

## Disease Investigation

Outbreak Investigation

## Overview

- Infectious diseases are important causes of morbidity and mortality in the United States and worldwide.
- There was a period in time where we thought we have essentially eradicated infectious disease with vaccines and antibiotics.

## Historic Perceptions of Infectious Disease 1967

...It is time to close the book on infectious disease and shift all national attention (and dollars) to "the New Dimensions" of health: chronic diseases.

U.S. Surgeon General William H. Stewart 1967 address to A White House gathering of state and territorial health officers

## 1966 CDC assessment of US Health

1. Diseases eradicated in the US (bubonic plague, malaria, smallpox)
2. Diseases almost eradicated (typhoid, polio, diphtheria)
3. Still health problems but technology exists for effective control (syphilis, TB, cervical cancer, injury, arthritis, breast cancer, gonorrhea)
4. Technology in early stage or non-existent (leukemia, some respiratory diseases, strokes)

## Emerging infectious disease

- New appreciation for infectious disease developed in 1980s
  - AIDS and related diseases (TB)
  - Lyme disease
  - Dengue
  - Hantaviruses
  - Ebola
  - West Nile-like Encephalitis



## Ebola outbreak

- <http://www.youtube.com/watch?v=UsOovQ1r0Sg&feature=related>

## Factors in the emergence of infectious disease

- Population growth
- Speed and ease of travel
- Global climate change
- War and Societal disruption
- Antibiotic use and misuse
- Increase in Day Care and Nursing Homes
- Economic changes
  - Dam building, relocation of animals, expansion into new areas
- Bioterrorism



## Examples of important infectious diseases

- Smallpox – great success, now a potential threat
- TB – great problem
- AIDS – great challenge
- West Nile Virus-emerging disease
- Bioterrorism



## Infectious disease

- A disease that is caused by the growth of pathogenic microorganisms in the body. May or may not be contagious



## Epidemiologic Triangle

- Three major factors in infectious disease
  - Environment – domain in which disease-causing agents exist
  - Host – person or other living animal that an infectious agent lives in
  - Agent – factor whose presence is essential for the occurrence of disease

## Infectious Disease Agents

- Infectivity – Capacity of an agent to enter and multiply in a susceptible host
- Virulence – Severity of the disease produced
- Diseases vary

## Agent characteristics

- Organisms enter the body and multiply and then cause disease
- Organisms produce a toxin which can cause illness

## Host characteristics

- People may have immunity
  - Hosts ability to resist infection
- Types of immunity
  - Active – immunity a host has developed as a result of a prior infection or vaccine
  - Passive immunity refers to immunity acquired from antibodies from a person or animal
    - Babies get immunity from their mothers
    - Direct injections of antibodies

## Herd immunity

- If you live in a community with many people immune to a disease your likelihood of being exposed is smaller
  - This works somewhat for parents who choose not to vaccinate their children but most children are vaccinated.
  - It is not a sure protection but it helps.

## Important infectious disease terms

- Incubation period
  - Time between invasion by an infectious agent and the appearance of the first sign or symptom of the disease
- Generation time
  - Time from lodging of an infectious agent and maximum communicability
- Subclinical infection
  - The individual does not show any symptoms but can transmit the infection to others
  - Known as a carrier “Typhoid Mary”

## Environment

- Physical environment
  - Sanitary conditions
- Climate
  - Temperature, amount of water, concern with global warming
- Biologic
  - Available plant and animal species that can serve as a reservoir of the disease, geographic variation
- Social and economic environment
  - Poverty is highly associated with infectious disease

## Number of cases

- Endemic – the disease is habitually present in an environment
- Epidemic – increase in the number of cases
- Pandemic – worldwide spread of disease

## Transmission

- Agent needs to move from the body to another
  - Portal of exit is the site from which the organism leaves one body
    - Respiratory passages, Alimentary canal, GI system, Skin lesions, Sexual system
  - Portal of entry
    - Site where the agent enters the body
      - The greatest protection we have is our skin

## Types of transmission

- Direct transmission
  - Direct and immediate transfer of an infectious agent from one person to another
    - Touching, kissing, biting, sexual intercourse
- Indirect transmission
  - Vehicle borne
  - Airborne
  - Vector-borne

## Vehicle borne

- Contaminated non-moving objects
  - Fomites ( an inanimate object that carries infectious disease like doorknobs, medical waste, linens)
  - Unsanitary food
  - Unclean medical needles

## Foodborne infections

- Contaminated by chemicals or infectious agents
  - Recent strawberry infections
  - Hamburgers at fast food restaurants

## Waterborne infection

- Contaminated water
  - Bacterial - Cholera, Typhoid
  - Parasitic – Giardiasis
  - Viral – Norwalk virus
- May result from inadequate sewage treatment and is a big issue in many developing countries

## Airborne infection

- Spread of droplets contaminated with viruses or bacteria
  - Influenza
  - SARS epidemic

## Vector-borne infections

- Vector – animate, living animal involved in the transmission of disease agents
  - Insects, rodents, for example
  - Zoonoses – diseases transmitted from animals to people
    - West Nile virus
  - <http://www.youtube.com/watch?v=91b3MCAIYSI&feature=fvsr>

## Examples of significant infectious diseases

- Sexually transmitted Disease
  - HIV/AIDS
  - <http://www.youtube.com/watch?v=P91nIGt1axs&feature=channel>
- Food-borne epidemics
  - July 10, 2008 a report on a major salmonella outbreak
  - <http://www.npr.org/templates/player/mediaPlayer.html?action=1&t=1&islist=false&id=92415004&m=92414993>

## Other types of infectious disease

- Vaccine-preventable disease (VPD)
  - Many diseases can be prevented by vaccine
  - Lack of adequate vaccine, esp. in developing countries
  - People choose not to be vaccinated
    - Much distrust and concern
- Zoonotic disease
  - Rabies, anthrax, hantavirus
- Bioterrorism

## Methods of outbreak investigation

- Table 8-7 in your book reviews outbreaks
- Identify if there is an epidemic
- Attempt to identify the causes
  - Epidemic curve
    - Common source
    - Point source
    - Propagated epidemic
  - Evaluate exposures among cases and non-cases
    - Calculate attack rates

## Unique factors of infectious disease

1. A case may also be a source
2. People may be immune
3. A case may be a source without being recognized as a case (asymptomatic)
4. There is sometimes a need for urgency
5. Often there are effective and easy to implement preventive methods (vaccination)

## Re-emergence of infectious disease

- Laurie Garrett who wrote The Coming Plague talks about epidemics
- <http://www.youtube.com/watch?v=j9gBdfL6Zqk>
- CDC investigation