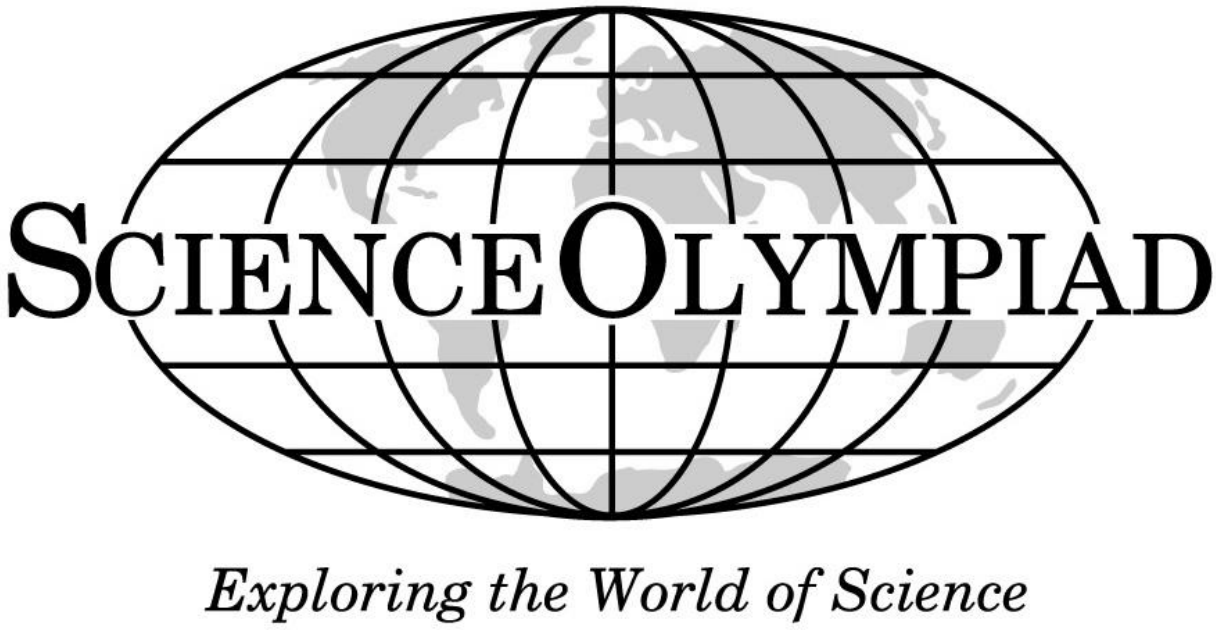
Disease Detectives Test: Rustin Invitational

January 6, 2018

Rustin High School, West Chester, PA



Directions: This is a 40 question test totaling 92 points. High score wins. You will have only 50 minutes allocated in the time block to complete the exam. The event proctor will announce the time that the exam is over. The tiebreakers questions will be used in the event of a tie, and will be assessed in the following order: 15, 16, 12, 18. Good luck!

Total Score: _____/92 Points

Tiebreakers Used, if any: __KEY_____

Rank: _____

Part I. Epidemiological Terms

This section with test your knowledge in the terms used in the field of epidemiology. Match the terminology to the correct definition. Write the answer on the line with the corresponding number. Not all definitions will have a matching term. (1pt each)

1. Carrier	a. an infectious disease that is transmissible from animals to humans
2. Incubation Period	b. 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
3.Epidemic	c. a person or animal without apparent disease who harbors a specific infectious agent and is capable of transmitting the disease to others
4. Fomite	d. the transmission of an agent carried from a reservoir to a susceptible host by droplet or animate or inanimate intermediaries
5. Pandemic	e.an epidemic occurring over a very wide area and usually affecting a large proportion of the population
6. Surveillance	f. an inanimate intermediary that carries the agent from a reservoir to a susceptible host
7. Indirect Transmission	g. large numbers of people over a wide geographic area affected
8. Outbreak	h. the systematic, ongoing collection, analysis, interpretation, and dissemination of health data
9. Host	i. the constant presence of a disease or infectious agent within a given geographic area or population group
10. Endemic	j. a period of subclinical or inapparent pathologic changes following exposure, ending with the onset of symptoms of infectious disease
	k. a person or other living organism that can be infected by an infectious agent under natural conditions
	l. an aggregation of cases of a disease or other health-related condition which are closely grouped in time and space
	m. a physical object that serves to transmit an infectious agent from person to person

1. __C___
2. __J___
3. __G__
4. __M___
5. __E___
6. __H___
7. __D___
8. __B___
9. __K___
10. __I___

Points on this page _____/10

Part II: Using the following data and information, answer questions 11 – 14.

11. Calculate the Attack Rate and Relative Risk for all of the listed food items in the empty boxes in the table below. (21 points. 1 point each box) *accept

Food Item	Ate food item			Attack Rate?	Did not eat food item			Attack Rate?	Relative Risk
	Total	ill	Not Ill		Total	Ill	Not Ill		
Rice	74	46	28	62.16%	26	7	19	26.92%	2.31 (1.2-4.5)
Chapati	86	46	40	53.49%	14	6	8	42.86%	1.25 (0.66-2.36)
Dal	75	41	34	54.67%	25	12	13	48.00%	1.14 (0.72 – 1.81)
Cabbage	59	32	27	54.24%	41	19	22	46.34%	1.17 (.78-1.75)
Potato bitter Gourd	85	51	34	60.00%	15	2	13	13.33%	4.5 (1.22-16.54)
Mutton	8	6	2	75.00%	92	47	45	51.09%	1.47 (.94-2.3)
Milk	32	22	10	68.75%	68	31	37	45.59%	1.51 (1.06-2.14)

12. What is the difference between **Attack Rate, Attributable Risk, and Relative Risk**? (3 points- Tiebreaker #3)

Attack rate is the biostatistical measure of frequency of morbidity, or speed of spread in an at-risk population. Attributable Risk is the difference in rate of a condition between an exposed population and an unexposed population. Relative Risk is the ratio of the probability of an event occurring (for example, developing a disease, being injured) in an exposed group to the probability of the event occurring in a comparison, non-exposed group.

13. Which food item is found to have the highest **attributable risk**? What does that data tell us? (2 points)

The highest Attributable Risk was noted for potato-bitter gourd vegetable. The answer is 46.67% as an attributable risk. The Relative Risk of 4.5 for potato-bitter gourd vegetable indicated that individuals who consumed that food were 4.5 times more likely to have food poisoning than those who did not consume it.

14. What is this type of study known as? (1 points)

A Retrospective-prospective study OR, cohort study are both acceptable answers.

Points on this page _____/27

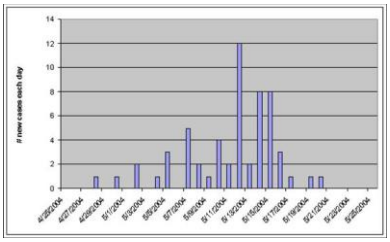
15* (Tiebreaker #1). Explain two advantages and two disadvantages of following study designs: (2pts each, total 16)

Type of Study	Advantages	Disadvantages
Case-Control study	-Can study rare diseases -Relatively less expensive and relatively fast -Is less expensive -Good for long latency periods	-Possible time-order confusion -Error in recalling exposures -Only 1 outcome -Not as good for rare exposures
Cohort Study	-Most accurate observational study -Good measure of exposure -correct time sequence -good for rare exposures -easy risk calculation	-Time consuming -Expensive -Bad for rare diseases -Possible loss of follow-up -Not good for long latency periods.
Cross-Sectional Study	-Fastest -Least expensive -Good for more than one outcome -Good for multiple exposures	-Possible time-order confusion – may not be able to distinguish cause and effect. -Least confidence in findings -Not good for rare or short-lasting diseases
Trial	-Most scientifically sound -best measure of exposure	-Time consuming -Unethical for harmful exposures -Most expensive

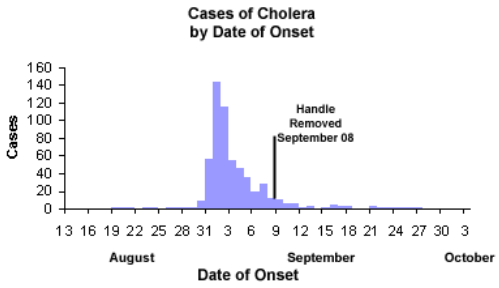
Points on this page _____/16

16*. List, draw, label, and describe three types of epidemic curves. (3pts each, 9 total). (Tiebreaker #2)

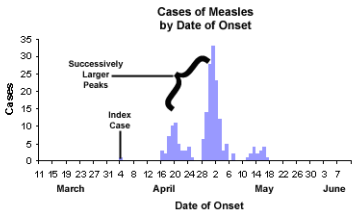
1. POINT SOURCE OUTBREAK INVOLVE A COMMON SOURCE SUCH AS CONTAMINATED FOOD OR AN INFECTED FOOD HANDLER, ALL THE EXPOSURES TEND TO OCCUR IN A RELATIVELY BRIEF PERIOD. ALL THE CASES TEND TO FALL WITHIN ONE INCUBATION PERIOD AND TEND TO HAVE EPIDEMIC CURVES WITH A RAPID INCREASE IN CASES FOLLOWED BY A SOMEWHAT SLOW DECLINE



2. COMMON "CONTINUOUS" SOURCE OUTBREAK WHICH ALSO RISE TO A PEAK AND FALLS BUT CASES DO NOT ALL OCCUR IN THE SPAN OF A SINGLE INCUBATION PERIOD. THIS IMPLIES THERE IS AN ONGOING SOURCE OF CONTAMINATION.
   OR; EXPOSURE TO THE SOURCE IS PROLONGED OVER AN EXTENDED PERIOD OF TIME AND MAY OCCUR OVER MORE THAN ONE INCUBATION PERIOD. THE DOWNSLOPE OF THE CURVE MAY BE VERY SHARP IF THE COMMON SOURCE IS REMOVED OR GRADUAL IF THE OUTBREAK IS ALLOWED TO EXHAUST ITSELF.



3. PROPAGATED (OR PROGRESSIVE SOURCE) OUTBREAK. THESE EPIDEMIC CURVES HAVE A SERIES OF EXCESSIVELY LARGER PEAKS WHICH ARE ONE INCUBATION PERIOD APART. ONE OR MORE OF THE PEOPLE INFECTED SUBSEQUENTLY AFFECT A GROUP OF PEOPLE WHO BECOME THE SECOND WAVE OF INFECTION, THEREBY INDICATING PERSON-TO-PERSON TRANSMISSION



Points on this page _____/9

Part III: Analyzing an Outbreak Using Data

It was a warm summer day in Washington, DC, in the summer of 2017. You were working as a new intern for the Center for Disease Control (CDC) when you received the following information about a food-bourne outbreak suspected to be from *Salmonella* serotype typhimurium.

17. What of the below terms refers to the systematic collection and use of epidemiologic information for the planning, implementation, and assessment of disease control and prevention? (1 point)

a) Epidemiology

b) Investigation

c) Research

d) Surveillance

18. What are the symptoms of *Salmonella*? Describe three symptoms (3 points- Tiebreaker #4)

Nausea, Vomiting, Abdominal Cramps, Diarrhea, Fever, Chills, Headache, Blood in Stool.

19) What two food items are at a high risk of *Salmonella*? (2 points)

Accept any two of the following for full credit: Eggs, Meat, and Poultry.

Points on this page _____/6

Comparison of exposure to raw eggs, tomatoes, milk, 2% milk, and shopping at supermarkets in Chain A or Chain B among persons infected with *Salmonella* serotype typhimurium with that among persons infected with other enteric pathogens.

	Persons infected with *Salmonella* serotype typhimurium		Persons infected with other enteric pathogens		Odds Ratio (95% confidence intervals)
	Exposed	Not Exposed	Exposed	Not Exposed	
Raw Eggs	4	45	9	34	0.3 (0.09 – 1.18)
Tomatoes	43	6	38	5	0.9 (0.2 – 3.3)
Milk	45	4	31	12	4.4 (1.3 – 14.8)
2% Milk	45	4	25	18	8.1 (2.5 – 26.6)
Shopped supermarket in chain A	46	3	29	14	7.4 (2.0 – 28.0)
Shopped supermarket in chain B	26	23	23	20	1.0 (0.4 – 2.2)

20. Based on the results of the above table, what food item is the most likely cause of this outbreak, and where was the food item most likely purchased? (2 points)

2% milk is the most likely cause and it is likely purchased at Supermarket Chain A

21. Which of the below epidemic patterns is illustrated by this outbreak? (1 point)

A) Propagated

B) Continuous Source

C) Point Source

D) Intermittent Source

E) Mixed Source

Points on this page _____/3

Part IV - **Food Poisoning**

Every year, thousands of cases of bacterial food poisoning are reported. In each case, a medical detective is assigned to find out how the person got food poisoning. Once the cause of the food poisoning has been determined, the medical detective can move to correct the conditions that led to the food poisoning.

Two types of bacteria that cause food poisoning are *Salmonella* and *Staphylococci*. A medical detective knows that these bacteria produce very different symptoms. So in order to determine which bacteria is the culprit, the detective will ask a series of important questions. The first thing the detective will want to know is exactly what the patient ate in the 24 hours prior to becoming ill and where the food was eaten. Other important information that the detective will gather includes how long after eating the patient became ill and whether the patient developed a fever. The detective will also want to know if the patient developed chills. Armed with answers to these questions, the detective can determine what caused the food poisoning and which meal contained the tainted food. But how?

The medical detective knows many details about these two types of bacterial food poisoning. For example, *Staphylococci* produce a toxin, or poison, that is secreted into the food source as the bacteria multiply. Once a person eats the tainted food, the toxin will be carried throughout his or her body by the bloodstream. Within a few hours after the food has been ingested, the toxin will usually cause symptoms that include diarrhea, vomiting, nausea, and abdominal cramps. Fortunately, recovery is usually complete 24 to 48 hours after the onset of the symptoms.

Like *Staphylococci*, *Salmonella* produce a toxin. This toxin, however, is contained in the bacteria's cell walls and is released only when the bacteria lyse, or burst. Because of this difference, the symptoms produced by *Salmonella* are somewhat unlike those produced by *Staphylococci*. For instance, it takes longer for a person to feel the effects of *Salmonella*, often 12 hours or more. *Salmonella* infections almost always cause diarrhea. They also generally result in a fever, chills, frequent vomiting, and abdominal pain. It may also take a patient quite a bit longer to recover from a case of *Salmonella* food poisoning.

Now it's time for you to play medical detective. Analyze each case study to determine whether the food poisoning was caused by ***Salmonella* or *Staphylococci***. Support your diagnosis based on the data provided.

22) Case Study 1: A patient with food poisoning reports that he ate his last meal at about 6:00 pm. Although he felt fine the next morning, the patient became very sick at work. Due to severe abdominal pain and vomiting, the patient returned home. The patient also had a fever, chills, and severe diarrhea. He still felt sick the next day and did not fully recover for several days.

Analysis (2 points):

Salmonella- the onset of symptoms was not felt until the following day. The symptoms of abdominal pain and vomiting, and the recovery time is evidence that Salmonella was the cause of the food poisoning.

23) Case Study 2 - You interview a patient who is suffering from food poisoning. However, this patient shows signs of recovery and feels well enough to go back to work. You discover that the last time the patient ate was about 6:00 pm the night before. While watching television later that evening, the patient became ill and had extremely severe abdominal cramps. The patient had a mild case of diarrhea that has subsided. There was no fever.

Analysis (2 points):

The likely cause of food poisoning is ***Staphylococci*** due to the quick onset of symptoms occurring shortly after the last meal. In addition, there was no fever which is typically present with Salmonella cases, and not the Staph.

Points on this page _____/4

Bacterial Diseases

Read the descriptions of various bacterial diseases. For each disease, the bacterial agent is given in *italics*. Then diagnose the bacterial disease of fictitious patients based on the different case histories presented.

Botulism: very dangerous form of food poisoning: *Clostridium botulinum*. Symptoms include headache, weakness, constipation, and nerve paralysis; may cause death if respiratory organs are paralyzed.

Cholera: common in areas where sanitation is very poor: acute and infectious: *Vibrio cholera*. Symptoms include severe diarrhea and vomiting, extreme dehydration, muscle cramps, and prostration.

Diphtheria: highly contagious childhood disease: *Corynebacterium diphtheria*. Symptoms include sore throat, fever, headache, and nausea. A yellowish membrane forms in the throat that restricts breathing.

Gonorrhea: a sexually-transmitted disease that attacks the reproductive system: *Neisseria gonorrhoeae*. Symptoms do not appear immediately and include painful urination, pus discharged from penis or vagina. If untreated, this may result in sterility.

Lobar Pneumonia: inflammation of the lung; leading cause of death in infants and elderly: *Streptococcus pneumonia*. Solidified lung tissue prevents air from entering alveoli.

Scarlet Fever: contagious childhood disease: *Group A beta-hemolytic streptococci*. Symptoms include sore throat, swelling of lymph nodes in neck, bright red rash, nausea, hot dry skin, and a fever.

Tetanus: fatal unless treated: *Clostridium tetani*. Symptoms include lockjaw, muscle spasms, convulsions, stiffness, restlessness, headache, and chills. Bacterial organisms enter body through a puncture wound.

Typhoid Fever: transmitted by contaminated water and food: *Salmonella typhosa*. Symptoms include sore throat, high fever, loss of appetite, diarrhea and constipation, and period of sweating and chills.

Whooping Cough: infectious disease common in children under 10: *Bordetella pertussis*. Symptoms include chills, vomiting, and bluish skin because extreme coughing prevents air from entering the alveoli.

Note: Questions 24 – 40 are 1 point each.

24) _Lobar Pneumonia_____ **Patient A:** 82 years old. Has generally poor health. Has sharp chest pains and blood streaked saliva. High fever and rapid pulse rate. X-Ray confirms solid material in lung tissue.

25) __Scarlet Fever_____ **Patient B:** 6 years old. Mother thought child has a slight cold until a red rash broke out. Child is listless and has a slight fever.

26) __Cholera_____ **Patient C:** Recently traveled to an undeveloped country and unknowingly consumed contaminated food and water. Proper toilet facilities were nonexistent. Exhibits severe muscle cramps dehydration.

27) __Typhoid Fever_____ **Patient D:** Food handler in rural areas where proper toilet facilities are not always available. Exhibits a very high fever and the chills. Blood in his stool.

28) __Gonorrhea___ _____ **Patient E:** 30 years old. Recently discovered a whitish fluid being discharged by penis. Has had sever pain in urination for the last several weeks. Additional tests have shown that inflamed testes have resulted in sterility.

29) __Tetanus_____ **Patient F:** Teenager walking barefoot in a construction area has been punctured with a rusty nail. Several days later he exhibited mild convulsions that rapidly became more severe.

30) __Botulism_____ **Patient G:** Has recently eaten food from a damaged can. Has difficulty in seeing, swallowing, and breathing.

Points on this page _____/7

Part V – Multiple Choice

31) Infection by which of the following does NOT typically cause life-threatening illness?

A) *Salmonella*

B) Clostridium Botulinum

C) Campylobacter jejuni

D) Calciviruses

32) A foodborne illness caused by _____ would be considered an infection.

A) Bacteria

B) Insecticides

C) Mercury

D) Melamine

33) After eating canned corn, Diana suffered severe gastrointestinal illness and muscle paralysis. While being treated at the hospital doctors told Diana that her acute symptoms were likely due to bacterial contamination of the canned corn she had consumed. Which of the following organisms is the most likely culprit for Diana's illness?

A) *Campylobacter jejuni*

B) Salmonella

C) Clostridium botulinum

D) Cryptosporidium parvum

34) Which of the following pathogens is protozoan rather than bacterial or viral?

A) *Clostridium botulinum*

B) Salmonella

C) E- Coli

D) Cryptosporidium parvum

35) Which of the following can be used to inhibit bacterial growth?

A) Dehydration

B) High levels of salt

C) High levels of sugar

D) Low pH

E) All of the above

36) Which of the following agencies is responsible for monitoring domestic and imported meat and poultry?

A) Food and Drug Administration

B) Environmental Protection Agency

C) Food Safety and Inspection Service

D) Bureau of Alcohol, Tobacco, Firearms, and Explosives

37) Which of the following is NOT a safe food handling practice?

A) Storing cooked and fresh meat in the same container

B) Cleaning cutting boards and knives thoroughly after using with fresh meat

C) Prompt refrigeration of fresh and cooked foods in separate containers

D) Thoroughly cooking poultry before eating

38) A physician should be consulted for which of the following symptoms of diarrheal illness?

A) Diarrhea lasting 1 day

B) Temperature of 98 degrees Fahrenheit

C) Blood in stool

D) Upset stomach

39) Which type of agent does NOT enter our bodies through the ingestion of food contaminated with fecal matter?

A) Salmonella

B) E Coli

C) Caliciviruses

D) Campylobacter jejuni

40) Why do so many foodborne illnesses go unreported?

A) Some ill people do not seek medical attention

B) Proper diagnostic tests may not be performed

C) The state does not monitor that particular illness

D) All of the above are reasons

Multiple Choice Total from the last three (3) pages: _____/10