ESTIMATION OF ADULT MORTALITY TRENDS USING ORPHANHOOD METHOD IN MOWE-IBAFO, OGUN STATE

ALABI OLALERE

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BY

ALABI OLALERE

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CERTIFICATION

I certify that this research work was carried out by **Olalere ALABI** of the Department of Epidemiology and Medical Statistics, Faculty of Public Health, College of Medicine, University of Ibadan, Ibadan.

Prof. E.A. Bamgboye, Ph.D (London)

Supervisor

DEDICATION

This research work is dedicated to the Alpha and Omega, the beginning and the end in whose hand is the power and strength to do all things. I also want to dedicate this research work to Mr Amos Olalere Alabi and Mrs Motunrayo Bukola Alabi for their endless love and sacrifice for me. May the Almighty God grant you long life to reap the fruit of your labour.

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ABSTRACT

The vital registration system, a direct method of estimating mortality, is often incomplete and inaccurate in developing countries. Alternative estimates of reliable mortality indices are needed to assess the impact of health intervention programmes at population subgroups. This study therefore provides estimates of adult mortality level and trends using orphanhood method, an indirect technique, in Mowe-Ibafo area of Ogun State, Nigeria.

A cross-sectional study was conducted among 1250 women of reproductive age (15-49 years), selected using a two-stage cluster sampling technique. Six out of 11 clustered communities were randomly selected. All households were visited in each selected cluster and one eligible woman was randomly interviewed in each household. A validated semi-structured questionnaire was used to collect data on respondent's and household member's socio-demographic characteristics, the survivorship status of respondent's parents, number of Children Ever Born (CEB) and those surviving. The socio-demographic data were summarised using descriptive statistics while a periodic cohort was used to project an estimate of CEB and surviving children of the women at the end of their reproductive age. The orphanhood method was used to relate the proportion of respondents with living mothers and fathers to measures of survivorship probabilities by means of multipliers whose values depend on the mean age at childbearing. This was obtained by averaging age of respondents who gave birth within a year before the survey. The adult mortality derived from the complement of survivorship probability is the probability of parents dying from birth to the current age of respondents. Brass and Bamgboye's method of estimating time period in mortality was used to determine adult mortality trends. Abridged life-tables were constructed by linking the survivorship probabilities in childhood and adulthood using the two-parameter logit system.

The age of respondents was 30.5±9.0 years with 19.4% in the 25-29 years age group. The sex ratio of household members was 92 males per 100 females. Less than half (46.8%) of the respondents had secondary education. The age at childbearing was 28.5±9.0 years while respondents CEB and surviving children at the end of their reproductive age was 4.14(95% CI: 3.98-4.30) and 3.36(95% CI: 3.12-3.60) respectively. The mortality estimates of respondents' fathers decreased from 0.40 to 0.09 between 1997 and 2004 while it decreased from 0.40 to 0.07 between 1999 and 2004 among their mothers. Life expectancy at birth for male and female were 59.2 and 62.9 years respectively. Also, the life expectancy at age 50

for male and female were 21.7 and 22.1 years respectively. The conditional probability of a male dying between age 15 and 60 years (0.26) was higher than that of females (0.21).
Adult mortality estimates declined over the years in Mowe-Ibafo with females having higher life expectancy than males. There is a need to identify and implement health intervention programmes that will improve the life expectancy, especially among men. Periodic monitoring of adult mortality using orphanhood method in the absence of a reliable vital registration system is also recommended.

Keywords: Adult mortality, Life expectancy, Orphanhood method, Vital registration system
Word count: 486

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INTRODUCTION

1.0 Background of study

In many developing countries the overall level of adult mortality is unknown particularly in Sub-Saharan Africa. In Nigeria as with other developing countries, the data collection systems such as the vital registration system barely exist. Even when complete and accurate civil registration data are available, the calculation of rates requires the estimation of denominators (United Nations, 2004). Denominators however are difficult to estimate. Denominators are usually total populations or mid-year population which are often estimated once in several years through census. They usually require a lot of resources in terms of time, finance and personnel. As such very often direct information suffers from many deficiencies. (Timaeus,1990).

Whereas in the developed countries, regular census, functional and reliable vital registration systems are routine activities and so represent a permanent source of data for calculating mortality rates for various components of the population (Timaeus, 1991).

The development of a reliable and affordable method for measuring adult mortality in countries that lack adequate vital statistics systems has proved a major challenge. While considerable ingenuity has been deployed to good effect to devise ways of rendering incomplete reports of recent deaths usable, such methods can be applied only when the majority of events are reported (Brass, 1975; Preston and others, 1980; Preston,1984 ; Timaeus and Graham, 1989).

The first simple robust method for estimating mortality from orphan-hood was proposed by Brass and Hill (1973). It relates the proportions of respondents with living mothers or fathers in two adjoining age groups to measures of life table survivorship by means of a system of weighting factors whose values depend on the mean age at child-bearing. Subsequent to the derivation of this weighting factors, several regression-based approaches have been proposed (Hill and trussel, 1977; Palloni and Heligman,1985 ; United Nations, 1983). Equivalent methods for the estimation of men's mortality from paternal orphan-hood have not been developed because of the lack of a satisfactory, flexible model of male fertility and persistent scepticism about the robustness of the method (Brass, 1975; Hill and Trussel, 1977; Hill. 1984; Palloni and Heligman, 1986).

Accurate data on child mortality can usually be collected from the children's parents and in particular their mothers. In-addition, the characteristics of parents are among the more important determinants of the risk of dying in childhood (UN Manual X, 1983). It is often unreasonable in adult mortality, to use the social and economic characteristics of the respondent as a proxy for those of the dead parents, as it cannot be regarded as a direct determinant of mortality risk in adulthood (UN Manual X, 1983).

Estimates from other methods of estimating adult mortality such as 'Widowhood', 'Sisterhood' and 'Brotherhood' approaches are subject to relatively greater inaccuracies compared to the Orphan-hood method (United Nations Manual X, 1983). The greater inaccuracies arise from less accurate reporting. The link between brothers and sisters may not be as strong as the mother- child link, thus some people might not know with certainty whether their siblings are alive or not. Moreover the sisterhood method is not appropriate for studying trends in mortality (United Nations Manual X, 1983).

Another advantage of the orphan-hood method of mortality estimation is that they rely upon information gathered by questions that are simple and easy to answer. The normal forms of the questions on orphan-hood are "is your father alive?" and "is your mother alive?", the possible answers being Yes, No or Not known (UN Manual X, 1983).

1.1 PROBLEM STATEMENT

The Federal Government of Nigeria (2004) stated that Nigeria still faces major challenges in developing a timely and high quality database particularly for the adult population. In many developing countries, especially Sub-Saharan Africa countries the overall level of adult mortality and the distribution of adult death among national population is unknown.

Estimating adult mortality from conventional data in developing countries like Nigeria is not reliable as a result of the poor quality of the census figures often attributed to inaccuracy of the returns in coverage and data quality (Cooper et al, 1998). Also, associated with unreliable census figures were insufficient personal details about the population enumerated and unavailability of disaggregated population data for local areas. The incomplete and scepticism about the robustness of the method (Brass, 1975; Hill and Trussel, 1977; Hill. 1984; Palloni and Heligman, 1986).

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Estimating adult mortality from conventional data in developing countries like Nigeria is not reliable as a result of the poor quality of the census figures often attributed to inaccuracy of the returns in coverage and data quality (Cooper et al, 1998). Also, associated with unreliable census figures were insufficient personal details about the population enumerated and unavailability of disaggregated population data for local areas. The incomplete and inadequate vital statistics system is also a contributing factor to the difficulties encountered in generating accurate and reliable estimates of adult mortality. Thus this study estimates adult mortality in a local community in Ogun State of Nigeria, using the orphanhood approach.

According to Ujah et al, 2005, maternal mortality ratio, a subset of overall female adult mortality, by region, was highest in Africa (830/100,000 live birth), followed by Asia (330/100,000 live birth), Oceania (240/100,000 live birth), Latin America and the Caribbean (190/100,000 live birth), and least in the developed countries (20/100000 live birth). With the exception of Afghanistan, the countries with high maternal mortality ratios (MMRs) were all in Africa (Ujah et al, 2005). Maternal mortality ratio for Nigeria was estimated at 576/100,000 live birth (NDHS, 2013).

1.2 RATIONALE

The reliability of data from the vital registration system in Nigeria is seriously affected by the problems of under-registration and age misreporting. The lack of a reliable demographic data from traditional sources (Vital registration and census) makes the development of indirect techniques for estimating demographic indicators of mortality imperative in Nigeria (Bamgboye, 2006).

The geographic information given in the past Nigeria Demographic and Health Surveys is highly aggregated and may therefore conceal local and state specific effects.

This study generated estimates of mortality using indirect techniques in the study area where no such estimates either from conventional data or deficient data existed. This estimate will serve as a baseline level of mortality to monitor the on-going health projects in the community.

The population structure (pyramid) of Sub-Saharan Africa reveals the existence of a broad-base population (high birth) with very little proportion surviving to the adult ages (PRB, 2013).This clearly indicate that the life expectancy is relatively low across Sub-Saharan Africa and Nigeria is not an exception.

Indicators need to be estimated to assess and monitor millennium development goals (MDGs) set to be achieved by year 2015. Measurement of mortality and analysis of cause specific mortality will provide programmers with information on where to allocate resources (Walker et al, 2002). Regional estimates of demographic indicators mask differences between smaller groups. It is therefore important to study smaller populations. Antunes and Waldman, (2002) report that temporal and spatial assessment of epidemiological and demographic data can lead to improvements in the effectiveness of social policies by guiding the targeting of resources and identifying groups to which educational measures and health programmes should be preferentially directed.

Studies showed that in some countries in Sub-Saharan Africa, much of Asia, and parts of Latin America, the registration of deaths falls short of the 60 percent limit below which adjustment of the data becomes infeasible (Preston, 1984). A large number of countries are making efforts to improve the coverage of their civil registration systems (Gil, 1989). There are large parts of the world in which it is unlikely that routine reporting systems will produce adequate data on adult mortality in the foreseeable future.

The adult ages encompass the main productive years of life. Because those aged 15-59 years are responsible for caring for old people and dependent children, the impact of an adult death on other household members can be catastrophic. Though little quantitative evidence of this exists at present, it is likely that adult deaths have major adverse economic consequences. Thus death of adults may have important implications for the distribution of income and welfare between socio-economic groups, for the social support of dependents and for overall production (Timaeus, 1990).

1.3 Objectives

1.3.1 Broad objective

To explore the indirect technique in estimating mortality and life expectancy at population subgroup in the absence of reliable conventional data source from vital registration and census.

1.3.2 The specific objectives were to:

1. Estimate adult mortality levels using the orphan-hood approach.
2. Observe the trend in mortality in the study area.
3. Generate an abridged Life-Table for males and females in Mowe-Ibafo using Brass' 2 parameter logit system.

CHAPTER TWO

LITERATURE REVIEW

2.1 REASONS FOR MEASURING MORTALITY DATA

Mortality data are important in the measurement of consequences of disease and useful in the planning of health care services. Mortality statistics provide baseline indicators from which health profiles can be constructed and health policy formulated. Studying trends in mortality overtime helps to understand how the health status of the population is changing. Several methods have been applied in studying this trend in mortality overtime. The patterns of mortality in a community in terms of cause, age, sex, population group, and geographical distribution, also inform the work of epidemiologists, medical personnel, and those working in health policy, planning and administration (Anderson, 2006).

2.2 EARLIER ATTEMPTS AT ESTIMATING ADULT MORTALITY IN AFRICA

Vital registration systems are the ideal source of data with which to monitor mortality levels and trends. However, the statistics systems of most Sub-Saharan Africa countries continue to be underdeveloped with only few countries been able to provide adequate vital statistics. In 2001 the World Health Organization (WHO) contacted all member states in Sub-Saharan Africa to try to obtain death statistics for a global assessment of the burden of disease (Kowal, Rao, and Mathers 2003). Just 9 out of 46 member states provided such data. Furthermore, coverage of registration was less than 60 percent in most of these 9 countries, with only Mauritius and the Seychelles providing vital registration data that were more than 90 percent complete. Adequate vital statistics are far more widespread in other regions, particularly Europe and the Americas, and 60 percent of the countries for which the WHO could not obtain registration data are in Sub-Saharan Africa. Due to a lack of appropriate data for direct estimates of adult mortality in developing countries, the WHO project studied trends in adult mortality in 27 developing countries (Hill, 2003), and included only 2 countries from mainland Sub-Saharan Africa (Benin and Zimbabwe).

Concerns exist about both the reliability and validity of reports on the survival of respondents' siblings. Although Bicego (1997) found good correspondence with other data, Stanton, Abderrahim, and Hill (1997) suggest that sibling survival may progressively underestimate adult mortality as the time since the event lengthens. These authors conclude that sibling histories can at best provide an estimate of adult mortality in the few years before the data were collected. Comparison of successive sets of sibling history data in the three African countries that have collected them in two DHS surveys also supports this conclusion (Timaeus and Jasseh, 2004).

Analyses of data from censuses in Kenya also suggest that a reversal in the trend in adult mortality occurred in that country during the 1990s. The orphanhood estimates of person-years lived in Kenya indicates that slight improvements were made between the 1970s and 1980s but that an even larger decline occurred in the next decade. In this country, the mortality of women is lower than that of men.

Analysis of a range of data sources from Zimbabwe, including vital registration data, has also shown a marked rise in the adult mortality rates during the 1990s (Feeney, 2001). This is in keeping with the rising prevalence of HIV observed in antenatal clinics during the late 1980s and early 1990s. The estimates from vital registration, household deaths, and survival of parents are reasonably consistent, although the last of these series may underestimate somewhat for the earlier period and place the subsequent rise in mortality slightly too early (Feeney, 2001).

Church records from northern Namibia have been used to estimate the mortality experience of the parishioners (Notkola, Timaeus, and Siiskonen 2004). Adult mortality did not change much during the 1980s but increased rapidly from about 1994. In 2000 the death rates of women at ages 20–64 were 3.5 times higher than in 1993; for men they were 2.5 times higher.

An analysis of the sibling histories collected prior to 1997 in 11 DHS surveys in Sub-Saharan Africa showed that, although adult mortality was falling or stagnant in Western Africa and in Namibia in the 1980s, it had begun to rise sharply in Eastern Africa (Timaeus, 1999). Moreover, four of the six Eastern African countries considered were characterized by unusually high mortality of young adults relative to older adults. Unfortunately, DHS surveys collect sibling histories only from women of reproductive age (although respondents report on siblings older than themselves) and the surveys cover rather small samples for the study of adult mortality, especially at ages 45–59. Thus, these surveys lack the statistical power to enable one to produce meaningful estimates of how the age pattern of mortality in adulthood is evolving in each country as the overall death rate rises (Timaeus, 1999).

One common index of measuring the pace of mortality change is the life table survivorship from age 15 to 60 years, which can be interpreted as the probability of surviving to old age, subject to surviving childhood, at the prevailing level of mortality. This index, which is a complement of the probability of dying between exact age 15 and 60, has been adopted as the preferred index of adult mortality (Timaeus, 1998).

Timaeus (1993) pointed out that some of the results on adult mortality based on data that have been subjected to smoothing and adjustment have shown that, for example around 1980, more than 75 per cent of those aged 15 would survive to age 60 in Benin and The Gambia. In Ghana, Mauritania, and Zimbabwe, the equivalent figure is more than 80 per cent. The increase from low to high mortality in some countries has been substantial. For example, Feeney (2001) reported that in Zimbabwe the probability of surviving between exact age 15 and 60 decreased from about 80 percent in 1982 to about 50 percent in 1997. In Malawi, this value increased from 56 per cent in 1966 to 58 percent in 1977 and further increased to 68 percent in 1987 before declining to 52 percent in 1998 (MNSO 1994,2002).

In 1995, a Lusaka study on adult mortality (Kelly et al, 1998) found that among young adults, death rates were 20 times higher than in another study in rural and urban Nigeria (Cooper et al, 1998). The Lusaka study comprised poor urban neighbourhoods where a total of 2,258 households (representing 6,440 adults and 5,073 children) were initially interviewed in 1995 and followed up for two years. It was found that 29 percent of all households reported one or more deaths within two years, a total of 392 adults (202 men and 190 women). The crude death rate in Lusaka was 2.5 times higher than the Nigerian cohorts. The Nigerian study (Cooper et al, 1998), conducted in 1995, followed 7,628 adults over the age of 15 years in an urban cohort of Ibadan and 4,205 adults over the age of 25 years in the nearby rural district of Igbo-Ora. A follow-up was done every three months for two years to see if a death had occurred. The findings showed that a total of 216 deaths occurred during the follow-up.

2.3 VITAL REGISTRATION SYSTEM IN NIGERIA

Vital registration system is a procedure that is designed to register vital events on a routine basis (Kpedekpo and Arya, 1981). According to UN (2003) vital events are regarded as live births, deaths, foetal deaths, marriage, divorce, adoption, legitimation of birth, recognition of parenthood, and annulment of marriage or legal separation. The vital registration system serve as the main source of data for estimating changes in the size of a population at any given point in time. Vital statistics systems provide the most reliable source of information on births and deaths. However, such an accurate system exists only in theory as most developing countries have deficient vital registration system and Nigeria is no exception. One of the key issues that have kept the Sub-Saharan African countries in the state of underdevelopment is the unavailability of accurate statistical data for social and economic planning purposes (Adedini, 2011). The completeness of vital registration was as low as 13.49% in the year 2007 (NPC, 2008). Mortality measures based on data from vital registration systems are very scanty in Nigeria. An assessment of the country's death registration system by UNICEF in 1999 revealed a completeness rate of about 20%.

In Nigeria, the first attempt at obtaining data on birth dates back to 1863 with the promulgation of the ordinance No. 21 at the Lagos colony. The success of the program, in terms of numbers of births and marriages registered, made the colonial government to extend it to Warri and Calabar in 1903 and 1904 respectively (Sule, 2003). A more comprehensive registration system throughout the country was introduced in 1917 (NPC, 1998). Throughout the colonial period and even beyond, the operation of vital registration system in the country lacked uniformity in operations (Adedini, 2011). Beside, coverage was both incomplete and inaccurate and the objectives then were basically narrowed to the colonial needs for tax assessment and security purposes (NPC, 2010). In search of an alternative to census exercise which was frequently marred by crises, litigation and cancellations of figures in the 1960s and 1970s, the Nigerian government promulgated a decree on compulsory registration of births and deaths in 1979 (NPC, 2010).

Between year 2003 and 2005, the National Population Commission (NPC) developed an action plan to create a more sustainable registration system. The plan included the involvement of every part of society, local communities and stakeholders. In a bid to ensure an improvement in the registration system, the NPC waived the payment of registration fees for three years, from July 2005 – July 2008. Payment of fee in the past had hindered considerable number of parents from registering the births of their children (UNICEF Nigeria, 2007). The waiver, coupled with heightened sensitization, resulted in a slight increase of birth registration from a former national figure of 28 percent in 2001 to an average of 30.2 percent in 2006 (UNICEF Nigeria, 2007). Though the system started in Nigeria as far back as 1863, Nigeria experience with registration system has not been any better up till the recent time (NPC, 1998). Time estimates of infant mortality and crude death rates based on the data from the vital registration system for Lagos between the periods from

1950 to 1963 was published in the 1966 U.N. demographic Year Book. The Table below shows these rates (United Nations, 1966).

Table 1: Estimates of IMR and CDR for Lagos, based on Death Registration System, 1950-1963

Year	IMR	CDR
1950	87.5	14.4
1951	73.9	15.5
1952	103.8	15.9
1953	85.3	13.6
1954	89.0	13.0
1955	81.8	12.6
1956	75.6	11.7
1957	79.3	13.9
1958	79.1	12.5
1959	76.2	13.4
1960	62.9	11.8
1961	81.0	13.4
1962	62.0	10.9
1963	67.8	13.5

Source: UN. Demographic Year Book, 1966

The crude death rate figures indicate that there has been very little change in the mortality experience in Lagos since 1950. Estimates for the infant mortality rate depict the same trend. It is almost impossible to agree that mortality in Lagos in 1950 would have been as low as indicated by the U.N. estimates. All these point towards a strong likelihood: an underestimation of the mortality level by the registration system. This could have been as a result of incomplete death registration and/or inflated population base.

A number of countries in Sub-Saharan Africa have realized the importance of having a comprehensive and continuous vital registration system in their country and therefore, they are making frantic efforts to improve its performance in their domain. For instance, in her bid to improve vital registration system in Ghana, September 1st was set aside for the annual celebration of births and deaths registration in Ghana in order to draw people's attention to the importance of registering births and deaths in the country and besides, the law of Ghana requires that all deaths must be registered before burial is permitted (Kwankye et al, 2007).

In Nigeria, however, vital registration system has not been given the necessary attention among the general populace, and because of this, birth and death recording is yet to receive recognition as a valuable data source for demographic analysis (Adedini, 2011). The present level of civil registration system in Nigeria is low as compared with that of developed and even some developing countries like India. In India for instance the level of birth and death registration was 69.7% and 63.2% respectively around 2006 (Tiwari, 2011).

Some of the possible causes of low registration identified by Tiwari, 2011 included lack of awareness about the need and importance of registration of births and deaths, lack of awareness about the place and registration authorities to whom to report, particularly in the case of rural areas, inadequate and ill-equipped staff, low importance assigned to civil registration work, and insufficient registration centres.

2.4 CENSUS SITUATION IN NIGERIA

National census as the name suggests and as defined by the United Nations in 1975 is the total process of collecting, compiling and publishing demographic, economic and social data pertaining at a specified time or times to all persons in a country or delimited territory. All population censuses worldwide are affected by both coverage and content errors. However, the magnitude of these errors differs from one country to another. Census data with minimal errors can be used to produce estimates of mortality in population with deficient death registration system. Coverage errors are more serious in rural remote areas (NPC, 2010). Since census data are collected retrospectively, content error occur as a result of (age) misunderestimation of the mortality level by the registration system. This could have been as a result of incomplete death registration and/or inflated population base.

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Due to under-coverage, Nigeria census data undermines the population base necessary for calculation of rates particularly for the rural areas and urban slums (Morah, 1985). Unfortunately, Nigeria's census taking, like the vital statistics is also inconsistent.

The first attempt at a population census in Nigeria was in 1866. Subsequent censuses before 1952, such as 1911 and 1922, were restricted to some parts of the country (NPC, 2010). The 1952-53 enumeration was the first nationwide census. This attempt yielded a total population figure of 31.6 million within the current boundaries of the country. This census has usually been considered an undercount for a number of reasons such as apprehension that the census was related to tax collection, political tension at the time in eastern Nigeria, logistical difficulties in reaching many remote areas, and inadequate training of enumerator in some areas.

The first post-independence census conducted in 1962 was cancelled because of alleged irregularities in its conduct and another census conducted in 1963 was officially accepted though encumbered with charges of inaccuracy and manipulation for regional and local political purposes. Indeed the official 1963 figure of 55.6 million as total national population is inconsistent with the census of a decade earlier because it implies a virtually impossible annual growth rate of 5.8 percent.

In addition to likely inflation of the aggregate figure, significant intraregional anomalies emerge from a close comparison of the 1953 and 1963 figures. In portions of the southeast, for example, the two sets of data imply that some non-urban Local government areas (LGAs) had increased at a rate of almost 13 percent per year, while other neighbouring areas experienced a minute growth rate of 0.5 percent per year. Despite the controversy, the results of the 1963 census were eventually accepted. After the civil war of 1967-70, an attempt was made to hold a census in 1973, but the results were cancelled in the face of repeated controversy.

No subsequent nationwide census was held until 1991, although there have been various attempts to derive population estimates at a state or local level. The great improvements in transport and accessibility of most areas, in technological capability, and in the level of education throughout the country, favoured the success of the 1991 census (NPC, 2010). In reporting, memory-lapse errors and in the process of recording information provided by respondents (El Badry, 1961 cited in United Nations, 1983).

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In addition to likely inflation of the aggregate figure, significant intraregional anomalies emerge from a close comparison of the 1953 and 1963 figures. In portions of the southeast, for example, the two sets of data imply that some non-urban Local government areas (LGAs) had increased at a rate of almost 13 percent per year, while other neighbouring areas experienced a minute growth rate of 0.5 percent per year. Despite the controversy, the results of the 1963 census were eventually accepted. After the civil war of 1967-70, an attempt was made to hold a census in 1973, but the results were cancelled in the face of repeated controversy.

No subsequent nationwide census was held until 1991, although there have been various attempts to derive population estimates at a state or local level. The great improvements in transport and accessibility of most areas, in technological capability, and in the level of education throughout the country, favoured the success of the 1991 census (NPC, 2010). In other to reduce possible controversy, religious and ethnic identification was excluded from the census forms and verification of state results were handled by supervisors from outside the state (NPC, 2010).

The most recent census was carried out in March 2006. A post enumeration survey was carried out in July that same year to assess the quality of the census results and to collect information on fertility and mortality data. The population total as of March 2006 was provisionally given as 140.0million (NPC, 2009). The total is higher than the projected population of Nigeria in the UN's 2004 revision estimates, which shows a mid-2006 population of 134.4 million.

Some of the identified reasons for paucity of fertility and mortality data from census in developing countries include; the inaccuracy of the returns in coverage and data quality, censuses being few and far apart, insufficient personal details about the population enumerated and unavailability of disaggregated population data for local area (Ayeni, 1975).

2.5 SAMPLE SURVEYS

The effort to generate reliable demographic data in Nigeria has included the conduct of numerous sample surveys. These include the 1965-66 Rural Demographic Sample Survey and the 1980 National Demographic Sample Survey (NDSS) conducted by the Federal Office of Statistics and the National Population Bureau, respectively. The 1981-1982 Nigeria Fertility Survey (NFS) conducted by the National Population Bureau among women of reproductive age was the first nationally representative surveys on fertility, family planning, contraceptive use, and related topics. The first Nigeria Demographic and Health Survey (NDHS) followed in 1990, with subsequent ones conducted in 1999, 2003, 2008 and 2013 by ICF Macro. In addition to the topics covered by the NFS, the NDHS also collected information on issues related to maternal and child health.

2.5.1 NIGERIA DEMOGRAPHIC AND HEALTH SURVEYS (NDHS)

The Nigeria Demographic and Health Survey (NDHS) is a national sample survey of women of reproductive age designed to collect data on socioeconomic characteristics, history of child bearing, mortality pattern, breastfeeding, use of contraception, immunization of children, marriage pattern, nutritional status of children, accessibility to health and family planning services, treatment of children during episodes of illness. This was intended to assist policy makers and administrators in evaluating and designing programmes, and to develop strategies for improving health and family planning services in Nigeria which in turn should reduce childhood mortality levels (NPC, 2004).

Mortality estimates are calculated from information that was collected in the birth history section of the individual questionnaire. The section began with questions about the aggregate child bearing experience of respondents (i.e. the number of sons and daughters who live in the household, who live elsewhere, and who died). These questions were followed by a retrospective birth history in which data were obtained on sex, date of birth, survivorship status, and current age or age at death of each of the respondents' live births. This permits calculation of various child mortality rates such as infant mortality and under-five rates (NPC, 2004).

The direct estimation technique is based on a life-table approach: probabilities of dying are computed from reported dates of birth and death and the numbers of children of a particular age exposed to the risk of dying during a specified period (Hill et al, 1988 and Bicego et al, 1996). Each survey produces national mortality rates for the intervals 0-4, 5-9, and 10-14 years preceding the survey. These estimates can be considered to indicate the mortality rates at a mean of 2.5 years, 7.5 years, and 12.5 years preceding the survey, respectively.

The reported ages at death and years since death of respondents' brothers and sisters can be used in making direct estimates of adult mortality (NDHS, 2013). Mortality rates are calculated by dividing the number of deaths in each age group of women (and men) by the total person-years of exposure to the risk of dying in that age group during a specified period prior to the survey. Nevertheless, age-specific mortality rates obtained in this manner are subject to considerable sampling variation (NDHS, 2013).

The birth history data for the less recent periods are thought to be of lower quality because event omission and misreporting of date of birth and age at death for deceased children are likely to occur more frequently at longer durations of recall. This leads to progressive underestimation of mortality rates with increased time preceding the survey, as can be demonstrated by comparing rates for a given calendar period between recent and less recent surveys (Bicego et al, 1996).

2.6 FACTORS AFFECTING THE VALIDITY OF ESTIMATES FROM ORPHANHOOD METHOD

The estimated mortality does not refer to specific time periods, rather it provide direct information about cohort mortality not period mortality. This is not a problem if mortality has been constant. But in most cases, the estimates represent average measures over a somewhat lengthy and varying period of exposure. A method to 'date' the estimates has been developed by Brass and Bamgboye (1981).

Another potential bias arises from the fact that only surviving children can report about the survivorship of their mothers. This selection effect probably biases survival estimates upwards because mortality risks across generations in the same family are likely to be positively correlated. The bias may be offset in part by the tendency for poor women, (whose mortality risks are usually above average) to have higher fertility.

The most serious drawback of the Orphan-hood method is the so- called 'adoption effect'. This is the tendency of respondent to give reports not about the biological mother but about the social mother who may have adopted the respondent after the death of the actual mother. This tends to underestimate mortality estimate of the real mother. This bias is very problematic below age 15 years when children are not reporting for themselves. The interviewers will often assume that the mother is living which leads to implausibly low mortality below age 15. This is a serious problem in some parts of Nigeria, and in the extended family system and child fostering.

Thus the Orphan-hood approach to the estimation of adult mortality is designed primarily to be used with reports from off-springs age 15 and above. The 'adoption' problem affects other ages also, but it becomes relatively less important as mortality itself becomes higher among aging cohorts (United Nations Manual X, 1983).

2.7 MATERNAL MORTALITY

Sustained progress in development and access to health services throughout the world has not prevented an increase in mortality rates in Sub-Saharan Africa of prime aged adults and children under age-five. This increase is largely due to communicable diseases such as tuberculosis, Malaria, Hepatitis B, Lower respiratory infections and perhaps most conspicuously HIV/AIDS (Murray and Lopez, 1997; World Bank, 1993).

The reduction of maternal deaths is a key international development goal. Evidence-based health policies and programmes aiming to reduce maternal death need reliable and valid information. It is well known that poor countries are the ones with highest maternal mortality rates. The maternal death in Nigeria as estimated in the 2013 NDHS is 576/100000 live births. In analogy to the link between poverty and infant mortality, the relationship between poverty-maternal mortality has become part of common wisdom.

During the past half century there was a marked reduction in maternal mortality rate especially in developed countries, to such a level that the standard of Obstetric care could no longer be assessed in terms of mortality rates. However, the picture is different in the developing world, and the disparity in deaths between developed and developing is greater for maternal mortality than for any other global health problem. Of all the health statistics compiled by the World Health Organization (WHO), the largest discrepancy between developed and developing countries occurred in maternal mortality. Many believe that the most important common denominator that is central to the increasing maternal deaths in Africa is poverty. The expanding AIDS epidemic also means that an understanding of adult mortality levels and trends in the region will become at once increasing important and more difficult to achieve over the next two decades (Bicego, 1997).

2.8 FACTORS INFLUENCING MATERNAL MORTALITY IN NIGERIA

(1) Poverty as a cause of Maternal Mortality in Nigeria

Poverty limits accessibility to basic services like health. It influences negatively the ability to utilize modern health facilities. Such limitation tend to cause high mortality especially among the poor (Alti-Muazu, 1995). Problems of poverty limit access to food and balanced diet, thereby causing hunger and malnutrition which are closely related. According to the World Health Organization report (1997), only 31 percent of women in Nigeria deliver with a skilled attendant's assistance.

(2) Poor Government policies as a cause of Maternal Mortality in Nigeria

Many years of poor governance eroded health infrastructure. Delivery and reproductive health services in Nigeria are substandard. While health service delivery is poor nationwide, it is weakest in the northern region and rural communities (USAID, 2006). National budget expenditures for the health sector are very minimal.

(3) Cultural factors as a cause of Maternal Mortality in Nigeria

Health seeking behaviour, particularly of women is often determined by social norms of behaviour, beliefs and practices (UNFPA, 2001). Most women tend to conform to culturally defined norms when it comes to health-seeking during pregnancy and childbirth. Despite the presence of formal health services, they are often bypassed for traditional providers. These cannot be separated from the fact that, the communities where the mother resides influence her attitude and behaviour towards seeking health care (Machando & Hill, 2004).

In the north, there are several practices like massaging the womb and eating of local herbs during pregnancy and child birth. A study conducted by Alti-Muazu (1995) reveals that in some traditional Hausa communities, during labour a woman is given raw beans which have been soaked in water for hours to help speed labour, a fairly long stick is pushed into the woman's mouth to induce vomiting and help expel placenta. Most of these practices can be harmful to maternal and infant health.

Circumcision of pregnant women is a common practice among the Urhobos and Isokos of Delta State in Southern Nigeria. It is a commonly held belief among these people that a girl cannot graduate into womanhood unless she is circumcised and this circumcision must take place during the advanced stage of her first pregnancy, usually about seven (NCPEA,1995). Such practice has serious medical implications especially at child-birth. It is reported that prolong labour is more common among women who have undergone these circumcision. (NCPEA).

(4) Age at marriage and childbirth

Age at first birth (maternal age) and number of children born are very much influenced by the social institution of marriage. Nigerian women marry young and bear on average six children (NDHS, 2013). It is believed that early marriage lowers the risk of pre-marital sexuality. as such; it is widely practiced. But at the same time 'very early' marriage can put the young girl at high health risks of morbidity and mortality.

A study on maternal death conducted by United Nations population Fund (2001) reveals that the risk of death at child birth is three times higher among the adolescent girls between the ages of 15-19 years than among their older cohort (20-24). Also in the traditional community of Mbaises in Imo state, a woman who has 10 or more children is compensated with a cow on the 10^{th} live birth (NCPEA, 1995).

CHAPTER THREE

METHODOLOGY

3.1 STUDY AREA

Ogun state is located in the south-western part of Nigeria, occupying a land area of 16,409.26 SqKm. The state consists of heterogeneous population, made up of different ethnic groups, culture and life style. It was created in February 3, 1976. Mowe-Ibafo, a residential and an industrial community is located in Obafemi-Owode local government, Owode-Egba, Ogun state. Obafemi/Owode local government area is one of the 20 LGAs in Ogun state consisting of 161 primary schools, 1 state general hospital and with a population of 228,851 (NPC, 2006). Obafemi-owode Local Government Area (LGA) consists of 3 zones namely Owode, Obafemi and Oba. Each of these zones consists of 4 different wards. Mowe-Ibafo is a community situated in Ofada ward. Ofada ward happens to be grouped under Owode zone.

3.2 STUDY POPULATION

Mowe-Ibafo is a town located in the south-western state of Ogun, bordering Lagos state, the commercial capital of Nigeria. It is in a strategic location as it hosts several religious worship headquarters and key industries. Due to time, finance and other logistics, only a subset (sample) of the target population was studied. The study population consist of 1250 women of reproductive age living in households in the selected area of Mowe-Ibafo, whose completed interviews was processed for analysis. For this study, the reproductive age group for women is defined as 15 to 49 years.

3.3 STUDY DESIGN

It is a single round cross-sectional survey to collect retrospective data on the survivorship of parents. Fertility data was also collected from the respondents.

3.4 SAMPLE SIZE DETERMINATION

The sample size for the study was calculated using the statistical formula for calculating sample size to estimate proportion of a condition. This was done to ensure that statistical consideration was carried out in determining the sample size, among other considerations.

$$N = \frac{(Z\alpha + Z\beta)^2 PQ}{D^2}$$

Where:

N= minimum sample size

α=significant level: 0.05

β= 0.10 (Type 2 error)

$Z\alpha$ =1.96 (Standard normal deviate at α=0.05)

$Z\beta$ = 1.65 (standard normal deviate at β=0.10)

Power =1-β =0.9

P= the estimate of adult mortality is 0.0046 (4.6 per 1000person-year of exposure) according to the 2008 NDHS.

D =absolute deviation 1% from true value

Q= 1-P = (1-0.0046) = 0.9954

$(Z\alpha + Z\beta)^2$ =13.0321

N= 13.0321 x 0.0046 x 0.9954/0.01² =597

However given that the above is for simple random sampling, a design effect (DEFT) has to be applied. According to the 2008 NDHS, for the total women sample, the value of the design effect (DEFT) averaged over all variables is 1.86, which means that due to taken a multi-stage cluster sample, the average standard error is increased by a factor of 1.86 over that in an equivalent simple random sample. The minimum sample size is therefore multiplied by the design effect of 1.86.

$N = 597 \times 1.86 = 1110$

To allow for non response: assuming a response rate of 90%

$N = 1110 \times 100/90$

$N = 1233$

However, a sample size of 1250 households was used for the study.

3.5 SAMPLING PROCEDURE

Multi-stage cluster sampling technique was used in the process of selecting study participants. Mowe and Ibafo communities consist of major entry roads linked at different point by several adjoining roads to the different streets thus making it easy for natural clusters to be identified. Simple random technique was used to select 6 clusters out of 11 identified cluster communities in the study area. The sample size was then divided proportionally across all the selected clusters based on the number of streets in each clusters. In each selected cluster, the listing of the buildings which usually represent a single household in Mowe-Ibafo layout was done before visiting all the households. Occasionally the entire households in buildings with more than one household were sampled to make up for buildings with single household but no eligible respondent. Household member listing was also done to identify eligible respondents in a particular household. This listing involved recording every member of the household by their age and sex. Simple random technique was applied to select a single respondent from any household with more than one eligible respondent. This was done to avoid repetition of information collected from respondents (like information on survivorship of mother and father). The study instrument was then administered on eligible respondent identified in each household after seeking their consent.

Cluster sampling strategy has the advantage of enabling larger sample to be taken for a similar fixed cost and less time needed for listing and implementation while the deficiency in this sampling method as against simple random method has been taken into consideration by factoring the design effect (DEFT) into the sample size estimation.

All questionnaires were reviewed for quality and consistency of data before the team departed for the round of survey each day.

3.8 DATA PROCESSING AND ANALYSIS

Data entry was carried out by the researcher. The open ended questions were coded to ease the data entry. The data was entered using the SPSS version 16. Checking was carried out as part of the data processing procedure in order to clean the data. This involved the correction of omissions and reconciling inconsistencies that was inevitable during the administration of the survey instruments. Some of this checking was also on-going during the field work.

Frequency distribution tables were produced to check for outliers. The data from the questionnaires were also subjected to different quality control measures which included: range checks, consistency checks and typographic checks. Thereafter, descriptive statistics was used to summarize the data in frequencies and percentages and they were presented in tables and charts. The indirect demographic estimation of adult mortality and the child mortality needed to construct the life-table for the study population was done with excel work sheets and manually by the use of a calculator. The methodology of the demographic analysis is fully described below. Some of the variables that would enhance the derivation of estimates of adult and child mortality included; total children ever born, birth in the previous year before the survey, proportion of respondents with surviving mother and father.

3.9 ESTIMATION OF MORTALITY USING THE ORPHANHOOD APPROACH

The following data are required for this method:

(a) The proportion of respondents with surviving mother (father) in each five year age group from n to n+4. This proportion is denoted by S(n). The set of proportions S(n) can be calculated when any two of the following items are available: (a) the number of respondents with mother (father) alive; (b) the number of respondent with mother (father) dead; (c) the total number of respondents whose mother's (father's) survival status is known. It is important to exclude from the calculations all respondents who did not know or did not declare their mother's (father's) survival status. In every case, data was classified by five-year age group

(b) The number of births in a given year classified by five year age group of mother (father). This information is needed to estimate M, the mean age of mothers (fathers) at the birth of their children in the population being studied. The M estimated is not the mean age of the fertility schedule (also known as ''mean age of childbearing''); it is, rather, a mean age of the fertility schedule weighted by the age distribution of the female (male) population. It may be regarded as an estimate of the average age difference between mother (father) and child in the population, thus being an indicator of the average age at which the target persons (parents) begin their exposure to the risk of dying.

(i) Computational procedure

The steps of the computational procedure are described below.

Step 1: Calculation of mean age at maternity (paternity).

The mean age of mothers (fathers) at the birth of a group of children (normally those born in the year before the survey) is denoted by M. If one uses the index i to denote the different five year age groups in the reproductive life span of a woman and lets B(i) be the number of births during a particular year among women in age group i, then

$$M = \frac{\sum a(i)\, B(i)}{\sum B(i)}$$

Where a(i) is the mid-point of age group i. Note that if the births used to calculate M are those reported as occurring during the year preceding the survey and are tabulated by age of mother at the time of the survey, the age group of the mother will be, on average, six months younger than stated, so that six months should be subtracted from the mid-point of each age group when calculating M.

The estimation of M for males is one of the additional problems associated with the estimation of male adult mortality from the proportions of respondents with a surviving father. Fertility questions are generally not asked of males, so the information from which the female M is estimated is usually not available for fathers. Births during the year preceding a survey are sometimes tabulated by age of husband, but this tabulation is generally limited to those cases in which the mother and her husband are enumerated in the same household. Calculating the male M from such tabulation often biases its value upward because young fathers are more likely to be temporarily absent on the day of interview.

A more robust procedure for estimating M for males consists of adjusting the female M by using information on marital status. The median age of the currently married population can be calculated by sex, and the difference between the male and female medians can be added to the previously calculated female M to obtain an estimate of the male M. Medians are used to reduce the influence of older and , for the purpose in hand, largely irrelevant couples. In principle, the assumption of constant fertility can be relaxed by employing different values of M for different age groups of respondents, But in practice the data required to follow this approach are often lacking.

Step 2: Calculation of weighting factors. For the value of M calculated above and for each value of n, the weighting factors, W(n), are calculated by interpolating linearly.

Step 3: Calculation of survivorship probabilities. If the survivorship of mothers is being considered, the probabilities of surviving from age 25 to age 25 + n are calculated by using the equation.

$$Lf(25+n)/Lf(25)= W(n)\ S_{n-5} +(1.0-W(n))S_n$$

Where S(n) is the proportion of respondents aged from n to n+4 who declared that their mothers were alive at the time of the interview.

In the case of fathers, the value 25 is replaced by the values 32.5 or 37.5 to allow for the fact that men are usually older than women at the birth of their children. The survivorship probabilities are estimated in this case by the following equations:

$$Lm\ (35+n)/Lm\ (32.5) = W(n)S(n-5)+(1.0-W(n))S_n$$

$$Lm(40+n)/Lm(37.5) =W(n)S(n-5)+(1.0-W(n))S(n)$$

(b)In both cases, S(n) stands for the proportion of respondents in the age group from n to n+4 whose father was alive at the time of the interview. If the M value is less than or equal to 36, the first equation be used; if it is greater than 36, the second equation be used.

Step 4: Calculation of number of years before the survey to which the survivorship estimates refer; it can be shown that if the level of mortality is declining linearly on the logit scale, the survivorship estimates obtained from orphan-hood data are equal to those prevalent at specific time periods prior to the survey and that the time location of these periods is largely independent of the rate of the mortality change. In addition, when female mortality in adulthood has a pattern similar to that embodied by the general standard, the number of years before the survey to which each estimate derived from maternal orphan-hood data refers, denoted by t(n), can be estimated as

$$t(n)= n(1.0-u(n))/2.0 \text{ where}$$

$$u(n)= 0.3333\ln({}_{10}S_{n-5})+Z(M+n)+0.0037(27-M),$$

and the value of Z(M+n) is obtained by interpolating linearly from the table of standard function (shown in Table 1 of annex) for calculating the time reference for indirect estimates of adult survivorship (Brass and Bamgboye, 1981).

Note that in this case ${}_{10}S_{n-5}$ represents the proportion of respondents in the age group from n-5 to n+4 with mother alive, and that n is the mid-point of the 10-year age group being considered.

When data on paternal orphan-hood are being used, the previous equations become

$$t(n)= (n+0.75)(1.0-u(n))/2.0 \text{ and}$$

$$u(n)=0.3333\ln({}_{10}S_{n-5})+Z(M+n) +0.0037(27-M+0.75)$$

Where Z(x) is still observed from the table of the values for standard function; ${}_{10}S_{n-5}$ now represents the proportion of respondents aged from n-5 to n+4 with father alive; M is the mean age of fathers at the time of their children's birth; n is the mid-point of the age group considered; and 0.75 or three quarters of a year have been added to make allowance for the fact that a father must have been alive at the time of conception, but not necessarily at the time of the birth of his offspring.

3.10 Limitation of the Ophanhood method

(1) Migrant may constitute a special group of persons with characteristics concerning orphanhood different from those of persons who did not migrate.

(2) Orphanhood information may not be accurate in countries with high internal migration and poor communication systems.

(3) If the population has a mortality pattern significantly different from those of model life tables, the estimates will be affected.

3.11 Estimating Childhood Mortality

Childhood mortality from children ever born will be estimated using the Trussell variant of the method developed by Brass (1971). This is necessary in the construction of an abridge life table for male and female.

The basic data required for this method of estimation are:

(a) The number of births in the last 12 months preceding the survey classified by sex and five year age group of the women.

(b) The number of children surviving (or the number of children dead), classified by sex and by five year age groups of women.

(c) The total number of women (irrespective of marital status), classified by five year age groups.

Procedure

The idea is to translate the proportion of children dead (Di) estimated directly from survey data into a conventional life table measure q(x), which is probability of death between age 0 and x. Using the following equation:

$qx = Di * Ki$

where qx is the probability of dying between birth and exact age x, Di is the proportion of dead children ever born to women in the age group i, and Ki is a multiplier that adjusts for non-mortality factors determining the value of Di

This relationship between D(i) and q(x) is primarily determined by the age pattern of fertility because it determines the distribution of the length of exposure to the risk of dying of the children of a group of women (United Nations, 1983).

Step 1: Calculation of average parity per women. P(1) refers to the parity in age group 15-19, P(2) to 20-24 and P(3) to 25-29. In general,

$$P(i) = CEB(i)/TNW(i)$$

Where CEB(i) is the children ever born by women in age group i and TNW(i) is the total number of women in age group i. Variable i refers to the different five- year age groups considered. Thus, the value i=1 represents age group 15-19, i =2: age group 20-24 and so on.

Step 2: Calculation of the proportion of dead children for each age group of mothers. The proportion of children dead, D(i), is defined as the ratio of reported children dead to reported children ever born, that is,

$$D(i) = CD(i)/CEB(i)$$

Where CD(i) is the number of children dead reported to women in age group i.

Step 3: Calculation of multipliers. Table **(2)** in appendix 1 presents the necessary coefficients to estimate the multipliers, K(i), according to Trussell variant of the original Brass method. The West Family was used because it is recommended where sufficient information for informed choice is not available. A different set of coefficients is provided for each of the four different families of the Coale-Demeny model life tables.

$$K(i) = a(i) + b(i)(P1/P2) + c(i)(P2/P3)$$

Where a, b, and c are coefficients generated by Trussell

Step 4: Calculation of probabilities of dying and of surviving. Estimates of the probabilities of dying, q(x), are obtained for different values of exact age x as the product of the reported proportion dead, D(i), and the corresponding multipliers, K(i). Note that the value of x is not generally equal to that of 1, because x is related to the average age of the children of women in age group i.

The complement of q(x), p(x), the probability of surviving from birth to exact age x can be obtained as $p(x) = 1.0 - q(x)$.

Step 5: Calculation of Reference Period. When mortality is changing smoothly, the reference period, t(x), is an estimate of years before the survey date to which the child mortality estimate, q(x), obtained refers. The value of t(x) is estimated by the equation: The coefficients were estimated by Trussel (UN, 1983) from simulated cases by using linear regression: $t(x) = a(i) + b(i)(P1/P2) + c(i)(P2/P3)$.

Where CEB(i) is the children ever born by women in age group i and TNW(i) is the total number of women in age group i. Variable i refers to the different five- year age groups considered. Thus, the value i=1 represents age group 15-19, i =2: age group 20-24 and so on.

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3.12 Smoothing of the estimated values of childhood mortality

The observed data and preliminary estimates often suffer from irregularities present in them. Usually, 'smoothing' is done in order to remove or to minimize these irregularities. A method of smoothing involves the use of standard l(x) values (from a 'standard life table') for smoothing the estimated l(x) values and then to extrapolate required values (U.N. Manuel X, 1983). The standard of choice for this study is the Brass African Standard Life Table, because it approximates the mortality conditions in developing countries. The Brass African Standard uses logit relational system, where the logit values for exact ages can be read off the table.

The smoothing of the estimated survivorship values is done by the use of the logit relational system against a model life table. The logit model can be written as: $\lambda(x) = \alpha + \beta\lambda s(x)$

However, it is reduced to a one parameter model by assuming that $\beta = 1$.

Where $\lambda(x)$ i.e. $\lambda_{(2)}, \lambda_{(3)}, \lambda_{(5)}$ = the graduated or smoothed estimates of logits l_2, l_3 and l_5

α Alpha = level of mortality

λs =Values from the Brass African Model life table

Thus the smoothing equation is: $\lambda(x) = \alpha + \lambda s(x)$

Where α above is replaced with it's solved value.

Estimating alpha

$\alpha = \lambda(x) - \lambda s(x)$

In estimating alpha, the mean values of λ may be used Like in this instance,

λ is the average of $\lambda(2), \lambda(3)$ and $\lambda(5)$ i.e. the logit of l_2, l_3 and l_5

And λs = the average of $\lambda s(2)$, $\lambda s(3)$, $\lambda s(5)$. The estimation is shown in the table below.

Values for Smoothing Female Child Mortality Data

Exact age (x)	l(x)	λ(x)	λs(x)
2	0.9742	-1.8117	-0.8052
3	0.9517	-1.4937	-0.7252
5	0.9126	-1.1754	-0.6515
	Total	-4.4808	-2.1819
	Mean	-1.4936	-0.7273

α= -1.4936 + 0.7273 = -0.7663

Values for Smoothing Male Child Mortality Data

Exact age (x)	l(x)	λ(x)	λ_5(x)
2	0.9397	-1.3758	-0.8052
3	0.9223	-1.2349	-0.7252
5	0.9104	-1.1568	-0.6515
	Total	-3.7675	-2.1819
	Mean	-1.2558	-0.7273

α= -1.2558 + 0.7273= -0.5285

Values for Smoothing overall child Mortality Data

Exact age (x)	l(x)	λ(x)	$λ_5$(x)
2	0.9547	-1.5225	-0.8052
3	0.9358	-1.3414	-0.7252
5	0.9116	-1.1692	-0.6515
	Total	-4.0331	-2.1819
	Mean	-1.3444	-0.7273

$\alpha = -1.3444 + 0.7273 = -0.6171$

The data for mothers at selected age groups provide the following information:

Index I	Age of Mother	Derived values
1	15-19	1q0 probability of dying between birth and age 1
2	20-24	2q0 probability of dying between birth and age 2
3	25-29	3q0 probability of dying between birth and age 3
4	30-34	5q0 probability of dying between birth and age 5
5	35-39	10q0 probability of dying between birth and age 10
6	40-44	15q0 probability of dying between birth and age 15
7	45-49	20q0 probability of dying between birth and age 20

3.13 Limitations of the Method

(1) The estimates of infant mortality based on information provided by women ages 15 to 19 years should be interpreted with caution. Usually children born to these young women have higher mortality than those born to older women. This appears to be true not only for biological reasons, but mainly because the socioeconomic characteristics of the young mothers may be related to higher infant mortality. The estimates for the 15 -19 year age group may also be more severely affected by sampling variation (since the youngest women have fewer births) and more sensitive to derivations of the actual pattern of fertility from the pattern implied by the model.

(2) If the pattern of fertility implied by the data has not been constant (due either to a change in the level of fertility or to a change in the pattern), the results may be affected.

(3) Poor quality of the data will produce results of uncertain reliability.

(a) If the estimates of child mortality fluctuate erratically, this is more likely to be due to data problems than to actual mortality changes.

(b) If the estimates imply that mortality was lower in the past than the present, then the data to which the technique was applied should be carefully evaluated for possible errors. In particular, older women may be more likely than younger women to underreport the number of children who died, especially those who died when the women were very young.

(c) Age misreporting of mothers can affect the results, since the children's length of exposure to the risk of dying is inferred from their mothers' ages.

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3.14 DERIVATION OF A LIFE TABLE FROM THE SET OF SURVIVORSHIP PROBABILITIES

Linkage of Child survivorship Probabilities with Conditional Adult Survivorship Probabilities

Child survivorship probabilities can be linked with conditional adult survivorship probabilities using a logit life table system. In the two parameter logit life table system, Any pair of survivorship probabilities, one from birth and another condition on attaining a certain age, uniquely determine values of the parameters and defining a life table in the system. However, because one of the probabilities is conditional, the values of these parameters have to be estimated iteratively, as there is no way of solving for them algebraically. The procedure provides a way of finding satisfactory values of α and β when a number of conditional survivorship probabilities, all referring to the same population, are available, without having to find parameter values for each one.

Data Required

The following data are required for this method

(a) Conditional probabilities of adult survivorship usually in the form of l(x)/l(y) ratio estimated by using the orphanhood or widowhood methods,

(b) An estimate of child survivorship. Survivorship probabilities l(z) for childhood ages can be estimated by using any of the indirect methods.

(c) A standard life table, which may be selected from the coale-Demeny methods, the United Nations models for developing countries, the general standard or any reliable life table thought to approximate the pattern of mortality in the population being studied.

Procedure

Step 1: Initial estimate of parameter α. Given an estimate of l(z) for children, such as $l_{(2)}$ or the average of a group of estimates, the initial estimate of parameter α is obtained as $\alpha_1 = \lambda(z) - \lambda s(z)$

Under the assumption that $\beta_1 = 1.0$, where $\lambda(z)$ is the logit transformation of l(z)

Step 2: Initial estimate of survivorship probability appearing as denominator. Given the value of α_1 estimated in step 1 and still to assume that $\beta_1 = 1.0$, a first estimate of this survivorship probability, l(y), denoted by $l_1(y)$, is obtained from

$$l_1(y) = (1.0+\exp(2\alpha_1 + 2\lambda s(y))\_1$$

Step3: Initial estimate of survivorship probabilities from birth. The initial approximation of l(y), $l_1(y)$, is now used to calculate the initial estimate of the survivorship probabilities from birth, l(x), for each value of x from the observed ratios l(x)/l(y):

$$l_1(x) = l(x)\ l_1(y)/\ l(y) \quad (1)$$

Step 4: Modified estimate of parameter β. If the logit transformation of $l_1(x)$ is denoted by $\lambda_1(x)$, each pair of points $(\lambda s(z), \lambda(z))$ and $(\lambda s(x), \lambda_1(x))$ and determines parameters α and β with respect to the standard being used. The main interest at present is in parameter β, which can be found as

$$\beta_{2(x)} = (\lambda(x)- \lambda(z) /((\lambda s(x)- \lambda s(z)) \quad (2)$$

A single estimate of β_2 can then be obtained by averaging the $\beta_{2(x)}$ values. It is often the case that the values of $\beta_{2(x)}$ vary sharply with x, it may be decided that a best estimate of β_2 can be obtained by averaging the $\beta_{2(x)}$ values after excluding obvious outliers, such as the highest and lowest values.

Step 5: Second estimate of parameter α. A second estimate of α, denoted by α_2, is obtained by repeating step 1, but now using the estimate of β_2 obtained in step 4 instead of the first assumed value of $\beta_1 = 1.0$. Thus, $\alpha_2 = \lambda(z) - \beta_2\lambda s(z)$. (3)

Step 6: Second estimate of survivorship probability used as denominator. The new value of α, denoted by α_2, second approximation of β_2, are now used to obtain a revised value of l(y), as follows:

$$l_2(y) = (1.0 +\exp (2\alpha_2 + 2\beta_2\lambda s(y))\_1 \quad (4)$$

Step 7: Further iteration. The iteration procedure continues, by repeating step 3 to obtain a second estimate of l(x), then repeating step 4 to find a revised estimate of β_2, then re-estimating α in step 5 and l(y) in step 6 with the new α and β values, and so on, until the first two or three decimal places of the estimate of β no longer change with repeated iteration. This unchanging value of β, denoted by β*, and the value of α* it implies (calculated by using equation (3)) are then accepted as best estimates of the parameters defining a life table consistent with the available survivorship probabilities in the logit system being used.

CHAPTER FOUR

RESULTS

The total household population enumerated was 5521 consisting of 2641 males and 2880 females. Table 4.1 shows the population structure by age and sex. Dissimilarities can be observed in the age distribution between the male and female sexes and across the male and female age groups. For the males there is an almost gradual decrease in population from the lowest age group of 0-4 to the oldest age group of 80-84 with the exception of the 30-34, 35-39 age groups which slightly exceed the preceding age group. For females also the population decreases with increasing age with the exception of 15-19, 20-24, 25-29 age groups which exceed the preceding ones.

An observation of the male versus the female age distribution from the Table in 4.1 shows more females at birth than their male counterpart while the males exceed females in the 5-9 years age group. A drastic drop in the number of males as compared to that of females can be noticed in the youthful age groups of 10 to 39.

Table 4.1: HOUSEHOLD POPULATION OF THE STUDY AREA BY AGE AND SEX AS PERCENT OF THE TOTAL POPULATION

	Male		Female		
Age group	**Frequency**	**Percent of total population**	**Frequency**	**Percent of total population**	**SEX RATIO**
0-4	397	7.19	400	7.25	99.3
5-9	368	6.67	348	6.30	105.7
10-14	268	4.85	284	5.14	94.4
15-19	203	3.68	333	6.03	61.0
20-24	192	3.48	341	6.18	56.3
25-29	179	3.24	342	6.19	52.3
30-34	207	3.75	260	4.71	79.6
35-39	215	3.89	224	4.06	96.0
40-44	193	3.50	154	2.79	**
45-49	162	2.93	143	2.59	**
50-54	127	2.30	22	0.40	**
55-59	52	0.94	11	0.20	**
60-64	35	0.63	6	0.11	**
65-69	17	0.31	4	0.07	**
70-74	19	0.34	1	0.02	**
75-79	3	0.054	7	0.13	**
80-84	4	0.072	0	0.00	**
85+	---	---	---	----	---
Total	2641	47.8	2880	52.2	91.7

The unavailability of significant number of household members above age 40 years shows that Mowe-Ibafo is a young population. It is a fast developing settlement, been inhabited more by the younger population. This has made the estimate of sex ratio above age 40 years unreliable.

Age distributions are also prone to certain errors; such errors include digital preference and age misstatements. In order to reveal the predilection for certain digits when reporting age data, digital preference in the study area was further examined. Table 4.2 shows the last digits of age and the numbers and percent reported for each digits of age based on the total household population of the study area. There seem to be a preference for reporting ages with digits 0, 2 and 5.

Table 4.2 PREFERENCES FOR DIGITS OF AGE FOR BOTH SEXES IN THE STUDY AREA

Digits of Age	Numbers	Percents
0	984	17.8
1	355	6.4
2	683	12.4
3	504	9.1
4	384	7.0
5	872	15.8
6	412	7.5
7	432	7.8
8	488	8.8
9	407	7.4
Total	5521	100.0

4.1 Socio-demographic characteristics of respondents

A total of 1250 respondents were included in the study. Table 4.3 shows the age distribution among the respondents. The largest proportion of respondents fell within the 25years to 29years age group (19.4%) while the smallest proportion of the respondents falls into the 45 to 49 years age group (8.8%). The mean and standard deviation of the age distribution are 30.5years and 9.05 respectively.

TABLE 4.3 AGE GROUPS OF THE RESPONDENTS

Age groups	Frequency	Percent (%)
15-19	154	12.3
20-24	197	15.8
25-29	243	19.4
30-34	225	18.0
35-39	200	16.0
40-44	121	9.7
45-49	110	8.8
Total	1250	100.0

Table 4.4 shows the socio-demographic characteristics of respondents. There is variation in the educational levels of the women in the study area; majority (46.8%) having secondary education, while 24.7% have a primary education, 17.3% of the respondents completing higher education and 11.2% with no formal education.

TABLE 4.4 SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Educational level	Frequency	Percent (%)
No formal education	140	11.2
Primary	309	24.7
Secondary	585	46.8
Higher	216	17.3
Total	1250	100.0
Occupation		
Civil Servant	19	1.5
Artisan	348	27.8
Trader	669	53.5
Others(Specify)	214	17.1
Total	1250	100.0
Ethnicity		
Yoruba	1085	86.8
Igbo	78	6.2
Hausa	7	0.6
Others	80	6.4
Total	1250	100.0
Marital status		
Never Married	230	18.4
Married	993	79.4
Divorced	1	0.1
Separated	2	0.2
Widowed	23	1.8
Living together	1	0.1
Total	1250	100.0
Religion		
Christian	779	62.3
Islam	462	37.0
Traditional	2	0.2
Others	7	0.6
Total	1250	100.0

The table also reveals that most of the respondents are traders (53.5%) while 27.8% are artisans, with only 1.5% been civil servants while other occupation account for 17.1% of the respondents. Majority of the respondents are from the Yoruba speaking tribe (86.8%), Hausa (0.6%), Igbo (6.2%) while other tribes (6.4%).

The table also shows the distribution of the marital status of the respondents, with majority of them belonging to the married group (79.4%), while 18.4% of the respondents have never been married, 0.1% are divorced and 1.8% of them are widowed. As regard the religious composition, 62.3% are Christians, 37.0% are Muslims and 0.2% reported to be traditional worshipers.

TABLE 4.5 MAIN SOURCE OF WATER FOR DOMESTIC USE

Source of water	Frequency	Percent (%)
Tap water	70	5.6
Borehole	800	64.0
Well	362	29.0
Stream/Spring/Lake water	18	1.4
Total	1250	100.0

The main source of water for domestic use among the respondents according to the information provided by the table below shows that 64.0% of respondents in the study area rely on water from borehole while 29.0% use well water, 5.6% utilize tap water and only 1.4% claim to use water from streams.

TABLE 4.6 RESPONDENTS' FORM OF SEWAGE DISPOSAL

Type of Toilet facility	Frequency	Percent (%)
Bush system	59	4.7
Pit Latrine	296	23.7
Water closet (flush system)	895	71.6
Total	1250	100.0

The type of sewage disposal system reported by the respondent shows 71.6% use the Water Closet, 23.7% rely on the Pit latrine while 4.7% dispose their sewage in the Bush.

4.2 CHILDREN EVER BORN

Table 4.7 shows the children ever born and children dead by sex and age of mother. The Male children ever born were simply obtained by the sum of sons living at home, sons living elsewhere and sons that are dead. Likewise the same method applied for the female children ever born.

Table 4.7: Children Ever Born and Children Surviving, by Sex and Age of Mother

Age group	Total Number of women	Male Children Ever Born	Male Children Dead	Female Children Ever born	Female Children Dead	Both Sexes Ever born	Both Sexes Dead
15-19	154	20	2	23	1	43	3
20-24	197	98	6	72	2	170	8
25-29	243	243	19	215	10	458	29
30-34	225	296	26	287	23	583	49
35-39	200	360	52	327	27	687	79
40-44	121	241	29	226	20	467	49
45-49	110	235	41	212	25	447	66
Total	1250	1493	175	1362	108	2855	283

4.3 CHILD MORTALITY

Table 2 (of appendix 1) shows the Trussell's Multipliers for Child mortality estimation for males, females and both sexes. The process involved has been explained in the methodology section, but essentially it involves the use of the Trussel's estimation equation:

$$K=a_1 + b_1(P_1/P_2) + c_1(P_2/P_3)$$

Where a, b, and c are coefficients generated by Trussell and the values for the West model were been used. While the P_1 represent the mean parity of males, females, and both sexes for age group 15-19 years of respondents. P_2 for age group 20-24 years and P_3 for age group 25-29 years.

Table 4.8 shows the estimated levels of female child mortality at different ages 1, 2, 3, 5, 10, 15 and 20. The information for proportion of female children dead, categorized for women of different age groups were used to indirectly estimate female child mortality at different childhood ages. This was estimated based on the equation: q = D*K, explained in the methodology. The q(x) values at different childhood ages increase gradually. While the probabilities of survival also decrease gradually across the age groups. The estimated q(x) values in the study were erratic and thus graduated to smooth out the irregularities as explained in the methodology.

Table 4.8 Estimation of **female** childhood mortality

Age group of women	Index I	Mean female children ever born per woman Pi	Proportion of female children dead Di	Multiplying factor Ki	Estimated Mortality q(r)	Estimated survivorship l(r)	R
15-19	1	0.1494	0.0435	0.3508	0.0153	0.9847	1
20-24	2	0.3655	0.0278	0.9272	0.0258	0.9742	2
25-29	3	0.8848	0.0465	1.0385	0.0483	0.9517	3
30-34	4	1.2756	0.0801	1.0913	0.0874	0.9126	5
35-39	5	1.6350	0.0826	1.1286	0.0932	0.9068	10
40-44	6	1.8678	0.0885	1.1227	0.0994	0.9006	15
45-49	7	1.9273	0.1179	1.1112	0.1310	0.8690	20

The same method applied in the estimation of the female childhood mortality was also applicable to the male childhood mortality. The erratic estimates of q(x) were also graduated to smooth out irregularities.

Table 4.9 Estimation of **male** childhood mortality

Age group of women	Index I	Mean male children ever born per woman Pi	Proportion of male children dead Di	Multiplying factor Ki	Estimated Mortality q(r)	Estimated survivorship l(r)	R
15-19	1	0.1299	0.1000	0.8166	0.0817	0.9183	1
20-24	2	0.4975	0.0612	0.9846	0.0603	0.9397	2
25-29	3	1.0000	0.0782	0.9936	0.0777	0.9223	3
30-34	4	1.3156	0.0878	1.0204	0.0896	0.9104	5
35-39	5	1.8000	0.1444	1.0452	0.1509	0.8491	10
40-44	6	1.9917	0.1203	1.0352	0.1245	0.8755	15
45-49	7	2.1364	0.1745	1.0263	0.1791	0.8209	20

Table 4.10 shows the estimated levels of child mortality at different ages 1, 2, 3, 5, 10, 15 and 20. The information for proportion children dead, categorized for women of different age groups were used to indirectly estimate child mortality at different childhood ages. The q(x) values at different childhood ages increase gradually except for the 40-44 age groups. While the probabilities of survival also decrease gradually across the age groups except 40-44 age groups.

The corresponding smoothed probabilities of dying, q*(x) are presented here. The smoothed q*(x) values shows a continuing increase from q*(1) to q*(20) as can be seen in the table below.

Table 4.12 Adjusted **male** Child Probabilities of Dying and Surviving Classified by Age of Mother

Age group of women	Age group index	Exact age (x)	Adjusted q*(x)	Adjusted l*(x)
(1)	(2)	(3)	(4)	(5)
15-19	1	1	0.045	0.955
20-24	2	2	0.065	0.935
25-29	3	3	0.075	0.925
30-34	4	5	0.086	0.914
35-39	5	10	0.104	0.896
40-44	6	15	0.111	0.889
45-49	7	20	0.123	0.877

Assuming that $\beta = 1$, the value of α, for the overall child estimated as -0.6171, was obtained by averaging the logits of l_2, l_3 and l_5 as explained in the methodology section. The smoothing equation was obtained as:

$\lambda(x) = -0.6171 + \lambda s(x)$

The corresponding smoothed probabilities of dying, q*(x) are presented here. The smoothed q*(x) values shows a continuing increase from q*(1) to q*(20), as can be seen in table 4.13.

Table 4.13 Adjusted **Overall** Childhood Probabilities of Dying and Surviving Classified by Age of Mother

Age group of women	Age group index	Exact age (x)	Adjusted q*(x)	Adjusted l*(x)
(1)	(2)	(3)	(4)	(5)
15-19	1	1	0.038	0.962
20-24	2	2	0.055	0.945
25-29	3	3	0.064	0.936
30-34	4	5	0.073	0.927
35-39	5	10	0.088	0.912
40-44	6	15	0.094	0.906
45-49	7	20	0.105	0.895

The corresponding smoothed probabilities of dying, q*(x) are presented here. The smoothed q*(x) values shows a continuing increase from q*(1) to q*(20) as can be seen in the table below.

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$$\lambda(x) = -0.6171 + \lambda s(x)$$

The corresponding smoothed probabilities of dying, q*(x) are presented here. The smoothed q*(x) values shows a continuing increase from q*(1) to q*(20), as can be seen in table 4.13.

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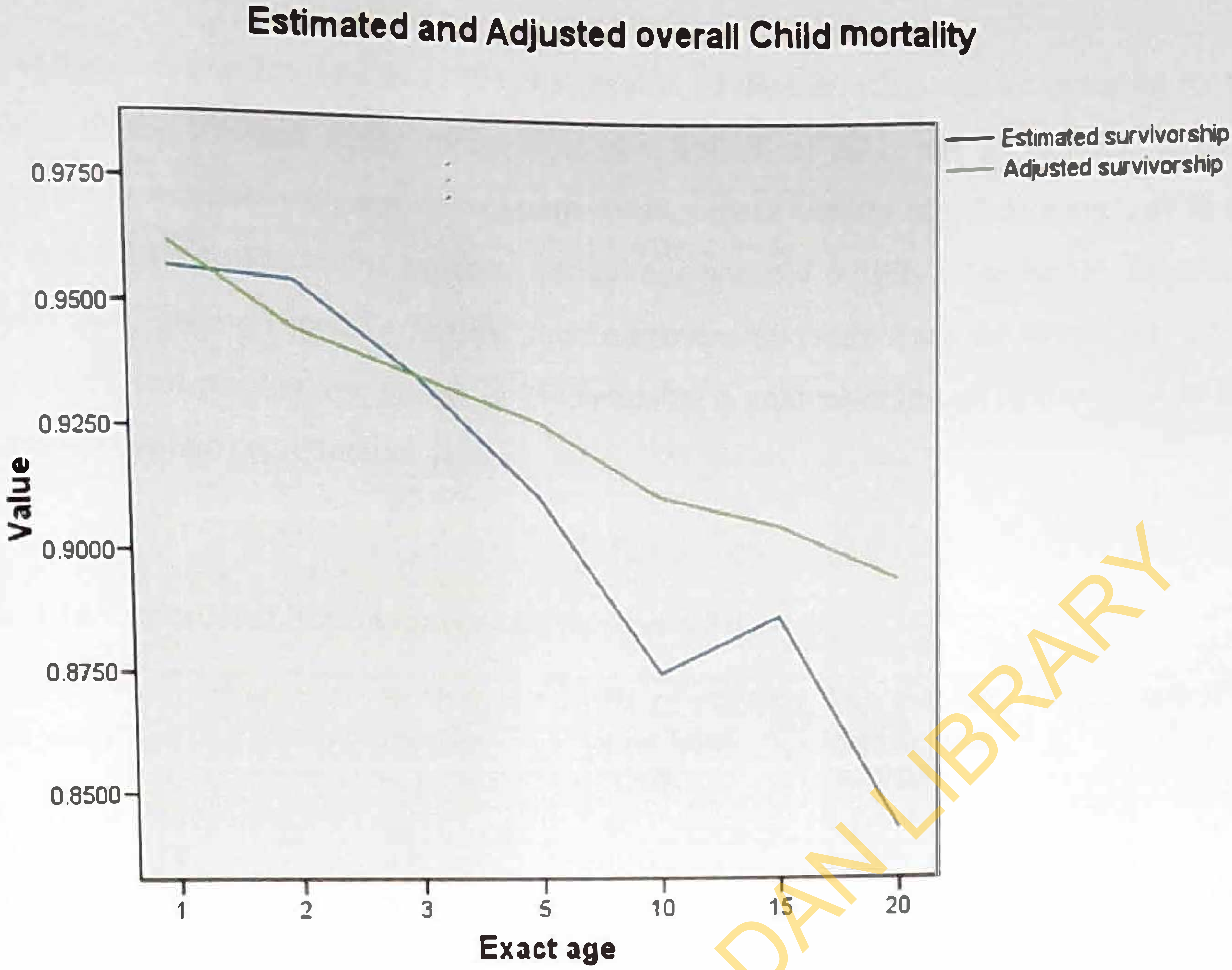

Figure 1: **Estimated and Adjusted overall child mortality**

The reference period for the estimated probabilities of dying and surviving, obtained using coefficients (a_1, b_1 and c_1) based on the West model is shown in table 3 (of appendix 1). Under conditions of changing mortality, each proportion dead identifies a probability of death, from some point in the past, where the point in the past lies between the time of the survey and the longest exposure time of the children, so the reference period of an estimate can be approximated by the average time ago of the deaths of the children reported on.

Table 4.14 gives detail information about the current fertility (birth in the past 12 months) and retrospective fertility (total number of children ever born) across the different age group of respondents. The 15 to 19 age group has the smallest mean number of children ever born (average parity), while the oldest women, the 45 to 49 age group have the highest mean number of children ever born, an average of 4.0 children per each woman in the age group. Table 4.14 shows that the mean number of children ever born rises gently with increasing age of the women. According to UN (1983) the quality of data on CEB can be assessed by the behaviour of the average parity reported by the women of each age group. The average parities should increase with age up to group 45-49, unless fertility has risen sometime in the past. Table 4.14 also shows the reported current age specific fertility rates for the women in the study area. The age specific fertility rates increases gradually from the lowest age group (15-19 years) and peak at age group 25-29, thereafter a gradual drop can be observed in this rate towards the late reproductive ages.

Table 4.14 Current and Retrospective data on reproduction

Age of women(years)	No of women	Birth in last 12 months	No of children ever born (CEB)	Age specific fertility rate (ASFR)	Parity data (Pi)
15-19	154	22	43	0.1429	0.2792
20-24	197	41	170	0.2081	0.8629
25-29	243	64	458	0.2634	1.8848
30-34	225	52	583	0.2311	2.5911
35-39	200	30	687	0.1500	3.4350
40-44	121	5	467	0.0413	3.8595
45-49	110	0	447	0.0000	4.0636
Total	1250	214	2855	1.0368	

4.4 ADULT MORTALITY

Table 4 (of appendix 1) gives details of the information required in estimating the mean age of the mother at the birth of their children. This age is required in conjunction with the central age (N) in locating the weighting factor (Wn) required to convert proportion surviving to probability estimates. The mean age of the mother at birth of their children as obtained from the table is 28.5 years.

Table 5 (of appendix 1) shows the proportion of daughters with mothers alive across the different age groups. This was obtained by dividing respondents with mother alive in each age group with the sum of respondents with mother alive and dead in that age group. It can be observed that the proportion of respondent with mother alive tend to decline with increasing age.

Table 6 (of appendix 1) shows that the same pattern of decline observed with that of daughters with mother alive across the age of respondents can be found also with the proportion of daughters with father alive. The proportion of daughters with father alive tends to be less in any particular age group as compared to proportion of daughters with mother alive.

The estimating equation for the female adult survivorship probability is shown in the equation below table 4.15 while the weighting factor for the conversion to survivorship probability is obtained by interpolating between the central age and Mean age M, for mothers at maternity. The survivorship estimates tend to decrease with increasing age except for the survivorship estimate with central age 35.

Table 4.15 Estimation of **Female** Adult Survivorship from Proportion of Daughters with Surviving Mothers

Central age(n)	Weighing factor W(n)	Proportion with mother surviving S(n-5)	Complement of weighing factor (1-W(n))	Proportion with mother surviving S(n)	Female adult survivorship probability l*f*(25+n)/l*f*(25)
(1)	(2)	(3)	(4)	(5)	(6)
20	0.9625	0.942	0.0375	0.888	0.9400
25	1.0670	0.888	-0.0670	0.802	0.8938
30	1.1420	0.802	-0.1420	0.804	0.8017
35	1.1990	0.804	-0.1990	0.720	0.8207
40	1.1925	0.720	-0.1925	0.529	0.7568
45	1.1565	0.529	-0.1565	0.464	0.5392

Estimating equation:

$L(25+N)/L25 = Wn({}_5Sn_{-5}) + (1-Wn){}_5Sn$

The graduation (smoothing) process for Table 4.16 was done using the Brass' 2 parameter logit life table method.

Table 4.16 Graduation of **Female** Adult Survivorship Probabilities from Proportion of Daughters with Surviving Mothers

Central age (N)	Estimated Female adult survivorship probability l*f*(25+n)/l*f*(25)	Graduated Female adult survivorship probability l*f*(25+n)/l*f*(25)
20	0.9400	0.9290
25	0.8938	0.9000
30	0.8017	0.8600
35	0.8207	0.8044
40	0.7568	0.7216
45	0.5392	0.6045

to be less in any particular age group as compared to proportion of daughters with mother alive.

The estimating equation for the female adult survivorship probability is shown in the equation below table 4.15 while the weighting factor for the conversion to survivorship probability is obtained by interpolating between the central age and Mean age M, for mothers at maternity. The survivorship estimates tend to decrease with increasing age except for the survivorship estimate with central age 35.

Table 4.15 Estimation of **Female** Adult Survivorship from Proportion of Daughters with Surviving Mothers

Central age(n)	Weighing factor W(n)	Proportion with mother surviving S(n-5)	Complement of weighing factor (1-W(n))	Proportion with mother surviving S(n)	Female adult survivorship probability lf(25+n)/lf(25)
(1)	(2)	(3)	(4)	(5)	(6)
20	0.9625	0.942	0.0375	0.888	0.9400
25	1.0670	0.888	-0.0670	0.802	0.8938
30	1.1420	0.802	-0.1420	0.804	0.8017
35	1.1990	0.804	-0.1990	0.720	0.8207
40	1.1925	0.720	-0.1925	0.529	0.7568
45	1.1565	0.529	-0.1565	0.464	0.5392

Estimating equation:

$L(25+N)/L25 = Wn({}_5Sn_{-5}) + (1\text{-}Wn){}_5Sn$

The graduation (smoothing) process for Table 4.16 was done using the Brass' 2 parameter logit life table method.

Table 4.16 Graduation of **Female** Adult Survivorship Probabilities from Proportion of Daughters with Surviving Mothers

Central age (N)	Estimated Female adult survivorship probability lf(25+n)/lf(25)	Graduated Female adult survivorship probability lf(25+n)/lf(25)
20	0.9400	0.9290
25	0.8938	0.9000
30	0.8017	0.8600
35	0.8207	0.8044
40	0.7568	0.7216
45	0.5392	0.6045

The determination of M (mean age of the father at the birth of their children) raises some difficulties. M is best found by adding to the M for women the mean difference between ages of husband and wife at marriage. Slight modification as also be made to the survivorship probability equation to allow for the fact that the father of a child is known to be alive at its conception but not necessarily at its birth. Thus the mean age M of the father at the birth of their children was estimated to be 35.5 years.

Table 4.17 Estimation of **Male** Adult Survivorship from Proportion of Daughters with Surviving Fathers

Central age(n)	Weighing factor W(n)	Proportion with father surviving S(n-5)	Complement of weighing factor (1-W(n))	Proportion with father surviving S(n)	Male adult survivorship probability $l_m(25+n+2.5)/l_m(25)$
(1)	(2)	(3)	(4)	(5)	(6)
20	0.9150	0.903	0.085	0.736	0.8888
25	0.9420	0.736	0.058	0.634	0.7301
30	0.8550	0.634	0.145	0.600	0.6291
35	0.6960	0.600	0.304	0.515	0.5742
40	0.3920	0.515	0.608	0.298	0.3831
45	0.0585	0.298	0.942	0.255	0.2576

Mean age of the father at the birth of their children M =35.5 years

Estimating equation:

$lm(25+N+2.5)/lm25 = Wn({}_5Sn-_5) + (1-Wn)_5Sn$

The graduation (smoothing) process for Table 4.18 was done using the Brass' 2 parameter logit life table method.

Table 4.18 Graduation of **Male** Adult Survivorship Probabilities from Proportion of Daughters with Surviving Fathers

Central age (N)	Estimated Male adult survivorship probability $l_m(25+n+2.5)/l_m(25)$	Graduated Male adult survivorship probability $l_m(25+n+2.5)/l_m(25)$
20	0.8888	0.9101
25	0.7301	0.8755
30	0.6291	0.8293
35	0.5742	0.7677
40	0.3831	0.6800
45	0.2576	0.5962

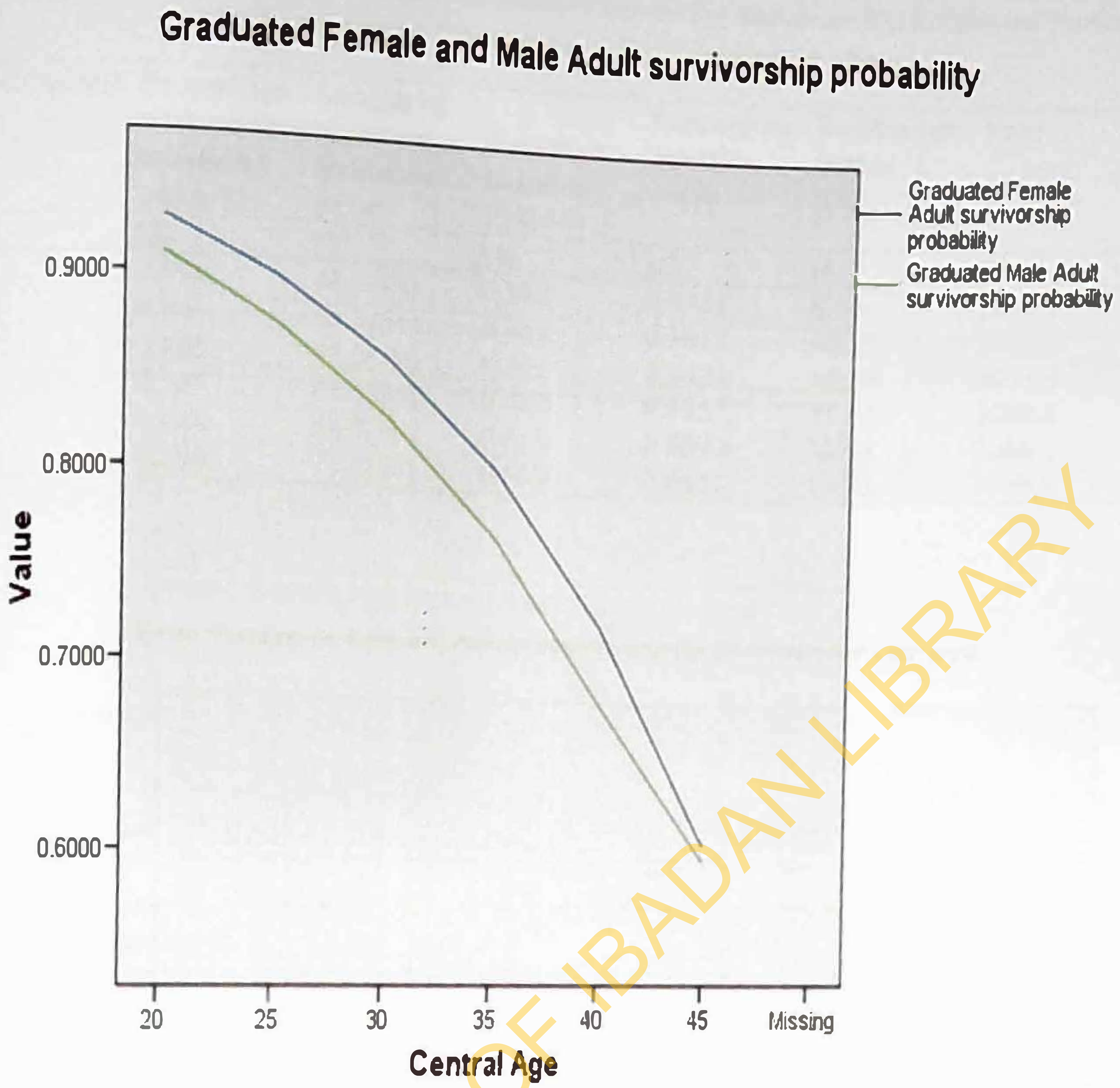

Figure 2: **Graduated Female and Male Adult Survivorship probability**

Table 4.19 and 4.20 shows the reference period to which the conditional adult survivorship estimates represent. The reference period is the number of years prior to the survey to which the estimates refer to. The proportion of respondent with surviving parents used in the computational procedure refers to 10 years age group. The length of exposure is the sum of the central age (N) and the mean age of the parents at the birth of their children. The detailed computation procedure can be seen in the methodology section.

Table 4.19: Estimation of Time Reference Periods for Survivorship Estimates Derived From Proportion of Daughters with Surviving Mothers

Central age (n)	Proportion with mother surviving $_{10}S(n-5)$	Length of exposure indicator M+n	Standard function Z(M+n)	Correction function u(n)	References period t(n)	Year
(1)	(2)	(3)	(4)	(5)	(6)	(7)
20	0.912	48.5(49)	0.182	0.1458	8.54	2004.2
25	0.841	53.5(54)	0.245	0.1817	10.23	2002.5
30	0.803	58.5(59)	0.321	0.2424	11.36	2001.4
35	0.765	63.5(64)	0.411	0.3162	11.97	2000.0
40	0.648	68.5(69)	0.518	0.3679	12.64	2000.1
45	0.498	73.5(74)	0.650	0.4121	13.23	1999.5

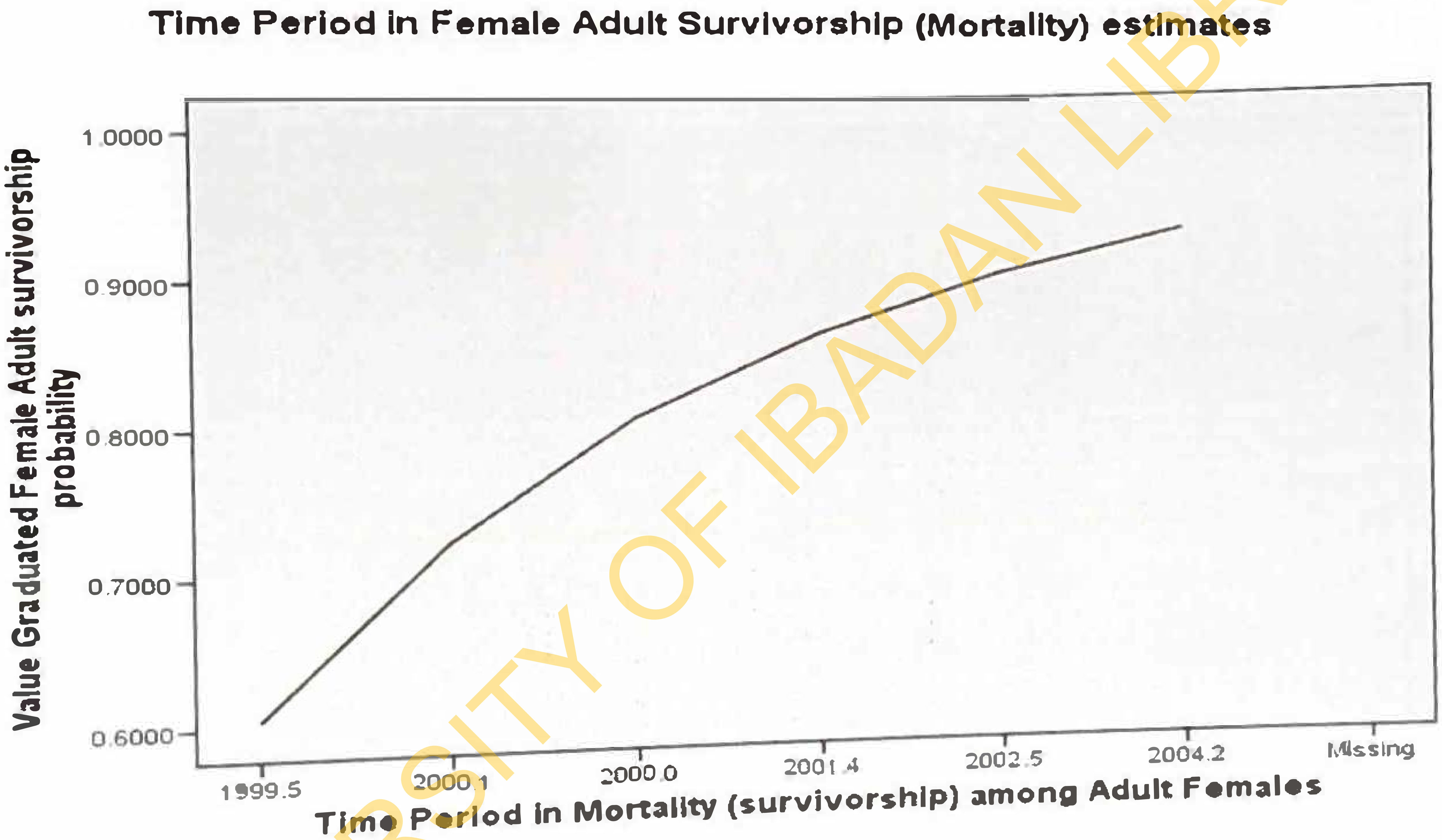

Figure 3: Time period in Female Adult Survivorship (Mortality) estimates

Table 4.20: Estimation of Time Reference Periods for Survivorship Estimates Derived From Proportion of Daughters with Surviving Fathers

Central age (n)	Proportion with father surviving $_{10}S(n-5)$	Length of exposure indicator M+n	Standard function Z(M+n)	Correction function u(n)	References period t(n)	Year
(1)	(2)	(3)	(4)	(5)	(6)	(7)
20	0.809	55.5(56)	0.274	0.1747	8.56	2004.2
25	0.680	60.5(61)	0.356	0.1988	10.32	2002.4
30	0.618	65.5(66)	0.452	0.2629	11.33	2001.4
35	0.560	70.5(71)	0.568	0.3461	11.69	2001.1
40	0.433	75.5(76)	0.686	0.3783	12.67	2000.1
45	0.277	80.5(81)	0.806	0.3495	14.88	1997.8

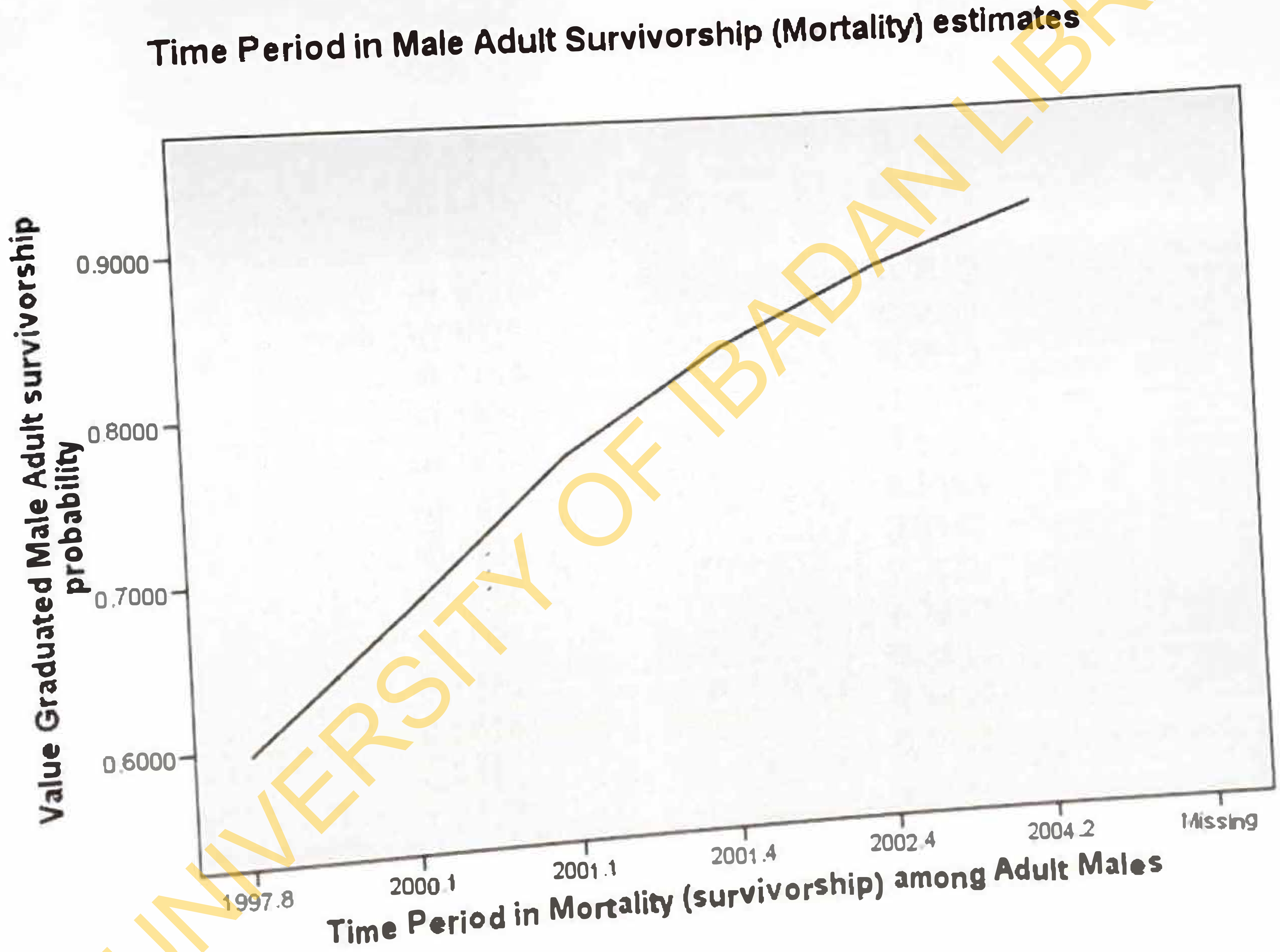

Figure 4: Time period in Male Adult Survivorship (Mortality) estimates

4.5 LIFE TABLE FOR THE STUDY POPULATION

A smoothed Life Table was obtained by combining the data on female child mortality and female adult mortality from proportion of daughters with surviving mother. Iteration process was used to obtain the estimates of α and β parameters. Table 4.21 shows the estimated smoothed life table survivorship probabilities for females in Mowe-Ibafo obtained using the Brass two parameters logit system.

Table 4.21: Estimated Smoothed Life Table for **Females**, Mowe-Ibafo, 2012

Age	African Standard logit system	Estimated probability of surviving to age (x)
X	$\lambda s(x)$	$l^*(x)$
0	----	1.0000
1	-0.9970	0.9724
2	-0.8052	0.9591
3	-0.7252	0.9518
5	-0.6515	0.9440
10	-0.5498	0.9314
15	-0.5131	0.9262
20	-0.4551	0.9172
25	-0.3829	0.9047
30	-0.3150	0.8915
35	-0.2496	0.8772
40	-0.1816	0.8606
45	-0.1073	0.8405
50	-0.0212	0.8142
55	0.0832	0.7780
60	0.2100	0.7277
65	0.3746	0.6528
70	0.5818	0.5469
75	0.8611	0.3992
80	1.2375	0.2291

The reliable estimates of α and β obtained is then fitted into the survivorship equation below to estimate the probability of surviving from birth to different ages.

$\alpha^* = (-0.7161)$, $\beta^* = (1.069)$, $l^*(x) = [1.0+\exp(2\alpha+2\beta\lambda s(x))]^{-1}$

A similar computation procedure is also applied for males. A smoothed Life Table was obtained by combining the data on male child mortality and male adult mortality from proportion of daughters with surviving father. Iteration process was used to obtain the estimates of α and β parameters. Table 4.22 shows the estimated smoothed life table

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10	-0.5498	0.9314
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20	-0.4551	0.9172
25	-0.3829	0.9047
30	-0.3150	0.8915
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45	-0.1073	0.8405
50	-0.0212	0.8142
55	0.0832	0.7780
60	0.2100	0.7277
65	0.3746	0.6528
70	0.5818	0.5469
75	0.8611	0.3992
80	1.2375	0.2291

The reliable estimates of α and β obtained is then fitted into the survivorship equation below to estimate the probability of surviving from birth to different ages.

$\alpha^* = (-0.7161)$, $\beta^* = (1.069)$, $l^*(x) = [1.0+\exp(2\alpha+2\beta\lambda s(x))]^{-1}$

A similar computation procedure is also applied for males. A smoothed Life Table was obtained by combining the data on male child mortality and male adult mortality from proportion of daughters with surviving father. Iteration process was used to obtain the estimates of α and β parameters. Table 4.22 shows the estimated smoothed life table survivorship probabilities for males in Mowe-Ibafo obtained using the Brass two parameters logit system.

Table 4.22: Estimated Smoothed Life Table for **Males**, Mowe-Ibafo, 2012

Age	African Standard Logit system	Estimated probability of surviving to age (x)
X	λs(x)	l*(x)
0	---	1.0000
1	-0.9970	0.9544
2	-0.8052	0.9349
3	-0.7252	0.9247
5	-0.6515	0.9139
10	-0.5498	0.8969
15	-0.5131	0.8901
20	-0.4551	0.8784
25	-0.3829	0.8625
30	-0.3150	0.8459
35	-0.2496	0.8284
40	-0.1816	0.8086
45	-0.1073	0.7850
50	-0.0212	0.7551
55	0.0832	0.7153
60	0.2100	0.6621
65	0.3746	0.5865
70	0.5818	0.5142
75	0.8611	0.3532
80	1.2375	0.2070

$\alpha^* = (-0.5423)$, $\beta^* = (0.981)$, $l^*(x) = [1.0+\exp(2\alpha+2\beta\lambda s(x))]\_1$

The survivorship estimates from birth form the basic parameter used to calculate other life table functions for both males and females in the study area.

Table 4.23: Abridge Life Table (smoothed) for **females** obtained by combining data on female child mortality and female adult mortality

Exact Age (x)	l*(x)	Dx	Qx	Lx	Tx	Ex
0	10000	276	0.0276	9807	629341	62.93
1	9724	284	0.0292	38129	619534	63.71
5	9440	126	0.0133	46885	581405	61.59
10	9314	52	0.0056	46440	534520	57.39
15	9262	90	0.0097	46085	488080	52.70
20	9172	125	0.0136	45548	441995	48.19
25	9047	132	0.0146	44905	396447	43.82
30	8915	143	0.0160	44218	351542	39.43
35	8772	166	0.0189	43445	307324	35.03
40	8606	201	0.0234	42528	263879	30.66
45	8405	263	0.0313	41368	221351	26.34
50	8142	362	0.0445	39805	179983	22.11
55	7780	503	0.0647	37643	140178	18.02
60	7277	749	0.1029	34513	102535	14.09
65	6528	1059	0.1622	29993	68022	10.42
70	5469	1477	0.2701	23653	38029	6.95
75+	3992	3992	1.0000	14376	14376	3.60

Table 4.24: Abridge Life Table (smoothed) for **males** obtained by combining data on male child mortality and male adult mortality

Exact Age (x)	l*(x)	Dx	Qx	Lx	Tx	Ex
0	10000	456	0.0456	9681	592426	59.24
1	9544	405	0.0424	37083	582745	61.06
5	9139	170	0.0186	45270	545662	59.71
10	8969	68	0.0076	44675	500392	55.79
15	8901	117	0.0131	44213	455717	51.20
20	8784	159	0.0181	43523	411504	46.85
25	8625	166	0.0192	42710	367981	42.66
30	8459	175	0.0207	41858	325271	38.45
35	8284	198	0.0239	40925	283413	34.21
40	8086	236	0.0292	39840	242488	29.99
45	7850	299	0.0381	38503	202648	25.82
50	7551	398	0.0527	36760	164145	21.74
55	7153	532	0.0744	34435	127385	17.81
60	6621	756	0.1142	31215	92950	14.04
65	5865	723	0.1233	27518	61735	10.53
70	5142	1610	0.3131	21685	34217	6.65
75+	3532	3532	1.0000	12532	12532	3.55

CHAPTER FIVE

DISCUSSION

The population pyramid of Mowe-Ibafo that showed a broad base becoming narrower at the older ages is typical of populations in Nigeria and other developing countries (PRB, 201 3). The broad base of the pyramid indicates that fertility rate in Mowe-Ibafo is fairly high. Information on current and cumulative fertility is essential to monitor population growth. Measure of current fertility presented in this study includes age specific fertility rates (ASFR).

The age specific fertility rate for this study area follows the normal age pattern of fertility with the least fertility rate in the early age group of 15-1 9years, which increases steadily and peaks at the 25-29 years, before gradually declining with increasing age. The study shows that at the end of a woman's reproductive year, she is likely to have given birth to 4 children, which is closely similar to the 4.8 mean number of children ever born to women age 40-49 years in Southwest, Nigeria (NDHS, 201 3).

The mean age of the mother at the birth of their children, obtained as 28.5 years is relatively high as compared to that of rural areas. According to a study conducted by Lawoyin and Onadeko (1997) in a typical village in Southwest Nigeria, mean age of women who delivered in the 2 year study period was 24 years. The implication is that for higher age of the mother at childbirth, it takes longer time for generation replacement to occur thus affecting the population size in a given space of time (PRB, 201 3).

Age and sex are important demographic variables and are the primary basis of demographic classification. They are also important variables in the study of mortality. The distribution of the household population in the study area by five year age groups according to sex shows that about 52.2 percent of the population are females and 47.8 percent males. Mortality, fertility and sometimes migration differences between sexes at various ages influence the age specific sex ratios.

Fertility creates inequalities at birth resulting in more boys been born than girls but boys tend to have higher mortality rates (NPC, 19 98) The overall sex ratio for the study area is 92 which is less than the reported 201 3 NDHS figure of 97 and 2006 census figure of 99 for Ogun State. While the national figure for 2006 census reports excess males to females for five years age groups from 0-4 to 15-19 years, only the 5-9 years age group in the study area exhibit same pattern, the other early age groups reveal more females than males. This is indicative of the high mortality among males compared to females, as can be observed in the relatively high infant and child mortality for males in the study area. Beginning from 20-24 to 35-39 years age groups, the observed sex ratio for the study area is consistent with an earlier findings in the 2006 census report with more females than males.

Because of the risk-taking behaviour of male folk that exposes them to increased mortality and the high tendency by men in this age categories to migrate, one would have expected few males to females at the older age groups. Across many real world domains, men engage in more risky behaviours than do women. This may be because of women's greater perceived likelihood of negative outcomes and lesser expectation of enjoyment which may partially mediate their lower propensity towards risky choices (Harris et al, 2006).

The preference for digits such as 0, 2 and 5 in this study population may have given rise to age heaping into another age group. Age errors can also be attributed to factors such as wilful misstatements for social, personal, or economic reasons, aversion to certain numbers, ignorance of exact ages, carelessness in reporting and recording age (Ewbank, 1981). Age errors affect the estimate of child mortality because the age stated by respondents (mother) determine the age group they belong, which consequently affect the estimates of proportion of dead child (Di) and multiplier factors (ki) for each age group used to estimate child mortality.

Child mortality for this study area was estimated to enable the construction of an abridged life table system by linking the estimates with conditional adult survivorship. In populations with no discrimination against either sex, biomedical factors are the major determinants of sex differentials in infant and child mortality (Coale, 1991).

The infant mortality rate estimated for this study area is 43 per thousand live births, which is much lower than the 2013 NDHS estimate for southwest region (61 per thousand births). The estimated under –five mortality rate for the study area (88 per thousand births) is closer to the rate estimated in the 2013 NDHS for southwest region (90 per thousand births) which is the geo-political region the study area is located.

The relatively lower infant mortality rate for the study area as compared to the value for the south western region may be due to the fact that there were few women for that age group in the study area and again, possibly under reporting of children dead which is typical in African communities due to cultural or other reasons. NDHS, 2013 report noted that mothers may be reluctant to talk about their dead children either because it brings back sad memories or because their culture discourages mention of the dead. When selective omission of childhood deaths occurs, it is usually most severe for deaths in early infancy (NDHS, 2013).

Data collected on the survivorship of respondents' parents were used to estimate the conditional adult survivorship which was linked with child mortality estimate, enabling the construction of life table through iterative process using the brass logit 2-parameter system from which the life expectancy at different ages was obtained. The estimated adult mortality shows that parents of respondents at younger ages have a better survivorship than do those of respondents at older ages. This is well understood since the exposure to the risk of mortality for parents of older respondents is more than for the younger respondents.

Also mothers tend to have better survivorship than fathers at all the age group of respondents. This may be attributed to the risk-taking behaviours of male counterpart that exposes them to mortality. The expectation of life at birth for residents in this study area was lower for male (59.2 years) as against 62.9 years observed for females. The expectation of life at birth across sexes in the study area is similar with the national figure in terms of females having a higher life expectancy at birth than their male folks.

On average, women in the richer parts of the world live an extra six years compared to men; in poorer countries they live an extra three years. Morbidity studies indicate that men have a poorer prognosis than women for many diseases common to both sexes, possibly due in part to men's greater lack of concern about health, their reluctance to seek healthcare at an early stage and according to some accounts, because male-only illness, such as prostate cancer are often poorly treated (Francome, 2000). Examining the reasons why, overall men have poorer health and lower life expectancy than women, Francome, (2000) notes the influence of biological factors, lifestyle differences and problems with the male role.

The reference period of the female and male adult survivorship estimates obtained as 13.2 years to 8.5 years for females and 14.9 years to 8.6 years for males implies that the mortality estimates obtained refer to ones operating between June 1999 and Feb. 2004 for females and September 1997 and Feb. 2004 for males (the survey took place between August and October, 2012).

The α value for both female and male (-0.7161 and -0.5423 respectively) indicates higher life expectancy in the study area than in the African Standard Life Table, that is, low mortality level. The resulting β value for females and males (1.069 and 0.981 respectively) implies the relationship between adult and child mortality remains nearly the same as in the African Standard life table. The mortality pattern as evident in the value of β obtained is consistent with, though slightly higher than that of 0.91 made by Ayeni (1974). The values are close to the central value of 1 suggested by Brass and others (Brass et al 1968).

The observed relatively low level of childhood and adult mortality accounts for the improvements in life expectancy to an average of 62.9 years for females and 59.2 years for males in the community. The expectation of life at birth obtained in the estimated abridged life table is not within reach of many Sub-Saharan countries. The quality of life can be improved on if there is adequate information on mortality indicators on which basis better planning can be made.

Some shortcoming may have arisen in the course of conducting this study. The study was based on self report by respondents. However, to limit this shortcoming, questions were framed in such a way that correct information was generated.

5.1 CONCLUSION

In the absence of vital registration and detailed birth history data, estimates of mortality calculated by indirect methods are the next best form of providing much needed data for planning and further research in Nigeria. The proximity of the study area to Lagos, the commercial nerve of the country which has a relatively high level of socioeconomic development and medical care may have resulted in improved living standard and better medical care for residents in this study area as reflected in the various mortality estimates.

The estimates of mortality from this research should provide programmers with the needed information as regards allocating resources and indirectly assist in the attainment of the millennium development goals. The developed nations have been able to attain social and economic development because their socio-economic planning is regularly based on a reliable and timely socio-economic and demographic data. Thus there is the need for a reliable and accurate vital registration system if Nigeria's vision of becoming one of the top 20 economies in the world in 2020 would be realized.

5.2 RECOMMENDATION

Policy makers in the country should endeavour to establish compulsory and reliable vital registration system. Demographic data collection should be a continuous exercise to assist in monitoring of trend in mortality overtime and also ascertain the effectiveness of the various intervention efforts from policy makers. The act of gathering reliable demographic data should be encouraged at both the micro and macro levels. There is the need also for a public enlightenment campaign of the importance of giving accurate information by respondents during census and surveys. Or better still the standard of education should be improved on at all levels as education is not only associated with better health and hygiene but also with making individuals have awareness of the importance of births and deaths registration, as well as giving proper information on age thus providing a means of quality database.

Accessibility of people to vital registration centres by increasing the number of such centres should be a top priority for policy makers. India for example has more than 200 thousand local registration centres (Tiwari, 2011). Vital registration should also be made active. The indirect method as it is, seem to provide us with plausible estimate and further work is recommended to strictly look at the methodology again particularly the assumption on the pattern of decline in the mortality. The method of estimation should also be refined to provide current estimates of adult mortality.

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APPENDIX I

TABLE1: Values of the standard function for calculation of the time reference for indirect estimates of adult survivorship

Age (X)	Standard function Z(x)	Age (X)	Standard function Z(x)	Age (X)	Standard function Z(x)	Age (x)	Standard function Z(x)	Age (X)	Standard function Z(x)
26	0.090	36	0.092	46	0.149	56	0.274	66	0.452
27	0.090	37	0.093	47	0.160	57	0.289	67	0.473
28	0.090	38	0.095	48	0.171	58	0.305	68	0.495
29	0.090	39	0.099	49	0.182	59	0.321	69	0.518
30	0.090	40	0.104	50	0.193	60	0.338	70	0.542
31	0.090	41	0.109	51	0.205	61	0.356	71	0.568
32	0.090	42	0.115	52	0.218	62	0.374	72	0.595
33	0.090	43	0.122	53	0.231	63	0.392	73	0.622
34	0.090	44	0.130	54	0.245	64	0.411	74	0.650
35	0.091	45	0.139	55	0.259	65	0.431	75	0.678

Source: United Nations Manual X; Indirect techniques for demographic estimation, 1983.

Table 2 Trussell's Multipliers for Child Mortality Estimation, West Model

Age group	Age group Index	Multipliers K For males	Multipliers K for females	Multipliers K for Both sexes
(1)	(2)	(3)	(4)	(5)
15-19	1	0.8166	0.3508	0.6155
20-24	2	0.9846	0.9272	0.9612
25-29	3	0.9936	1.0385	1.0143
30-34	4	1.0204	1.0913	1.0521
35-39	5	1.0452	1.1286	1.0823
40-44	6	1.0352	1.1227	1.0740
45-49	7	1.0263	1.1112	1.0643

Table 3 Estimates of the Reference Period to which the Estimated Overall Childhood Probabilities of Dying Refer, West Model

Age group	Age group index	Parameter estimate	Number of years prior to the survey	Year
15-19	1	q(1)	2.0	2010
20-24	2	q(2)	3.2	2009
25-29	3	q(3)	4.6	2007
30-34	4	q(5)	6.0	2006
35-39	5	q(10)	7.4	2005
40-44	6	q(15)	9.3	2003
45-49	7	q(20)	12.1	2000

Table 4 Estimation of M, the mean age of mother at the birth of their children

Age of respondent (year)	Middle age (x)	No of women	Birth in the last year (b)	Age specific fertility rate fi	Fx	Bx
15-19	17.5	154	22	0.1429	2.5008	385
20-24	22.5	197	41	0.2081	4.6823	922.5
25-29	27.5	243	64	0.2634	7.2435	1760
30-34	32.5	225	52	0.2311	7.5108	1690
35-39	37.5	200	30	0.1500	5.6250	1125
40-44	42.5	121	5	0.0413	1.7553	212.5
45-49	47.5	110	0	0.00000	0.0000	0
Total		1250	214		29.3177	6095

Mean age of the mother at the birth of their children M= £bx/£b = 6095/214=28.5 years

Table 5 Proportion of Daughters with Mothers Alive

Age group of respondent	Central age (N)	Mother alive	Mother dead	Proportion with mother alive
(1)	(2)	(3)	(4)	(5)
15-19	20	145	9	0.942
20-24	25	175	22	0.888
25-29	30	195	48	0.802
30-34	35	181	44	0.804
35-39	40	144	56	0.720
40-44	45	64	56	0.529
45-49	--	51	59	0.464

Table 6 Proportion of Daughters with Fathers Alive

Age group of respondent	Central age (n)	Father alive	Father dead	Proportion with Father alive
(1)	(2)	(3)	(4)	(5)
15-19	20	139	15	0.903
20-24	25	145	52	0.736
25-29	30	154	89	0.634
30-34	35	135	90	0.600
35-39	40	103	97	0.515
40-44	45	36	84	0.298
45-49	--	28	82	0.255

Table 7 Iteration process to Estimate the α and β parameters Defining a Life Table for Females in the Logit System Generated by the African Standard

Age	Estimated conditional female survivorship probability		First Iteration $\alpha_1 = -0.7663$ $\beta_1 = 1.0000$ $l_1(25) = 0.9087$	
X	l(x)/l(25)	$l_1(x)$	$\lambda_1(x)$	β2(x)
45	0.9400	0.8542	-0.8832	0.731
50	0.8938	0.8122	-0.7315	1.257
55	0.8017	0.7285	-0.4948	1.232
60	0.8207	0.7458	-0.5387	1.019
65	0.7568	0.6877	-0.3954	0.997
70	0.5392	0.4900	-0.020	1.126
				Average =1.060

Age	**Estimated conditional female survivorship probability**		**Second Iteration** **$\alpha 2 = -0.7227$** **$\beta 2 = 1.060$** **$l2(25) = 0.9053$**	
X	**l(x)/l(25)**	**l2(x)**	**λ2(x)**	**β3(x)**
45	0.9400	0.8510	-0.8712	0.746
50	0.8938	0.8092	-0.7218	1.273
55	0.8017	0.7258	-0.4872	1.242
60	0.8207	0.7430	-0.5308	1.027
65	0.7568	0.6851	-0.3884	1.003
70	0.5392	0.4881	-0.0238	1.123
				Average =1.069

Age	Estimated conditional female survivorship probability	Third Iteration $\alpha 3= -0.7161$ $\beta 3=1.069$ $l3(25) = 0.9047$		
X	$l(x)/l(25)$	$l3(x)$	$\lambda 3(x)$	$\beta 4(x)$
45	0.9400	0.8504	-0.8673	0.750
50	0.8938	0.8086	-0.7218	1.273
55	0.8017	0.7253	-0.4847	1.245
60	0.8207	0.7425	-0.5308	1.021
65	0.7568	0.6847	-0.3884	1.003
70	0.5392	0.4878	-0.0244	1.122
				Average=1.069

Converged value of $\beta^*= 1.069$ Estimated value of $\alpha^*= -0.7161$

Table 8: Iteration process to Estimate the α and β parameters Defining a Life Table for males in the Logit System Generated by the African Standard

Age	Estimated conditional male survivorship probability	First Iteration $\alpha_1= -0.5285$ $\beta_1=1.0000$ $l_1(25) =0.8609$			
X	$l(x)/l(25)$	$l_1(x)$	$\lambda_1(x)$	$\beta 2(x)$	
45	0.8888	0.7645	-0.5881	0.800	
50	0.7301	0.6285	-0.2640	1.636	*
55	0.6291	0.5416	-0.0842	1.446	*
60	0.5742	0.4943	-0.0114	1.328	
65	0.3831	0.3298	-0.3545	0.818	
70	0.2576	0.2218	-0.6276	0.480	*
				Average =0.982	

Age	Estimated conditional male survivorship probability	Second Iteration $\alpha 2= -0.5416$ $\beta 2= 0.982$ $l2(25) = 0.8624$			
X	$l(x)/l(25)$	$l2(x)$	$\lambda 2(x)$	$\beta 3(x)$	
45	0.8888	0.7665	-0.5957	0.791	
50	0.7301	0.6296	-0.2661	1.633	*
55	0.6291	0.5425	-0.0862	1.443	*
60	0.5742	0.4952	-0.0096	1.330	
65	0.3831	0.3304	-0.3532	0.819	
70	0.2576	0.2222	-0.6264	0.481	*
				Average=0.980	

Age	Estimated conditional male survivorship probability		Third Iteration α3= -0.543 β3= 0.980 l3(25) = 0.8625		
X	l(x)/l(25)	l3(x)	λ3(x)	β4(x)	
45	0.8888	0.7659	-0.5929	0.794	
50	0.7301	0.6297	-0.2661	1.633	*
55	0.6291	0.5426	-0.0862	1.443	*
60	0.5742	0.4952	-0.0096	1.330	
65	0.3831	0.3304	-0.3532	0.819	
70	0.2576	0.2222	-0.6264	0.481	*
				Average=0.981	

Converged value of β*= 0.981 Estimated value of α*= -0.5423

Table 9: Logit values for the Brass African Standard Life Table

Exact Age (x)	$l_{5(x)}$	$\lambda s(x)$
1	0.8802	-0.9970
2	0.8335	-0.8052
3	0.8101	-0.7252
4	0.7964	-0.6819
5	0.7502	-0.6515
10	0.7362	-0.5498
15	0.7130	-0.5131
20	0.6826	-0.4551
25	0.7810	-0.3829
30	0.6525	-0.3150
35	0.6223	-0.2496
40	0.5898	-0.1817
45	0.5535	0.1073
50	0.5106	-0.1212
55	0.4585	0.0832
60	0.3965	0.2100
65	0.3210	0.3746
70	0.2380	0.5818
75	0.1516	0.8611
80	0.0768	1.2433
85	0.0276	1.7810
90	0.0059	2.5642

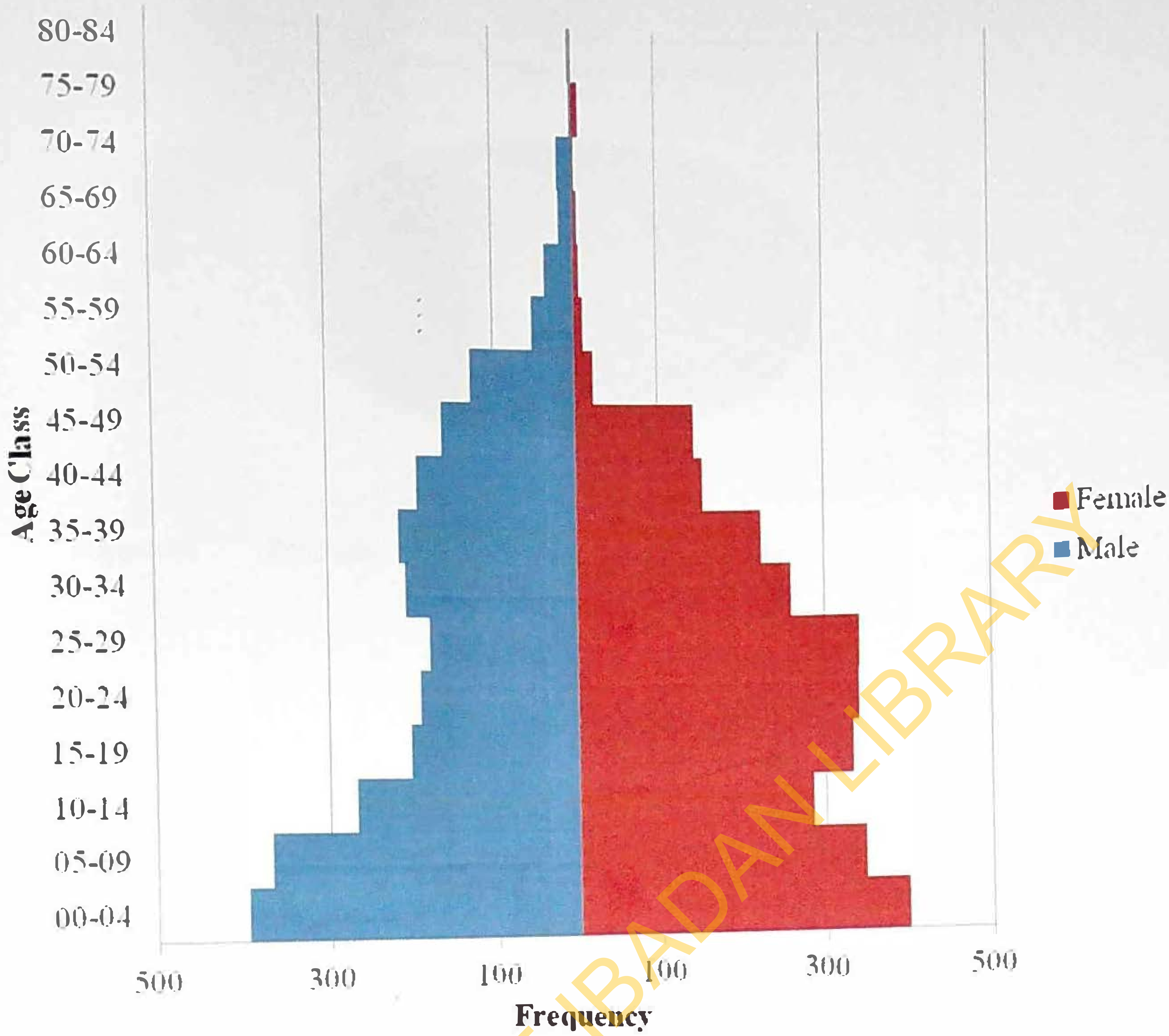

Figure 5: **Population Pyramid for Mowe-Ibafo, 2012**

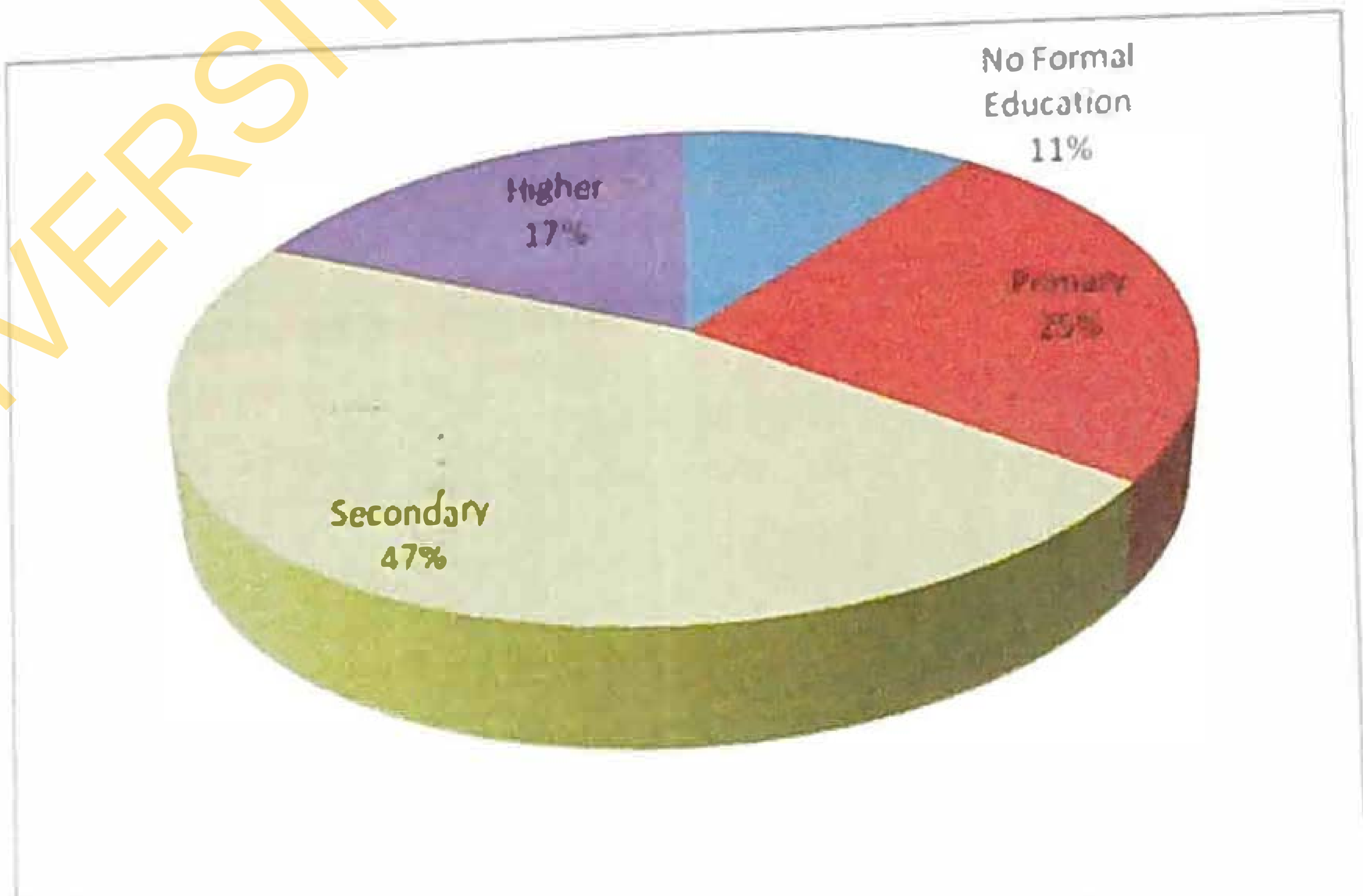

Figure 6: **Educational level of respondents in Mowe-Ibafo**

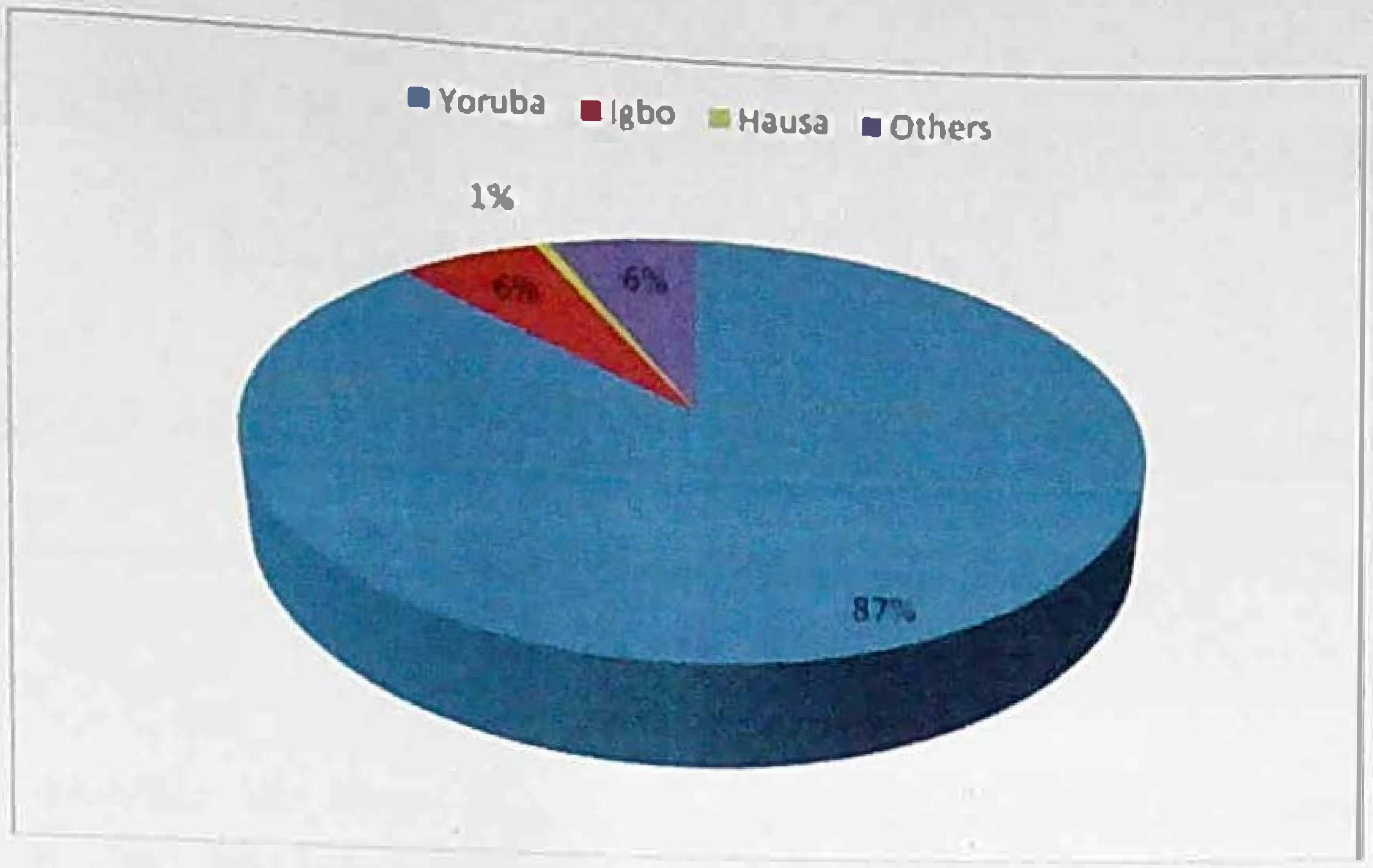

Figure 7: **Ethnicity of respondents in Mowe-Ibafo**

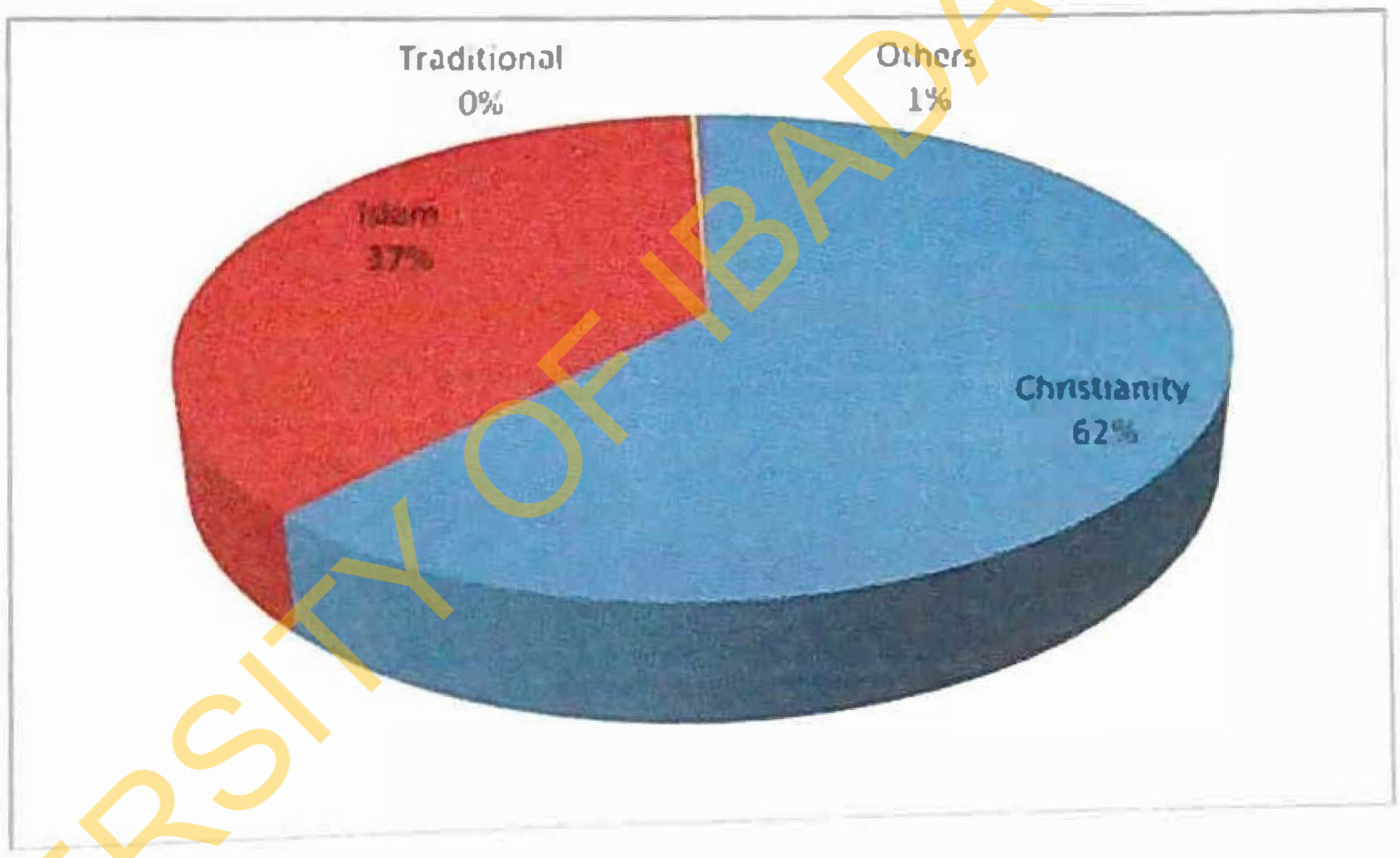

Figure 8: **Religion of respondents in Mowe-Ibafo**

APPENDIX II

DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS
FACULTY OF PUBLIC HEALTH
UNIVERSITY OF IBADAN, NIGERIA

QUESTIONNAIRE ON ADULT MORTALITY TRENDS IN MOWE-IBAFO, OGUN STATE

Locality Name.................................. **Household No**....................**SERIAL NUMBER**...........

Dear Respondent,

Introduction and Consent: My name is... I am working with the Principal Investigator. We are interviewing people here in Mowe-Ibafo Area in order to find out mortality rates in this environment. I am going to ask you questions some of which may be very personal. Your answers are completely confidential and will not be shown to other persons. The information collected from you and people like you will be used solely for academic purpose. Your honest answers to these questions will be greatly appreciated.

....

Participant's Signature & date Interviewer's Signature & date

Section A: HOUSEHOLD LISTING

Please I would like some information about all the people who usually live in your household, including you.

S/N	NAME	SEX (M1 F2)	AGE	S/N	NAME	SEX (M1 F2)	AGE
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

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S/N	NAME	SEX (M1 F2)	AGE	S/N	NAME	SEX (M1 F2)	AGE
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

SECTION B: SOCIAL DEMOGRAPHIC CHARACTERISTICS

Q101	How old were you as at your last birthday?	AGE IN COMPLETED YEARS..................	
Q102	What is the highest level of school you attended?	NO FORMAL EDUCATION........1 PRIMARY.................................2 SECONDARY..............................3 HIGHER.....................................4	
Q103	Religion	CHRISTIANITY......1 TRADITIONAL...........3 ISLAM....................2 OTHERS.........................4	
Q104	Current marital Status	NEVER MARRIED...1 WIDOWED..................4 MARRIED.................2 SEPERATED................5 DIVORCED..............3 LIVING TOGETHER...6	
Q105	To which tribe do you belong?	YORUBA ....1 IGBO......................................2 HAUSA...................................3 OTHERS (SPECIFY) 4	
Q106	Occupation	CIVIL SERVANT.......................1 ARTISAN.................................2 TRADER....................................3 OTHERS(SPECIFY)................4	
Q107	At what age did you first get married?	....	
Q108	What was the age of your spouse (partner) at the time of first marriage?	....	
Q109	What is your main source of water?	Tap water.................................1 Borehole..................................2 Well..3 Stream/Spring/Lake water........4	
Q110	What type of toilet facility do you use?	Bush system...............................1 Pit Latrine..................................2 Water Closet(Flush system).........3	

SECTION C: REPRODUCTION AND MOTHER'S INFORMATION

S/NO	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
Q201	Have you ever given birth to a boy or girl who was born alive? IF NO, PROBE: Any baby who cried or showed signs of life?	1. YES 2. NO 9. NO RESPONSE	IF NO GO TO 301
Q202	Do you have any sons or daughters to whom you have given birth who are **now living with you?**	1. YES 2. NO 9. NO RESPONSE	SKIP TO 205 IF NO
Q203 Q204	How many sons are alive and live with you? How many daughters are alive and live with you?	SONS AT HOME................. DAUGHTERS AT HOME..............................	

SECTION B: SOCIAL DEMOGRAPHIC CHARACTERISTICS

Q101	How old were you as at your last birthday?	AGE IN COMPLETED YEARS..................	
Q102	What is the highest level of school you attended?	NO FORMAL EDUCATION........1 PRIMARY....................................2 SECONDARY...............................3 HIGHER..4	
Q103	Religion	CHRISTIANITY......1 TRADITIONAL...........3 ISLAM...................2 OTHERS.........................4	
Q104	Current marital Status	NEVER MARRIED...1 WIDOWED..................4 MARRIED................2 SEPERATED.................5 DIVORCED..............3 LIVING TOGETHER...6	
Q105	To which tribe do you belong?	YORUBA ....1 IGBO.......................................2 HAUSA....................................3 OTHERS (SPECIFY) 4	
Q106	Occupation	CIVIL SERVANT.......................1 ARTISAN....................................2 TRADER......................................3 OTHERS(SPECIFY).................4	
Q107	At what age did you first get married?	....	
Q108	What was the age of your spouse (partner) at the time of first marriage?	....	
Q109	What is your main source of water?	Tap water..................................1 Borehole...................................2 Well...3 Stream/Spring/Lake water........4	
Q110	What type of toilet facility do you use?	Bush system..............................1 Pit Latrine.................................2 Water Closet(Flush system).........3	

SECTION C: REPRODUCTION AND MOTHER'S INFORMATION

S/NO	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
Q201	Have you ever given birth to a boy or girl who was born alive? IF NO, PROBE: Any baby who cried or showed signs of life?	1. YES 2. NO 9. NO RESPONSE	IF NO GO TO 301
Q202	Do you have any sons or daughters to whom you have given birth who are **now living with you?**	1. YES 2. NO 9. NO RESPONSE	SKIP TO 205 IF NO
Q203	How many sons are alive and live with you?	SONS AT HOME.................	
Q204	How many daughters are alive and live with you?	DAUGHTERS AT HOME..............................	

	IF NONE RECORD "00"	NO RESPONSE...................9	
Q205	Do you have any sons or daughters to whom you have given birth who are alive but **do not live** with you?	1. YES 2. NO 9. NO RESPONSE	SKIP TO 208 IF NO
Q206	How many sons are alive but do not live with you?	SONS ELSEWHERE............	
Q207	How many daughters are alive but do not live with you? IF NONE RECORD "00"	DAUGHTERS ELSEWHERE.....................	
Q208	Have you ever given birth to a boy or girl who was born alive but **later died**? **If No Probe:** Any baby who cried or showed signs of life but did not survive?	1. YES 2. NO 9. NO RESPONSE	SKIP TO 211 IF NO
Q209	How many boys have died?	BOYS DEAD..................	
Q210	How many girls have died?	GIRLS DEAD.................	
Q211	SUM ANSWERS TO **Q203, Q204 & Q206,Q207,& Q209, Q210**.	TOTAL..................	
	Just to make sure I have this right: you have had in TOTAL __________ births during your life. Is that correct? Yes, Go to Next section No, Probe and correct 203-211 as necessary		
Q212	Did you have a live birth during the past 12 months	Yes.......................1 No........................2 No response..........9	
Q213	What is the sex of the birth in the last 12 months	Male.........1 Female......2	

SECTION D: **ADULT MOLTALITY**

No.	Question and filters	Coding categories	Skip No.
Q301	Where did your parent lived most?	Mother............ Father.............	
Q302	Is your Mother alive? Probe: I mean your biological Mother	Yes..............1 No...............2 No response......9	
Q303	Is your father alive? Probe: I mean your biological father	Yes..............1 No...............2 No response......9	

Q304	How long have you lived in your present location?	Less than 5 years........1 More than 5 years......2 Always Lived............3	

This is the end of my questionnaire. I thank you very much for taking time to answer the questions.

Date.................................... Signature of the Investigator.................................

INFORMED CONSENT FORM

(1) IRB Research approval number: (NHREC/05/01/2008a)

This approval will elapse on: 23rd October, 2013

(2) Title of the research:

'Estimation of Adult mortality trends using Orphanhood method in Mowe-Ibafo , Ogun State'.

(3) Name and affiliation of researcher of applicant:

This study is being conducted by Mr. Olalere ALABI of the Faculty of Public health, College of Medicine, University of Ibadan.

(4) Purpose of research:

The purpose of the research is to estimate the level and trends of adult Mortality in Mowe-Ibafo using Orphanhood method, an indirect technique in the absence of a reliable vital registration system that would have enabled direct estimation.

(5) Procedure of the research:

Participants are expected to give information on the birth in a year before the survey and the no of children ever-born so as to estimate the mean age at child birth. Information on survivorship status of the mother and father of respondent will be used for computing survivorship probability. An approximate total 1250 women, aged 15 years and above will be enrolled in the study, using a two-stage sampling technique.

(6) Duration of research & participant involvement:

Primary data collection will be conducted for approximately 4 weeks

(7) Risk(s): No risk is involved in the research.

(8) Benefit(s):

Participants stand to benefit from the study because the findings from the study will make policy makers aware of the prevailing situation in the study area.

(9) Confidentiality of data:

Efforts will be made to ensure that data collected will be saved into a personal computer system and password protected to restrict access. Study participants will not be contacted beyond the scope of the research. The data collected will also be used only for research purposes and identifiers like the names of respondent will not be collected. Research assistants will also be trained on the importance of maintaining confidentiality of the data collected and thoroughly monitored to ensure compliance. As part of my responsibility to conduct this research properly, officials from NHREC and ethics may have access to the data.

(10) Voluntariness:
Your participation in this research is entirely voluntary

(11) Statement of person obtaining informed consent:
I have fully explained this research to------------------------------ and have given sufficient information, including about risks and benefits, to make an informed decision.

DATE: ----------------------- SIGNATURE-------------------
NAME: ---

(12) Statement of person giving consent:
I have read the description of the research and I understand that my participation is voluntary. I know enough about the purpose, methods, risks and benefits of the research study to judge that I want to take part in it. I understand that I may freely stop being part of this study at any time. I have received a copy of this consent form.

DATE-------------------------- SIGNATURE------------------
NAME---

(13) This research has been approved by the UI/UCH ethical review committee and the Secretary of this Committee can be contacted at IMRAT building, College of Medicine, University of Ibadan. In-addition if you have any question about your participation in this research, you can contact the principal investigator. Mr Olalere ALABI on +2348066113361.