Module 4: Lesson 10 – Disease
No textbook – ALL LESSON NOTES

Objectives:
- Identify and explain the hazards of disease and epidemics
- Identify the current threats to global health
- Explain the role of geography in warning and controlling diseases
- Evaluate global vulnerabilities to the spread of diseases

10.0 Introduction
- in 2014 the world faced Ebola Virus disease (EVD) is a communicable disease that is spread from person to person by contact – has no known cure
- it spread across Africa but health workers struggled to contain the disease in one region due to air traffic, tourists, visitors and health workers moving around the globe affecting other regions

CBC LINK 1 – what are the causes of this becoming a disaster?
- what sets this outbreak apart from previous ones, and makes it "incredibly hard to control" is that this time around, it has taken hold over a large geographical area and three countries.
- Ebola is spread by bodily fluids but only when the infected person displays symptoms, which include fever, vomiting and diarrhea. Over half the people who get the disease die.
- One challenge the international assistance effort has to confront is the mistrust of the local population, including a belief that they are the ones spreading the virus. Health-care workers still get attacked when they try to go into a community.
- Lives are being lost because the response is too slow - Fear and denial hampering efforts

CBC LINK 2 - What are the potential of a pandemic – global spread of the disease
- An Ontario hospital treating a patient who has recently traveled back from Nigeria
- Health Canada says there has never been a case of Ebola in Canada and the risk is very low
- Ebola become a global disease and every country needs to have safety precautions
- By studying the biology of diseases and how they are spread we will have a better chance to control them.

10.1 Disease and Epidemics – Types and Processes
- Of all disasters, large scale diseases, described generally as epidemics, or plagues, affect human populations most directly
- They differ from many of the natural hazards we have studied so far in that they tend to only impact on the people, not the structures of society
- As seen in science fictions novels, after a pandemic disaster all that is left of the planet are empty buildings

Levels of Disaster

3 Levels of Spread:

- 1. Outbreak - *Outbreak* - simultaneous, related occurrence of several cases
- *Epidemic* - uncontrolled outbreak of communicable (infectious or contagious) disease
- *Pandemic* - international or wide-travelling simultaneous epidemics of the same condition

Key Terminology:

- Epidemiology - study of distribution and determinants of health-related events in human population
- the agent - the disaster
- the environment – the place which it affects
- the host - affected people
- Pathogen – a biological agent that causes disease or illness in the host
- Infectious or communicable disease – a disease caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi through direct or indirect contact through humans.
- Zoonotic disease – an infectious disease found in animals and transmitted from animal to human
- Emerging infectious disease – an infectious disease that is newly appeared or a known disease that has recently rapidly expanded its occurrence or geographic range. Some examples of these include (adapted from Medicine.com at this link)
- Ebola virus - outbreaks in 1976
- HIV/AIDS - virus isolated in 1983
- Hepatitis C - identified in 1989 now known to be the most common cause of post-transfusion hepatitis worldwide)
- Influenza A(H5N1) virus (well known pathogen in birds but first isolated from humans in 1997)
- E. coli O157:H7 (first detected in 1982, often transmitted through contaminated food, has caused outbreaks of hemolytic uremic syndrome)
- Borrelia burgdorferi (first detected in 1982 and identified as the cause of Lyme disease)

1. Which of the following is not considered an emerging infectious disease?

A: Small pox

B: Ebola virus

C: H5N1 or Bird flu

D: Lyme disease

2. The name for an infectious disease found in animals and transmitted to humans is

A: Junglnese disease

B: Zoonotic disease

C: Borealis disease

D: None of the above

3. Which of the following is not a pathogenic microorganism?

A: Fungi

B: Bacteria

C: Parasite

D: All of the above

Emerging Infectious Diseases (EID)

- These new diseases or variants of older ones will likely prove to be the pandemic in the future
- The new diseases are poorly understood and medicines that limit their spread have not been developed

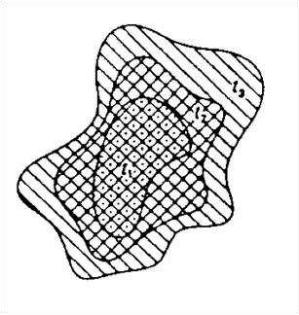
World Health Organization report
Causes for this spread and barriers for combatting it

- The WHO urges increased efforts to combat disease outbreaks, and sharing of virus data to help develop vaccines.
- Urges governments to be open about disease outbreaks, saying nearly half of all outbreak alerts it receives comes from the media
- Drug resistance poses a threat to disease control, the WHO says blaming misuse of antibiotics and poor medical treatment, particularly in the case of tuberculosis
- Given todays universal vulnerability to these threats, better security calls for global solidarity
- International public health security is both a collective aspiration and a mutual responsibility

Spread of Disease

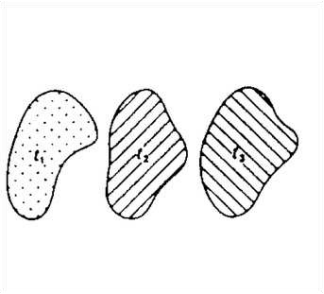
- Diseases become disasters when they are not contained and rapidly spread across continents and oceans to cover the globe
- We can approach the problem of understanding disease spread by considering geographical theory on diffusion.
- Diffusion: a general term for the process of dispersal or dissemination & the concept of spreading widely away from a central point.

<u>Different types of Diffusion</u>
Expansion



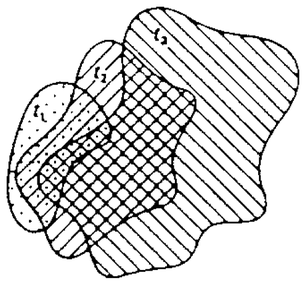
- Occurs when a disease spreads from one place to another
- In this expansion process, the disease often intensifies in the originating region
- As the disease expands into new years it is likely to weaken
- This type of diffusion was recognized in the recent H1N1 flu virus that had its source in Mexico

Relocation



- Is a spatial process, whereby the disease leaves the areas in which it originated as it moves into new areas
    - Ex: the migration of disease carriers, whether it be a migrant with HIV or measles

- The spread of cholera in Haiti in 2010, which killed 6000 people was thought to be brought into the country by aid workers from Nepal in the emergency response to the earthquake
- It is quite common to see a mixture of two or more types of disease diffusion
    - Ex below: mix between expansion and relocation



Network Diffusion

- Occurs when a disease spreads via transportation and social networks
- Ex: HIV, spread along important transport routes such as those countries with a developed road network in southern Africa and also within social (sexual) networks
- Ex: H1N1 flu virus, quickly went global via the aviation network of flights and major international airports

Contagious Diffusion

- Illustrated below in model form and in the scanned map of the original map identifying the cluster and source or the cholera outbreak of Broad Street in 1852
- The process is strongly influenced by distance because nearby individuals or regions have a much higher probability of contact then remote individuals or regions

Hierarchical Diffusion

- Involved the spread of disease through an ordered sequence of classes or places
  - Ex: large cities to remote villages
- Cascade diffusion is a term used to describe a process assumed to be downwards from larger to smaller centres
- This hierarchical spread can also be seen with HIV in regard to social status and sexual habits
- HIV spreads is contained at first among a few carriers with high status and high concurrency of sexual relations
- The disease is spread first to people with medium status and medium level of sexual concurrency
- Finally the disease may then spread from the second tier of carriers to people with lower status and lower sexual concurrency

Q: An epidemic is a simultaneous, related occurrence of several cases
A: False

Q: A pathogen is a biological agent that causes disease or illness in the host
A: True

Q: during expansion diffusion diseases typically weaken the farther from the origin
A: True

Q: With a spatial spread type of diffusion the disease will intensify in the originating region
A: False

Q: During relocation diffusion, new disease nodes are created in spatially separate regions and it declines and disappears in previously infected areas

A: True

Q: Relocation diffusion is enhanced by migrant workers and emergency aid volunteers
A: True

Epidemic Spread

- Several other terms related to the process of disease spread
- Common-vehicle or source epidemic is a term that describes the case when the disease is spread by a pathogen form a single or common source such as contaminated water in the case of cholera or E-coli
- Propagated epidemic is an event in which the disease is transmitted by an infectious agent
- Can be from person-to-person contact or indirect transmission from human to animal and back to human as with malaria

Vector

- Term used in discussing the movement of diseases
- Refer to animal agents that transfer the disease from one host to another
- Typically, vectors are insects or rodents
    - Ex: mosquitos can transfer West Nile Virus and malaria while rats combined with fleas are responsible for the spread of Bubonic plague

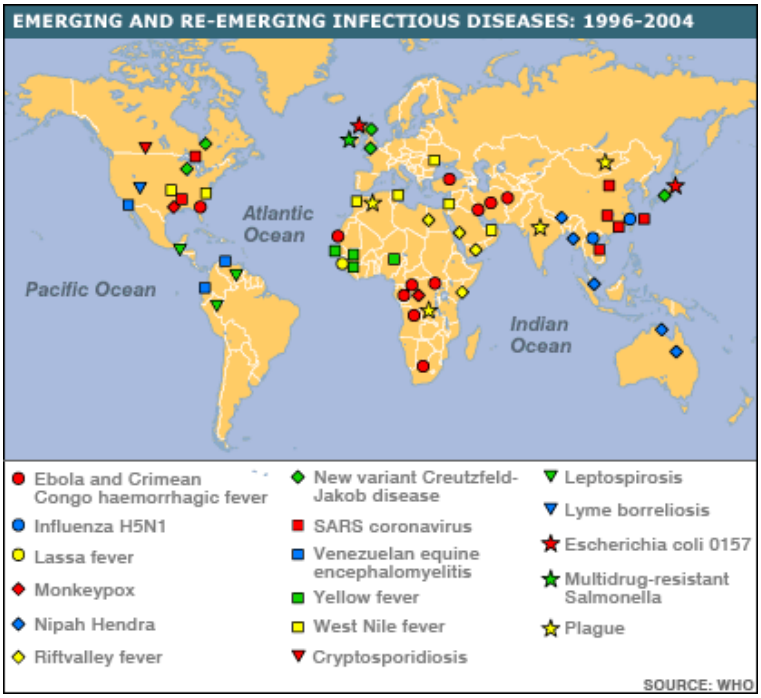
Spread of disease with occur:

- The population is not immune and include carriers
- Susceptibility to disease increases through conditions such as malnutrition

Transmission rates increase because of:

- Physical events such as sewer and water main rupture resulting in fecal contamination
- Lack of routine programs of disease control which spread endemic diseases such as cholera
- Overcrowding in refugee camps which increases human contact and poor sanitation

<u>10.2 Geography of Risk</u>



- Ebola- Africa
  - Gabon, Congo, Democratic Republic of the Congo
- Sars- China
  - Singapore, hong kong
  - US-148
  - Canada-91

Canada Diseases

- SARS, cryptosporidiosis, New variant Creutzfeld Jakob disease

H5N1

- Indonesia- highest cases, 159 deaths

Disease hotspots

- China, India, UK, Germany, Nigeria, US