Lecture 1 : Introduction
Overview

- **Medical Geography Defined**
- **Geographical Approaches to Health and Disease**
- **Sub-Branches**
- **Disease categories**
- **Outline History of Infectious Diseases**

Medical / Health Geography

"Medical Geography uses the concepts and techniques of the discipline of geography to investigate health related topics"

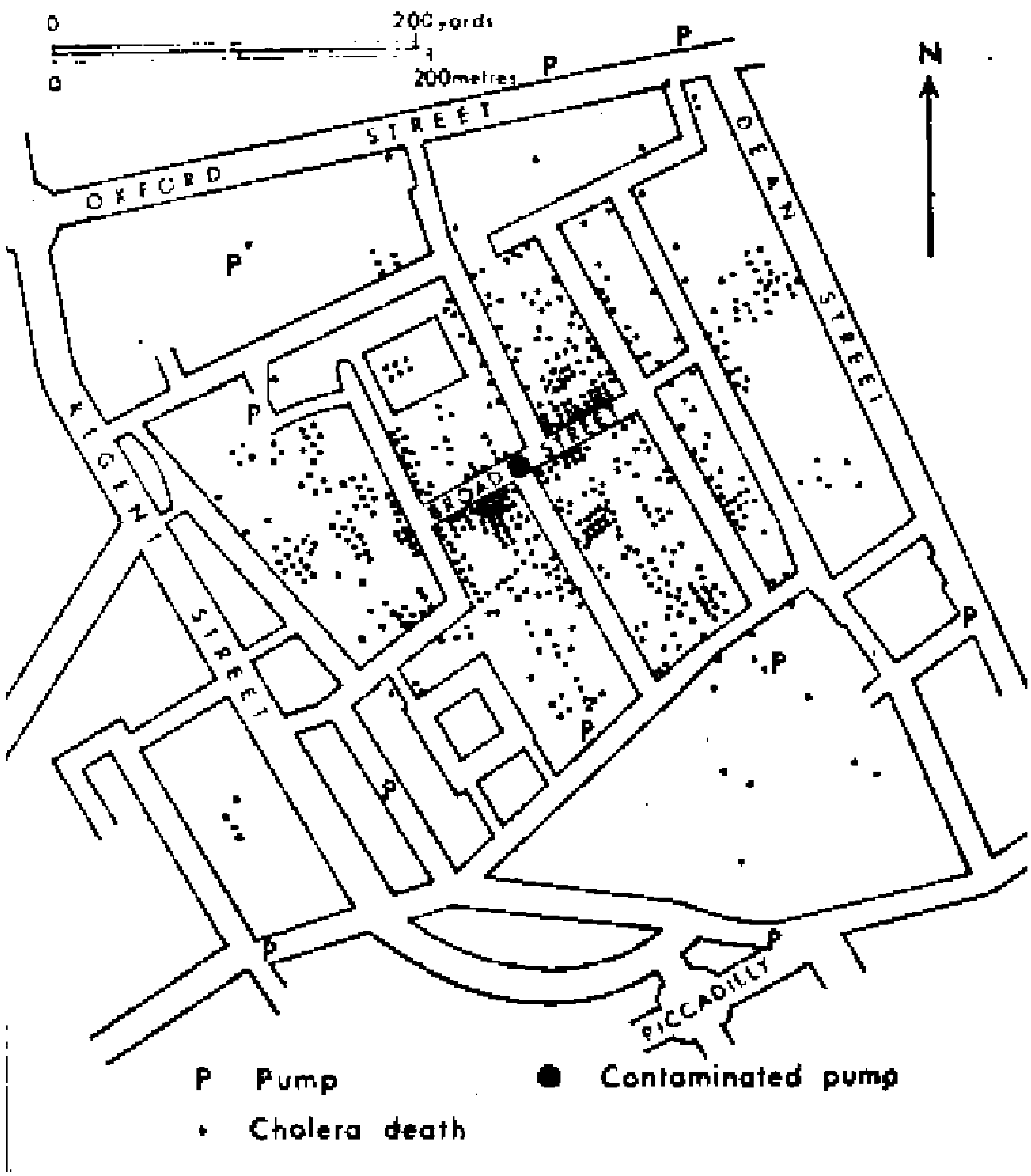
- Note: items in blue are direct quotes from text book.

The first map known to have saved lives (1855):

"After the panic-stricken officials followed Snow's advice to remove the handle of the Broad Street Pump that supplied the water to this neighborhood, the epidemic was contained. Through mapping the locations of deaths related to Cholera, Snow was able to pinpoint one of the major sources of causation of the disease and support his argument relating to the spread of Cholera.

Snow's classic study offers one of the most convincing arguments of the value of understanding and resolving a social problem through the use of spatial analysis."

(http://www.csiss.org/classics/content/8)



www.york.ac.uk/depts/maths/histstat/snow_map.htm)

Medical Geog. Def. Contd……

"The emergency of a systematic interest in medical geography can be dated from the first report of the commission on Medical Geography (ecology) of Health and Disease to the international geographical union in 1952"

Geographic variation in health has long been studied under such interdisciplinary rubrics as:

- Geographic pathology
- Medical ecology
- Medical topography
- Geographical epidemiology
- Geomedicine

Names and dates of publications associated with early development of the field:

May, Jacques M. (1950) "Medical geography: Its methods and objectives".
May, Jacques M. (1958) "Medical Geography"
May, Jacques M. (1961) "Studies in Disease Ecology"
Barrett, Frank A. (1980, 1991, 1993, 1996, 1998)

Sub branches:

• A distinction is sometimes made between Medical Geography and Health Geography.
• The term 'Health Geography' was originally used in the 1990s to signify a particular form of social / cultural geography.
• Today it is used more or less as a synonym for 'Medical Geography'.

Definitions of Health and Disease:

- "Health is more than the absence of disease"
- "The problem remains of how to define health without reference to disease"

Health def. WHO 1946:
"Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity"

Disease def. May, 1961

Disease is "that alteration of living cells or tissues that jeopardizes survival in the environment"

Medical Geography Today: New developments

New developments in **technology** and the challenge of emerging (and reemerging) infectious diseases in a globalizing world as well as the increasing importance of degenerative diseases due to population aging, have led to explosive growth in Medical Geographical research.

The Geographic Information Systems (GIS) has allowed the replacement of paper maps with digital maps and descriptive speculation about disease has been replaced with scientific analysis of spatial patterns of disease including hypothesis testing, multi-level modeling, and multivariate analysis.

Medical Geography today draws on the concepts and techniques of geography, and epitomizes the interdisciplinary nature of the discipline. It provides an excellent bridge between the biomedical and social sciences and the application of GIS in health is particularly demanded because it provides unique insights for disease control.

GIS provide a digital lens for exploring the dynamic connections between people, their health and well-being, and changing physical and social environments. It permits identification and mapping of vulnerable populations, health outcomes, risk factors, and exploration of associations between them at varying scales. By making it easy to link disease data to other information about the environment including geographic distribution of risk factors, GIS provides a powerful tool for medical geographers.

http://www.unt.edu/honors/eaglefeather/2006_Issue/2006_PDFs/Oppong.pdf

Medical Geography Today: **Example**

Journal articles: International Journal of Health Geographics 2010 publications (http://www.ij-healthgeographics.com/)

Latest articles [more info]

Research Open Access
Analysis of simultaneous space-time clusters of Campylobacter spp. in humans and in broiler flocks using a multiple dataset approach
Malin E Jonsson, Berit Tafjord Heier, Madelaine Norstrom, Merete Hofshagen
International Journal of Health Geographics 2010, **9**:48 (22 September 2010)
[Abstract] [Provisional PDF] [PubMed] [Related articles]

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Jeffrey S Wilson, David C Shepherd, Marc B Rosenman, Abel N Kho
International Journal of Health Geographics 2010, **9**:47 (17 September 2010)
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Research Open Access
Using Landsat satellite data to support pesticide exposure assessment in California
Susan K Maxwell, Matthew Airola, John R Nuckols
International Journal of Health Geographics 2010, **9**:46 (16 September 2010)
[Abstract] [Full Text] [PDF] [PubMed] [Related articles]

Research Open Access
A high resolution spatial population database of Somalia for disease risk mapping
Catherine Linard, Victor A Alegana, Abdisalan M Noor, Robert W Snow, Andrew J Tatem
International Journal of Health Geographics 2010, **9**:45 (14 September 2010)
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Research Open Access
Community contextual predictors of endoscopic colorectal cancer screening in the USA: spatial multilevel regression analysis
Lee R Mobley, Tzy-Mey Kuo, Matthew Urato, Sujha Subramanian
International Journal of Health Geographics 2010, **9**:44 (3 September 2010)
[Abstract] [Full Text] [PDF] [PubMed] [Related articles]

Research Open Access Highly accessed
Spatial patterns of diabetes related health problems for vulnerable populations in Los Angeles
Andrew J Curtis, Wei-An Andy Lee
International Journal of Health Geographics 2010, **9**:43 (27 August 2010)

Determinants of tick-borne encephalitis in counties of southern Germany, 2001-2008

Christian Kiffner, Walter Zucchini, Philipp Schomaker, Torsten Vor, Peter Hagedorn, Matthias Niedrig, Ferdinand Rühe

International Journal of Health Geographics 2010, **9**:42 (13 August 2010)

[Abstract] [Full Text] [PDF] [PubMed] [Related articles]

The effects of summer temperature, age and socioeconomic circumstance on Acute Myocardial Infarction admissions in Melbourne, Australia

Margaret E Loughnan, Neville Nicholls, Nigel J Tapper

International Journal of Health Geographics 2010, **9**:41 (11 August 2010)

[Abstract] [Full Text] [PDF] [PubMed] [Related articles]

An evaluation of edge effects in nutritional accessibility and availability measures: a simulation study

Emily M Van Meter, Andrew B Lawson, Natalie Colabianchi, Michele Nichols, James Hibbert, Dwayne E Porter, Angela D Liese

International Journal of Health Geographics 2010, **9**:40 (27 July 2010)

[Abstract] [Full Text] [PDF] [PubMed] [Related articles]

Density estimation and adaptive bandwidths: A primer for public health practitioners

Heather A Carlos, Xun Shi, James Sargent, Susanne Tanski, Ethan M Berke

International Journal of Health Geographics 2010, **9**:39 (23 July 2010)

[Abstract] [Full Text] [PDF] [PubMed] [Related articles]

Research Open Access

Physical accessibility and utilization of health services in Yemen

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International Journal of Health Geographics 2010, **9**:38 (21 July 2010)

[Abstract] [Full Text] [PDF] [PubMed] [Related articles]

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The relationship between mosquito abundance and rice field density in the Republic of Korea

Erin E Richards, Penny Masuoka, David Brett-Major, Matthew Smith, Terry A Klein, Heung Chul Kim, Assaf Anyamba, John Grieco

International Journal of Health Geographics 2010, **9**:32 (23 June 2010)

[Abstract] [Full Text] [PDF] [PubMed] [Related articles]

Research Open Access

Temporal and spatial dynamics of *Cryptosporidium parvum* infection on dairy farms in the New York City Watershed: a cluster analysis based on crude and Bayesian risk estimates

Barbara Szonyi, Susan E Wade, Hussni O Mohammed

Disease Categories

Two main types of diseases:

1. Infectious / transmissible / contagious /communicable / pathogenic.

Diseases that can be transmitted from person to person (or between species). Usually involve a causal agent (e.g. bacteria or virus), but may be genetic.

2. Degenerative / non-infectious / non-transmissible /non-communicable.

Traditionally assumed to be associated with the ageing process (i.e. risks increase as body degenerates with age).

Animations infectious and non-infectious
http://www.youtube.com/watch?v=y6osMO5xnag
http://www.youtube.com/watch?v=V_1hxz8XxVk&feature=related

- Infectious diseases were the major cause of death throughout history.

  - Infectious diseases declined as the major cause of death in developed countries mid-19th century to mid-20th century.
  - Non-infectious diseases are now the major cause of death, and life expectancy is much higher.
  - Infectious diseases could make a comeback (example **MRSA - methicillin-resistant Staphylococcus aureus, or staph infections).**

• Most infectious diseases are caused by a particular species of **microorganism** (or **microbe**), but some larger organisms also cause disease.
• Microorganisms are ubiquitous. Only a small minority of microorganisms are **pathogenic** (i.e. disease causing).
• **Pathogens** do not have malicious intent. Jacques May (1950): diseases are 'merely the by-product of an accidental collision between two or more forms of life, each pursuing its own destiny'.

Pathogenic Factors

1. Hosts - the human (or other organism) infected.
2. Causal agents – the organism that causes the disease.
3. Vectors – organisms (usually an arthropod) which transmit the causal agent from one infected host to a new host.

4. Intermediate hosts - organisms (usually molluscs, fish or mammals) which are essential to the life cycle of the causative agent.
5. Reservoirs – other species which act as a host to the causal agent.

Disease Prevention

• All infectious diseases require at least two factors (host + agent).
• Many require additional factors (i.e. vector, intermediate host, or reservoir).
• Each factor has its own 'geography'. These geographies must overlap for the disease to be present.
• Diseases may be prevented by eliminating one of the factors.
• This is not only difficult, but it may have unforeseen ecological consequences.

Means of Transmission

• Most infectious diseases are associated with a particular means of transmission.
• There are numerous means of transmission, but a few broad categories may be identified.

Airborne

• Agents present in nasopharynx or respiratory tract are disseminated in salivary droplets during coughing, sneezing or breathing.
• The droplets are very small and soon evaporate leaving the agent floating in the air.
• They are breathed in by the next victim.
• Diseases spread in this manner include mumps, measles, chicken pox, colds, and influenza (viral); and whooping cough, diphtheria and tuberculosis (bacterial).

Water- and Food-Borne

• Food may become contaminated (e.g. *Salmonella, Clostridium botulinum*).
• Agents passed in faeces may find their way into the water supply (the **faecal-oral route**). Cholera and typhoid are transmitted in this manner.
• Sanitary reforms in the late-19th century reduced the risk of these diseases by ensuring clean water supplies.
• Risks of infection may be reduced by good personal hygiene, but infection is still easier than might be realized.

Vector-Borne

• Transmission is by an organism (the **vector**), in most cases an arthropod (and generally an insect).
• Two mechanisms:
a) Mechanical – e.g. flies, cockroaches, mice, rats.
b) Bites – e.g. mosquitoes (malaria, yellow fever, dengue), fleas (bubonic plague), ticks (Lyme disease) and louse/ mites (typhus).

Direct Physical Contact

• Venereal diseases (e.g. syphilis, gonorrhoea, genital herpes) are transmitted by direct contact during sexual intercourse.
• A few diseases (e.g. leprosy, yaws) may be transmitted by direct contact of a non-sexual nature.

Indirect Physical Contact

• The causal agent may be transmitted via an inanimate object (**fomite**).
• Sharp instruments which penetrate the skin may carry infection (e.g. surgical intruments, syringes, razor blades, needles).
• Dust and soil carrying an infectious agent may gain acces through a cut to cause diseases such as tetanus (*Clostridium tetani)* or gas gangrene (*Clostridium perfringens*).

The role of Diseases in Human Evolution

1. Descent from the trees – exposure to new vectors and agents.
2. Omnivorous diet – exposure to zoonoses.
3. Expansion into new regions – new zoonoses, but fewer helminths.

Low population density and mobility provided protection against extinction.
Palaeolithic hunter gatherer societies had a balanced diet and probably enjoyed good health.

• Population densities were low. This prevented many diseases becoming endemic.
• Population numbers were kept in check by food supplies.
• Life expectancy was probably around 40.

- The world's population is estimated as:
  - 4 million by 10,000BC
  - 5 million by 5,000BC
- There were two major developments:
  - The Neolithic revolution / agricultural revolution
  - The urban revolution
- The agricultural revolution began in the hilly regions of the Middle East about 9,000 to 7,000 BC.
  - Developed out of the domestication of animals such as cattle, sheep, pigs and goats, and t the cultivation of grasses
- (e.g. wheat, barley) and legumes (e.g. peas, lentils).
  - May have emerged elsewhere around the same time.

After the revolution: Various factors contributed to worsening health:

1. **Population density**: Agriculture supported much higher population densities – 10x to 100x hunter gathering.
2. **Diet**: Diets deteriorated due to dependence upon cereals, resulting in beri-beri, pellagra, riboflavin deficiency rickets and kwashiorkor.
3. **Permanent settlements**: water-borne infections due to sewerage contamination of water supplies; rodent transmission of disease due to stored food.
4. **Animal contacts**: Diseases such as flu, the common cold, smallpox, measles, and mumps mutated from animal diseases. Increase in helminth infestations.
5. **Land clearances**: Mosquito transmitted diseases such as yellow fever, malaria, dengue and several kinds of viral encephalitis.
6. **Scrub**: Rickettsial diseases transmitted by ticks (e.g. scrub typhus, endemic typhus).
7. **Fertilisers**: Night soil increased faecal bacterial and worms.