

Science Olympiad
Battle of Valley Forge
January 14, 2017
Disease Detectives
Division C

Names: _____

School: _____
Team Number: _____

Directions: You have *fifty minutes* to complete this exam. Per national guidelines, you are allowed *one 8.5" x 11" sheet of paper* that may contain information on both sides from any source and up to two non-programmable, non-graphing calculators.

Page Number	Points	
2	/24	
3	/16	
4	/22	
5	/13	
6	Case study	
7	/12	
8	/11	
9	/13	

Tie Breakers

I. Investigation Protocol: List the ten steps to be followed to investigate an outbreak. (10 pts.)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

II. Disease Causing Agents: Choose the causative agent of the following diseases. Circle V for virus, B for bacteria, F for fungus, PS for parasites, and Pn for Prion.

(14pts.)

1. Mad-cow Disease	V	B	F	PS	Pn
2. Hepatitis A	V	B	F	PS	Pn
3. E. Coli	V	B	F	PS	Pn
4. Giardia lamblia	V	B	F	PS	Pn
5. MRSA	V	B	F	PS	Pn
6. Salmonella	V	B	F	PS	Pn
7. Athlete's Foot	V	B	F	PS	Pn
8. Shigellosis	V	B	F	PS	Pn
9. Listeriosis	V	B	F	PS	Pn
10. Common Cold	V	B	F	PS	Pn
11. Tinea Corporis	V	B	F	PS	Pn
12. Campylobacter	V	B	F	PS	Pn
13. Cryptosporidium	V	B	F	PS	Pn
14. Toxoplasmosis	V	B	F	PS	Pn

III. **Epidemiological Terms:** Match each term on the left with a definition from the right. (16 pts.) Write the letter choice in the column to the right of the number.

1		case-control	a. a complex of signs and symptoms that tend to occur together and often characterize a disease
2		cluster	b. the pathway by which an infection gets in a host
3		cohort	c. period following exposure when pathogenic changes are not apparent prior to onset of symptoms of the disease
4		surveillance	d. US agency based in Atlanta, GA – slogan 24/7 saving lives, protecting people
5		CDC	e. well-defined group of people who have a common experience or exposure
6		exposure	f. compare people with and without the disease to find common exposures
7		Incidence rate	g. frequency of occurrence of deaths in a defined population during a specific interval of time
8		outbreak	h. the first appearance of signs and symptoms
9		mortality	i. a person or animal that harbors the infectious agent for a disease and can transmit it to others, but does not demonstrate signs of the disease
10		onset	j. relative pathogenicity of an infectious microorganism
11		syndrome	k. the systematic and ongoing collection, analysis, interpretation, and dissemination of health data
12		Portal of entry	l. living things that transmit disease such as insects
13		vector	m. 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
14		carrier	n. A measure of the frequency with which an illness occurs in a population over a period of time.
15		virulence	o. an aggregation of cases over a particular period closely grouped in time and space, regardless of whether the number is more than the expected number
16		latency	p. the process by which an agent comes in contact with an animal or host such that disease ensues

IV. **Modes of Transmission:** Using the following terms explain the mode of transmission for the disease and a possible precaution to prevent that disease. (Airborne(non-contact), Vehicle, Vector-borne, Indirect, Direct, and Droplet(contact) (12pts.)

	Mode	Precaution
1. Chlamydia		
2. Lyme Disease		
3. Tuberculosis		
4. Meningococcus		
5. Rhinovirus		
6. E.Coli (lettuce at Taco Bell)		

V. **Reducing the Risk of Food Borne Illness:** Give the five primary ways to reduce the risk of Food Borne Illness. (5 pts.)

- 1.
- 2.
- 3.
- 4.
- 5.

VI. **Situations and Diseases:** Identify which disease is reflective of the situation. **Sporadic Disease, Endemic Disease, Hyperendemic Disease, Pandemic Disease, Epidemic Disease** (5pts.) (write answer in space)

1. 22 cases of Legionellosis occurred within 3 weeks among residents of a particular neighborhood (usually 1 to 2 per year) _____
2. Average annual incidence was 364 cases of pulmonary tuberculosis per 100,000 population in one area, compared with national average of 134 cases per 100,000 population _____
3. Over 20 million people worldwide died from influenza in 1918-1919 _____
4. Single case of AIDS was diagnosed in the community _____
5. About 100 cases of syphilis are usually reported in this region per week, slightly less than national average _____

VII. **Types of Agents:** Identify the following as Biological (B), Chemical (C) or Physical (P) given the disease and the agent. (7pts.)

Disease	Agent	Type
Lung cancer	Tobacco smoke	
Food poisoning	Salmonella bacteria	
Mesothelioma	Asbestos	
Anthrax	Infected Animal	
Vision Loss	Optical Radiation	
Concussion	Hit by a baseball	
Avian influenza	poultry	

VIII. **Cohort Study:** The table below shows the occurrence of disease among those who were exposed to a suspected risk factor with with occurrence those who were not exposed at a wedding. One hundred and fifty individuals attended a wedding reception. Several people became ill with diarrhea and vomiting between 12 and 48 hours after eating food served at the reception. (6 pts.)

	Ill	Not ill	Total
Ate food at wedding	72	63	135
Did not eat food	2	13	15
Totals	74	76	150

1. Which group is the experimental group for this outbreak? (1pt.)
2. What is the control group for this outbreak?(1pt.)
3. Determine the Attack Rate for the Exposed Group who ate the wedding food.(1pt.)
4. Determine the Attack Rate for the Unexposed Group who did not eat the food. (1pt.)
5. Determine the Relative Risk for this outbreak.(1pt.)
6. Interpret the Results: Explain what the Relative Risk means? (1pt.)

IX: Case Study: Outbreak of food borne *Salmonella* among guests of a wedding ceremony (adapted from J. Family Community Med. 2010 Jan-Apr. 17 (1)29-34)
Background:

Sulyyel is a small town located 400 kilometers to the southwest of Riyadh city and 40 kilometers to the west of the Empty Quarter. It belongs administratively to the Riyadh region and the Riyadh Directorate of Health Affairs. Sulyyel's population is about 30,000. The health services are composed of one general hospital, three primary health care centers, two private clinics, and one private pharmacy.

The wedding ceremony was held on a vacant plot of land surrounded by houses in the eastern area of Sulyyel. The dinner was served in two sittings, first at 10 pm and the second at 2 am in the small hours of the next morning. In the second shift, the left-over-food from the first shift was served along with what had been set aside for the second sitting.

In order to obtain a preliminary idea of the situation, develop the case definition, and design the questionnaire, the investigating team met the Director of the hospital along with the doctors, nurses, and health inspectors involved. The Emergency Department records were reviewed, the admitted patients were interviewed and some of the party guests were met. A preliminary list of patient's names, addresses, telephone numbers and names of treating health facilities was prepared and the active surveillance kept by the hospital was reviewed. In addition, the health care workers at the private clinics and pharmacy were interviewed.

For the purpose of this investigation, a case was defined as "any individual who developed diarrhea with or without abdominal pain, vomiting, and a fever within three days of eating at the wedding ceremony."

Based on the available information, it was decided that a retrospective cohort study to identify food items and other contributing factors to the outbreak be conducted. The groom was requested to provide the list of all the guests who had attended the wedding party to enlist the cohort. As the groom was not cooperative, other patients and guests were traced through the interviewed patients and their families and relatives, and local religious and tribal leaders. The first author interviewed the guests, face to face, using a structured questionnaire that elicited demographic data, symptoms of gastroenteritis, date and time of eating dinner, date and time of onset of symptoms, food items eaten, and history of hospitalization and any recent history of diarrheal illness.

Using an open-ended interview, the first author interviewed the food handlers from the restaurant asking for information about the list of food items prepared at the restaurant, the ingredients, preparation techniques, method of preservation of each food item and job description for each food handler. After that, the level of hygiene of food-handlers was examined and they were checked for open wounds, skin infections and health certificates. The local team had already visited and inspected the general sanitation of the restaurants; as well as the cleanliness of the food preparation site, storage area, and utensils. They had already taken swabs randomly from different sites such as tables, utensils, and refrigerators. Stool cultures were requested for all diarrhea patients, and *Salmonella* isolates were serogrouped at the MOH central laboratory. Rectal swabs were taken from all the nine food handlers and cultured for enteric pathogens including *Salmonella* at the MOH central laboratory.

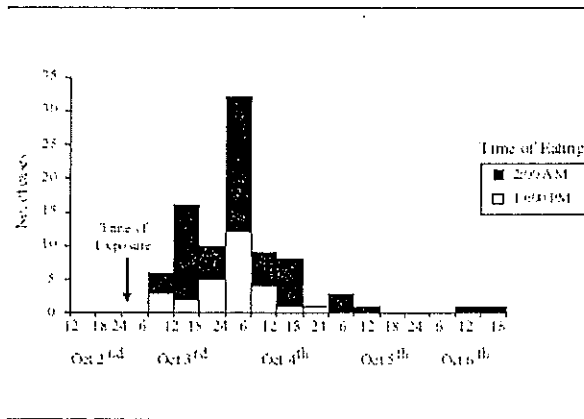
A total of 238 guests were interviewed. Their ages ranged from 2-80. Of those interviewed 126 were female and 112 were male. All persons interviewed ate at the wedding ceremony.

Table 1

Eating practices	Females No. (%)	Males No. (%)	Total
Total number of guests	126 (52.9)	112 (47.1)	238
Time of eating			
10 pm	12 (10.0)	108 (90.0)	120
2 am	114 (96.6)	4 (3.4)	118
Ate left-overs			
Yes	53 (93.0)	4 (7.0)	57
No	73 (40.3)	108 (59.7)	181
Total number of patients	69 (78.4)	19 (21.6)	88
Time of eating			
10 pm	11 (39.3)	17 (80.7)	28
2 am	58 (96.7)	2 (3.3)	60
Ate left-overs			

Table 1: Gender-wise distribution of eating practices and disease status among guests.

1. Of those interviewed what percentage of persons became sick after eating? (1pt.)
2. Of the female patients what was the percentage that ate at 10 pm?(1pt.)
3. Of the female patients what was the percentage that ate at 2 am?(1pt.)
4. Why were more females be eating later than males?(1pt.)



5. What type of epi curve is this: point source, continuous common source, or propagated? Explain why. (2pts.)
6. What is the independent variable? How is it measured? (2pts.)
7. What is the dependent variable? How is it measured? (2pts.)
8. How many cases were present at the peak? (1pt.)
9. When was the onset of the first case? (1pt.)

Table 2

Food Items	Ate the food item		Did not eat the food item		Relative risk
	Ill/Total	Attack rate	Ill/Total	Attack rate	
Meat	67/200	43.5	1/55	2.6	16.7
Rice	67/200	43.5	1/55	2.1	13.5
Restaurant made sweets	46/88	52.3	42/150	28	1.9
Home made sweets	13/30	43.3	75/205	36.1	1.2
Soft drinks	33/69	47.8	55/146	37.7	3.65
Coffee	15/50	30	74/156	47.2	0.3
Tea	12/76	15.8	70/150	47.8	0.3

Attack rates and relative risk for food items served (N=238)

10. What two foods cause the patients to be ill?(2pts.)
11. Based on this why would more people be ill after eating these items at 2 am?(1pt.)

None of the nine restaurant workers had a valid health certificate. All the restaurant workers had *Salmonella* group C non-typhoid in their stool samples. According to the health inspector's report, the food preparation room, the floor and tables were not clean; the ambient temperature was high and there was no air-conditioning. The food preparation room was connected by a backdoor to a toilet at the back of the restaurant. The swabs taken from the restaurant were positive for coliforms. No food consumed during the wedding was available for sampling at the time of inspection.

Based on the interview of the restaurant staff, it was found that the preparation of the food in question started at 1 p.m., on the day of the wedding ceremony. The meat was cut up and cleaned in pots filled with warm water, using bare hands (without gloves). It was then kept in large dishes at room temperature until 4 p.m., when it was boiled in large pots for two hours. At 4 p.m., the rice was washed in deep pots filled with cold water, again using bare hands and was kept in strainers for two hours. At 6 p.m., the meat was put onto large plates, covered with aluminum foil and kept at room temperature for one hour. At the same time, the rice was put into the sauce and cooked for one hour. At 7 p.m., the meat was mixed with rice and kept over very low heat for two hours. At 9 p.m., the food was transported to the site of the wedding in a pickup truck. At 10 p.m., the food was served onto large serving dishes and served initially to the male guests. The remaining food was kept in the large pots and/or on the dishes covered with aluminum foil until 2 a.m., when it was served in the second session along with some of the food left from first sitting, to the female guests without reheating.

12. What food borne illness was present in this study? (1pt.)
13. Who were the asymptomatic carriers in this case? (1pt.)
14. When could the food items have been contaminated? Give two ways. (2pts.)
15. Why can they not determine which of the two foods caused the outbreak? (1pt.)
16. What were the three most important factors that led to this outbreak? (3pts.)

8

ID	Initials	Diarrhea	Fever	Cramps	Symptoms with 2 days	Date of Onset	Laboratory Confirmation
1	AB	yes	no	yes	yes	Oct 5	yes
2	TC	yes	yes	yes	no	Oct. 10	Not done
3	RD	yes	yes	yes	yes	Oct. 5	Pending
4	AE	yes	yes	no	yes	Oct. 6	Pending
5	DF	no	yes	yes	yes	Oct 6	Not Done
6	KB	no	yes	yes	yes	Oct. 5	Yes
7	AH	yes	no	yes	yes	Oct. 5	Not Done
8	TT	yes	yes	yes	yes	Oct. 6	Yes

Using the above information, assign the appropriate case definition classification (confirmed, probable, possible, or not a case) to the individuals below. (8pts.)

- A. AB _____
- B. TC _____
- C. RD _____
- D. AE _____
- E. DF _____
- F. KB _____
- G. AH _____
- H. TT _____

X. Calculations: Mean, Median and Mode

The following individuals are comparing the number of times they have been to the doctor's office in the last year. The following table illustrates how many times each person went each month. (5pts.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bob	1	3	2	5	2	3	1	4	2	3	2	1
John	1	2	1	1	1	3	3	2	2	4	1	2
Lucy	1	3	2	2	1	4	5	3	2	2	1	3
Dolly	2	2	1	1	3	2	4	1	3	2	3	2

1. By comparing modes, which person went to the doctor's the least?
2. By comparing medians, which person went to the doctor's the most?
3. Rank the friends in order of most doctor visits to least doctor visits by comparing means.
4. Which month, by comparing the means of visits, is the most popular month to visit the doctor?
5. By comparing medians, which month is the least popular month?

Tie Breaker Questions:

1. Who was the father of Epidemiology?
2. What were the five biggest outbreaks and pandemics in history?
3. The Cholera Outbreak in 1854 occurred on what street?
4. What was found in Flint, Michigan?

ANSWER KEY

I. Investigation Protocol: List the ten steps to be followed to investigate an outbreak. (10 pts.)

1. Prepare for Field Work
2. Establish the Existence of an Outbreak
3. Verify the Diagnosis
4. Define and Identify Cases
5. Describe and Orient the Data
6. Develop Hypothesis
7. Evaluate Hypothesis
8. Refine Hypotheses and Carry Out Additional Studies
9. Implement Control and Prevention Measures
10. Communicate Findings

II. Disease Causing Agents: Choose the causative agent of the following diseases. Circle V for virus, B for bacteria, F for fungus, PS for parasites, and Pn for Prion. (14pts.)

15. Mad-cow Disease	V	B	F	PS	<u>Pn</u>
16. Hepatitis A	<u>V</u>	B	F	PS	Pn
17. E. Coli	V	<u>B</u>	F	PS	Pn
18. Giardia lamblia	V	B	F	<u>PS</u>	Pn
19. MRSA	V	<u>B</u>	F	PS	Pn
20. Salmonella	V	<u>B</u>	F	PS	Pn
21. Athlete's Foot	V	B	<u>F</u>	PS	Pn
22. Shigellosis	V	<u>B</u>	F	PS	Pn
23. Listeriosis	V	<u>B</u>	F	PS	Pn
24. Common Cold	<u>V</u>	B	F	PS	Pn
25. Tinea Corporis	V	B	<u>F</u>	PS	Pn
26. Campylobacter	V	<u>B</u>	F	PS	Pn
27. Cryptosporidium	V	B	F	<u>PS</u>	Pn
28. Toxoplasmosis	V	B	F	<u>PS</u>	Pn

III. **Epidemiological Terms:** Match each term on the left with a definition from the right. (16 pts.) Write the letter choice in the column to the right of the number.

1	F	case-control	a. a complex of signs and symptoms that tend to occur together and often characterize a disease
2	O	cluster	b.the pathway by which an infection gets in a host
3	E	cohort	c.period following exposure when pathogenic changes are not apparent prior to onset of symptoms of the disease
4	K	surveillance	d. US agency based in Atlanta, GA – slogan 24/7 saving lives, protecting people
5	D.	CDC	e.well-defined group of people who have a common experience or exposure
6	P	exposure	f. compare people with and without the disease to find common exposures
7	N	Incidence rate	g.frequency of occurrence of deaths in a defined population during a specific interval of time
8	M	outbreak	h. the first appearance of signs and symptoms
9	G	mortality	i. a person or animal that harbors the infectious agent for a disease and can transmit it to others, but does not demonstrate signs of the disease
10	H	onset	j.relative pathogenicity of an infectious microorganism
11	A	syndrome	k. the systematic and ongoing collection, analysis, interpretation, and dissemination of health data
12	B	Portal of entry	l. living things that transmit disease such as insects
13	L	vector	m. 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
14	I	carrier	n. A measure of the frequency with which an illness occurs in a population over a period of time.
15	J	virulence	o. an aggregation of cases over a particular period closely grouped in time and space, regardless of whether the number is more than the expected number
16	C	latency	p. the process by which an agent comes in contact with an animal or host such that disease ensues

IV. **Modes of Transmission:** Using the following terms explain the mode of transmission for the disease and a possible precaution to prevent that disease. (Airborne(non-contact), Vehicle, Vector-borne, Indirect, Direct, and Droplet(contact) (12pts.)

	Mode	Precaution
1.Chlamydia	Direct	condoms
2.Lyme Disease	Vector	cover up, wear spray
3.Tuberculosis	Airborne	masks, cover mouth,
4.Meningococcus	Droplet	masks, cover mouth, stand clear
5. Rhinovirus	Indirect	disinfecting areas
6.E.Coli (lettuce at Taco Bell)	Vehicle	don't eat there, rinse lettuce

V. **Reducing the Risk of Food Borne Illness:** Give the five primary ways to reduce the risk of Food Borne Illness. (5 pts.)

1. Keep Clean
2. Separate Raw and Cooked Food
3. Cook Thoroughly
4. Keep Food at Safe Temperatures
5. Use Safe water and raw materials

VI. **Situations and Diseases:** Identify which disease is reflective of the situation. **Sporadic Disease, Endemic Disease, Hyperendemic Disease, Pandemic Disease, Epidemic Disease** (5pts.) (write answer in space)

1. 22 cases of Legionellosis occurred within 3 weeks among residents of a particular neighborhood (usually 1 to 2 per year) -epidemic
2. Average annual incidence was 364 cases of pulmonary tuberculosis per 100,000 population in one area, compared with national average of 134 cases per 100,000 population -hyperendemic
3. Over 20 million people worldwide died from influenza in 1918-1919 -Pandemic
4. Single case of AIDS was diagnosed in the community -Sporadic Disease
5. About 100 cases of syphilis are usually reported in this region per week, slightly less than national average -Endemic

VII. **Types of Agents:** Identify the following as Biological (B), Chemical (C) or Physical (P) given the disease and the agent. (7pts.)

Disease	Agent	Type
Lung cancer	Tobacco smoke	C
Food poisoning	Salmonella bacteria	B
Mesothelioma	Asbestos	C
Anthrax	Infected Animal	B
Vision Loss	Optical Radiation	B
Concussion	Hit by a baseball	P
Avian influenza	poultry	B

VIII. **Cohort Study:** The table below shows the occurrence of disease among those who were exposed to a suspected risk factor with with occurrence those who were not exposed at a wedding. One hundred and fifty individuals attended a wedding reception. Several people became ill with diarrhea and vomiting between 12 and 48 hours after eating food served at the reception.

	Ill	Not ill	Total
Ate food at wedding	72	63	135
Did not eat food	2	13	15
Totals	74	76	150

1. Which group is the experimental group for this outbreak? (1pt.)

Those that ate at the wedding

2. What is the control group for this outbreak?(1pt.)

Those that did not eat the food

3. Determine the Attack Rate for the Exposed Group who ate the wedding food.(1pt.)

$$A / (a+b) = 72/135 \quad 53\%$$

4. Determine the Attack Rate for the Unexposed Group who did not eat the food. (1pt.)

$$C / (c+d) = 2/15 \quad 13\%$$

5. Determine the Relative Risk for this outbreak.(1pt.)

$$a / (a+b) / c / (c+d) \quad 4$$

6. Interpret the Results: Explain what the Relative Risk means? (1pt.)

A person that ate at the wedding was 4 times more likely to get the disease than one that did not eat.

IX: Case Study: Outbreak of food borne *Salmonella* among guests of a wedding ceremony (adapted from J. Family Community Med. 2010 Jan-Apr. 17 (1)29-34)
Background:

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For the purpose of this investigation, a case was defined as "any individual who developed diarrhea with or without abdominal pain, vomiting, and a fever within three days of eating at the wedding ceremony."

Based on the available information, it was decided that a retrospective cohort study to identify food items and other contributing factors to the outbreak be conducted. The groom was requested to provide the list of all the guests who had attended the wedding party to enlist the cohort. As the groom was not cooperative, other patients and guests were traced through the interviewed patients and their families and relatives, and local religious and tribal leaders. The first author interviewed the guests, face to face, using a structured questionnaire that elicited demographic data, symptoms of gastroenteritis, date and time of eating dinner, date and time of onset of symptoms, food items eaten, and history of hospitalization and any recent history of diarrheal illness.

Using an open-ended interview, the first author interviewed the food handlers from the restaurant asking for information about the list of food items prepared at the restaurant, the ingredients, preparation techniques, method of preservation of each food item and job description for each food handler. After that, the level of hygiene of food-handlers was examined and they were checked for open wounds, skin infections and health certificates. The local team had already visited and inspected the general sanitation of the restaurants; as well as the cleanliness of the food preparation site, storage area, and utensils. They had already taken swabs randomly from different sites such as tables, utensils, and refrigerators. Stool cultures were requested for all diarrhea patients, and *Salmonella* isolates were serogrouped at the MOH central laboratory. Rectal swabs were taken from all the nine food handlers and cultured for enteric pathogens including *Salmonella* at the MOH central laboratory.

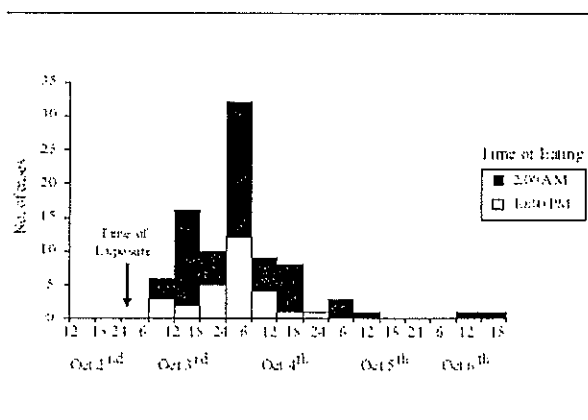
A total of 238 guests were interviewed. Their ages ranged from 2-80. Of those interviewed 126 were female and 112 were male. All persons interviewed ate at the wedding ceremony.

Table 1

Eating practices	Females No. (%)	Males No. (%)	Total
Total number of guests	126 (52.9)	112 (47.1)	238
Time of eating			
10 pm	12 (10.0)	108 (90.0)	120
2 am	114 (96.6)	4 (3.4)	118
Ate left-overs			
Yes	53 (93.0)	4 (7.0)	57
No	73 (40.3)	108 (59.7)	181
Total number of patients	69 (73.4)	19 (21.6)	88
Time of eating			
10 pm	11 (39.3)	17 (80.7)	28
2 am	58 (96.7)	2 (3.3)	60
Ate left-overs			

Table 1: Gender-wise distribution of eating practices and disease status among guests.

- Of those interviewed what percentage of persons became sick after eating? (1pt.)
37%
- Of the female patients what was the percentage that ate at 10 pm?(1pt.)
39.3 %
- Of the female patients what was the percentage that ate at 2 am?(1pt.)
96.7%
- Why were more females eating later than males?(1pt.)
Cultural difference where males eat before the females



- What type of epi curve is this: point source, continuous common source, or propagated? Explain why. (2pts.)
point source because it has a high spike than goes down
- What is the independent variable? How is it measured? (2pts.)
Dates of symptoms, time of exposure
- What is the dependent variable? How is it measured? (2pts.)
No of cases, in numbers
- How many cases were present at the peak? (1pt.)
About 32 or 33
- When was the onset of the first case? (1pt.)
6am on October 3rd

Table 2

Food items	Ate the food item		Did not eat the food item		Relative risk
	Ill/Total	Attack rate	Ill/Total	Attack rate	
Meat	87/260	43.1	1/30	3.0	16.7
Rice	67/190	43.2	1/32	3.1	13.8
Restaurant made sweets	4/28	14.3	4/150	2.7	1.9
Home made sweets	13/20	43.2	75/268	30.1	1.2
Salt chives	3/10	30.0	55/146	37.7	0.8
Coffee	15/20	75.0	7/150	4.7	0.4
Tea	12/25	48.0	70/150	47.3	0.3

Attack rates and relative risk for food items served (N=238)

10. What two foods cause the patients to be ill?(2pts.)

Meat and rice

11. Based on this why would more people be ill after eating these items at 2 am?(1pt.)

Food was not kept correctly

None of the nine restaurant workers had a valid health certificate. All the restaurant workers had *Salmonella* group C non-typhoid in their stool samples. According to the health inspector's report, the food preparation room, the floor and tables were not clean; the ambient temperature was high and there was no air-conditioning. The food preparation room was connected by a backdoor to a toilet at the back of the restaurant. The swabs taken from the restaurant were positive for coliforms. No food consumed during the wedding was available for sampling at the time of inspection.

Based on the interview of the restaurant staff, it was found that the preparation of the food in question started at 1 p.m., on the day of the wedding ceremony. The meat was cut up and cleaned in pots filled with warm water, using bare hands (without gloves). It was then kept in large dishes at room temperature until 4 p.m., when it was boiled in large pots for two hours. At 4 p.m., the rice was washed in deep pots filled with cold water, again using bare hands and was kept in strainers for two hours. At 6 p.m., the meat was put onto large plates, covered with aluminum foil and kept at room temperature for one hour. At the same time, the rice was put into the sauce and cooked for one hour. At 7 p.m., the meat was mixed with rice and kept over very low heat for two hours. At 9 p.m., the food was transported to the site of the wedding in a pickup truck. At 10 p.m., the food was served onto large serving dishes and served initially to the male guests. The remaining food was kept in the large pots and/or on the dishes covered with aluminum foil until 2 a.m., when it was served in the second session along with some of the food left from first sitting, to the female guests without reheating.

12. What food borne illness was present in this study? (1pt.)

Salmonella

13. Who were the asymptomatic carriers in this case? (1pt.)

Food Handlers

14. When could the food items have been contaminated? Give two ways. (2pts.)

Preparation, transporting, and serving

15. Why can they not determine which of the two foods caused the outbreak? (1pt.)

Eaten together

16. What were the three most important factors that led to this outbreak? (3pts.)

Non-adherence to temperature regulation, inadequate heating practices, and unhygienic handling

ID	Initials	Diarrhea	Fever	Cramps	Symptoms with 2 days	Date of Onset	Laboratory Confirmation
1	AB	yes	no	yes	yes	Oct 5	yes
2	TC	yes	yes	yes	no	Oct. 10	Not done
3	RD	yes	yes	yes	yes	Oct. 5	Pending
4	AE	yes	yes	no	yes	Oct. 6	Pending
5	DF	no	yes	yes	yes	Oct 6	Not Done
6	KB	no	yes	yes	yes	Oct. 5	Yes
7	AH	yes	no	yes	yes	Oct. 5	Not Done
8	TT	yes	yes	yes	yes	Oct. 6	Yes

Using the above information, assign the appropriate case definition classification (confirmed, probable, possible, or not a case) to the individuals below. (8pts.)

- a. AB confirmed
- b. TC not a case
- c. RD probable
- d. AE possible
- e. DF possible
- f. KB not a case
- g. AH possible
- h. TT confirmed

X. Calculations: Mean, Median and Mode (5pts.)

1. John
2. They all went the same.
3. Bob and Lucy, Dolly, and John
4. July
5. January

Tie Breaker Questions:

1. Who was the father of Epidemiology? **John Snow**
2. What were the five biggest outbreaks and pandemics in history? **Black Death "The Plague", 1918 The Spanish Flu, HIV/AIDS, The Plague of Justinian, The Antonine Plague**
3. The Cholera Outbreak in 1854 occurred on what street? **Broad Street**
4. What was found in Flint, Michigan? **Lead in water**