Epidemiology

- The study of factors and mechanisms involved in the frequency and spread of diseases and other health-related problems within populations of humans, animals and plants.
- Etiology is the study of the cause of disease.

Epidemiology

- Communicable Disease
  - Disease transmitted from one host to another
- Non-communicable Disease
  - Not transmitted from one host to another
    - Usually caused by one's own normal flora or an environmental reservior

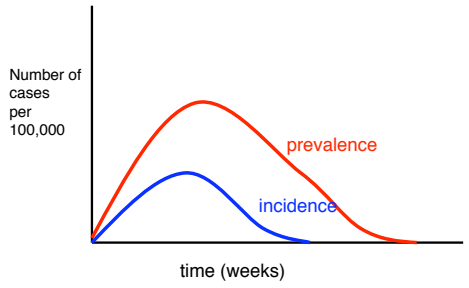
Morbidity and Mortality Frequencies

- Morbidity rate
  - the number of individuals affected by the disease in a certain period of time in relation to the total number in the population.
- Mortality rate
  - the number of deaths due to a disease in a population during a specific period in relation to the total population.

Incidence versus prevalence

- Incidence
  - the number of NEW cases of a disease in a population within a specific period of time.
- Prevalence
  - the TOTAL NUMBER of people infected within the population at any time.

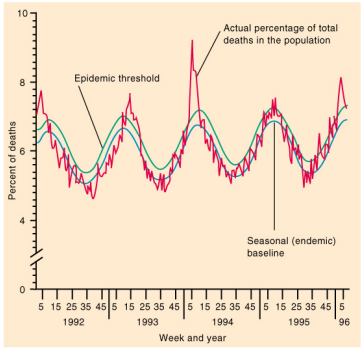
Incidence and prevalence rates



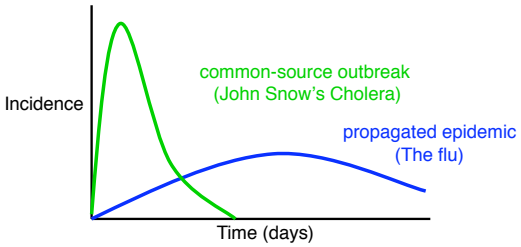
Diseases in populations

- Endemic
  - Present continually in the population of a given geographical area.
- Epidemic
  - Disease suddenly has higher than normal incidence in the population
- Pandemic
  - Worldwide epidemic

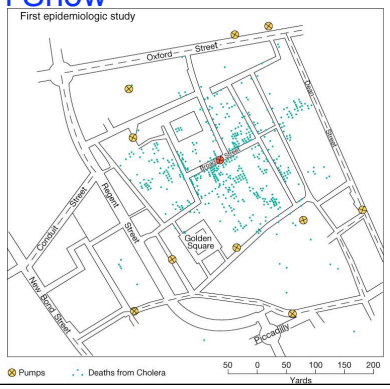
Rates of Disease in a population



Common source vs. propagated epidemic



John Snow



Chicken pox in the US

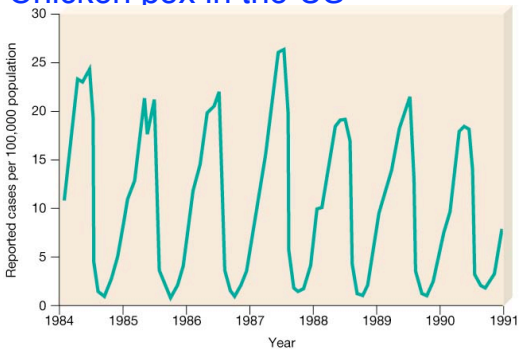


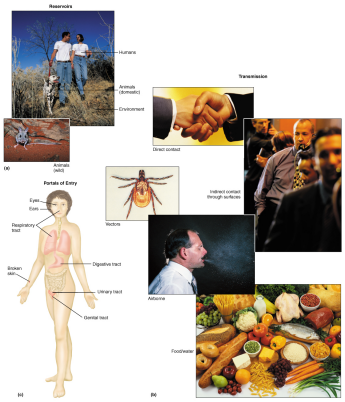
Table 20.1 Common Terms in Epidemiology

Term	Definition
Attack rate	The proportional number of cases developing in the population that was exposed to the infectious agent
Communicable disease	An infectious disease that can be transmitted from one host to another
Endemic	A disease or other occurrence that is constantly present in a population
Epidemic	A disease or other occurrence whose incidence is higher than expected
Herd immunity	A phenomenon that occurs when a critical concentration of immune hosts prevents the spread of an infectious agent
Incidence	The number of new cases of a disease in a population at risk during a specified period of time
Index case	The first identified case of a disease in an outbreak or epidemic
Morbidity	Illness. Most often expressed as the rate of illness in a given population at risk
Mortality	Death. Most often expressed as a rate of death in a given population at risk
Non-communicable disease	A disease that is not transmitted from one host to another
Outbreak	A cluster of cases occurring during a brief time interval and affecting a specific population; an outbreak may herald the onset of an epidemic
Pandemic	A worldwide epidemic
Portal of entry	Surface or orifice through which a disease-causing agent enters the body
Portal of exit	Surface or orifice from which a disease-causing agent exits and disseminates
Prevalence	The total number of cases in a given population at risk at a point in time
Reservoir	The natural habitat of a disease-causing organism

Reservoirs of Infection

- Human reservoirs
  - Carriers (symptomatic or asymptomatic)
    - Often there are no signs of the disease
  - Chronic carrier
    - Long time
  - Intermittent carrier
    - Periodically releases organisms
- Animal reservoirs
  - Zoonoses
    - Rabies, plague,
- Non-living reservoirs (Environmental)
  - Soil, food, water (cholera, anthrax)

Reservoirs and the spread of pathogens



Portals of exit

- Eyes (tears)
- Nose (secretions)
- Ear (ear wax)
- Skin (flakes)
- Mouth (sputum)
- Mammary glands (milk, secretions)
- Vagina (secretions, blood)
- Urethra (urine)
- Seminal vesicle (semen and other secretions)
- Anus (feces)
- Broken skin (blood)

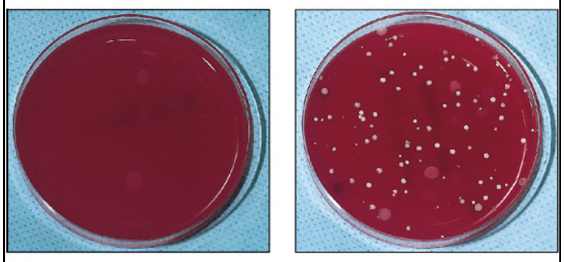
Portals of entry

- Eye
- Ear
- Nose
- Mouth
- Anus
- Urethra/vagina
- Mammary glands
- Wounds
- Placenta

Modes of Transmission of Diseases

- Horizontal Transmission
  - Contact with food, water, or living agent
- Vertical transmission
  - Mother to fetus or child (breast feeding)
- Contact transmission
  - Direct contact
    - Fecal, oral, touching (herpes)
  - Indirect contact
    - Fomites (non living objects, clothes, doorknobs, utensils)
  - Droplets (coughs, sneezes)
- Vehicle transmission
  - Waterborne (sewage)
  - Airborne (viruses, air conditioning systems)
  - foodborne

Air sample



(a) Empty hospital room

(b) Room with 12 people

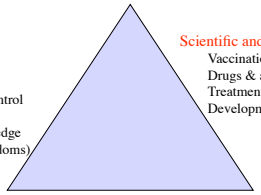
Modes of Transmission of Diseases

- Vector transmission (living organisms)
  - Mechanical vectors
    - food, or insect bodies
  - Biological
    - ticks, fleas

Control of Disease Transmission

- Isolation
- Quarantine
- Immunization
- Vector control

The Disease Control Triangle



Public Sanitation
Water purification
Sewage treatment
Quarantine
Mosquito/rodent control
Garbage disposal
Disseminate knowledge
(sterile needles/condoms)

Scientific and Medical Research
Vaccinations
Drugs & antibiotics
Treatment protocols
Development knowledge

Personal Hygiene and Behavior
become informed, and act accordingly to avoid disease, and if infected take advantage of available resources

Infectious Disease Surveillance

- Eradication/reduction of Disease
  - Improving sanitation
  - Reservoir & vector control
  - Vaccination
  - Antibiotic treatment

  Small pox
- Emerging disease
  - new opportunities of infe
    - New diseases emerge
      - Increase in incidence past two decades
    - Old controlled diseases make a comeback

- Factors that contribute to emergence and reemergence include
  - Microbial evolution
  - Complacency and breakdown of public health
  - Changes in human behavior
  - Advances in technology
  - Population expansion
  - Development
  - Mass distribution and importation of food
  - War and civil unrest
  - Climate changes

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MORBIDITY AND MORTALITY WEEKLY REPORT

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Outbreak of Ebola Hemorrhagic Fever — Uganda, August 2000–January 2001

Evaluation of a Child Sexual Abuse Prevention Program — Vermont, 1995–1997

Outbreak of Ebola Hemorrhagic Fever — Uganda, August 2000–January 2001

On October 8, 2000, an outbreak of an unusual febrile illness with occasional hemorrhage and significant mortality was reported to the Ministry of Health (MoH) in Kampala by the superintendent of St. Mary's Hospital in Lacor, and the District Director of Health Services in the Gulu District. A preliminary assessment conducted by MoH found additional cases in Gulu District and in Gulu Hospital, the regional referral hospital. On October 15, suspicion of Ebola hemorrhagic fever (EHF) was confirmed when the National Institute of Virology (NIV), Johannesburg, South Africa, identified Ebola virus infection among specimens from patients, including health-care workers at St. Mary's Hospital. This report describes surveillance and control activities related to the EHF outbreak and presents preliminary clinical and epidemiologic findings.

Control activities were organized around surveillance and epidemiology, clinical case management, social education and mobilization, and coordination and logistic support. An active EHF surveillance system was initiated to determine the extent and magnitude of the outbreak, identify foci of disease activity, and detect cases early. Ill persons were encouraged to be assessed at a hospital and, if indicated, to be hospitalized to reduce further community transmission. Targeted prevention activities included follow-up of contacts of identified cases for 21 days; establishment of trained burial teams for all potential and confirmed EHF deaths; community education; cessation of traditional healing and burial practices; cessation of large public gatherings; and updates of hospital infection-control measures, including isolation wards. Laboratory testing was performed at a field laboratory established at St. Mary's Hospital by CDC and supplemented by additional testing at CDC and NIV. Sequence analysis revealed that the virus associated with this outbreak was Ebola-Sudan and differed at the nucleotide sequence level from earlier Ebola-Sudan isolates by 3.3% and 4.2% in the polymerase (362 nucleotides sequenced) and nucleocapsid (146 nucleotides sequenced) protein encoding genes, respectively.

During the third week of October, active surveillance was established and included three case notification categories: alert, suspect, and probable. The alert category comprised persons with sudden onset of high fever, sudden death, or hemorrhage, and was used by community members to alert health-care personnel. The suspect category comprised persons with fever and contact with a potential case-patient; persons with unexplained bleeding; persons with fever and three or more specified symptoms (i.e., headache, vomiting, anorexia, diarrhea, weakness or severe fatigue, abdominal pain, body aches or joint pains, difficulty swallowing, difficulty breathing, and hiccups), and all

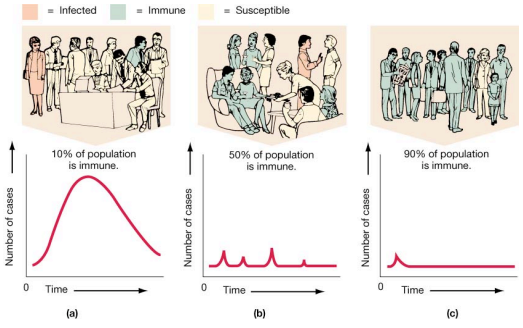
CDC notifiable Infectious Disease

TABLE 20.1 Notifiable Infectious Diseases

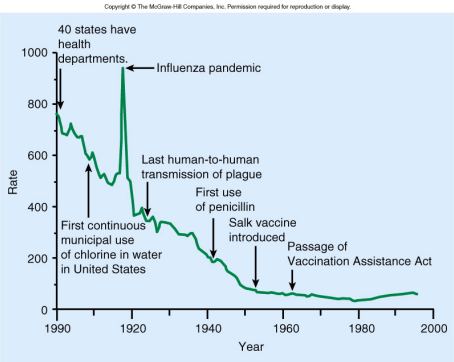
Individual states and territories require physicians to report cases of these notifiable diseases. In turn, the number of cases is reported to the CDC, where they are collated and published in the *MMWR*.

- AIDS
- Anthrax
- Arboviral neuroinvasive and non-neuroinvasive diseases
- Botulism
- Brucellosis
- Chancroid
- *Chlamydia trachomatis*, genital infections
- Cholera
- Coccidioidomycosis
- Cryptosporidiosis
- Cyclosporiasis
- Diphtheria
- Ehrlichiosis
- Enterohemorrhagic *Escherichia coli*
- Giardiasis
- Gonorrhea
- *Haemophilus influenzae*, invasive disease
- Hansen's disease (leprosy)
- Hantavirus pulmonary syndrome
- Hemolytic uremic syndrome, post-diarrheal
- Hepatitis, viral, acute and chronic
- HIV infection
- Influenza-associated pediatric mortality
- Legionellosis (Legionnaires' disease)
- Listeriosis
- Lyme disease
- Malaria
- Measles
- Meningococcal disease
- Mumps
- Pertussis
- Plague
- Poliomyelitis, paralytic
- Psittacosis
- Q fever
- Rabies, animal and human
- Rocky Mountain spotted fever
- Rubella
- Rubella, congenital syndrome
- Salmonellosis
- Severe acute respiratory syndrome-associated coronavirus (SARS-CoV) disease
- Shigellosis
- Smallpox
- Streptococcal disease, invasive, group A
- Streptococcal toxic shock syndrome
- *Streptococcus pneumoniae*, drug-resistant, invasive disease
- *Streptococcus pneumoniae*, invasive in children < 5 years
- Syphilis
- Syphilis, congenital
- Tetanus
- Toxic shock syndrome
- Trichinosis
- Tuberculosis
- Tularemia
- Typhoid fever
- Vancomycin-intermediate *Staphylococcus aureus* (VISA)
- Vancomycin-resistant *Staphylococcus aureus* (VRSA)
- Varicella
- Yellow fever

Herd immunity

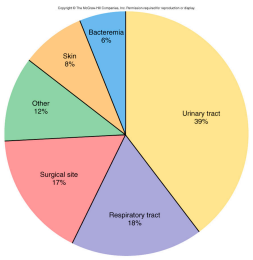


Infectious Disease Death Rate in the US

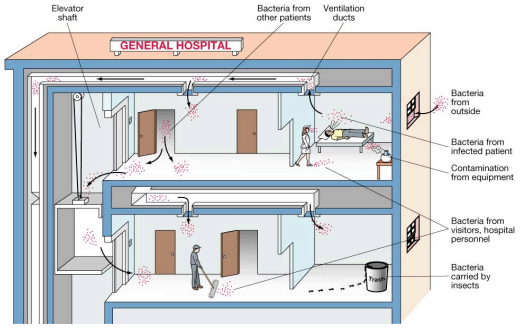


Nosocomial Infections

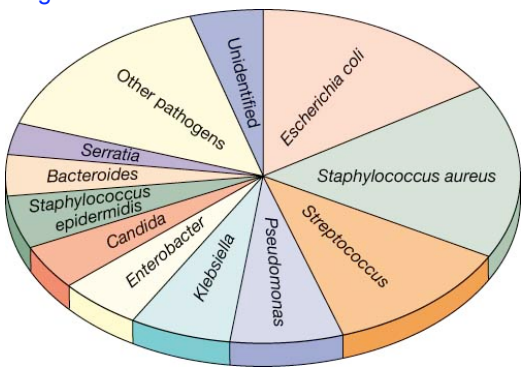
- Nosocomial infections
  - hospital-acquired infections
- factors
  - Length of time of exposure
  - Manner of exposure
  - Virulence and number of organisms
  - State of host defenses



Transmission of nosocomial infections



Organisms that cause nosocomial infections



Common nosocomial infections

•Commonly implicated organism include

- –*Enterococcus* species
  - •Part of normal intestinal flora
- –*Escherichia coli* and other species in family *Enterobacteriaceae*
  - •Part of normal intestinal flora
- –*Pseudomonas* species
  - •Common cause of nosocomial pneumonia and urinary tract and burn infections
- –*Staphylococcus aureus*
  - •Survives in environment for prolonged periods
  - •Easily transmissible to fomites
- –Other *Staphylococcus* species
  - •Often part of normal skin flora