Slide 1

Epidemiology

Lecture 18

Slide 2

Learning Outcomes

- Epidemiology
- Terminology of diseases
- Transmission of diseases
- Vaccination

Slide 3

Definition of Terms

- Pathology — Study of disease
- Etiology — Study of the cause of a disease
- Pathogenesis — Development of disease
- Infection — Colonization of the body by pathogens
- Disease — An abnormal state in which the body is not functionally normally

Using your own words provide a definition of the term epidemiology.

Explain the difference between an infection and a disease.

Using your own words provide definitions of the following terms; etiology, pathology, and pathogen.

Slide 4

You and Your Microbiota

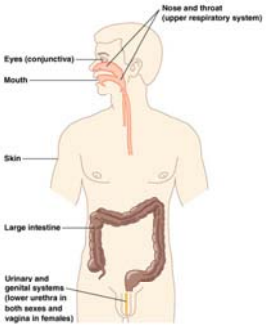
- Transient
- Normal
- Commensalism
- Mutualism
- Parasitism
- Pathogenic

Provide an example of how your own microbiota protects you against potential pathogens.

Slide 5

Locations of Microbiota

- Skin
  - Probionibacterium
  - Malassezia
- Eyes
  - Staph epidermidis
- Nose
  - *Staphylococcus aureus*,
- Throat
  - Strep pneumoniae, Haemophilus, Nesseria
- Mouth
  - Strep mutans, Actinomycetes
- Large Intestine
  - E.coli, Bacteroides,
- Vagina
  - lactobacilli, Candida, Trichomonas



Provide an example of how your own microbiota protects you against potential pathogens.

Slide 6

What Have you Done for Me Lately?

- Normal microbiota protect the host by:
  - occupying niches that pathogens might occupy
  - producing acids
  - producing bacteriocins
- Probiotics
  - live microbes applied to or ingested into the body, intended to exert a beneficial effect.

Provide an example of how your own microbiota protects you against potential pathogens.

What are probiotics and what is the medical purpose of using probiotics?

Slide 7

Signs, Symptoms and Syndromes

- Sign
  - Objective
  - Measurable
  - Temperature
  - Swollen lymph nodes
- Symptom
  - Subjective Complaints
  - Aches
- Syndrome
  - Specific group of signs or symptoms
  - Always accompany a particular disease

Explain the difference between signs of a disease and symptoms of a disease.

Slide 8

Classification of Diseases

- Communicable
  - Spreads through population
  - Genital herpes, Typhoid Fever,
- Contagious
  - Spreads easily
  - Measles,
- Noncommunicable
  - Does not spread
  - Tetanus

Provide examples of communicable and non communicable bacterial diseases.

Slide 9

Occurrence of Disease

- Incidence
  - Number of people in a population develop the disease during a particular time period
  - = New cases
- Prevalence
  - Number of people in a population develop the disease at a specified time
  - = old and new cases
- Incidence of AIDS in US in 2004
  - 40,000
  - 40,000 cases in 2006
- Prevalence US 2004
  - 1 million
- approx 1 in 302 or 0.33%

Explain the difference between the incidence of a disease and the prevalence of a disease.

Slide 10

Occurrence of Disease

- Sporadic
  - Occasionally present
  - Typhoid
- Endemic
  - Constantly present in population
  - Common cold
- Epidemic
  - Many people acquire disease at same time
  - Cholera
- Pandemic
  - Disease present worldwide
  - Influenza
  - AIDS

Use examples of named disease to explain the difference between an endemic disease, and an epidemic disease.

Slide 11

Severity and Duration

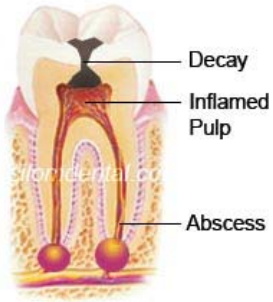
- Acute
  - Develops Rapidly generally last a short time
  - Influenza
  - SARS
- Chronic
  - Develops slowly
  - May recur
  - TB
- Subacute
  - Between Acute and Chronic
- Latent
  - Disease remains inactive
  - Shingles

Use examples to explain the difference between an acute infection and a chronic infection.

Slide 12

Extent of Host Involvement

- Local
  - Pathogens limited to small area
- Systemic
  - Infection throughout the body
- Focal Infection
  - Site of original infection that spread to other areas
  - Endocarditis due to tooth decay
- Bacteremia
  - Presence of bacteria in blood
- Septicemia
  - Growth of bacteria in blood
- Toxemia
  - Toxins in blood
- Viremia
  - Viruses in blood



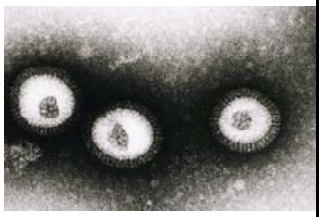
Explain the differences in terms of host involvement between a local infection, a focal infection and a systemic infection. Provide a named microorganisms that could be responsible for each type of infection.

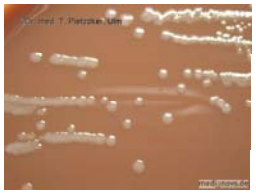
Provide definitions of the following terms; septicemia, toxemia, bacteremia.

Slide 13

Primary and Secondary Infections

- Primary
  - Often acute disease
  - Weakens immune system
  - Influenza A
- Secondary infection
  - May be an opportunistic pathogen
  - Commensal bacterium
  - *Haemophilus influenzae*





Use an example to demonstrate your understanding of the term opportunistic pathogen.

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Primary and Secondary Infections

• Toxemia	Toxins in the blood
• Viremia	Viruses in the blood
• Primary infection	Acute infection that causes the initial illness
• Secondary infection	Opportunistic infection after a primary (predisposing) infection
• Subclinical disease	No noticeable signs or symptoms (inapparent infection)

The bacterium *Haemophilus influenzae* was, responsible for the often fatal pneumonias that developed in victims of the 1918 influenza epidemic. Using this information how would you categorize Influenza virus A, and *Haemophilus influenzae*. [page 429]

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Predisposing Factors

- Make the body more susceptible to disease
  - Short urethra in females
  - Inherited traits such as the cystic fibrosis
  - Climate and weather
  - Fatigue
  - Age
  - Lifestyle
  - Chemotherapy

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Stages of a Disease

- Incubation
- Prodromal
- Period of illness
- Period of decline
- Period of Convalescence

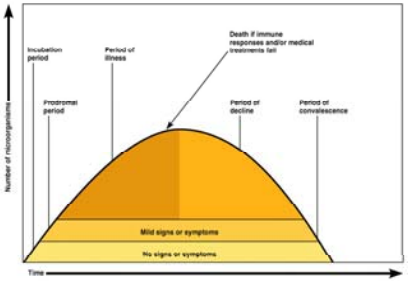

Diagram and describe the five stages of a disease.

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Reservoirs of Infection

- Human
  - Respiratory diseases
  - STI's
  - May have inapparrent infection
- Animal
  - Zoonoses
  - Rabies
  - Tick borne diseases
  - Lyme
  - Plague
- Nonliving
  - Soil
  - Botulism
  - Tetanus

Provide named examples of diseases that have animal and non living reservoirs that allow them to be transmitted to humans periodically.

Slide 18

Transmission of Disease

- Direct Contact
  - Person-to-person
    - Touching
    - Kissing
    - Sex
  - Animal-to-person
- Indirect Contact
  - Fomites
  - Inanimate objects
- Droplet Transmission
  - Droplets travel < 1m
  - Coughing, sneezing, talking

Explain the difference between droplet transmission and airborne transmission.

Describe the role of a fomite in the transmission of a Gastrointestinal virus (Stomach flu), at a day care center. What can be done to limit the spread of infections diseases by fomites?

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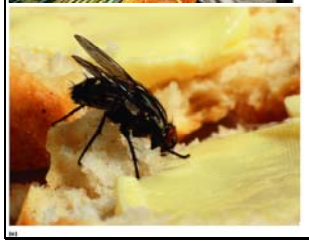
Transmission of Disease



- Vehicle
  - Inanimate reservoir
  - Food or water
  - Airborne transmission
- Vector
- Fleas, ticks, and mosquitoes
  - Mechanical
    - Passive – fly's foot pad
  - Biological
    - Pathogen reproduce inarthropods
    - Injected from salivary glands

Explain the difference between vehicle transmission of a disease and vector transmission of a disease

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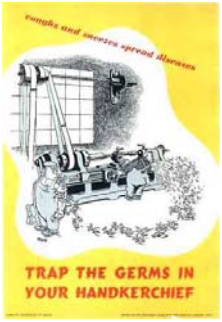
Coughs and Sneezes Spread Diseases

- Public Health Campaign aimed at TB 1950's
- Respiratory tract
  - Coughing, sneezing



Coughs and Sneezes Spread Diseases; explain how, and from the microbes point of view why?

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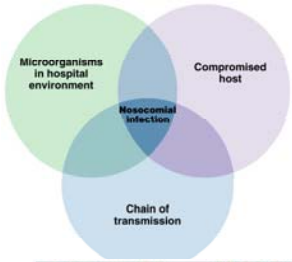
Nosocomial Infections

- Hospital Acquired
- 5-15% of all hospital patients acquire nosocomial infections



What factors contribute to the transmission of nosocomial infections.

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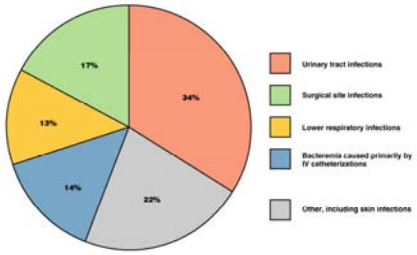
Relative frequency of Nosocomial infections



What factors contribute to the transmission of nosocomial infections.

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The Usual Suspects

	Percentage of nosocomial infections	Percentage resistant to antibiotics
Gram + cocci	34%	28%-87%
Gram – rods	32%	3-34%
Clostridium difficile	17%	
Fungi	10%	

What factors contribute to the transmission of nosocomial infections?

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2006 E.coli O157:H7

- Case Reporting
- E.coli O157:H7 notifiable disease
- Increase in incidence 2006
- Collect data
- Infective pathogen compared
- DNA fingerprinting established diseases caused by same strain of E.coli
- Common Source

To find cases in an outbreak of *E. coli* O157 infections, public health laboratories perform a kind of "DNA fingerprinting" on *E. coli* O157 laboratory samples. Investigators determine whether the "DNA fingerprint" pattern of *E. coli* O157 bacteria from one patient is the same as that from other patients in the outbreak Bacteria with the same "DNA fingerprint" are likely to come from the same source.

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Identifying Common Source

- Case by case analysis
- Monitoring of suspected cases
- Establish common link
- Uncooked spinach
- Match E.coli strain in spinach to outbreak
- Recommendations

Public health officials conduct intensive investigations, including interviews with ill people, to determine if people whose infecting bacteria match by "DNA fingerprinting" are part of a common source outbreak.

The time from the beginning of the patient's illness to the confirmation that he or she was part of an outbreak is typically about 2-3 weeks. The average for cases in this outbreak so far has been 15 days. Case counts in the midst of an outbreak investigation must be interpreted within this context.
E. coli O157 was isolated from 11 packages of spinach supplied by patients living in 9 states. All packages were marketed as baby spinach and labeled with the same brand name. The "DNA fingerprints" of all 11 of these *E. coli* match that of the outbreak strain.

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Locating Source of Infection

- Stop current outbreak
- Establish new regulations to prevent similar future outbreaks
- Cattle Ranch 1 mile from fields

All of the contaminated spinach responsible for an E. coli outbreak that spread to half the country can be traced to the Natural Selection Foods processing center in San Juan Batista, FDA officials said today.
“Spinach processed by other manufacturers has not been implicated in the outbreak,” said Dr. David Acheson with the Food and Drug Administration’s Center for Food Safety and Applied Nutrition.

Although FDA investigators have narrowed their search to one specific company and its processing center, the exact source of contamination in the production chain still has not been isolated.

On Thursday, the company vowed to establish new testing procedures, and announced plans to personally contact all those sickened from their product and will reimburse them for out of pocket medical expenses.

Company Chief Executive Officer Charles Sweat said that Food and Drug Administration testing has shown that Natural Selection's processing plants are currently free from E. coli contamination. He said tests by an independent lab hired by the company were also clean.
E. Coli-157 has been found in five of the company's packages in four states: Nevada, New Mexico, Utah and Pennsylvania, but the source hasn't been found.

Investigators still do not know how the feces could have contaminated the spinach implicated in the bacterial outbreak. They also do not know whether the ranch used manure from the cattle to fertilize its fields. Nor is there evidence that livestock entered the spinach fields on the ranch. However, wild pigs roamed the property, they said.
"There's lots of wildlife and lots of potential for breakdown in the fencing," Reilly told reporters.
The strain of pathogenic E. coli O157:H7 was found in three cattle fecal samples collected at the ranch, one of four under investigation, the officials said. It matched the strain found in sick patients and in bags of recalled spinach.