Epidemiology

OBJECTIVES/RATIONALE

Epidemiology is considered the basic science of public health. The student will investigate instances of disease using epidemiological principles.

TEKS 121.152A, 2B, 2C, 2D, 6A, 7D

TAKS ELA 1, 3, 4, 6
Mathematics 2, 3, 4, 5, 9, 10
Social Studies 5
Science 1, 2, 3

National Science Education Standards A9-12; C9-12; E9-12; F9-12; G9-12
National Health Care Skills Standards .01, .02, .03, .05, .06, .07, .08
National Curriculum Standards for School Mathematics S1; S3; S5; S10; S11; S12

KEY POINTS

I. Epidemiology comes from Greek words
   A. epi, meaning "on or upon"
   B. demos,meaning "people"
   C. logos, meaning "the study of"
   D. Study of distribution and determinants of health-related conditions or events in populations

II. History of epidemiology
   A. Hippocrates (circa 400 B.C.) attempted to explain disease occurrence from a rational instead of a supernatural viewpoint
   B. John Graunt, a London haberdasher, published his landmark analysis of mortality data in 1662. He was the first to quantify patterns of birth, death, and disease occurrence, noting male-female disparities, high infant mortality, and seasonal variations
   C. In the mid-1800's
      1. William Farr began to systematically collect and analyze Britain's mortality statistics.
      2. John Snow, an anesthesiologist,conducted a series of investigations in London that later earned him the title "the father of epidemiology."
   D. Epidemiology did not flourish until the end of the Second World War

III. Uses of Epidemiology
   A. Population or community health assessment
      1. What are the actual and potential health problems in the community?
      2. Where are they?
      3. Who is at risk?
      4. Which problems are declining over time?

5. Which ones are increasing or have the potential to increase?
6. How do these patterns relate to the level and distribution of services available?
7. Factors which influence one's risk of disease

B. Individual decisions – use information to decrease personal risk factors, i.e. vaccinations for traveling

IV. The Epidemiologic Approach

A. Case Definition – a set of standard criteria for deciding whether a person has a particular disease or disorder.

B. Statistics and Reports

1. When physicians diagnose a case of a reportable disease they send a report of the case to their local health department.
    a. Time - when the case occurred
    b. place - where the patient lived
    c. person - the age, race, and sex of the patient
2. Health departments convert the case counts into rates, which relate the number of cases to the size of the population where they occurred

C. Descriptive Epidemiology – organize and summarize data according to time, place, and person

1. Time – disease rates change over time – the seasonal increase in influenza with the onset of cold weather
    a. time data is usually shown on a graph
    b. graph the rate of cases or deaths on the vertical, *y-axis*; put the time periods along the horizontal, *x-axis*
2. Place - describe a health event by place to gain insight into the geographical extent of the problem.
    a. residence
    b. birthplace
    c. place of employment
    d. school district
    e. hospital unit, etc
3. Person
    a. inherent characteristics of people
        (1) age
        (2) race
        (3) sex
    b. acquired characteristics
        (1) immunity
        (2) marital status
    c. activities
        (1) occupation
        (2) leisure activities
        (3) use of medications/tobacco/drugs
    d. conditions under which people live
        (1) socioeconomic status

(2) access to medical care

D. Analytic Epidemiology - analytic epidemiology is used to search for causes and effects, or the *why* and the *how*.
   1. experimental - determine the exposure status for each individual (clinical trial) or community (community trial); individuals or communities are followed to detect the effects of the exposure
   2. observational - observe the exposure and outcome status of each study participant
      a. cohort study - categorize subjects on the basis of their exposure and then observe them to see if they develop the health conditions being studied
      b. case-control study - enroll a group of people with disease ("cases") and a group without disease ("controls") and compare their patterns of previous exposures

V. Causation
   A. cause of disease is a factor (characteristic, behavior, event, etc.) that influences the occurrence of disease
      1. An increase in factors leads to an increase in disease.
      2. Reduction of factors leads to a reduction in disease
   B. Epidemiologic triangle - traditional model of infectious disease causation.
      1. Agent - an infectious microorganism - must be present for disease to occur
         a. Virus
         b. Bacterium
         c. Parasite
         d. other microbe
      2. Host factors - intrinsic factors influencing an individual's exposure, susceptibility, or response to a causative agent.
         a. Age
         b. Race
         c. Sex
         d. socioeconomic status
         e. behaviors
            (1) smoking
            (2) drug abuse
            (3) lifestyle
            (4) eating habits
      3. Environmental factors - extrinsic factors affecting the agent and the opportunity for exposure
         a. physical factors
            (1) geology
            (2) climate
            (3) physical surroundings
         b. biologic factors - insects that transmit the agent
         c. socioeconomic factors
            (1) crowding

(2) sanitation
(3) availability of health services

VI. Epidemiology and Disease

A. Chain of Infection

1. reservoir of an agent is the habitat in which an infectious agent normally lives, grows, and multiplies.
2. Portal of exit is the path by which an agent leaves the source host
3. Modes of transmission
    a. Direct – immediate transfer of the agent from a reservoir to a susceptible host by direct contact or droplet spread
        (1) Direct contact
        (2) Droplet spread
    b. Indirect – an agent is carried from a reservoir to a susceptible host by suspended air particles or by animate (vector) or inanimate (vehicle) intermediaries
        (1) Airborne
        (2) Vehicleborne
        (3) Vectorborne
        (4) Mechanical
        (5) Biologic
4. Portal of entry – means by which an agent enters a susceptible host
5. Host – individual infected with the agent

B. Epidemic Disease Occurrence

1. Level of Disease - amount of a particular disease that is usually present in a community
    a. Sporadic - irregular pattern of occurrence, with occasional cases occurring at irregular intervals
    b. Endemic - persistent level of occurrence with a low to moderate disease level
    c. Epidemic or Outbreak- occurrence of a disease within an area is clearly in excess of the expected level for a given time period
    d. Pandemic - an epidemic spreads over several countries or continents, affecting a large number of people

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ACTIVITIES

I. Complete an epidemiological study.

- Design a survey to determine the incidence of the flu.
- Collect data from teachers and students.
- Utilize data to develop charts and graph(s).
- Analyze data and draw conclusions. Address possible limitations.
- Disseminate results to class in an oral presentation.

MATERIALS NEEDED

http://Teachnet.com
http://pc65.frontier.osrhe.edu/hs/science/hsimeth.htm
http://www.uic.edu/sph/prepare/courses/ph490/resources/epilesson01.pdf

ASSESSMENT

Laboratory Investigation Rubric

ACCOMMODATIONS

For reinforcement, the student will find examples of epidemiological studies on the Internet.

For enrichment, the student will interview a public health professional to determine what epidemiological studies are being conducted locally and the tools being used for data collection.

REFLECTIONS