence

Finally, rural dwellers had a higher risk of perinatal deaths when compared to urban residents. This is supported by Silins et al (1985) and Golding et al (1994). According to Silins et al (1985) this may be attributable in part to better access to perinatal care facilities in the urban areas reflecting social inequalities between th two groups. When we disaggregate the multivariate analysis by rural/urban settings we see slight differences in the predictors of perinatal mortality in the two groups. In urban areas, birth size and childs gender remain significant but religion becomes insignificant. The reason for this may be that as far as religion is concerned, majority (72%) of the traditional religion pracitioners who were found to be at increased risk of perinatal deaths, reside in the rural areas.

The multivariate model for rural areas is very similar to the overall model (Model 1) in terms of significant predictors of perinatal deaths. That is, child's gender, birth size and religion remain significantly associated with perinatal deaths. In fact the changes to the p-values are such that there is overlap between the adjusted odds ratios of each predictor variable in the two models – that is the general and the model for rural areas. However, the main difference in the rural areas is that gender of the child and religion interact significantly. That is, the association between religion and perinatal deaths in rural areas is modified by a third factor –gender of the child. To quantify this effect modification we stratified the model for rural areas by gender of the child (see Table 3.12). We see from the results that if the child was male, the association between traditional religion and perinatal deaths was much weaker than if the child was female. This could suggest some form of discrimination against female children by mothers who practice traditional religion. This is somewhat similar to the conclusions of Nielsen et al (1997) in India where families are openly known to prefer male children.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

This study has examined risk factors for perinatal mortality with the main aim of determining the role of place of delivery and delivery assistants in determining perinatal deaths. Results from the fitted logistic regression models show lack of association between place of delivery, delivery assistants and perinatal morality in Nigeria. Even after disaggregating the analysis by rural/urban settings, this lack of association persists. On the other hand, religion, birth size, gender of the child and place of residence (rural/urban) were found to be significantly associated with perinatal mortality.

The absence of significant association between place of delivery and perinatal mortality is difficult to explain. Uncontrolled confounding may be a possible reason for this lack of association. This uncontrolled confounding may be attributable to other known risk factors for perinatal mortality which were not included in this study due to their absence in the primary data set –the NDHS 2003. For example, labour complications are strong confounders when exploring perinatal mortality. Unfortunately, information on labour complications was grossly inadequate in the 2003 NDHS. Another hypothetical explanation may be that a large proportion of the pregnant women in Nigeria who chose to give birth at an institution (hospital or clinic), only do so if complications arise during labor and often do so after a protracted period. And coupled with the unavailability of specialized perinatal care units in many hospitals in Nigeria, it then means by the time these women arrive the hospitals much damage has been done to the child.

This may explain why the level of perinatal mortality in this study is almost equal between home and hospital deliveries and why no significant association exists. Also, the absence of association between delivery assistants and perinatal mortality is also difficult to explain. Perhaps the untrained persons such as TBAs who attend to majority of births in Nigeria are in fact really good at their jobs and have succeeded in avoiding differences in their perinatal death rates that may have led to statistically significant association. Further investigation may be necessary.

Some other risk factors however showed significant association with perinatal mortality. For instance, female children were found to be at lower risk of perinatal deaths than males and this was attributed to biologic reasons. Furthermore, traditional religion practitioners in the rural areas had children with a higher risk of perinatal deaths than children born into Christianity or Islam. Female children born to traditional religion practitioners in the rural areas were found to have higher risk of perinatal deaths than their male counterparts. Perhaps gender preference may be implicated in this regard.

Finally, being smaller than average in birth size (a proxy for birth weight which was unavailable in the primary data set used in this study) was significantly associated with high risk of perinatal deaths in both rural and urban areas. Because low birth weight is often a consequence of some underlying pathology, we concur with those researchers who believe that birth weight is in fact an intermediate pathway in the causality between certain risk factors and perinatal mortality. However we make such an assertion with caution since this study is a cross sectional study through secondary data analysis and therefore assessing temporality limits our position.

5.2 RECOMMENDATIONS

As regards the role of place of delivery and delivery assistants in determining perinatal health outcome, further research may be required. Considering the various limitations of this study perhaps a different study design and/or data of higher quality may yield results on these two factors that will be more consistent with available information. For instance, data which has more detailed information on variables such as the circumstances surrounding labour (history of labor complications) may yield better quality results.

In terms of data analysis, perhaps a hierarchical approach to modeling may also yield better quality of results. This approach, unlike the stepwise modeling, takes into consideration the various hierarchical interrelationships that exist between various factors influencing perinatal mortality. However, the results of such an analysis should not contradict the findings of the stepwise model but make the results more amenable to interpretation in the light of the conceptual framework previously described.

There may also be a role for qualitative studies in examining the role of place of delivery and delivery assistants in determining perinatal mortality. It will be interesting for instance, to investigate through in-depth interviews and focus group discussions, the factors that influence how and why Nigerian women choose their preferred place of delivery and the delivery assistant. The experiences of such women may throw more light on the circumstances surrounding delivery and highlight impact that their choices are having on perinatal mortality levels across the diverse socio-cultural settings that exist in Nigeria.

In terms of health policies, it goes without saying that the Nigerian government should continue to strive towards the attainment of improving maternal and child health and one of the United Nations MDG indicators to this regard is the proportion of deliveries attended by a skilled attendant. This proportion should be increased via building and equipping accessible and affordable health care facilities and training more health personnel to attend to these facilities especially in the rural areas. The establishment of adequate and functional referral systems especially in the rural areas may also serve to reduce the perinatal mortality and morbidity that may be associated with unsupervised home deliveries.

Despite hints of gender preference among traditional religion practitioners in the rural areas, females survive the perinatal period better than males. Nonetheless public awareness campaigns by the Nigerian Health Ministry and other relevant agencies may be useful in educating rural dwellers, especially those into traditional religion, on some basic issues in maternal and child health including gender equality.

Finally the disparity in perinatal deaths between rural and urban areas should suggest to the Nigerian government that more needs to been done to attain socio-economic equality in the rural areas particularly in the area of quality, affordable and accessible perinatal and child health facilities. Although reducing perinatal mortality is only one aspect in the drive to reduce childhood mortality by two-thirds in 2015 in line with the UN-MDG, it will be an essential step which must be taken if sustainable progress is to be made as regards child health.

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APPENDIX 1

Percentage distribution of births assisted by DOCTORS in the 5 years preceding the study by place of delivery and according to selected variables(NDHS,2003)				
No.	**Variable**	**Place of delivery (%)**		
		Home	**Government Hospital**	**Private Hospital**
a.	**Mother's age at birth**			
	Less than 20 years	13	39.1	47.8
	20-34.9 years	3.5	39.6	56.9
	35 years or more	8.6	39.1	52.3
b.	**Place of residence**			
	urban	3.5	41.2	55.3
	rural	9.2	36.2	54.6
c.	**Geo-political zone**			
	North	11.1	51.4	37.5
	South	2.1	32.4	65.5
d.	**Ethnicity**			
	Hausa	15	75	10
	Yoruba	1.7	34.5	63.8
	Igbo	0	32.1	67.9
	Other	9.5	41.4	49.1
e.	**Wealth Index**			
	Poor	12.7	46.8	40.5
	Middle	6	44	50
	Rich	4.1	37.5	58.4
f.	**Childs Gender**			
	Male	6.1	39.6	54.3
	Female	4.5	39.2	56.3
g.	**Size of child at birth**			
	large	4.8	42.3	52.9
	average	6	34.4	59.6
	small	6.4	44.7	48.9

APPENDIX 2

Percentage distribution of births assisted by NURSES/MIDWIVES/CHW in the 5 years preceding the study by place of delivery and according to selected variables(NDHS,2003)

No.	Variable	Place of delivery (%)		
		Home	Government Hospital	Private Hospital
a.	**Mother's age at birth**			
	Less than 20 years	24.2	61.5	14.3
	20-34.9 years	11.4	52.9	35.7
	35 years or more	14.9	52.7	32.4
b.	**Place of residence**			
	urban	11.1	55.6	33.3
	rural	14.5	51.1	34.4
c.	**Geo-political zone**			
	North	16.1	61.3	22.6
	South	9.5	45.5	45
d.	**Ethnicity**			
	Hausa	19.1	73.7	7.2
	Yoruba	9.1	49.1	41.8
	Igbo	9.1	37.5	53.4
	Other	14.2	56.8	29
e.	**Wealth Index**			
	Poor	14.9	51.8	33.3
	Middle	17.8	51.9	30.3
	Rich	10.5	54.4	35.1
f.	**Childs Gender**			
	Male	12.4	53.5	34.1
	Female	13.3	53.1	33.6
g.	**Size of child at birth**			
	large	10.5	55.1	34.4
	average	12.9	51.6	35.5
	small	20.3	52.5	27.2

APPENDIX 3

Percentage distribution of births assisted by TBA/Others in the 5 years preceding the study by place of delivery and according to selected variables(NDHS,2003)

No.	Variable	Place of delivery (%)		
		Home	**Government Hospital**	**Private Hospital**
a.	**Mother's age at birth**			
	Less than 20 years	98.5	0.8	0.8
	20-34.9 years	97.8	0.5	1.7
	35 years or more	97.5	0.5	2
b.	**Place of residence**			
	urban	96.3	0.9	2.8
	rural	98.3	0.4	1.3
c.	**Geo-political zone**			
	North	99	0.5	0.5
	South	89.1	0.9	10
d.	**Ethnicity**			
	Hausa	99.7	0.3	0
	Yoruba	82.2	0.9	16.9
	Igbo	92.9	2.7	4.4
	Other	97.4	0.7	1.9
e.	**Wealth Index**			
	Poor	98.7	0.3	1
	Middle	98.1	0.4	1.5
	Rich	94.9	1.3	3.8
f.	**Childs Gender**			
	Male	97.3	0.7	2
	Female	98.3	0.4	1.3
g.	**Size of child at birth**			
	Large	97.5	0.7	1.8
	average	97.9	0.5	1.6
	Small	98.5	0.4	1.1