Epidemiology
- Microepidemiology
- Environmental issues
- Also applies to noninfectious diseases, like cancer
- We’ll mostly be discussing infection disease today

Epidemiology: The study of the occurrence, distribution, and control of disease in a population
- Testing
- Chart: mortality rate per 100,000 in the United States
  - The big spike is from the Influenza virus of 1918
  - Mortality has also gotten a little bit worse again in the last 20-30 years
  - This recent rise has a lot to do with increased travel

Epidemiology Vocabulary
- Acute – dramatic onset of the illness – they come and go quickly
- Chronic – lasts for a long long time, or your entire lifetime. Sometimes you might not have a lot of symptoms
- Carrier – somebody that is infected but may not show signs of the illness. They don’t appear sick, and so they act as a human vector.
- Reservoir – a carrier of illness. A Carrier is a human reservoir, but often when we talk about reservoirs we mean animals or inanimate places or objects.
- Morbidity – the incidence of illness in a population. This involves clinical symptoms, because it won’t get recorded unless people are visibly sick. Thus there is actually more morbidity in a population than gets recorded, because people don’t always go to the doctor.
- Mortality – the incidence of deaths in a population.

Map of the world: colored by child mortality

Transmission
- Vertical transmission – parent-to-child transmission, such as from a pregnant mother to her fetus
- Horizontal transmission – generalized person-to-person transmission
- Direct host-host transmission
- Indirect host-host transmission

Clinical Disease Progression
- Infection – has to do with the actual onset – when the pathogen is in the host and replicating, rather than just when the person gets sick
Incubation Period – time between infection and onset of clinical disease symptoms. This could last as long as years or decades.

- Acute period – the height of clinical disease
- Decline period – the organism has left your body and you’re recovering
- Convalescent period – return to prior health and strength

- Maps of amount of disease in different parts of the world
  - Prevalence: fraction of people infected
  - Incidence: number of people infected
  - Endemic disease – relatively constant
  - Epidemic disease – clusters
  - Pandemic disease – epidemics on multiple continents, consistent throughout neighboring countries

- Epidemics
  - Common source epidemics
    - Such as cholera originating from one city well in London
  - Host-to-host epidemics
    - This is much harder to contain, because you have to find everybody that’s infected and quarantine them

- Eradication and Elimination
  - Control – the reduction of a disease to a locally acceptable level – a lot of the time it’s just impossible to totally eliminate a disease, such as when it’s an environmental pathogen
  - Elimination of disease – you’re not controlling the infections, but you are controlling the illness – tetanus is an example
  - Elimination of infection – stopping infection, such as with polio in most countries
  - Eradication – as a result of worldwide efforts, intervention measures are no longer needed. Smallpox is eradicated – they’ve stopped needing to vaccinate for it. It’s not extinct, however, because there are still some contained laboratory strains in the U.S.
  - Extinction – infection agent no longer exists in nature.

- Eradication
  - Some diseases that can be targeted for eradication:
    - Polio
    - Guinea worm disease
    - Lymphatic filariasis
    - River blindness
    - Trachoma
    - Schistosomiasis
  - Many organisms can’t ever be eradicated because:
    - There’s not a vaccine
    - There’s always going to be an environmental source
They tried to eradicate hookworm and yellow fever in the early 1900s

- They tried to kill all the mosquitoes that acted as a reservoir, but you can never truly kill all those mosquitoes, and after 5 or 6 years it came back

### Control Measures

- **Cycle:** Reservoir → Portal Exit → Transmission → Portal Entry → Susceptible Host → Reservoir again
- **Against reservoir:**
  - You can vaccinate domestic animals, such as for rabies or polio
  - You can prevent contact with wild animals
- **Against transmission**
  - You can prevent contamination
- **Immunization**
- **Quarantine**
  - Control measure for outbreaks
- **Surveillance**
  - Careful observation, recognition, and reporting of diseases as they occur
  - This is typically done with pathogens that have the potential to create epidemics
- **Herd immunity**
  - Vaccines won’t really be effective for public health until you make a high enough percentage of the population immune
  - Once enough people are vaccinated, you can prevent transmission
  - Typically at least 70% must have protective immunity
  - Highly infection agents require up to 95% protection
    - Polio requires this kind of high percentage of protection, which is one of the reasons they’re having such a hard time eradicating it.

### Pie chart: causes of death as a percentage of mortality in the total population in the Americas versus Africa

- Infectious diseases cause far more deaths in Africa. In America it’s only around 10%.