Disease Detectives Key

Created by SOnerd for the 2015 SSSS.

Section 1- Vocabulary

Define the following words:

1. Cluster- An aggregation of cases over a particular period closely grouped in time and space.
2. Contagious- Capable of being transmitted from one person to another by contact or close proximity
3. Etiology- The scientific study of the origin or cause of a disease.
4. Hyperendemic- A disease that is constantly present at a high incidence and/or prevalence rate and affects all age groups equally (similar to an endemic, but the disease is present at higher levels)
5. Index Case- The first known case of a disease in an outbreak.
6. Susceptible Host- A person who cannot resist a microorganism invading the body, multiplying, and resulting in infection.
7. Vaccine- A biological preparation that provides active acquired immunity to a particular disease.
8. Zoonosis- An infectious disease that is transmissible from animals to humans. (ex. mad cow disease, West Nile virus; Rocky Mountain spotted fever, rabies)

Compare/Contrast

*Teams are not required to provide definitions for each word, but they must explain how they are different. *

Group 1-

Epidemic, Pandemic, and Outbreak

Definitions: (not required, but can help in explaining differences)

- **Epidemic** - Large numbers of people over a wide geographical area are affected; The occurrence of more cases of disease, injury, or other health condition than expected in a wide area or among a large group of persons during a particular period
- **Outbreak** – (localized epidemic) more cases of a particular disease than expected in a given area or among a specialized group of people over a particular period of Time.
- **Pandemic** -An epidemic occurring over a very wide area (several countries or continents) and usually affecting a large proportion of the population; When an epidemic spreads throughout the world

Differences: (required)

- The term "**outbreak**" simply refers to the presence of more cases than expected of a certain disease in a group of people. An **epidemic** is a larger **outbreak**, it is spread across a wide geographical area and larger numbers of people are affected. A **pandemic** is a larger **epidemic** in which people across the entire world can be affected.
- If you were to rank them by "size" from smallest to largest, it would be: **outbreak, epidemic, pandemic.**

Group 2-

Fomite, Vector, and Vehicle

Definitions: (not required, but can help in explaining differences)

- **Vector**- An animate intermediary in the indirect transmission of an agent that carries the agent from a reservoir to a susceptible host

- **Vehicle**- Objects such as food, water, biological products(e.g. blood) and fomites (see above) that may indirectly transmit an infectious agent from a reservoir to a host
- **Fomite** - A physical object that serves to transmit an infectious agent from person to person. (ex. comb with lice)

Differences: (required)

- **Vectors** differ from **vehicles** and **fomites** because they are living (Vector = Living; Fomite and Vehicle: Non-living)
- A **fomite** serves to transmit an infectious agent from person to person, while a **vehicle** is an object (food, water, blood, etc) that may indirectly transmit an infectious agent from a *reservoir to a host*
- All **fomites** are **vehicles**, but not all **vehicles** are **fomites**.

Group 3-

Epidemic Curve, Line Listing

Definitions: (not required, but can help in explaining differences)

- **Line listing**- a type of epidemiologic database, organized similar to a spreadsheet with rows and columns in which information from cases or patients are listed each column represents a variable, and each row represents an individual case or patient
- **Epidemic Curve**- A histogram that shows the course of a disease outbreak by plotting the number of cases by Time of onset

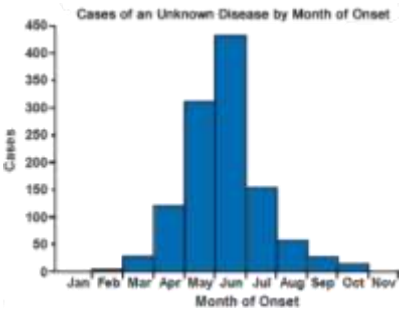
Differences: (required)

- Main difference- **Epidemic Curves** are graphs, while **Line Listings** are spreadsheet-like.
- **Line Listings** show data from individual patients, **Epidemic Curves** don't
- **Epidemic Curves** give a better general overview of outbreak, while **Line Listings** show individual cases of disease
- Teams may have chosen to draw diagrams for this section. This is acceptable, as long as the diagrams are clear and well-explained. They could look something like this:

Line Listing:

ID	Initials	Date Onset	Diagnosis	How Confirmed	Age	Sex	County	Physician	Cleveland - McKay Bedding
1	KR	7/23	probable trichinosis	not done	29	m	Columbia	Goodman	Yes
2	DM	7/27	trichinosis	biopsy	33	m	Columbia	Baker	Yes
3	JG	8/14	probable trichinosis	not done	26	m	Columbia	Gibbs	Yes
4	RD	7/25	trichinosis	serologia	45	m	King	Webster	Yes
5	NT	8/4	trichinosis	not done	27	f	Columbia	Stanley	Yes
6	AM	8/11	R/O trichinosis	pending	54	f	Clayton	Mason	Yes

Epidemic Curve:



Group 4-

Symptom, Sign

Definitions: (not required, but can help in explaining differences)

- **Sign**- an indicator of a disease that are observable by a doctor
- **Symptom**- any indication of disease noticed or felt by a patient

Differences: (required)

- **Symptoms** are felt by patient, they are subjective
- **Signs** are observable by others
- Example of a **symptom**- headache, nausea, excessive hunger or thirst
- Example of a **sign**- welts on skin, discoloration of skin, rashes, runny nose

Group 5-

Quarantine, Isolation

Definitions: (not required, but can help in explaining differences)

- **Isolation**- the separation of ILL persons to prevent transmission to susceptible ones.
- **Quarantine**- the separation of WELL persons who have been exposed or are suspected to have been exposed to a communicable disease, to monitor for illness and to prevent potential transmission of infection to susceptible persons during the incubation period. Quarantine refers to separation of potentially exposed but well persons

Differences: (required)

- If people who are well, but suspected to have been exposed, are separated, it is referred to as **quarantine**
- If people who are confirmed to be infected are separated, it is referred to as **isolation**

Complete the following sentences with the most logical vocabulary word:

1) A (n) carrier is a person or animal without apparent symptoms of disease who harbors an infectious agent and can transmit it to others.
2) After becoming infected with Ebola, Sammy did not show signs or symptoms of the disease until about 21 days later. This period of time is known as the disease's incubation period.
3) A(n) antibody is any substance that is recognized as foreign by the human body and triggers the production of antibodies.
4) A(n) antigen is any variety of proteins in the blood that are produced in response to an antigen.
5) If a disease is constantly present in a given population, it is considered to be endemic.
6) Much like how rapid population growth can cause an epidemic in humans, it can cause a(n) epizootic in animals.
7) The three forms of plague are bubonic, septicemic, and pneumonic.
8) A(n) determinant is any factor that brings about change in a health condition or in other defined characteristics.

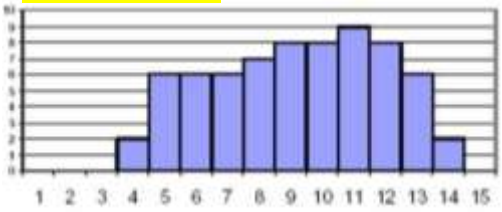
Match the following terms with their characteristics:

Pairs-
A goes with 3
B goes with 7
C goes with 8
D goes with 4
E goes with 1
F goes with 6
G goes with 2
H goes with 5
I goes with 9

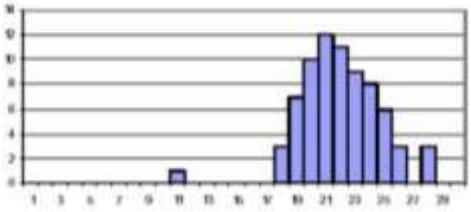
Part 1- Graph

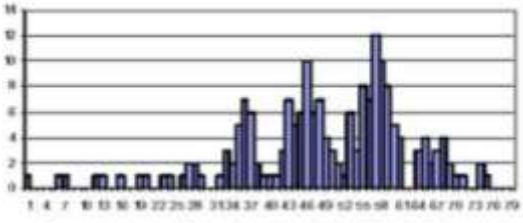
1. In Epidemiology, this type of graph is known as a(n) epidemic curve.
2. The y-axis of this graph tells you the number of cases.
3. The x-axis of this graph tells you the date of symptom onset.
4. Which of the following is an appropriate title for this type of graph?
   A) Outbreak of Disease in New York City
   B) Cholera Cases by Date of Onset in New York City, January 2000-December 2000
   C) Cholera Spread Patterns
   D) Diseases in New York City from January 2000 to December 2000
5. Point source, Propagated, Common Source
6. Three graphs are shown. Label each one as the correct type. Use your answers to question #5 as a word bank.

Common Source



Point Source





Propagated

7. What are 4 things that this graph can tell you about an outbreak? (Choose 4)
   - The outbreak's time trend, which is the distribution of cases over time
   - Outliers, that is, cases that stand apart from the overall pattern
   - General sense of the illness magnitude
   - Inferences about the outbreak's mode of spread
   - The most likely period of exposure

Part 2- Calculations (Div B only, no C stats)

Create a two-way table based on the following data.

200 total people attended a dinner party. At the party, there was a salad that was suspected to have been the cause of a sudden spread of sickness among party attendees. Of the 200 total people at the party, 137 reported eating the salad. Of those 137 people, 98 became ill. Out of the people who did not eat the salad, only 20 became ill.

	Disease	No Disease	
Exposed (ate salad)	98	39	137
Not Exposed (Didn't eat salad)	20	43	63
	118	82	200

8. Based on your table, calculate the relative risk. 8.36
9. What is the purpose of calculating relative risk, in general?

Relative risk is a calculation used to estimate the extent of the association between an exposure and a disease. It estimates the likelihood of developing the disease in the exposed group compared to the unexposed group.

10. What does a relative risk of greater than one indicate?

A positive association or an increased risk; This risk increases in strength as the magnitude of the relative risk increases.

11. What does a relative risk equal to one indicate?

A RR of less than one indicates that the incidence rates of disease in the exposed group is equal to the incidence rate in unexposed group. Therefore the data does not provide evidence for an association.

12. What type(s) of study design is a relative risk used in? What type(s) of study design is an odds ratio used in?

Relative Risk- cohort; Odds Ratio- cohort and case control

13. What is the formula for calculating odds ratio?

$$\hat{\text{OR}} = \frac{a/b}{c/d} = \frac{ad}{bc}$$

14. How is prevalence calculated? Incidence?
    - **Prevalence**- for one point in time, take the number of people with the disease and divide it by the total population. Then, multiply by 1,000; 10,000; or 100,000 (whichever is most fitting for the population size that you're dealing with)
    - **Incidence**- number of new cases over period of time divided by size of population at risk during period of time, multiplied by 1,000; 10,000; or 100,000 (depending on population size).

15. What is the difference between prevalence and incidence?

    Incidence is the measure of a number of NEW cases of a disease, while **prevalence** is for one point in time.

Section 3- Study Types

Part 1- Fill in the blank

For this section, use this as a word bank:

Case-Control Cohort Cross-Sectional Ecological

1. Cohort is based off exposure status.

2. Cross-Sectional is also known as a survey.
3. Case-Control uses the odds ratio to calculate relevant data.
4. Cohort uses relative risk to quantify the relationship between exposure and disease.
5. Case-Control is based off of disease status.
6. Cohort is used within a small, well-defined population.
7. Case-Control compares groups of people to determine the cause of a disease.

Part 2- Taxonomy of study types

1. What does it mean when a study has **forwards directionality**? **Backwards Directionality**?

   - A study has **forwards directionality** when the exposure status is known (the epidemiologist knows whether or not participants have been exposed), and it needs to be determined whether or not the participants will develop the disease in question.
   - A study has **backwards directionality** when the disease status is known (the epidemiologist knows whether or not the participants have the disease), and it needs to be determined whether or not the participants have been exposed to the exposure in question.

2. Indicate whether the following types of studies have **forward directionality** or **backwards directionality.** (write F or B)
   a. Case-Control B
   b. Randomized Control F
   c. Cohort F

3. What type of data is generally provided by **analytic** studies? **Descriptive** studies?

Analytical studies tell **why** people have the disease and **how** it spreads; **Descriptive studies** tell **who** has the disease, **what** the disease is, **when** the disease was discovered/first identified (etc) , and **where** the outbreak of the disease is occurring

4. Indicate whether the following types of studies are **analytical** or **descriptive**. (write A or D)
   a. Cohort A
   b. Case-Control A
   c. Randomized Control A
   d. Ecological D
   e. Case Report/Series D
5. Descriptive studies are used to generate hypotheses, while analytical studies are used to test hypotheses.
6. What is the difference between a **retrospective study** and a **prospective study**?
   - A **retrospective study** looks backwards and examines exposures to suspected risk or protection factors in relation to an outcome that is established at the start of the study.
   - A **prospective study** watches for outcomes, such as the development of a disease, during the study period and relates this to other factors such as suspected risk or protection factor(s).

7. Indicate whether the following types of studies are **retrospective** or **prospective**. (write R or P)
   a. Cohort Either
   b. Case-Control R
   c. Randomized Control P

Part 3- Pros and Cons of Study Designs

List 2 pros and 2 cons of each study type.

1. Cohort

Pros	Cons
• Good Measure of Exposure; • You can tell causality: • Able to study multiple diseases at once	• Time Consuming; • Expensive; • Not good for diseases that are rare or take a long time to develop; • Loss of follow-up;

2. Ecological

Pros	Cons
• Fast and Cheap; • Use information that is readily available	• Cannot control for effects of confounding factors; • No information on level of exposure; • Ecological Fallacy

3. Cross-Sectional

Pros	Cons
• Fastest; • Least Expensive; • Useful for generating hypotheses; • Useful for public health planning; • Data on all variables is only collected once; • Able to measure prevalence for all factors under investigation; • Multiple outcomes and exposures can be studied;	• Possible Time-Order Confusion; • Least Confidence in Findings; • Provides no info about causality; • Prevalence- incidence Bias; • Unable to measure incidence; • Difficult to determine whether the outcome followed exposure in Time or exposure resulted from the outcome; • Not suitable for studying rare diseases or diseases with a short duration.

4. Case-Control

Pros	Cons
• Can Study Rare diseases; • Relatively Less Expensive; • Relatively Fast; • Lots of different exposures; • Don't need huge sample size;	• Possible Time-Order Confusion • Possible Error in Recalling Past Exposures (Recall bias); • Only can deal with one disease at Time; • Hard to tell causality

Section 4- Epidemiology Practice & General Epidemiology

Part 1- Famous Figures of Epidemiology

A) 8
B) 5
C) 3
D) 9
E) 2
F) 7

G) 1
H) 6
I) 4

Part 2- Miscellaneous

Concisely list the ten steps for controlling an outbreak.

1. Prepare for field work
2. Establish the existence of an outbreak
3. Verify the diagnosis
4. Define and identify cases
5. Describe in terms of time, place, and person triad
6. Develop Hypothesis
7. Evaulate Hypothesis
8. Refine Hypothesis and do additional studies
9. Implement control and preventative measures
10. Communicate findings
11. Relating the 10 Steps to the Scientific Method- Tell which step (just write numbers) from above relates to the following parts of the Scientific Method.
    a. Obtain background information- Steps 1-3
    b. Define the problem- Steps 4-5
    c. Formulate hypothesis- Step 6
    d. Develop a study to test the hypothesis- Step 7
    e. Collect data and observations- Step 7
    f. Evaluate results- Step 7
    g. Determine if a hypothesis is true/modify- Step 8
    h. Formulate conclusions- Step 9
    i. Report results- Step 10
12. Name and define the three characteristics of an agent.
    a. Infectivity- capacity to cause infection in a susceptible host
    b. Pathogenicity- capacity to cause disease in a host
    c. Virulence- severity of disease that the agent causes to host; Having the quality of infectiousness
13. What are Hill's Criteria for Causation used for? Establishing a cause and effect relationship
14. Concisely list all 9 Criteria (1- 3 words is sufficient)
    a. Strength of association
    b. Consistency
    c. Specificity
    d. Alternative Explanations
    e. Temporality
    f. Dose-Response Relationship
    g. Biological Plausibility
    h. Experimental Evidence
    i. Coherence

15. What are Koch's Postulates used for? Identifying the causative relationship for a particular disease
16. Concisely list the 4 Postulates
    a. The microorganism/pathogen must be present in all cases
    b. The pathogen can be isolated from the disease host and grown in pure culture
    c. The pathogen from the pure culture must cause the disease when inoculated into a healthy, susceptible lab animal
    d. The pathogen must be re-isolated from the new host and down to be the same as the originally inoculated pathogen
17. Name the three components of the epidemiological triad. Agent, Host, Environment
18. Name the three components of the chain of transmission triad: Agent, Vector/Fomite, Host
19. What is a case definition?
    - A set of uniformly applied criteria for determining whether a person should be identified as having a particular disease, injury, or other health condition. In epidemiology, particularly for an outbreak investigation, a case definition specifies clinical criteria and details of Time, place, and person.
20. Name the three most important elements of a case definition.

Person, Place, Time

21. Concisely list the six elements of the Chain of Infection.
    a. Infectious Agent
    b. Reservoir
    c. Portal of Exit
    d. Mode of Transmission
    e. Portal of Entry
    f. Susceptible Host

Section 5- Disease Prevention & Modes of Transmission

1. Fill in the table appropriately.

Mode of Transmission	3 Basic Ways to Prevent Spread (not specific to individual diseases)
Droplet Spread	Cover mouth when coughing and sneezing; Wash hands; Use Kleenex; Disinfect commonly touched surfaces frequently
Mosquito-Borne	Use bug spray; Stay away from areas heavily populated by mosquitoes; Cover as much skin as possible with clothes; Frequently take breaks indoors;
Food-Borne	Cook all food thoroughly; Wash surfaces used to prepare food; Wash hands regularly; Keep your fridge and freezer at the correct temperature;
Fecal-Oral	Clean surfaces touched by small children frequently; Make sure children are wearing fresh diapers; Disinfect bathroom surfaces regularly;

2. Define the following types of prevention:
    a. Primary Prevention: early intervention to avoid initial exposure to agent of disease; preventing the process from starting
    b. Secondary Prevention: during the latent stage (when the disease has just begun), process of screening and instituting treatment may prevent progression to symptomatic disease

   a. Tertiary Prevention: during the symptomatic stage (when the patient shows symptoms), intervention may arrest, slow, or reverse the progression of disease
   c. Quaternary Prevention: set of health activities to mitigate or avoid consequences of unnecessary/excessive intervention of the health system. Social credit that legitimizes medical intervention may be damaged if doctors don't prevent unnecessary medical activity and its consequences.

3. Indicate the mode of transmission for each disease:
   a. Anthrax = Direct contact, Contact with a contaminated surface
   b. Brucellosis = contact with infected tissues, blood, urine, vaginal discharges
   c. Mumps = Droplet
   d. Ebola = Direct contact, through droplets
   e. Smallpox = Droplet
   f. Measles = Droplet or direct contact
   g. Chicken Pox = Droplet (coughing or sneezing)

Section 6- Tiebreakers!

Answer as few or as many as you like, these will be used as tiebreakers (first question is first tiebreaker, etc)

1. What are the four types of data collected by epidemiologists?

Demographic, Identification, risk Factors, Clinical disease Data

2. Define:
   a. **Metazoa**- Multicellular animals, many of which are parasites (The same thing as an animal, just a different name)
   b. **Morbidity**- Disease
   c. **Mortality**- Death
   d. **Mycology**- The branch of biology concerned with the study of fungi
   e. **Null Hypothesis**- a general statement or default position that there is no relationship between two measured phenomena
   a. **Herd immunity**- a form of immunity in which the majority of the population is immunized so that those who have not developed immunity can stay protected
   b. **Public Health Surveillance**- the systematic collection, analysis, interpretation, and dissemination of health data to gain knowledge of the pattern of disease occurrence in order to control and prevent disease in the community.
   c. **Infection**- invasion of the body by pathogenic agents
   a. **Histamine**- What the body produces when lymphocytes encounter an allergen
   b. **Contingency Table**- A two-variable table of cross-tabulated data
   c. **Bimodal**- Having two data peaks
   d. **Asymmetrical**- Without symptoms
3. Name factors leading to the emergence of infectious diseases- speed of travel; Global climate change; War and social disruptions; Increase antibiotics in both animals and humans; Animal and human contact