Introduction to Epidemiology

Dr. Andrew Kumwenda

BSc.(HB), MBChB (UNZA), MPhil.(Stellenbosch), MPH (University of Western Cape), MMed. (OBGYN) (UNZA), PhD candidate (Witwatersrand)

MBChB VI Research Methods Course,

School of Medicine, UNZA.

Wednesday 3rd February, 2021.

Introduction

- Epidemiology is very much part of our lives
- Regularly, media reports describe results of epidemiological investigations
- Stories of new strains of serious viral diseases e.g. covid-19 catch the headlines because of the interest and anxiety they inspire in readers

Introduction

- Political battles are also sometimes fought over hospital mortality statistics e.g. over maternal deaths, etc

- For your level of training, the focus is largely on what is called observational epidemiology i.e. case control, cohort and cross-sectional studies

What is epidemiology?

- Epidemiology is “the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to control health problems”.
  - Why does a disease develop in some people and not in others?
  - Each of us has certain characteristics that predispose us to, or protect us against a variety of different diseases

What is epidemiology?

- The premise underlying epidemiology is that disease, illness and ill health are not randomly distributed in humans

- Key words to note from the epidemiology definition:

1. Distribution

2. Determinants

3. Control or intervention of health problems

What is epidemiology?

- We need to distinguish between the epidemiology of a specific disease and epidemiology, the discipline.

- Epidemiology of a disease is the description of what is known about the distribution & determinants of that disease e.g. 25% of HIV exposed babies will be infected

- Epidemiology, the discipline is a methodology for gaining valid information about the distribution & causes of disease & about effectiveness of control methods

The objectives of epidemiology

1. To identify the aetiology or cause of a disease and the relevant risk factors - wanting to know how the disease is transmitted

2. To determine the extent of disease found in the community - question crucial for planning purposes

3. To study the natural history and prognosis of the disease e.g. certain diseases are more severe than others

The objectives of epidemiology

4. To evaluate both existing and newly developed preventive and therapeutic measures and modes of health care delivery

   - Example, does screening men for prostate cancer using the PSA test improve survival in people found to have prostate cancer?

Types of epidemiological approaches

- Descriptive epidemiology - This describes the occurrence of disease and other related characteristics in the population with respect to:
  - The person (i.e. ‘the who’, such as age, gender, social class)
  - The place (i.e. ‘the where’, such as region) and
  - The time (i.e. the ‘when’, such as season or year)

Types of epidemiological approaches

- Analytical epidemiology
  - This investigates the association between various factors and disease or health status to try to establish if those factors are causative or protective

- Experimental epidemiology
  - Here, the researcher introduces a treatment or intervention to determine effectiveness

- The detail of these approaches will be discussed under the topic ‘Study designs’

Types of epidemiological approaches

- Note: While the term ‘disease’ is often used for simplicity, in public health, a wide range of outcomes may be studied including:
  - Injury,
  - Health behavior,
  - Health knowledge,
  - Good health

Key concepts in epidemiology

- Causation
  - What is a cause? – A large part of epidemiology focusses on the search for associations between various factors and disease outcomes
  - Consistent associations can be useful for predicting the likelihood of disease from the presence of predictive factors
  - The term ‘risk factor’ is frequently used to describe predictive factors

Key concepts in epidemiology

- Levels of disease determinants – there are many candidates for causal factors or disease determinants in epidemiology

- These occur in levels e.g.
  - Physiological level - genetic or biochemical markers could predict disease differences between individuals or groups as part of a biological model of disease

  - Behaviour – diet, exercise, smoking, alcohol consumption etc can be determinants of disease

Key concepts in epidemiology

- Social characteristics - gender, race, ethnicity, socio-economic status etc as other determinants

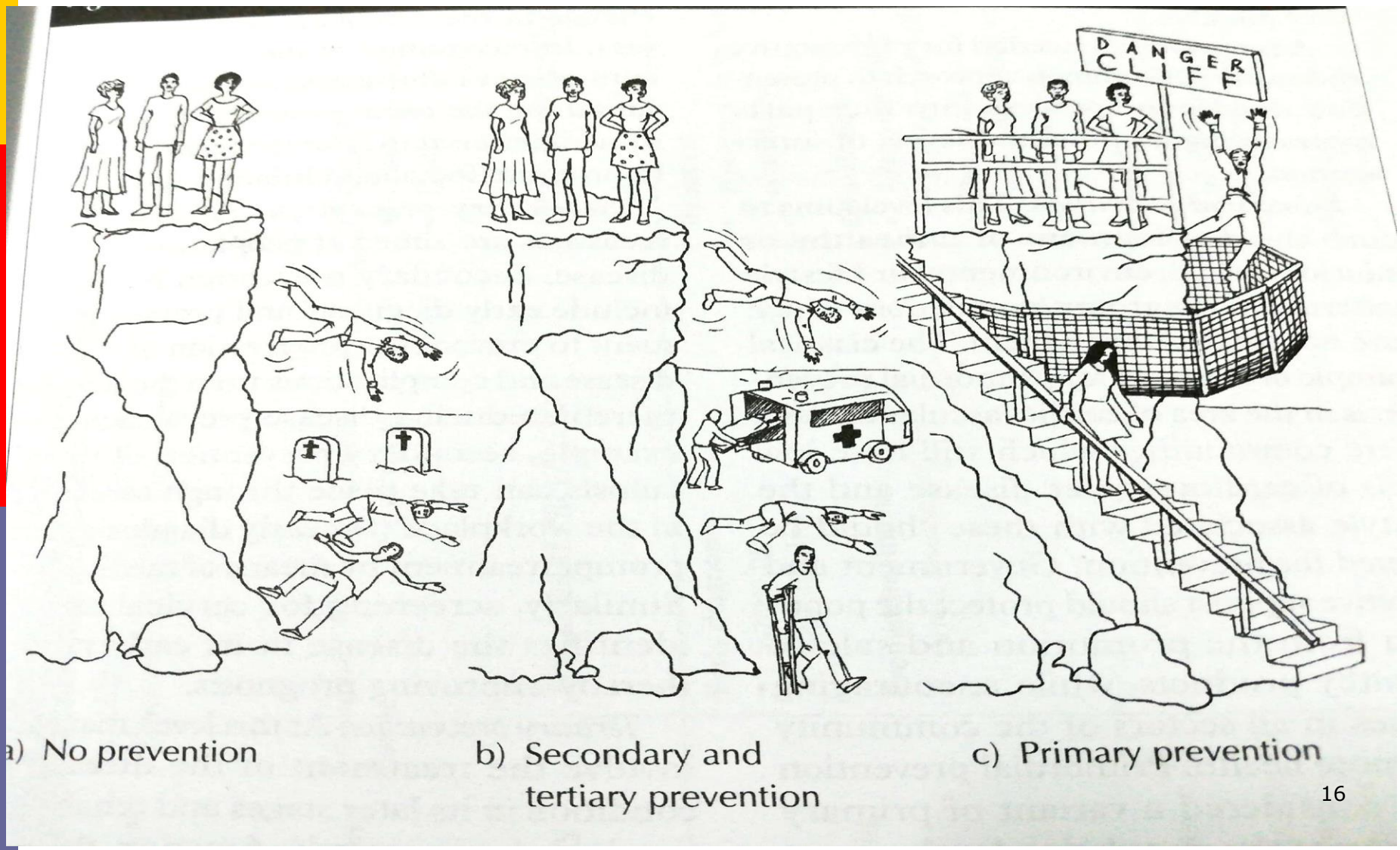
- Levels of prevention:
  - Much time and money are spent providing ambulance and emergency services
  - Few resources are allocated to alternative strategies that prevent the problems

Key concepts in epidemiology

- Although it is agreed that in general that ‘Prevention is better than cure’, a lot of resources have continued being invested in treating the sick and the injured than preventing the sicknesses and the injuries

- See illustration of people being injured over a dangerous cliff in fig 1 below

Fig 1. The dangerous cliff – what can be done



Key concepts in epidemiology

- Look at figure 1 above and spot out what interventions or things were done at the different levels prevent injuries

Key concepts in epidemiology

- Ambulance provided at secondary and tertiary level
- At primary care level, the following have been put up:
  1. Fence
  2. Ladder
  3. Poster

Key concepts in epidemiology

- Interventions should be on as many levels as possible
- Each level of action represents a level of prevention
- There should therefore be an attempt to prevent the disease from occurring at all
- Once the disease occurs, it should be identified early and prevented from getting worse

Key concepts in epidemiology

- Once the disease occurs, it should be identified early and prevented from getting worse
- If residual effects of the disease remain, these should be minimized and disability and discomfort prevented wherever possible
- Can you apply these concepts to the national response to covid-19?

Key concepts in epidemiology

- A framework for prevention interventions divides the endeavours into four parts:

1. Primordial prevention – this level aims to curb the development of unhealthy or injurious social, environmental or lifestyle patterns

2. Primary prevention – aimed at general population

Key concepts in epidemiology

3. Secondary prevention – Aimed at people with the disease

4. Tertiary prevention – aimed at treating the condition in its later states e.g. a covid 19 patient requiring ventilation

Key concepts in epidemiology

- Measures of the frequency of health events – disease frequency van be measured by incidence or prevalence
- Incident cases – number of new cases reported during a specified period in a defined population
- Prevalent cases – number of people who have a particular disease at a specific time

Key concepts in epidemiology

- You also need to be aware of the following measures:
  - Rates
  - Ratios
  - Proportions
- Do read up on these

Epidemiology and clinical practice

- Epidemiology is critical not only to public health but also to clinical practice.
- The practice of medicine is dependent on population data
- For example, if a physician hears an apical systolic murmur, how does he or she know that it represents mitral regurgitation?

Epidemiology and clinical practice

- The diagnosis is based on correlation of the clinical findings with the findings of surgical pathology or autopsy and with the results of catheterization or angiography studies in a large group of patients.

References

- Brink, H., van der Walt, C. & van Rensburg, G. (2018). Fundamentals of Research methodology for Healthcare Professionals (4th edition). Juta, South Africa.

- Ehrlich, R. & Joubert, G. (2018). Epidemiology – A Research Manual for South Africa (3rd Edition). Oxford University Press

- Gordis, L. (2009). Epidemiology (4th edition). Saunders Elsevier