QUALITY OF AGE DATA IN THE NIGERIA DEMOGRAPHIC AND HEALTH SURVEYS 1990 – 2013.

BY

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A DISSERTATION SUBMITTED TO THE DEPARTMENT OF EPIDEMIOLOGY AND MEDICAL STATISTICS, FACULTY OF PUBLIC HEALTH, COLLEGE OF MEDICINE, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN MEDICAL DEMOGRAPHY OF THE UNIVERSITY OF IBADAN

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CERTIFICATION

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DEDICATION

This research work is dedicated to the ALMIGHTY ALLAH for his divine strength favour shown towards the success of this study. I also dedicate this success to my beloved parents (Mr. & Mrs. Sanusi) and my elder brother Mr. Adegboyega AbdulJeleel whose assistance and candid advice were inevitable during my tough times.

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My unquantifiable appreciation also goes to my parents, my father Prince AbdulAzeez Alabi Sanusi and my mother Mrs. Taibat Alabi Sanusi, they are very wonderful, my elder brother AbdulJeleel Adegboyega Sanusi, my younger sister Alimot Sanusi, my step mother Mrs. Khadijat Alabi Sanusi, my brother's wife Mrs. Kafayat Adegboyega, and my younger brothers altogether for their supports morally, candidly, spiritually and financially throughout my stay in this noble university.

My profound gratitude goes to my supervisor Prof. Olusola Ayeni, not only as a supervisor but also as a father; his constructive criticism, fatherly advice and his intellectual guidance during the course of this work really assisted a lot. I thank God for giving me such a wonderful professor as my supervisor. I do call him my role model. I did call him, mailed him and visited him in his office anytime without any word of assault or embarrassment so that I can become somebody in life. Ha! In God Grace you shall be lifted up in all ramifications and live long for us. I cannot forget my co-supervisor Dr B.M. Gbadebo, he also did wonderfully well, some of the shortcomings that I would have overlooked were pointed out and corrected accordingly. Also my amiable lecturers: Dr S. Adebowale, Dr J.O. Akinyemi among others for their care, advice and support throughout my stay at the university. My thanks also go to all the staffs of the Department of Epidemiology and Medical Statistics and the entire staffs at large at the Faculty of Public Health, University of Ibadan for their noble supports.

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ABSTRACT

Information collected about age is an important variable in a survey and census because of its usefulness in providing further demographic analyses and estimations, such as estimation of fertility and mortality, migration estimation, population estimation and estimation of demographic parameters and model. Age is one of the key demographic variables and it is the primary basis of demographic classification in censuses, vital statistics and surveys. Age data are also very essential in calculating the basic measure relating to the components of change (fertility, mortality and migration), as well as in the study of population projections and nuptialities. Much of the demographic information in use is expressed in terms of age at which something happens. Therefore due to the frequent use of NDHS datasets in carrying out research in Nigeria, quality of age data in the NDHS 1990-2013 were examined in the study.

Ages are commonly rounded with terminal digit 0 and 5, this has resulted in digit preference. The mechanisms for data collection put in place in Nigeria is worse. Inaccurate data reporting in Nigeria has affected most of the research conducted in Nigeria.

Surveys no matter how it is being obtained are subject to errors. These errors are troublesome as they occur frequently and their presence also introduce subsequent errors. The study is examining the quality of age data in the NDHS 1990-2013.

The study evaluated the accuracy of age data reported from the NDHS 1990-2013; examined the level of age misreporting among males and females in the surveys; determined age preference and/or avoidance among the males and females in the survey; and finally assessed the pattern of age deviations of the reported from the stable age distributions.

The study was a cross-sectional and the data were obtained from the NDHS age datasets for the households. The age data reported were grouped into 5-years range and the UN Age-Sex Accuracy Index were used to check for irregularities in age data. Also the ages were cumulated into 5-year range and the Coale-Demeny Model life Table for estimating deviations in age data were used to correct such erroneous age data.

The results of the study revealed that across all the surveys, quality of age data were inaccurate; preference for terminal digits "0" and "5" were very much pronounced among males and

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The results of the study revealed that across all the surveys, quality of age data were inaccurate; preference for terminal digits "0" and "5" were very much pronounced among males and females; revealed that the patterns of preferences were the same among males and females; found higher degree of deviations of the reported from the stable age distributions.

The quality of age data in the NDHS 1990-2013 were very inaccurate and no significant improvement were observed between the surveys. This may result in wrong estimations, wrong projections, wrong planning and developments in entirety in Nigeria may be retarded. Hence, it is recommended that the Coale-Demeny Model Life Table for the "West" is considered the best method to correct such erroneous age mis-statement, because of its effectiveness in estimating the patterns of deviations in age data especially for country like Nigeria.

Keywords: Digit Preference; Age misstatement; Age Ratio; Sex Ratio; Nigeria.

Word counts: 315

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1. AIDS	Acquired Immune Deficiency Syndrome
2. AIS	AIDS Indicator Surveys
3. ARSF	Age-Ratio Scores for Females
4. ARSM	Age-Ratio Scores for Males
5. CDMLT	Coale-Demeny Model Life Table
6. e_0	Expectation of life
7. HDSS	Health and Demographic Surveillance Systems
8. JS	Joint Scores
9. MDGs	Millennium Development Goals
10. MIS	Malaria Indicator Surveys
11. NBS	National Bureau of Statistics
12. NDHS	Nigeria Demographic and Health Surveys
13. NGOs	Non-Governmental Organisations
14. SDGs	Sustainable Development Goals
15. SRS	Sex-Ratio Scores
16. UN	United Nations
17. WHO	World Health Organisation

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CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Age is an important demographic variable and very useful in epidemiological studies. It is the primary basis of demographic classification in censuses, vital statistics and survey works. Age, together with sex, is one of the key "demographic variables" (Bogue, 1969). Age is the "centerpiece" of much demographic theory (Poston, *et al*, 2006). Age is defined according to International Workshop on Population Projections, 14-16 January, 2013 in Beijing, China as; "The interval of time between the date of birth and the date of the census, expressed in completed solar years". Age no doubt is the most vital in population study. Data on age are essential in calculating the basic measures relating to the factors of production dynamics and in the study of the components of change (fertility, mortality and migration) as well as in the study of nuptiality (Selome, 2006). The date of birth (year, month and day) gives a more precise information and is preferred. Age reported in completed years (age at the individual's last birthday) is less accurate. Much of the demographic information in use is expressed in terms of the age at which something happens; for example, when an individual leaves school, enters employment, votes in an election, obtains travelling passport or dies etc.

Age is a socio-demographic variable related to the host in descriptive studies and the accuracy of age collected house-to-house surveys varies in different set-ups and depends on numerous factors. Age data provide an indispensable basis for studies of a nation's manpower potentials and its requirements for schools, housing, food and various kinds of goods and services. Health indicators are extensively based on the age data and thus warrant a detailed assessment of data. Information collected about age is an important variable in a survey because of its usefulness in providing further demographic analyses and estimations such as estimation of fertility and mortality, migration estimation, population estimation and estimation of demographic parameters and model. Age seems simple to collect conceptually in any demographic enquiry but many literatures have shown to us that its collection is not as simple as it seems.

Tabulations on age cannot be over-emphasized in the analysis of factor of labour supply and in the study of the problem of economic dependency. The importance of demographic surveys data on age in studies of population growth is greater for countries such as Nigeria where vital statistics registration system has not been established at all and for other countries where adequate information on vital events are not available. Age is an important variable in measuring potential school population, the potential voting population and potential manpower. Age data are required for preparing current population estimates and projections; projections of households, school enrolment and labour force, as well as projections of requirements for schools, teachers, health services, food and housing. In conjunction with the appropriate vital statistics, the fundamental measures of population growth, age specific fertility and mortality rates, reproductive rates and life table functions can be estimated. It is the starting point for population projections. Age data are very vital for socio-economic planning, political, administrative, research and several others purposes in order to make informed decisions at all levels.

The study of quality of data began in the 1950s, as a result there were a series of definitions, for examples, quality is; "The degree to which a set of inherent characteristics fulfill the requirements" (General Administration of Quality Supervision, 2008); "Fitness for use" (Wang & Strong, 1966); "Conformance to requirements" (Crosby, 1988) were published. According to an Oxford Advanced Dictionary, quality is defined as; "The degree to which a man-made object or system is free from bugs and flaws, as opposed to the scope of functions or quality of items". Later, with the rapid development of information technology, research turned to the study of the data quality.

Data quality is of paramount importance to the Demographic and Health Surveys (DHS) project, which has long been considered the gold standard for nationally representative data collection in the developing world. Data from the DHS project, including DHS surveys, Service Provision Assessments, AIDS Indicator Surveys (AIS), and Malaria Indicator Surveys (MIS), are used for national agendas in population and health, for informing programmes and policy makers at the national and international levels, and among researchers, for analytically examining a broad array of population and health issues. DHS provides information for making evidence-based decisions and recommendations. Given the central roles that DHS plays in this regard, it is critical that the data collected through the DHS project are as accurate as possible. Obtaining the on age in studies of population growth is greater for countries such as Nigeria where vital statistics registration system has not been established at all and for other countries where adequate information on vital events are not available. Age is an important variable in measuring potential school population, the potential voting population and potential manpower. Age data are required for preparing current population estimates and projections; projections of households, school enrolment and labour force, as well as projections of requirements for schools, teachers, health services, food and housing. In conjunction with the appropriate vital statistics, the fundamental measures of population growth, age specific fertility and mortality rates, reproductive rates and life table functions can be estimated. It is the starting point for population projections. Age data are very vital for socio-economic planning, political, administrative, research and several others purposes in order to make informed decisions at all levels.

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Developing appropriate and equitable policies in Africa requires accurate and reliable data (Sara, *et al.* 2016). In Nigeria, we are not sure whether existing data can accurately assess the population structures, let alone provide the detailed information needed to inform the policy decision-making.

In a perfect world, data would always be complete, accurate, current, pertinent, and unambiguous. In the real world, data are generally flawed on some or all of these dimensions (Feeney, 2003). The task of evaluating and assessing data is an essential part of identifying the nature, direction, magnitude and likely significance of these flaws. Therefore the age structure of a population is considered basic to the study of population problems. Some of the authors have pointed out reasons the age reporting in censuses or surveys is full of errors, some of the reasons are: ignorance of exact age, conscious or subconscious evasion of certain ages, digit preference, carelessness in reporting and recording, tendency to round-up ages and some other factors like social, economic, and cultural factors such as literacy, urban location etc. Demographic and Health Surveys have been the major secondary data use for research in developing countries. Quality of age data in the Nigeria Demographic and Health Surveys (NDHS) needs to be examined due to its constant use in carrying out research in Nigeria. Disaggregation by sex needs to be performed in order to know which sex reported is slightly better in age-misreporting.

In demographic studies, age is one of the most commonly assessed variable and other parameters either demographic or not are often analysed and result interpreted in relation to age. When subjects to be studied are divided into different age groups, those who provide incorrect age group could be put into a wrong age sub-group and this will affect the analysis and consequently a faulty results. Different social values are attached to age in different set-ups. A variety of mis-statements and irregularities have been noted with respect to age-related data. A common example of content errors in censuses and surveys is a mis-statement of age. Of these irregularities age heaping is a common phenomenon. Age data frequently exceed frequencies at round or attractive ages, such as even numbers and multiples of 5 leading to age heaping. This age heaping is considered to be a measure of data quality and consistency. In a situation where decision is to be made at the level of conclusion, the correct age of the respondents is very important because many decisions are age-sensitive and misrepresentation of age may lead to inaccurate or inappropriate decisions.

The error may be small or large, depending on the obstacles to accurate recording which are present in the area concerned; the methods used in compiling the data and the relative frequency with which these methods are applied. Most of the researches conducted in Nigeria are based on NDHS datasets, therefore there is need for accurate data on the age of population's members. Errors on age reporting on censuses and surveys have received considerable attention from demographers because "errors are readily apparent" and "measurement techniques can be more easily developed for age data" (Shryock, *et al*. 1976). The quality of age reported needs to be examined. There is no doubt faulty data will give faulty analyses, which definitely bring about faulty conclusion. The quality of age data in Nigerian censuses and surveys data is poor as a result of misreporting and no significant improvement or difference was observed between the census or survey (Tukur, *et al*. 2013). There is need to improve on the quality of age data in Nigeria, therefore, this study examines quality of age data reported in the Nigeria Demographic and Health Surveys 1990 – 2013.

1.2. Statement of the problem

Censuses and surveys in developing countries are prone to errors of age-misreporting due to ignorance, low literacy levels, and other social, economic and cultural factors. Ages are commonly rounded with great affinity for 0 or 5. This tendency to digit preference and/or avoidance results in age heaping or concentration of ages at certain digit. In developing countries (Nigeria inclusive) data quality is highly inaccurate and very poor; the diversity of data sources bring abundant data types and complex data structures and increases the difficulty of data integration (Cai, *et al*. 2015). Poor data quality will lead to low data utilization efficiency and even bring serious decision-making mistakes (Cai, *et al*. 2015). Data collection mechanisms put in place in Nigeria is worse. There has been a rampant age-misreporting in Nigeria and this has affected most of the research conducted due to inaccurate age reporting. There is no accurate data collection system in Nigeria due to poor data registration/collection systems put in place. No country will develop without adequate and up-to-date information on data collection.

Nigerian governments are showing a lackadaisical attitude towards data collections, the accuracy of age data reported in NDHS are not very ascertained; as a result, the quality of age data collection needs to be looking at through the use of indices for demographic estimations of age errors.

Surveys and censuses conducted across Africa have been documented to suffer from errors in the form of over-enumeration or under-enumeration of ages and misreporting of ages is very rampant. The reliability of age data obtained from censuses and surveys in countries of tropical Africa is generally poor (Kpedekpo, 1982). Age mis-statements are common to most demographic investigations. This age mis-statements are classified into two groups: net age mis-statement and gross age mis-statements. Net age mis-statement is the number of persons reported at a particular age, minus the true number of persons at that age. It can be distinguished from gross age mis-statement by the fact that some of the persons reporting themselves at aged x who are not aged x are counter-balanced by persons aged x reporting themselves at other age. Age displacement can occur due to either the misstatement of age by the respondent or due to the interviewer's deliberate efforts to move an eligible woman outside of the age range of eligibility in order to reduce interviewer workload (Kiersten, *et al*. 2009). As respondent age increases, the percentage of true score variance in survey measures tend to decline, the percentage of both random and correlated error variance tend to increase and people tend to have more interrelated or less differentiated views about their worlds (Frank, *et al*. 1986).

·The age distributions of populations in many African countries show these irregularities: "Deficiency in the number of infants and young children, heaping at ages ending in 0 and 5, so a relatively large concentration of persons enumerated with ages ending in 0 and 5, a preference for even ages over odd ages, so a relatively large concentration of persons enumerated with even-numbered ages, unexpected large differences between the frequency of males and females at certain ages, unaccountably large differences between the frequency of males and females at certain ages, unaccountably large differences between the frequencies in adjacent age groups and lastly non-stated or unknown ages". Most of the health indicators are based on age data, assessment and adjustment of reported age in the evaluation and formulation of relevant health plans and policies at national, regional, districts and local levels and for programs to achieve the Sustainable Development Goals (SGDs), since Millennium Development Goals (MDGs) were

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1.3. Justification

Population statistics, like all other demographic statistics, whether they are obtained by enumeration, registration, or other means are subject to errors (Moultrie, 2012). Errors in age classification are troublesome, not only because they occur frequently, but because their presence .introduces errors in tabulations of population characteristics by age; such tabulations are fundamental to more sophisticated analysis such as the construction of life tables, calculations of measures of fertility and mortality and population projections.

Most of the studies conducted in Nigeria are using secondary data from the Nigeria Demographic and Health Surveys. The rate at which NDHS datasets are being used call for checking the quality of age data reported in the NDHS from 1990 – 2013. Therefore the present study is looking at these angle using demographic methods for estimating irregularities in age data; the United Nations Age-Sex Accuracy Index and the Coale-Demeny Model Life Table to detect the patterns of deviations of the reported from the stable age distributions; graphs and charts are plotted for easy comparison of results across the surveys.

Therefore, the outcome of this study will support existing evidence from other African countries that the quality of age data in the developing countries (mostly Africa) is very rough. Age data quality in this cohort of patients from developing countries was low, preference for age ending with numbers '0' and '5' is common and pattern of preference is the same for both sexes (Srdjan, *et al*. 2004).

1.4. Objective

1.4.1. Broad Objective

The main objective of the study is:

To evaluate the accuracy of age data reported from the Nigeria Demographic and Health Surveys 1990-2013.

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1.4.2. Specific Objectives

The specific objective of the study are:

- To evaluate the degree of under or over statements of age data reported in the surveys.
- To examine the level of age misreporting among males and females in the surveys.
- To determine age preference and/or avoidance among the males and females in the surveys.
- To assess the pattern of age deviations of the reported from the stable age distributions.

CHAPTER TWO

LITERATURE REVIEW

2.1. Patterns of Age Misreporting in Sub-Saharan African Surveys and Censuses

Age reported in censuses and surveys in developing countries are subject to errors and bias resulting in uncertainties in population estimates and age distributions (Ewbank, 1981). The study carried out in Malawi, the United Nations' Sex Ratio Scores were calculated and indicate that the quality of the data for Malawi as a whole has been getting poorer and poorer at each succeeding enumeration. Errors and bias in age determination are most often studied by conducting analysis at the aggregate level, examining the distortions they produce in the age distributions.

Another trend, especially in West Africa, is to underestimate the age of children and adolescents, when they have not yet reached puberty or have never been married, and to overestimate it when they are pubescent or get married. This results in a "hole" in the pyramids around ages 15 to 20, the age groups from 10 to 24 years being underrepresented in favour of the two neighbouring groups of 5-9 years and 25-29 years (Ewbank, 1981; Gendreau and Nadot, 1967; Hertrich and Lardoux, 2014).

With the progress of education, ages should be better known, especially for younger generations, but it is possible that the reported ages continue to be affected by errors. While most people interviewed or identified in current large national surveys have some sort of identity, birth dates that may not necessarily be reliable. They may have been purposely biased, for example if reporting a younger age is needed for a child too old to be enrolled in a class.

The determination of ages can be improved using particular techniques. Pison (1979) lists some of the most widely used: historical calendars (Blanc 1962; Scott and Sabagh 1970); collection of relative ages by ranking a whole population by birth order (Gubry 1975; Howell 1979; Pison 1980); checking the internal consistency of the reports within the questionnaire; or the use of calendar of events - a systematization of the internal consistency of the questionnaire by establishing a file of all events recorded on an individual and reconstructing with him the order in which these events have occurred (Ferry 1976; Freedman et al. 1988; Helleringer et al. 2014).

In Nigeria studies have shown that there is a tendency for understatement or overstatement of age in order to suit certain social and biological expectations. Censuses and surveys in Nigeria where civil registration is incomplete face problems in assessing ages. Reported ages can depart quite substantially from real ages. The impact on the population estimates can be serious because, to a general imprecision is often added systematic errors or biases, plaguing reports for certain ages or specific population groups. Conventionally, age statements are affected by two types of errors: age heaping, which is a tendency to round ages to specific digits (0 or 5), and the tendency to systematically exaggerate or, conversely, under-estimate ages (Ewbank, 1981; Pullum, 2006). These problems are exacerbated when individuals are reporting on the ages of other members of their household or family, as is frequent in household interviews. Whatever the method used to improve the age determination, in most cases we do not know the direction and magnitude of the error, because the "true" age remains unknown. To measure this error, we must know the true age from registration-type data, such as information from parish registers, or civil registration. However, even in population well covered by civil registration, direct evaluation studies are difficult to conduct since the existence of an effective civil registration system obviously alters the awareness of ages, thus limiting the inference that can be made for settings without vital registration.

Health and demographic surveillance systems (HDSS) are a special case where the analyst can know the precise date of birth of almost all individuals in a population, while these individuals themselves might not necessarily know it.

2.2. Systematic underestimation or overestimation of age in Nigeria

Artificial "aging" or rejuvenation are common in Nigeria, but there has been relatively few attempts to understand patterns of age misreporting. The literature on age misstatement is somewhat outdated and little is known on age misreporting in recent surveys and censuses. Ewbank (1981) discusses a number of important issues related to age errors and selective underenumeration and refers to some direct evaluation studies. For instance, children below the age of five, found playing with their peers at the time of the enumeration, may be reported as belonging to the age group 5 to 9, and females in the age group 10 to 14 who have passed puberty (menarche) may be recorded in the age group 15 to 19, especially if they are married or have children. Likewise, women above the age of 40 who are still rearing (nursing) their own children may be assigned to a younger age group. There is also a tendency especially among the elderly males, to exaggerate theisr age for prestige purpose or perhaps a desire to be granted a senior citizenship status which, in some cases, exempt people paying tax.

2.3. Age Heaping: Age distributions derived from African censuses and surveys can exhibit large irregularities when the reported ages are considered by single years of age; typically, ages ending by a multiple of five will "attract" more reports than surrounding ages (Gendreau and Nadot 1967). Census enumerators and survey interviewers may face difficulties in determining the exact age of a person with a precision of one year, and sensitive to heaping, preferentially attribute ages ending in 0 or 5. But there are also counter-examples. In some cases, such as in a survey in Guinea in 1955, investigators were strongly warned against the heaping, and this resulted in an opposite pattern showing deficit at these ages. In other cases, such as in the census of Senegal in 1988, there was a distinct heaping on ages ending in 9 or 4 (Pison et al. 1995). This was due to the conversion by investigators of ages into years of birth, themselves subsequently converted into ages, resulting at the end for some people in a reduction of one year of their age because of this conversion (Pison and Ohadike 2006). Several indices have been developed to assess the amount of digit preference, such as the Myer's index or Whipple's index (Spoorenberg and Dutreuilh 2007). If a population tends to report certain ages (say, those ending in 0 or 5) at the expense of other ages, this is known as age heaping. Age heaping is most pronounced among populations or population subgroups having a low education status. The most common age-related reporting irregularities are the digit preferences and age heaping around some attractive ages (Yusuf, *et al.* 2016).

2.4. Digit Preference: Digit preference, or the lack of heaping (digit avoidance), are the major forms of errors typically found in single-year of age data. Irregularities in reporting single-years of age can be detected using indices, charts and graphs. Systematic peaks at ages ending in 0 and, less prominently, 5 are typical features for countries with less accurate vital registration. Moreover, this phenomenon seems particularly severe at older ages. Also even numbers in general seem to be preferred over odd digits. Current age-at-death distributions are the result of the number of births and deaths, and migration flows in the past, and individual years may show particular outcomes, like epidemics, when birth cohorts are considerably smaller than the years before and after the crisis, or years of armed conflicts, when deaths are higher, especially among men. Thus there is the possibility of irregularities in an age distribution; however, the specific reasons for such irregularities are usually well understood from the historic records. In the absence of such specific past events, the assumption of a smooth age distribution is reasonable, implying that the peaks and gaps are the result of certain preferences in reported ages. If spikes or troughs in the distribution are due to events in the past, rather than digit preference, these digits will be excluded from the smoothing procedure. An analogous concept carries the added feature of respondents having a preference for various ages having the same terminal digit. The causes and patterns of age or digit preference vary from one culture to culture, but preference for ages ending in 0 and 5 is quite widespread, especially in the African countries. The pattern is the same among males except that the "rush for 0" is less among them than among females while preference for digit "5" is at approximately the same level (Ayeni, 1974).

2.5. Reasons for Age Misreporting

Age reporting suffers from a number of errors due to a variety of reasons. The reasons vary but the causes can be classified as follows; ignorance of correct age, carelessness in reporting and recording, a general tendency to state age in figures ending in certain digits, a tendency to exaggerate length of life at advanced age, a possibly subconscious aversion to certain numbers, mis-statements arising from motives of an economic, social, political or purely personal character (Kpedekpo, 1982). Interviewers can potentially misstate age, creating age shifts across age eligibility boundaries. Age displacement is also one of the factors responsible for errors in age data. Age displacement can occur due to either the misplacement of age by the respondent or due to the interviewer's deliberate efforts to move an eligible woman outside of the age range of eligibility in order to reduce interviewer workload (Kiersten, *et al.* 2009 & ICF Macro, 2009). Therefore to evaluate the quality of age data and the extent of deviations of the reported from the stable age data, United Nations Age-Sex Accuracy Index and Coale-Demeny Model Life Table for estimation of deviations of the reported from stable age distributions are used. Comparison of the two methods are made in order to know the best method applicable to check for irregularities in age data in Nigeria.

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2.6. Quality of Age Data

The quality of age data is poor as a result of misreporting, and there was no significant improvement used in data collections in Nigeria (Tukur, *et al.* 2013). In the assessment of data quality used in demographic and health surveys, it was found that there was intentional misrecording of information in order to exclude some women for in-depth interviews (Tukur, *et al.* 2013). The pattern of preference is the same for both sexes, consists of very large preferences for digits "0" and "5" in that order (Ayeni, 1974). The age data quality in populations from developing countries is very low, preference for age ending with numbers "0" and "5" is common (Srdjan, *et al.* 2004). Misreporting of age may bias results, decrease a study's power to detect difference between age groups and prevent generalization of the findings to other populations (Srdjan, *et al.* 2004). There were very obvious preference for ages with end-digits 0 and 5 while other end-digits were avoided in the two censuses 1991 and 2006; and this was more pronounced with the females than males (Emmanuel, 2015).

Data quality is usually perceived in relation to how it meets user requirements (Akpon-Ebiyomare, *et al.* 2012). Given the practical needs and many uses of age data, obtaining accurate and complete information on this variable is of paramount importance. However, due to various reasons misreporting of age is a common problem in developing countries, such as Nigeria. In studies conducted in developing countries, age data quality should be analysed as it may bias results and weaken the power of the study (Srdjan, *et al.* 2004). If ages have been deliberately mis-stated, there is more likelihood of a bias in the distribution towards either overstatement or understatement of age, affecting certain broad age range.

Selection of reference age distribution for the Index Population can be compared with the Standard Population from a model life table system such as Coale-Demeny or Brass System using additional information such as mortality level of Index Population, comparison of the difference between the Standard Population and Index Population using some techniques of linear interpolation provide information about levels of age mis-statements (Ayeni, 1974).

As a result, there is need to measure the accuracy of age data in the demographic surveys as reported in Nigeria.

In the analysis of single-years age data, if there are no irregularities, the counts for adjacent ages should be similar. Examples of irregularities are digit preference and avoidance. The tendency of enumerators or respondents to report certain ages at the expense of others is called age heaping, age preference or digit preference. The pattern of heaping is pronounced from age 20 onwards, this revealed heaping at ages ending in zero and five years and it is true for both males and females (Mukherjee, *et al*. 1988).

2.7. Methods of Detection of Errors in Age Data

Over the past two decades, there have been great advances in the development of techniques for examining the reliability of age data obtained from censuses and surveys. The need to devise new techniques to meet new problems has led to a multiplicity of techniques. Essentially, there are two broad approaches to the problem of identifying possible errors in age data. The first approach, useful before the data are published, involves the case-by-case checking techniques, employing data from interviews and independent lists or administrative records. The second approach involves the use of demographic analysis. It is with the later that will be dealing. Almost all the techniques succeed in identifying some of the errors in the age data; a few of them go further to suggest methods of "correction" such errors when detected.

2.7a. Age Ratio Analysis: Age ratios and Sex ratios can be used either separately or jointly in evaluating the quality of the census or surveys returns by age groups. Therefore, age ratio is usually defined as the ratio of the population in the given age group to one half the populations in the two adjacent age groups. The computation of age ratios are then compared with the expected values, which is usually 100.00. The discrepancy at each age group is a measure of net age misreporting. An overall measure of the accuracy of an age distribution, called an Age Accuracy Index, is derived by taking the average deviation (regardless of sign) from 100.0 of the age ratios and summing over all age groups. The lower this index, the more adequate the census or survey data on age. The ratios are usually calculated for males and females separately and can be calculated for each age group (except the youngest and the oldest) provided the intervals are equal. An age ratio under 100 implies either that members of age group were selectively under-enumerated or that errors in age reporting resulted in mis-classifying persons who belonged to

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Generally, age ratios should be studied for a series of age groups, preferably for the entire span of age for which they can be calculated.

2.7b. Age-Specific Sex Ratio

This is defined as number of males per 100 females in each age group and can be used in evaluating census or surveys age data. The general pattern of age-specific sex ratios is such that they approximate to the sex ratio at birth in the younger ages and fall gradually with advancing age. For countries with a similar level of sex ratio at birth, the patterns of the age-specific sex ratios are quite similar from country to country if there is no migration. Likewise, an age-specific sex ratio under 100 implies either that members of age group were selectively under-enumerated or that errors in age reporting resulted in misclassifying persons who belonged to the age group. A ratio of more than 100 suggests the opposite of one or other, or both, of these conditions.

2.7c. United Nations Age-Sex Accuracy Index (The Joint Scores) Techniques

This method unlike Whipple's and Myers' Indexes is applicable to five years group of ages up to about age 70. Censuses or surveys age-sex data are described by the United Nations as "Accurate", "Inaccurate", or "Highly Inaccurate" depending on whether the UN index is under 20, 20 to 40, or over 40 (Shryock & Siegel, 1976). The United Nations suggested a joint accurate index to summarise the age and sex ratios. The index of Sex-Ratio Score (SRS) is defined as: "The mean difference between sex ratios for the successive age groups", average irrespective of sign, while that of Age-Ratio Score (ARS) is defined as: "The mean deviations of the age ratios from 100 percentage", also irrespective of sign. Based on empirical relationships between the SRS and the ARS, the index Age-Sex Accuracy Index (ASAI) is defined as the Joint Score (JS). In the case of sex- ratios, successive differences between one age group and the next are noted and their average is taken irrespective of sign. In the case of age-ratios for either sex, deviations from 100 are noted and averaged irrespective of sign. Three times the average of sex-ratio differences is then added to the two averages of deviations of age ratios from 100 to compute the index. This index combines the sum of the mean deviations of the age ratios from 100 for males the age group. A ratio of more than 100 suggests the opposite of one or other, or both, of these conditions.

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2.7d. Coale-Demeny Model Life Table Methods for Estimating Deviations between Reported Cumulative and Stable Age Distributions

Assessment of extent of deviations of the reported age data from the stable age data can be done with the use of a reference (standard) age distributions. A reference age distribution is selected for the index population through the use of a Coale-Demeny Model Life Table (CDMLT) using additional information such as mortality level of the index population. The model stable population that best fit the index population is determined by comparing certain recorded or estimated features of the index population with the tabulated values of the stable populations. In CDMLT, there are four sets referred to; 'North', 'South', 'East' and 'West' regions and each of these sets has a slightly different pattern of mortality. The 'West' family is chosen for Nigeria because it has similar average mortality pattern. The set is presented for 25 levels of mortality with expectation of life (eo) ranging from 20 to almost 80 years presented separately for male and female for the set.

Specifically, errors in the reported age distributions are examined by comparing the proportion in each quinary age group in the enumerated population with that of the stable age distributions. For the population under consideration we assumed that the stable age distribution is correct from these corresponding ages, the stated ages were subtracted algebraically to obtain age deviations representing average errors in the stated ages. Then points on the graph (the deviations) can be interpreted as average errors in age statements. Thus a point two years above the x-axis at age 20 represents a percentage under 20 years which is equal to that under 22 years in the stable population. Similarly a point two years below at age 20 represent the proportion under 18 years. Simply put, the point 2 years above the x-axis at age 20 means that ages of respondents reported as being under 20 had been under-estimated by 2 years, while the point 2 years below the x-axis at age 20 means an over-statement by two years.

Two features of an actual (index) population are sufficient to locate a stable population within one of the families (Ayeni, 1974).

Table 2.8. below shows the expectation of life at birth (eo) reported by the National Bureau of Statistics (NBS); Statistical Reports on Men and Women in Nigeria and by Index Mundi; Annual Population Growth Rates; 1990 (Male 47years, Female 49years, Rate 2.58%), 2003 (Male 43years, Female 44years, 2.55%), 2008 (Male 53years, Female 54years, 2.66%) and 2013 (Male 53years, Female 56years, 2.68%) to select the level of mortality from the stable population for the West Region Model life table.

Table 2.8a: Expectation of Life at Birth (eo) and Annual Population Growth Rates (r in %)

Years	Males	Females	Rate %
1990	47	49	2.58
2003	43.1	43.5	2.55
2008	53	54	2.66
2013	53	56	2.68

Source: National Bureau of Statistics (NBS); *Statistical Reports on Men and Women in Nigeria* and Index Mundi Reports; *Nigeria Population Growth; Annual reports*

Therefore the corresponding ages in the standard population (interpolated ages) are subtracted from the cumulative ages to give the extent of over or under selection of ages. Also differences between cumulative age distributions in the standard and the index populations at particular ages can provide information about levels of age mis-statements.

CHAPTER THREE

METHODOLOGY

3.1. Study Area

Nigeria is one of the sub-Saharan African countries. It is located in the West Africa region of the world, with the headquarters at the Federal Capital Territory of Abuja. The country has an area of 923,768.00sq kilometers and lies between latitude 40 and 140 North of the Equator and longitude 30 and 140 East of the Greenwich Meridian. It is bothered by the Republic of Benin on the west, on the east by the Federal Republic of Cameroon, on the North by the Republic of Niger, on the North-East border is Lake Chad and on the south it borders the Gulf of Guinea and the Nigerian coast-line is bothered by the Atlantic Ocean. Nigeria is often referred to as the "Giant of Africa" owing to its large population size. The 2006 Nigeria provisional population census figure put the population as 140.4 million (NPC, 2006) and the current estimated figure as approximately 188.5 million inhabitants (UN, 2016). It has one of the largest populations of youths (nearly 70 million persons) in the world (NBS, 2012). The population growth rate of the country is estimated as 3.2 percent per annum NPC [Nigeria] and ICF [Macro Int.]), 2014). Nigeria is a country of rich ethnic diversity composed of over 250 ethnic groups. The three largest ethnic groups in Nigeria are the Hausa, Igbo and Yoruba.

Despite the great importance of demographic data in Nigeria, the quality of data in the country is poor as most demographic data are inaccurate, non-comprehensive, inconsistent, and sometimes outdated and untimely which may constitutes an impediment to the country's development. This study, is therefore, carried out in Nigeria in order to find an appropriate method of estimating demographic data for the country.

3.2. Study Design

The study design used in the study is cross-sectional. The age data reported for the NDHS datasets for the household were obtained from the NDHS 1990, 2003, 2008 and 2013 and demographic methods for detection of age errors were used to answer the study objectives.

$$\text{Age Ratio} = \frac{{}_5P_x}{1/2({}_5P_{x-5} + {}_5P_{x+5})} \times 100$$

Age Specific Sex Ratio = $\frac{{}_5Pm_x}{{}_5Pf_x} \times 100$,

Where ${}_5Pm_x$ stands for males aged x to x+5, and ${}_5Pfx$ stands for females aged x to x+5.

Age-specific sex ratio for persons aged 5 - 9 = $\frac{males\ aged\ 5-9\ {}_5Pm_x}{female\ aged\ 5-9\ {}_5Pf_x} \times 100$

Joint Scores = 3 x SRS + ARSM + ARSF.

3.3. Sample Design and Data Source

The study grouped age data reported into 5-years range and the United Nations Age-Sex Accuracy Index (Joint Scores) are used to check for errors in age data. In the same vein, the age reported were also cumulated into 5-years intervals and the Coale-Demeny Model Life Table for estimation of age deviations of the reported from the stable age data were used to check for irregularities in age data reported in the surveys. Graphs and charts were also plotted to show patterns of deviations in age data across all the surveys.

3.4. Statement of Ethical Approval

The study used secondary data and the approval to use the datasets was got through application online for DHS programme.

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CHAPTER FOUR

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4.1. NIGERIA DEMOGRAPHIC AND HEALTH SURVEY, 1990 AGE DATA

Table 4.1.1 below (NDHS 1990) is the estimation of the United Nation Age-Sex Accuracy Index, it reveals that the age data reported is highly inaccurate. Since the joint scores 106.77 is greater than the United Nations recommendations which stated that any score above 40 is regarded as highly inaccurate.

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Table 4.1.1: Estimation of the United Nation Age-Sex Accuracy Index (Joint Scores), Age Ratio, Age Specific Sex Ratio

	Males			Females				
Age Group	Number	Age Ratio	Dev. From 100	Number	Age Ratio	Dev. From 100	Sex Ratio	First Difference
0-4	3837	-	-	3956	-	-	97.00	-10.08
5-9	4294	123.53	+23.53	4010	110.70	+10.7	107.08	+12.37
10-14	3115	96.04	-3.96	3289	114.22	+14.22	94.71	-30.68
15-19	2193	97.97	-2.03	1749	69.06	-30.94	125.39	+48.7
20-24	1362	75.60	-24.4	1776	100.54	+0.54	76.69	-2.35
25-29	1410	105.15	+5.15	1784	109.21	+9.21	79.04	-9.49
30-34	1320	108.02	+8.02	1491	107.81	+7.81	88.53	-16.77
35-39	1034	90.23	-9.77	982	81.97	-18.03	105.30	-2.10
40-44	972	107.70	+7.7	905	110.64	+10.64	107.40	-10.49
45-49	771	90.65	-9.35	654	66.16	-33.84	117.89	+49.89
50-54	729	120.10	+20.1	1072	168.95	+68.95	68.00	-4.03
55-59	443	65.92	-34.08	615	75.05	-24.95	72.03	-36.44
60-64	615	144.03	+44.03	567	133.10	+33.1	108.47	-64.95
65-69	411	-	-	237	-	-	173.42	-
Total	**22506**			**23087**				
Total |Signs|			**192.12**			**262.93**		**298.34**
			192.12/12			262.93/12		298.34/13

Mean			**=16.01**			**=21.91**		**=22.95**

Joint Score = 3 x SR + (Male + Female Age Ratio Scores)

$$= 3 \times 22.95 + (16.01 + 21.91)$$

$$= 68.85 + 37.92$$

$$= 106.77$$

4.1.2. Coale-Demeny Model Life Table Methods for estimating deviations in age data, NDHS 1990

Table 4.1.2a below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.41years (in column 4) have been reported during the survey (1990) as under 5years (under reporting of 1.41years), those under 13.45years (column 4) have been reported as under 10years (under reporting of 3.45years), those under 18.15years (column 4) have also been reported as under 20years (over reporting of 1.85years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

Table 4.1.2a: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 13: Males

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	16.3	12.71	6.41	+1.41
10	18.4	13.68	13.45	+3.45
15	13.3	11.84	16.85	+1.85
20	9.3	10.25	18.15	-1.85
25	5.7	8.81	16.2	-8.80
30	6.0	7.54	23.9	-6.10
35	5.7	6.42	31.1	-3.90
40	4.5	5.44	33.1	-6.90
45	4.1	4.59	40.2	-4.80
50	3.3	3.85	42.9	-7.1
55	3.1	3.19	53.4	-1.6
60	1.9	2.58	44.2	-15.8
65	2.6	2.01	84.1	+19.1
70	1.8	1.48	85.2	+15.2

Table 4.1.2a: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 13: Males

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	16.3	12.71	6.41	+1.41
10	18.4	13.68	13.45	+3.45
15	13.3	11.84	16.85	+1.85
20	9.3	10.25	18.15	-1.85
25	5.7	8.81	16.2	-8.80
30	6.0	7.54	23.9	-6.10
35	5.7	6.42	31.1	-3.90
40	4.5	5.44	33.1	-6.90
45	4.1	4.59	40.2	-4.80
50	3.3	3.85	42.9	-7.1
55	3.1	3.19	53.4	-1.6
60	1.9	2.58	44.2	-15.8
65	2.6	2.01	84.1	+19.1
70	1.8	1.48	85.2	+15.2

Table 4.1.2b below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.9years (in column 4) have been reported during the survey (1990) as under 5years (under reporting of 1.9years), those under 12.5years (column 4) have been reported as under 10years (under reporting of 2.5years), those under 14.6years (column 4) have also been reported as under 20years (over reporting of 5.4years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

Table 4.1.2b below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.9years (in column 4) have been reported during the survey (1990) as under 5years (under reporting of 1.9years), those under 12.5years (column 4) have been reported as under 10years (under reporting of 2.5years), those under 14.6years (column 4) have also been reported as under 20years (over reporting of 5.4years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

Table 4.1.2b: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 13: Females

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	16.9	12.71	6.9	+1.9
10	17.1	13.68	12.5	+2.5
15	13.9	11.84	17.6	+2.6
20	7.5	10.25	14.6	-5.4
25	7.6	8.81	21.6	-3.4
30	7.4	7.54	29.4	-0.6
35	6.3	6.42	34.3	-0.7
40	4.2	5.44	30.9	-9.1
45	3.9	4.59	38.2	-6.8
50	2.8	3.85	36.4	-13.6
55	4.5	3.19	77.6	+22.6
60	2.6	2.58	60.5	+0.5
65	2.5	2.01	82.1	+17.1
70	1.1	1.48	52.0	-18.0

Table 4.1.2b: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 13: Females

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	16.9	12.71	6.9	+1.9
10	17.1	13.68	12.5	+2.5
15	13.9	11.84	17.6	+2.6
20	7.5	10.25	14.6	-5.4
25	7.6	8.81	21.6	-3.4
30	7.4	7.54	29.4	-0.6
35	6.3	6.42	34.3	-0.7
40	4.2	5.44	30.9	-9.1
45	3.9	4.59	38.2	-6.8
50	2.8	3.85	36.4	-13.6
55	4.5	3.19	77.6	+22.6
60	2.6	2.58	60.5	+0.5
65	2.5	2.01	82.1	+17.1
70	1.1	1.48	52.0	-18.0

Therefore, in a nutshell, the two demographic methods used for detection of age data errors (United Nations Age-Sex Accuracy Index (Joint Scores) Technique and Coale-Demeny Model Life Table Techniques for Measuring Deviations in Age Data) proved that the age data reported for both male and female populations (NDHS 1990) are inaccurate and rough.

4.2. NIGERIA DEMOGRAPHIC AND HEALTH SURVEY, 2003 AGE DATA

Table 4.2.1 below (NDHS 2003) shows that the age data reported is highly inaccurate. Since the joint scores 50.65 is greater than the United Nation recommendations which stated that any score above 40 is regarded as highly inaccurate.

Table 4.2.1: Estimation of the United Nations Age Sex Accuracy Index (Joint Scores)

Age Ratio, Age Specific Sex Ratio

	Males			Females				
Age Group	**Number**	**Age Ratio**	**Dev. From 100**	**Number**	**Age Ratio**	**Dev. From 100**	**Sex Ratio**	**First Difference**
0-4	2973	-	-	2867	-	-	103.70	-1.56
5-9	2660	103.97	+3.97	2527	100.22	+0.22	105.26	+6.73
10-14	2144	97.54	-2.46	2176	99.84	-0.16	98.53	+3.77
15-19	1736	95.96	-4.04	1832	96.83	-3.17	94.76	+3.09
20-24	1474	100.58	+0.58	1608	97.04	-2.96	91.67	+11.04
25-29	1195	95.49	-4.51	1482	112.27	+12.27	80.63	-19.08
30-34	1029	103.42	+3.42	1032	87.83	-12.17	99.71	+8.12
35-39	795	90.70	-9.30	868	98.19	-1.81	91.59	-6.78
40-44	724	102.84	+2.84	736	101.38	+1.38	98.37	-6.6
45-49	613	96.23	-3.77	584	84.09	-15.91	104.97	+20.74
50-54	550	111.68	+11.68	653	132.32	+32.32	84.23	-8.08
55-59	372	77.42	-22.58	403	81.17	-18.83	92.31	-28.57
60-64	411	126.46	+26.46	340	113.14	+13.14	120.88	-19.52
65-69	278	-	-	198	-	-	140.40	-
Total			**95.60**			**114.34**		**143.68**
|Signs|			95.60/12			114.34/12		143.68/13
Mean			**=7.97**			**=9.53**		**=11.05**

Table 4.2.1: Estimation of the United Nations Age Sex Accuracy Index (Joint Scores)

Age Ratio, Age Specific Sex Ratio

	Males			Females				
Age Group	Number	Age Ratio	Dev. From 100	Number	Age Ratio	Dev. From 100	Sex Ratio	First Difference
0-4	2973	-	-	2867	-	-	103.70	-1.56
5-9	2660	103.97	+3.97	2527	100.22	+0.22	105.26	+6.73
10-14	2144	97.54	-2.46	2176	99.84	-0.16	98.53	+3.77
15-19	1736	95.96	-4.04	1832	96.83	-3.17	94.76	+3.09
20-24	1474	100.58	+0.58	1608	97.04	-2.96	91.67	+11.04
25-29	1195	95.49	-4.51	1482	112.27	+12.27	80.63	-19.08
30-34	1029	103.42	+3.42	1032	87.83	-12.17	99.71	+8.12
35-39	795	90.70	-9.30	868	98.19	-1.81	91.59	-6.78
40-44	724	102.84	+2.84	736	101.38	+1.38	98.37	-6.6
45-49	613	96.23	-3.77	584	84.09	-15.91	104.97	+20.74
50-54	550	111.68	+11.68	653	132.32	+32.32	84.23	-8.08
55-59	372	77.42	-22.58	403	81.17	-18.83	92.31	-28.57
60-64	411	126.46	+26.46	340	113.14	+13.14	120.88	-19.52
65-69	278	-	-	198	-	-	140.40	-
Total			**95.60**			**114.34**		**143.68**
|Signs|			95.60/12			114.34/12		143.68/13
Mean			**=7.97**			**=9.53**		**=11.05**

Joint Score = 3 x SR + (Male and Female Age Ratio Scores)

= 3 x 11.05 + (7.97 + 9.53)

= 33.15 + 17.50

= 50.65

4.2.2. Coale-Demeny Model Life Table Techniques for Measuring Deviations in Age Data, NDHS 2003

Table 4.2.2a below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.61years (in column 4) have been reported during the survey (2003) as under 5years (under reporting of 1.61years), those under 11.05years (column 4) have been reported as under 10years (under reporting of 1.05years), those under 19.20years (column 4) have also been reported as under 20years (over reporting of 0.80years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

4.2.2. Coale-Demeny Model Life Table Techniques for Measuring Deviations in Age Data, NDHS 2003

Table 4.2.2a below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.61years (in column 4) have been reported during the survey (2003) as under 5years (under reporting of 1.61years), those under 11.05years (column 4) have been reported as under 10years (under reporting of 1.05years), those under 19.20years (column 4) have also been reported as under 20years (over reporting of 0.80years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

Table 4.2.2a: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 12: Males.

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	17.1	12.93	6.61	+1.61
10	15.3	13.84	11.05	+1.05
15	12.3	11.95	15.44	+0.44
20	9.9	10.31	19.20	-0.8
25	8.4	8.84	23.76	-1.24
30	6.9	7.53	27.49	-2.51
35	5.8	6.39	38.56	+3.56
40	4.5	5.39	33.40	-6.60
45	4.3	4.53	42.72	-2.28
50	3.5	3.78	46.30	-3.7
55	3.2	3.11	56.60	+1.6
60	2.1	2.50	50.4	-9.6
65	2.2	1.93	74.09	+9.09
70	1.6	1.40	80.00	+10.00

Table 4.2.2b below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 4.09years (in column 4) have been reported during the survey (2003) as under 5years (over reporting of 0.91years), those under 10.06years (column 4) have been reported as under 10years (under reporting of 0.06years), those under 15.42years (column 4) have also been reported as under 15years (under reporting of 0.42years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

Table 4.2.2b: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 11: Females

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	16.1	13.16	4.09	-0.91
10	14.1	14.01	10.06	+0.06
15	12.4	12.06	15.42	+0.42
20	10.3	10.38	19.85	-0.15
25	8.4	8.87	23.68	-1.32
30	6.9	7.53	27.49	-2.51
35	5.8	6.35	38.03	+3.03
40	5.1	5.34	38.20	-1.80
45	4.2	4.46	42.38	-2.62
50	3.4	3.70	45.95	-4.05
55	3.8	3.02	69.21	+14.21
60	2.4	2.41	59.75	-0.25
65	1.8	1.85	63.24	-1.76
70	1.1	1.32	58.33	-11.67

Therefore, in a nutshell, the two demographic methods or techniques for detection of age data errors (United Nations Age Sex Accuracy Index (Joint Scores) and Life Table Techniques for measuring deviations in age data) proved that the age data reported for both male and female populations (NDHS 2003) were highly inaccurate and rough.

4.3. NIGERIA DEMOGRAPHIC AND HEALTH SURVEY, 2008 AGE DATA

Table 4.3.1 (NDHS 2008) below shows that the age data reported is highly inaccurate. Since the joint scores 43.63 is greater than the United Nation recommendations which stated that any score above 40 is regarded as highly inaccurate.

4.3. NIGERIA DEMOGRAPHIC AND HEALTH SURVEY, 2008 AGE DATA

Table 4.3.1 (NDHS 2008) below shows that the age data reported is highly inaccurate. Since the joint scores 43.63 is greater than the United Nation recommendations which stated that any score above 40 is regarded as highly inaccurate.

Table 4.3.1: Estimation of the United Nations Age Sex Accuracy Index (Joint Scores)

Age Ratio and Age Specific Sex Ratio

	Males			Females				
Age Group	**Number**	**Age Ratio**	**Dev. From 100**	**Number**	**Age Ratio**	**Dev. From 100**	**Sex Ratio**	**First Difference**
0-4	13020	-	-	12644	-	-	102.97	+0.56
5-9	11670	104.80	+4.80	11395	106.41	+6.41	102.41	-3.03
10-14	9251	102.02	+2.02	8774	97.59	-2.41	105.44	+7.28
15-19	6466	88.87	-11.13	6587	87.77	-12.23	98.16	+13.15
20-24	5301	89.88	-10.12	6236	94.82	-5.18	85.01	+3.85
25-29	5330	109.24	+9.24	6567	119.74	+19.74	81.16	-13.01
30-34	4457	96.15	-3.85	4733	90.45	-9.55	94.17	-6.93
35-39	3941	103.66	+3.66	3898	99.91	-0.09	101.10	-1.41
40-44	3147	94.42	-5.58	3070	94.24	-5.76	102.51	-1.62
45-49	2725	102.44	+2.44	2617	90.70	-9.30	104.13	+23.68
50-54	2173	100.37	+0.37	2701	120.20	+20.20	80.45	-5.06
55-59	1605	79.75	-20.25	1877	87.81	-12.19	85.51	-32.15
60-64	1852	128.92	+28.92	1574	106.78	+6.78	117.66	-0.74
65-69	1268	-	-	1071	-	-	118.40	-
Total |Signs|			**102.38**			**109.84**		**112.47**
			102.38/12			109.84/12		112.47/13
Mean			**=8.53**			**=9.15**		**=8.65**

Joint Score = 3 x SR + (Male and Female Age Ratio Scores)

= 3 x 8.65 + (8.53 + 9.15)

= 25.95. + 17.68

= 43.63

4.3.2. Coale-Demeny Model Life Table Techniques for Measuring Deviations in Age Data, NDHS 2008

Table 4.3.2a below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.52years (in column 4) have been reported during the survey (2008) as under 5years (under reporting of 1.52years), those under 10.86years (column 4) have been reported as under 10years (under reporting of 0.86years), those under 16.57years (column 4) have also been reported as under 20years (over reporting of 3.43years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

Table 4.3.2a: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 16: Males.

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	17.5	13.43	6.52	+1.52
10	15.6	14.36	10.86	+0.86
15	12.3	12.21	15.11	+0.11
20	8.6	10.38	16.57	-3.43
25	7.0	8.78	19.93	-5.07
30	7.1	7.40	28.78	-1.22
35	6.0	6.22	33.76	-1.24
40	5.3	5.20	40.77	+0.77
45	4.2	4.34	43.55	-1.45
50	3.7	3.59	51.53	+1.53
55	3.0	2.94	56.12	+1.12
60	2.1	2.36	53.39	-6.61
65	2.4	1.83	85.25	+20.25
70	1.7	1.35	88.15	+18.15

Table 4.3.2a: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 16: Males.

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	17.5	13.43	6.52	+1.52
10	15.6	14.36	10.86	+0.86
15	12.3	12.21	15.11	+0.11
20	8.6	10.38	16.57	-3.43
25	7.0	8.78	19.93	-5.07
30	7.1	7.40	28.78	-1.22
35	6.0	6.22	33.76	-1.24
40	5.3	5.20	40.77	+0.77
45	4.2	4.34	43.55	-1.45
50	3.7	3.59	51.53	+1.53
55	3.0	2.94	56.12	+1.12
60	2.1	2.36	53.39	-6.61
65	2.4	1.83	85.25	+20.25
70	1.7	1.35	88.15	+18.15

Table 4.3.2a: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 16: Males.

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	17.5	13.43	6.52	+1.52
10	15.6	14.36	10.86	+0.86
15	12.3	12.21	15.11	+0.11
20	8.6	10.38	16.57	-3.43
25	7.0	8.78	19.93	-5.07
30	7.1	7.40	28.78	-1.22
35	6.0	6.22	33.76	-1.24
40	5.3	5.20	40.77	+0.77
45	4.2	4.34	43.55	-1.45
50	3.7	3.59	51.53	+1.53
55	3.0	2.94	56.12	+1.12
60	2.1	2.36	53.39	-6.61
65	2.4	1.83	85.25	+20.25
70	1.7	1.35	88.15	+18.15

Table 4.3.2a: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 16: Males.

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	17.5	13.43	6.52	+1.52
10	15.6	14.36	10.86	+0.86
15	12.3	12.21	15.11	+0.11
20	8.6	10.38	16.57	-3.43
25	7.0	8.78	19.93	-5.07
30	7.1	7.40	28.78	-1.22
35	6.0	6.22	33.76	-1.24
40	5.3	5.20	40.77	+0.77
45	4.2	4.34	43.55	-1.45
50	3.7	3.59	51.53	+1.53
55	3.0	2.94	56.12	+1.12
60	2.1	2.36	53.39	-6.61
65	2.4	1.83	85.25	+20.25
70	1.7	1.35	88.15	+18.15

Table 4.3.2b below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.13years (in column 4) have been reported during the survey (2008) as under 5years (under reporting of 1.13years), those under 10.42years (column 4) have been reported as under 10years (under reporting of 0.42years), those under 14.15years (column 4) have also been reported as under 15years (over reporting of 0.85years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

Table 4.3.2b: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 15: Females.

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	16.7	13.62	6.13	+1.13
10	15.1	14.49	10.42	+0.42
15	11.6	12.30	14.15	-0.85
20	8.6	10.43	16.49	+3.51
25	8.3	8.80	23.58	-1.42
30	8.7	7.39	35.32	+5.32
35	6.3	6.18	35.68	+0.68
40	5.2	5.16	40.31	+0.31
45	4.1	4.28	43.11	-1.89
50	3.3	3.53	46.74	-3.26
55	3.6	2.87	68.99	+13.99
60	2.5	2.29	65.50	+5.5
65	2.1	1.77	77.12	+12.12
70	1.4	1.29	75.97	+5.97

Therefore, in a nutshell, the two demographic methods for detection of irregularities in age data errors (United Nations Age Sex Accuracy Index (Joint Scores) and Coale-Demeny Model Life Table method for measuring deviations in age data) proved that the age data reported for both male and female populations (NDHS 2008) were inaccurate and rough.

4.4. NIGERIA DEMOGRAPHIC AND HEALTH SURVEY, 2013 AGE DATA

Table 4.4.1 below (NDHS 2013) reveals that the age data reported is highly inaccurate. Since the joint scores 43.82 is greater than the United Nation recommendations which stated that any score above 40 is regarded as highly inaccurate.

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Table 4.4.1: Estimation of the United Nations Age-Sex Accuracy Index (Joint Scores)

Age Ratio, Age Specific Sex Ratio

	Males			Females				
Age Group	Number	Age Ratio	Dev. From 100	Number	Age Ratio	Dev. From 100	Sex Ratio	First Difference
0-4	15187	-	-	14950	-	-	101.59	-0.67
5-9	14588	111.32	+11.32	14265	111.49	+11.49	102.26	-1.34
10-14	11023	99.70	-0.30	10640	95.34	-4.66	103.60.	+10.18
15-19	7525	89.39	-10.61	8055	91.48	-8.52	93.42	+10.02
20-24	5814	87.82	-12.18	6971	90.10	-9.90	83.40	+6.35
25-29	5716	104.43	+4.43	7419	118.11	+18.11	77.05	-14.74
30-34	5133	100.02	+0.02	5592	91.30	-8.70	91.79	-2.33
35-39	4548	102.31	+2.31	4832	104.90	-4.90	94.12	-9.66
40-44	3758	94.91	-5.09	3621	88.99	-11.01	103.78	+1.81
45-49	3371	111.44	+11.44	3306	101.24	1.24	101.97	+23.21
50-54	2292	82.62	-17.38	2910	108.32	+8.32	78.76	-26.56
55-59	2177	102.35	+2.35	2067	88.43	-11.57	105.32	-5.84
60-64	1962	113.97	+13.97	1765	111.64	+11.64	111.16	-4.46
65-69	1266	-	-	1095	-	-	115.62	-
Total [Signs]			91.40			110.06		117.17
			91.40/12			110.06/12		117.17/13
Mean			=7.62			=9.17		=9.01

Joint Score = 3 x SR + (Male and Female Age Ratio Scores)

= 3 x 9.01 + (7.62 + 9.17)

= 27.03 + 16.79

= 43.82

4.4.2. Coale-Demeny Model Life Table Techniques for Measuring Deviations in Age Data, NDHS 2013

Table 4.4.2a below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.52years (in column 4) have been reported during the survey (2013) as under 5years (under reporting of 1.52years), those under 10.31years (column 4) have been reported as under 10years (under reporting of 0.31years), those under 16.57years (column 4) have also been reported as under 20years (over reporting of 3.43years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the standard population.

Table 4.4.2a: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 16: Males.

Cumulative Age (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviations (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	17.5	13.43	6.52	+1.52
10	16.8	14.36	10.31	+0.31
15	12.7	12.21	15.60	+0.60
20	8.6	10.38	16.57	-3.43
25	6.7	8.78	19.08	-5.92
30	6.6	7.40	26.76	-3.24
35	5.9	6.22	33.20	-1.80
40	5.2	5.20	40.00	+0.00
45	4.3	4.34	44.59	+10.59
50	3.8	3.59	52.92	+2.92
55	2.6	2.94	48.64	-6.36
60	2.5	2.36	63.56	+3.56
65	2.2	1.86	76.88	+11.88
70	1.5	1.35	77.78	+7.78

Table 4.4.2b below, column (4) is calculated by linear interpolation, then column (5) was gotten by subtracting column (1) from column (4). Therefore, deviation means, for example, that those under 6.22years (in column 4) have been reported during the survey (2013) as under 5years (under reporting of 1.22years), those under 11.07years (column 4) have been reported as under 10years (under reporting of 1.07years), those under 14.62years (column 4) have also been reported as under 15years (over reporting of 0.38years) and so on. Then column (5) shows the extent of deviations either under or over reporting from the stable population.

Table 4.4.2b: Reported vs Stable cumulative distributions: Average errors in reported ages for observed distribution to equal stable, using mortality level 15: Females.

Cumulative Age x (Years)	Percentage (%) under Age x		Corresponding Age (Years) in the Stable Population	Age Deviation (Years)
	Reported	Stable		
(1)	(2)	(3)	(4)	(5)
5	16.7	13.43	6.22	1.22
10	15.9	14.36	11.07	1.07
15	11.9	12.21	14.62	-0.38
20	9.0	10.38	17.34	-2.66
25	7.9	8.78	22.49	-2.51
30	8.2	7.40	33.24	3.24
35	6.2	6.22	34.89	-0.11
40	5.4	5.20	41.54	1.54
45	4.1	4.34	42.51	-2.49
50	3.7	3.59	51.53	1.53
55	3.4	2.94	63.61	8.61
60	2.3	2.36	58.47	-1.53
65	1.8	1.83	63.93	-1.07
70	1.3	1.35	67.41	-2.59

Therefore, in a nutshell, the two demographic indices or techniques for detection of age data errors (United Nations Age-Sex Accuracy Index (Joint Scores) and Coale-Demeny Model Life Table methods for measuring deviations in age data) proved that the age data reported for both male and female populations (NDHS 2013) are highly inaccurate and rough.

Therefore, in a nutshell, the two demographic indices or techniques for detection of age data errors (United Nations Age-Sex Accuracy Index (Joint Scores) and Coale-Demeny Model Life Table methods for measuring deviations in age data) proved that the age data reported for both male and female populations (NDHS 2013) are highly inaccurate and rough.

Therefore, in a nutshell, the two demographic indices or techniques for detection of age data errors (United Nations Age-Sex Accuracy Index (Joint Scores) and Coale-Demeny Model Life Table methods for measuring deviations in age data) proved that the age data reported for both male and female populations (NDHS 2013) are highly inaccurate and rough.

4.4.3. Presentation of tables and charts illustrating distributions of United Nations Age-Sex Accuracy Index and Coale-Demeny Model Life Table methods for estimating age deviations.

Table 4.4.3a: Summary table of UN age-sex accuracy index calculated for age data, NDHS 1990 – 2013

Years	1990	2003	2008	2013
Joint Scores	106.77	50.65	43.63	43.82

4.4.3. Presentation of tables and charts illustrating distributions of United Nations Age-Sex Accuracy Index and Coale-Demeny Model Life Table methods for estimating age deviations.

Table 4.4.3a: Summary table of UN age-sex accuracy index calculated for age data, NDHS 1990 – 2013

Years	1990	2003	2008	2013
Joint Scores	106.77	50.65	43.63	43.82

Figure 1 below indicates that the age data reported for the NDHS 1990 was highly inaccurate (106.77) score, followed by the NDHS 2003 with the score (50.65), also by the NDHS 2013 with the score (43.82) and lastly by the NDHS 2008 with the score (43.63). Above all, there was an improvement in the age data reported for the NDHS 2008 and 2013 respectively when compared to NDHS 1990 and 2003.

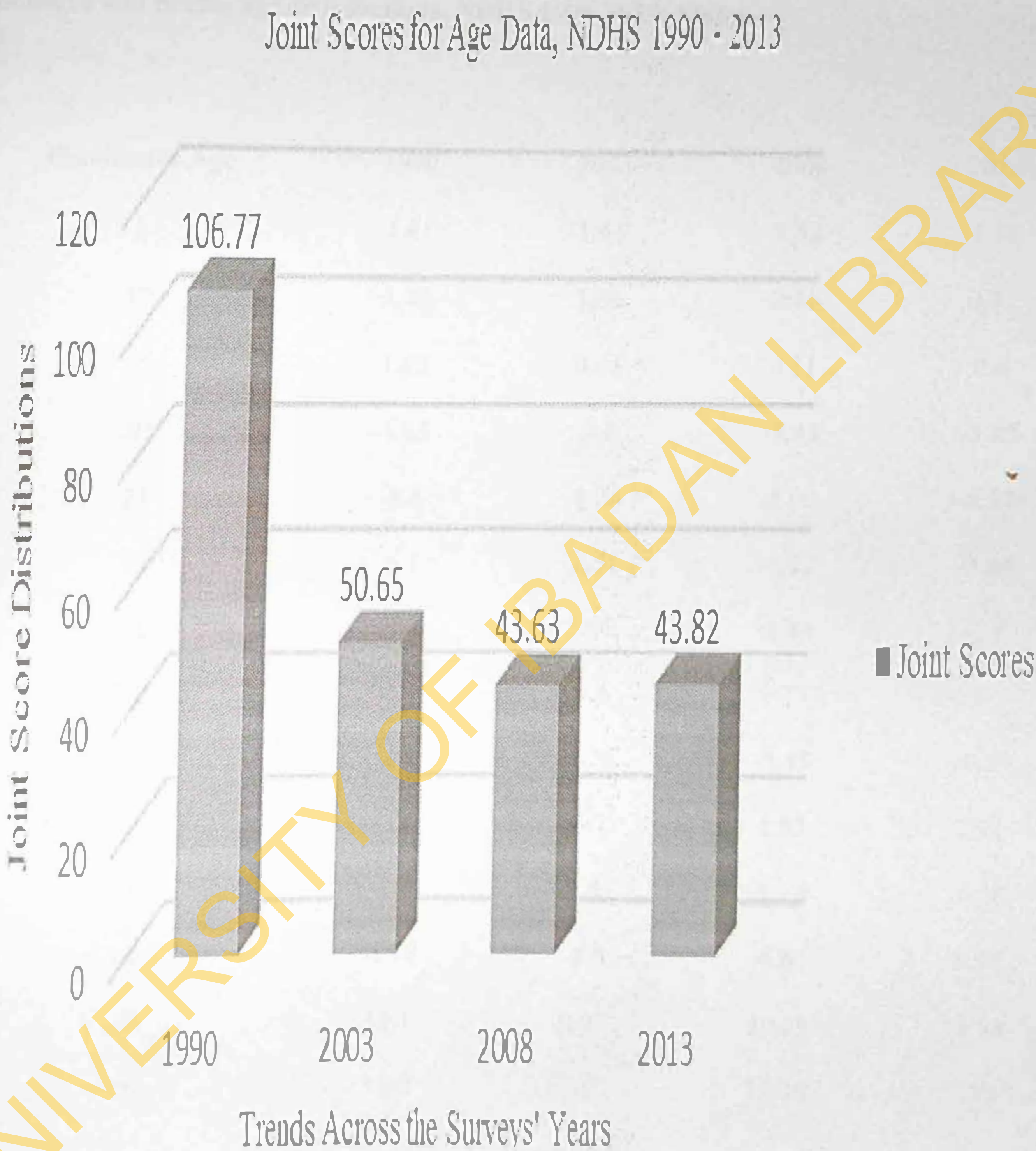

Figure 1: Bar chart illustrating ditributions of United Nations Age-Sex Accuracy Index for age data, NDHS 1990 – 2013

Table 4.4.3b: Summary table estimating age deviations (Years) between Reported cumulative and Stable age distributions, NDHS 1990-2013: Males.

Cumulative Age	1990	2003	2008	2013
5	1.41	1.61	1.52	1.52
10	3.45	1.05	0.86	0.31
15	1.85	0.44	0.11	0.6
20	-1.85	-0.8	-3.43	-3.43
25	-8.8	-1.24	-5.07	-5.92
30	-6.1	-2.51	-1.22	-3.24
35	-3.9	3.56	-1.24	-1.8
40	-6.9	-6.6	0.77	0
45	-4.8	-2.28	-1.45	10.59
50	-7.1	-3.7	1.53	2.92
55	-1.6	1.6	1.12	-6.36
60	-15.8	-9.6	-6.61	3.56
65	19.1	9.09	20.25	11.88
70	15.2	10	18.15	7.78

Figure 2 below shows different patterns of age deviations of reported ages from the stable age data, therefore age data for males populations reported are inaccurate, and there were errors of over and under reporting of ages across all the surveys.

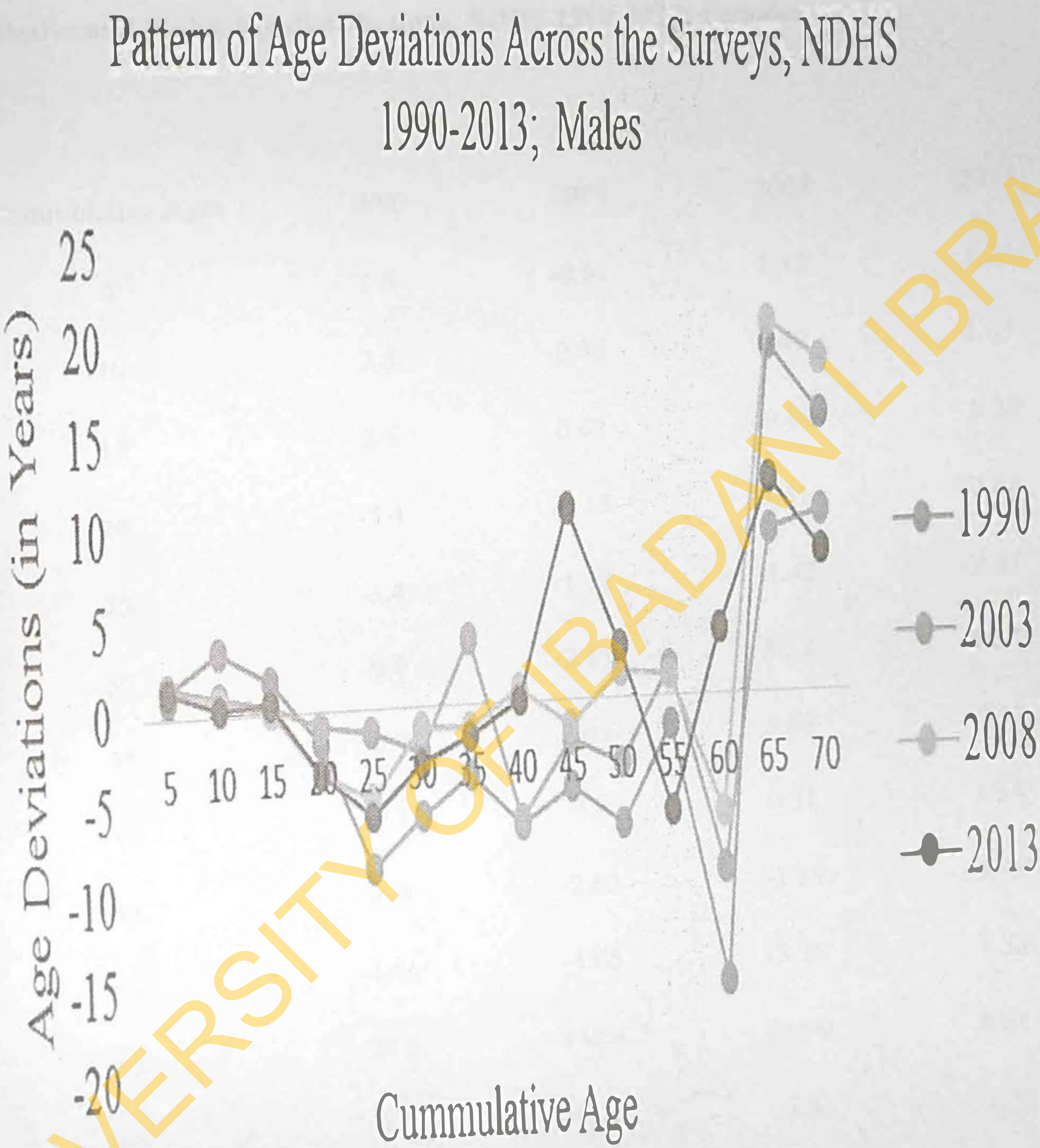

Figure 2: Graph estimating age deviations (in Years) between Reported cumulative and Stable age distributions, NDHS 1990-2013: Males.

Table 4.4.3c: Summary table estimating age deviations (in Years) between Reported cumulative and Stable age distributions, NDHS 1990-2013: Females

Cummulative Ages	1990	2003	2008	2013
5	1.9	-0.91	1.13	1.22
10	2.5	0.06	0.42	1.07
15	2.6	0.42	-0.82	-0.38
20	-5.4	-0.15	3.51	-2.66
25	-3.4	-1.32	-1.42	-2.51
30	-0.6	-2.51	5.32	3.24
35	-0.7	3.03	0.68	-0.11
40	-9.1	-1.8	0.31	1.54
45	-6.8	-2.62	-1.89	-2.49
50	-13.6	-4.05	-3.26	1.53
55	22.6	14.21	13.99	8.61
60	0.5	-0.25	5.5	-1.53
65	17.1	-1.76	12.12	-1.07
70	-18	-11.67	5.97	-2.59

Figure 3 below shows different patterns of age deviations of reported ages from the stable age data for female populations, therefore age data reported are inaccurate, there were errors of over and under reporting of ages across all the surveys.

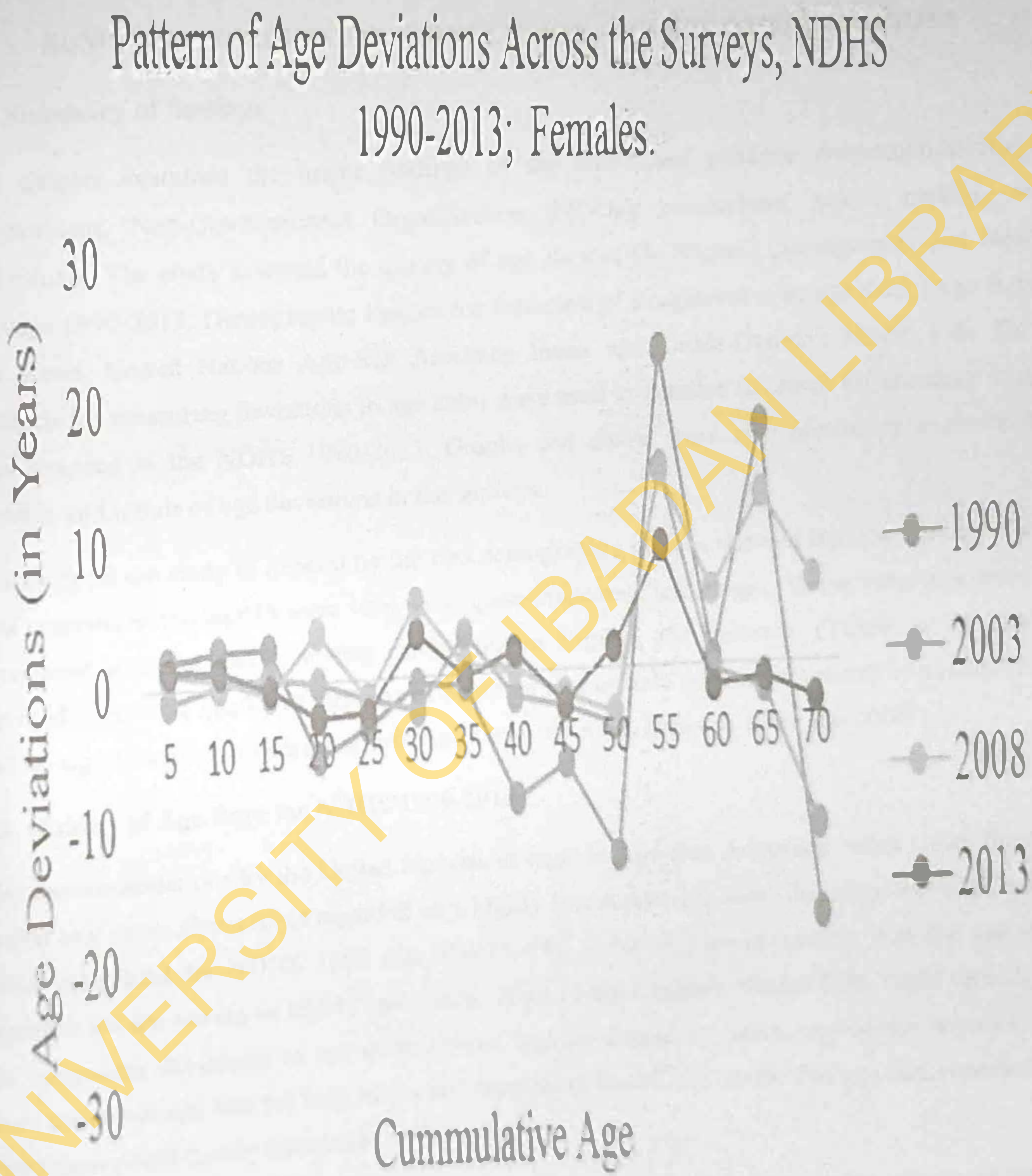

Figure 3: Graph estimating age deviations (in Years) between Reported cumulative and Stable age distributions, NDHS 1990-2013: Females

CHAPTER FIVE

SUMMARY, DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1. Summary of findings

The chapter examines the major findings of the study and possible recommendations to Government, Non-Governmental Organisations (NGOs), researchers, policy makers, and individuals. The study assessed the quality of age data in the Nigeria Demographic and Health Surveys 1990-2013. Demographic indices for detection of irregularities in age data; (Age Ratio, Sex Ratio, United Nations Age-Sex Accuracy Index and Coale-Demeny Model Life Table methods for measuring deviations in age data) were used in detailed to check for accuracy in age data reported in the NDHS 1990-2013. Graphs and charts were also plotted to evaluate the patterns and trends of age deviations in the surveys.

Results from the study in general by the two demographic indices showed that the quality of age data reported in the NDHS were very poor, quite inaccurate and rough. These outcomes were in agreement with the earlier studies carried out in Nigeria, for instance. (Tukur, *et al.* 2013), reported that; "The quality of age data in Nigerian census data is poor as a result of misreporting and no significant improvement or difference was observed between 1991 and 2006".

5.2. Quality of Age Data for NDHS 1990-2013

The recommendations by the United Nations as regards Age-Sex Accuracy Index (Joint Scores) is that any score above 40 is regarded as a highly inaccurate age data, therefore the joint scores value calculated for NDHS 1990 was 106.77, ($40 < 106.77$) an indication that the age data reported for the survey is highly inaccurate. Also Coale-Demeny Model Life Table techniques for estimating deviations in age data showed highest degree of deviations of the reported age from the stable age data for both males and females in the NDHS 1990. The age data reported for 1990 survey was mostly inaccurate and rough.

Also quality of age data for 2003, the United Nations Age-Sex Accuracy Index score was 50.65, ($40 < 50.65$) and this is above 40 recommended score by the United Nations, therefore the age data reported for NDHS 2003 were highly inaccurate. The Coale-Demeny Model Life table techniques for estimating deviations in age data for this survey showed high degree of deviations of the reported age from the stable age data for both males and females in the NDHS 2003.

Moreover, quality of age data for 2008, the United Nations Age-Sex Accuracy Index score was 43.63 (40 < 43.63), this score is above 40 as recommended by the United Nations and the age data reported for NDHS 2008 were highly inaccurate. The Coale-Demeny Model Life table techniques for measuring deviations in age data for this survey showed high degree of deviations of the reported age from the stable age data for both males and females in the NDHS 2008.

Furthermore, quality of age data for 2013, the United Nations Age-Sex Accuracy Index score was 43.82 (40 < 43.82), this score is above 40 as recommended by the United Nations, and therefore the age data reported for NDHS 2013 were highly inaccurate. Likewise, the Coale-Demeny Model Life table techniques for estimating deviations in age data for this survey showed high degree of deviations of the reported age from the stable age data for both males and females in the NDHS 2013.

5.3. Conclusion

The age data reported for NDHS 1990-2013 were not accurately reported and there were no significant improvement across all the surveys. So also the indices for data collection with the passage of time in-between the surveys 1990-2013 has not been significantly improved upon. It can be concluded that the quality of age data is very poor due to the following reasons observable in the study: "Age misreporting, age shifting, ignorance of correct age, carelessness in reporting and recording, tendency to state age in figures ending in certain digits, tendency to exaggerate length of life at advanced age, subconscious aversion to certain numbers. Mis-statements noticed also arose from motives of an economic, social, political or purely personal character" among others. These have repercussions for Government, Non-Governmental Organisations, Researchers, Demographers, Policymakers, Practitioners, Statisticians and Individuals. Therefore, these if not adjust may result in low projections for age and analysis makes on age data will not be accurate and this may lead to wrong information. Age data quality in Nigeria should be improved upon in order to prevent results bias and to enhance the reliability of age data.

Hence, the Coale-Demeny Model Life Table for the "West" is recommended the best method to correct such erroneous age mis-statement, because of its effectiveness in estimating the patterns of deviations in age data especially for country like Nigeria.

5.4. Recommendations

The following are recommended based on the findings of the study:

Educational improvement of Nigerians should be made a priority, this will go a long way in improving data quality as it was found in the study that illiteracy contributed immensely to poor data reporting.

In the same vein, greater emphasis on birth registrations should be enforceable, as higher proportion of the population do not have birth certificates. This will improve subsequent and future surveys or censuses. Aside that in future surveys/censuses, whenever age data is being collected the use of both the date of birth and asking respondent to report their completed years will complement each other in overcoming this problem where possible.

Moreover, adequate training to the interviewers/enumerators couple with practical exercises should be putting in place. It was found in the study that most of the so called enumerators do not have prior training before the surveys or censuses. Intensive training if provided with practical exercises (pre-tests) to the enumerators will enhance data quality for subsequent surveys or censuses.

Likewise, supervision, remuneration of enumerators and experience of the DHS personnel as well as from other institutions should help in getting better quality data from this huge operation. This will serve as a check on the enumerators which must be carried out by an experts like demographers, statisticians etc who are professionals in that regard. Adequate and timely remuneration will serve as an incentives to better data collection.

Also selection of enumerators should be given serious attention. Individual and household characteristics should be obtained from knowledgeable persons, this is one of the major problems we are facing in Nigeria. That is, we are not putting the right peg in a right hole.

In a nutshell, I believe absolutely that if these prescribed recommendations are employed maximally, there will be a greater improvement on the quality of age data reporting in Nigeria and this will eventually fast-track the country's development process.

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