

EPID600 (Spring 2007) module on Role of Epidemiology in Public Health

Objectives:

- Review fundamental concepts of epidemiology
- See how epidemiology has evolved over the centuries.
- Understand public health in a broader context.
- Consider what epidemiology can contribute to the solution of fundamental problems in human ecology.

Instructions:

1. Read the [lecture slides](#) and attend the lecture (or read the speaker notes).
2. Work on the case study, which is an online outbreak exercise, in your small group. You will submit your answers during the exercise. Your TA will give you the link to the exercise during the lab.

Case Study Questions

The link to the online outbreak exercise will be provided in lab.

Role of epidemiology in public health

Victor J. Schoenbach, PhD [home page](#)

Department of Epidemiology
School of Public Health
University of North Carolina at Chapel Hill
www.unc.edu/epid600/

Announcements

- Minority health events and resources at UNC – www.minority.unc.edu
- UNC School of Public Health Annual Minority Health Conference
- Annual Summer Public Health Research Videoconference on Minority Health

From A Prairie Home Companion Pretty Good Joke Book, 4th Edition

The secretary was leaving the office when she saw the CEO standing by a shredder with a piece of paper in his hand. "Listen," said the CEO, "this is a very important document. Can you make this thing work?"

From A Prairie Home Companion Pretty Good Joke Book, 4th Edition

The secretary turned the machine on, inserted the paper, and pressed the start button.

"Great," said the CEO as his paper disappeared inside the machine. "I just need one copy."

p177

"Getting better all the time."

- A little girl was sitting on her grandfather's lap as he read her a bedtime story. From time to time, she would take her eyes off the book and reach up to touch his wrinkled cheek. She was alternately stroking her own cheek, then his again. Finally she spoke up, "Grandpa, did God make you?"
- "Yes, sweetheart," he answered, "God made me a long time ago."

"It's getting better all the time."

- "Oh," she paused, "Grandpa, did God make me too?"
- "Yes, indeed, honey," he said, "God made you just a little while ago."
- Feeling their respective faces again, she observed, "God's getting better at it, isn't he?"

How to remember what you've learned – how to tell others

10 fundamentals of epidemiology

12/2/2001

Role of epidemiology in public health

7

1. Epidemiology studies populations

Epidemiology is the study of health and disease in populations for the purposes of (i) understanding disease dynamics, (ii) controlling disease, and (iii) promoting health.

Comparison across and within populations is the key strategy of epidemiologic inquiry.

12/2/2001

Role of epidemiology in public health

8

2. Populations are diverse

Populations (meaningful collections of people) are diverse, heterogeneous, dynamic, and interconnected.

Epidemiology depends on these qualities in order to make useful comparisons.

Comparisons must not be confounded by uncontrolled diversity.

12/3/2002

Role of epidemiology in public health

9

3. Measures for studying populations

- 1) Counts of people – rates, proportions, and ratios, e.g., birth rate, death rate, incidence, prevalence, abortion ratio;
- 2) Distributions of characteristics of people, e.g., mean age, mean education, mean cholesterol level;
- 3) Characteristics of groups or environment, e.g., sexual networks

7/29/2002

Role of epidemiology in public health

10

4. Incidence

Fundamental concept

Rate (incidence rate, “incidence density”) or proportion (incidence proportion, cumulative incidence).

Incidence *rate* measures the *process* of disease occurrence; incidence *proportion* measures the *result* of a process.

12/2/2001

Role of epidemiology in public health

11

5. Measurement

Observation and measurement are fundamental to scientific advances.

Choosing a measure – objective, conceptual model, and availability of data (technology, feasibility, and ethics).

12/2/2001

Role of epidemiology in public health

12

6. Error

All measurement involves error.

Science seeks to minimize error and to quantify it as a guide to interpreting data.

Sources of error include random error (e.g., variability from sampling) and systematic error (e.g., selection bias, information bias).

12/2/2001

Role of epidemiology in public health

13

7. Epidemiology is mass production

Collection, processing, management, and analysis of epidemiologic data (medical records, questionnaires, interviews, biological specimens, environmental measurements) involve mass production.

Skillful management and quality control are key though often unadvertised components of epidemiology.

12/3/2002

Role of epidemiology in public health

14

8. Health and disease are processes

Health and disease are complex, dynamic processes affected by multiple, interacting factors acting at multiple levels.

Can be challenging to define and to measure.

Interpretation must take this complexity into account but not become lost in it.

12/2/2001

Role of epidemiology in public health

15

9. Interpretation, inference, and action

Interpretation takes account:

1. how data were collected
2. underlying conceptual framework.

We are the source of our data and their spokesperson. Conclusions from data require inference and the weighing of evidence. One of the most difficult decisions is deciding when to act. Action should be accompanied by monitoring.

12/2/2001

Role of epidemiology in public health

16

10. Awareness and humility

Breadth of awareness and humility are important assets.

More factual knowledge but major public health problems and failings.

Good people can make mistakes, resist new knowledge, take deplorable actions.

When confronting the unfamiliar, how can we tell fact from illusion, insight from fantasy?

12/2/2001

Role of epidemiology in public health

17

Where have we come from, where do we need to go?

12/2/2001

Role of epidemiology in public health

18

Epidemiology in the 19th century – focus on acute infectious disease

- Virulent, highly contagious microorganisms – measles, yellow fever, smallpox, typhoid, cholera,...
- Prototypical for public health
 - widespread impact
 - Inherently social (external threat)

8/2/2002

Role of epidemiology in public health

19

Epidemiology in the 20th century

- Infectious diseases – tuberculosis
- Deficiency diseases – pellagra (niacin deficiency)
- Chronic diseases – CVD, cancer
- Psychiatric disorder – schizophrenia, depression

8/2/2002

Role of epidemiology in public health

20

Expanding beyond the original rationale

- Non-contagious diseases
- Indirect societal involvement
- Mass disease
- Opportunity for prevention

8/2/2002

Role of epidemiology in public health

21

Epidemiology in the 20th century

- Environment and occupation – pollution
- Population and reproduction – fertility, infant mortality, low birth weight, birth defects
- Health care – efficacy of prevention and treatment
- Health care – organization and delivery

8/2/2002

Role of epidemiology in public health

22

Some social forces

- Environmental movement, population “boom”
- Management science, operations research, computers
- Public financing of health care (Medicare, Medicaid), “Great Society” initiative (Pres. Lyndon Johnson)

11/30/2004

Role of epidemiology in public health

23

Epidemiology in the 20th century

- Injury – motor vehicle crashes, suicide, homicide
- Pharmaceuticals – efficacy and adverse effects
- Personal behavior – noncompliance with medical treatment regimens, smoking, alcohol, exercise

8/2/2002

Role of epidemiology in public health

24

Discovery of HP/DP

- Cannot cure so have to prevent
- Medical care costs
- Personal responsibility for health – “We have met the enemy and he is us.” (Pogo, by Walt Kelly)
- Blaming the victim

8/2/2002

Role of epidemiology in public health

25

Growing pains

- Each expansion encounters opposition from multiple quarters
- Is this “epidemiology”?
 - Chronic disease, psychiatric disorder
 - Injury
 - Health care
 - Laboratory research

8/2/2002

Role of epidemiology in public health

26

Epidemiology of behavior: a new frontier for epidemiology

- Epidemiology and public health have primarily studied personal behavior, e.g.:
 - Health care-related (treatment seeking, compliance)
 - Lifestyle behavior (smoking, use of alcohol, sloth, etc.)

12/2/2001

Role of epidemiology in public health

27

Behavior toward others has *profound* effects – war and civil strife

- War – Afghanistan (USSR, Taliban, US), Iraq (Kuwait, Iran, US), Vietnam, Israel and the Palestinians, and the Arab states, . . .
- Civil strife – Northern Ireland, Sri Lanka, Hindu/Muslim, El Salvador, Colombia, . . .
- Ethnic slaughter – Bosnia, Kosovo, Rwanda, East Timor, . . .

11/30/2004

Role of epidemiology in public health

28

Behavior toward others has *profound* effects – domination

- Subjugation – slavery, peonage
- Hate crimes
- Persecution, discrimination, favoritism by race, ethnicity, religion, language, . . . , in relation to land, jobs, housing, water, education, . . .

12/2/2001

Role of epidemiology in public health

29

Behavior toward women

- “Missing” infants in China
- Bride burning in India
- Extreme female subjugation in many countries
- Trafficking in women from Asia and Eastern Europe

4/20/2004

Role of epidemiology in public health

30

Material sex

- Commercial sex work
- Material sex - 40% of women at prenatal clinic in rural Haiti had at least one STD; 30% had sex from financial need (Fitzgerald, Behets, *et al.*)

These are examples of harm by individuals.

12/5/2006

Role of epidemiology in public health

31

World poverty and underdevelopment



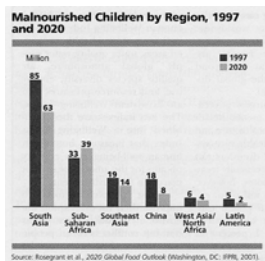
Rye Barcott, UNC-CH, May 2001, as an undergraduate in Kibera, Kenya (UNC-CH *Endeavors*, Spring 2001, p14)

12/5/2006

Role of epidemiology in public health

32

Malnourished children



Source: Rosegrant et al., 2002 *Global Food Outlook* (Washington, DC: IFPRI, 2001).

Source: "Response to hunger tests new priorities", *Population Today*, Nov-Dec 2001:8

12/2/2001

Role of epidemiology in public health

33

The right to health

"The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being without distinction of race, religion, political belief, economic or social condition." 1946 Constitution of the World Health Organization, *AJPH* Dec 2001:1923

12/2/2001

Role of epidemiology in public health

34

Universal Declaration of Human Rights

"a standard of living adequate for the health and well-being of himself and his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control." *AJPH* Dec 2001:1923

12/2/2001

Role of epidemiology in public health

35

Can these goals be attained?

Is it only a matter of priorities?

What will change them?

> The collision course between humanity and our ecosystem.

12/5/2006

Role of epidemiology in public health

36

Behavior toward the environment

Two key epidemiology books:

- *Planetary Overload* (1993)
- *Human Frontiers, Environments and Disease Past Patterns, Uncertain Futures* (2001)

8/5/2002

Role of epidemiology in public health

37

Economics and environment

- June 2001 report from Asian Development Bank (www.adb.org) describes the high environmental cost of Asia's economic development over past few decades, including pollution, deforestation, inadequate sanitation, threatening depletion and degradation of forests, fisheries, and other natural resources.

12/2/2001

Role of epidemiology in public health

38

Environment – air

- Nearly 100,000 premature deaths/year in southern Asian cities
- 12 of the 15 cities with highest levels of particulate matter are in Asian and Pacific regions.

12/2/2001

Role of epidemiology in public health

39

Environment - land



William Wallace Covington. Helping western forests heal. The prognosis is poor for US forest ecosystems. *Nature* 9 Nov 2000 p135

12/2/2001

Role of epidemiology in public health

40

Environment - water

- One in three Asians lack access to safe drinking water near their homes - contamination by sewage, urban and agricultural runoff and saline infusion.

12/2/2001

Role of epidemiology in public health

41

Urban health

“Over 600 million people in cities of developing countries cannot meet their basic needs for shelter, water, food, health and education”

– *Population Report*, Johns Hopkins Bloomberg SPH, www.jhuccp.org [quoted in the *Nation's Health* Aug 2001, p11]

12/2/2001

Role of epidemiology in public health

42

Urbanization

- Number of cities with population ≥ 10 million in developing countries is expected to rise from 3 in 1975 to 19 in 2015 - Bombay, Lagos, Dhaka, Sao Paolo will have > 20 million
- Within 5 years, half of world's population will live in cities. Nearly all population growth will be in the cities of developing countries.

11/29/2005

Role of epidemiology in public health

43

Urbanization in the developing countries

- Population of such cities will double by 2030, to 4 billion (size of total 1990 population of developing world)

12/2/2001

Role of epidemiology in public health

44

Standing at the edge of disaster

“Our societies haven't imploded yet only because most of the world lives at a level of privation Westerners would not accept, beyond the reach of the very resources Westerners cannot live without.”

(from David Morens' review of McMichael, 2001)

12/2/2001

Role of epidemiology in public health

45

Government matters

- Angola (30,000 dead since independence in 1975, *AJPH* Dec 2001:1921), Zaire (Laurie Garrett, *Betrayal of public health*)
- 9.7 million men missing in Russia
- AIDS Catastrophe in South Africa
- Economic resources and government

12/2/2001

Role of epidemiology in public health

46

World economic inequality

- Marked increase in world income inequality
- 20% of world population has 84% of world income; 20% has 1.2% of income
- International inequality in wealth and power underlies the degradation of the biosphere.

12/2/2001

Role of epidemiology in public health

47

Is this epidemiology?

- Epidemiologists lack appropriate training and methodology
- Epidemiology is “occurrence research”; disease and exposure occur in individuals.
- Historically, epidemiologists have not shied away for lack of adequate methods

8/2/2002

Role of epidemiology in public health

48

What can epidemiology contribute?

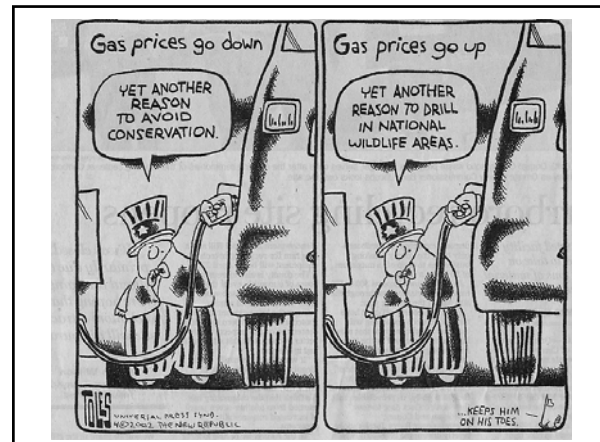
McMichael, according to Morens, makes “a strong if understated case for broader thinking and broader planning...”

We need to understand human behavioral and cognitive tendencies

8/2/2002

Role of epidemiology in public health

49



Human tendencies – optimism

“Under (almost) any profit outlook, stocks look cheap.” UBS PaineWebber newsletter, Oct 7, 2001.

12/2/2001

Role of epidemiology in public health

51

Human tendencies

- West Coast men who have sex with men have resumed high HIV risk behavior
- U.S.: Billions spent on entertainment, need to promote consumption to keep economy going
- Can we maintain affluence without overconsumption?

12/2/2001

Role of epidemiology in public health

52

How proactive can people be?

- AIDS epidemic but swine flu scare
- Y2K - were the forecasts incorrect or did we avoid them by timely action? Can it ever be known?
- Can't just act - (examples including arsenic in Bangladesh drinking water in AJPH Sept 2001:1359)

12/2/2001

Role of epidemiology in public health

53

Can humanity be smarter?

- Do humans have adequate intelligence for the challenges of the modern world?
- Low level lead exposure can reduce children's IQ (Needleman studies)
- Iodine deficiency – 2 billion people; can lower IQ in infants by 10-15 points (*NY Times*, 12/16/2006:A1,8)

12/16/2006

Role of epidemiology in public health

54

Why epidemiology?

"There is a need for innovative, transdisciplinary approaches. Epidemiology is already transdisciplinary. Epidemiology is well placed to take leadership."

(John M. Last, accepting the Abraham Lilienfeld Award at the American College of Epidemiology Annual Meeting, Boston, September 22, 1997).

8/5/2002

Role of epidemiology in public health

55

How consciousness can help – example

- Consumer consciousness has increased respect for workers rights (e.g., college vendors)
- But overall effects depend on the overall situation (e.g., child labor in Bangladesh)

8/5/2002

Role of epidemiology in public health

56

The role of epidemiology

"Epidemiology is fundamentally engaged in the broader quest for social justice and equality."

John Cassel, a founder of the UNC Department of Epidemiology and a revered figure among epidemiologists

12/2/2001

Role of epidemiology in public health

57

Thank you, gracias, asante sana, merci, dyanavad, kam-sa-ham-ni-da

Thank you so much for taking EPID 600. You have been a wonderful class.

May you all have fulfilling careers and lives.

Please visit me at www.epidemiolog.net

12/2/2001

Role of epidemiology in public health

58

Advertising in the global economy: speaking literally

American Airlines for exporting to Mexico the advertisement for its new leather first class seats ("*Fly In Leather*"), rendered as "*Vuela en cuero*" ("*Fly Naked*").

59