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Disease Detectives Test  
North Shore Country Day School Invitational  
(80 points total)

**Part One: 1-20 Select the best answers for each question, circle the correct answer (1 point each)**

1. An infectious disease is a disease that
  - a. is caught because the weather turns cold.
  - b. is caused by pathogens.
  - c. can be spread only by bacteria.
  - d. cannot be cured.
  
2. How are colds and flu usually spread?
  - a. by cold weather
  - b. through an animal bite
  - c. from pathogens that live naturally in soil
  - d. by direct or indirect contact with infected persons
  
3. How do breathing passages help keep pathogens out of the body?
  - a. Chemicals kill some pathogens.
  - b. Mucus and cilia trap pathogens.
  - c. Phagocytes in the breathing passages destroy pathogens.
  - d. They produce antibodies that kill pathogens.
  
4. A cut in the skin can lead to an infection because
  - a. it interferes with the immune system's ability to fight disease.
  - b. it allows pathogens to get into the body.
  - c. the cut destroys the cilia that remove bacteria.
  - d. the cut kills phagocytes.
  
5. What type of white blood cells are part of the inflammatory response?
  - a. Phagocytes
  - b. B cells
  - c. T cells
  - d. Cilia
  
6. The inflammatory response is called a general defense because
  - a. it responds in the same way to any kind of pathogen.
  - b. all the organ systems of the body are involved in it.
  - c. it kills every pathogen that gets into the body.
  - d. it is more effective than any of the body's other responses to disease.
  
7. Antibodies destroy pathogens by
  - a. infecting T cells.
  - b. breaking the cell membranes of pathogens.
  - c. binding to antigens on the pathogens.
  - d. destroying phagocytes.
  
8. Immunity is the body's ability to
  - a. distinguish pathogens from one another.
  - b. destroy pathogens before they can cause disease.
  - c. fight disease with the inflammation response.
  - d. produce antigens.

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9. Passive immunity is different from active immunity because passive immunity
  - a. does not protect a person from disease.
  - b. protects a person from many different diseases.
  - c. lasts a long time.
  - d. involves antibodies that have not been produced by the body of the immunized person.
  
10. Newborn babies have passive immunity to many diseases because
  - a. babies' T cells are more active than those of adults.
  - b. babies are given antibiotics immediately after birth.
  - c. babies are vaccinated immediately after birth.
  - d. babies have antibodies that were produced by their mothers' bodies.
  
11. A chemical that kills bacteria or slows their growth is called a(n)
  - a. antibody.
  - b. antibiotic.
  - c. aspirin.
  - d. decongestant.
  
12. A disorder in which the immune system is overly sensitive to a substance not normally found in the body is called
  - a. a carcinogen.
  - b. an antibody.
  - c. an allergy.
  - d. diabetes.
  
13. What does the body produce when lymphocytes encounter an allergen?
  - a. Carcinogens
  - b. Histamine
  - c. Insulin
  - d. Tumors
  
14. In which disease do a person's body cells multiply uncontrollably?
  - a. Cancer
  - b. Asthma
  - c. Diabetes
  - d. AIDS
  
15. Which kind of pathogen causes athlete's foot?
  - a. Bacteria
  - b. Viruses
  - c. Protists
  - d. Fungi
  
16. Which of the following is NOT part of the inflammatory response?
  - a. White blood cells destroy pathogens.
  - b. Chemicals may cause a fever.
  - c. Swelling increases blood flow to the infected area.
  - d. Antibodies are produced.

17. Substances that can cause cancer are called
  - a. carcinogens.
  - b. histamines.
  - c. asthma.
  - d. tumors.
  
18. The molecules on pathogens that enable the immune system to distinguish one kind of pathogen from another are called
  - a. T molecules.
  - b. B molecules.
  - c. antigens.
  - d. antibodies.
  
19. How does HIV damage the immune system?
  - a. by destroying T cells
  - b. by destroying B cells
  - c. by damaging antibodies
  - d. by delaying the inflammation response
  
20. When a person's own immune system produces antibodies in response to the presence of a pathogen, that person has
  - a. an allergic reaction.
  - b. passive immunity.
  - c. active immunity.
  - d. an antibiotic.

**Part Two: Asthma cases in Southern Illinois**

Questions 21-26 refer to a study of 3535 children at 12 daycare centers in southern Illinois with no previous history of asthma conducted over a period of three years. In each community, a monitoring station was set up to measure concentrations of ozone, nitrogen dioxide, and small particulates in the air. The communities were then divided into two categories on the basis of their overall levels of air pollution. Data was also collected on amount of time children spent outdoors.

Asthma: number of cases					
Hours outside	High Pollution		Low pollution		Total
	Asthma	No	Asthma	No	
0 hours	2	578	3	444	1027
1-2 hours	4	621	4	591	1220
3 or more hours	6	537	5	740	1288
Total	12	1736	12	1775	3535

21. Name the type of study conducted here. How do you know? (2)

22. Name two advantages and two disadvantages of this type of study (4).
23. Would this data support the contention that ozone pollution significantly increases risk of asthma? Explain. (2)
24. Among those in the high pollution zone, what is the impact of outdoor time on incidence of asthma? Explain, be specific, and show work (3).
25. Among those in the low pollution zone, what is the impact of outdoor time on incidence of asthma? Explain, be specific, and show work (3).
26. Suggest a possible explanation for your finding in question 24. (1)
27. What are two possible variables that are not controlled for this study? (2)
- Tiebreaker #1: Calculate the relative risk in the high pollution zone of 1-2 outdoor hours and 3 or more hours, using 0 sports as your baseline (3 points)

**Part 3: Incidence of Influenza**

Questions 28-32 relate to a study conducted by Mr. Gibbs at Rydell High to investigate the possible impact of wearing coats during the winter months on the incidence of influenza among the student population. To this end, he collected data on coat wearing habits from students who had come down with the flu in the preceding 30 days, and also from a number of students who had not come down with the flu but were otherwise similar in income, ethnicity, age, and place of residence. The following table summarizes his data:

	Students with Flu	Students without Flu	Total
Wears coat	47	50	97
Does not wear coat	65	56	111
Total	102	106	208

28. Name the type of study conducted by Mr. Gibbs. How do you know? (2)
29. Name two advantages and two disadvantages of this type of study.(4)
30. Besides wearing coats, what are three other reasons that could have effected this data? (3)
31. Calculate the odds ratio of contracting flu for Non-coat wearers as opposed to coat wearers. Show work. (2)
32. Mr. Gibbs contends that wearing your coat protects against the influenza virus. Does the data support this? Explain. (2)

Tiebreaker #2: Explain the difference between prevalence and incidence.(2)

**Part Four: Food Poisoning – Questions 33 – 49 (one point each)**

In the early 1990s, “1,364 children became ill out of a total of 5,824 who had eaten lunch served at 16 elementary schools in Louisiana. The lunches were prepared in a central kitchen and transported to the schools by truck. Epidemiological studies revealed that 95% of the children who became ill had eaten a Salisbury steak. The afternoon of the day preceding the lunch, frozen steaks were boiled for 3 hours. After cooking, the steaks were cooled to room temperature with a fan and placed into 12-inch-deep aluminum pans and stored overnight in a walk-in refrigerator at 42°-45°F. The following morning, the remaining ingredients were added. The food was placed in thermal containers and transported to the various schools at 9:30 AM to 10:30 AM. It was then kept at room temperature until served between 11:30 AM and noon. Bacteriological examination of the Salisbury steak revealed the presence of large numbers of *Staphylococcus aureus*.

Contamination of the steak probably occurred when it was cooled. The chicken was not cooled rapidly enough because it was stored in 12-inch-deep layers. Growth of the staphylococcus probably also occurred after delivery to the schools during the period when the food was kept in the warm classrooms. Prevention of this incident would have involved screening the individuals who transferred the steaks for carriers of the staphylococcus, more rapid cooling of the steak, and adequate refrigeration of the steak from the time of preparation to its consumption.” It is thought that Staphylococcal food poisoning is caused by eating the enterotoxins that some strains of staphylococcus aureus produce. Staphylococci are present in the nasal passages of at least 50% of all healthy individuals. But not all such individuals pass on disease to others. Growth of the bacteria and production of the toxin need to occur. This usually happens in foods that are not kept cold enough or hot enough.

33. What was the absolute risk in % of becoming ill in this outbreak?
- 10.9%
  - 33.4%
  - 50.5%
  - 23.4%
34. If the illness was indeed due to ingestion of Salisbury steak contaminated with staphylococcus, then how can you explain that only 95% of children who became ill had eaten it?
- they could have had another illness
  - they could have forgotten that they ate the steak
  - their food could have been contaminated by the salisbury steak
  - a, b, and c are all correct
35. What type of epidemiological study was used to gather the information above?
- retrospective
  - double-blind
  - prospective
  - randomized
36. If a randomized, controlled, prospective, double blind study is the best for the least biased method of study, then why shouldn't you do one of those to study food poisoning attack rates?
- too costly
  - unethical because you would have to infect people with Staphylococcal toxin or other agents
  - too time consuming
  - too difficult because there are so many different types of food poisoning

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37. Would isolating these children from their siblings for 3 days be important to help prevent the siblings from contracting the illness?

- a. yes
- b. no, because the children are contagious for 2 weeks
- c. no, because only people who directly ingest the toxin will get sick
- d. no, because isolation never works

38. What was the approximate relative risk of a brown bagger (someone who brings his/her lunch to school) getting sick that day with similar symptoms?

- a. 2
- b. 10
- c. difficult to know exactly unless you find out how many brown baggers there were that day and if any of them got sick
- d. 1

39. The detailed description of food handling in this scenario was

- a. tedious and of no use in understanding the outbreak
- b. important in defining the setting of the outbreak and helping track down the source
- c. evidence of how dangerous all improperly handled meat really is
- d. of some value but not critical to the conclusions of the investigation

40. Food related illness is important because

- a. it causes significant morbidity, even though it does not usually cause mortality
- b. it can be totally eradicated throughout the world
- c. it is always highly contagious
- d. it is usually incurable

41. Because 50% of all healthy individuals harbor Staphylococcus in their nasal passages:

- a. all food handlers should be tested so that they are free of this bacteria
- b. it is critical that school cafeterias adhere strictly to public health regulations
- c. we should expect 50% of those handling food will cause an outbreak like the one in this scenario
- d. we should treat all foods with antibiotics before consumption

42. What was the most definitive finding that confirmed this to be food poisoning?

- a. the fact that 95% of the sick children ate the Salisbury steak
- b. the fact that bacteriologic studies of the Salisbury steak showed Staphylococcus
- c. a and b were both critical
- d. the presence of Staphylococcus in 50% of healthy individuals

43. When handling frozen meat

- a. thawing should be done in a refrigerator
- b. thawing should be done in a warm bath of water overnight
- c. thawing should be done at room temperature over 24 hours
- d. boiling the steak will prevent contamination

### Part Five: Respiratory Illness reported in Florida questions 50-55

**Part I:** A total of 280 persons associated with the National Honors Society (NHS) National Convention in Miami on April 21-24 have been hospitalized with respiratory infections. Onsets of illness were in the period April 22 – March 3; the majority occurred from July 25 to July 31. The infected members were staying at two different hotels in the Miami area. Forty-nine of the infected persons have died. The deaths were primarily due to pneumonia. Local doctors who treated the NHS members isolated a bacterium in a majority of the fatalities similar to the bacterium *Legionellapneumophila*. You are the team of CDC detectives in Miami who received the telephone call from concerned NHS officials and Hotel managers.

**44. In the space provided, give at least three reasons why a Disease Detective should investigate the problem of respiratory illness among NHS convention members? (3 points)**

**45. Is this problem consistent with the definition of an outbreak? If so, why? If not, why not? (3 points)**

After collecting information from the infected and unaffected conventioners you discover the following facts:

- there were a total of 1500 members attending the convention
- 140 infected and 560 unaffected members stayed at Hotel A
- 28 infected and 260 unaffected members stayed at Hotel B
- 56 infected and 202 uninfected members stayed at Hotel C
- 56 infected and 198 uninfected members stayed at Hotel D
- 238 infected members attended the president's banquet on the first evening of the convention
- 610 unaffected members attended the same banquet held in ballroom B at the convention Center
- 84 infected members and 61 unaffected members attended the director's council meeting held in ballroom C at the convention Center
- 274 infected members and 1171 unaffected members attended the science supply display held in the convention center's main display hall

**45. Construct a chart or data table that describes the respiratory problem using the above information. (6 points)**

**46. Which location was most likely to be associated with risk of illness? Why? (2 points)**