NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: EHS 319

COURSE TITLE: INTRODUCTION TO DEMOGRAPHY

COURSE GUIDE

EHS 319
INTRODUCTION TO DEMOGRAPHY

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INTRODUCTION

EHS 319 – Introduction to Demography is a two unit credit course available to all students of Bachelor of Science (B.Sc.) Environmental Health, and other related programmes.

Demography is concerned with virtually everything that influences, or can be influenced by population size, distribution, process, structure or characteristics. Worldwide issues are really the sum of millions, indeed billions, of individual decisions and personal events,for example, everyone experiences at least two of the basic demographic processes – they are born and they die. In between, most will have children of their own; and some will migrate, at least once. In addition, there chances that you will marry, have children, and divorce. The kinds of support you can expect in old age, the price of gas at the pump, the lines at the supermarket, and the kind of housing you will find, are only a few examples of how our lives rely on demography. It is interesting to know that population changes affect our lives in a variety of ways, many of which may seem to be unrelated to population at first glance.

One of the important reasons for studying demography is that population growth can compound and magnify, if not create a wide variety of social, economic, and political problems. Weeks (1998) summarised some of the problems associated with the growth of the world's population as: food security, pollution, inflation, poor housing, reduced income, increased energy use, unemployment, illiteracy, and lack of individual freedom.

The importance of studying demography is to identify changes within the population such as: the growth of the population, mortality and morbidity rates, migration and also marriage.

In the subject matter (scope) of demography, we study: size, composition of population, distribution of population, labour force and population policy. To understand the size, composition and distribution of populations, demographers must study natality, morbidity and migration, and finally, he must search the social significance of statistics he has studied under these headings.

Demography is important to the Environmental Health Officer because it describes human population in all the variables including: age, sex, distribution in space and other characteristic factors in relation to disease and other factors. It also identifies and explains the age in cohorts and this helps in correlation of diseases and other conditions in the population and therefore facilitates targeted control and prevention measures.

WHAT YOU ARE TO LEARN IN THIS COURSE

The course contents consists of a unit of course guide which tell you briefly what the course is about, what course materials you need and how to work with such materials. It also gives you some guideline for the time you are expected to spend on each unit in order to complete it successfully.

It guides you concerning your tutor-marked assignment which will be placed in the assignment file. Regular tutorial classes related to the course will be conducted and it is advisable for you to attend these sessions. It is expected that the course will prepare you for challenges you are likely to meet in the field of Environmental Health.

COURSE AIM

The aim of the course is to provide you with an understanding of demography. It is intended to let you appreciate the uses of demographic studies in the sustainable development of Nigeria.

COURSE OBJECTIVES

To achieve the aim set out, the course has a set of objectives. Each unit has specified objectives which are stated at the beginning of the unit. You are advised to read the objectives before you study the unit because you may need to make reference to them during your study to check on your own progress. It is also good that you endeavour to check the unit objectives after completion of each unit to decipher level of accomplishment.

After going through the course, you should be able to:

- explain the concept of demography
- develop an understanding of population trends globally
- describe data collection methods; and participate in demographic data collection
- calculate some demographic measures
- interpret correctly demographic phenomena and implications for public health
- applythe knowledge of demography to public health in general and epidemiology in particular.
- usedemographic terms, methods and measures for the formulation of relevant policies.

WORKING THROUGH THIS COURSE

To complete this course, you are expected to read each study unit, as well as other related materials.. Each unit contains self-assessment exercises. In the course you would be required to submit assignment for assessment. At the end of the course there is a final examination. The course should take about 15 weeks to complete.

Listed below are the components of the course, what you have to do and how to allocate your time to each unit, in order to complete the course successfully and timely.

The course demands that you should spend good time to read and you are advised to attend tutorial session where you will have the opportunity of comparing knowledge with colleagues.

COURSE MATERIALS

The main components of the course materials are:

1. The course guide
2. Study units
3. Textbooks and references
4. Assignment file
5. Presentation schedule.

STUDY UNITS

The study units in this course are as follows:

Module 1 Principles of Demography

Unit 1 Definitions and History of Demography
Unit 2 Concept of Demography
Unit 3 Introduction to Principles of Demography

Module 2 Methods in Demography

Unit 1 Overview of Methods in Demography
Unit 2 Concept of Population and Sources of Population Data
Unit 3 Population Dynamics and Health Implications
Unit 4 Population Structure and Population Movement

Module 3 Census

Unit 1 Census: Types and Methods
Unit 2 Census Principles and Practice
Unit 3 Application of Census Data
Unit 4 Population Data and the Planning of Social Services

Module 4 Demographic Transition and Health Management

Unit 1 Concept of Demographic Transition
Unit 2 Demographic Transitions and Disease Patterns
Unit 3 Demographic Transitions and Health Services
Unit 4 Indices of Population, Health and Development

In Module 1, the first unit is focused on the definitions and history of demography. The second unit deals with the concept, objectives and people involved in demography. Unit three is about the uses, major areas of demography and factors of population change.

The first unit of Module 2 presents theories in demography and gives an overview of methods in demography, The second unit deals with human population growth and factors that limit population, The third unit has to do with the dynamics of population and their effect on health, while the last unit of the module discusses population structure and population movement and the implications for development.

In Module 3, Census types, principles, methods and procedures are treated in units 1, 2 and 3,while Unit 4 deals with the uses of population data in the planning of social services.

Module 4 introduces you to demographic transition and health management. Units1 to 3 are concerned with demographic transitions and the effect on disease patterns and health services. Unit 4 deals with the indices of population, health and development.

Each unit consists of one or two weeks work and includes an introduction, objectives, main content, reading materials, exercises, conclusion, summary, tutor-marked assignments (TMAs), references and other resources. The various units direct you to work on exercises related to the required reading. In general, the exercises test you on the materials you have just covered or require you to apply it in a way that will assist you to evaluate your own progress and to reinforce your understanding of the material. Alongside the TMAs, these exercises will help you achieve the stated learning objectives of the individual units and course as a whole.

PRESENTATION SCHEDULE

Your course materials have important dates for the early and timely completion and submission of your TMAs and attending tutorials. You are expected to submit all your assignments by the stipulated time and date and guard against falling behind in your work.

ASSESSMENT

There are three parts to the course assessment and these include: self-assessment exercises, tutor-markedassignments and the written examination or end of course examination. It is advisable that you do all the exercises. In tackling the assignments, you are expected to use the information, knowledge and techniques gathered during the course. The assignments must be submitted to your facilitators for formal assessment in line with the deadlines stated in the presentation schedule and assignment file. The work you submit to your tutor for assessment will count for 30% of your total course work. At the end of the course you will need to sit for a final end of course examination of about three hours duration. This examination will count for 70% of your total course mark.

TUTOR-MARKED ASSIGNMENT

The TMAs is a continuous component of your course. It accounts for 30% of the total score. You will be given four (4) TMAs to answer. Three of this must be answered before you are allowed to sit for the end of course examination. The TMAs would be given to you by your facilitator and returned after you have done the assignment.. However, it is desirable that you read the research more into your references, which will give you a wider view point of the subject.
Make sure that each assignment reaches your facilitator on or before the deadline given in the presentation schedule and assignment file. If for any reason you cannot complete your work on time, contact your facilitator before the assignment is due to discuss the possibility of an extension. Extension will not be granted after the due date except for exceptional circumstances.

FINAL EXAMINATION AND GRADING

The end of course examination for this course will be for about three hours and it has a value of 70% of the total course work. The examination will consist of questions, which will reflect the types of self-assessment exercises and tutor-marked assignment problems you have previously encountered. The examination covers information from all parts of the course.

COURSE MARKING SCHEME

The table below lays out how the actual marking scheme is broken down.

Table 1: Course Marking Scheme

Assignment	**Marks**
Assignment 1 - 4	Four assignments, best three marks of the four count 10% each of the 30% course marks
End of course examination	70% of overall course marks
Total	**100% of course materials**

FACILITATORS/TUTORS AND TUTORIALS

There are 15 hours of tutorials provided in support of this course. You will be notified of the dates, times and location of the tutorials as well as the name and the phone number of your facilitator, as soon as you are allocated a tutorial group.

Your facilitator will mark and comment on your assignments, keep a close watch on your progress and any difficulties you might face and provide assistance to you during the course. You are expected to mail your tutor-marked assignment to your facilitator before the scheduled date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible.

Do not hesitate to contact your facilitator by telephone or e-mail if you need assistance.

The following might be circumstances in which you would find assistance necessary, hence you would have to contact your facilitator if:

- you do not understand any part of the study unit
- you have difficulty with the assignment/exercise
- you have a question or problem with an assignment or with the grading of an assignment.

You should endeavour to attend the tutorials. This is the only chance to have face to face contact with your course facilitator and to ask questions which are answered instantly. You can raise any problem encountered in the course of your study.

To gain more benefit from course tutorials prepare a question list before attending them. You will learn a lot from participating actively in discussions.

SUMMARY

Introduction to demography is a course that intends to introduce you to the scientific study of human populations or population studies.

At the end of the course you should have a basic understanding of important concepts such as age structure, fertility, nuptiality, mortality and morbidity, migration, population projections, and demographic transition. You should also be familiar with data collection methods used in demography as well as the most important demographic measures. You will calculate some demographic measures and interpret correctly demographic phenomena and implications for public health.

In addition, you will be able to answer questions on the subject such as:

- State four objectives of demography.
- List the quantitative and qualitative aspects of demography.
- What are the factors of population change?
- State three (3) uses of demography.
- How does population affect the environment?
- Describe the effect of modernisation on pattern of disease occurrence.

The above list is just a few of the questions expected and is by no means exhaustive. To gain most from this course, you are advised to consult relevant books to widen your knowledge on the topic.

In the words of John Weeks (1994) “The applied uses of demography may help put demography in front of you for the rest of your life. You are likely to encounter demographics in magazines, newspapers, television, and in the course of your work. As that happens, please use your demographic literacy to keep track of local, national, and International population trends, because demographic events will contribute to many of the major social changes you will witness over your lifetime, just as you will continue to contribute to those population trends with your own behaviour.

I wish you success in the course. It is my hope you will find it both illuminating and useful.

GOOD LUCK!

MAIN COURSE

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MODULE1 PRINCIPLES OF DEMOGRAPHY

UNIT 1 DEFINITIONS AND HISTORY OF DEMOGRAPHY

CONTENTS

1.0 INTRODUCTION

Imagine that you are in a big city with a lot of people moving about, and it seems as if every space is occupied. Can you guess the number of people in that city? How would you know the number of men, women and children; the level of education and the occupation of everybody in this city? The answers to these questions can only come with the help of demography. So, what is demography?

Demography is the science of human population. Population here means: the inhabitants of a given area, but perhaps most importantly, the human inhabitants of the earth. In this unit, we shall look at the various definitions of demography to help your understanding of the subject.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define demography
- give various definitions of demography
- write a brief history of demography.

3.0 MAIN CONTENT

3.1 What is Demography?

Demography is the scientific study of the characteristics of human populations. Demography is usually defined as the study of human populations – their size, growth, density and distribution – and statistics regarding birth, marriage, disease and death. It is also sometimes called population studies or human ecology. Demography is considered to be a branch within the field of sociology (the study and classification of human societies).Vocabulary.com 2012 says that it isthe branch of sociology that studies the characteristics of human populations. However, Demographers have often suffered from 'identity' crises when trying to locate themselves within a scientific discipline. By nature, **demography is amultidisciplinary subject,** which emphasises rigorous data analysis using specific methods accompanied by theory that is often associated with sociology, statistics, anthropology, economics and public health, among others. According to some scholars, health demography has become a discipline in its own right.

Biggs, Kapicka and Lundgren (1998), stated that 'the study of population growth is the subject of demography'. Demography is the study of population. It looks at everything that influences population size, distribution, processes, and the influence that change in population has on other contemporary issues. **Demography** is the study of the changes in numbers of births, deaths, marriages, and cases of disease in a community over a period of time.

3.2 Other Definitions of Demography are:

- **Demography** is the study of population (Chambers, 1972).
- **Demography** is the statistical study of human populations (Oxford dictionary, 1999).
- **Demography** is the study of information in figures (Statistics) about the population of an area or country and how these figures vary with time (Procter, 1978).
- **Demography** is thestudy of the population in its static and dynamic aspects. The static aspects include characteristics such as composition by age, sex, race, marital status, economic characteristics. The dynamic aspects are fertility, mortality, nuptiality, and migration (John Hopkins University,2008).
- **Demography** is the study of size, composition, growth and distribution of human population (Henslin,2009).
- **Demography** is the statistical study of human populations and sub-populations. It can be a very general science that can be

applied to any kind of dynamic human population (Wikipedia, the free encyclopedia, 2012).

- **Demography** is the study of human population dynamics. It encompasses the study of the size, structure and distribution of populations, and how populations change over time (Wordiq.com).
- **Demography** is the statistical study of all populations (Webster's-online-dictionary,2012).
- **Demography** is the statistical study of the characteristics of human populations, such as size, growth, density, distribution, and vital statistics (Columbia Encyclopedia).
- **Demography** is the statistical science dealing with the distribution, density, vital statistics, etc. of human populations (www.yourdictionary.com**)**
- **Demography** is the study of the size, growth, age and geographical distribution of a human population(economics.about.com).

SELF-ASSESSMENT EXERCISE

Write out five different definitions of demography.

3.3 History of Demography

Demography had always existed. Throughout history, rulers have been interested in the number of population. This was important for taxation purposes and also, the power of several countries laid on a large number of men fit for military service. In addition, many philosophers pondered about the meaning of the number and structure of population.

Wikipedia (2009), outlined that: 'Demographic thoughts can be traced back to antiquity, and are present in many civilisations and cultures, like: Ancient Greece, Rome, India and China. For example, in ancient Greece, this can be found in the writings of Herodotus, Hippocrates, Plato and Aristotle. The *Natural and Political Observations ... upon the Bills of Mortality* (1662) of John Graunt contains a primitive form of life table. Mathematicians, such as Edmund Halley, developed the life table as the basis for life insurance mathematics. Richard Price was credited with the first textbook on life contingencies published in 1771, followed later by Augustus de Morgan, 'On the Application of Probabilities to Life Contingencies' (1838). The credit of fusing two Greek words to give the term demography goes to Achilles Guillard in 1885.

At the end of the 18th century, Thomas Malthus concluded that, if unchecked, populations would be subject to exponential growth. He feared that population growth would tend to outstrip growth in food

production, leading to ever-increasing famine and poverty. He is seen as the intellectual father of ideas of overpopulation and the limits to growth. Later, more sophisticated and realistic models were presented by Benjamin Gompertz and Verhuist.

The period 1860-1910 can be characterised as a period of transition wherein demography emerged from statistics as a separate field of interest. Within this period, 'great demographers' contributed to the development of demography and to the toolkit of methods and techniques of demographic analyses. Like many branches of the sciences, demography began in the 19th century (precisely 1875-80), when the general craze for cataloguing information about the world really took off (dictionary.reference.com).

4.0 CONCLUSION

Demography is the scientific study of the characteristics of human populations. Demography shows the fluctuations created by births, deaths, and migration; and as a discipline, seeks to present a statistical description of human population with respect to the structure of the population and demographic events that take place in the population.

5.0 SUMMARY

In this unit, we learnt that: Demography is also known as population studies; and is a branch of Sociology. Demography is defined as the study of size, composition, growth and distribution of human population. It looks at everything that influences population size, distribution, processes, and the influence that change in population, has on other contemporary issues. We also looked at various other definitions of demography. You saw that demography dates back to antiquity, but the 19thcentury is very important in the history of demography. All through the ages, the number of population and its development has been of interest to rulers, scientists and philosophers alike. In the next unit, you will learn more about what demography really is.

6.0 TUTOR–MARKED ASSIGNMENT

1. What is demography?
2. Write four other different definitions of demography.
3. What period would you describe as the most important in the history of demography?

7.0 REFERENCES/FURTHER READING

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UNIT 2 CONCEPT OF DEMOGRAPHY

CONTENTS

1.0 INTRODUCTION

Demography is defined as the scientific study of populations. It is clear from the definitions in unit 1 that demography is a dynamic and developing discipline and it can be studied either from its technical aspects which involve statistical analysis of the population size and its composition and factors responsible for its growth and its distribution (which is a narrow view of the subject), or from the societal aspects which are concerned with the relationship between demographic processes on the one hand and, social, economic, political. biological and ecological factors on the other.

This study of populations has a purpose and a lot of people are involved. Demography - counts, interprets, and seeks explanations for aggregate population statistics.

Let us look at the figure below.

Fig. 2.1: A Crowded Street and a completely built up area

Source: Photographs by author

Figure 2.1 depicts the picture you were asked to imagine at the beginning of unit 1. It is only with the knowledge and understanding of demography that a correct explanation of these photographs could be given.

Although demography is a vast area of study, this unit will assist you to have a general idea of the subject.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the concept of demography
- state the objectives of demography
- identify people involved in demography.

3.0 MAIN CONTENT

3.1 Concept of Demography

The word *demography* comes from two ancient Greek words, *demos*, meaning "the people," and *graphy*" meaning "writing about or recording something" or *graph* meaning shape or description. Demography literally translated from the Greek term means "writing about the people"; *a description of people.*

Demography is the study of the size, composition, dynamics and distribution of human population. Such study is important because the size of the aggregate (combination) of persons that constitute the population, its standard of living, its social system and culture are all

interrelated and have serious implications for the health and well- being of members of that population (Abanobi, 2004).

Business dictionary (Online, 2012), describes Demography as the (study) systematic research, examination, identification and understanding of both quantitative and qualitative aspects of human population. **Quantitative** aspects include composition, density, distribution, growth, movement, size, and structure of the population. **Qualitative** aspects are the sociological factors such as education quality, crime, development, diet and nutrition, race, social class, wealth, wellbeing. On the other hand, the United Nations (UN) Demographic Dictionary describes demography as *the scientific study of human populations primarily with respect to size, their, structure and their development.* Often a report is produced at the end of a study that summarises its findings and may also include recommendations on the next step(s) to be taken.

Demographic analysis can be applied to whole societies or to groups defined by criteria such as education, nationality, religion and ethnicity. Institutionally, demography is usually considered a field of sociology, though there are a number of independent demography departments. **Formal demography** limits its object of study to the measurement of population processes, while the broader field of social demography - population studies also analyse the relationships between economic, social, cultural and biological processes influencing a population (www.sociologyguide.com).

Demography therefore is concerned with the current size and characteristics of human populations, how they were attained, and how they are changing. Changes in the characteristics of human population are governed by the three main population processes: **Fertility, Mortality and Migration**. In turn, when these processes act, there are corresponding population outcomes which include changes in Population Size, Age and Sex Structure, and Spatial Organisation. Abanobi (2004) further said that one of the importance of demographic data, which has grave implications for levels of health status outcome of a population, is in population planning. This concept refers to actions undertaken by a society or the government of a nation to determine the growth and size of population it desires with the view of enabling its members enjoy fulfilling, healthy and productive lives. This is achieved by maintaining favourable equilibrium between the size and rate of growth of population, and the available resources and productive capabilities in terms of food supply, health services, educational facilities, employment opportunities, and pressure on environment.

While these main processes are the primary concern of demographers, it proves invaluable should these things not be detached from their relationships with other disciplines. As such, demography draws and contributes to the other fields of sciences ranging from Health and Medicine and Telegraphic to the social sciences such as Sociology, Anthropology and Political Science.

3.2 Objectives of Demography

Stockwell (1973), cited in Ogunbameru (2009), stated that the science of population or demography has four broad objectives namely:

a. Ascertaining the size, composition and distribution of the population in any given area of human habitation
b. Observing, measuring and describing changes in sizes, composition and distribution over time
c. Observing, measuring and describing the process through which such changes are being affected and
d. Analysing the underlying determinants and consequences of such changes.

Demography shows the fluctuations created by births, deaths, and migration; and gives information on the individual characteristics such as sex and age of each individual. Individuals make up populations and therefore, the sum of these individual quantitative and qualitative characteristics constitutes the demography. Demography as a discipline, therefore, seeks to present a statistical description of human population with respect to the structure of the population – the number of the population, composition by sex, age, marital status and demographic events (that is: births, deaths, marriage and migration) that take place in the population. From the counts of individuals in each sex and age group, secondary characteristics such as birth and death rates can be derived (Ogunbameru, 2009).

A common related word is *demographics*, referring to the raw statistical data that are used for analysis. Demographics are current statistical characteristics of a population. These types of data are used widely in sociology (and especially in the subfield of demography). Demographics mean the application of demographic science to practical problems; any applied use of population statistics. Also demographical - of or relating to demography: a portion of a population, especially considered as consumers.

SELF-ASSESSMENT EXERCISE

State four (4) objectives of demography.

3.3 People involved in Demography

Demography is a scientific study of the population. The people who study populations and their characteristics and needs are Mathematicians called Demographers. Demographers can study any type of population – plant, animal or human. Demographers study when we are born and when we die, as well as many of the really important events in our lives that occur in between (Poston and Bournier, 2010). Wikiversity (2009) stated that Demographers compute indicators that measure population size and structure, the levels of mortality, fertility and migration processes and certain aspects of demographic behaviour such as marriages, divorces, cohabitation etc. In other words, Demographers primarily handle information about basic life events like birth and death rates, migration, employment, divorce, contraceptive use, hunger, economics, access to running water, education, life expectancy, and so on.

The major professionals involved in demography are Demographers. Others are: Geographers, Sociologists, Planners, Economists and Statisticians.

Also, International organisations like: UNICEF –United Nations Children's Fund, UNFPA –United Nations Population Funds, UNDP – United Nations Development Programme, and WHO –World Health Organisation, etc. (Agencies of the United Nations: The United Nations operates several organisations with various population-related competencies, including the Commission on Population and Development, the United Nations Population Division and the United Nations Statistics Division); National Population Commissions; and other Non-governmental organisations are involved in demography.

UNFPA, the United Nations Population Fund, is an international development agency thatpromotes the right of every woman, man and child to enjoy a life of health and equalopportunity. UNFPA supports countries in using population data for policies and programmesto reduce poverty and to ensure that every pregnancy is wanted, every birth is safe, everyyoung person is free of HIV, and every girl and woman is treated with dignity and respect,because everyone counts (UNFPA, 2011).

Furthermore, all professionals that have anything to do with populations, and in fact, every individual are involved in demography, because: it is either you are collecting information or you are part of the information being collected.

Poston Dudley L. and Bournier Leon F. (2010), described demography as the study of many of the most important events in our lives, and we are very much involved in these events. They stated that 'we are all population actors' even though we hardly realise it.

Some historical persons central to demography, most of whom cannot be considered actual demographers but they have been involved in matters that later developed into a field of science in its own right – demography, are: John Graunt, William Petty, Edmund Halley, Benjamin Gompertz, Wilhelm Lexis, and Alfred Lotka.

SELF-ASSESSMENT EXERCISE

What do demographers do?

4.0 CONCLUSION

Demography is the scientific study of the characteristics of human populations. It relies heavily on statistical data, collecting, interpreting, and presenting the information to determine trends.

The study of populations is important because the size of the combination of persons that constitute the population, its standard of living, its social system and culture are all interrelated and have serious implications for the health and well- being of members of that population.

5.0 SUMMARY

In this unit, we learnt that: Demography is described as the (study) identification and understanding of both quantitative (composition, density, distribution, growth, movement, size, and structure of the population) and qualitative (sociological factors such as education quality, crime, development, diet and nutrition, race, social class, wealth, wellbeing) aspects of human population.

We found out that the major objectives of demography are: Finding out the size, composition and distribution of the population in any given area of human habitation; Observing, measuring and describing changes over time; Observing, measuring and describing the process through which such changes are being affected; and Analysing the underlying determinants and consequences of such changes. We identified Demographers as the major professionals that handle demographic information. Others are: Geographers, Sociologists, Planners, Economists and Statisticians. Also, national and international

government and non-governmental organisations are involved in demography.

6.0 TUTOR-MARKED ASSIGNMENT

1. List the quantitative and qualitative aspects of Demography.
2. What characteristics of the population do Demographers study?

7.0 REFERENCES/FURTHER READING

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UNIT 3 INTRODUCTION TO PRINCIPLES OF DEMOGRAPHY

CONTENTS

1.0 INTRODUCTION

In unit 2, you learnt that demography is the study of populations, and you had the general idea of the subject. Why do we need to read this subject? Why do we care about demography? Here, you will learn the uses of demography, and the major areas in demography.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the basic principles of demography
- state the uses of demography
- identify the major components of demography
- explain demographic variables.

3.0 MAIN CONTENT

3.1 Demographic Principles

Demography is the science that studies human population from different aspects. Demography is very important for health planning, recruitment and allocation of resources. It is clear that demography performs all functions characteristic of science such as cause and effect relation and prediction about the future. It employs scientific methods of observation and analysis. It is factual as well as universal. It is veridical. It establishes cause and effect relationship. Its laws are verifiable generalisations

Weeks (1998) and Ashry (2012) explained that demography may describe population from three main aspects, namely: size, composition and distribution.

Population Size

Population size is the number of people who live in a specified geographical area during a defined time.The size of the population is the total number of people in a givengeographical area such as a country, a state, a town or a community. This number is derived through head counts and periodic statistical projections. To know the number of all persons in the community, we use either census or estimated population.

Composition

This is the description of the quality of the population as shown by the population pyramid (graphical presentation of age and sex composition of the community) shown in Figure below.

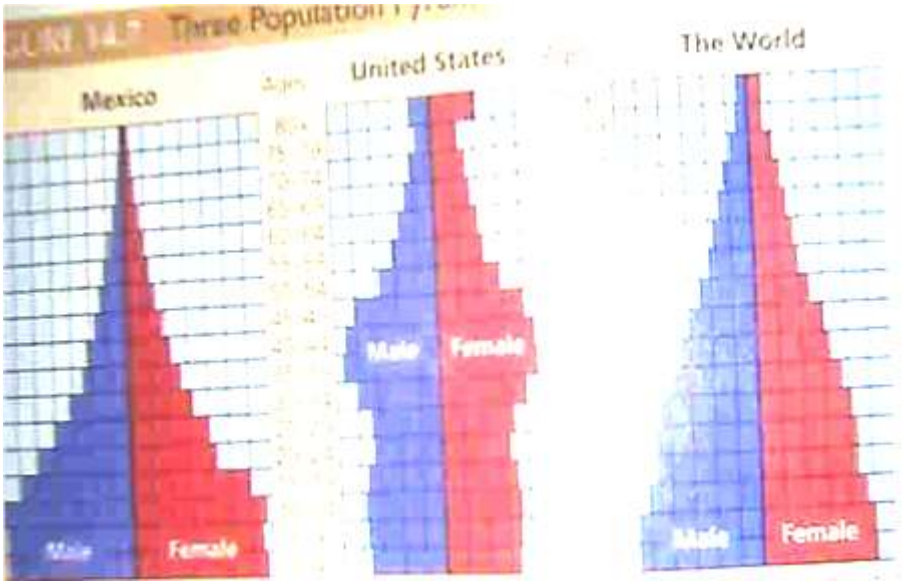

Fig. 3.1: Population Pyramids of Mexico, USA and the World

Source**:** Population Today (1998), cited in Henslin (2009). *Essentials of Sociology.* p. 402.

Study the three population pyramids for: Mexico, United States and the World in Figure above. The population pyramid is drawn as two histograms, one for each sex. Then the two histograms are rotated to settle on their side and back to back, forming a pyramid with the percentage on horizontal line and age on vertical one, with males on the left side and females on right one. Shape of the pyramid varies for different countries according to the age distribution of the population.

From the shape of the pyramid, conclusions are made about:

- Sex ratio: Percentage of males and percentage of females.
- Age structure: Percentage of each stratum.
- Mortality and emigration: Slope of the sides.
- Life span: Height of the pyramid and shape of the apex.
- Median Age: The point in the vertical axis of age through which passes the horizontal line that divides the surface area of the pyramid into two equal parts (50% younger and 50% older) and
- Dependency Ratio.

About population composition, Ogunbameru (2009), outlined that: "the basic characters used to express features of population as noted above are: number, space and time. These characters should not be confused with the factors that cause change in population. The relationship between characters and the factors is that characters enable us to talk about density (how many there are in a given space), distribution (how they are arranged in that space), and changes in density and distribution with respect to time. Each of the factors can operate at high or at low rates or of course, they can remain stable. Four possible conditions can, theoretically, result from their occurrence. For instance, births can be high or low and deaths can be high or low.

Consequently, the four expected results would be as follows:

- Births high + Deaths High = Stable population at low level.
- Births High + Deaths Low = A growing population with spreading age base.
- Births Low + Deaths High = A declining population.
- Births Low + Deaths Low = Stable population but aging.

Any such shift in population structure is called a demographic transition and can be of several kinds. Briefly stated, the theory of demographic transition "is an interpretation of historical changes in vital rates, from high to low rates of mortality and fertility and the trends in population growth in the process" (Notestein, 1945). The theory postulates that economic development causes a decline in death rate, which is followed after a time lag by a fall in the birth rate to stabilise population growth. This is based on the experience of industrialised countries. If the circumstances and the processes of economic development repeat themselves, developing countries, where mortality is already falling are thus expected to go from a stage of low mortality and continued high fertility to a state of low mortality and low fertility as in the developed countries.

Basically there are at least three axioms of human population:

- A declining population consists predominantly of old dependents.
- A declining population takes place because of lack of births or by emigration both of which result in a residual population of old people.
- A balance of births and deaths maintain a stable population.

This leads to the categorisation of population based on composition of ages. The first person to do the categorisation was Sandburg. He observed certain empirical circumstances between age structure and the rate of population growth and identified these types:

- Stationary population: Having moderate proportion of children and old persons and slow growth or stationary number.
- Regressive population: This has a high proportion of old persons and declining number of birth.
- Progressive population: High population of children and high growth rate.
- Ageing population: The concept of ageing population relates to the relative proportion of age distribution. It is a concept that is difficult to define because various countries tend to have different age group and this depends mostly on retirement age. Once a country has decided on what to be referred to as old age, and then moving toward this age, one can say the population is aging. Therefore, there cannot be a widely acceptable rule for defining aging population. In spite of the problem of definition, it is clear from Sandburg's topology that, the oldest population in technologically advanced countries is high considering such factor like low mortality.

The process of ageing in many advanced societies is also associated with a differential death rate between males and females. In most populations, males die earlier, leaving a preponderance of old females, even though there tends to be more births of males than of females. Males in most primitive tribes face higher environmental hazards from the risk of earning a living.

Distribution

Spatial organisation and the population mechanism are inseparable. Demography shows how people are distributed in the world by continent, countries, regions, urban versus rural areas or desert, natives, foreigners and races. Population distribution depends on environment, and environment has a great deal to do with population density as well.

3.2 Uses of Demography

Weeks, (1998) observed that demography is one of the areas in sociology that treats things from the practical point of view. The uses of demography are seen in our lives every day. Russ Long (2008), highlighted that demography can be used in politics, by government, as well as in business.

3.2.1 Demography and Politics

Politics is all about democracy, which is 'government of the people, for the people, by the people'. It is demographic results that will show the number of people to be governed, the areas (location, communities) to be governed or represented and the actual people (eligible voters) who will bring them to power. Demography is also an essential tool used in ensuring equal representation in Congress – National (Senate & House of Representative) and State houses of Assembly and Local Government Councils. For example, the makeup of the House of Representatives is determined by population distribution: each Local Government Area is represented.

3.2.2 Demography and Government

Government uses demography to plan and allocate resources. Demographic studies help to identify the various groups in a community, like: children, women, men, physically challenged, elderly, and youths etc. It is this information that is used in the allocation of resource to suit the needs of each group. For example, the recent out-reach education strategy launched in various parts of Nigeria by the Federal Government, to ensure that every child, no matter his/her circumstances, goes to school.

3.2.3 Demography and Business

People who are doing business can use the study of population to their advantage. The result of population studies could be put to specific use in business. For example, if a business sells a product that is desired or required by age-specific groups, that business can use information from demographic studies to discover communities where members of that age-specific group live. For example, a business of stationery will work out very well in areas where there are many students. A shop that sells fashionable dresses and shoes for young people will do very well in a college/University environment. Fertilizer will sell best in a farming community. What we are saying is that, demographic awareness could help in finding neighbourhoods where a business would yield the most profit and satisfaction.

3.3 Major Components of Demography

The major components of Demography include the following:

Demographic Perspective

Demographic perspective means understanding of the relative importance of and, particular attitude towards population issues. Demographic perspective is a way of relating basic information to theories about how the world operates demographically.

Demographic perspective influences the way people understand and interpret questions involving population. Some examples of demographic perspective are: the Malthusian theorem, and the Demographic transition model.

Population Processes

There are three main factors that cause changes in population. These three basic population processes, otherwise known as components of population change, include birth, death, and migration. Gains and losses from whatever cause, the bases of the dynamics, sometimes are called the population mechanism. Births add to population, while deaths subtract from the population. Migration can either add or subtract from the population (Ogunbameru, 2009).

Population Structure

Population structure addresses the relationship between population processes and demographic characteristics of populations such as the age and sex of a given population, the race and ethnicity of a population, their socioeconomic status, and education.

Population and Contemporary Social Issues

Weeks (1989), cited in Russ Long (2008), explored the demographic explanations of major issues confronting the world and contended that population growth often starts other problems that people face. Hanlon and Pickett (1998), Henslin (2009), and Ogunbameru (2009) all agree that demographic processes and structure interact with social issues like: Food security, women's rights, family structure, unemployment, aging, housing and urbanisation, economic development, inflation, energy, pollution and the ecosystem, literacy and education, and finally issues about individual freedom.

3.4 Demographic Variables

How does population change?
The population changes in accordance with three demographic variables: fertility/births,mortality/deaths and migration. This is otherwise known as components of population change. Population growth or decline in a society is influenced by the birth rate, the death rate, and the migration rate. Gains and losses from whatever cause, are the bases of the dynamics sometimes called the population mechanism.

Births add to population, while deaths subtract from population. Migration can either add or subtract from the population. Therefore, the growth of a nation's population is determined by the number of births minus the number of deaths plus the net migration rate. Thus, we have what is called balancing equation which is given as:

P t = Po + B – D _+M.
Where:

Pt = population at the time in the future
Po = the base population
B = births between time o and t
D = deaths between time o and t
M = net migration.

It will be clear from balancing the equation what the various sources of demographic data should be and they include P t and P o, which can be obtained through census, as well as D and B, which we can get through vital registration.

3.4.1 Fertility

Fertility explores the level of reproduction in a society. It refers to the number ofchildren born to a woman. Fecundity refers to the physical ability to reproduce.Demographers distinguish between population increases that happen because offertility (or natural increase) and increases that happen because of migration. Keepin mind that population growth will be negative if more people are dying than they are being born.

Birth Rate

The birth rate is the number of babies born every year for every thousand of a given population. The birth rate is called crude birth rate, which indicates that it is not a refined measure of fertility. One major

purpose of this measure is that it described the impact of fertility on population growth.

3.4.2 Mortality

The second demographic variable, mortality, refers to dying. Historically, disease determined mortality levels. Today, because of better health conditions and better medical care, disease has ceased to be an important issue (except in the realm of HIV/AIDS).The major causes of death are now degenerative problemslike heart disease.

Age impacts mortality levels early and late in life. Congenital health problems influence morality rates early in life. Death rates for infants are higher than death rates for older children. One explanation is that infants are less resistant to disease. When life expectancy increases, it does so because death is controlled at the beginning of life. Babies will live longer, but all those babies will bring down the average age of the population. Teens tend to die from accidents. The elderly suffer from degenerative problems.

Death Rates

The death rate is the number of deaths in a year for every 1000 members of a population. It is the simplest and commonest measure of mortality. Like birth rate, death rates are affected by many population characteristics, particularly age and age structure. Death rate has specific and general meaning. In specific terms, it could refer to the general death rate from the total population of an area. More generally, it may be used to refer to the general death rate for any population (the male population, female population).

3.4.3 Migration

The third way populations change is by migration. Migration could be immigration or emigration. Immigration refers to people moving in and emigration refers to peoplemoving out.People move for jobs more than for any other reason. Young people between the ages of 20 and 30 are the most mobile. Compared to the people in a population who do not migrate, migrants ahave higher levels of education. Obviously, people who move are more motivated than those who do not. The donor area is adversely affected. They lose young, motivated, andeducated people. The donor area loses the investment in those individuals. It costs the community resources to raise a young, motivated, educated worker. The community loses that investment. The recipient area gets a young, motivated, and educated citizen and has to pay nothing for that person's development.

4.0 CONCLUSION

Demography is one of the areas in sociology that treats things from the practical point of view and is therefore very important for health planning, recruitment and allocation of resources. Demography shows how people are distributed in the world by continent, countries, regions, urban versus rural areas or desert, natives, foreigners and races.

5.0 SUMMARY

In this unit, we looked more closely at demography and learnt that:
Demography can be used in every aspect of our lives like politics, by government and in business; and it describes population from three main aspects of size, composition and distribution.

The major components of demography were identified as: demographic perspective which influences the way people understand and interpretquestions involving population; population processes, otherwise known as components of population change which include birth, death, and migration; population structure; that is, characteristics of populations such as the age and sex of a given population, the race and ethnicity of a population, their socioeconomic status, and education; and that demographic processes and structure interact with other social issues.

The population changes in accordance with three demographic variables: fertility/births,mortality/deaths and migration. This is otherwise known as components of population change.

6.0 TUTOR-MARKED ASSIGNMENT

1. What are the factors of population change?
2. State three (3) uses of demography.
3. Briefly explain the terms: population size, population composition and population distribution.

7.0 REFERENCES/FURTHER READING

Henslin, James M. (2009). *Essentials of Sociology*: *A Down-to- Earth Approach.* (8th ed.).U.S.A.: Allyn and Bacon.

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MODULE 2 METHODS IN DEMOGRAPHY

UNIT 1 OVERVIEW OF METHODS IN DEMOGRAPHY

CONTENTS

1.0 INTRODUCTION

The analysis of demographic changes relies on the availability of accurate data about the relevant population characteristics and processes. The main features of formal demography, which we are studying, are that it is fundamentally descriptive or analytic rather than explanatory in nature, and that is concerned with demographic phenomena in isolation. It tries to answer questions which begin with ‘what is ----?’

Recall that in units 1 and 3, we defined demography as statistical study of populations and saw the components of demography, one of which is

demographic perspective. In this unit, you will see theories of demography, which form the demographic perspective; and you will start learning how data is collected and used to measure the demographic variables: Fertility, Mortality and Migration.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain some theories of demography
- describe the methods of data collection
- identify the various methods of analysing demographic data
- utilise the knowledge of demographic methodology in appreciating reports.

3.0 MAIN CONTENT

3.1 Theories of Demography

3.1.1 Malthus Theory

The essay on "the principle of population", an important work of Malthus is a landmark in the history of population studies. The theme of the essay was mainly to argue that the tendency of the population to grow faster in relation to its means of subsistence has led to human misery and placed several obstacles in the path of human progress. In 1803, Malthus published the second edition of his essay, a much expanded and changed edition which can't really be called a re print of the 1797 essay, for in the new edition, the emphasis was more on arguments against the poor laws than on country arguments against the opinions of Condorcet and Godwin.

Economic Theories of Population

Many Economists and Demographers argue that: with more income, people want more economic goods. Other things being equal, they would want more children. But other things are not equal. With incomes high, mother and father would lose much if they interrupt their careers. If parents are affluent, they wish to give greater quality to the upbringing of their children. The parents do not have much time so; only one, two or three children can be given intensive parental care which a larger family could not receive. Moreover, the city children are no longer the economic asset they used to be on the farm. With improved modern health care, child survival is high and the elderly are also somewhat cared for. All these shift the decision against the larger family.

The Malthusian Theory of Population

The law of diminishing returns has an important and interesting application in the field of population. Around 1800, Thomas Robert Malthus (1766-1834), a young English Clergyman, and Economist used to argue at breakfast against his father's perfectionist view that the human race was getting ever better. Finally, the son became so agitated that he wrote a book that became world's famous: An essay on the principle of population (1798). In it, Malthus proposed what became known as the Malthus theorem. He argued that although population grows geometrically, the food supply increases only arithmetically. This meant, he claimed, that if births go unchecked, the population of a country or even of the world will out strip its food supply.

The book influenced the thinking of people all over the world (including Charles Darion, the expositor of the doctrine of biological evolution). Malthus' views depend directly on the law of diminishing returns and continue to have relevance.

Malthus postulated, therefore, a universal tendency for population, unless checked by food supply, to grow at a geometric progression. Geometric progression grows fast and soon 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1,024…. becomes so large that there will be no space in the world.

3.1.2 Neo-Malthusian Theory

Neo-Malthusians maintain that although the gloomy predictions of Malthus may have been pre-mature. They are basically correct. According to Anti Malthusians' world's resources are adequate for a much larger population. Exploitation not over population is the basic cause of world hunger.

3.1.3 Demographic Transition Theory

Two different interpretations have been given for this theory.

1) Frank Notestein says that every country passes through three stages of population growth:

   i. High birth rate and high death rate
   ii. High birth rate and low death rate (population explosion)
   iii. Low birth rate and low death rate. In western nations, the desire for high standard of living led to the reductions in the birth rate .These nations are approaching a new equilibrium with both birth rates and death rates quite low

and little population growth. This is explained by the theory of demographic transition -the theory that industrial and commercial development first cuts the death rate but creates a desire for smaller families and eventually cuts the birth rate.

2) The other theory is given by C.P Blacker. There are five phrases in this theory:

   i. High stationary phase marked by high fertility and mortality rates
   ii. Early expanding phase marked by high fertility and high but declining mortality
   iii. Late expanding phase with declining fertility but mortality declining more rapidly
   iv. Low stationary phase with low fertility and equally low mortality
   v. Declining phase with low mortality, low fertility and an excess of deaths over births.

3.1.4 Optimum Population Theory

According to Canan, the profounder of this theory, population must grow up to certain desired level after which further growth is harmful. The two important principles of this theory are:

1. When there is an increase in population then the ratio between the total population and the working population remains almost constant
2. When at a point of time the population of a country increases, the natural resources capital and technical knowhow do not change with the result that after sometime the law of diminishing returns begins to operate. This law provides that for maximum production all the sources of production should be combined in that proper ratio than it shall not be possible to have maximum production.

SELF-ASSESSMENT EXERCISE

What is the main thought of each of these theories?

3.2 Data Collection Methods

There are two types of data collection: direct and indirect — with several different methods of each type.

3.2.1 Direct Methods

Direct data come from vital statistics registries that track all births and deaths as well as certain changes in legal status such as marriage, divorce, and migration (registration of place of residence). In developed countries with good registration systems (such as the United States and much of Europe), registry statistics are the best method for estimating the number of births and deaths.

Census is the other common direct method of collecting demographic data. A census is usually conducted by a national government and attempts to enumerate every person in a country. However, in contrast to vital statistics data, which are typically collected continuously and summarised on an annual basis, censuses typically, occur only every 10 years or so and thus are not usually the best source of data on births and deaths. Analyses are conducted after a census to estimate how much over or undercounting took place. These compare the sex ratios from the census data to those estimated from natural values and mortality data.

Censuses do more than just count people. They typically collect information about families or households in addition to individual characteristics such as age, sex, marital status, literacy/education, employment status, and occupation, and geographical location. They may also collect data on migration (or place of birth or of previous residence), language, religion, nationality (or ethnicity or race), and citizenship. In countries in which the vital registration system may be incomplete, the censuses are also used as a direct source of information about fertility and mortality; for example the censuses of the People's Republic of China gather information on births and deaths that occurred in the 18 months immediately preceding the census.

Census Data Collection

Accurate population data is a vital ingredient of social and economic policy. Governments cannot deliver efficient services and infrastructure without knowledge of the national demographic profile – the size of the population, where people live, how old they are, and the net effect of births, deaths and migration.

Compiling this essential information is far from straightforward. The conduct of a census requires professional management, a very large number of enumerators, and the application of new technologies and skilled interpretation of the results.

Nigeria is one example of a country which has had consistent difficulty in delivering reliable census results, doubly unfortunate in that it is

Africa's most populous nation. Led by the UN Population Fund (UNFPA), international agencies often provide generous financial and logistical support for census production in developing countries.

The UN strives to ensure that data has value in the global as well as national domain. Its 2010 World Population and Housing Census Programme have sought out the cooperation of every country to complete at least one census between 2005 and 2014. This agenda peaked in 2011 with censuses conducted in 70 countries (UNFPA, 2011).

3.2.2 Indirect Methods

Indirect methods of collecting data are required in countries where full data are not available, such as is the case in much of the developing world. One of these techniques is the sister method, where survey researchers ask women how many of their sisters have died or had children and at what age. With these surveys, researchers can then indirectly estimate birth or death rates for the entire population. Other indirect methods include asking people about siblings, parents, and children.

SELF-ASSESSMENT EXERCISE

Discuss the methods of data collection.

3.3 Demographic Methodology

Definitions

John Hopkins University (2008) defined some terms which may be met in this introduction to demographic methods as:

Demographic analysis: study of components of variation and change in demographic variables and the relationships between them. This is also called formal demography.

Demographic and health surveys: nationally representative household surveys carried out in about 50 developing nations by Macro International Inc. The objective of the surveys is to provide data concerning fertility, family planning and maternal and child health that can be used by program managers, policymakers and researchers. In the household questionnaire, there are questions on household composition, education and occupation of the wife and husband, household facilities, and household possessions, etc. Women of reproductive age in the households are identified and interviewed. The woman's questionnaire

includes sections on background characteristics, a birth history, knowledge and use of family planning, breastfeeding, immunisation and health of children under age five, marriage, and fertility preferences, etc.
Net nuptiality tables: takes into account mortality as well as marriage. Indicates the pace at which a group of single persons is decreased annually by marriage and death. Also gives the probability of a single person marrying at each year of age according to the current nuptiality and mortality rates. This also provides information on the average age at marriage. Multiple decrement life table techniques are needed.

Rate: Measure of the frequency with which an event occurs in a defined population during a given length of time. Consider the average number of people exposed i.e. midpoint population. Rates are special cases of a ratio and tend to be associated with population change.

Rate of natural increase: crude birth rate–crude death rate.

Ratio: value obtained by dividing one quantity by another. Ratio indicates the relative magnitude of a numerator and a denominator.

Standardisation: procedure of adjustment of crude rates to eliminate from them the effect of differences in population composition with respect to age and/or other variables. Note: adjusted rates have no direct meaning in themselves. They must be compared with the original crude rates or with other adjusted rates using the same standard

3.3.2 Analysis of Demographic Data

A standard array of techniques and measures forms the basis of much demographic analysis, the most common of which are described briefly below. Further detail is supplied in a number of textbooks (Shryock *et al.* 1976; Newell 1988; Pollard *et al.* 1990; Hinde 1998). Analysis involves not just the application of a particular technique, but decisions about what units of analysis to use and how to group them.

Rowland (2003) stressed that demographic methods assist in exploring and explaining some of our richest and most reliable sources of information about changes in societies. Also, there are many applied and practical subject areas requiring expertise in using demographic information. These include: planning for housing, schools, and urban services; public policy formulation in education, employment and health; and decision- making for business and private organisations.

Let us look at methods most commonly needed to analyse demographic information at national, regional and local levels.

There are a variety of demographic methods for modeling population processes. They include models of:

- Mortality- (including the life table, Gompertz models, hazards models, Cox proportional hazard models, multiple decrement life tables, Brass relational logits);
- Fertility – (Hermes model, Coale-Trussell models, parity progression ratios);
- Marriage – (Singulate Mean at Marriage, Page model);
- Disability – (Sullivan's method, multistate life tables);
- Population projections – (Lee Carter, the Leslie Matrix); and
- Population momentum – (Keyfitz).

3.3.2.1 Measurement of Fertility

Fertility means the child-bearing performance of a woman, couple, or population. Generally only live births are included. The simplest measure of fertility commonly used is the crude birth rate—the number of births in a particular year per 1000 population. As the denominator of this includes those not 'at risk' of giving birth (men and women outside the reproductive age groups), it is really a ratio rather than a rate. Crude birth rates are influenced by the age structure of the population, but less seriously than crude death rates.

Fertility is a more refined measure of the "risk" of birth in a population. The denominator is specific to persons in the population who are susceptible to pregnancy and childbirth, namely women of childbearing age, and not the total population.

$$\textbf{Crude Birth Rate} = \frac{\text{Number of live births in x}}{\text{Mid-year Population in time, x}} \times 1000$$

The Mid-year population is the population of an area as at 1st July of the year being considered. We can also refer to mean population as being equivalent to midyear population.

Mid-year/mean population, $P = ½ (Pt + Pt + n)$.
Where, Pt = Initial population; Pt+ n = population at a new date; and n = Time interval

Fertility is a more refined measure of the "risk" of birth in a population. The denominator is specific to persons in the population who are susceptible to pregnancy and childbirth, namely women of childbearing age, and not the total population.

$$\textbf{General Fertility Rate} = \frac{\text{Total number of births in year t}}{\text{Total population of women aged 15-49years}} \times 1000$$

$$\textbf{Age-Specific Fertility Rate (ASFR)} = \frac{\text{Number of births to women aged x to x+ n years}}{\text{Number of women aged x to x+ n years}} \times 1{,}000$$

ASFRs are frequently calculated for 5-year age groups from 15–19 to 40–44 or 45–49.
Total Fertility Rate (TFR) = ∑ (ASFR x 5)

$$\textbf{Gross Reproduction Rate (GRR)} = \text{TFR} \times \frac{\text{Female births}}{\text{All births}}$$

Net Reproduction Rate (NRR) = The NRR represents the number of female children that a female child just born can expect to bear, taking into account her risk of dying before the end of her reproductive years. Thus, the NRR is always less than the GRR, since some people always die before the end of their reproduction.

$$\textbf{Completed Fertility Rate or Final Birth Rate} = \frac{\text{Total number of births by all married women at the end of their reproductivity}}{\text{Total number of married women at the end of their child-bearing period}} \times 1000$$

= number of children ever born per 1,000 women at the end of their reproductive years (49years old)

$$\textbf{Sex Ratio} = \frac{\text{Number of males in population}}{\text{Number of females in population}} \times 100$$

$$\textbf{Child-Woman Ratio (CWR)} = \frac{\text{Total number of children aged 0-4 years}}{\text{Women aged 15 - 49 years}} \times 1{,}000$$

Reproduction rates

In the long term, populations will grow if mothers replace themselves with one or more (surviving) daughters and decline if they fail to achieve this. Theoretically, it would also be possible to measure the replacement of fathers by sons, but in practice, the difficulties involved in obtaining paternity data make this unfeasible. Reproduction rates thus relate only to female fertility—that is, births of daughters. The gross reproduction rate is derived in exactly the same way as the total fertility rate except that age-specific birth rates based only on births of daughters are used in the calculation.

3.3.2.2 Measurement of Mortality

As for fertility, the simplest measure of mortality is the crude mortality rate, deaths per 1000 population. However, as noted above, this is

strongly influenced by age structure, and age- and sex-specific rates, or measures based on them, which are much preferred if data are available to calculate them. As in epidemiology, both direct and indirect standardisations are sometimes used to make comparisons between populations with different age and sex structures.

The **CDR** of a given population is defined as the number of deaths per 1000 persons in that population in a calendar year.

$$\textbf{Crude Death rate in time, x} = \frac{\text{Number of deaths reported in t}}{\text{Mid-year population in time, t}} \times 1000$$

Example: For a given community in 2002, there were 2,000,000 thousand persons estimated to reside in the area in that year. A total of 30,000 deaths were recorded in that year. The annual crude death rate for 2002 for the community is:

$$\frac{30{,}000}{2{,}000{,}000} \times 1000$$

= 15 deaths per 1000 population of the given population in 2002.
The annual death rate is a generalised indicator of the health status of a population, but because it is based on the total population, it is a crude rate.

$$\textbf{Cause –Specific Death Rate} = \frac{\text{Number of deaths due to a specified cause}}{\text{Estimated population at mid-year}} \times 100{,}000$$

$$\textbf{Age- Specific Death Rate for persons in Defined age-bracket} = \frac{\text{Number of deaths occurring among persons in specified age interval during t}}{\text{Total number of persons in Age-bracket (interval) in time, t}} \times 1000$$

$$\textbf{Under-five Mortality Rate} = \frac{\text{Total number of deaths in children 0-4 years old in the year}}{\text{Estimated total population of children 0-4years in that year}} \times 100{,}000$$

$$\textbf{Age-Sex-Specific Death Rate for Males 30-40 years} = \frac{\text{Number of deaths among males aged 30-40 years in year t}}{\text{Total number of males aged 30-40 years in year t}} \times 1000$$

For Age-sex-specific death rate, the age and sex should be substituted to achieve desired results.

$$\textbf{Infant Mortality Rate in year t} = \frac{\text{Number of deaths of children 0-1 year in t}}{\text{Total number of live births in t}} \times 1000$$

$$\textbf{Maternal Mortality Rate in period t} = \frac{\text{Number of Maternal deaths due to puerperal causes in t}}{\text{Number of live births in t}} \times 1000$$

$$= \text{Number of maternal deaths per 1000 Live births in the period t}$$

$$\textbf{Proportional Mortality Ratio of x} = \frac{\text{A given cause (x) in a specified time period}}{\text{Total number of deaths due to all causes in the same period}} \times 100$$

$$\textbf{Case Fatality Rate For Disease/Health Problem y in t} = \frac{\text{Number of deaths due to y occurring during time t}}{\text{Total number of cases of y occurring during time t in the given population}} \times 100$$

In addition to empirical analyses, demographers have led methodological developments in the analysis of mortality with frailty models, given that medical models cannot fully explain changes in mortality over time. Finally, an important demographic contribution has been the application and continuing development of life tables methods used in epidemiological and sociological analyses.

The Life Table

The life table is a statistical device for summarising the mortality experience of a population. It is a basic demographic tool and has a wide

range of applications beyond the study of mortality. Life-table analysis is a core demographic technique and life tables provide one of the most powerful tools for analysing mortality and other non-renewable processes. Chiang (1984) in Weeks (1998) stated that life-table techniques have been used to study divorce, labour force participation, fertility, family planning and other problems. It is the backbone of the insurance industry.

The life table has been around since the middle of 17th century, when an Englishman, John Graunt, developed it as a means to show the different patterns of mortality in London. He found, for example, that some parts of London had consistently higher levels of mortality than other areas.
The major goal of the life table, as it is applied to mortality trends and levels, is to calculate the average remaining lifetime, or expectation of life as it is usually called. It is an index of the number of additional years beyond the current age that a typical individual can expect to live if mortality levels remain unchanged. It is an average, representing the potential experience of a hypothetical group of people.

Table 1.1: Life Table for U.S. Females (1989)

					Of 100,000 Hypothetical people Born Alive	Number of Years Lived	(8) Expectation of Live
(1) Age Interval	(2) Age-Specific Death Rates in Age Interval	(3) Probability of Death(proportions of persons alive at beginning who die during interval)	(4) Number Alive at Beginning of Interval	(5) Number Dying during Age Interval	(6) In the Age Interval	(7) In this and All Subsequent Age Intervals	Average Number of Years of Life Remaining at Beginning of Age Interval
x to x+n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e^0_x
0-1	0.0090	0.0088	100,000	882	99,247	7,860,815	78.6
1-5	0.0004	0.0017	99,118	171	396,063	7,761,568	78.3
5-10	0.0002	0.0010	98,947	101	494,460	7,365,505	74.4
10-15	0.0002	0.0010	98,846	100	494,014	6,871,045	69.5
15-20	0.0005	0.0025	98,746	243	493,161	6,377,031	64.6
20-25	0.0005	0.0027	98,503	264	491,867	5,883,870	59.7
25-30	0.0006	0.0032	98,239	317	490,419	5,392,003	54.9
30-35	0.0009	0.0043	97,922	416	488,618	4,901,584	50.1
35-40	0.0011	0.0056	97,506	551	486,250	4,412,966	45.3
40-45	0.0017	0.0084	96,955	817	482,884	3,926,716	40.5
45-50	0.0026	0.0130	96,138	1,251	477,790	3,443,832	35.8
50-55	0.0043	0.0213	94,887	2,022	469,494	2,966,042	31.3
55-60	0.0069	0.0338	92,865	3,141	456,935	2,496,348	26.9
60-65	0.0107	0.0523	89,724	4,694	437,568	2,039,413	22.7
65-70	0.0162	0.0778	85,030	6,613	409,483	1,601,845	18.8
70-75	0.0251	0.1183	78,417	9,280	370,076	1,192,362	15.2
75-80	0.0399	0.1815	69,137	12,547	315,798	822,286	11.9
80-85	0.0624	0.2698	56,590	16,402	243,090	506,488	9.0
85 and over	0.1403	1.0000	40,188	40,188	263,398	263,398	6.6

Source: Weeks (1998) – Appendix: Life Tables, Net Reproductive Rates and Standardisation. Table A-1

Table 1.2: Life Table for U.S. Males (1989)

					Of 100,000 Hypothetical people Born Alive	Number of Years Lived	(8) Expectation of Live
(1) Age Interval	(2) Age-Specific Death Rates in Age Interval	(3) Probability of Death (proportions of persons alive at beginning who die during interval)	(4) Number Alive at Beginning of Interval	(5) Number Dying during Age Interval	(6) In the Age interval	(7) In this and All Subsequent Age Intervals	Average Number of Years of Life Remaining at Beginning of Age Interval
x to x+n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e^0_x
0-1	0.0111	0.0109	100,000	1,086	99,065	7,182,240	71.8
1-5	0.0005	0.0021	99,914	211	395,167	7,083,175	71.6
5-10	0.0003	0.0014	98,703	134	493,149	5,688,008	67.8
10-15	0.0003	0.0016	98,569	163	492,548	6,194,859	62.8
15-20	0.0012	0.0062	98,406	606	490,674	5,702,311	57.9
20-25	0.0017	0.0085	97,800	827	486,977	5,211,637	53.3
25-30	0.0018	0.0091	96,973	885	482,628	4,724,660	48.7
30-35	0.0022	0.0109	96,088	1,047	477,853	4,242,032	44.1
35-40	0.0028	0.0138	95,041	1,308	472,100	3,764,179	39.6
40-45	0.0035	0.0172	93,733	1,608	464,923	3,292,079	35.1
45-50	0.0050	0.0245	92,125	2,255	455,407	2,827,156	30.7
50-55	0.0076	0.0375	89,870	3,368	441,466	2,371,749	26.4
55-60	0.0123	0.0598	86,502	5,174	420,303	1,930,283	22.3
60-65	0.0191	0.0912	81,328	7,419	389,030	1,509,980	18.6
65-70	0.0282	0.1316	73,909	9,726	346,142	1,120,930	15.2
70-75	0.0431	0.1947	64,183	12,499	290,381	774,788	12.1
75-80	0.0662	0.2839	51,684	14,675	221,862	484,407	9.4
80-85	0.1036	0.4115	37,009	15,229	146,096	262,545	7.1
85 and over	0.1762	1.0000	21,780	21,780	116,449	116,449	5.3

Source**:** Weeks (1998) – Appendix: Life Tables, Net Reproductive Rates and Standardisation. Table A-2

The life tables represented in tables above are abridged and not complete life tables. The former groups ages into five-year categories, while the latter uses single years of age. The calculations are slightly different for the two different kinds of life table, but the interpretation of the results is identical.

For example, the probability of dying (${}_nq_x$) between ages x and x+n is obtained by converting age/sex-specific death rates to probabilities according to the following formula:

$$ {}_nq_x = \frac{(n)({}_nM_x)}{1 + (1 - a)\,(n)\,({}_nM_x)} $$

Which is only an estimate of the actual probability of death (Weeks, 1998).

3.3.2.3 Measurement of Migration

There are no universally agreed upon measures of migration that summarises the overall levels in the same way that total fertility rate summarises fertility and life expectancy captures a population experience with mortality. However, one way of measuring the contribution that migration makes to population growth is to calculate the ratio of migration to natural increase. Thus, the migration ratio is:

$$\frac{\text{Net migration}}{\text{Births-Deaths}} \quad X \quad 1{,}000$$

SELF-ASSESSMENT EXERCISE

Visit a primary school in your area: obtain the population of the pupils, and calculate the ration of male pupil to female pupils.

4.0 CONCLUSION

Accurate population data is a vital ingredient of social and economic policy. For the population to be adequately monitored, there should be appropriate collection, compilation, and skilled interpretation of results.

5.0 SUMMARY

We have looked at some demographic theories, and explained methods of direct and indirect data collection. We identified the various methods, created by great demographers, of analysing demographic data, which the life table illustrated. Finally, you learnt the simple formulae used in measuring: Fertility, Mortality and Migration rates or ratios. In the next unit, we shall look more closely at sources of population data.

6.0 TUTOR-MARKED ASSIGNMENT

1. The Malthus theory is very popular. Explain this theory.
2. State three (3) methods each for measuring Fertility and Mortality.
3. Briefly explain the methods stated in 2 above.

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UNIT 2 CONCEPT OF POPULATION AND SOURCES OF POPULATION DATA

CONTENTS

1.0 INTRODUCTION

Population constitutes a major factor in the development process of any country. In this unit, we shall discuss: the world population and projections; and the Nigerian population. You will learn to use tables and figures to study populations; and identify sources of population data.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain various terms used, frequently, in discussions of issues relating to population.
- appreciate reports and discussions on the world population.

- state the purpose of the World Population Day.
- describe the Nigerian population.
- identify the sources of population data.

3.0 MAIN CONTENT

3.1 Concept of Population

Procter, (1978) defined Population as 'the number of people (or animals) living in a particular area, country, etc.; the people living in an area; a particular described group or kind of people living in a particular place'.

Biggs, Kapicka and Lundgren (1998), further explained that: "a population is a group of organisms of one species that interbreed and live in the same place at the same time. No population of organisms of one species lives independently of other species, and just as a population is made up of individuals, a community is made up of several populations. A community is a collection of interacting populations, and a change in one population in a community will cause changes in the other populations.

3.1.1 Definitions of Population

The following terms occur frequently in discussions of issues relating to population:

Population Explosion

If there is a sudden decrease in the death rate which is accompanied by an increase in the birth rate, overall growth may be very rapid. This is called population explosion.

Population explosion is a population problem. Mere growth in number does not necessarily mean development. Indeed as Malthus warned, unchecked increase in numbers is likely to invoke the law of diminishing returns and to work increases in per capital living standards. Thus, we find many developing countries repeating the pattern of the 18th and 19th century economics: improved medical technology (e.g. sanitation and, in our day, cheap insecticides) first reduces the death rate; and then, with the birth rate remaining high, the population explodes.

Natural Increase

Natural increase is the difference between the birth and death rates. This may be positive or negative. For example, if the death rate exceeds the birth rate, the total population (ignoring the effects of migration) will fall so that the natural increase has a negative value.

3.1.2 Population Density

Another measure of population is population density, the average number of people living in each unit area. Population density is the average number of people living in a particular area. It is a concept that refers to the number of persons per square kilometre or other unit of area, e.g. 500 per square Kilometre. Densities may vary from country to country, or even within countries.. It is a useful proxy measure of degree of crowding in population. The usual formula for calculating population density or the phenomenon of crowding (measure of intensity of aggregation of population units) is:

Population Density = $\frac{\text{Number of persons inhabiting a defined place in time "t"}}{\text{Area of the place in square kilometers}}$

= Number of persons per square kilometer of the place in "t"

It increases with high immigration and high fertility rates, especially where infra structural development is stagnant.

According to Bunnett (1973), the land surface of the earth occupies only about 30 per cent of the total surface, and of this, about 10 per cent contains very few people either because it is too cold or too dry or too hot and wet or too mountainous. The remaining 70 per cent of the surface is occupied by water. This means that a lot of the population lives on 20 per cent of the total earth's surface. This gives an average of just over 50 people per 2.5 square kilometres (1 square mile). Most of the people live where they do because of suitable climates, fertile soils, mineral deposits and other natural resources.

The density of population, which is the number of people per unit area, varies considerably from region to region. This is because the degree of suitability for human settlement varies from one region to the other. The natural environment of most regions usually enables the inhabitants to carry out several types of work. If a region contains forests, good soils and valuable mineral deposits, it is possible that lumbering, agriculture and mining may all take place. But whether they take place depends on the suitability of the climate [for agriculture] and the accessibility of, and demand for, minerals [for mining]. Some regions can be more easily utilised than others.

Over the centuries, man has picked out the fertile regions and has cultivated them intensively, and these regions, because of abundant harvests, have become densely populated.
The reasons for the rapid increase in population in modern times include:

- **Agricultural and industrial revolutions**, which resulted in this region becoming densely populated in the 19th century.
- **New forms of transport**, which made it possible to collect food supply and raw materials from any part of the world.
- Modern development including a vast **increase in medical knowledge**, which has reduced mortality and improved natural increase.
- **Modern technology and communications** also enable us to offset the worst effects of famine, flood and pestilence, so that fewer people now die from natural hazards.
- Many societies do not believe in **birth control**, so the population grows rapidly.

We have already seen that there are several factors which affect this, but for most countries the main factors responsible for population density are:

- **Agriculture**. Extensive agriculture which gives low crop yield per hectare will support a smaller population than intensive agriculture which has high crop yields per hectare.
- **Industry**. Industrial activities are much more productive than agricultural activities and the population density of an industrial region is nearly always higher than that of an agricultural region.
- **Commerce**. Centers of trade are usually centers of high population density. This is especially true of ports and markets, for example, New York, London, Singapore, Lagos, Onitsha, Kano.

3.1.3 Over-Population

A country is said to be over-populated when it has more people than its resources can support. We have seen that the world's population is increasing at an alarming rate, practically all countries are faced with major problems arising out of the rapid increase in their populations over the past 50 years, and those that do not yet have these problems will probably have them within the next 20 years. Several countries are already over-populated, but their populations are still increasing.

Possible Solutions for Over-Population

In the first place, dense population can be of two kinds, which are commonly- though not always- distinct from one another. They are: rural and highly urbanised and industrialised countries and regions.

A. **Rural over-population:** If the rural population of a country is greater than its agricultural resources can support, then it will have to introduce measures to balance its population to its resources. One of the most important actions is to increase agricultural productivity. This can be done by: introducing new farming techniques (these are intended to increase crop yield), and land reform.

B. **Urban over –population:** Some of the measures which can be taken to increase job opportunities, and expand housing, education, and transport facilities thereby reducing the problem are:

- The building of satellite or new towns
- The building of high-rise blocks of flats
- The expansion of existing commercial and industrial activities and the creation of new ones.

Nevertheless, industrialisation is a palliative rather than a cure for the problem of over-population. It has enabled certain countries – those first in the field – to achieve a high standard of living; it is not a magic process which will bring security and prosperity to all the poor, ignorant and crowded masses of the world. At best it may postpone for a while the days of Malthusian doom.

3.2 The World Population

The **world population** is the sum total of all living humans on earth. As of March, 2012, it is estimated to number **7.026 billion** by the United States Census Bureau (USCB).

Table 2.1:World Population Milestones (USCB Estimates)

Population (in billions)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Year	1804	1927	1960	1974	1987	1999	2012	2027	2046
Years elapsed	—	123	33	14	13	12	13	15	19

Source: United States Census Bureau (USCB) Estimates.

It is estimated that the world population reached one billion for the first time in 1804. It was another 123 years before it reached two billion in 1927, but it took only 33 years to reach three billion in 1960. Thereafter, the global population reached four billion in 1974, five billion in 1987, six billion in 1999 and, according to the United States Census Bureau, seven billion in March 2012. The United Nations, however, estimated that the world population reached seven billion in October 2011

Table 2.2: World Population by Continent

Continent name	Density (inhabitants/km^2)	Population (2011)	Most populous country	Most populous city
Asia	86.7	4,140,336,501	China (1,341,403,687)	Tokyo (35,676,000)
Africa	32.7	994,527,534	Nigeria (152,217,341)	Cairo (19,439,541)
Europe	70	738,523,843	Russia (142,905,200)	Moscow (14,837,510)
North America	22.9	528,720,588	United States (313,485,438)	Mexico City/Metro Area (8,851,080 / 21,163,226)
South America	21.4	385,742,554	Brazil (190,732,694)	São Paulo (19,672,582)
Oceania	4.25	36,102,071	Australia (22,612,355)	Sydney (4,575,532)
Antarctica	0.0003 (varies)	4,490 (non-permanent, varies)	N/A	McMurdo Station (955)

Source: United Nations (2012), World Population Guide.

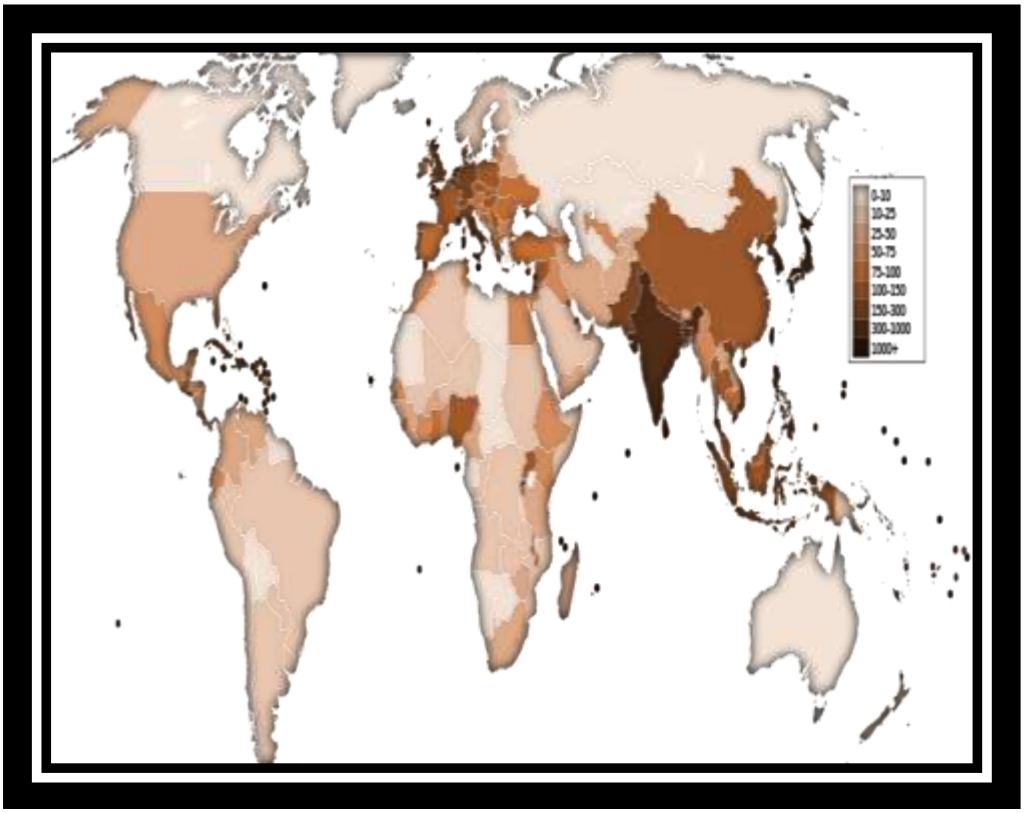

Fig.2.1: Countries by Population Density
Source: Wikimedia Commons - Own work of Miguel Contreras, Guatemala. 10 January 2007.

The figure above shows a map of the world, with colours to highlight the population density of each country or territory. Numbers on the legend are in people per km^2, and all countries smaller than 20,000 km^2 are represented by a dot.

Table 2.3: The Ten(10) Countries with the Largest Total Population

Rank	Country/Territory	Population	Date	% of World population
1	China	1,351,930,000	July 13, 2012	19.2%
2	India	1,203,710,000	March 2011	17%
3	United States	313,906,000	July 13, 2012	4.47%
4	Indonesia	238,400,000	May 2010	3.33%
5	Brazil	196,684,000	July 13, 2012	2.8%
6	Pakistan	180,091,000	July 13, 2012	2.56%
7	Nigeria	170,123,740	July 2012	2.42%
8	Bangladesh	161,083,804	July 2012	2.29%
9	Russia	141,927,297	January 1, 2010	2.02%
10	Japan	127,610,000	May 1, 2012	1.82%

Approximately 4.06 billion people live in these ten countries, representing around 58% of the world's population as of April 2012.
Source: United Nations (2012), World Population Guide.

3.2.1 Global Projections

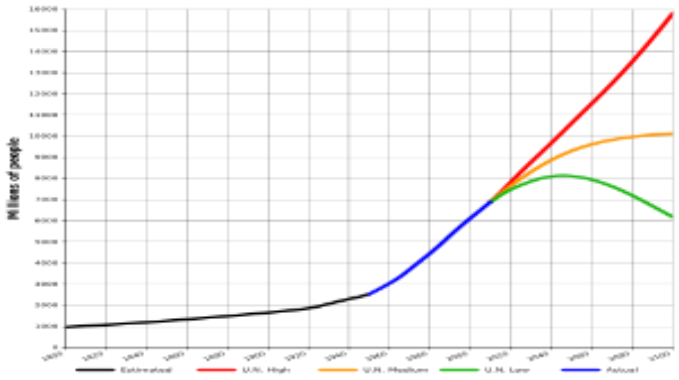

Fig.2.2: World Population 1800-2100 Projection
Source: Wikipedia, the free encyclopedia "U.S. Census Bureau – World Population Clock Projection."

World population estimates from 1800 to 2100, based on UN 2010 projections (red, orange, and green) and US Census Bureau historical estimates (black). According to the highest estimate, the world population may rise to 16 billion by 2100; according to the lowest estimate, it may decline to only 6 billion.

The world population has experienced continuous growth since the end of the Great Famine and the Black Death in 1350, when it stood at around 370 million. The highest rates of growth – global population

increases above 1.8% per year – were seen briefly during the 1950s, and for a longer period during the 1960s and 1970s. The growth rate peaked at 2.2% in 1963, and had declined to 1.1% by 2011. Total annual births were highest in the late 1980s at about 138 million, and are now expected to remain essentially constant at their 2011 level of 134 million, while deaths number 56 million per year, and are expected to increase to 80 million per year by 2040. Current projections show a continued increase in population (but a steady decline in the population growth rate), with the global population expected to reach between 7.5 and 10.5 billion by 2050.

Each day the world population increases by over 200,000, demanding the equivalent of a new city for more than a million inhabitants every week. The total passed seven billion in October 2011 and will almost certainly reach eight billion in 2025. The median projection for 2050 is 9.3 billion.

Table 2.4: Most Populous Countries, 2011 and 2050

2011		**2050**	
COUNTRY	**POPULATION (MILLIONS)**	**COUNTRY**	**POPULATION (MILLIONS)**
China	1,346	India	1,692
India	1,241	China	1,313
United States	312	Nigeria	433
Indonesia	238	United States	423
Brazil	197	Pakistan	314
Pakistan	177	Indonesia	309
Nigeria	162	Bangladesh	226
Bangladesh	151	Brazil	223
Russia	143	Ethiopia	174
Japan	128	Philippines	150

Source: Population Reference Bureau (2011), World Population Data Sheet

According to current projections, the global population will reach eight billion by 2030, and will likely reach around nine billion by 2050. Alternative scenarios for 2050, range from a low population of 7.4 billion to a high of more than 10.6 billion. Projected figures vary depending on underlying statistical assumptions and the variables used in projection calculations, especially the fertility variable. Long-range predictions to 2150 range from a population decline to 3.2 billion in the 'low scenario', to 'high scenarios' of 24.8 billion. One extreme scenario predicted a massive increase to 256 billion by 2150, assuming the global fertility rate remained at its 1995 level of 3.04 children per woman;

however, by 2010 the global fertility rate had declined to 2.52 (United Nations, 2003).

The whole of the increase of 2.3 billion between now and 2050 is predicted to occur in developing countries. India's population of 1.25 billion will shortly overtake China, rising to 1.7 billion in 2050. Together these two countries may then account for almost a third of the global population (Table 2.4 above).

Every two years, the Population Division of the UN Department of Economic and Social Affairs publishes its *World Population Prospects*, essentially a "revision" of previous projections. Based on the latest national census results and other surveys, this is the acknowledged source of global population data.

The 2010 revision concedes that the two key variables in population projections, **life expectancy** and **fertility**, are fraught with uncertainty over such a long period. For example, the significant impact of HIV and AIDS in Southern Africa could not have been anticipated on the timescale of these projections. Even a modest error of 0.5 in the assumed total fertility rate (TFR - the average number of children per woman) is sufficient to generate lower and upper estimates of 8.1 and 10.6 billion for the 2050 population projection. This sensitivity is an important motivation for strategies to stabilise the world population.

3.2.2 Population and Development

The UN's population projections assume not only that the demographic transition will be reproduced in the poorest countries, but also that it happens relatively quickly, with fertility rates falling as low as 2.2 by 2050.

These assumptions are far from certain and will be closely monitored. Even if they prove accurate, the outcome will not in itself relieve the challenge of sustaining a world population of 9-10 billion but it will create the conditions necessary for long term stability, or maybe reduction.

As the projected increase will occur entirely in developing countries, the task of stabilising world population must be captured within the international development agenda. This was exactly the conclusion reached at the landmark 1994 International Conference on Population and Development (ICPD) whose 20-year Programme of Action, known as the Cairo Consensus, has proved to be a decisive influence on population policy.

Now coordinated by UNFPA, the Cairo Consensus clarified that population concerns are best addressed by redoubling commitment to national poverty reduction plans in general and women's education and empowerment in particular. For example, a full period of schooling for girls reduces the risk of teenage marriage and increases awareness and demand for contraception.

Economic development represents a growth in average income – a rise in the material well-being of people in a society. Economic growth often occurs with population growth, but an economic development may be hampered by a high rate of population growth. Ultimately, continued population growth would lead to a population too large for the world's resources (Weeks, 1998).

The relationship between economic development and population growth is currently a star attraction of world debate.

3.2.3 World Population Day

According to United Nations (2012), **World Population Day** is an annual event, observed on July 11, which seeks to raise awareness of global population issues. The event was established by the Governing Council of the United Nations Development Programme in 1989. It was inspired by the public interest in Five Billion Day on July 11, 1987, approximately the date on which the world's population reached five billion people. There is no estimation for the exact day or month the world's population surpassed the one or two billion marks. The days of three and four billion were not officially noted, but the International Database of the United States Census Bureau places them in July 1959 and April 1974. The United Nations did determine, and celebrate, the "Day of 5 Billion" on July 11, 1987, and the "Day of 6 Billion" on October 12, 1999. The "Day of 7 Billion" was declared by the Population Division of the United Nations to be October 31, 2011.

The United Nations' (UN) World Population Day is observed to reaffirm the human right to plan for a family. It encourages activities, events and information to help make this right a reality throughout the world. World Population Day aims to increase people's awareness on various population issues such as the importance of family planning, including gender equality, poverty, maternal health and human rights. The day is celebrated worldwide by business groups, community organisations and individuals in many ways. Activities include seminar discussions, educational information sessions and essay competitions. World Population Day is a global observance and not a public holiday.

In 1968, world leaders proclaimed that individuals had a basic human right to determine freely and responsibly the number and timing of their children. About 40 years later, modern contraception remains out of reach for millions of women, men and young people. The UN authorised the event as a vehicle to build an awareness of population issues and the impact they have on development and the environment.

In 1989, in its decision 89/46, the Governing Council of the United Nations Development Programme (UNDP) recommended that, in order to focus attention on the urgency and importance of population issues in the context of overall development plans and programmes and the need to find solutions for these issues, 11 July should be observed by the international community as World Population Day.

Since then, with the United Nations Population Fund's (UNFPA) encouragement, governments, non-governmental organisations, institutions and individuals organise various educational activities to celebrate the annual event.

As the world population edged to seven billion people in 2011 (up from 2.5 billion in 1950), it has had profound implications for development. A world of seven billion is both a challenge and an opportunity with implications on sustainability, urbanisation, and access to health services and youth empowerment.

This year's World Population Day, 11 July 2012, focuses on the theme of **"Universal Access to Reproductive Health Services."** Reproductive health problems remain the leading cause of ill health and death for women of childbearing age worldwide. Some 222 million women who would like to avoid or delay pregnancy lack access to effective family planning. Nearly 800 women die every day in the process of giving life. About 1.8 billion young people are entering their reproductive years, often without the knowledge, skills and services they need to protect themselves. On the World Population Day, many activities and campaigns call attention to the essential part that reproductive health plays in creating a just and equitable world.

The Nigerian Population – (Course SST 202, NOUN, adopted)**.**

Fig.2.3: Map of Nigeria
Source: The Sun Newspaper, 2012

3.3.1 Size

The actual size of Nigeria's population has been a source of controversy since the colonial era. The sample census of 1952 under colonial administration put the population of Nigeria at 30 million people. The first national census to be conducted in independent Nigeria took place in 1963 and a controversial figure of 55.6 million was recorded. The census of 1971/1972 conducted under military administration was cancelled because of the highly politicised nature of the counting and fraudulent practices which were noticed. The census of 1991 put the population of Nigeria at 88.5 million people. The 2006 census put the population of Nigeria at about 140 million. This figure rose to about 150 million, using an annual growth rate of 1.9 %. Currently, it is estimated, by the United Nations to be 162 million, and the growth rate is 2.5%.

3.3.2 Population Distribution and Density

There are three major areas of population density and distribution in Nigeria. These are areas of high concentration, areas of moderate concentration and areas of sparse concentration.

Table 2.5: Population Distribution by State in 2006

S/N	**State**	**Total**	**% of the Nation**
1.	Abia	2,833,999	2.02
2.	Adamawa	3,168,101	2.26
3.	Akwa Ibom	1,920,208	2.80
4.	Anambra	4,182,032	2.99
5.	Bauchi	4,676,465	3.34
6.	Bayelsa	1,703,358	1.22
7.	Benue	4,219,244	3.01
8.	Borno	4,151,193	2.97
9.	Cross River	2,888,966	2.06
10.	Delta	4,098,391	2.93
11.	Ebonyi	2,173,501	1.55
12.	Edo	3,218,332	2.30
13.	Ekiti	2,384,212	1.70
14.	Enugu	2,353,879	2.33
15.	Gombe	2,353,879	1.68
16.	Imo	3,934,899	2.81
17.	Jigawa	4,348,649	3.11
18.	Kaduna	6,066,562	4.33
19.	Kano	9,383,682	6.70
20.	Katsina	5,792,578	4.14
21.	Kebbi	3,238,628	2.31
22.	Kogi	3,258,487	2.33
23.	Kwara	1,548,412	2.22
24.	Lagos	9,013,534	6.44
25.	Nasarawa	1,863,275	1.33
26.	Niger	3,950,249	2.82
27.	Ogun	3,658,098	2.16
28.	Ondo	3,441,024	2.46
29.	Osun	3,42,535	2.45
30.	Oyo	5,591,589	3.99
31.	Plateau	3,178,712	2.27
32.	Rivers	5,185,100	3.70
33.	Sokoto	3,696,999	2.64
34.	Taraba	2,300,736	1.64
35.	Yobe	2,321,591	1.66
36.	Zamfara	3,259,846	2.33
37.	Federal capital	1,405,201	1.00
	Total	140,003,542	100.00

Source**:** National Population Commission, Abuja

The greatest concentrations are in the south of the country particularly in the south east and the south west. The third area of high density is the central north of the country around Kano and Zaria. The most densely

populated areas (over 250 persons per sq.km) are in southern Nigeria and include the localities of Orlu, Owerri and Okigwe in Imo State, Ikeja and Agege in Lagos State and parts of Osun and Ekiti States. Orlu has the highest density of about 900 persons per square kilometer. Population densities of between 150 and 250 persons per sq.km are recorded around Ibadan, Ilesha, Badagry, Aba, Nsukka, Bende (Abia State), Awgu, Afikpo and Udi. In the northern part of the country, population densities of over 100 persons per sq. km are found in Kano close settled area, Katsina and Jos. Other areas with high population densities are Abakaliki, Degema, Enyong, Okene, Abeokuta, Owo, Warri, Asaba and Akure. Areas of moderate population concentration (50-100 persons per sq.km) are Ahoada, Ilorin, Aboh, Auchi, Ondo, Okitipupa, Ijebu, Epe, Gombe, Idah, Potiskum and Dutse. The population in these places is supported by farming activities. Sparsely populated areas with less than 50 persons per sq.km are the Middle Belt of Nigeria, Kaduna, Niger, Kebbi, northern Kwara, Sokoto, Niger Delta and the coastal region.

3.3.3 Growth Rates

Nigeria has experienced rapid population growth since the first national population sample of 1921. The annual population growth rate was approximately 5.8% between 1952 and 1963. This rate was higher than the estimated 2.3% for the whole of Africa and has been criticised. The unreliable nature of population statistics in Nigeria has made the Planners to adopt an annual growth rate of between two and three per cent. For example, 1.9% has been adopted by the National Population Commission in projecting the population of Nigeria. According to the United Nations, the current growth rate is 2.5%.

3.3.4 Age-Sex Composition

The population of Nigeria, like that of other developing countries, is largely composed of young people. The country is just in the incipient stage of the demographic transition theory with control over death but with little or no control over the fertility rates. About 40 % of the total population falls less than 15 years of age while those between 15 and 49 ages are about 50 %. The aged or old people constitute about 6 % of the population. Rural-urban differentials are noticed in the sexes of the people. In the urban centres, the proportion of females in each five age groups exceeds that of males in the 15 to 35 age categories. The proportion of urban population in ages zero to 14 is lower than that of rural population. For ages 15 to 49, the percentage in urban population is higher than the rural population. The rural population is a little higher for ages 50 and above than the urban population.

3.3.5 Ethnic Characteristics

Nigeria is a multi-ethnic society with over 350 ethno-linguistic groups. The three major ethnic groups are the Hausa/Fulani, the Yoruba and Igbo which constitute over 50 % of the total population. Other ethnic groups are the Kanuris, Ibibios, Tivs, Ijaws, Edos, Annangs, Nupes, Igallas, Idomas and Itsekiris which constitute about 25 % of the total population. There are minority groups like the Igbira, Gwari, Ekoi, Mumuye, Ogoni, Isoko, Bura, Efile and Chamba. The Hausas are found in Kano, Jigawa, Kaduna, Zamfara and Katsina States. The Fulanis are found mainly in Sokoto and other northern states while the Kanuris live in Bornu State. Nupes live in Niger and Kwara States, the Tivs and Idomas live in Benue State, Igalas live in Kogi State, the Igbos in Enugu, Anambra, Ebonyi, Imo, Abia, parts of Delta and Rivers States. The Ijaws live in Bayelsa, parts of Delta and River States. The Yorubas live in Oyo, Lagos, Ogun, Kwara, Kogi, Osun, Ekiti and Ondo states.

SELF-ASSESSMENT EXERCISE

i. Study all the figures and tables in this unit and note what each is trying to illustrate.
ii. On the map of Nigeria, locate the high population density areas.

3.4 Sources of Population Data

In order to analyse the demography of a particular society, we need to know how many people live there, how they are distributed geographically, how many are being born, how many are dying, how many are moving in, and how many are moving out. Weeks (1998) says that: "that is of course only the beginning."

Sources of population data include: Census data, surveys, civil registration, church registers, hospital records, interviews. Data from statistical censuses are the basic *inputs*, but have to be augmented with input from questionnaires and surveys. The trends are extrapolated (projected forwards).The practical purpose is that the *output* forms the basis for the prediction of number of customers for public and private services and products (Wikipedia, 2012).

3.4.1 Population Canvass (Census)

The total population and its geographical distribution can be known quite easily from a census record.
A census is the total process of collecting, compiling and publishing demographic, economic and social data pertaining to a specified time or times to all persons in a country or in a delimitated territory. Censuses

tell us the size of the population by sex, age, marital status and citizenship. It gives information on other population compositions such as educational level, religion, work status, and occupation.

3.4.2 Record System

This consists of some forms or record, which make vital registration of all vital events from day to day. Such events include births, deaths and marriages. Record system uses population register.

Population Register involves continuous recording of essential information pertaining to steady members of the country concerned. The recording system is more complex than census and is designed to cover all age and sex groups, all social classes, and all ethnic groups. It is an inventory of inhabitants of each area of a country, which is continuously amended to take accounts of births, death, marriages, divorce, change of name and residence, and change of occupation (Olusanya, 1981), cited in Ogunbameru (2009). Registers are established for specific administrative purposes and cover only those persons directly affected by the particular programmes. They are in most cases collected on day-to-day basis. Most of these registers are continuous, e.g. birth registers, attendance registers; others are periodic or exist only during emergency periods, e.g. Immunisation registers. Some countries that have complete population register include: Sweden, Netherlands, Taiwan, Israel and Italy.

3.4.3 Other Data Sources

Sample surveys now represent a major addition or, in some cases an alternative, to conventional demographic data sources. Most developed countries have a range of government-sponsored surveys which provide far more detailed information on, for example, health-related behaviour, family building strategies, or reasons for migration than it would be possible to collect in a census. In the developing world, where other data sources are scarce, surveys of various kinds often present the best source of data on basic demographic parameters. Data quality is potentially much better in a survey than a census, as it is more likely that well-trained interviewers can be used. The World Fertility Survey, an international population research programme launched in 1972 to determine fertility levels throughout the world, and its successor, the Demographic and Health Survey Programme, and special surveys have been particularly valuable in providing data for a range of countries, including many lacking adequate vital registration systems. Other approaches to data capture include multi -round surveys, in which respondents are asked about events since last contact, and dual-record systems which involve two independent data collection systems (one

often a multi- round survey), the results of which are then combined. This method allows some estimation of missed events to be made, but it is expensive. Also, historical sources are useful. Historical demography requires that we almost literally dig up information about the patterns of mortality, fertility and migrations in past generations. These approaches are described in more detail in most standard demographic textbooks (Shryock *et al*,. 1976; Newell 1988; Pollard *et al*., 1990; Hinde, 1998) in Weeks, (1998). For published information, the Demographic yearbook; and Population Bulletin and World Population Data Sheet, published by the United Nations and Population Reference Bureau, respectively, are available, even on-line.

4.0 CONCLUSION

The world population which is the sum total of all living humans on earth, has grown from one billion in 1804 to seven billion in 2011; and may still grow.

Ultimately, continued population growth would lead to a population too large for the world's resources**.**

5.0 SUMMARY

In this unit, population was defined as the people living in an area, and population density is the average number of people living in a particular area. Population explosion and over population were discussed.

We learnt that: the world population is seven billion and is still growing; Nigeria is the seventh most populous country in the World and the most populous country in Africa, while Cairo is the most populous city in Africa. The World Population Day which is an annual event, observed on July 11, seeks to raise awareness of global population issues.

We further learnt: that Nigeria has a population of about 162 million people distributed over the 36 states and the Federal Capital and the annual growth rate is between 2 and 3 % per annum. The southern part is more densely populated than the northern part due to ecological and historical differences. Population growth rates also vary from one part of the country to the other, due to socio-economic and ecological differences. Nigeria has over 350 ethnic groups.

Finally, we identified the sources of population data as: censuses, registration of vital events, and surveys.
In the next two units, you would use the information obtained here to learn more about populations.

6.0 TUTOR-MARKED ASSIGNMENT

1. Explain the following:

    i. Population density
    ii. Population explosion
    iii. Natural increase rate
    iv. World population day
    v. Sources of population data.

7.0 REFERENCES/FURTHER READING

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UNIT 3 POPULATION DYNAMICS AND HEALTH IMPLICATIONS

CONTENTS

1.0 INTRODUCTION

Fertility, migration and urbanisation all affect a population. Increased population densities and unhealthy living conditions can ease the transmission of infections; migration may also increase vulnerability to disease.

In unit 5, we deliberated on the concept of population; in this unit, we shall examine the effect of the structure and movements of a population on the health of the population.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain, compare and contrast exponential and linear population growth
- explain limiting factors to population growth
- identify factors and interactions that limit population growth and size
- predict effects of environmental factors on population growth
- relate public health to population growth.

3.0 MAIN CONTENT

3.1 Population Dynamics

The term refers to the ever-changing interrelationships among the set of variables that influence the demographic makeup of populations as well as variables that influence the growth and decline of population sizes. Among the factors that relate to the size as well as the age and sex composition of populations are fertility, death rates, and migration.

3.1.1 Principles of Population Growth

Population growth is defined as the change in the size of a population with time (Biggs, Kapicka and Lundgren, 1998).

The growth of living organisms is different from the growth of other familiar things like money. Non-living things like income grow in a straight line. It has **linear** increase and the growth is steady. For example, a daily paid labourer who earns ₦800 per day will in ten days earn: ₦ 800+ ₦ 800+ ₦ 800+ ₦ 800+ ₦ 800+ ₦ 800+ ₦ 800+ ₦ 800+ ₦ 800+ ₦ 800 = ₦ 8000 (i.e. ₦ 800 x10). For living organisms, the initial increase in the number of organisms is slow because the number of reproducing organisms is small. Soon, however, the rate of population growth increases rapidly because the total number of potentially reproducing organisms increases. This is exponential growth, and it is the type seen in human beings. **Exponential growth** of a population of organisms occurs when the number of organisms rises at an ever increasing rate. Linear is like a straight line graph (/) while Exponential is (**j**) shaped (look at Figure 3.1.). An exponential growth curve means that if growth doubles during approximately equal intervals of time, it suddenly accelerates. Exponential growth results in population explosion.

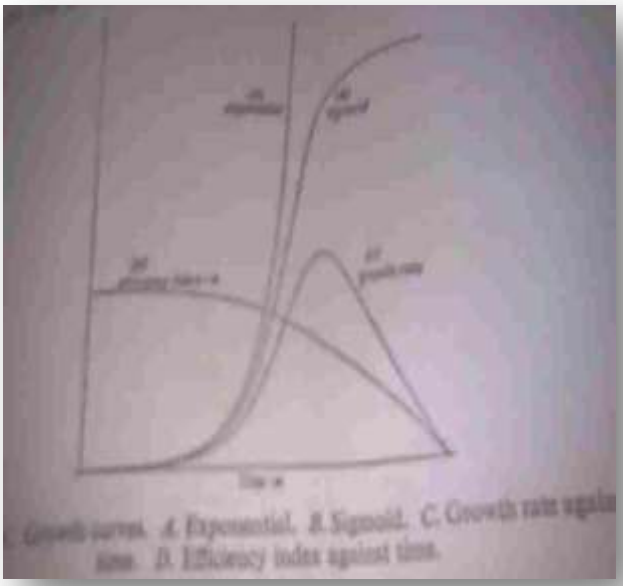

Fig. 3.1: Growth Curves
Source: Vines and Rees (1972).pp. 489.

Can populations grow indefinitely? The answer is no. Populations do have limiting factors in their environment, such as availability of food and space. The number of organisms of a population that a particular environment can support over an indefinite period of time is known as its **carrying capacity**. Carrying capacity is represented by the letter K. When populations are under the carrying capacity of a particular environment, births will exceed deaths until the carrying capacity is reached. If the population temporarily overshoots the capacity, deaths will exceed births until population levels are once again at carrying capacity.

3.1.2 Limits to Population Growth and Size

Environmental factors, such as food availability and temperature, which affects an organisms' ability to survive in its environment are ***'Limiting factors.'*** A limiting factor is any biotic or abiotic factor that restricts the existence, numbers, reproduction, or distribution of organisms. Apart from biology, population increase depends on other social factors like - wars, booms and depressions, plagues and famines, fluctuations of rates of births, deaths and migration. Factors that limit one population in a community may also have an indirect effect on another population. The ability to withstand fluctuations in biotic and abiotic environmental factors is known as **Tolerance**.

Limiting factors also regulate the size of a population. Limited food supply, extreme temperatures, and even storms, can affect population

size. The two kinds of limiting factors identified are: density-dependent and density- independent factors. **Density-dependent factors** include disease, competition, and parasites, which have an increasing effect as the population increases. Disease for example, spreads more quickly in a population whose members live close together, than in smaller populations whose members live farther from each other. In less dense populations, fewer individuals may be affected; while in dense populations, the entire population may be affected. **Density-independent factors** affect all populations, regardless of their density. Most density-independent factors are abiotic factors such as temperatures, storms, floods, and drought.

Apart from environmental factors, other interactions that limit population size include **effects of competition and crowding**. Organisms within a population constantly compete for resources. When population numbers are low, resources are plentiful. Competition is a density-dependent factor. When population size increases to the point at which demand for these resources exceeds the supply, the population size decreases. Also, when populations of organisms become crowded, individuals may exhibit stress including aggression, decreased fertility, and decreased resistance to disease. All of these symptoms can lead to a decrease in population size.

SELF-ASSESSMENT EXERCISE

Write a sentence that shows your understanding of each of the following terms:

Tolerance, carrying capacity, population density, density independent factors.

3.2 Human Population Growth

Demography is the study of population characteristics such as growth rate, age structure, and movement of individuals. Birth rate, death rate, and fertility differ considerably among different countries, resulting in uneven population growth patterns across the world.

Kpedekpo (1992), cited in Nnodu, Okoye and Onwuka (2008), maintained that population growth could also be termed population change. The change may be an increase or decrease in the population size and components.

The total of the three demographic variables – fertility, mortality, and net migration- gives us a country's **growth rate,** the net change after people have been added to and subtracted from a population. The **basic**

demographic equation is: growth rate = births – deaths + net migration.

3.2.1 Problems in Forecasting Population Growth

The difficulty in predicting the future population growth of the world became very clear when the United Nations and the US Census Bureau both gave different estimates for 'the world at seven billion'. According to the latter, the world population reached seven billion in March 2012, while the UN asserted that this occurred in late 2011.

How fast can populations grow? According to Weeks (1998), a common way of measuring the growth potential of any combination of birth and death rates is to calculate the doubling time. The **doubling time** ***is the time required for a population to double if the current rate of growth continues.*** The doubling time is approximately equal to 70 divided by the growth rate (in per cent per year). The 70 in the formula derives from the fact that populations grow exponentially; each generation builds on the preceding generation in a compound fashion. Mathematically, this exponential growth is expressed by natural logarithms. Thus, to find out how long it would take a population to double in size, we must find the natural logarithm (l_n or $\log_e$) of 2. This turns out to be 0.70 which becomes 70 when multiplied by 100 to get rid of the decimal points. Then dividing the rate of growth into 70 tells us how many years would be required for a population to double. In the same way, if we want to find out how long it would take the population to triple in size, we first find the natural logarithm of 3, which is 1.10 or 110. Dividing 110 by the growth rate tells us how long it would take for the world population to triple in size.

3.2.2 Problems of Population Growth

The greatest single challenge facing nearly all countries is the need to control the growth of population. The problem is not so much of the size of the population, but its rate of growth. The main problems are:

- the world does not have unlimited resources
- the more developed countries use up more resources than poorer countries
- the poorer countries which have the most rapid increases in populations are unable to increase their food production rapidly
- low levels of education and inadequate facilities make it difficult to introduce birth control programmes in some least economically developed countries
- tradition and religious beliefs also discourage birth control

- only about one –fifth of the land area of the world can be used for agriculture and habitation
- the difficulty of adequately housing and feeding the increasing population can lead to unrest and high crime rates
- rapid population growth leads to increasing urbanisation.

But urgent action is still required in many regions, to ensure that effective measures are taken, to prevent the population of a country from increasing to a point which will threaten, and eventually erode the standard of living of those regions.

3.2.3 Population and Public Health

Fig. 3.2: Sanitation Problems of Population Growth
Source**:** Photographs by author

No discussion of changes in the health of the people of our world can be viewed in perspective without consideration of the single most significant phenomenon in our history….the population explosion. The potential consequences of this biologic surge are so great and far reaching in terms of local and world politics, economics, ethics, and even ultimate existence as to justify concern and possibly pessimism. Increasingly, public health workers are criticised for compounding the problems of the world by causing widespread overpopulation through their dramatic saving and extension of lives. Public health workers, sociologists, political scientists, and others have long been aware of a relationship between public health activities and increases in the populations of nations and of the world. Awareness has been sharpened by recent world events, especially the sustained rise in birth rates in many areas and the growth and success of international technical assistance programs in health and sanitation. This awareness has reached the point of acute concern, which increasingly is voiced in part by questioning (indeed, even condemnation) of the activities of the "dangerous doctor" the "heedless hygienist," and the "cynical

sanitarian"(Hanlon and Pickett, 1979). On the other hand, there are those who are optimistic concerning the ability of this planet to sustain us.

Fertility, migration and urbanisation affect the spread of diseases including tuberculosis, malaria and HIV/AIDS. Increased population densities and unhealthy living conditions in urban slums can ease the transmission of infections. Migration may also increase vulnerability to disease.

Infectious diseases such as HIV/AIDS have had a large impact on demographic trends, altering the age structures of heavily affected countries.

Comprehensive prevention policies, programs and services are the most cost-effective ways of reducing the burden of HIV/AIDS and other infectious diseases. Those who seek reproductive health services and those who seek HIV services share many common needs and concerns. Therefore, integrating these services has the potential to increase access to health services and improve health outcomes. Integrated programmes that increase women's access to contraceptives result in healthier families and reduced health care expenditures to treat malaria, tuberculosis and other communicable diseases. Beyond access to health care, HIV and infectious disease prevention programs must also address the gender inequalities that increase the likelihood of infection among women.

However, as Sears (1959) has observed, "No form of life can continue to multiply indefinitely without eventually coming to terms with the limitations of its environment. . . . Every wise gardener knows better than to crowd his luck by crowding his plants too closely. Even the most aggressive organisms, such as weeds, rodents, and noxious insects, do not increase and spread indefinitely."

3.2.4 Dynamics of Population Growth

When population growth data are studied, it becomes apparent that many forces in addition to public health are involved. Thus the onset of the upswing in world population actually antedates the modern public health movement. Hanlon and Pickett (1979) noted that a significant quickening in the rate of population increase began about 1650. It is difficult to determine the relative importance of the various factors that must have been involved in the reduction of mortality and in the resultant increase in population. However, the increases during the first part of this period could not have been due to public health measures because few if any existed. Rather, the determining factors appear to

have been changing social organisation, a rising standard of living, gradually improved nutrition and work conditions, and appearance of certain social reforms.

In Europe, a significant excess of births over deaths was already well established by the 18th century. This produced a steady population increase despite fluctuations due to frequent epidemics and occasional famine. Then in the mid-19th century, a great decrease in mortality began, with a consequent upsurge in the rate of population increase. A peak was reached in the early 20th century, despite much emigration. This upsurge may be attributed to the development of improved transportation, which facilitated a wider distribution of goods and people; to the technologic progress of the Industrial Revolution, which provided more goods and improved living conditions for greater number of people; and more recently, to the acquisition and wide application of new knowledge concerning the cause and prevention of disease. Subsequently, despite a continued decline in death rates, population growth in Europe decelerated as a result of a rapid fall in birth rates.

The larger the area effectively available to a species, the more the species tends to move and also increase. Thus an inoculum multiplies and spreads throughout a container of nutrient broth. This has also been the experience of humans, most noticeably when new lands were discovered or developed. It was obviously more than chance that the beginning population upswing in the world coincided with the great period of discovery, colonisation, and exploitation, and with more widely available and more rapid means of transportation.

Without doubt, public health measures have contributed to the increase in population during the past century. They have done so in four ways: (1) by improving the chances of fruitful conception, (2) by greatly increasing the chances among infants and young children, (3) by preventing the premature deaths of many young adults who comprise the most fertile component of a population and the group that has the longest period of future fecundity, and (4) by greatly reducing the number of marriages dissolved by the death of the partner.

Among the social and economic factors related to the dynamics of population, consideration must be given to the extent of urbanisation and industrialisation. These are two of the most notable phenomena of our time and are closely related. They have an interesting two-phased effect on population growth….initial encouragement, followed by secondary retardation. The sequence is complex but basically appears to be about as follows. Industry, concentrated in centres of population and offering a means to obtain cash income, trends to attract especially the more mobile, vigorous, and adventurous young adults. At first, they tend

to follow the old established, essentially rural customs of their kind….marry young and aspire to large families. Sexual union among them is more fruitful because of their youth and because of the long average remaining period of fecundity. To this extent, industrialisation and urbanisation result in a substantial initial increase in the rate of population growth.

However, with improved education, growing sophistication, stabilisation of the labour force, the wish for an improved standard of living, social rivalries, and competition for time, energy, and income, there develops an emphasis on rationality and independence from tradition, with a breaking away from the traditional conservative cultural ties. Marriages are delayed, and families are kept small for the sake of more education, increased income, or improved social position. Children come to be considered less an economic asset and more an economic burden. Family life becomes less cohesive because individuals have many contacts outside the home. Since life becomes increasingly complex, sexual intercourse becomes less frequent or more vicarious and chances of fertilisation decrease. Added to this is the more ready availability of methods of contraception and the knowledge to obtain and use them. Hence, industrialisation and urbanisation result eventually in a decreased rate of reproduction and population growth. This has been found to hold true in eastern as well as in western civilisations.

3.2.5 Population and Environment

Friis (2010), observed that: "Currently increasing at a geometric rate, the human population threaten to overwhelm available resources. One of the consequences of population growth has been to encourage the conversion of large rural forested areas of the earth into cities. Urbanisation is linked to numerous adverse implications for the health of populations, unduly increasing rates of morbidity and mortality".
Largely as a result of human action, profound changes are occurring in our environment. The basic course of almost all of those problems is the world's larger and growing population, which consumes so much energy and produces so much quantity of toxic wastes. Environmental changes if accompanied by economic and political instability, could lead to the collapse of organised health services.

Vulnerable subgroups of the population, that is, the elderly persons with disabilities and chronic diseases, pregnant women and children are more likely to be affected by environmental hazards for example than are members of the general population.

A growing body of evidence shows that recent climate change is primarily the result of human activity, according to the State of World

Population 2009. "But the influence of human activity on climate change is complex and non-linear. Climate change's influence on people is also complex, spurring migration, destroying livelihoods, disrupting economies, undermining development and exacerbating inequities between the sexes."

Population dynamics are especially relevant to the debate about coping with or adapting to climate change. Some poor countries with rapid population growth may not have the capacity to adapt through, for example, migration from low-lying coastal areas to urban areas because services, housing and employment opportunities for the new residents may be inadequate.

As populations are growing, it makes economic and environmental sense for people to move closer together in urban areas. Urbanisation creates jobs and enables countries to provide essential services at lower costs per capita. It can also reduce energy consumption, especially in transportation and housing, and it can ease population pressures in rural areas.

The growth of cities everywhere poses real challenges for governments and the people who live in them. But urbanisation can be a positive driver for sustainable economic, environmental and social development. According to a 2011 UNFPA report, developing countries are in charge of growing the food and feeding the family, they are the first ones to feel the effects of environmental problems like droughts or floods." Climate change has the potential to reverse the hard-earned development gains of the past decades and the progress towards achieving the Millennium Development Goals, according to the World Bank. Setbacks will result from water scarcities, intense tropical storms and storm surges, floods, loss of glacial melt water for irrigated agriculture, food shortages and health crises (United Nations, 2009).

The Green Revolution is a recent phenomenon involving an increase in grain yields through the development of new strains of plants. One side effect of the effort to grow more food is degradation of the environment. The impact on the environment of population growth is compounded by the level of social affluence and economic technology.

Weeks (1998), indicated that food production and consumption are paradoxically associated with potential health hazards. Many ingredients that go into increased yields, increased storage time, and increased palatability of foods may be inadvertently lowering the overall quality of life.

Anderson, Morton, and Green (1978), pointed out that environmental resistance is expressed in parasitism, food supply, accidents, cold, heat, and other factors that may affect life adversely.

To a certain extent, man can bend nature to his will and control his environment. The extent to which man will be able to control the factors of environmental resistance will be the important element in determining the direction of human population growth in the world in the immediate future as well as over the coming centuries. For an individual nation to survive, it must have a positive vital index which is the relationship of births per thousand to deaths per thousand populations. For example, if a country has a birth rate of 14.9 per thousand and a death rate of 9.2 per thousand, it still has a healthy vital index of 5.6. When a nation's vital index begins to approach two, that nation's population is becoming static. If deaths exceed births in a nation, that nation will have a negative vital index symptomatic of national decline.

SELF-ASSESSMENT EXERCISE

How does population affect the environment?

4.0 CONCLUSION

Density dependent factors such as disease and food supply, and density-independent factors such as weather, have effects on population size. Interactions among organisms also limit population size. Unlike other organisms, humans can manipulate and regulate limiting factors, and this has resulted in a large increase of world's human population. Many ecologists suggest that the pollution observed today is directly related to the world's increasing human population. If the human population continues to grow at the present pace, additional environmental problems will result from such things as a diminishing energy supply and increasing pollution, with consequent health implications.
Since increased population densities and unhealthy living conditions can ease the transmission of infections; and migration may also increase vulnerability to disease, adequate care should be taken to ensure that composition, size and distribution/movements of a population do not have negative implications on the health of the population.

5.0 SUMMARY

In this unit, we looked at population dynamics and learnt that: Populations grow exponentially until they reach the carrying capacity of the environment.

We also learnt that: Environmental factors which affect an organisms' ability to survive in its environment are called ***'limiting factors'*** and they could be density dependent or density-independent. The ability to withstand fluctuations in biotic and abiotic environmental factors is known as **tolerance**. Apart from environmental factors, other interactions that limit population size include **effects of competition and crowding**.

We further learnt that: population growth could also be termed population change. The change may be an increase or decrease in the population size and components. The total of the three demographic variables – fertility, mortality, and net migration- gives us a country's **growth rate,** and therefore, the **basic demographic equation** is: Growth rate = births – deaths + net migration.

A common way of measuring the growth potential of any combination of birth and death rates is to calculate the doubling time. The **doubling time *is the time required for a population to double if the current rate of growth continues.*** The doubling time is approximately equal to 70 divided by the growth rate (in per cent per year).

The problem of population is not so much of the size of the population, but its rate of growth which threatens to overwhelm available resources. One of the consequences of population growth is urbanisation which is linked to numerous adverse implications for the health of populations, unduly increasing rates of morbidity and mortality.

We learnt that recent climate change is primarily the result of human activity, and the influence of climate change on people is complex.

6.0 TUTOR-MARKED ASSIGNMENT

1. Differentiate between exponential and linear population growth.
2. Explain 'Limiting factors'; and give two examples each, for density dependent and density-independent factors.
3. How would an increase or decrease in the population of a Local Government Area affect the occurrence of water related diseases in that locality?

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UNIT 4 POPULATION STRUCTURE AND POPULATION MOVEMENT

CONTENTS

1.0 INTRODUCTION

The previous unit focused on the components of demography, and demographic variables, and also explained population structure and migration. In this unit, we shall study in more detail, the makeup of population – population structure; we shall also discuss population movement or migration.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- describe population structure using population pyramids
- explain the meaning of dependency
- discuss migration.

3.0 MAIN CONTENT

3.1 Population Structure

The population structure is the distribution of the population by age groups. Population structure addresses the relationship between population processes and demographic characteristics of populations such as the age, sex, race, ethnicity, marital status, education, occupation, and income.

A structure is something that is built or constructed. In social science, it refers more broadly to a pattern of interrelationships between parts of a society. Weeks (1998), said that an age and sex structure actually combines both definitions, since it represents the number of people of a given age and sex in society and is built from the input of births at age zero and deaths and migration at every age.

Age and sex influence the working of society in important ways because society assigns social roles and frequently organises people into groups on the basis of their age and gender. Further, at very young and very old ages, people are more dependent on others for survival, and so the proportions of people at these ages will influence how society works. A population is considered old or young, depending on the proportion of people at different ages. In general, a population with more than about 35 per cent of its people under age 15 is "young", and a population with more than about 10 per cent of its people aged 65 or older can be considered "old".

There are three major ways in which we can graphically or statistically quantify the age structure. These include: constructing a population pyramid, calculating the average of a population, and calculating the dependency ratio.

To illustrate population dynamics, demographers use **population pyramids**. A population pyramid is a graphic representation of the distribution of a population by age and sex. These depict a country's population by age and sex. Countries with high birth rates have a population pyramid with a broad base, tapering in the higher age ranges. By contrast, a population with low birth rates is top heavy, due to a high proportion of people of retirement age and of those receiving pensions. Figure 4.1 shows the population pyramids of Germany, Mexico and the United States of America. In each pyramid: the male population is on your left hand side, while the female population is on the right hand side. As you can see from these population pyramids, a much higher percentage of Mexican women are in their childbearing years. Even if Mexico and the United States had the same birth rate, a larger percentage of women in Mexico would be giving birth, and Mexico's population would grow faster. Demographers refer to this as **population momentum.** Here, Mexico's age structure gives it greater population momentum.

As shown also in Figure 4.1, Mexico's population momentum is so strong that its population will double in thirty-five years. Henslin (2009), observed that the implications of a doubling population are worrisome. He noted that just to stay even, within thirty-five years, Mexico must double the number of available jobs and housing facilities;

its food production; its transportation and communication facilities; its water, gas, sewer, and electrical systems; and its schools, hospitals, churches, civic buildings, theatres, stores, and parks. If Mexico fails to double them, it's already poor standard of living will drop even further. Henslin (2009) highlighted the threat of political instability which conflict theorists point out that a declining standard of living poses. They are protests, riots, and even revolution; and in response, the government tries to stop them. This can give rise to more trouble and can spill from one country to another.

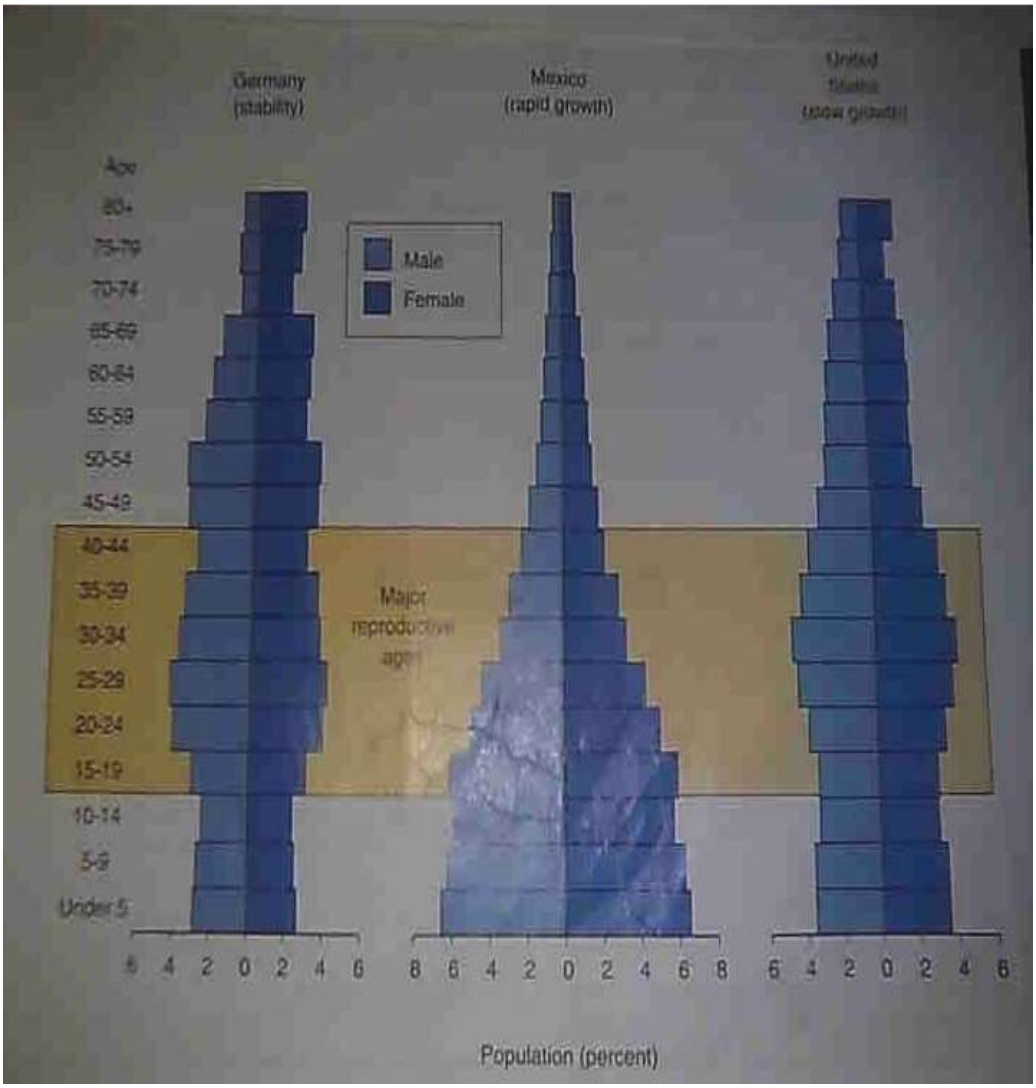

Fig.4.1: Three Population Pyramids of Germany, Mexico & USA
Source**:** Biggs, Kapicka & Lundgren (1998). *Biology in Action*.

3.1.1 Dependency

What is Dependency?

Demographers make the assumption that most of the people between the ages of 15 and 65 are working and that people between the ages of zero to 15, and 65 and over are dependent on those who work. People view children and the elderly as dependent on those who work (Weeks, 1996:257).

Dependency within the Family

Compare two families with equal resources. One family, however, has two children while the other family has 10 children. The family with 10 children has to spend more of the family resources on providing essentials for the family's survival (food, shelter, etc.). A smaller family does not have to spend as much as the larger family on necessities. The extra money can be used to build security.

Nations and states experience the same problems that families do, when the number of dependents in the population is too large compared to the number of people who are available to support those dependents. Dependency ratios describe the relationship between workers and dependents. In countries with high rates of dependency, money that should be directed toward building an infrastructure has to go toward feeding babies and supporting an excess population. High dependency ratios mean that money is being directed toward support of dependents and not toward the development of the infrastructure. What infrastructure that is already in place experiences even greater strain as population pressure increases (Russ Long's, 2008).

The population of a country can be divided into: the non-economically active, generally those still at school or college or who have retired; and the economically active or population of working age. Those who are non- economically active are dependent on those at work, and this can be shown statistically as a **dependency ratio**.

$$\frac{\text{Children and elderly}}{\text{Those of working age}} \times 100 = \textbf{dependency ratio}.$$

This depends on the legal meaning of Children and elderly in the country of application. For example, in Nigeria, children are persons under 18years old, and the retirement age for the majority of public servants is 60 years. So, demographic dependency ratios are calculated by dividing the population aged 0–14 (or 0–19) plus the population aged 60 (or 65) by the remaining population (conventionally called the

working age population). The old age dependency ratio is calculated as the ratio of older people to the working age population.

$$\textbf{Dependency Ratio} = \frac{\text{Population of persons 0-14 (or 0-19) years old + Population of persons 60 (or 65) years old or more}}{\text{Population of persons 15-64 years or 19 – 59 years old}} \times 100$$

3.1.2 Demographic Dividend

The prospective contribution of growth to this strategy for stabilising population is bolstered by an economic theory of demographics. Poor countries enjoy favourable dependency ratios, their populations dominated by potentially productive young people.

This is often described as the "demographic dividend" and has been associated with the tiger economies of East Asia.

Some economists interpret recent strong rates of growth in Africa as evidence of this demographic dividend. Others fear that poor infrastructure, governance and education will stifle the potential. Very high rates of youths unemployment do indeed persist in Africa and parts of the Middle East.

The demographic dividend is a fleeting opportunity which can quickly overturn into social unrest, as illustrated by recent dramatic events in several Arab countries.

There is further concern that a hard core of about 25 of the very poorest countries cannot possibly benefit from the demographic dividend. They show signs of being trapped in a demographic vortex, where low resilience to the impact of climate change on food and water scarcity offers no escape from exceptionally high fertility rates of around eight children per woman.

Whilst there is some truth in the adage that "development is the best contraceptive," it is wise to award at least equal status to the view that "contraception is the best development."

SELF -ASSESSMENT EXERCISE

Study Figure 4.1 carefully. Which age groups are shaded? What are they called?

3.2 Population Movement

Migration is the movement of people from one geographical area to another. It is one of the components of population growth apart from

fertility and mortality. The third demographic variable is the **net migration rate,** which is the difference between the number of immigrants (people moving into the country) and emigrants (people moving out of a country) per 1000 populations. Unlike fertility and mortality, migration does not affect the global population, for people are simply shifting their residence from one country or region to another. It is very important in demographic study and it is not just about movement. For example, traveling to Lagos from Ilesa or Kaduna to Abuja, or Abakaliki to Enugu for a short stay cannot be regarded as migration.

The reasons for migration are many and varied but they can usually be classified either as push factors or pull factors. **Push factors** come in to play when conditions in the home area are such that people feel they need to move to a different area in search of an improvement to their lifestyle. **Pull factors** take effect when opportunities are offered in another area so that people are drawn towards life in a different place.
People who are forced to leave their home are known as refugees. Refugees seek refuge in another area because of circumstances over which they have no control. These circumstances include: natural disaster, famine, ethnic cleansing, accidents, slavery, politics, religious persecution and war.

3.2.1 Types of Migration

We have two major types of migration: internal and international migration.

1. Internal Migration: is the movement of people within the same country without crossing any international boundary. The term is relative. In terms of a given State, internal migration is movement within the State without crossing to another State. In terms of nation, say Nigeria, it is movement within, without crossing boundary or move to other nations. In internal migration, there are no legal constraints on migrants. You do not need to obtain visa or passport or any other document before you can migrate internally.
2. International Migration: this is movement of persons across boundaries between two or more countries after having satisfied all the conditions necessary. People moving from one area into another within the same country –such people moving are referred to as in-migrants, while those moving out of an area are known as out-migrant. This will depend on one's reference point i.e. origin or destination. The process is called in-migration and out-migration respectively. On the other hand, when people move from one country to another, such people are referred to in the

receiving areas of destination as immigrants. The process is referred to as **immigration** and **emigration** respectively.

Ogunbameru (2009), stressed that the internal movements are more important than the international ones. There are various types of movement within a country: Rural – rural migration; Rural – urban migration; Urban – urban migration; Urban – rural migration.

i. Rural-rural migration: This involves people moving from one rural area to another. An example of this kind of migration is the movement of farmers from one agricultural area to another looking for fertile land.
ii. Rural-urban migration: Is the movement of people from rural area (urban area has a population of at least 20,000 people; anything less than this is regarded as rural by 1963 census) to urban area.
iii. Urban-urban migration: This is another type of migration that involves movement from one urban location to another. It is a form of migration that predominates in societies with a high index of urbanisation; it is confined to countries where both medium-sized towns and large cities co-exist. Urban-urban migration is a feature of countries with diversified urban systems and social, economic, and administrative facilities. It may be a movement from an area of industrial concentration to an area with an expanding services sector. In some instances, it may be occasioned by the desire to avoid a particular neighbourhood.
iv. Urban-rural migration: This is not so common, although it does happen. For instance, people who worked for many years in the urban centre but now determined to return home after retirement, though it is not a case of permanent movement.

In the whole of Africa over the years, the most common one is the rural-urban migration, whereby the youth move to the urban centres to seek for white collar job. It was as a result of the movement of these people that farm settlements were established in various places of Nigeria so that the movement may be reduced. In most cases, the urban centres, particularly in Nigeria are not ready for them.

Around the world, the flow of migration is from the least industrialised nations to the industrialised countries. After "migrant paths" are established, immigration often accelerates as network of kin and friends become additional magnets that attract more people from the same nation, and even the same village (Henslin, 2009).

Using the United States of America economy for example, opinions are divided among Experts as to whether immigrants contribute to the economy or drain it. According to Simon (1986, 1993), cited in

(Henslin, 2009), they conclude that immigrants produce more than they cost. Looking at the same data, other economists conclude that immigrants drain tax payers of billions of dollars a year (Huddle 1993; Davis and Weinstein 2002) cited in (Henslin, 2009).

As a factor of population dynamics, migration causes increases or decreases of population in a particular area, depending upon which way the flow goes. Also, the organisation of living things in space is generally quite related to the methods they use to exploit their environment. Spatial organisation and the population mechanism are inseparable. Since migration operates in two ways at the same time, it provides a good example of how spatial organisation and the population mechanism are correlated. As expected, movement of an individual or group out of one area automatically means movement into another and thus, spatial reorganisation.

3.2.2 Consequences of Migration

According to Lines and Norman (1997): "the movement of people either within a country or to another country affects both the source and the destination of the migrants in both positive and negative ways thus:
At source:

- The birth rate may be lowered
- There may be less pressure on job and certain resources
- Migrants may send money back to their families
- New skills may be learned which may eventually be brought back to the area
- Labour shortages may be created in some places of work
- Families may be split up, often only the male family members migrate
- Those who migrate tend to be those with skills and education
- The average age of the population may increase
- A concentration with a high proportion of older people puts a strain on services and amenities.

At destination:

- Labour shortages are solved
- Less attractive jobs not wanted by local people are often taken willingly by immigrants
- Migrant workers are often prepared to work longer hours than the host population
- New cultures are introduced including foods, music and leisure activities

- Population growth is affected as many migrants are of child-bearing age
- In times of recession, migrants may be seen as a burden on health and social services provision
- Racial tension may result from international migration and resentment can develop
- International migrants are not always prepared to become part of the host culture and ghettos may develop.

SELF-ASSESSMENT EXERCISE

Relate your knowledge of migration to the process of urbanisation.

4.0 CONCLUSION

Our focus in this unit was on population structure and population movement. In conclusion, note that: A country's population structure is the distribution of the population by age groups and sex. Populations that are dominated by potentially productive young people enjoy favourable dependency ratios. As a factor of population dynamics, migration causes increases or decreases of population in a particular area, depending upon which way the flow goes. People move within their own country or to a different country for a variety of reasons. They may be 'pushed' from their origin due to war, famine or natural disasters. They may be 'pulled' to a new area by the attraction of work, housing, health and social service provision.

5.0 SUMMARY

In this unit, you learnt that: The population structure is the distribution of the population by age groups. Demographers use **population pyramids,** which depict a country's population by age and sex, to illustrate population dynamics. A country that has a high percentage of women in their reproductive years would grow faster, and demographers refer to this as **population momentum**. Also, those who are not-economically active, the children and elderly, are dependent on those of working age.

You further learnt that: there are two types of population movement: International migration from one country to another and Internal migration from one part of a country to another part. Those who migrate are called migrants; and the place they have come from is known as the source or origin, and the place where they go to is called the destination. People moving out of a country are emigrants and when they arrive in their new country of destination they become immigrants to that country. The movement of people within a country is called in-

migration, out-migration or transmigration depending upon the direction of movement.

6.0 TUTOR-MARKED ASSIGNMENT

Write notes on:

a. Dependency
b. Population pyramid
c. Migration.

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MODULE 3 CENSUS

UNIT 1 CENSUS: TYPES AND METHODS

CONTENTS

1.0 INTRODUCTION

Earlier on, you read about census as a direct method of data collection. You learnt that censuses do more than just count people. They typically collect information about families or households in addition to individual characteristics such as age, sex, marital status, literacy/education, employment status, and occupation, and geographical location. In this unit, we shall discuss the types and methods of census.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- identify types of census
- explain what population census is
- describe various census methods
- explain census data capturing methods.

3.0 MAIN CONTENT

3.1 Definition of Census

The word "census" originated in ancient Rome from the Latin word *censere* ("to estimate"). Census played a crucial role in the administration of the Roman Empire, as it was used to determine taxes. It provided a register of citizens and their property from which their duties and privileges could be listed. It is said to have been instituted by the Roman king Servius Tullius in the 6th century BC. During the Roman Republic, the census was a list that kept track of all adult males fit for military service. The modern census is essential to international comparisons of any kind of statistics; and censuses collect data on many attributes of the population, not just how many people they are, although population estimates remain an important function of the census.

A **census** is the procedure of systematically acquiring and recording information about the members of a given population. It is a regularly occurring and official count of a particular population.

3.2 Types of Census

Let us examine the various types of census.

3.2.1 Population Census

The term is used mostly in connection with national population and housing censuses. A census of population is the total process of collecting, compiling, evaluating, analysing and publishing demographic, economic and social data pertaining, at a specified time, to all persons in a country or in a well-delimited part of a country. Population censuses are taken at least every 10 years.

United Nations (1969), pointed out that "Population is basic to the production and distribution of material wealth. It is impossible to plan for, and carry out, economic and social development, administrative activity or scientific research without precise and detailed data on: the size, distribution and composition of population". The population census is a primary source of these data.

Population censuses have been taken in Nigeria during colonial time in 1866, 1871, 1896, 1901, 1911, 1921 and 1952. The censuses covered only the southern part of the country except for the 1952 census which was country wide, and the censuses before 1921 were based on administrative estimates rather than on an actual enumeration.

Censuses during the independence were taken 1963, 1973, 1991 and 2006. The results from 1973 and 2006 were highly disputed. The preliminary result for 2006 indicates a population of 140 million people. Seven hundred thousand (700,000) enumerators were engaged in this operation.

3.2.2 Census of Housing

An especially close association exists between population censuses and housing censuses. The two censuses may comprise one statistical operation or they may be two separate but well-co-ordinated activities, but they should never be considered completely independently of each other because essential elements of each census are common to both. For example, an essential feature of a population census is the identification of each occupied set of living quarters and of the persons living therein and an essential feature of a housing census is the collection of information on the characteristics of each set of living quarters in association with the number and characteristics of its occupants.

In many countries, the population and housing censuses are taken concurrently, often with the use of a single schedule. In this way, the information on population and living quarters can be more readily matched, processing is facilitated and extensive analysis can be carried out. This also makes it possible to relate to the housing census data the information on demographic and economic characteristics of each household member which is routinely collected in the population census; if this information cannot be taken from the population census, it has to be collected in the housing The advantages of simultaneous investigation may be offset to some extent by the additional burden on the respondent and the enumerator resulting from the increased amount of information which must be collected at one time. In countries where this is likely to be a serious problem, consideration might be given to collecting data for a limited number of topics on the basis of a complete enumeration in the population and housing census, with more complex data in both fields being collected on a sample basis only, either concurrently with or immediately following the full enumeration.

3.2.3 Census of Agriculture

Population censuses and agricultural censuses do not have as close an association as that existing between population censuses and housing censuses because they do not have common essential aspects.

Although both the population census and the agricultural census can provide information on persons engaged in agriculture, they do not have

a common definition of this group of persons. For the agricultural census, the group (referred to as "persons employed in agricultural work") consists of persons employed in farm work or planning necessary to the operation of an agricultural holding. Because information on these persons is always collected in relationship to a given holding, persons working on more than one holding during the census reference period may be counted more than once in the census. In a population census, information is obtained on persons principally engaged in the agricultural industry or at least on persons engaged in an agricultural occupation. Persons who worked on an agricultural holding only incidentally during the reference period might not be included in either of these categories. Precisely because of the differences in definition, however, it may be useful for a country to have both types of information 'for comparative' purposes.

In the preparation of an agricultural census, information from a recent population census can be utilised for demarcation of enumeration areas, the preparation of the frame for the census and the designing of the sample if a complete agricultural enumeration is not undertaken. In planning for a population census, consideration might be given to the possibility of collecting some agricultural information which would facilitate the preparation of a subsequent agricultural census.

If it is desired to collect information in an agricultural census on some demographic or social characteristics of persons employed in agricultural work or of the farm population, it would be useful to employ the same definitions and classifications of such characteristics as used in the population census, in order to permit as high a degree of comparability as possible between the results of the two censuses. In some cases, the utilisation of supplementary sample surveys in connection with either census may serve to provide the information desired on the relationship between the characteristics of the population of holdings and the characteristics of the holdings.

3.2.4 Census of Establishments

Although the collection of information on industrial and commercial establishments is not a part of the population census, some of the information which is collected regarding economic characteristics of individuals can be used for preparing listings of the proprietors of such establishments and/or of the establishments themselves. Experience shows that these listings can be used in a subsequent census of establishments or for supplementing the registers of establishments which are maintained by most countries and utilised in their establishment censuses. Since most of the registers cover at least all establishments in which more than a minimum of persons (e.g., five or

10) are employed, it is usually only necessary to obtain information through the population census on smaller establishments, particularly those operated by self-employed persons. The population census information needed for these purposes is the industry and status (as employer, employee, own-account worker etc.) of economically active persons, the name and address of their establishments (if any) and (for employers) the number of employees. If all of this information appears on the census questionnaire, the data for the small employers and own-account workers can be extracted from the schedule or from the processing documents after the enumeration. If only industry and status appear on the schedule, the remaining information may be obtained from the desired group at the time of the population census enumeration and entered on a separate schedule.

3.3 Census Methods

We shall deliberate on census methods in terms of *approaches and data capture methods.*

The approaches include:

a. **The traditional approach:** The traditional approach comprises a complex operation of actively collecting information from individuals and households on a range of topics at a specified time, accompanied by the compilation, evaluation, analysis and dissemination of demographic, economic, and social data pertaining to a country or a well-delimited part of the country. Members of the public respond to a census questionnaire, or interviewers are deployed to collect information from respondents. The traditional census has unrivalled merit in providing a snapshot of the entire population at a specified period and the availability of data for small geographic domains. In that sense, the traditional census is perhaps unique in nature. This approach is particularly suitable for countries having a federal structure and having the requirement of producing population numbers by various social and economic characteristics simultaneously for all geographical levels to meet the needs of planning and the allocation of funds (UN, 2007).

b. **The register-based approach:** The philosophy underlying this concept is to take advantage of the existing administrative sources, namely, different kinds of registers, of which the following are of primary importance: households, dwellings and individuals. One of the essential preconditions of this approach is that the country should have an established central population register of high quality and good coverage linked with a system

of continuous updating. In the case of local registers, continuous updating along with communication between the register systems must be good. The primary advantages of a register approach are reduced cost for the census process and greater frequency of data. However, establishing and conducting administrative registers involve higher costs than the census alone may justify.

c. **The rolling census approach:** A "rolling census" represents an alternative to the traditional model of the census by means of a continuous cumulative survey covering the whole country over a long period of time (generally years), rather than a particular day or short period of enumeration. The two main parameters of a rolling census are the length of the period of enumeration (which is linked to the frequency of updates required) and the sampling rate (which depends on the available budget and the geographic levels required for dissemination purposes). Implementation of such an approach requires highly complex sampling and modeling techniques; a high quality sampling frame in order to allow sampling at very low levels of geography (a master address file updated annually is indispensable); and successful consultation about the approach with major stakeholders, including national and local governments and the user community. The main advantage of this approach is the higher frequency for updating data: a traditional census provides an update every five or10 years, whereas a rolling census provides annual updates.

d. **Traditional enumeration with yearly updates of characteristics:** This design is a variation on the traditional census design and focuses on counting the population and collecting only the basic demographic data in the census year. A very large household survey collects and tabulates detailed demographic, social, economic, and housing data every year throughout the decade, replacing a census year long form to collect these detailed data from a sample of the population. The primary impetus for this approach is twofold: to provide more frequent and relevant data on the population than are available when a census is conducted only once a decade and to reduce the operational risks associated with the census.

The United Nations (2009) outlined a variety of methods of capturing data for national census projects. All of the main methods have been used in one form or another and in some cases, multiple methods have been implemented to complement each other. All methods have been used successfully in the commercial environment and all have their own unique technical challenges when being adopted for use in census.

National Population Commissions (NPC) or National Statistical Offices (NSO's) that have no experience in these methods should take heart that other NSO's have been in their position before and thus lessons learnt from those experiences may make any technology transition easier. These data capture methods include:

- Manual Entry From paper – Operators type in responses they see on the physical census form into the computer system. Key from image – Operators type in responses they see on an image of the scanned census form presented to them on a computer screen.
- Optical Mark Reading (OMR) – Using special scanners, data is automatically extracted from the census form at the point of being scanned by the recognition of marks (such as tick boxes or multiple choice lozenges) in specific locations on the form.
- Intelligent Character Recognition (ICR) – Software is used that attempts to recognise handwritten text on each census forms' scanned image.
- Personal Digital Assistant (PDA) – A digital handheld device is used to log and record census information by an enumerator (alternatives are Pocket or Portable PC's).
- Telephone and Internet – Remote capture of data either by automated telephone interviews or entry of data via a dedicated, secure website.

The method/s choices above may be restricted or determined by the logistics of the census project, for example, if the NPC is planning to undertake self-enumeration by undertaking a mail-out of census forms for the public to complete, then choice of PDA is not a viable option. (PDAs could be used for follow-up of non-respondents, using interviewing staff).

The workflow typically used when paper based data capture is used varies depending upon the method selected.

Manual Entry

This section gives an overview of the two main methods for NSO's to manually enter the census forms' data into their computer systems. They both require large numbers of staffing and associated computer infrastructure.

a) From Paper

This is by far the solution that requires the least amount of technical knowledge and implementation and requires an operator to key data directly into the computer from the physical census form. Where a wide

area network infrastructure is available, installed systems can be easily replicated and connected to create a de-centralised configuration if required by the NPC.

During the data capture phase, each completed census form has its response codes manually entered into one of the networked computers by an operator. Typically, each operator processes one entire census form at a time and when finished entering, responses for that form physically moves it to the completed file and picks up the next physical form to process. This method is also used to process textual responses into classification categories.

Advantages

- Method requires simple software systems and low-end computing hardware.
- Low cost (depending on the costs of local skilled manpower).
- There will be a large number of workstation computers available for other uses after the census is completed.

Disadvantages

- Requires very large numbers of staff, both PC operators and managers.
- Standardisation of operations is difficult as performance may be individually dependant.
- Staff needs to be kept motivated due to repetitive nature of their work.
- Physical space to house PC operators and all of the associated requirements.
- Only data in the computer system will exist after being processed.

b) Key from Image (KFI)

This method involves initially scanning the completed census forms using an industry standard document scanner that captures each form's image. These images are then sent in turn to computer screens for operators to select the appropriate corresponding response.
Each operator can be assessed accordingly, increasing the potential accuracy of the process. Scanning of the completed census forms is typically undertaken using a batch control process. For example all the forms that are returned from a specific Enumeration Area (EA) are scanned and all images produced are electronically 'tagged' with the EA code they relate to. Network and file security relating to the images scanned needs to be considered especially relating to any confidentiality

of information on them. Access should be restricted to the images captured as deemed appropriate by any confidentiality/anonymity policy of the NPC.

Advantages

- There will be a large number of workstation computers available for other uses after the census is completed.
- A digital image archive of all completed census forms is created automatically from the scanning process. The paper forms can be removed for long term storage or disposed of if appropriate.
- It has been reported that an increased speed from operators can be achieved (compared with manual entry from paper) of between 20% - 40% less time as they do not need to move physical forms around.

Disadvantages

- The keying process cannot be undertaken until forms have been scanned.
- There is a need for a relatively sophisticated workflow to be put in place in order to manage the keying process and smooth flow of images.
- Large numbers of staff required and extra costs associated with the technical infrastructure needed (Hardware and Software).
- Finding a suitable use for the document scanners after the processing has been completed.

Optical Scanning

This section gives an overview of the two main methods (OMR and ICR) for NSO's considering using optical scanning techniques to enter the census forms data into their computer systems. They both require sophisticated software applications and associated computer infrastructure.

Optical Mark Recognition (**OMR**) is the term associated with recognising tick box/multiple choice data. Optical Character Recognition (OCR) is the term associated with the recognition of machine printed characters, like printed text and as such has a limited application in census projects.

Intelligent Character Recognition (**ICR**) is the term associated with recognition of hand written data. Barcode recognition can also be achieved with optical scanning methods and may prove very useful in

the processing of census forms if they are required to be uniquely identified.
Both of the main methods are well proven with OMR being used for around 40 years and ICR for approximately 20 years. Both technology methods are used successfully today in lots of large volume paper based data capture projects other than census and each have their own set of advantages and disadvantages.

For the successful implementation and use of these methods, staff will be required with the necessary IT skills that are familiar with databases, software configuration/support for set-up, management and maintenance of such deployments.

It should be noted that the resultant quality of data output for any paper based method chosen will be heavily dependent upon how well the enumerators complete the forms and the condition that they arrive at the processing centre. Processing of bad forms will be slow and inaccuracies are more likely. Therefore, the most important factors for timely and accurate data capture is to make sure the forms are filled in correctly and are returned in good condition. This means form design and training of the enumerators are both significant factors to consider spending time and effort on to reduce the associated risks as any data capture processes chosen cannot make bad forms good.

There are international standards (ISO) that printing companies can conform to, giving a greater consistency of output of their product by having detailed and defined internal procedures. Selection of such suppliers of large volumes of printed forms may be worthwhile considering to this end. It is advantageous to try and limit the questionnaires to a single page form that can be scanned without being split into two or more parts.

Optical Mark Recognition (OMR)

OMR is a form-scanning method whereby “tick box” style responses are interpreted by a specially configured OMR scanner (using predefined rules and tolerances to gauge the significance of the marks made) and are automatically and immediately passed into a computer systems file or database without the use of a keyboard. This is achieved very fast and very accurately. OMR is the fastest method of automated data capture. OMR technology reads marked responses to questions on specially designed and printed paper. The design, print and cutting of the forms is particularly important to make sure that the scanner has the best possible chance of capturing the intended mark on the form. Therefore any handwritten responses on the form must be manually entered or coded

using computer-assisted methods. This part of the process should not be underestimated and could require significant planning and resource.

Advantages

- Very accurate and very high speed processing can be achieved.
- Equipment is relatively inexpensive; simple to install and run.
- A well-established technology that's been used in many countries.
- If OMR scanner is used that has image capture ability then the digital filing of questionnaires resulting can be achieved, allowing for the storage and retrieval of questionnaires images for future use.

Disadvantages

- Requires specially printed and cut forms and scanners.
- Tick box responses are not suited to all types of questions.
- The forms are not easy to fill in for the public and usually need a small amount of training for enumerators to complete the form.

Intelligent Character Recognition (ICR)

ICR systems interpret hand written number and letter character responses from electronic images of forms scanned. ICR technology interprets responses in predefined specific locations on the form and transforms any responses into output data for a computer system to use. For census applications, their use should only currently be considered for interpreting characters that are not connected or joined together (Cursive).

Providers of ICR systems can offer solutions that will be able to interpret most commonly used scripts (Roman, Arabic, Cyrillic, etc.). This is based on the ICR engine that they use with their application software. All ICR applications will require the use of one or more ICR engines. This is the core software that will try to recognise each hand-written response. To improve the recognition process, many systems will enhance the image prior to passing it to the ICR engine. Typically ICR engines will expect to receive a bi-tonal image i.e. pure black and white - like a fax image, for processing. Enhancements will improve the engines' ability to recognise characters correctly.

ICR engine training – Most current ICR engines have been well trained with various language sets, and training of ICR engines is not commonly undertaken.
There will be a limit to the capability of the chosen system due to the quality of handwriting from the enumerators. ICR solutions cannot make bad forms good. The number of staff required to verify and correct the data and to fill the gaps, should not be under-estimated. To give the ICR

the best chance at recognising the handwritten characters correctly, the NSO may consider training all enumerators on how to best write characters into the response areas on the form. This training can be reinforced by the addition of an example being printed onto every census form, assuming there is room to facilitate it.

Scanner maintenance should be planned and exercised regularly due to build-up of dirt and paper dust from the forms being scanned.

Advantages

- Form design is not as stringent as traditional OMR forms.
- Processing time can be reduced due to automated nature of the process compared to manual entry method.
- Allows for digital filing of questionnaires resulting in efficiency of storage and retrieval of questionnaires for future use.
- No specialist hardware required.
- Very high speed scanning can be achieved.
- Forms designed for ICR are relatively intuitive to complete. Locally printed forms can be used.

Disadvantages

- Comparatively higher costs of equipment (sophisticated hardware/software required).
- Significant hardware/software and trained IT staff will be required to support the system.
- Handwriting on census forms needs to be concise to avoid recognition error.
- Possibility for error with character substitutions which would affect data quality.

Personal Digital Assistant (PDA)

The PDA is a small handheld electronic device which can substitute the traditional paper based enumeration. It allows for census data to be captured and stored electronically. The traditional census form is replaced by a series of sequential questions appearing on the PDA screen where the enumerator enters the answer by either selecting predefined responses or entering a variable. They are typically used with a stylus (a pen shaped device) to enter data via the devices' touch screen interface. It is acknowledged that technology is constantly evolving and that PC technology is becoming more portable but for the purposes of this document, this section will focus on the PDA. Many of the points discussed in this section will also apply to any portable PC technology

being considered for implementation. Data can either be stored on the device locally in its memory and/or be transmitted to a central location if the appropriate communication infrastructure is present. Locally stored data can be transferred using the PDA download function via various ways, including direct attachment to host computer, transfer of data to memory stick/card, device to device transfer, etc.

PDA devices have a number of technical options that can aid the enumerator and census process. They have the ability to make telephone calls (if within the network coverage area) and transmit data, although consideration should be given to data security. Enumeration Area (EA) maps and/or address information can also be loaded onto the device and even aerial or satellite photos to help the enumerator find the correct housing units to visit. If the PDA has integrated GPS, tracking could be undertaken to assist the enumerator in understanding their current location and also capture the geographical location of where the census data was captured.

All of the technical features discussed here require the devices to be pre-programmed in some way and for a large number of these devices this exercise should not be underestimated. Power consumption and the practicalities of charging the device should be tested and checked as failure in the field would also cause support issues.

Fig.1.1: Used for Data Collection
Source: United Nations (2009).Census Data Capture Methodology.

Advantages

- Instant data capturing at the point of collection, reducing manual input errors.
- Immediate data validation, reducing re-verifications at later stage.
- Time effective with real time logical validation rules, reducing logical errors.
- Faster processing of census information leading to timely availability of results.
- Additional functionalities can be included such as GPS, camera, Bluetooth, etc.

Disadvantages

- Setting up of process may take a long time as it requires extensive testing.
- Requires that enumerators have ability to use the device and therefore requires intensive training of enumerators.
- Need to recharge the battery which could run out during enumeration.
- Possibility of equipment failure.
- Expensive capital equipment costs with limited high volume use after the census exercise.
- Loss of devices (not returned).

Computer- Aided Telephone Interviews (CATI) and Internet

The use of the Internet and Computer Aided Telephone Interviews (CATI) for census data collection is growing. However, the methods are always complementary to other more established methods. From the experience of countries that have undertaken this method, it is deemed essential that there are adequate levels of literacy for self-enumeration to take place in an Internet census option.

CATI is a method whereby the housing unit is contacted on the telephone by an interviewer who follows an on-screen script on a computer or completes an internet form on behalf of the housing unit. The computer may also be used to call the telephone number of the housing unit if an appropriate list is available and loaded into the system. Confirmation may be required from whoever answers the telephone at the housing unit before data is collected.

Advantages

- Reduced resources necessary for form handling and data capture.
- For CATI, there is a better opportunity to enumerate difficulties to reach population groups.
- Automatic filtering of irrelevant questions.
- Better quality data due to in-built interactive verification mechanism.
- Faster availability of census results through simplified data entry and editing.
- The running costs are significantly cheaper than paper based methods

Disadvantages

- Requires that respondents have a computer with Internet access or telephone.
- Management of responses can be problematic, e.g., that households have responded once and only once, and that the actual householder has completed it (security).
- Need to build parallel processing system as not everyone will use the Internet or telephone.
- Requires mechanism to check for omitted and duplicate submissions.
- Is costly and requires a lot of resources for setting up and adequately testing the system.

Method Selection Considerations

The choice of which data capture method to use is likely to be dependent on national circumstances. As such, the choice of method should be part of the overall strategic objective of the census in terms of timeliness, accuracy and cost. Maintaining the integrity of the system and confidentiality of the data will also be key in the decision making process. The choice of which processing system and technology to use for the census data capture needs to be established early in the census cycle so that enough time is available to effectively test and implement it.

In choosing a paper based data capture method, the design and paper quality of census forms should be linked to the method of data capture. This will aid the data capture process when the forms are returned for processing. When imaging technology is to be used, adequate training of enumerators on how to properly fill in the forms is crucial.

Considering the population to be enumerated may also assist in the decision making process, especially if Internet or telephone systems are to be thought of. Also how the data would be collected from special populations such as the hospitalised, prisoners, temporary visitors and nationals travelling abroad.

The skills of the enumerators should be considered as they are a key stakeholder group that will have an overall impact on how well data is finally captured.

4.0 CONCLUSION

The various types of census are associated and information from one could be used in another. The choice of census method depends on the need and resources available at any given time.

It is evident there is not just one preferable set of data capture technology for any national census exercise. The challenges faced by a National Statistics Office when planning which data capture method to implement in their national census project varies depending upon a number of factors and external influences including, but not limited to: Budget and current funding situation; Project time frame; Political requirements; Availability of local technical skill set; Previous data capture method employed; Regional trends; Expectations of output data quality.

5.0 SUMMARY

In this unit, we defined census as: the procedure of systematically acquiring and recording information about the members of a given population. We examined the types of census: population, housing, agriculture, and establishment; and also deliberated on the census methods which include: the traditional approach, the register-based approach, the rolling census approach, traditional enumeration with yearly updates of characteristics. We studied the various census data capture methods, and learnt that a number of factors should be considered when choosing data capture method/s to employ as it may not be appropriate just to use the most ‘cutting‘ edge technology. Proven technology also has a big part to play. Anything that previously worked well should not be disregarded without investigation into the impact any alternative may have.

6.0 TUTOR-MARKED ASSIGNMENT

1. Identify four (4) types of census and briefly explain two (2).
2. State: a) Four (4) census methods. b) Six (6) census data capturing methods.

7.0 REFERENCES/FURTHER READING

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UNIT 2 CENSUS PRINCIPLES AND PRACTICE

CONTENTS

1.0 INTRODUCTION

In this unit, we shall focus on the principles of census, and study the procedure for population census.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- identify the essential features of a population census
- explain the principles of census
- describe the procedure for population census.

3.0 MAIN CONTENT

3.1 Principles of Census

The essential features of a population census are individual enumeration, universality within a defined territory, simultaneity and defined periodicity.

i. Individual Enumeration

A "census" implies that each individual is enumerated separately and that characteristics of each person in the total population, or in a representative sample of the total population, are separately recorded. Only by this procedure can the data on the various characteristics of an individual (e.g., age, literacy, occupation) be cross-classified. A procedure of "group enumeration" is not a census in the strict sense of the term because the recording of aggregated or summarised information on the characteristics of a group of persons usually precludes the cross-tabulation of data on several characteristics. Even though a well-

designed "group enumeration" can produce cross-classifications of certain individual characteristics, such as sex and age, the possibilities in this respect are so limited that the procedure is not recommended for general use, particularly since it tends to result in under-enumeration of the population. Individual enumeration does not preclude the use of sampling techniques for obtaining data on specified characteristics, provided that the sample design is consistent with the size of the areas for which the data are to be tabulated and the degree of detail in the cross-tabulations to be made.

ii. Universality within a Defined Territory

The census should cover a precisely defined territory (e.g., the entire country or a well-delimited part of it) and, depending upon the type of population count required, should include every person present and/or residing within its scope, without omission or duplication.

iii. Simultaneity

Each person should be enumerated as nearly as possible in respect of the same well-defined point of time and the data collected refer to a well-defined reference period. The time-reference period need not, however, be identical for all of the data collected. For most of the data, it will be the day of the census; in some instances, it may be a period prior to the census.

iv. Defined Periodicity

Censuses should be taken at regular intervals so that comparable information is made available in a fixed sequence. A series of censuses makes it possible to appraise the past, accurately describe the present, and estimate the future.

The census data of any country are of greater value nationally, regionally and internationally if they can be compared with the results of censuses of other countries which were taken at approximately the same time. It is, therefore, recommended that, whenever possible, each country undertake a population census in the years ending in "0" or as near to those years as feasible. This is referred to as International Simultaneity.

It is obvious, however, that legal, administrative, financial and other considerations often make it inadvisable for a country to adhere to a standard international pattern in the timing of its population censuses. In fixing a census date, therefore, such national factors should be given greater weight than the desirability of international simultaneity.

3.2 The Procedure for Census

The United Nations (1969, 2007) provided a guideline on the organisation and administration of a population census.

According to the UN statistics division, the population census is one of the most extensive and complicated statistical operations, consisting of a complex series of closely inter-related steps which must be carefully planned in advance so that a proper and uninterrupted sequence of operations can be maintained. A small oversight in planning may lead to serious defects and inefficiencies. Careful planning of the census is, therefore, of the first importance to the successful conduct of the operation, not only in countries with comparatively little statistical experience but also in countries with a developed system of statistics.

Censuses cannot all follow a uniform pattern but there are certain common major elements which must be taken into account in all censuses. In general, census operations can be divided into seven sequential phases: *(a)* preparatory work, *(b)* enumeration, *(c)* data processing, *(d)* evaluation of the results, *(e)* analysis of the results, (f) dissemination of the results and *(g)* systematic recording of census experience. It will be readily apparent that these phases are not entirely chronologically separate or mutually exclusive. For example, a post-enumeration check may be undertaken simultaneously with the tabulation of the results of the regular enumeration. Furthermore, certain elements which are discussed under "Preparatory work", such as the budget and staff, may have to be amended according to circumstances which arise at a later stage of operation. In addition, the systematic recording of census experience should start with the beginning of the preparatory work and continue through all the subsequent phases. The elements of each of the phases, which are briefly discussed below, are intended, therefore, only as indicators of the points to be considered in planning and executing a census.

A. Preparatory Work

i. Legal basis for a census

Legal authority for the census is required for fixing primary administrative responsibility, for obtaining the necessary funds, for determining the general scope and timing of the census and for placing a legal obligation upon the public to co-operate and to give truthful answers and a legal obligation upon the enumerator to record the responses faithfully.

ii. Budget and cost control

No universal system of census budgeting and cost control can be suggested since financial practices vary greatly among countries. However, a few generally accepted principles can be noted. Effective planning and control of the various census operations is not possible without a very careful financial estimate of the cost of each census operation. No part of the census work is too small to be clearly recognised as a component of the total cost. It is important that persons at the administrative and supervisory levels who will be responsible for the execution of each operation participate in estimating the budget items. Such an organisation of the work presupposes detailed advance planning and "cost-consciousness" on the part of those responsible for a census.

iii. Census calendar

An indispensable aid in the planning of a census is a calendar or time-table indicating the sequence and estimated duration of each of the component operations of the census. At the early stages of census planning, it is important to prepare a provisional calendar, which should be revised and made final as early as practicable. Such calendars are essential, since they indicate the dates on which each of the numerous operations which make up a census are to be started and completed, and they serve as a guide for measuring the progress of each stage of the census operation. Serious delays in work, on errors in time estimates, can be detected by comparing the calendar target dates with the actual dates of each operation. Obviously, the time schedule will differ for each national census depending upon the general census plan and the resources that are available. Census calendars sometimes take the form of a chart or graph, in addition to a detailed check list of operations.

The census calendar usually shows the various operations grouped into three broad sectors: (a) pre-enumeration, (b) enumeration and (c) post-enumeration. For purposes of control, many operations which in fact overlap are shown separately in the calendar.

iv. Administrative organisation

In planning the organisation and administration of a census, it is important to consider the role and relationship of the various executive and advisory organs. National, sub national and local commissions and committees frequently may be useful in the planning and preparation of a census. Such bodies may be composed of representatives of governmental agencies and of non-governmental users of the census data. It is, however, important that their promotional and advisory

functions be well defined and that the final responsibility for planning rests with the executive agency.

v. Cartographic (mapping) work

The determination, for the purpose of the census, of the national and internal boundaries of the territory and its detailed subdivision into enumeration areas is one of the basic and most important census operations and generally takes a considerable part of the time and effort invested in the pre-enumeration stage. As a supplementary method of identifying small areas, a systematic, complete and up-to-date listing of localities may be used.

In recent years, many countries have adopted the use of Geographic Information Systems (GIS) to facilitate census mapping in the production of both enumeration maps and dissemination products. As the cost is declining and the basic technology is now well established, it is expected that this will continue. It is likely that the census could be a useful catalyst for increasing capacity within the statistical office (or the country as a whole).

vi. Tabulation programme

In most censuses, the tabulation programme represents a compromise between the information that it would be ideally desirable to tabulate and the limits imposed by practical circumstances. It is essential that the programme be outlined sufficiently early so that the procedures and costs involved may be investigated thoroughly before a final decision is reached. The testing of questionnaires will help to indicate if it will be reasonably possible to gather the material desired for tabulation.

vii. Questionnaire preparation

The type of questionnaire, its format and the exact wording and arrangement of the questions merit the most careful consideration, since the handicaps of a poorly designed questionnaire cannot be overcome during or after enumeration. Among the many factors which should be taken into account in designing the questionnaire are the method of enumeration, the type of questionnaire, data to be collected, the most suitable form of the questions and their arrangement and the processing techniques to be employed.

viii. Census tests

The testing of various aspects of a census plan prior to the enumeration is a very useful practice for all countries.

ix. Plan of enumeration

The complete enumeration plan should be prepared well before the enumeration begins. This involves (a) the determination of the enumeration method to be used and the basic procedures to be followed in the collection of the data and the control of the enumeration, (b) the procedures for the control of the quality of the data and (c) an estimation of the probable size of the population to be enumerated, so that the number of questionnaires and other materials required for the enumeration and the number of enumerators and supervisors needed can be properly ascertained.

x. Plans for data processing

The plans for the processing of the data should be completed before the enumeration begins so that processing can start immediately upon receipt of the completed questionnaires. The decision on the type of processing to be used must be made early in the planning stage, both because of its effect on the design of the questionnaire and because machine processing requires a long lead time for acquisition of machines, training of personnel and programming the operation. This is particularly important if electronic data processing is to be used.

xi. Publicity

Arranging the publicity for the census is another of the important tasks in the pre-enumeration stage and entails an educational campaign, the purpose of which is to enlist the interest and co-operation of the public.

xii. Staff recruitment and training

Early and adequate arrangements are necessary to secure the proper number and type of personnel required for each of the various census operations.

It is important to note that any chosen data capture method will be directly impacted by the quality, quantity and timing of training given to enumerators. If data collected in the field is inaccurate or incomplete, no data capture method will be able to correct this. It is therefore critical that the appropriate resources, funding and time is given by census planners to this part of the overall census plan.

B. Enumeration

i. Method of enumeration

There are two major methods of enumeration. In the canvasser (or enumerator) method, information for each individual is collected and entered on the questionnaire by a census official designated to perform this operation in a specified area. In the householder method, the major responsibility for entering the information is given to a person in the unit being enumerated - usually the head of the household although the questionnaire is usually distributed, collected and checked by a census official.

Also, there is need for residence definition. Normally the census response is made by a household, indicating details of individuals' resident there. An important aspect of census enumerations is determining which individuals can be counted from which cannot be counted. Broadly, three definitions can be used: *de facto* residence; *de jure* residence; and, permanent residence. This is important to consider individuals who have multiple or temporary addresses. Every person should be identified uniquely as resident in one place but where they happen to be on census day, their *de facto* residence, may not be the best place to count them. Where an individual uses services may be more useful and this is at their usual, or *de jure*, residence. An individual may be represented at a permanent address, perhaps a family home for students or long term migrants. Counting individuals at their legal residence without regard to whether or not they are physically present at the time of the census produces factual figure, but may be very expensive. On the other hand, counting individuals wherever they actually are on the day of census is easier and economic.

It is necessary to have a precise definition of residence to decide whether visitors to a country should be included in the population count.

ii. Period of enumeration

In the interest of simultaneity and to avoid double counting or omissions, it is important to keep the period of enumeration as brief as possible, consonant with careful work and budgetary and staff resources.

iii. Supervision

Adequate supervision of the enumeration is essential.

iv. Use of sampling in the enumeration

Sampling may be employed in the enumeration for collecting information on any topics which need not be tabulated for small areas.

C. Data Processing

No matter how thorough and accurate the census enumeration is, the census tabulations will not be accurate and useful unless the raw data are properly processed.

i. Method of processing

The choice of an appropriate method of processing is determined by the circumstances of each country.

ii. Processing control

Regardless of the processing method used, careful planning and control are required to ensure an uninterrupted flow of work through the various stages from receipt of the census questionnaires through the preparation of the final tabulations.

iii. Advance and final tabulations

Because of the urgent need for information on some census topics and the length of time required for final tabulation of census results, consideration should be given to the preparation of advance tabulations of selected topics. These are usually based on a small sample of the raw data and may be issued as provisional results.

D. Analysis of the Results

Analytical studies of the census results should be undertaken by, or under the direction of, the office responsible for the census.

E. Dissemination of the Results

A census is not complete until the information collected is made available to potential users in a form suited to their needs. It is important, therefore, that plans be made and sufficient funds allocated to ensure publication of the tabulations of widespread interest. The final tabulations should be presented and explained in a way which will make them usable by as many persons as possible. Not all of the processed materials need to be published. Every effort should be made to publish the principal results (such as those on age, sex and geographic

distribution of the population) as soon as possible after the date of the enumeration; otherwise, their usefulness and the extent of their interest to the public will diminished

F. Evaluation of the Results

Good census practice requires a careful consideration and evaluation of the completeness and accuracy of the census results.

G. Systematic Recording of Census Experience

Also, there is need for systematic recording of census: the cumulative experience of past censuses in a country can be of great help in the preparation of a new census. Because of the lapse of time between censuses and the likelihood of changes in upper-echelon personnel even in a permanent census office, it is most useful to assemble complete records on the methodology of each census, an evaluation of the techniques employed and the costs. These records should be arranged in such a way that information on each aspect of the census operation can be found easily.

4.0 CONCLUSION

Careful planning of the census is of the first importance to the successful conduct of the operation, there should be definition of residence, enumeration strategies, appropriate technology, and privacy.

5.0 SUMMARY

In this unit, we have studied the principles of census. We learnt about the essential features of a population census which are: individual enumeration, universality within a defined territory, simultaneity and defined periodicity. We concluded the unit by looking at the guideline on the organisation and administration of a population census.

6.0 TUTOR-MARKED ASSIGNMENT

1. Write notes on: a. Simultaneity. b) Defined periodicity.
2. State any five steps in the population census procedure, and briefly explain one.

7.0 REFERENCES/FURTHER READING

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UNIT 3 APPLICATION OF CENSUS DATA

CONTENTS

1.0 INTRODUCTION

In the last two units we studied the various types and methods of census; as well as the essential features of and procedure for carrying out population censuses. In this unit, we shall deliberate on what could be done with the information obtained from census.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the significance of census data
- identify census data relevant for planning
- discuss the application/uses of census data.

3.0 MAIN CONTENT

3.1 Significance of Census Data

Every nation needs accurate population data to be able to plan for necessary development. It is of absolute importance for a government to effectively plan for its people, and prevent errors, in the development of education, transportation, health, agriculture, commerce and industry, defence and security, and in the power and energy sectors.

Failure to undertake an accurate census has very serious implications for planning in any country. There is therefore no substitute for an accurate headcount.

The purpose of a population census is primarily to satisfy certain national needs for statistical data; those needs are the major factors in

determining the content of the census. Compiling this essential information is far from straightforward. The conduct of a census requires professional management, a very large number of enumerators, and the application of new technologies and skilled interpretation of the results.

The population and housing census plays an essential role in public administration. The census also plays an essential role in all elements of the national statistical system, including the economic and social components. The basic feature of the census is to generate statistics on small areas and small population groups with no/minimum sampling errors. The census results are used as a benchmark for research and analysis. Population and housing censuses are principal means of collecting basic population and housing statistics as part of an integrated programme of data collection and compilation aimed at providing a comprehensive source of statistical information for economic and social development planning, for administrative purposes, for assessing conditions in human settlements, for research and for commercial and other uses. It is critically important to produce detailed statistics for small areas and small population groups as a building block for efficient governance at all levels.

Population census data are used for: policymaking, planning and administrative purposes; for research purposes; business, industry and labour; electoral boundary delimitation; as a sampling frame for surveys.

3.2 Census Data Relevant for Planning

According to NPC (2003), the main topics on which census provides useful data are:

- Population size and spatial distribution of the population
- Age and sex structure of the population
- Household size, structure and composition
- Marital status
- Literacy and educational attainment
- Economic and employment characteristics
- Disability status
- Fertility
- Mortality
- Migration
- Urbanisation
- Growth rate and population projections.

3.3 Application (Uses) of Census Data

Census statistics often try to predict what will happen in the future, which may help to avoid or plan for potential problems. Demographers may study why things happen and what the consequences are, including the effects of population trends on the environment. Population data help determine how governments allocate their funds and where aid resources go. The analysed results are often used to advocate for disadvantaged groups of people by researchers and independent organisations as well as government agencies. They can help determine policies and decide which town gets a new health clinic or job creation resources. The fields of advertising and economics also use demography statistics to a large extent.

Population censuses are traditionally used for public and private sector policymaking, planning, and administrative and research purposes. One of the most basic of the administrative uses of census data is in the demarcation of constituencies and the allocation of representation on governing bodies. Information on the size, distribution and characteristics of a country's population is essential to describing and assessing its economic, social and demographic circumstances and to developing sound policies and programmes aimed at fostering the welfare of a country and its population. The population and housing census, by providing comparable basic statistics for a country as a whole and for each administrative unit and locality therein, can make an important contribution to the overall planning process and the management of national development. The availability of information at the lowest levels of administrative units is valuable for the management and evaluation of such programmes as education and literacy, employment and human resources, reproductive health and family planning, housing and environment, maternal and child health, rural development, transportation and highway planning, urbanisation and welfare. Population and housing censuses are also unique sources of data for producing relevant social indicators to monitor the impact of these government policies and programmes.

Census data give characteristics features of the population, and provide data needed to calculate statistical rates and planning of different community programmes.

Specifically, Weeks (1998) outlined that census data are used for:

Planning in business (marketing, investment, and management demographics) - Making a profit in business requires, among other things, having an edge over your competitors. One of the most impressive (and profitable) ways in which demographics are employed

in business is for marketing. A good example here is that demographic data can help a company to segment and target populations to buy their product. Demographic data also help in making investment decisions. To invest is to put your money to use for the purpose of securing a gain in income. Basically, making sound investment decisions involves peering into the future, forecasting likely scenarios, and then acting on the basis of what seems likely to happen.

Social planning (such as education, public services, and health services) – Census data are used to chart population movements and plan for social change. Local population estimates and projections allow planners to see the needs, and decide what to plan, who to plan for, and what location to plan for. The social services planned are: education, health, employment, public utilities like electricity, water supply, transportation, fire service, sanitation, etc.

Political planning (such as legislative analysis and campaign strategy) – Census data are used to determine how membership in the House of Representatives is distributed, and for campaign by politicians. Also, demographics underlie many of the major issues that confront national and state legislators and are used for legislative analysis.

The census is also an important source of data on persons with **disabilities**. Census data help to monitor the social and living conditions of persons with disabilities in terms of school attendance, educational attainment, employment, marital status and living arrangements. The data also provide a basis for developing policies to meet the needs of persons with disabilities and for evaluating the effectiveness of these policies (UN, 2007).

Uses of a Population Census in an Integrated Programme of Data Collection

As part of an integrated programme of data collection, the population census is the primary source of basic national population data required for administrative purposes and for many aspects of economic and social research and planning. The value of the census results is increased if they can be employed together with the results of other investigations, as in the use of the census data as a base or bench-mark for current statistics. The usefulness of the census is also enhanced if it can furnish the information needed for conducting other statistical investigations.

It can, for example, provide a statistical frame for other censuses and sample surveys. The purposes of a continuing programme of data collection can best be served, therefore, if the relationship between the population census and other statistical investigations is considered when

census planning is under way and if provision is made for facilitating the use of the census and its results in connection with intercensal sample surveys, with continuous population registers, with other types of censuses and with civil registration and vital statistics, and with labour force, educational and similar statistics. The use of consistent concepts and definitions throughout an integrated programme of data collection is essential if the advantages of these relationships are to be fully realised.

i. Uses of census data for administrative and policy purposes

The original and fundamental purpose of the census is to provide the facts essential to governmental administration and policy. One of the most basic of the administrative uses of census data is in the demarcation of constituencies and the allocation of representation on governing bodies. Detailed information on the geographic distribution of the population is indispensable for this purpose. Certain aspects of the legal or administrative status of territorial divisions may also depend on the size of their populations.

Information on the geographic distribution of the population, its size and its other characteristics is essential to the study and evaluation of economic and social problems, which must precede the determination of policy affecting economic and social development.

Consideration of questions of employment and manpower programmes, migration, housing, education, public health and welfare, social services, economic and social planning, and numerous other aspects of the life of a country, are facilitated if accurate information about the characteristics of the population is available for civil and other administrative divisions.

ii. Uses of census data for research purposes

In addition to specific administrative purposes, the population census provides indispensable data for the scientific analysis and appraisal of the composition, distribution and past and prospective growth of the population. The changing patterns of urban-rural concentration, the development of urbanised areas, the geographic distribution of the population according to such variables as occupation and education, the evolution of the sex and age structure of the population, and the mortality and natality differentials for various population groups, as well as the economic and social characteristics of the population and labour force, are questions of scientific interest which are of importance to both pure research and practical problems of industrial and commercial growth and management.

iii. Uses of census data for business and industry

In addition to those given above, the census has many important uses for individuals and institutions in business and industry. Reliable estimates of consumer demand for an ever-expanding variety of goods and services depend on accurate information on the size of the population in sub national areas and its distribution at least by age and sex, since these characteristics heavily influence the demand for housing, furnishings, food, clothing, recreational facilities, medical supplies and so forth. Furthermore, the local availability of labour for the production and distribution of such commodities and services may be important in determining the location and organisation of enterprises.

iv. Relationship of the population census to sample surveys

The rapidity of current changes in the size and other characteristics of populations and the demand for additional detailed data on social and economic characteristics which are not appropriate for collection in a full-scale census, have brought about the need for continuing programmes of intercensal sample surveys to collect current and detailed information on many topics which are usually investigated at 10 year intervals in the population censuses.

The census can provide the frame for scientific sample design in connection with such surveys; at the same time, it provides bench-mark data for evaluating the reasonableness of the over-all survey results as well as a base against which changes in the characteristics investigated in both inquiries can be measured. To permit comparison of census and survey results, the definitions and classifications employed should be as nearly alike as possible consistent with the aims of each investigation.

v. Relationship of the population census to continuous population registers

Population censuses have been used in some countries as the starting point for the establishment of a continuous population register. If a register is already in operation, results of subsequent censuses can be compared with register data as a check on the accuracy of both. Information from each source can be transferred to the other, as required and appropriate, after investigation and resolution of discrepancies.

vi. Relationship of the population census to electoral rolls

Some countries have taken advantage of the enumeration for a population census to collect, at the same time, information needed for the establishment of electoral rolls. This procedure is not generally

advisable because of the deleterious effect the secondary purpose might have on the quality of the census results. It increases the burden on the enumerator and it may tempt some respondents deliberately to falsify their replies to some census questions (e.g., on age or citizenship) in order to appear eligible for placement on the electoral roll.

vii. Relationship of the population census to other types of censuses

Certain information collected as part of a population census, or incidental to it, can be most useful in conducting and/or utilising the results of housing, agricultural or establishment censuses taken at about the same time as the population census.

4.0 CONCLUSION

Census data give characteristic features of the population; and provide data needed for: planning in business (marketing, investment, and management demographics) as well as planning for social purposes (such as education, public services, and health services) and political planning (such as legislative analysis and campaign strategy).

5.0 SUMMARY

In this unit, we deliberated on the significance, relevance and application of census data, and you noted that: every nation needs accurate population data to be able to plan for necessary development. Failure to undertake an accurate census has very serious implications for planning in any country, and there is therefore no substitute for an accurate headcount.

We identified the main topics on which census provide useful data. You learnt that census statistics often try to predict what will happen in the future, which may help to avoid or plan for potential problems.
You further learnt that as part of an integrated programme of data collection, the population census is the primary source of basic national population data required for administrative purposes and for many aspects of economic and social research and planning.

6.0 TUTOR-MARKED ASSIGNMENT

1. State ten (10) main topics on which population census can provide useful data.
2. Briefly explain five (5) areas of application of census data.

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UNIT 4 POPULATION DATA AND THE PLANNING OF SOCIAL SERVICES

CONTENTS

1.0 INTRODUCTION

In the previous unit, we learnt that census data give characteristic features of the population; and provide data needed for administrative purposes and for many aspects of economic and social research and planning. Here, we shall discuss population data and the planning of social services.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- identify the major sources of information on the population processes
- appreciate the need for, and assist in the, identification of population problems, using social indicators
- explain the relationship between population and resources
- participate in the planning of social services.

3.0 MAIN CONTENT

3.1 Population Data

Accurate population data is a vital ingredient of social and economic policy. Governments cannot deliver efficient services and infrastructure without knowledge of the national demographic profile – the size of the population, where people live, how old they are, and the net effect of births, deaths and migration.

If we want to unravel the mystery of why things are the way they are and not just describe how they are, we have to know about the social, psychological, economic and even physical characteristics of the people being studied. We already know the sources of basic information about the number of living people, births, deaths and migrants.

Population data for development planning can be obtained primarily through- Vital registration, Censuses, and Sample Surveys. In Nigeria, population data may be obtained from the National Population Commission (NPC); the Ministries of Health, Education, Women Affairs and Social Services; the Federal Office of Statistics (FOS); the National Manpower Board and the Ministry of Labour. Where specific data of a particular nature are required for planning but cannot be obtained from these agencies, special sample surveys may be undertaken by the NPC, the FOS and Non- governmental Organisations (NGOs) to generate data.

In other words, the kind of information that we are looking for is often broken down into three categories: (i) Population size and distribution, (ii) Population processes (fertility, mortality, and migration), and (iii) Population structure and characteristics. The primary source of data on size and distribution, as well as on structure and characteristics, is the census of population. The major source of information on the three population processes is the registration of vital statistics. In addition, these sources are often supplemented with data from sample surveys as well as historical sources.

Odama (1995) amply enumerated the necessary data appropriate for planning. According to him, among the more important population data are: rate of population growth; estimate of fertility; estimate of mortality; projection of future population; estimate of current school age population; and projection of future working-age population.

Demographic data relevant for planning

The main topics on which demographic data should be presented for planning are:

- Population size for the country and the component states and LGAs; including population density, and rural- urban distribution
- Age and sex structure of the population
- Household size, structure and composition
- Marital status
- Literacy and educational attainment
- Economic and employment characteristics
- Disability status

- Fertility
- Mortality
- Migration
- Urbanisation
- Growth rate and population projections.

Development objectives are the desired economic, social and demographic outcomes of development planning.

3.2 Measurement of Social Problem

It is widely recognised that the lack of reliable data in developing countries is an important obstacle to the effective management of health care and other social services. It is necessary to develop and improve information systems which decision makers and health care givers can use for planning, implementing and evaluating services.

Crucial to the use of population data in planning is the identification of population problems. Social problems in a community can be assessed by various statistics which point to serious social difficulties, and these are often referred to as social indicators. It is possible to measure the objective conditions known to be associated with the development of social difficulties and to show how such conditions have contributed to the problem. For instance, very poor housing conditions are known to be associated throughout the world with high levels of crime and social deprivation (M. Davies, 1999). The age structure of a population especially as regards the elderly can have marked effect on the social problems likely to be encountered.

In practice, the health of a whole community is assessed by collection, analysis, and interpretation of data about important events which serve as indicators of the health of the community, deaths (mortality data), sickness (morbidity data) and data about the utilisation of medical services.

Unless the social services provided in an area are being constantly checked against needs, it is very easy for them to become unbalanced; an example is the picture below. It is, therefore, important that all field work staff become used to using and referring to such data.

The collection and analysis of various social statistical data from different areas will enable a national picture to be built up.

Fig.4.1: Inadequate Social Services
Source**:** Photographed by author

The sensitivity of development planners to population problems determine to a large extent, what population data are used in planning. Unlike economic parameters, demographic variables cannot be easily modified or influenced by ad-hoc measures or in a panic situation. The current reproductive behaviour of the population, for instance, will in time affect education expenditure, investment in housing, health requirements and employment situation. All these require long-term planning based on demographic data.

3.3 Population and Resources

The relationship between population and resources could be studied from various viewpoints. Four of these viewpoints of common interest are: the behavioural, the ethical, the economic, and the ecological. The behavioural approach examines the behaviour of human beings in their use of resources. It recognises the fact that people use resources in different ways and hence relate this to socio-cultural and psychological characteristics of the people. The ethical perspective, as the term suggests, emphasises on how people should utilise resources. The interest of the economic perspective is the exploitation of resources to ensure the satisfaction of human needs. It is assumed that demand will always be matched by supply and once demand increases, resource exploitation has to be increased. The ecological perspective views a resource in terms of the interaction of man, the biota and environment. The relationship between population and resources may be one of the social equations, first understood by man (Ogunbameru, 2009).

There is no question about the fact that populations of organisms fluctuate within more or less definite limits, in space as well as in time. The rapid increase in population has been found to affect resources availability and the environment. The stock of many resources cannot be increased rapidly over time. Indeed, some resources get exhausted after some time. Therefore, it is necessary that a population does not grow beyond the limit that can be supported by available resources.

In many countries, migration is the predominant influence on the spatial distribution of the population. In the developing and newly industrialised world, recent rural to urban migration has resulted in the phenomenal growth of cities, often lacking the infrastructure to meet the needs of the expanding population for basic services such as sanitation and power. In the older developed world, by contrast, urbanisation has been succeeded by 'counter-urbanisation' involving migration from cities to suburbs or beyond. One result has been a growing concentration of those unable to move (the old and disadvantaged) in inner-city areas.

Population and Economic Progress

A population necessarily depends on its economy, whereas economic development in turn requires a population and is pursued to serve that population's purposes. Theoretically at least, the greater the population total, the more will be its productivity. On the other hand, the greater the population, the more it must produce. Furthermore, the more a population grows, the broader and deeper must be its economic base. The breadth and depth of the economic base are dependent in turn on the resources that nature has made immediately and potentially available. These have tangible limits, and the avoidance of their depletion depends on careful husbandry and conservation to allow for whatever natural regeneration and replenishment may be possible.

To this point, the word population has been used in a loose and general sense. It is important to consider certain of its components. Each population contains a proportion of socially dependent non- producers; the young, the elderly, the infirm, and the unemployed. It must be recognised also that these groups are constant consumers. Indeed, at least two of the groups, the young and the infirm in many societies such as in the United States of America tend to consume proportionately more of the products and services of society than the rest. Obviously, therefore, the more dependents there are in a society, the larger must be the corps of producers. Any circumstance that alters the number and proportions of the various types of dependents and producers affects the economy. Similarly, any change in the extent or nature of the economy tends to affect the number and proportion of non- producers. The most obvious effect is an increase in unemployed persons. Usually close on

the heels of unemployment, however, comes a decrease in the number of conceptions and births. Excellent examples of this sequence were provided by the economic recession and a major steel strike in the United States in the late 1950s. More recent has been some apparent demographic effects of the so- called "stagflation" of 1974-1976. If a lowered economy should persist, financial inability to obtain adequate nutrition and preventive and therapeutic medical care as well as other necessities and amenities results inevitably in the increase in the number and proportion of individuals who become acutely and chronically ill. Finally, because of the interplay between these last two effects, there eventually occurs at least a temporary increase in the proportion of dependent adults and elderly persons (United Nations, 1953).

SELF-ASSESSMENT EXERCISE

Describe the relationship between population and economic progress.

3.4 Planning of Social Services

Social services include: health services, water supply, communication services, power supply, education, sanitation services, social welfare services etc.

The essence of the concept of population growth is to give direction on the future trends of population dynamics. It is pertinent to develop interest in keeping records on demographic variables and statistics at urban and rural levels. Ofomata (1976) in Okoye *et al.* was optimistic that regional development planning could be achieved in the country, if enough geographic information system data are provided.

Population data or demographics are widely used to chart population movements and plan for social change. When such plans fail, as they often do in developing countries, the result is: confusion, negative reactions and even political upheaval. To have a good plan, there should be series of local area demographic estimates and projections – population data, already enumerated.

Local population estimates and projections allow planners to decide: where new roads need to be built; how much water need to be stored in local reservoirs and the location of these reservoirs; where new sewage pipes need to go and how big they should be, if that is to be used; how many Police officers and fire fighters need to be recruited; how many jobs must be created; how many schools, health facilities, and other services need to be established, what type and where should they be located.

Demographic information is very important in the education sector. Public primary and secondary schools, and even universities cannot be established and run smoothly without appropriate and adequate data. Odama (1995) stated that: "generally, educational data are required in three forms: educational input such as- *school enrolment*; educational progression such as - *school retention*, and *scholastic retardation and acceleration*; and educational output such as- *literacy level*, *educational attainment*, and *field specialisation*. Hagemann *et al.* (1977) in Weeks (1998) warned that the consequences of failing to project public school enrolment accurately are clear. Underestimates may result in crowded classrooms, shortage of educational personnel, and outmoded facilities. The quality of education suffers as a result. On the other hand, overestimates may lead to underutilisation and waste of resources.

4.0 CONCLUSION

The rapid increase in population has been found to affect resources availability and the environment. Accurate population data is a vital ingredient of social and economic policy. Population data or demographics are widely used to chart population movements and plan for social change.

5.0 SUMMARY

In this unit, we examined the uses of population data in the planning of social services and learnt that: the major source of information on the three population processes is the registration of vital statistics which are often supplemented with data from sample surveys as well as historical sources.

You learnt that: the identification of population problems is crucial to the use of population data in planning. The relationship between population and resources could be studied from the behavioural, ethical, economic, and ecological viewpoints.

Also, the more important population data necessary for planning are: rate of population growth; estimate of fertility; estimate of mortality; projection of future population; estimate of current school age population; and projection of future working-age population.

Population data or demographics are widely used to chart population movements and plan for social change.

6.0 TUTOR-MARKED ASSIGNMENT

1. Enumerate five (5) Organisations in Nigeria from where population data could be obtained.
2. The relationship between population and resources could be studied from various viewpoints. Explain three (3) of these viewpoints of common interest.
3. What are social indicators?

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MODULE 4 DEMOGRAPHIC TRANSITION AND HEALTH MANAGEMENT

UNIT 1 CONCEPT OF DEMOGRAPHIC TRANSITION

CONTENTS

1.0 INTRODUCTION

Previously, under population composition, we learnt that the theory of demographic transition is an interpretation of historical changes in vital rates from high to low rates of mortality and fertility and the trends in population growth in the process. The theory postulates that economic development causes a decline in death rate, which is followed after a time lag by a fall in the birth rate to stabilise population growth. Our focus in this unit shall be on the concept of demographic transition.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of demographic transition
- describe phases of demographic transition
- relate economic development to patterns of population growth.

3.0 MAIN CONTENT

3.1 Meaning of Demographic Transition

Demographic transition is the process whereby a country moves from high birth and high death rates to low birth and low death rates with an increase in population growth.

Demographic transition is a three –stage historical process of population growth; first, high birth rates and high death rates; second, high birth rates and low death rates; and third, low birth rates and low death rates; a fourth stage in which deaths out number births has made its appearance in the most Industrialised nations (Henslin, 2009). Consequently, as illustrated by Ogunbameru (2009), the four expected results would be as follows:

Births high + Deaths high = Stable population at low level.
Births high + Deaths low = A growing population with spreading age base.
Births low + Deaths high = A declining population.
Births low + Deaths low = Stable population but aging.

Any such shift in population structure is called a demographic transition and can be of several kinds.

3.2 Phases of Demographic Transition

The Figure below indicates the different phases of demographic transition.

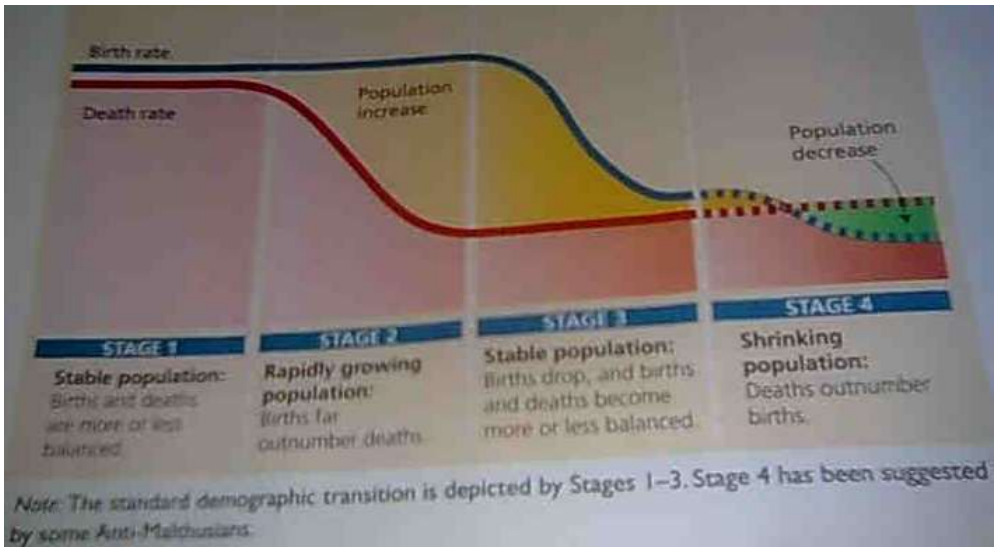

Fig.1.1: The demographic Transition
Source: Henslin, (2009). Page 396

Using past birth and death rate statistics over a long period of time for a number of developed countries, a model has been developed called the demographic transition model. It suggests that all countries pass through similar population stages, as seen in Figure 1.1 above. After fluctuating high birth and death rates in stage 1, death rates fall because of better medical care and improved food production. With birth rates fairly constant, the fall in the death rate results in a rapid population increase in stage 2 of the model. In stage 3, birth rates also fall because of family planning and the desire for more material possessions instead of children. In stage 4, birth and death rates level out. According to this model, this sequence of change should apply to low economically developed countries as they become industrialised and standards of living should rise just as they did in the past for many developed countries (Lines, Bolwell and Norman, 1997).The model assumes that all countries will become industrialised and experience a fall in the death rate in stage 2.

Table 1.1: Countries with the Youngest and Oldest Populations, 2011

YOUNGEST	% AGES<15	OLDEST	%AGES 65+
Niger	48.9	Japan	23.2
Uganda	48.3	Germany	20.7
Mali	47.6	Italy	20.2
Angola	47.3	Greece	18.9
Zambia	46.5	Sweden	18.5
Burundi	46.3	Portugal	17.9
Congo, Dem. Rep.	46.0	Bulgaria	17.7
Mozambique	45.3	Austria	17.6
Chad	45.3	Finland	17.5
Burkina Faso	45.2	Latvia	17.4

Source: Population Reference Bureau (2011). World Population Data Sheet

3.3 Demographic Transition: An Economic Explanation of Population Dynamics

Demographic transition is a population theory that relates economic development to patterns of population growth. The general position of demographic transition is that if people feel economically secure, then the population growth will slow. In other words, through industrialisation, people obtain a better standard of living which encourages smaller families. To pass the "good life" on to their children, parents keep their families small. It makes sense! Middle-class necessities, like a university education, are expensive. Therefore, families with several children find it more difficult to send all of their

children to college. For much of the industrial world, the demographic transition model may be a good predictor of how populations in the world change. There are signs, however, that much of the developing world is not following the industrialised nations into the final phase of demographic transition. Some nations have gotten "stuck" in the second phase. Countries that continue to experience high birth rates and low death rates might drop back into the first phase that means that death rates will go up dramatically.

4.0 CONCLUSION

All countries pass through similar population stages of demographic transition. The demographic transition model assumes that all countries will become industrialised and experience a fall in the death rate with the resultant population increase, before stabilising.

5.0 SUMMARY

Our focus in this unit was on the concept of demographic transition. You learnt that demographic transition is the process whereby a country moves from high birth and high death rates to low birth and low death rates with an increase in population growth. We studied the phases/stages of demographic transition; and concluded by finding out that: the general position of demographic transition is that if people feel economically secure, then the population growth will slow. In other words, through industrialisation, people obtain a better standard of living which encourages smaller families.

6.0 TUTOR-MARKED ASSIGNMENT

Use the various stages to explain meaning of demographic transition.
Briefly describe the effect of economic development on patterns of population growth.

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UNIT 2 DEMOGRAPHIC TRANSITIONS AND DISEASE PATTERNS

CONTENTS

1.0 INTRODUCTION

We learnt in previous units that demographic transition is one of the most popular population theories. We understood that every country passes through demographic transition, although the number of phases depends on individual countries' circumstances. In this unit, you will be reminded of the definition of disease. We shall also look at the relationships between population growth, population structure, population movement and disease occurrence.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define disease
- describe the relationship between population growth and disease occurrence
- identify diseases that exist as a result of population growth.

3.0 MAIN CONTENT

3.1 Disease

In its 1948 charter, the World Health Organisation defined health as: "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". However, for most practical purposes, objectives of health programmes are more readily defined in terms of prevention or treatment of disease.

One of the topics which finds a prominent place in conversation today is the question of disease. Throughout human evolution, the three great causes of death have been famine, disease and war. The loss of life from the latter cause is almost negligible compared with the other two. In the past, famine had caused devastating loss of life, and even today there are large areas of the world where it is still a notable cause of premature death. Modern scientific agriculture, better distribution and storage of surpluses could eradicate famine for all time.

Disease has been defined in many ways and is somewhat difficult to define. If we mean any departure from the normal condition of the body, then we have to define this normal condition. There are few people who have abounding and persistent health throughout their whole lives. It is however customary to define disease as some malevolent changes in the tissues of the body, though this definition excludes certain mental disorders where no tissue change is demonstrable. According to Vines and Rees (1972), diseases may be divided into nine main groups: Inherited abnormalities; Dietary deficiency; Infection by pathogenic organisms, this is a vast group of diseases ranging from virus to helminthic – infection, it includes all epidemic and pandemic diseases e.g. poliomyelitis, influenza, tuberculosis, amoebic dysentery, malaria, sleeping sickness, hookworm disease, schistosomiasis, etc.; Physical injury; Poisons; New growth, ranging from benign to malignant carcinoma; Degeneration with age; Anxiety states; Hormone deficiency or excess. But for our purpose here, disease is anything that a population (or an individual) experiences that causes, literally, "disease", pain, distress of all sorts, disability of any kind, or death. These constitute disease from whatever cause, including injuries or psychiatric disability.

Measuring Health and Disease

The many reasons for obtaining health related information all hinge on the need for data to guide efforts toward reducing the consequences of disease and enhancing the benefits of good health. These include the need to identify which interventions would have the greatest effect, to identify emerging trends and anticipate future needs, to assist the determining priorities for expenditure, to provide information for education to the public, and to help in setting health research agenda.
The relative importance (burden) of different diseases in a population depends on their frequency (incidence and prevalence), severity (mortality and extent of serious morbidity), consequences (health, social, economic), and the type of people affected (gender, age).

The first task in measuring disease in a population is to count its occurrence. There are three (3) commonly used methods of disease occurrence: Cumulative incidence, incidence density and prevalence.
Cumulative incidence or incidence proportion is the number of new cases of a disease that occur in a population at risk for developing the disease during a specified period of time. For this to have meaning, three components are necessary:

- A definition of onset of event
- A defined population and
- A particular period of time.

Incidence density or often simply Incidence rate is the occurrence of new cases of disease per unit of person – time.
Prevalence is a measure of present status rather a newly occurring disease. It measures the proportion of people who have a disease at a specific time.

To understand the burden of disease in a population, it is important to consider also the severity as indicated by the morbidity and premature mortality that it causes. Mortality has been the most important measure of Health.

3.1.1 Pandemics

Anderson, Morton and Green, (1978) observed that diseases related to demographic transitions usually present as pandemics. The term "pandemic" literally means "all people" and is used to denote a disease conflagration over a considerable area. A state-wide outbreak of a disease may be regarded as a pandemic, but generally the term is used to denote a nationwide, continent wide or worldwide outbreak.

In some of the under-developed nations of the world during the past decades, pandemics of acute infectious diseases such as cholera have occurred. These outbreaks have usually been confined to a single nation or to a small group of nations. Even in the developing nations, there is not the likelihood of a devastating pandemic of an acute infectious disease such as occurred in the past, but moderately severe outbreaks can be expected. In well developed nations, scientific advances in the field of epidemiology make even a moderate pandemic of an acute infectious disease highly unlikely.

Chronic infections still plague vast segments of the population in many nations of the world. Presently there are millions of malaria cases, ascariasis, hookworm disease and leprosy.

Advances in our knowledge of infection and its control will pay ample dividends in terms of protection for the future.

High population density is a risk factor in the incidence of several health problems including communicable diseases like hepatitis A, contact transmitted diseases, crowding associated diseases like tuberculosis, homicide and diseases associated with poor sanitation and those associated with stressful living conditions such as hypertension.

An important demographic phenomenon that has serious implications for levels of health status outcome in a population is demographic transition. In peasant societies, both birth and death rates tend to be high. The inadequate state of public health attendant on high incidence and prevalence of communicable diseases, poor maternal and child health facilities all contribute to claim a high death toll. The rapid population growth is characterised by high use pressure on available social and physical infrastructures, overcrowding, the emergence of unhealthful environmental and living conditions, etc. All these are associated with a set of health risk factors associated with the aetiology of chronic and degenerative diseases (Abanobi, 2004).

3.2 Links between Population and Infectious Diseases

Population density and urbanisation are two major factors affecting disease spread. People who live in close proximity to one another spread diseases more quickly and easily. Slums around urban areas are extremely vulnerable to infectious diseases due to poor sanitation, high population density and high levels of poverty, all of which increase disease incidence. For example, the increasing number of people living in urban areas around the world will continue to facilitate tuberculosis transmission and weaken attempts to control the disease. Migration also affects the spread of disease. The probability of encountering new diseases increases as humans move into previously uninhabited lands because of population growth, or as humans migrate into areas where they do not have resistance to certain diseases.

People who move from dry highlands to wet lowlands can become exposed to malaria. Migrants may be particularly vulnerable to malarial infection because of the fatigue and malnutrition that accompany relocation. The risk is highest when migrants move to tropical areas, which are home to a larger number of infectious disease pathogens than areas at higher latitudes (Morens *et al.,* 2004) and *Jones et al.,* (2008).

3.3 Demographic and Epidemiologic Transition

According to Merson (2006), 'The term demographic transition was first used by F. W. Notestein in 1945 to describe the changes in birth and death rates that historically have accompanied the shift from a traditional to a modern society. With modernisation (a complex term indicating social and economic development), sharp declines in mortality have been followed by a reduction in fertility, although unduly lagging by years or decades. The term transition refers to the shift away from a stable, high – stationary stage of population in which very high birth rates are balanced by very high death rates and there is little or no population growth. Merson further observed that "historically, all countries that have undergone modernisation with a marked drop in under-five mortality rate have had rapid population growth. In the past, this population growth was followed by falling fertility rates but the reasons for the drop are not entirely clear. It has been pointed out that a potential major problem that may arise, termed the demographic trap, in which fertility rates do not drop. This situation would lead to the classic Malthusian scenario in which massive starvation and epidemic disease overtake the population.

In 1971, Omran described the underlying reasons for demographic transition and used the term Epidemiologic transition to explain the changing causal factors of disease that accounted for the dramatic drop in under-five mortality which was largely due to reduction in malnutrition and communicable diseases.

It is important to note that although high rates of maternal mortality are characteristic of low and middle income world, reduction of mortality occur in a different time frame from those of under- five mortality. Reduction in maternal mortality requires a much better development infrastructure, including ready availability of surgical and blood transfusion capacity, plus improved communication and transportation systems.

Thus, drops in maternal mortality occur much further along the road towards economic development, and changes occur only after shifts in the under-five mortality have been seen.

Major changes in the patterns and causes of injury are also likely to occur with modernisation. For example, road traffic injury tends to increase as countries go through the stages of development in which there is great increase in vehicles.

Vines and Rees (1972), observed that a number of diseases have increased in incidence because of three main causes: the concentration

of large populations in cities, making for large spread of infections; ease of transport which has spread many localised diseases all over the world; owing to the vast amount of medical attention now dispensed, it is often possible to cure diseases which would have been fatal. Thus there is, in most countries, a gradually aging population, less resistant than the young.

4.0 CONCLUSION

An important demographic phenomenon that has serious implications for levels of health status outcome in a population is demographic transition.

5.0 SUMMARY

In this unit, we learnt that population density and urbanisation are two major factors affecting disease spread and that diseases related to demographic transitions usually present as pandemics. We also learnt that people who live in close proximity to one another spread diseases more quickly and easily. Major changes in the patterns and causes of injury are also likely to occur with modernisation.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define disease.
2. What is pandemic?
3. Explain how population density influences disease occurrence and prevalence
4. Describe the effect of modernisation on pattern of disease occurrence; give three examples.

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UNIT 3 DEMOGRAPHIC TRANSITIONS AND HEALTH SERVICES

CONTENTS

1.0 INTRODUCTION

In the previous unit, we studied the relationship between demographic transition and diseases. We shall now look at the relationships between population growth, population structure, population movement and health services.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain demographic transition
- define health and health services
- explain the relationship between population and health
- identify the population variables and data required for health planning.

3.0 MAIN CONTENT

3.1 The Demographic Transition

The main contribution of demographic thinking to wider debates about population change is the demographic transition theory. This has had a deep impact on the work of national and international agencies in both the developed and the developing world for the last 50 years. The theory identifies different stages of demographic transition based on fertility and mortality levels, ranging from stage one, when fertility and

mortality are balanced at very high levels; to stage two, when mortality starts to decrease and fertility subsequently declines; to the third stage, when population growth is close to zero, with low birth and death rates. This pattern has been experienced by every country in the developed world and has been crucial for studies of the relationship between fertility and mortality. One of the major implications of the developed world demographic studies based on this model has been the realisation that fertility decline in the developing world is not necessarily dependent on increasing industrialisation or modernisation, as it was in developed countries (Caldwell, 1976).

3.2 Population and Health

Population had been defined before as: the people living in an area. It is the degree to which an area has been populated. The World Health Organisation (WHO) defines health as: "A state of complete physical, mental, and social well-being of an individual and not merely the absence of disease or infirmity". The services provided to ensure the achievement and maintenance of health are referred to as health services, and these are many and varied.

Park (1985) in (Iragunima, 2006), defined health care as "all those personal and community health services including medical care and related educational and research directed towards the protection and promotion of health of the community." Iragunima (2006) explained that service is generally defined as 'an act of helpful activity.' He further said that the terms: health care, health services and health care delivery are used interchangeably. Health services are actions or activities undertaken by health professionals for the purpose of prevention, cure and rehabilitation of the individual, family and community.

Health services in developing countries, including Nigeria, are characterised by numerous problems among which are: insufficient manpower; insufficient health facilities; inadequate equipment and supplies; lack of infrastructure such as electricity, potable water, good roads and means of transportation, especially in rural areas. All these problems are as a result of increase in population.

The health and health care needs of a population cannot be measured or met without acknowledge of its size and characteristics. Demography is concerned with this essential 'numbering of the people' and with understanding population dynamics—how populations change in response to the interplay between fertility, mortality, and migration. This understanding is a prerequisite for making the forecasts about future population size and structure which can underpin healthcare planning. Analysis of both the present and the future necessitates a review of the

past. The number of very old people in a population, for example, depends on the number of births eight or nine decades earlier and risks of death at successive ages throughout the intervening period. The proportion of very old people depends partly on this numerator but more importantly on the denominator (the size of the population as a whole)—itself a function of reproductive behaviour, mortality, and net migration from yesterday back through time. The number of births in a population depends not just on current patterns of family building, but also on the number of women 'at risk' of reproduction—itself a function of past trends in fertility and mortality. Similarly, the number of deaths (and their distribution by cause) is strongly influenced by age structure. For this reason, although life expectancy at birth in the developed world is some 13 years longer than in the less developed world (78 and 65 years respectively), crude death rates—deaths per 1000 population of all ages—are very similar (eight and nine) (World Bank, 1999).

3.3 Population Variables and Planning for Health Needs

In order to plan a health system which will provide health care services, well, baseline data is essential. In addition, an analysis of the following data could be utilised:

Population size and spatial distribution- apart from the total population figure for any given area (country, state, local government, community), population distribution and population density, particularly at state and national levels, can assist. The information here will help in determining, in line with WHO standards, the number and type (hospital, clinics, primary health care centres) of health care facilities that will serve the population; the location of these facilities; and the number of health personnel required, as a ratio to the population.

Age and sex structure- Data on the age and sex structure of a society are crucial to the planning of health care systems. Knowledge of the total number of infants, children, youth, middle aged, and elderly people, is essential for planning. Each of them has their requirements in terms of drugs, facilities, and medical specialists. Also, the number and percentage of those in the different groups will provide information on future population growth.

Fertility- statistics on fertility, of course, indicate the pattern of reproduction and growth of the population.

Mortality- statistics on mortality will indicate the trend in death rates, especially infant, under-five, and maternal. The mortality and fertility statistics together will show the phase of transition.

Population growth and projections- this shows the population structure and predicted expectations.

Disability- this should indicate likely disability in children, disabilities associated with aging, and the extent of problems of mental illness. Others are

Household size, structure and composition; marital status; literacy and educational attainment; economic and employment characteristics; migration and urbanisation.

3.4 Future Population Growth Estimates

To be able to objectively plan for health services calls for regular supply and availability of population data. It is vital that planning takes account of both current social and economic needs of the population, and its future requirements. A way out has been to undertake population projections into the future based on the existence of an agreed and statistically disciplined base population census data.

Methodologically, the component method of projection, which entails assessing the dynamic interaction of the population components of fertility, mortality and migration variables, is applied. The young age structures of many populations in the developing world mean that these populations have a huge built-in potential for growth.

3.5 Impact of Population Growth on Health Services

The rate of population growth and indeed distribution affects the demand and supply of all types of health services. The provision and utilisation of all health infrastructures and institutions, personnel and manpower, support services including maternal and child health and family planning, and preventive services including immunisation and environmental sanitation, must take account of the growth, structure and distribution of the population.

Data about the resources available for the delivery of health care to the community are necessary for the efficient management of health services. The inventory should include data on health institutions and details of the number of various types of health personnel.

If standards of health are not to suffer and decline, it will be necessary to match the rapid increase in the rate of population growth with a commensurate increase in the supply of needed funds and resources – infrastructure, personnel and services. Health services, particularly in the rural areas where roads, transportation and communications are

difficult, should be suitably located to make them easily accessible for use.

Population Growth and Health Needs

There are two key issues: population growth is slowing down the achievement of the Millennium Development Goals (MDGs) and has a detrimental impact on the environment and food security. Demographers are calling upon governments to pay more attention to population growth issues in general and family planning in particular, which are not as prominent now as they were after the UN Conference on Population and Development held in Cairo, in 1994. Regardless of their limitations, the MDGs have drawn attention to population growth and family planning issues.

At UNFPA, which has the leading role at the United Nations on population and development issues, Osotimehin now hopes to turn the focus of the agency, donors, civil society and the governments of the countries served by UNFPA to practical, workable measures that hasten progress towards the International Conference on Population and Development (ICPD) objectives, as well as the Millennium Development Goals, particularly Target 5-b, to achieve universal access to reproductive health by 2015. "And we know that to meet development goals, we need to pay greater attention to adolescents and youth," said Osotimehin, noting there are more than 1.2 billion adolescents between the ages of 10 and 19, about nine in 10 of them living in developing countries. The report warns that without a firm commitment to population, reproductive health and gender issues, "it is unlikely that the goals and targets of the International Conference on Population and Development and the Millennium Summit will be met." "Population is about people, supporting rights and human dignity and creating conditions for each one of us to live on a healthy planet and reach our full potential."

In many parts of the developing world, where population growth is outpacing economic growth, the need for reproductive health services, especially family planning, remains great. The attainment of a stable population is a sine qua non for accelerated, planned economic growth and development. Governments that are serious about eradicating poverty should also be serious about providing the services, supplies, information that women need to exercise their reproductive rights (Tiziana Leone, 2010).

In developing countries, where continuous population growth is the result of steady fertility levels in a period of decreasing mortality, analysis of fertility trends is crucial to understanding the impact that

population growth will have on development and on health care systems.

4.0 CONCLUSION

We have reviewed the meaning and phases of demographic transition; defined health and health care services; and linked changes in the size and structure of populations to health needs, and consequently required health services.

5.0 SUMMARY

At the end of this unit, you learnt that:

- The health and health-care needs of a population cannot be measured or met without knowledge of its size and characteristics; and therefore, in order to plan a health system which will provide health care services, well, data is essential.
- The rate of population growth and indeed distribution affects the demand and supply of all types of health services.
- The structure and transition phase will determine the type of health services, health institutions, personnel and services to be provided.
- The size or density of the population determines the quantity or amount of health care services provided.

6.0 TUTOR- MARKED ASSIGNMENT

1. State three (3) problems of health services in Nigeria, and relate them to population.
2. Briefly explain any five (5) of the data which could be utilised to plan, a health system which will provide health care services.

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UNIT 4 INDICES OF POPULATION, HEALTH AND DEVELOPMENT

CONTENTS

1.0 INTRODUCTION

Health status indicators and indices play a major role in the measurement and assessment of population health status. They are very important to the practicing public health professional. Without them, the process of community diagnosis will be cumbersome and meaningless. In this concluding unit, we shall consider the indices of population, health and development.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of indices
- state the uses of indices
- identify indices of population, health and development
- utilise the knowledge of these indices to understand and utilise technical reports.

3.0 MAIN CONTENT

3.1 What are Indices?

The term index or indicator connotes something that can be regarded as a sign that shows the presence of an empirical phenomenon or as is sometimes the case, in what direction something is changing. Indices are pointers or alarm in a sector.

Indices are used to: study populations, plan and re-plan, set targets, monitor and evaluate activities in populations, with the view of achieving goals.

Criteria for Selection of Indices

Because of inappropriate data and imperfect measures, indices or indicators that are currently available must be utilised. The basic criteria for selecting appropriate quantitative assessment tools to reflect the status of the population being assessed are: data availability, level of analysis, data quality, comprehensiveness, specificity, index calculation, and utility.

The purpose of providing the criteria is to encourage the adoption of standardised procedures in the development, selection, and application of a indices, so as to avoid invalid comparisons or disparities in results and, potentially, erroneous conclusions (Abanobi (2004); Aibor and Olorunda (2006) and Nnodu *et al.* (2009).

According to Nnodu *et al*. (2009), population growths over time and across space are mostly explained by rates ratios and spacing. Rates generally are indices of measurements between sets, variables or phenomena. Rate compares the relative increase or decrease between population characteristics or components being measured. A ratio on the other hand is a relationship between two variables or number and it compares the degree of the relationship over time and across space.
Examples of population ratios include:

Sex ratio
Dependency ratio
Age ratio
Ratio of married females to married males
Ratio of births to deaths
Sex ratio at death in the population
Ratio of literate to illiterate population
Ratio of doctors to population.

3.2 Indices of Population

A population is usually described in terms of its size or the number of people who make up the aggregate and its composition. The indices used in studying populations include:

$$\text{Population Density} = \frac{\text{Number of persons inhabiting a defined place in time "t"}}{\text{Area of the place in square kilometres}}$$

= Number of persons per square kilometre of the place in time "t"

$$\text{Dependency Ratio.} = \frac{\text{Population of persons 0-14 years old} + \text{Population of persons 65 years old or more}}{\text{Population of Persons 15 – 64 years old}} \times 100$$

Doubling Period (D.P.)

This refers to the number of years it will take the population of a place to double itself.

$$D.P. = \frac{\log_e 2}{t}$$

Where; D.P. = Doubling period; r = Growth rate in %

Crude Birth Rate is defined as the number of live births during the year per 1000 population of the specified area. The numerator is derived from all reported live births during the period. It is therefore derivable from archival records and from census reports.

$$\text{Crude Birth Rate in time "t".} = \frac{\text{Number of live births in t}}{\text{Mid-year Population in time, t}} \times 1000$$

The Mid-year population is the population of an area as at 1st July of the year being considered. We can also refer to mean population as being equivalent to midyear population.

Midyear/mean population, $P = ½ (Pt + Pt + n)$.
Where, Pt = Initial population; Pt+ n = population at a new date; and n = Time interval

Fertility is a more refined measure of the "risk" of birth in a population. The denominator is specific to persons in the population who are susceptible to pregnancy and childbirth, namely women of childbearing age, and not the total population.

$$\text{Fertility Rate in time, t} = \frac{\text{Number of live births in t}}{\text{Number of women between The ages of 15-49years old in time, t}} \times 1000$$

$$\text{Completed Fertility Rate Or Final Birth Rate} = \frac{\text{Total number of births by all married women at the end of their reproductivity}}{\text{Total number of married women at the end of their child-bearing period}} \times 1000$$

= number of children ever born per 1,000 women at the end of their reproductive years (49years old)

$$\text{Sex Ratio} = \frac{\text{Number of males in population}}{\text{Number of females in population}} \times 100$$

3.3 Indices of Health

A health status index is a multivariate factor derived from a composite of variables that are demonstrably predictive, statistically or by use of other causal criteria, which reflects the health status of an individual or a defined population group. Some examples of health status indices are: " the Health Appraisal Index, Wellness Appraisal Index, Cornell Medical Index (CMI), the Quality of Life Index (QLI), the Health Promoting Lifestyle Profile, and the Lifetime Health Monitoring Program " (Abanobi,2004).

Health indices are prominently used in health risk appraisal exercises and in the assessment of needs for health promotion programming. In their use, it is necessary to ascertain the extent to which the component variables or attributes of the index determine health status outcome. A health status determinant is a factor in the presence of which the occurrence, magnitude, and impact of disease or health problem increases. They could be biological, environmental, behavioural, social, psychological, economic, organisational, cultural, or otherwise (Abanobi, 2004).

The indicators of health include: fertility levels, maternal and child mortality, as well as immunisation and nutrition levels.

Infant and child mortality rates are basic indicators of a country's socio-economic situation and quality of life (UNDP, 2007). The rates are important for identifying population groups at risk; planning, monitoring, and evaluating population and health programmes and policies; and monitoring progress towards the Millennium Development Goal to reduce child mortality by two-thirds by the year 2015.

The 2008 NDHS presented the levels, trends, and differentials in mortality among children under the age of five. Childhood mortality estimates are based on information from women's birth histories.

Age-specific childhood mortality rates are presented as follows:

Neonatal mortality: the probability of dying within the first month of life
Post-neonatal mortality: the difference between infant and neonatal mortality

Infant mortality: the probability of dying before the first birthday

Child mortality: the probability of dying between the first and fifth birthdays

Under-five mortality: the probability of dying between birth and the fifth birthday.

All rates are expressed per 1,000 live births, except for child mortality, which is expressed per 1,000 children surviving to 12 months of age.

Also, other morbidity and mortality statistics are used as health indices; they include:

Mortality

The CDR of a given population is defined as the number of deaths per 1000 persons in that population in a calendar year.

$$\text{Crude Death rate in time, t.} = \frac{\text{Number of deaths reported in t}}{\text{Mid-year population in time, t}} \times 1000$$

Example: For a given community in 2002, there were 2,000,000 thousand persons estimated to reside in the area in that year. A total of 30,000 deaths were recorded in that year. The annual crude death rate for 2002 for the community is:

$$\frac{30{,}000}{2{,}000{,}000} \times 1000$$

= 15 deaths per 1000 population of the given population in 2002.

The annual death rate is a generalised indicator of the health status of a population, but because it is based on the total population, it is a crude rate.

$$\text{Cause –Specific Death Rate} = \frac{\text{Number of deaths due to a specified cause}}{\text{Estimated population at mid-year}} \times 100{,}000$$

$$\text{Age- Specific Death Rate for Persons in Defined Age-bracket} = \frac{\text{Number of deaths occurring among persons in specified age interval during t}}{\text{Total number of persons in age-bracket (interval) in time, t}} \times 1{,}000$$

$$\text{Under-five mortality Rate} = \frac{\text{Total number of deaths in children 0-4 years old in the year}}{\text{Estimated total population of children 0-4years in that year}} \times 100{,}000$$

$$\text{Age-sex-Specific Death Rate for Males 30-40 years} = \frac{\text{Number of deaths among males aged 30-40 years in year t}}{\text{Total number of males aged 30-40 years in year t}} \times 1{,}000$$

For Age-sex-specific Death Rate, the age and sex should be substituted to achieve desired results.

$$\text{Infant Mortality Rate in year "t"} = \frac{\text{Number of deaths of children 0-1 year in "t"}}{\text{Total number of live births in "t"}} \times 1{,}000$$

$$\text{Maternal Mortality Rate in period "t"} = \frac{\text{Number of Maternal deaths due to puerperal causes in "t"}}{\text{Number of live births in "t"}} \times 1{,}000$$

= Number of maternal deaths per 1,000 Live births in the period "t"

$$\text{Proportional Mortality Ratio of "X"} = \frac{\text{Total number of deaths due to A given cause (X) in a specified time period}}{\text{Total number of deaths due to all causes in the same period}} \times 100$$

$$\text{Case Fatality Rate For Disease/Health Problem "y" in "t"} = \frac{\text{Number of deaths due to "y" occurring during time "t"}}{\text{Total number of cases of "y" occurring during time "t" in the given population.}} \times 100$$

Morbidity

There are limitations in measuring disease occurrence and these manifests at both individual and population levels of assessment. The most frequently used are:

$$\text{Incidence Rate of Disease X in period t} = \frac{\text{Number of new cases of X occurring in population at risk in t}}{\text{Total number of persons in the population Who are susceptible to disease X and Exposed to its causative agent(s) /risk factors in t}} \times 1{,}000$$

$$\text{Prevalence Rate of Disease X in period t} = \frac{\text{Number of old and new cases of X occurring in population in period t}}{\text{Total number of persons in the population during time period t}} \times 1{,}000$$

= Number of cases of disease X per 1,000 persons in t.

3.4 Indices of Development

Development involves measures that ensure adequate housing and work space. It is aimed at providing more efficient transportation, water supply, sufficient energy, and education. Development is consequently not a simple numerical definition, but a complex quality of life issue.

Characteristics of Underdevelopment

Ezeala- Harison, (1996) observed that under development is:

Consistent with low GDP levels; specifically, an underdevelopment indicator, the nation's GDP would be lower than ¼ of the GDP of United States of America. The per capital income would be quite low, even to those developed countries with relatively low population levels.
The economy tends to be agrarian. That is, the GDP and overall production activities is dominated by agriculture; not only for production, but for employment (income and livelihood).

High population growth: more than 2%/year. The population growth rate tends to be more than the growth GDP.

The exports are monoculture. The foreign trade depends only on one or two agricultural products for export, to earn foreign exchange.

There is always a vicious cycle of poverty (VCP) syndrome.

The most common characteristic is economic dualism. This means: the coexistence of two interrelated and interdependent sectors: the traditional and modern sectors within the same economy.

The Indicators of Development

One difficulty in defining and measuring the level of development of a nation is that we are not always comparing like with like. As a result, there are a number of ways used to show development called indicators. There are a number of indicators which help to measure how developed a country is. Each indicator has its strengths and shortcomings. They include:

Gross National Product (GNP): is the total value of all goods and services produced by a country in one year, plus income from abroad for such things as financial services and company profits. By dividing this sum by the total population of the country, the GNP per capita is obtained. To give standardisation, this is expressed in US dollars. The GNP is a crude indicator of the standard of living of a country, but it ignores a number of other factors that other indicators cover.

Gross Domestic Product (GDP): measures the total value of a country's goods and services without adding income from abroad.

Infant Mortality Rate: the relationship between GNP and infant mortality is that – when the GNP is high, infant mortality is low; but when the GNP is low, infant mortality rises.

Life Expectancy: the average number of years a baby born today can expect to live. The male life expectancy rate is generally lower than the female.

Calorie Intake: this is the average number of calories a person consumes each day. About 2400 calories every day will maintain good health.

Other Indicators: these include literacy rate percent of total population; cars per 1000 population; people per doctor; Telephones per 1000 people.

Human Development Index: the HDI is a creation of the UNDP and represents the practical embodiment of their vision of human development as an alternative vision to what they perceive as the dominance of economic indicators in development. Economic development had the Gross Domestic Product (GDP), so human

development had to have the HDI, representing a measure of "quality of life". It attempts to measure the extent to which a country is developed.

The HDI which came into use in 1990 comprises three components:

Life expectancy (a proxy indicator of health care and living conditions).
Adult literacy combined with years of schooling, enrolment in primary, secondary and tertiary education.

Real GDP/ Capital

The UNDP have argued that these three components can act as proxy indicators for many others. For example, provision of clean water supply and (or adequate nutrition) would be reflected in life expectancy.

The index is scaled (0-1) or 0 to 100, with countries scoring over 80 being considered as having a high human development. Scores of 50 – 79 have medium human development and those under 50 have low human development. Countries can also be placed in rank order using the HDI, as in Table 4.1 below.

Table 4.1: Some Indicators Applied to 10 Countries

Country	GNP US$	Life expectancy(Years) Female/	Infant Mortality Rate	Literacy %	HDI 0-100	Rank* (175 countries)
Ethiopia	130	52	121	24	23	171
Pakistan	440	59	99	26	31	128
Sri Lanka	640	75	21	87	66	97
Philippines	960	68	50	89	60	100
Argentina	8060	75	29	95	83	30
Australia	17,980	81	7	99	97	11
UK	18,410	80	7	100	96	18
Finland	19,174	80	5	100	95	5
USA	25,860	80	8	96	98	2
Japan	34,630	82	4	100	98	3

*Canada is ranked as 1- the most developed country
Source: Lines, Bolwell and Norman (1997), p.62.

As a key part of this strategy, the UNDP decided to present the HDI within a country 'league-table' format and tables of 'high', 'medium' or 'low' human development applied by UNDP depending upon each country's value for the HDI. Both the league table presentation and 'labelling' promote a sense of 'name and shame' and comparison of performance across peers.

Sadly and unsurprisingly, a lot of countries in Africa have low values for the HDI, implying that the level of human development for the continent is poor.

It is not hard to appreciate how the three components may be related: higher income /capital could mean greater expenditure on education and health care for example. In that sense, even though the three components are quite different (a heterogeneous index) the HDI does have an internal consistency.

There are typically a two-year time lag in the data and gaps are filled in various ways, typically by making assumptions based upon data available for assumed 'peers'.

Corruption Perception Index (CPI)

It is a recognised fact that one of the recognised drivers to bring about human development is good governance, and controlling corruption is an important element of this. Corruption can result in resources being diverted from public good to private consumption with the result that impacts intended to be of wider benefit are lost. Corruption may also drive up the cost of doing business with the result that investment is deterred and economic growth will suffer. But the very nature of corruption makes it difficult to gauge.

The Corruption Perception Index (CPI), created by the Berlin- based Transparency International (TI; a non-governmental organisation) was designed to provide a more systematic snapshot of corruption in the same way that the HDI provides a snapshot of human development. Like the HDI, it combines a number of different 'indicators' intone, but unlike the HDI the indicators which are combined all measure corruption. The CPI is a homogeneous index in the sense that all the components upon which it is based seek to measure the same thing. Like the HDI, the CPI is based on data collected over a number of years prior to release of the index. It uses several surveys and expert assessments.
The CPI is based, at least in part, upon judgments made by non-residents and non-nationals of the countries.

SELF -ASSESSMENT EXERCISE

Study all the tables in this unit: write out their headings, and the various indicators. Locate Nigeria and record her scores

Table 15.5.1 POPULATION, HEALTH, AND ENVIRONMENT DATA AND ESTIMATES FOR THE COUNTRIES AND REGIONS OF THE WORLD

	Population mid-2011 (millions)	Births per 1,000 Population	Deaths per 1,000 Population	Rate of Natural Increase %	Net Migration Rate per 1,000	Projected Population (millions) mid-2025	Projected Population (millions) mid-2050	2050 Population as a Multiple of 2011	Infant Mortality Rate*	Total Fertility Rate*	Percent of Population Ages <15	Percent of Population Ages 65+
WORLD	6,987	20	8	1.2	—	8,084	9,587	1.4	44	2.5	27	8
MORE DEVELOPED	1,242	11	10	0.2	2	1,290	1,333	1.1	5	1.7	16	16
LESS DEVELOPED	5,745	22	8	1.4	-1	6,794	8,254	1.4	48	2.6	29	6
LESS DEVELOPED (Excl. China)	4,480	25	8	1.7	-1	5,390	6,942	1.6	52	3.0	33	5
LEAST DEVELOPED	861	35	11	2.4	-1	1,170	1,826	2.1	76	4.5	41	3
AFRICA	1,031	36	12	2.4	-1	1,444	2,300	2.2	74	4.7	41	4
SUB-SAHARAN AFRICA	883	38	13	2.6	-1	1,245	2,069	2.3	80	5.2	43	3
NORTHERN AFRICA	213	25	6	1.8	-1	261	323	1.5	33	2.8	31	5
Algeria	36.0	19	5	1.5	-1	42.0	46.5	1.3	22	2.3	27	5
Egypt	82.6	25	5	2.0	-1	100.9	123.5	1.5	23	2.9	31	5
Libya	6.4	22	4	1.8	-8	7.5	8.8	1.4	14	2.5	31	4
Morocco	32.3	19	6	1.3	-3	36.4	39.2	1.2	30	2.2	28	6
Sudan†	44.6	33	9	2.4	1	60.8	91.0	2.0	59	4.5	40	4
Tunisia	10.7	18	6	1.2	-8	12.1	12.6	1.2	18	2.1	24	7
Western Sahara‡	0.5	32	9	2.3	6	0.7	1.2	2.3	60	4.3	39	4
WESTERN AFRICA	313	40	14	2.6	-1	452	782	2.5	85	5.5	43	3
Benin	9.1	40	11	2.9	0	13.0	21.7	2.4	78	5.4	44	3
Burkina Faso	17.0	43	12	3.1	-1	25.5	46.7	2.8	73	5.8	45	2
Cape Verde	0.5	22	5	1.7	-5	0.6	0.6	1.3	19	2.5	32	6
Côte d'Ivoire	22.6	37	13	2.3	-1	30.4	45.6	2.0	97	4.9	41	4
Gambia	1.8	39	9	3.0	-1	2.5	4.0	2.3	68	5.0	44	2
Ghana	25.0	31	8	2.3	-0	33.4	49.1	2.0	45	4.1	38	4
Guinea	10.2	39	13	2.7	-1	14.3	23.8	2.2	86	5.3	43	3
Guinea-Bissau	1.6	39	16	2.3	-1	2.1	3.3	2.1	103	5.1	41	3
Liberia	4.1	43	12	3.1	-1	6.0	10.8	2.6	78	5.8	43	3
Mali	15.4	45	15	3.1	-5	22.0	35.2	2.3	116	6.4	48	3
Mauritania	3.5	33	9	2.4	-1	4.7	7.1	2.0	71	4.4	40	3
Niger	16.1	48	12	3.6	-0	26.2	55.4	3.4	88	7.0	49	2
Nigeria	162.3	41	16	2.5	-0	237.1	433.2	2.7	89	5.7	43	3
Senegal	12.8	35	9	2.8	-2	17.9	28.6	2.2	51	4.7	44	2
Sierra Leone	5.4	37	15	2.2	-0	7.5	13.6	2.5	89	5.0	42	4
Togo	5.8	36	8	2.8	0	8.4	14.3	2.4	55	4.7	42	4
EASTERN AFRICA	339	39	11	2.8	-1	486	826	2.5	69	5.3	44	3

Source: Population Reference Bureau (PRB), 2011 World Population Data Sheet.

Table 15.5.2

POPULATION, HEALTH, AND ENVIRONMENT DATA AND ESTIMATES FOR THE COUNTRIES AND REGIONS OF THE WORLD

	Life Expectancy at Birth (years)				Percent of Population With HIV/AIDS 15–49		Percent of Married Women 15–49 Using Contraception						
	Both Sexes	Males	Females	Percent Urban	2001	2009	All Methods	Modern Methods	GNI PPP per Capita (US$) 2009	Population per Square Kilometer	Percent of Population Below US$2/Day PPP 2000/2009	Percent of Population With Improved Water Supply (2008) Urban	Rural
WORLD	70	68	72	51	0.8	0.8	61	55	10,240	51	48	96	77
MORE DEVELOPED	78	74	81	75	0.3	0.4	72	62	32,470	27	—	100	97
LESS DEVELOPED	68	66	70	46	—	0.9	59	54	5,440	69	51	94	76
LESS DEVELOPED (Excl. China)	66	64	68	44	1.4	1.2	51	44	5,000	60	56	93	74
LEAST DEVELOPED	59	57	60	28	2.7	2.5	29	25	1,220	41	77	80	54
AFRICA	58	56	59	39	4.8	4.3	29	25	2,720	35	63	85	52
SUB-SAHARAN AFRICA	55	53	56	37	5.9	5.0	23	19	2,000	36	72	82	47
NORTHERN AFRICA	71	69	73	51	0.1	0.3	49	43	5,540	25	18	90	78
Algeria	73	72	75	67	<0.1	0.1	61	52	8,110	15	24	85	79
Egypt	73	71	75	43	<0.1	<0.1	60	58	5,680	83	19	100	98
Libya	75	73	78	78	—	—	42	20	16,400	4	—	—	—
Morocco	72	70	75	56	0.1	0.1	63	52	4,400	72	14	98	60
Sudan[1]	62	60	63	41	0.4	1.1	8	6	1,990	18	—	64	52
Tunisia	75	73	77	68	<0.1	<0.1	60	52	7,810	65	13	99	84
Western Sahara[1]	61	59	63	82	—	—	—	—	—	2	—	—	—
WESTERN AFRICA	54	53	55	45	3.1	2.7	15	10	1,690	51	75	81	50
Benin	56	54	58	43	1.4	1.2	17	6	1,510	81	75	84	69
Burkina Faso	56	55	57	24	2.1	1.2	17	13	1,170	62	81	95	72
Cape Verde	74	70	78	62	—	—	61	57	3,530	123	40	85	82
Côte d'Ivoire	52	51	54	51	6.5	3.4	13	8	1,640	70	46	93	68
Gambia	59	57	60	59	0.6	2.0	18	13	1,330	157	57	98	86
Ghana	64	63	65	52	2.3	1.8	24	17	1,530	105	54	90	74
Guinea	54	53	56	28	1.7	1.3	9	6	940	42	70	89	61
Guinea-Bissau	48	47	50	30	2.0	2.5	24	14	1,060	45	78	83	51
Liberia	57	56	58	47	3.1	1.5	11	10	290	37	95	79	51
Mali	52	50	53	33	1.6	1.0	8	6	1,190	12	77	81	44
Mauritania	59	57	61	42	0.6	0.7	9	8	1,940	3	44	52	47
Niger	55	54	55	17	1.0	0.8	11	5	680	13	76	96	39
Nigeria	52	51	53	51	3.8	3.6	15	10	2,070	176	84	75	42
Senegal	59	58	61	43	0.6	0.9	12	10	1,810	65	60	92	52
Sierra Leone	53	51	56	39	1.1	1.6	8	7	790	75	76	86	26
Togo	62	60	65	37	3.6	3.2	17	11	850	103	69	87	41
EASTERN AFRICA	56	55	57	22	—	—	29	24	1,080	53	75	85	45

Source: PRB, 2011 World Population Data Sheet

Table 15.5.3

Demographic, social and economic indicators

World and regional data[a]	Total population in millions, 2011[m]	Population in millions, 2011 male	Population in millions, 2011 female	Population growth rate, per cent, 2010-2015	Urban population, per cent, 2010	Total fertility rate, per woman aged 15-49, 2010-2015	Life expectancy at birth, 2010-2015 male	Life expectancy at birth, 2010-2015 female	Population using an improved sanitation facility, per cent, 2000/2008[n]	Population living below $1.25 (PPP) per day, per cent, 1992/2008[o]
World Total	**6974.0**	**3517.3**	**3456.8**	**1.1**	**50**	**2.5**	**68**	**72**	**61**	**26**
More Developed Regions[b]	**1240.4**	**603.1**	**637.3**	**0.4**	**75**	**1.7**	**75**	**82**	**97**	**1**
Less Developed Regions[c]	**5733.7**	**2914.2**	**2819.5**	**1.3**	**45**	**2.6**	**67**	**70**	**53**	**27**
Least Developed Countries[d]	**851.1**	**425.4**	**425.7**	**2.2**	**29**	**4.2**	**57**	**59**	**36**	**54**
Arab States[e]	**360.7**	**185.0**	**175.7**	**2.0**	**56**	**3.1**	**69**	**73**	**76**	**5**
Asia and the Pacific[f]	**3924.2**	**2008.0**	**1916.2**	**0.9**	**41**	**2.1**	**69**	**72**	**52**	**27**
Eastern Europe and Central Asia[g]	**473.7**	**226.8**	**247.0**	**0.3**	**65**	**1.8**	**68**	**76**	**90**	**5**
Latin America and the Caribbean[h]	**591.4**	**292.1**	**299.3**	**1.1**	**79**	**2.2**	**72**	**78**	**80**	**7**
Sub-Saharan Africa[i]	**821.3**	**410.5**	**410.8**	**2.4**	**37**	**4.8**	**54**	**56**	**31**	**53**
Country, territory or other area										
Myanmar	48.3	23.8	24.5	0.8	34	1.9	64	68	81	
Namibia	2.3	1.2	1.2	1.7	38	3.1	62	63	33	49
Nepal	30.5	15.1	15.4	1.7	19	2.6	68	70	31	55
Netherlands	16.7	8.3	8.4	0.3	83	1.8	79	83	100	
New Zealand	4.4	2.2	2.2	1.0	86	2.1	79	83		
Nicaragua	5.9	2.9	3.0	1.4	57	2.5	71	77	52	16
Niger	16.1	8.1	8.0	3.5	17	6.9	55	56	9	66
Nigeria	162.5	82.3	80.2	2.5	50	5.4	52	53	32	64
Norway	4.9	2.5	2.5	0.7	79	1.9	79	83	100	
Occupied Palestinian Territory	4.2	2.1	2.0	2.8	74	4.3	72	75	89	
Oman	2.8	1.7	1.2	1.9	73	2.1	71	76	87	

Source: UNFPA - The State of World Population 2011

Table 15.5.4

Monitoring ICPD goals: selected indicators

World and regional data*	Maternal and Newborn Health				Education						Sexual and Reproductive Health						
	Under age 5 mortality rate, per 1,000 live births, 2009	Maternal mortality ratio, per 100,000 live births, 2008	Adolescent birth rate, per 1,000 women aged 15-19, 1996/2008*	Births attended by skilled health personnel, per cent, 1992/2009*	Primary school enrolment, net per cent of school-age children, 1991/2009*		Secondary school enrolment, net per cent of school-age children, 1998/2010*		Literacy rate, population aged 15-24, per cent, 1991/2008*		Contraceptive prevalence rate, women aged 15-49, any method, 1990/2010*	Contraceptive prevalence rate, women aged 15-49, modern method, 1990/2010*	Unmet need for family planning, per cent, 1992/2009*	Population aged 15-24 with comprehensive correct knowledge of HIV/AIDS, per cent, 2000/2008*		HIV/AIDS prevalence rate, population aged 15 to 24 per cent, 2009	
					male	female	male	female	male	female				male	female	male	female
World Total	**61.7**	**285**	**49**	**66**	**88**	**86**	**61**	**61**	**91**	**86**	**63**	**56**	**22**	**31**	**19**	**0.4**	**0.7**
More Developed Regions†	**7.1**	**18**	**24**	**98**	**96**	**96**	**90**	**91**	**99**	**100**	**72**	**62**	**12**	**29**	**32**	**0.2**	**0.1**
Less Developed Regions†	**68.9**	**283**	**53**	**63**	**88**	**85**	**53**	**53**	**89**	**84**	**61**	**55**	**23**	**31**	**19**	**0.4**	**0.8**
Least Developed Countries‡†	**122.4**	**587**	**120**	**39**	**78**	**73**	**31**	**24**	**75**	**65**	**30**	**24**	**27**	**28**	**20**	**0.8**	**1.7**
Arab States‡†	**50.7**	**247**	**45**	**72**	**89**	**86**	**65**	**58**	**91**	**84**	**47**	**39**	**21**	**16**	**7**	**0.2**	**0.3**
Asia and the Pacific‡†	**50.0**	**182**	**34**	**64**	**93**	**89**	**22**	**56**	**88**	**86**	**67**	**61**	**21**	**32**	**18**	**0.1**	**0.1**
Eastern Europe and Central Asia‡†	**19.7**	**30**	**31**	**97**	**94**	**94**	**86**	**83**	**99**	**99**	**70**	**60**	**13**	**20**	**26**	**0.1**	**0.2**
Latin America and the Caribbean‡†	**22.4**	**85**	**74**	**88**	**94**	**94**	**72**	**76**	**97**	**96**	**73**	**67**	**17**	**34**	**30**	**0.3**	**0.2**
Sub-Saharan Africa‡†	**130.1**	**688**	**122**	**47**	**76**	**72**	**30**	**25**	**76**	**67**	**26**	**19**	**26**	**32**	**25**	**1.6**	**4.0**
Country, territory or other area																	
Morocco	37.5	110	18	63	92	88	37	32	85	68	63	52	10		12	0.1	0.1
Mozambique	141.9	550	186	55	82	77	17	15	78	62	17	12	18	33	14	3.1	8.6
Myanmar	71.2	240	17	57			49	50	95	95	41	38	19			0.3	0.3
Namibia	47.5	180	74	81	88	93	49	60	91	95	55	54	21	62	65	2.3	5.8
Nepal	48.2	380	106	19	81	66			86	75	48	44	25	44	26	0.2	0.1
Netherlands	4.4	9	4	100	99	99	88	89			69	67				0.1	<0.1
New Zealand	6.2	14	32	100	98	100	90	92			75	72				<0.1	<0.1
Nicaragua	26.6	100	109	74	93	94	42	48	85	89	72	69	8		22	0.1	0.1
Niger	160.3	820	198	33	60	48	11	7	52	23	11	5	16	16	13	0.2	0.5
Nigeria	137.9	840	123	39	86	80	29	22	78	65	15	8	20	33	22	1.2	2.9
Norway	3.3	7	9		99	99	96	96			86	82				<0.1	<0.1
Occupied Palestinian Territory	29.5		60	99	77	78	82	87	99	99	50	39					
Oman	12.0	20	8	99	71	73	83	81	98	98	32	25				<0.1	<0.1

Source: UNFPA - The State of World Population 2011

The examples of indicators given here are only meant to illustrate the way in which development, health and social conditions can be measured.

4.0 CONCLUSION

Indices are very important to the professional health worker because they play a major role in the measurement and assessment of population, health, and development activities.

Indicators and indices play a major role in the measurement and assessment of population health status. They are very important to the practicing public health professional.

5.0 SUMMARY

In this concluding unit, we explained the meaning of indices and stated their uses. We identified various population, health, and development indices.

6.0 TUTOR- MARKED ASSIGNMENT

State three (3) indices for each of – population, health and development. Identify the broad areas and indicators selected under each to monitor ICPD goals, in Table 15.5.4.

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