# What is Descriptive Epidemiology?

**UNIT 1**

## Introduction

Before beginning to study this module, and in order to increase your engagement with

its content, we strongly encourage you first to reflect on these four questions below:

* What is data?
* How do you think you regularly interact with data?
* What is the usefulness of data in general?
* How do you think data can help you in your work?

The data we will refer to in this module is quantitative data, which means it is data expressed in numbers. The analysis of quantitative data enables us to see how often something occurs or to what degree a phenomenon exists. The information produced in the process of analyzing or summarizing data answers questions such as “How many?” or “How often?” Quantitative data is considered to be objective; it can be collected in a standardized format and is quite easily analyzed and understood. The measure or results of the analysis of data should be easily comparable to similar measures from other communities and levels.

You can be involved at any stage of the data and information cycle. The cycle usually starts at ground-level with data collection from the facility or individual (on paper or electronically, routine or for a specific purpose), the data is then compiled at sub-district or district level; it is then summarised (analysed), scrutinised and interpreted, after which it is fed back to the place or setting where it was collected.

Data might be analysed in order to get useful information about the epidemiological profile of your population, measure levels of, or trends in, a disease or health problem, to check if an intervention is being effective, to monitor a disease evolution, to assess the needs in terms of financial or human resources in a certain area etc.

*As a clinician monitors the course of illness in the patient, so the Public Health worker must continually assess progress within the community. The most powerful tool at the disposal of Public Health workers to diagnose and monitor community health is epidemiology.*

*(*AO Lucas in Vaughan & Morrow, 1989)

Unit 1 is an introduction to epidemiology and provides a foundation for studying the rest of the module. The unit begins by asking you to identify areas of your current work environment in which you are likely to undertake epidemiological tasks. It then proceeds to explore the meaning of epidemiology, its main characteristics and its role in understanding health and disease. Study Sessions 1 and 3 provide the conceptual foundation for the rest of the module, and guide you through the most frequently used measures and calculations you are required to use. Work through them carefully, completing all tasks to make sure you grasp the different concepts and epidemiological measures.

In Study Session 2, you are introduced to the investigative process that might be used by a health manager faced with a health problem in a community: you will try out a set of key questions that can be used to interrogate any set of data. In Study Session 3 you are also introduced to concepts, indicators and measures used to describe health status. Finally, in Study Session 4, you look at the study of populations, i.e. demography. Key demographic concepts and characteristics of populations are covered. You will also be exposed to a variety of ways of using and presenting population statistics in relation to health issues and particularly for epidemiological purposes.

## Study Sessions

There are four Study Sessions in Unit 1: Study Session 1: What is Epidemiology?

Study Session 2: Investigate Health Problems

Study Session 3: Epidemiological Principles and Practice Study Session 4: Describe a Population

In the course of this unit, you will be encouraged to read texts and do a range of tasks that will lead to your achieving these outcomes:

### Intended Learning Outcomes

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| **By the end of this unit you should be able to:** |
| ***Health Measurement Outcomes***1. Define common epidemiological and demographic terms and concepts.
2. Describe the role of epidemiology in providing critical information on key health conditions.
3. Recognise contextual influences on epidemiology in Africa.
4. Develop a conceptual framework to describe community health.
5. Critically review the technical content of scientific reports.
 | ***Academic Learning Outcomes**** Develop working definitions of key terms and concepts.
* Interpret a simple set of statistical data.
* Compare, interpret and draw conclusions from graphs and tables.
* Use graphical representation techniques to illustrate (demographic) information.
* Develop a systematic approach to reading reports and published research.
* Select and evaluate meaningful indicators and measures.
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**Unit 1 - Study Session 1 What is Epidemiology?**

**Introduction**

This Study Session introduces epidemiology, its terminology, definitions, and its different uses in research, clinical practice and community or district health management. In the course of the Study Session, you will also focus on reading graphs and tables. This is an essential competence for studying in this field. The Study Session is intended to provide you with a foundation for understanding and engaging in Descriptive Epidemiology. You are certain to discover that you have already encountered epidemiological information in some form or another.

Epidemiology will help you to answer questions like these:

* How do you know if a DOTS programme is succeeding?
* What does it mean if prevalence is reported as 200/1 000, or when a TB prevalence is 850/100 000?
* Is this a Public Health problem or not?

Examples will be used to illustrate how health activities are measured or monitored. Having understood these examples, we hope you will be able to analyse similar sets of data from elsewhere in the country and internationally.

The careful completion of the tasks in this Study Session is important as this unit provides the foundation that you will need for the rest of the module.

## Contents

1. Learning outcomes of this session
2. Readings
3. Clarify key concepts used in epidemiology
4. Explore your experience with epidemiology
5. The applications of epidemiology
6. Session summary

## Timing of this session

This Study Session contains two readings, one of which is a glossary of terminology and five tasks. It should take you up to three hours to complete depending on your familiarity with the terms and with graphs and tables.

## LEARNING OUTCOMES OF THIS SESSION

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| **By the end of this Study Session, you should be able to:** |
| ***Health Measurement Outcomes**** Identify the role of epidemiology in Public Health.
* Recognise the contextual influences on epidemiology in Africa.
* Define the concepts and terms used to describe the measurement of health and disease events in communities.
* Consider the quality and relevance of data describing community health and illness.
 | ***Academic Learning Outcomes**** Prepare your own definitions for new technical terms.
* Interpret simple graphical representations.
* Develop a systematic approach to reading reports and published research.
* Interpret a simple set of statistical data.
 |

1. **READINGS**

The two readings for this Study Session are listed below. You will be directed to them in the course of the Study Session. The second reading is a glossary of terms that you may want to refer to during this Study Session and later in the module. You should also use the link in the Reader Index to access to rest of Chapter 1 of the Bonita et al., (2006) online to help with this Unit.

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| --- | --- |
| **Author/s** | **Publication Details** |
| Bonita, R., Beaglehole, R. & Kjellstrom, T. | (2006). Ch 1 – What is Epidemiology? In *Basic Epidemiology.*2nd Ed. Geneva: WHO: 1–6, 10. |
| Vaughan, J. P. & Morrow, R. H. | (1989). Ch 14 – ABC of Definitions and Terms. In *Manual of Epidemiology for District Health Management.* Geneva: WHO: 155–167. |

## CLARIFY KEY CONCEPTS USED IN EPIDEMIOLOGY

Like many other areas of health and medicine, the study of how health and disease is measured has generated a variety of new terms and concepts. It will be important to develop your own working definitions in order to read the material contained in this module more effectively and critically. The following tasks help you to do this.

Start off by previewing Bonita, Beaglehole & Kjellstrom (2006). You will find guidance on how to preview texts in the *SOPH Academic Handbook,* Section 5.3.3. Previewing helps you to read with focus and understanding.

Broadly, the text present a definition of epidemiology, its historical origins, current applications and achievements, its role in Public Health research and its particular value in the African context. The chapter by Bonita, Beaglehole & Kjellstrom (2006) takes a more historical approach in its introduction, and identifies some of the achievements of epidemiology. This reading provides a useful set of study questions on page 11. Bear these questions in mind while you read, then try to answer them.

**READINGS**

Bonita, R., Beaglehole, R. & Kjellstrom, T. (2006). Ch 1 – What is Epidemiology? In

*Basic Epidemiology.* 2nd.Ed. Geneva: WHO: 1–6, 10.

**TASK 1 – Develop a definition of *epidemiology***

When previewing, it is helpful to identify key questions to which you would like answers. If I were reading this, I would try to find answers to the following two questions, as a way of focusing my reading:

1. What do epidemiologists do? (Figure 1.2 on page 4 may be helpful.)
2. What is the main difference between the work done by clinicians and epidemiologists?
3. Once you have taken these notes, write your own definition of epidemiology.

#### FEEDBACK

The work of epidemiology differs most fundamentally from that of clinical health workers in that it addresses health issues at the population level, whereas most health workers are involved in treating individuals or small groups of patients.

The information built up over decades of epidemiological research has provided clinicians with fundamental information about the natural history of the diseases they treat, about what causes them, what interventions work best and also about the distribution of disease and risk factors in the population at large.

The word *epidemiology* is derived from the Greek *epi* (upon) and *demos* (people). Most people would agree on a definition of epidemiology something like this:

*The study of the distribution and determinants of health-related states or events in specified populations and the application of this study to the control of health problems.*

(Bonita, Beaglehole & Kjellstrom: 2006: 4)

The reading offers a variety of illustrations of epidemiology and its application to the assessment of different health and disease problems over time. Have you encountered any of the examples described before?

In the next task, you will check and expand your understanding of key concepts used in epidemiology. The following reading lists some epidemiological terms.

**READING**

Vaughan, J. P. & Morrow, R. H. (1989). Ch 14 – ABC of Definitions and Terms. In

*Manual of Epidemiology for District Health Management.* Geneva: WHO: 155–167.

**TASK 2 – Identify and work out the meaning of new concepts**

1. Underline any terms or concepts that you have come across for the first time, or which are unclear to you.
2. Try to write down an explanation of these terms using your own words. Check their meaning in any of the readings for this Study Session. If these texts do not adequately clarify the meaning, consult Chapter 14 of Vaughan & Morrow (1989) or a good dictionary.

#### FEEDBACK

Your list of new terms might have included the following concepts:

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| --- | --- |
| Public HealthEpidemic (note Greek origins) EpidemiologyDescriptive Epidemiology Analytic Epidemiology EpidemiologistEndemic Pandemic | Mortality rate Communicable diseases Clinical Epidemiology SubclinicalCausationEnvironment (Refer also to a dictionary) Natural history (Reading 2 page 4) Health status information |

Make sure that you are really clear about what these concepts mean as it is difficult to study or to read effectively without this clarity. Consult a more experienced colleague or the readings if you are unclear about any of the terms.

## EXPLORE YOUR EXPERIENCE WITH EPIDEMIOLOGY

Most people already know something about the subject they are starting to study and the same is probably true for you as you begin this epidemiology module. This section aims to identify areas of your work experience where you may already have encountered or even done some epidemiology.

**TASK 3 – Explore examples of health status information in your work**

As a Public Health worker, it may be important for you to know the extent to which a particular health condition affects people in your district, e.g. the percentage of a district population affected.

1. List 2–3 health conditions encountered in your area or in the course of your work, for which there is information available. Try to find out the proportion of people in your area affected by these conditions.
2. Where does this information come from?
3. What does this information tell you about the health status of your community?
4. If you work with this information, does that mean you are doing epidemiology? Explain.
5. What sorts of decisions are made in your workplace using this information?

#### FEEDBACK

Whether they know it or not, most health workers work with or come across information describing the health or illness of a population in the course of their work. This is one of the four main areas of epidemiology. Perhaps you simply have to record the number of cases of diarrhoea seen at a clinic, or the age and weight of children with malnutrition. All these pieces of information together provide a picture of the health status of your community, and they all contribute to the process called epidemiology.

So perhaps without recognising it, you already know something about epidemiology because you have already been doing it.

**TASK 4 – Identify other epidemiology tasks you perform**

Make a list of the different types of health information you encounter as a health worker and make a note of what you actually do with this information.

Which of these activities fit the definition of Descriptive Epidemiology as you expressed it in Task 2?

How do these epidemiological activities contribute to the Public Health work of your organisation or institution?

#### FEEDBACK

Epidemiology has provided us with a very strong research basis for understanding health and disease events and patterns in populations. You may have recognised that information obtained from epidemiology research or data collection can guide your understanding of health events, or help you to make decisions. Epidemiology provides some very powerful tools for tasks such as problem identification, decision-making or even programme evaluation. The sad thing, however, is that it appears to be so under- utilised in the health bureaucracies of Africa.

Epidemiology can provide data to show improvements in health status and may also identify serious failures or pitfalls in the health system. It may also be ignored or even deliberately concealed. This makes it a potential political football. Worse still, it may point to areas of causation located in underdevelopment, poverty and political incompetence. To address these situations adequately requires massive resources and political will.

## THE APPLICATIONS OF EPIDEMIOLOGY

From fairly focussed beginnings (which you read about in Bonita, Beaglehole & Kjellstrom, 2006) the field of epidemiology has grown to include and influence a wide range of clinical and Public Health activities. Some of the more prominent applications of epidemiology are identified in the next task.

**TASK 5 – Identify current public health applications**

1. From your reading of the texts, identify at least four main roles or uses for epidemiology. Prepare a short written description of each of these applications.
2. Identify one example of each of these main uses of epidemiology from your own experience or from the readings. Bonita, Beaglehole & Kjellstrom (2006) contains several examples.
3. Explain how the knowledge in the example identified can contribute to an important Public Health strategy or decision.

#### FEEDBACK

1. A particularly neat, simple summary of the ways in which epidemiology has contributed to our understanding and practice of Public Health is found in Bonita, Beaglehole & Kjellstrom (2006). Here the main uses of epidemiology are grouped into four categories, namely causation, the natural history of disease, description of the health of populations and the evaluation of interventions. Note that these have relevance in both the clinical health care arena as well as in Public Health.
2. In the section entitled *Achievements of Epidemiology,* Bonita, Beaglehole & Kjellstrom (2006) pages 6–11, provide several examples to illustrate the uses of epidemiology*.*

Here are some examples of the different categories of epidemiology and their contributions to Public Health strategies:

* + One well-known example of using epidemiology to establish causation is the link between smoking and deaths due to lung cancer. Causation studies provided this information and numerous anti-smoking or smoking cessation programmes have been based on the premise that there is a link between smoking and death from lung cancer.
	+ In order to manage our TB programmes, we need to know what proportion of the population is affected in each area. A TB prevalence of 850/100 000 in a specific area tells us that there is a massive problem to be addressed here.
	+ New antiretroviral drugs are a major new area of research which aims to evaluate which medications work best at controlling AIDS. These, and many other interventions, are the subject of epidemiological trials.
	+ Virtually every immunisation programme owes its existence to intervention studies that established the efficacy of immunisation against infectious diseases such as measles, tetanus, smallpox, and so on.
	+ The natural history of Ebola, a very recent disease outbreak, is only now becoming clear, as case records from numerous cases around the region are collated and reviewed.
	+ Both TB and HIV/AIDS are conditions where it is critical that we understand the natural history of these diseases. They both have a long period in which they exist as sub-clinical infections, that is, before they produce symptoms that the patient or health worker can detect. During this period, patients are unlikely to seek treatment and can infect their partners or those around them.
	+ Public Health workers are particularly concerned with the size and distribution of different diseases or health risks in the population, such as what proportion of the population has TB or how many new cases are occurring each month. This guides decisions as to how to respond, e.g. provide more TB beds, improve treatment adherence, extend BCG programmes, and so on.

## SESSION SUMMARY

In this Study Session, you have explored the meaning of certain key concepts used in epidemiology, considered its role in Public Health and its application in your own work context. You have also developed your academic reading skills both of texts and graphical illustrations.

In the next Study Session, we introduce a set of important questions you need to ask in order to understand and respond to a Public Health problem. This set of questions should become part of your own systematic framework for assessing the epidemiological profile of a given community or event for which you have responsibility.

**KEY POINTS IN UNIT 1 SESSION 1**

**Defining Epidemiology**

A newly arrived scientist at CDC did not fully understand the field of epidemiology ... The first person he asked was a medical student, who told him that epidemiology was "the worst taught course in medical school". The second, a clinical faculty member, told him epidemiology was "the science of making the obvious obscure". Finally, knowing that statistics are important to epidemiology, he asked a statistician, who told him that epidemiology is "the science of long division" and provided him with a summary equation. Giving up on finding a real answer, he returned to Center for Diseases Control (CDC). On the way, however, he decided to try one more time. He stopped a native Atlantan who told him that epidemiology was "the study of skin diseases”.

A less entertaining, but more conventional, definition of epidemiology is "… the study of the distribution and determinants of health-related states in specified populations, and the application of this study to control health problems."

From: CDC. *Introduction to Epidemiology Course.* Atlanta, USA: Center of Diseases Control, Atlanta, USA. [Online] Available: // <http://www.cdc.gov/excite/classroom/intro_epi.htm>)

# Unit 1 - Study Session 2 Investigate Health Problems

## Introduction

A wide variety of sophisticated and often quite complex epidemiological and statistical tools are available to measure the precise health status and health risks in a particular area such as a health district. However, rather than complicating the process unnecessarily, one simply needs to develop the skill of asking questions of the problem or of the data representing the problem.

This Study Session provides the opportunity to try out questions which have been developed to guide you when investigating a health problem. An approach to investigating a problem is sometimes termed a conceptual framework. The one presented here consists of themed questions which can assist you to identify, describe and even prioritise the most important Public Health problems in any given community and, therefore, to understand the community’s health status.

## Contents

1. Learning outcomes of this session
2. Readings
3. Research a health problem
4. Use a conceptual framework
5. Session summary

## Timing of this session

There is one reading and four tasks for this Study Session, one of which requires you to spend some time (if possible) working through a set of questions with your colleagues. It is likely to take you about two hours, depending on how long you spend on discussing the questions.

## LEARNING OUTCOMES OF THIS SESSION

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| **By the end of this Study Session you should be able to:** |
| ***Health Measurement Outcomes**** Describe the Public Health status of a selected community.
* Review a set of generic questions to describe community health status.
* Identify key epidemiology principles in community health measurement.
 | ***Academic Learning Outcomes**** Apply a conceptual framework.
* Locate and organise local health information for easier interpretation.
* Adapt a conceptual framework for application in own work context.
 |

1. **READINGS**

There is just one reading in this Study Session.

|  |  |
| --- | --- |
| **Author/s** | **Publication Details** |
| Centers for Disease Control and Prevention (U.S.). | Lesson One: Introduction to Epidemiology. *Principles of epidemiology in public health practice; an introduction to applied epidemiology and biostatistics.* Atlanta: U.S. Department of Health and Human Services: 1-1-1-6. |

## RESEARCH A HEALTH PROBLEM

In this section, you have the opportunity to apply epidemiological skills to a Public Health problem. This simple example demonstrates the kind of role that a Public Health manager might take when faced with a health status problem.

Read the case scenario below. Try to identify the nature of the problem and what information you will need if you are to successfully address the alleged problem. Note down the questions you would ask in order to get a better grasp of the situation.

#### Case scenario

You work for a local health authority and you hear that 150 children were treated at the local hospital for diarrhoea over the past weekend.

Would you consider this to be a problem? What is your immediate response to this problem? What assumptions did you make when you made this decision?

This looks like an epidemic or outbreak of disease but we cannot know this until we have collected certain crucial information about it and about the general health status of this community.

**TASK 1 – Determine the information you need to address a problem**

1. Consider the case scenario above and answer these key questions:
	* What do I need to know in order to understand enough about the problem to respond to it?
	* Where can I find this information?
2. Write down the questions you would ask and where you would obtain the information you need.

#### FEEDBACK

The information that you have been given, that 150 children were admitted to hospital with diarrhoea, is very scanty. This is done on purpose in order to challenge you with the key questions.

Understanding the seriousness of the problem arises from asking the right or most relevant questions, in other words, *researching the problem*. You will do this in more detail in the next task. At the same time, it is important *not* to ask questions that simply have curiosity value and do not focus on the immediate problem and ways of responding to it. An example of a curiosity question might be: *What is the socio- economic status of these children or the gender distribution of the illness?*

The children might indeed share similar circumstances, but right now we urgently need to find out:

* Did they attend the same event?
* Was there an exposure to disease risk factors that they all shared?
* What actually happened to the children over the weekend?

The best strategy is not to ask all possible questions, but to establish *just enough*

reliable evidence upon which you can base a decision about how to intervene.

It is likely that you may wish to apply a particular *case definition* of childhood diarrhoea. This established set of clinical signs and symptoms helps to clarify more specifically whether all the children in the sample have in fact got the same illness.

Another line of questions could be community health status questions such as:

* How often and where does diarrhoea “normally” occur in this area and in this group?

You would need to consider the immediate intervention options available and attempt to choose the best option. Later you will need to clarify the social and economic characteristics of the population affected, in order to determine the broader environmental risk factors that need to be addressed (such as water and sanitation systems).

Now review your questions: Do your questions at least address these issues? Have you asked any unnecessary or curiosity questions?

In the next task, you are asked to respond to this problem as a Public Health manager and make some recommendations.

**TASK 2 – Outline your response to the problem**

1. Imagine now that you have found out that these children all live in the same part of an informal settlement, which relies on a particular well for its water supply.
2. After carefully reviewing this situation and consulting others, prepare a short outline report to your line manager assessing the situation. Indicate how you think the local health authority should respond to this situation.
3. Note that as a representative of the local health authority, your concerns should extend beyond just the hospital care procedures. Consider what you might do at community level, and what you could do through your clinical facilities.

#### FEEDBACK

In an emergency situation like this one, it is very unlikely that you will have all the information you want, but you will still have to make a report and decide what action should be taken. You may want to recommend that more information be gathered in order to respond more effectively. However this should not prevent you from acting decisively where you can.

In your recommendations, did you propose any community-level response? Did you recommend any preventive strategy that might have a longer-term impact in preventing a recurrence in this community?

A short-term response might include tracing further victims through community members, recommending emergency treatment for those affected and providing education concerning individual preventive measures. If a common water or food source is the cause, then the hygiene standards of the caterer concerned or the water source should be addressed. A faulty water source should be fixed or closed off and plans for alternative water provision should be urgently drawn up.

In the longer term, community education on basic health and hygiene, the early detection of childhood diarrhoea and the use of oral re-hydration solution could be a good investment of time and energy. Addressing environmental sources of risk with better sanitation, sewage and water supplies is fundamental to addressing this problem.

## USE A CONCEPTUAL FRAMEWORK

In the previous task, you considered the kind of information you really need in order to understand and address a specific health problem. In the next task you will consider the health situation of an entire community.

You would benefit from working with fellow students or colleagues as you apply a systematic set of questions to a community health situation with which you are familiar. Try to choose one where you or your colleagues have already made some interventions.

This set of questions is termed *a conceptual framework* for understanding the health status of a community. In other words, it is a way of systematically organising your information about a population so that you can understand it better.

Each theme or section of the framework, from 1 – 4, contains different potentially relevant questions that attempt to throw light on an aspect of the community’s health status, e.g. the size and distribution of the problem and the source of the problem.

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| **CONCEPTUAL FRAMEWORK FOR IDENTIFYING A HEALTH STATUS PROBLEM** |
| 1. **Identify the problem**

Question 1: What are the main health problems in your community or district?1. **Determine the magnitude and distribution of the problem**

Question 2: How many cases or health events did you come across? Question 3: When do these events generally occur?Question 4: Where do these health events occur? Question 5: Who is, and who is not, affected?1. **Analyse the problem**

Question 6: Why does the problem occur? (What are the main factors involved?)1. **Take measures to address the problem**

Question 7: What kind of measures were taken or could be taken to deal with it?Question 8: What results were achieved? What difficulties were encountered?Question 9: What else could be done? What kind of assistance is needed? |

Using this framework is part of the aspect of epidemiology that Bonita, Beaglehole & Kjellstrom (2006) referred to as *of Health Status of Populations* in Figure 1.5 on page 5 of their book.

As a Public Health professional starting work in a new district or region, you will have to ask yourself what the main health problems are in this community. Some health issues may be more widespread or more urgent than others.

In addition, you will need to recognise the main features of the population, its size, and its age and gender profile, and so on. If you wish to make improvements in health status, you will also have to understand the risk factors at work in the environment as well as the infrastructure available to support you. Later, you will also want to know whether you are succeeding in your work. For example, have disease rates dropped or are they increasing?

The following task sets out to explore the kind of information you will need in order to answer these questions.

#### TASK 3 – Use the conceptual framework to analyse key health problems in a community

Put yourself in the role of a District Health Manager in charge of a district of your choice. Refer to a community that you know well for information.

Use the questions that follow to build up an understanding of the key health problems in that community.

* 1. Identify the problem

#### Question 1: What are the main health problems in your community or district?

This pertains only to aspects of health status such as diseases, low weight, disabilities, and so on, and not to aspects related to the delivery of health services.

Write down the three main problems encountered in the community you have chosen. Compare the problems you identify with the problems identified by the fellow students or colleagues you are able to consult.

Choose one particular problem for further exploration. You will apply the remaining eight questions in the conceptual framework to this particular problem. Use these criteria to select a particular problem:

* + - **Severity:** This refers to the number of deaths from the disease or the number of people disabled as a result of the disease.
		- **People’s concerns:** This relates to the social stigma attached to the disease or the level of fear it generates.
		- **Sensitivity to Public Health measures:** This refers to the feasibility of control and the costs involved.

Having identified and selected a particular health problem, we now want to try to understand how widespread it is, who is and who is not affected and when they are affected. This process involves looking for any patterns in the distribution of illness. To do this, go on to the next step in the conceptual framework. This is to:

* 1. Determine the magnitude and distribution of the problem

#### Question 2: How many cases or health events did you come across?

Try to ascertain the actual extent of the problem in your selected community. Write a short summary of the situation.

The answer should preferably come from your own experience, the knowledge of colleagues you consult or from information you or they are handling or producing.

#### Question 3: When do these events generally occur?

Consider whether these health events occur at a particular time of year, in a particular week, or on a specific day. Record your answers with as much useful detail as you can derive from your own experience and knowledge.

#### Question 4: Where do these health events occur?

Are they limited to a particular area? Indicate their location on a map.

Record your answers.

#### Question 5: Who is, and who is not, affected?

Does the problem affect particular individuals – men, women, the very young, the elderly, families or particular ethnic groups? Are people with the same income level, similar habits, occupations or family structures more affected than others?

Prepare a list that identifies and describes the individuals (or categories of individuals) who do, and do not, suffer from the disease. Continue to record your answers.

#### Note:

**While formulating your answers to these questions, you may come up with new questions that need to be answered. Make a list of these as they arise.**

Now that you have gathered the background information, you should try to identify *why* the problem occurs. The patterns you have noted in the answers to questions 2–5 might help you answer the next question of the conceptual framework.

* 1. Analyse the problem

#### Question 6: Why does the problem occur? Or what are the main factors involved here?

Try to work out what causes and factors are at work here. You may need to ask further questions at this point. Respond to these questions in the same way as you have done with the other questions.

* 1. Take measures to address the problem

#### Question 7: What kind of measures were taken or could be taken to deal with the problem?

List the most important solutions or interventions that you consider appropriate to cope with the problem you have identified. Try to work out which causes each intervention is intended to address.

Which interventions have you decided to exclude and why?

#### Question 8: What results were achieved? What difficulties were encountered in dealing with the problem?

Focus on the changes in health status of the community you are discussing. Can you identify which interventions were responsible for which changes? What are some of the difficulties you have encountered in the delivery or evaluation of interventions that really achieve meaningful results?

#### Question 9: What else could be done? What kind of assistance is needed?

Consider what other support would be needed. Try to foresee the barriers or obstacles that exist that may affect the process of intervention. How could barriers impact on the health status assessment that you have been discussing? Which elements lie within and which ones lie beyond the confines of the health system? How could they be controlled or overcome?

#### FEEDBACK

Completing this questioning process should give you a fair understanding of key health problems in a community.

**TASK 4 – Modify these questions for your setting**

1. What do you think about using this same process of discussion and epidemiological exploration in your own clinic or community? Could it be useful in that setting?

2. Prepare a modified set of questions, based on the questions above. This set of questions forms the basis of your own conceptual framework – one that is relevant to your local context and will be a useful, personal resource that you can apply in your future work.

#### FEEDBACK

Epidemiology is about asking the right questions, as well as about using many different tools or research methods to find answers.

**READING**

Centers for Disease Control and Prevention (U.S.), (2006) Lesson One: Introduction to Epidemiology. *Principles of epidemiology in public health practice; an introduction to applied epidemiology and biostatistics.* Atlanta: U.S. Department of Health and Human Services: 1-1-1-6.

The CDC manual 2006, page1-2-6 in the text box, presents another short list of key epidemiological questions. However, these are expressed in a much more generic style, i.e. they suggest asking: *What? Who? Where? When? Why?/How?* The questions they propose are at the very core of the practice of Descriptive Epidemiology.

Clearly, you will need to adapt the form of such questions to your particular area of enquiry if they are to have meaning. You can adapt these questions to reflect your own special disciplinary or research interest. After completing the reading, review your own set of questions. Make any changes or additions you think are necessary.

## SESSION SUMMARY

In this Study Session, we have practised the process of doing an epidemiological investigation of the causes of a health problem and considered how one might intervene. In doing this, you were going through the process that a Public Health manager might engage in when faced by a sudden health problem. You have also tried out a conceptual framework for the purpose of creating a health status report for a community. Hopefully, you have adapted the framework to your own context and recognised the importance of doing so.

Your assignments require exactly the same kind of questioning approach. In the assignments, you are presented with a real situation with facts and figures reflecting some aspect of Public Health in a given population. Your task is to make sense of the health status of this community by analysing and interpreting the information, in order to respond with ways to improve their health status.

The next Study Session looks in detail at health indicators and at how and why we are interested in measuring (the frequency). Data needs to be measured, examined, and analysed in context and for this reason it also includes how to describe a population.

It is important, when generating information or using data for research or surveillance purposes, to be systematic, in order to not miss out any possible interpretation, to avoid misinterpretation and to make the maximum use of the data.

The conceptual framework is a tool to investigate a specific problem, arising from your data, in a systematic way.

**KEY POINTS IN UNIT 1 SESSION 2**

**Investigating Health Problems**

**Self-evaluation question:** Imagine that you are a new arrived district manager and your data manager gives you the latest tuberculosis incidence in the district, which is 2 000 per 100 000 inhabitants.

She already checked the accuracy of this information, having been concerned that it is very high compared to previous year; notably the incidence doubled.

Using the conceptual framework provided in the session, try to generate the questions that you are going to ask to your data manager to investigate this problem.

**Unit 1 - Study Session 3 Epidemiological Principles and Practice**

**Introduction**

In the first two Study Sessions of Unit 1, you established a working definition of epidemiology and its main uses and considered the key questions that epidemiology helps us to answer as Public Health workers. You have also been briefly introduced to various types and sources of epidemiological data. You have seen the importance of using a conceptual framework to fully understand a specific health problem and to work out the best way to intervene.

This Study Session takes a closer look at health indicators, considers the notion of *population at risk*, and describes the construction of measures and other important epidemiological concepts. The measurements of health conditions are called *indicators*.

## Contents

1. Learning outcomes of this session
2. Readings
3. Define key terms
4. Calculate a selection of measures
5. Select meaningful indicators and measures
6. Session summary

## Timing of this session

This Study Session contains three readings and eight tasks. It should take you up to three hours to complete.

## LEARNING OUTCOMES OF THIS SESSION

|  |
| --- |
| **By the end of this Study Session you should be able to:** |
| ***Health Measurement Outcomes**** Define key terms in health management.
* Evaluate different health indicators.
* Calculate rates and proportions.
* Apply descriptive epidemiology concepts and principles to Public Health problems.
* Select meaningful indicators and rates.
 | ***Academic Learning Outcomes**** Define new technical terms.
* Carry out some simple calculations.
* Select and evaluate meaningful indicators and rates.
 |

1. **READINGS**

There are three readings in this Study Session. You will use them mainly as references for clarifying your understanding of key concepts.

|  |  |
| --- | --- |
| **Author/s** | **Publication Details** |
| Bonita, R., Beaglehole, R. & Kjellstrom, T. | (2006). Ch 2 – Measuring Health and Disease In Basic Epidemiology. 2nd Ed.Geneva: WHO: 17-32. |
| Joubert, G., Ehrlich R., Katzenellenbogen,J. M. & Abdool Karim,S. S. | (2007). Ch 2 – Key Concepts in Epidemiology.In *Epidemiology: A Manual for South Africa.* 2nd Ed. Cape Town: Oxford University Press: 12–29. |
| Centers for Disease Control and Prevention (U.S.). | (2006) Lesson Three: Measures of Risk. *Principles of epidemiology in public health practice; an introduction to applied epidemiology and biostatistics.* Atlanta: U.S. Department of Health and Human Services: 3-1 – 3-8, 3-9– 3.38. |

## DEFINE KEY TERMS

Earlier when you looked at a district health problem (Unit 1 Study Session 2), you encountered several questions about how many people are affected by a health condition and how often a condition occurs in the population. To arrive at answers to these questions and to enable us to compare settings and measure change or progress, several forms of health measurement are required.

Before embarking on this session read the following section about frequency

measures, this will be a reminder about the differences between the primary measurements that you will calculate in this module.

**READING**

Centers for Disease Control and Prevention (U.S.). (2006) Lesson Three: Measures of Risk. *Principles of epidemiology in public health practice; an introduction to applied epidemiology and biostatistics.* Atlanta: U.S. Department of Health and Human Services: 3-1 – 3-8.

Some examples of indicators include various types of mortality rates, disease frequency measures, immunisation coverage, per capita income, literacy levels, birth rates and others. It is important to establish a set of precise definitions or descriptions of these measurements, for use in the future.

There are two readings to help you familiarise yourself with some of the key terms. Start with Chapter 2 of Bonita et al., (2006), and then refer to Chapter 2 of Joubert *et al.* (2007) for explanations of certain key terms.

**READING**

Bonita, R., Beaglehole, R. & Kjellstrom, T. (2006). Ch 2 – Measuring Health and Disease In *Basic Epidemiology.* 2nd Ed.Geneva: WHO: 17-32.

Joubert, G., Ehrlich, R., Katzenellenbogen, J. M. & Abdool Karim S. S. (2007). Ch 2

– Key Concepts in Epidemiology: Measure of the frequency of health events. In *Epidemiology: A Manual for South Africa.* 2nd Ed. Cape Town: Oxford University Press: 19–24.

Centers for Disease Control and Prevention (U.S.). (2006) Lesson Three: Measures of Risk. *Principles of epidemiology in public health practice; an introduction to applied epidemiology and biostatistics.* Atlanta: U.S. Department of Health and Human Services: 3-1 – 3-8, 3-9 – 3.38.

**TASK 1 - Read a text and identify new terms**

Work through Chapter 2 of Bonita et al., (2006), pages 17-32.

List any terms with which you are not familiar. Some of these are in bold. Try to write a definition of each term in your own words, using the text as a reference.

#### FEEDBACK

The terms that are important to define at this stage include:

|  |  |  |
| --- | --- | --- |
| Incidence | Prevalence | Population at risk |
| Numerator | Denominator | Episode |
| Case definition | Indicator | Health (status) indicators |
| Morbidity | Mortality | Crude death rate |

If you get stuck, consult the glossary in Chapter 14 of Vaughan and Morrow (1989), or a dictionary, for definitions of some of these terms. You will find clarification of key measures like *crude rate* and *(cause) specific rate* on page 23 in Joubert *et al.* (2007).

A few of the definitions can also be found in the following reading.

A good way to consolidate your understanding of new concepts is to use them in context. Although the readings provide a number of examples to illustrate how these different measures are used, the best way for you to understand and remember them is to find a few good examples from your own context.

**TASK 2 - Find your own examples of these measures**

1. Draw on your own experience or reading and identify one example of each of the different measures and indicators given above. Include an incidence rate, prevalence, a health indicator, a health status indicator, a morbidity rate, a mortality rate, a crude death rate and a cause-specific mortality rate.
2. As you select your examples, try to identify how they were derived.

#### FEEDBACK

Some examples:

an incidence rate: 85/100 000 new cases of TB annually

prevalence: 21.5% or 21.5/100 cases HIV infection

a health indicator: 74% in SA have access to clean water a health status indicator: 6.4/100 000 SA males have oral cancer a morbidity rate: 36% of students had colds in June

a mortality rate: Infant mortality in SA is 54/1000 live births

a crude death rate: SA death rate is about 1.8%

a cause-specific mortality rate: Rabies death rate is 98% untreated

To illustrate one of these: TB incidence in Cape Town was given as 85/100 000. This means, out of every 100 000 people in Cape Town who do not already have TB, 85 people were diagnosed as new cases of TB in a given year.

For health workers to avoid spending all their time collecting data on unimportant health conditions or events, it is essential that they choose indicators very carefully

according to what they require.

## CALCULATE A SELECTION OF MEASURES

You may not need to calculate many of these measures in the course of your work, but there is no doubt that you will come across them in reports, discussions and journal articles. A clear understanding of how they are derived makes it a lot easier to interpret the reports or articles in which they appear.

This section provides you with the opportunity to become familiar with calculating these measures and with deciding whether to calculate the incidence rate or prevalence.

You will need a calculator to do this and you may find the following reading helpful in clarifying the definition of these measures and their calculation.

**READING**

Joubert, G., Ehrlich, R., Katzenellenbogen, J. M. & Abdool Karim, S. S., (2007). Ch 2 – Key Concepts in Epidemiology: Measure of the frequency of health events. In *Epidemiology: A Manual for South Africa.* 2nd Ed. Cape Town: Oxford University Press: 19–24.

Bonita, R., Beaglehole, R. & Kjellstrom, T. (2006). Ch 2 – Measuring Health and Disease In *Basic Epidemiology*. 2nd Ed. Geneva: WHO: 18-21.

**Note:** Prevalence means the total number of cases at a particular point in time, divided by the total population at that same moment.

*Prevalence = total number of cases at a particular point in time the total population at that same moment*

Notice that these measures require both a numerator and a denominator, and that the denominator is derived from counting the population in question. See Joubert *et al.* (2007) for further clarification.

**TASK 3 - Calculate the prevalence of malaria**

Suppose that a random sample survey of 300 Under-5 children in your district found 70 of them with malaria.

1. What is the prevalence of malaria in the sample, expressed as a rate per 1000 population?
2. How many cases of malaria would you expect to find in the entire district at any given time, if the total population of Under- 5s is about 25 000?

#### FEEDBACK

1. A random sample of 300 Under-5 children shows that 70 have malaria. We express this as 70/300 and treat it as a rate. To work out the rate per 1000, we divide 70 by 300 and multiply by 1 000 to get 233. This is the same process as working out a percentage, but here you are doing it out of 1 000 (instead of 100).
2. You would expect to find that 233 children in every 1 000 have malaria, or

233/1 000. Now, if the total population of Under-5s is 25 000, this means there are 25 sets of 1 000 children, each set containing 233 children with malaria. Multiply the 233 by 25 to get 5 825. So, in a population of 25 000, there are likely to be

1. 825 cases of malaria.

In the next task, using the same scenario as in the previous task, we calculate the incidence rate of malaria for the same population the following year.

**TASK 4 - Calculate the measure of new cases of malaria**

In the year following the survey, 12 cases of malaria are notified. Assume that the mid-year estimate of the population of Under-5s has increased to 26 000.

1. Calculate the number of notifications per 100 000 population.
2. Is this an incidence rate or a prevalence? Explain your answer.

#### FEEDBACK

Out of a population of 26 000 there are 12 notifications of new cases of malaria. Because they are new cases, this means that we can calculate the *incidence* rate as 12/26 000. Expressed as a rate per 100 000 this becomes:

(12  26 000) x 100 000 = 46 per 100 000.

Remember that *incidence* means the number of *new cases* occurring in a defined population within a given period, usually one year.

Now calculate the annual incidence of spina bifida in newborns.

**TASK 5 - Calculate spina bifida rate**

Of the 129 600 children born in Cape Town between January 1, 1992 and December 31, 1994, 212 were diagnosed with spina bifida at birth.

1. Which measure of disease occurrence can be calculated – the prevalence or incidence rate?
2. Calculate this as an annual rate.

#### FEEDBACK

Because these children have just been born, they are new cases of spina bifida being recorded for the first time, and we can therefore calculate an *incidence* rate.

The dates cover a three-year period, so the three-year incidence of spina bifida is 212/129 600.

Expressed as an incidence rate this becomes: (212  129 600) x 100 000 = 164 per 100 000.

You can express this as an annual incidence rate by dividing this by 3.

164  3 = 54 per 100 000.

Notice that the fact that these are new born infants enables us to calculate incidence, or new cases.

Now look at the implications of this when we deal with breast cancer measures.

**TASK 6 - Calculate breast cancer measures**

In a mass screening of 5 000 women, 25 of them were found to have breast cancer. Over the next five years, 10 more women from the original screened group of 5 000 women developed breast cancer.

1. Which measure of disease occurrence can be calculated?
2. Work out the calculation.

#### FEEDBACK

We can calculate both point prevalence and five year incidence. The prevalence of breast cancer in this group will be 25/5 000 or 5 per 1 000.

The point prevalence is:

10 + 25 = 35/5 000 i.e. (35  5 000) x 1 000 = 7 per 1 000.

To calculate incidence over five years, we look for new cases in the given period. The 25 women originally identified as having breast cancer either still have breast cancer or have died and left the group. Either way, they cannot be included as new cases.

Since we are calculating incidence of *new* disease and since they are not part of the population at risk of being a new case, they must be subtracted from the denominator (or total population) i.e. 5 000 − 25 = 4 975.

The five year incidence rate is then: (10  4 975) x 1 000 = 2 per 1 000.

Now think about the measure we would use for prevention programmes.

**TASK 7 – Choose a rate for prevention programmes**

Disease occurrence can be measured as prevalence or incidence.

1. Which measure is better for the evaluation of prevention programmes?
2. Explain why you say this.

#### FEEDBACK

It is assumed that prevention programmes aim to provide people with ways of not becoming ill in the first place, i.e. they will hopefully never become a new case of the disease you are trying to prevent. You can measure your success (or failure) rate by monitoring the incidence of this disease. The appearance of a lot of new cases will suggest that your programme is not working very well.

## 5 SELECT MEANINGFUL INDICATORS AND MEASURES

Many of you may have experienced the overloaded data collection process that exists in many parts of the health system. In earlier Study Sessions, it was strongly suggested that any kind of health measurement activity should be goal-directed, i.e. health information must be collected for a specific purpose. For example, it could be collected to help you understand something important about the health problems in your area, or to assist you with decision-making and planning, or to help you evaluate the success or failure of your health intervention strategies. For this reason, it is important to very carefully select the indicators that are most appropriate to the goals of your particular part of the health system.

**TASK 8 - Select your district *health status indicators* based on needs**

1. Select no more than five priority *health status indicators* for your district.
2. Briefly motivate your choice, saying what each indicator would be used for, from where you would get the data for calculating the indicator, and how you would ensure the quality of the data.

#### FEEDBACK

On pages 21 and 22, Joubert et al. (2007) suggest a list of eight basic *health status indicators*. You might like to compare their list with the one you prepared for your area. How different is your list from their list? What were your reasons for including a different set of indicators?

It is quite acceptable to include other indicators as long as they serve a useful, important purpose. It is also important to ensure that a number of different types of indicators are used. There is clearly no point in only using mortality rates, which

measure the worst possible outcome of disease or failed health care. Morbidity rates, disease specific rates or indicators of various aspects of health may be more important.

Take account of the fact that your selection is likely to change depending on your exact location in the health system in which you work. A dentist will want to know about tooth decay, oral cancer and oral HIV prevalence. A physiotherapist may be interested in the prevalence of back pain or skeletal deformity. A paediatrician in a hospital may want to know the case fatality rates for 2–3 prominent conditions she encounters, like upper respiratory tract infection, paraffin poisoning and diarrhoea.

## SESSION SUMMARY

In this Study Session, you have familiarised yourself with some of the important key terms used in epidemiology, and calculated incidence rates and prevalence, distinguishing the context in which they are used. You have also focused on the epidemiological principles and terms used to define the population and important characteristics of demography. We also reinforced the importance of collecting data which is goal directed and meaningful within the setting where it will be used.

In the next Study Session, you will learn to define a population and to represent population information in visual ways. You will also explore how the various characteristics of populations impact on the study of epidemiology.

Epidemiology measures health-related states using indicators.

Indicators have to be carefully defined and selected, accordingly to what exactly one wants to measure. Definition of indicators has to be made explicit, as measurements will rely on these indicators.

Every indicator has to be expressed using units.

To allow comparisons between indicators, one must check the period of time that these indicators cover and the part of the population to which they are applied.

**KEY POINTS IN UNIT 1 SESSION 3**

**Epidemiological Principles and Practice**

**Self-evaluation questions:**

1. In 2007, Botswana reported that 40% of its population was affected by latent tuberculosis.

In 2009, Namibia reported 25 000 adults newly diagnosed with active tuberculosis. How would you compare the burden of tuberculosis in the two countries?

1. The district has been testing a new indicator - the number of diabetes patients at the outpatients department. However, a problem arises quickly at the facilities. Health workers complain that what is required from them is not clear. Why do you think this is so?

# Unit 1 - Study Session 4 Describe a Population

## Introduction

As Public Health practitioners, your concern is for the health of communities and populations, rather than for the individuals or patients you may have learnt to care for during your clinical training. It is therefore important for you to have a clear idea of the nature of the population that you now serve.

You will definitely want to know who is part of the population and how many people there are. You will probably want to know how many babies, young people and older people there are and their distribution by sex and location amongst other things. From this, you can calculate a variety of disease or health condition measures.

Perhaps you have already noticed that almost all the indicators you have already encountered require both a numerator and a denominator, and that the denominator in almost every case is derived from counting the population in question. This illustrates the importance of population measurement or *demographic* measurement.

In this Study Session, we examine the indicators that tell us about the population and discuss some population dynamics that have implications for the health care system.

## Contents

1. Learning outcomes of this session
2. Readings
3. Clarify demographic terms and concepts
4. Use indicators to measure a population
5. The health implications of a changing population
6. Session summary
7. Additional references

## Timing of this session

This Study Session contains three readings and nine tasks. It should take you up to three hours to complete.

## LEARNING OUTCOMES OF THIS SESSION

|  |
| --- |
| **By the end of this Study Session you should be able to:** |
| ***Health Measurement Outcomes**** Define key demographic terms.
* Calculate commonly used demographic indicators and measures.
* Apply demographic concepts to the interpretation of epidemiological indicators.
 | ***Academic Learning Outcomes**** Use graphical representation techniques to illustrate (demographic) information.
* Compare, interpret and draw conclusions from graphs.
 |

1. **READINGS**

There are four readings to which you will be referred in the course of the Study Session.

|  |  |
| --- | --- |
| **Author/s** | **Publication Details** |
| Joubert, G., Ehrlich, R., Katzenellenbogen,J. M. & Abdool Karim,S. S. | (2007). Ch 2 – Key Concepts in Epidemiology: Demography. In *Epidemiology: A Manual for South Africa.* 2nd. Ed. Cape Town: Oxford University Press: 24-29. |
| UNICEF. | UNICEF. (2014). Statistical Tables. In The State of the World’s Children 2014 In Numbers: Every Child Counts. Geneva: UNICEF: 21-35. |
| Vaughan, J. P. & Morrow, R. H. | (1989). Ch 3 – District Population. In *Manual of Epidemiology for District Health Management.* Geneva: WHO: 21–32. |
| Vaughan, JP & Morrow, RH | (1989). Ch 4 – Epidemiological Health Information. In *Manual of Epidemiology for District Health Management.* Geneva: WHO: 39–42. |

## CLARIFY DEMOGRAPHIC TERMS AND CONCEPTS

The word demography means:

*The study of populations in terms of factors like size, age, mortality, growth and social and economic variables.*

(Vaughan & Morrow, 1989: 159)

In order to calculate a variety of disease or health condition frequency measures, you will need the tools to analyse different aspects of the various populations you encounter. For example, you will probably want to know how many babies, young people and older people there are and their distribution by sex and location amongst other things. This type of information is vital if any measurements are to be meaningful and useful.

**READING**

Joubert, G., Ehrlich, R., Katzenellenbogen, J. M. & Abdool Karim, S. S. (2007). Ch 2

– Key Concepts in Epidemiology: Demography. In Epidemiology: A Manual for South Africa. 2nd. Ed. Cape Town: Oxford University Press: 24-29.

Start your study of demography by working through the above section of the Joubert et al. (2007) reading. As in the study of any new field, the study of demography comes with a substantial number of technical terms that you might not have encountered before. As you do so, clarify the terms listed in Task 1 and any others you come across.

If these terms are not clear from the text in which they are used, you may also need to refer to a dictionary or the epidemiology index in Chapter 14 of Vaughan & Morrow (1989).

|  |  |  |
| --- | --- | --- |
| Demography | Population census | Maternal mortality rate |
| Population pyramid | Population density | Child mortality rate |
| Crude birth rate | Crude death rate | Population growth |
| Infant mortality rate | Neonatal mortality | Rate of natural increase |

## USE FREQUENCY MEASURES TO UNDERSTAND A POPULATION

**TASK 1 – Define new demographic terms**

1. Ensure that you have a clear understanding of the following terms from the text and if necessary look these up in the glossary.

2. Write explanations for these terms in your own words and, where possible, give examples from your own experience.

Perhaps you have noticed that almost all the frequency measures you have encountered so far require both a numerator and a denominator, and that the denominator in almost every case, is derived from counting the population in question.

The tasks that follow will familiarise you with selected population indicators. Population information can tell you about the size, shape and other changing features of a population. Some of these can dramatically influence how you plan and deliver health services.

**TASK 2 - Analyse district or provincial demographic indicators**

Use some of the same reports you used earlier to locate local (where you live and/or work) indicators of health and health care. You may have located some of these indicators through the learning task in Unit 1, Study Session 3 when you searched for and evaluated a regional or district dataset. Where possible, quote the source and year of the figures you obtained.

1. This time specifically look for reported district or provincial demographic indicators such as those listed below.
	* Total population
	* Crude birth rate (CBR)
	* Crude death rate (CDR)
	* Infant mortality rate (IMR)
	* Maternal mortality rate (MMR)
	* Any other indicators that interest you
2. What do these indicators tell you about this population?

#### FEEDBACK

You might like to check on the boundaries (city, province, region, district, country, and so on) within which this population has been counted, how recently this was done and the method used to count, before trusting the reported population figures.

Ensure that the same denominator is used for the crude birth and death rates. How different are the values stated in your data? You will usually find the CBR is much greater than the CDR. This tells you something about the rate at which the population is growing. You might like to try and calculate the number of people being added to the population each year using the following method:

Rate of natural increase= CBR - CDR

The IMR is a popular and very important indicator of the state of health and health care in countries around the world. The UNICEF tables in your readings folder, show that a variety of social, economic and political variables seem to be quite strongly associated with the IMR in different countries. Consult these tables from UNICEF (2014) and review this correlation.

**READING**

UNICEF. (2014). Statistical Tables. In The State of the World’s Children 2014 In Numbers: Every Child Counts. Geneva: UNICEF: 21-35.

On page 26, Bonita et al., (2006) comment that “the infant mortality rate is commonly used as an indicator of the level of health in a Community”. An acceptable IMR is probably between 10 and 15 per 1 000 live births. The MMR is strongly related to the wealth of a country and is also considered quite a strong indicator of the state of health care services in a given country, and of antenatal and maternity services in particular.

The rate may also reflect the social and economic status of women in certain countries. WHO targets for MMR are for it to be less than 70 per 100 000 live births.

The next task draws your attention to indicators of the most frequent causes of death. An example of the top ten causes of death is provided by the CDC from Tanzania in 2013.

**Table of top ten causes of death in Tanzania for 2013**

|  |  |
| --- | --- |
| Diseases | % of total deaths |
| 1. | HIV | 17% |
| 2. | Lower Respiratory Infections | 11% |
| 3. | Malaria | 7% |
| 4. | Diarrheal Diseases | 6% |
| 5. | Tuberculosis | 5% |
| 6. | Cancer | 5% |
| 7. | Ischemic Heart Disease | 3% |
| 8. | Stroke | 3% |
| 9. | STDs | 3% |
| 10. | Sepsis | 2% |
|  | Total for top ten causes | 62% |

Source: [GBD Compare,](http://viz.healthmetricsandevaluation.org/gbd-compare) 2013

**TASK 3 – Classify and comment on the most frequent causes of death**

1. If the data are readily available for the hospital, district or region where you work, make a frequency table like that above. Indicate the percentage of the total number of deaths from each cause. Most Local Health Authority annual reports, or the reports from a national department of health, contain this kind of information.
2. You might find it useful to categorise these causes into infectious diseases, chronic diseases and other causes of death. Categorising the causes of death can help you later on to select the best type of intervention strategy for each category.
3. Are you surprised by the causes of death at the top of the list? What other causes of death do you think just missed being in the top ten?

#### FEEDBACK

As an example, here are the top 5 causes of death in five districts of Cape Town.

|  |
| --- |
| **TOP 5 CAUSES OF DEATH 1999/2000** |
|  | **Tygerberg** | **Klipfontein** | **Mitchells Plain** | **Khayelitsha** | **Cape Metro** |
| **1** | HIV | HIV | HIV | HIV | HIV |
| **2** | TB | Intrapersonal violence | Intrapersonal violence | Intrapersonal violence | Intrapersonal violence |
| **3** | Ischaemic heart disease | TB | TB | TB | TB |
| **4** | Intrapersonal violence | Diabetes | Diabetes | Road injury | Ischaemic heart disease |
| **5** | Diabetes | Ischaemic heart disease | Lower respiratory infection | Lower respiratory infection | Road injury |

Source: Groenewald et al,, 2013

**TASK 4 - Compare your data with Tanzanian (or Cape Town) data**

1. Comment on similarities and differences between your data (from Task 3) and the Tanzanian data above. Try to explain any differences you see.
2. How accurate a picture does your data present of the mortality in the entire district/province/country?
3. What demographic factors might influence the data?

#### FEEDBACK

1. Major differences could be explained by such social, economic and political variables as mentioned earlier. One unknown factor is the extent to which the average age of the population might influence the data.
2. Even within health districts, there can be variations within the population that are not evident in the averaged figures. Certain suburbs may experience higher levels of homicide; others might have more elderly people who are then more likely to die of chronic diseases or cancer.
3. An older population might have different conditions in the top ten to those affecting a young population.

In the next task, we ask you to clarify how births and deaths are registered. Understanding this process may help you to anticipate the potential for inaccuracies.

**TASK 5 - DETERMINE HOW BIRTHS AND DEATHS ARE COUNTED**

1. Briefly describe the system for registration of births and deaths in your district.
2. What are the common faults in this system?
3. What can be done to improve the system?
4. How does the registration of births and deaths affect health information?

#### FEEDBACK

See what Bonita et al., (2006) say about the faults of the vital registration systems on pages 23 and 24. Clearly, the efficiency of the documentation processes described can dramatically affect the accuracy of all your health information.

In most developing countries, including South Africa, the system of birth and death registration has been notoriously unreliable or even non-existent in many parts of the country over many years. This inaccuracy has a substantial impact on the planning of health and other services. One example is the *per capita* allocation of health funds by central government to provinces. If, for example, a province has an under-estimate of its population, it will get less money for its health budget.

These are some of the critical aspects of demographic data. In the next section, we consider the problems related to a changing population.

## THE HEALTH IMPLICATIONS OF A CHANGING POPULATION

Having a clear picture of the distribution of young and old, males and females in the population and of the rate at which the population is changing in size over time can be important for planners of health services.

As it is difficult to visualise how these different variables impact upon a given population, a way of representing them graphically has been developed. This is called a population pyramid. This name comes from the shape it takes, particularly in developing communities or countries. See pages 24 and 25 of the Joubert et al., (2007) reading for examples of population pyramids.

**TASK 6 – Draw and interpret population pyramids**

South African mid-year population information from 2011 and Tanzania Census population data from 2012 are included in the table below.

1. Use this data to draw two population pyramids on the gridlines provided on the next two pages [for males and females from the two countries]. Certain components of the population pyramids have been put in already to assist you.
2. Once completed, you should look for symmetry between the male and female sides of the pyramid. Note any differences in these two sectors of the population.
3. Compare the shape and size of the first and second pyramids. What do you notice about the population distribution? Note also the size of the steps in the pyramids between each age group. What does the difference in the length of the bars forming these steps tell you?

**Distribution of National Population by five year age groups and sex**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Age (years)** |  | **Tanzania (2012)** |  | **South Africa (2011)** |
| **Gender** | **Male** |  | **Female** | **Male** |  | **Female** |
| 0–4 | 3.64 | 3.64 | 26.17 | 25.73 |
| 5–9 | 3.33 | 3.33 | 26.74 | 26.3 |
| 10–14 | 2.89 | 2.90 | 26.68 | 26.39 |
| 15–19 | 2.24 | 2.37 | 26.03 | 25.72 |
| 20–24 | 1.79 | 2.16 | 24.62 | 24.38 |
| 25–29 | 1.55 | 1.84 | 22.5 | 23.48 |
| 30–34 | 1.38 | 1.53 | 20.21 | 20.2 |
| 35–39 | 1.18 | 1.26 | 17.45 | 18.55 |
| 40–44 | 0.94 | 0.96 | 12.15 | 13.98 |
| 45–49 | 0.72 | 0.79 | 10.1 | 12.34 |
| 50–54 | 0.61 | 0.60 | 9.05 | 11.33 |
| 55–59 | 0.39 | 0.38 | 7.45 | 9.28 |
| 60–64 | 0.38 | 0.39 | 5.83 | 7.69 |
| 65–69 | 0.24 | 0.25 | 4.19 | 5.7 |
| 70-74 | 0.23 |  | 0.25 |  | 2.89 |  | 4.26 |
| 75-79 | 0.14 |  | 0.15 |  | 1.73 |  | 2.88 |
| 80+ | 0.21 | 0.26 | 1.25 | 2.49 |

Sources: National Bureau of Statistics (2013) and Statistics South Africa (2012)

Population numbers have been rounded off to the nearest 100 000.

### Distribution of Tanzanian Population by five year age groups and sex 2012

|  |  |  |  |
| --- | --- | --- | --- |
| **Age** |  | 0 |  |
| 80+ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 75-79 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 70-74 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 65–69 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60–64 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 55–59 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50–54 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 45–49 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40–44 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 35–39 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30–34 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25–29 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20–24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15–19 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10–14 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5–9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0–4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | **MALE** | **FEMALE** |
| **NUMBER OF PEOPLE x 100 000** |

**Distribution of South African Population by five year age groups and sex 2011**

|  |  |  |  |
| --- | --- | --- | --- |
| **Age** |  | 0 |  |
| 80+ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 75-79 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 70-74 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 65–69 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60–64 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 55–59 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50–54 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 45–49 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40–44 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 35–39 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30–34 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25–29 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20–24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15–19 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10–14 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5–9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0–4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | **MALE** | **FEMALE** |
| **NUMBER OF PEOPLE x 100 000** |

#### FEEDBACK

The difference in the length of the bars forming the steps of the pyramid approximates the number of people who die before reaching the next age group. In developing countries, the step is usually largest in the 15–24 year age groups.

In the example, note that the Tanzania has a much higher proportion of young people, while South Africa has a more even distribution of people across all age groups.

You are already aware that the economic status of a community has a significant impact on health. Now analyse comparative data in terms of economic status.

**TASK 7 – Compare the population pyramids of two different countries**

1. Compare the features of the two population pyramids you have drawn above. What do all the pyramids show?
2. Other examples of population pyramids, such as those in the Joubert et al. (2007) page 24 and 25, use percentages to construct the pyramid while these examples use the number of people. Which method do you think is best and why do you think this?
3. What are the implications of this kind of pyramid for health services? You can reasonably assume that the economic status of the South African population is somewhat higher than that of the Tanzanian population.

#### FEEDBACK

* 1. We have already noted that Tanzania has a much higher proportion of young people, while South Africa has a more even distribution of people across all age groups.

The Tanzanian pyramid shows a much more rapid tapering towards the top than the South African pyramid. This is likely due to a higher death rate that results in a more pointed pyramid shape in the Tanzanian population pyramid.

The South African pyramid shows the number of children under 4 is decreasing possible suggesting an increased death rate in this age group but more likely suggesting a reduced birth rate. Lower death rates from year to year lead to the more vertical column shapes observed in the South African pyramid, especially for those under 301 years. Columnar shaped diagrams resemble that of populations in wealthy countries such as those in Western Europe and North America. Both birth rates and death rates have come down dramatically in these countries over the past 100 to 200 years. All that these columnar pyramids tell us is the size of the different age and gender groups that make up the whole population. Some of these groups are more at risk of ill-health than others.

* 1. The examples using percentages to construct the pyramid enable an even clearer illustration of the age and gender distribution of the population for comparison purposes.
	2. See Task 8 for more detailed feedback.

**TASK 8 - Discuss the implications of these demographic pictures for the health system**

1. Identify the main health needs and subsequent demands on the health system of a developing country population like that represented in the population pyramids for Tanzania and South Africa above. These populations have high proportions of younger people, high birth and death rates, and a relatively small proportion of elderly people. What are the implications of this for the health system?
2. Contrast this with the health needs, and subsequent demands on the health

system, of the other populations such as for Western Europeans. These populations have lower birth and death rates in every age group and a fairly high proportion of retired and elderly people. The population is probably also a lot wealthier than the populations in developing countries. What are the implications of this for the health system?

#### FEEDBACK

Certain groups within developing countries are particularly at risk of ill-health, namely infants, young children, all children and women. This suggests that a population with a high proportion of younger people has many more people at risk of things like infectious diseases, and very limited health care services due largely to poverty. A wealthier population lives in a healthier environment and experiences much lower risks of ill-health and death. It can be shown that they may experience higher levels of chronic diseases and cancers because more of the population lives longer. Chronic diseases can require very complex and expensive health services to treat.

**TASK 9 - How do patterns of illness and death differ between rich and poor populations?**

Examine the illustration below (adapted from Figure 2.5, Sanders, 1985).

1. Identify and rank the main causes of death in rich and in poor communities.
2. Offer an explanation as to why they differ in this way.
3. Compare the health system needs of rich and poor countries on the basis of this information.

### Percentage Distribution of Deaths by Cause

#### Poor Country (or Community) and a much Wealthier Country (or Community)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Percent** | **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** |
|  |
| **Poor** | Infectious diseases, Parasites, Respiratory system illness | Cancer | Cardio- vascular disease | **Traumatic injury** | All other causes |
|  |
| **Rich** | Infection Parasites Chests | Cancer | Cardio-vascular disease | **Trauma** | All other causes |

**FEEDBACK**

1. Rich countries have their highest mortality rates attached to cardiovascular diseases and cancer. Poorer countries are most affected by deaths from infectious diseases and respiratory illness of every description and trauma in various forms.
2. Poor countries and communities generally face a wide range of infectious disease risk from which they can die. Their health system probably offers little protection

against that risk. Infants and children who are malnourished and vulnerable can account for a high proportion of deaths from infectious diseases. Wealthy countries have a high proportion of elderly people who are more likely to die of chronic diseases, cancers and cardiovascular diseases. Their health systems can often assist in prolonging their lives, even at great financial cost.

1. Clearly the health system in the poor community or population will need to focus on basic health care requirements to address the risk of infectious diseases, parasitic infections and respiratory tract infections, in a mainly young population. Traumatic injuries arising from violence, war, traffic and alcohol related incidents are becoming increasingly demanding on health services. These are less pertinent issues in wealthier communities. Instead, these communities require care for chronic diseases of the cardiovascular system, cancer and a certain amount of trauma from factors such as traffic accidents.

## SESSION SUMMARY

In this Study Session, we have tried to familiarise you with a number of key demographic concepts and how to interpret demographic data for epidemiological purposes. In the process, you have worked with comparative data, recognising the very different patterns that emerge when measures from poor and more affluent communities is compared. This has also highlighted the very different implications for health services in these populations.

## ADDITIONAL REFERENCES

* GBD Compare. (2015) *Tanzania Cause of Death 2013.* Washington: Institute for Health Metrics and Evaluation, University of Washington. <http://vizhub.healthdata.org/gbd-compare/>
* Groenewald P, Berteler M, Bradshaw D, Coetzee D, Cornelius K, Daniels J, Evans J, Jacobs, C, Neethling I, Msemburi W, Matzopoulos R, Naledi T, Shand L, Thompson V, Vismer M. (2013). Western Cape Mortality Profile 2010. Cape Town: South African Medical Research Council.
* National Bureau of Statistics (NBS). (2013). *Population Distribution by Age and Sex*, Dar es Salaam, Tanzania
* Sanders, D. & Carver, R. (1985). *The Struggle for Health: Medicine and the Politics of Underdevelopment.* London: Macmillan.
* Statistics South Africa (2012) *Mid-year population estimates 2011*. Pretoria: Central Statistical Services.
* Vaughan, J. P. & Morrow, R. H. (1989). Ch 14 – ABC of Definitions and Terms. In *Manual of Epidemiology for District Health Management.* Geneva: WHO: 155– 167.

Socio-demographic factors influence health-related states.

Demographic factors, such as age, could also influence health status through physiological or life-style differences. Socio-economic factors, such as income, could influence health status through the diet or life-style differences.

Knowledge about the population, from which the data are extracted, is of paramount importance, to be able to track the determinants of the health-related states of the population.

**KEY POINTS UNIT 1 SESSION 4**

**How to describe a population**