DISEASE DETECTIVES TEST DIVISION B

Solon Invitational Science Olympiad

January 31, 2015

TEAM NUMBER:	**SCHOOL NAME:**
STUDENT NAME:	**STUDENT NAME:**

GOOD LUCK!

Section A (General Epidemiology)

Match the person with the description that best fits: (1 point for each correct answer)

1. Father of medicine and first epidemiologist
2. Father of epidemiology
3. Established first nursing school in St. Thomas' hospital in London
4. Because of the health problems that occurred due to this person's hygiene, public health officials realized the importance of keeping track of carriers
5. Advanced exercise, fresh air and healthy diet as health promoting
6. Identified tuberculosis and cholera microorganisms
7. Successfully proved that vaccinations were effective in controlling certain diseases

Hippocrates **John Snow** **Florence Nightingale**
Typhoid Mary **Thomas Sydenham** **Robert Koch** **Louis Pasteur**

8. Being a disease detective means learning a new vocabulary. Write the words from the list below next to their definitions: (1 point for each correct answer)

Attack rate	**Carrier**	**Cluster**	**Cohort**	**Colonized**
Control	**Dendrogram**	**Endemic**	**Epidemic**	**Fomite**
Immunity	**Incidence**	**Nosocomial**	**Morbidity**	**Incubation period**
Outbreak	**Pandemic**	**Prevalence**	**Bar chart**	**Surveillance**

Answer	Definition
a.	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.
b.	The length of time between when someone is infected with a pathogen and when they first show symptoms.
c.	The occurrence of more cases of disease, injury, or other health condition than expected in a small area or among a specific group of persons during a specific period.
d.	The number of cases of a given disease in a given population at a specific point in time.
e.	A well-defined group of persons who have had a common experience or exposure and are then followed up to determine the incidence of new diseases or health events.
f.	The number of new cases in a given population over a specified time period.
g.	The constant presence of a disease or infectious agent within a geographic area or population
h.	A visual display of the size of the different categories of a variable

Choose the one best response for Q 9 to Q 32. (1 point for each correct answer)

9. What kind of study method is used when you generate hypotheses by watching an activity?
   A. Case-control study
   B. Observational study
   C. Galileo method
   D. Dartboard approach

10. A researcher is interested in recording the number of individuals in a particular geographic region who have a common cold at some point during the month of February 2001. Which of the following measures of morbidity would be most appropriate in answering this question?
   A. Point prevalence
   B. Period prevalence
   C. Cumulative incidence
   D. Incidence density

11. A researcher is interested in knowing how many new cases of measles developed at St. Theresa's elementary school in April 2014. Assuming that no children enrolled during that month, and no children moved during that month, which measure of morbidity would be the most appropriate in answering the question?
   A. Prevalence
   B. Point prevalence
   C. Cumulative incidence
   D. Incidence density

12. It is assumed that diseases can be transmitted directly or indirectly. A vector such as a mosquito is an example of
   A. direct disease transmission
   B. indirect disease transmission
   C. single exposure
   D. vehicle exposure

13. The attack rate in susceptible people who have been exposed to a primary case is referred to as
   A. attack rate
   B. post primary attack rate
   C. secondary attack rate
   D. person-to-person attack rate

14. Which of the following is the pathogen for malaria?
   A. Mosquitoes
   B. Plasmodia
   C. Red blood cells
   D. Tse-tse flies

15. Diseases that are due mostly to environmental changes, increased population densities, and pollution that result from modernization in third world nations are referred to as:
   A. Diseases of poverty
   B. Diseases of development
   C. Behavioral diseases
   D. Evolving diseases

16. A useful measure of lethality of an acute infectious disease is:
    A. Attack rate
    B. Incidence rate
    C. Case fatality rate
    D. Mortality rate

17. Case fatality rate is
    A. Ratio
    B. Proportion
    C. Numerator is always constant
    D. Numerator and Denominator are two completely separate entities.

18. Virulence is indicated by
    A. Proportional mortality rate
    B. Specific mortality rates
    C. Case fatality ratio
    D. Morbidity rate

19. All are true about case control studies except
    A. Odds ratio can be calculated
    B. It is less expensive than cross-sectional studies
    C. Suitable for rare diseases
    D. They are backward studies.

20. The indices used to measure variation or dispersion among scores are all except
    A. Range
    B. Variance
    C. Standard deviation
    D. Mean

21. The statistical approach which helps the investigator to decide whether the outcome of the study is a result of factors planned within the design of the study or determined by chance is called
    A. Descriptive statistics
    B. Normal distribution
    C. Inferential statistics
    D. Controlled statistics

22. A type of graphical presentation of data used to explain correlation between dependent and independent variable is
    A. Histogram
    B. Frequency curve
    C. Frequency polygon
    D. Scatter plot

23. A systematic method for continuous monitoring of diseases in a population in order to be able to detect change in disease patterns and then to control them is
    A. Conditional probability
    B. Screening
    C. Prevalence
    D. Surveillance

24. In epidemiological research, if Relative Risk > 1.00 then the group exposed to the suspected risk factor
    A. Has a lower incidence of disease
    B. Has a higher incidence of disease
    C. No relationship with risk
    D. None of the above

25. In a village, twenty thousand are exposed to smoking. 200 of those exposed to smoking develop cancer. Among 40, 000 unexposed to smoking, 40 develop cancer. The relative risk of developing cancer and smoking is
    A. 20
    B. 5
    C. 10
    D. 15

26. All are true of cohort studies except
    A. Mostly prospective
    B. Expensive
    C. Necessary for incidence
    D. Suitable for rare diseases

27. The best method to calculate incidence rate is
    A. Case Control
    B. Sentinel surveillance
    C. Cohort
    D. Cross sectional prevalence study

28. Relative Risk could show a positive association between
    A. Smoking and Cancer
    B. Oral contraceptive pills and pregnancy
    C. Efficacy of two different drugs
    D. Altitude and endemic goiter

29. Which of the following statements is true about cohort studies
    A. Prevalence can be calculated
    B. Used to study chronic diseases
    C. Less expensive than case-control studies
    D. Used to compare two different treatments

30. All are true about Case Control studies except
    A. Quick results
    B. Incidence rate measures
    C. Proceeds from effect to cause
    D. Relatively less expensive than cohort study

31. Secondary attack rate reflects
    A. Severity
    B. Communicability
    C. Fatality
    D. Infectivity

32. The following are discrete variables except
    A. Gender
    B. Cancer diagnosis
    C. Temperature
    D. Religion

SECTION B

State True (T) or False (F) (1 point for each correct answer)

33. Pollution due to human activity is a relatively new phenomenon starting only during the Industrial revolution.

34. Acid rain is an example of a primary pollutant.

35. Lead is an air pollutant that has been around since the time of the Roman empire.

36. Photochemical smog or “brown smog” is usually formed on hot sunny days in urban areas.

37. Ozone is harmful in the stratosphere and is a much needed defense against UV radiation in the trophosphere.

38. CFCs are responsible for ozone depletion.

39. Legionnaire’s disease is an example of building-related illness.

40. In general, affluent populations have a higher ecological foot print than non-affluent ones.

41. Ammonium and particulates are major criteria air pollutants.

42. Filtering water through activated carbon granules reduces chlorine requirement in the final step of water purification.

SECTION C (Population Epidemiology)

Choose the one best response for Q 43 to Q 53. (1 point for each correct answer)

43. In a population of 2,000 people, 40 babies were born and 30 people died in one year. Among the 30 people who died, 10 were under the age of one year old. What were the birth rate and infant mortality rate?
    A. 1.5%; 0.5%
    B. 2%; 1.5%
    C. 1%; 2%
    D. 2%; 0.5%

44. Industrial societies are characterized by:
    A. high birth rates and high death rates
    B. low birth rates and high death rates
    C. low birth rates and low death rates
    D. high birth rates and low death rates

45. The current rapid growth in the human population is due mainly to:
    A. Low death rate
    B. High birth rate
    C. High birth rate and high death rate
    D. Low birth rate and low death rate.

46. Which of the following statement about replacement fertility is true?
    A. Defined as the average number of children born to a woman over her lifetime
    B. Is roughly 2.1 births per woman for most industrialized countries
    C. A population with a replacement fertility will decrease rapidly in size.
    D. A population with a replacement fertility will slowly increase in size.

47. The population pyramid is much wider at the base than at the top for a country experiencing:
    A. Slow growth
    B. Zero growth
    C. Rapid growth
    D. Negative growth

48. To figure out the human population density of your community, you would need to know the number of people living there and _____.
    A. The birth rate of the population
    B. The carrying capacity
    C. The size of the area in which you live.
    D. The dispersion pattern of the population

49. Pottsville, Pennsylvania, had a population of 1,200 individuals. Last year they had a birth rate of 13/100, a death rate of 70/1000, and an emigration (individuals leaving the population) rate of 2/200. Nobody moved into Pottsville last year. How many people were added to Pottsville population in last year?
    A. 72
    B. 60
    C. 156
    D. 1260

50. Among a total of 25,000 residents for town A in the year 2013, 1.4% of people died of heart attack. This is an example of:

A. Case fatality rate
B. Cause specific mortality rate
C. Mortality and morbidity rate
D. Crude mortality rate.

51. Which of the following statements about population overgrowth is NOT true?

A. High fertility rate strongly correlates with high infant mortality rate.
B. Population overgrowth is associated with more infection outbreaks.
C. Population growth is one way of coping with population aging.
D. Sustained economic development requires negative population growth.

52. Which of the following statements is TRUE about population growth?

A. Women who have more education choose to have smaller families.
B. Population growth rate in USA equals that of world population.
C. Only developing countries are affected by population growth.
D. Population growth has no influence on species extinction.

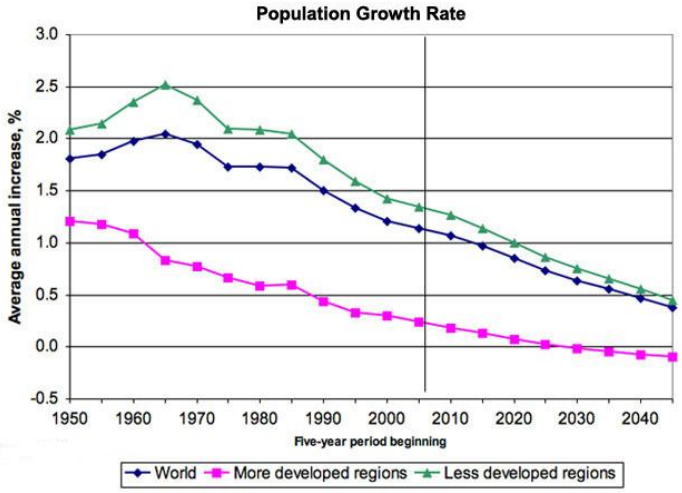
53. All the following have contributed to population growth except:

A. Improved nutrition
B. Availability of clean drinking water
C. Better medical care
D. Improved sanitary waste disposal

54. The J-curve represents logistic growth in population growth graphs. Say TRUE or FALSE (1 point)

55. Give two epidemiological measures that influence population growth. (1 point)

56. Based on the figure, answer the following: Uppermost line – Less developed countries. Bottom line graph more developed countries. (2 points)



A. In 2010, what was the annual growth rate in more developed countries?
B. In 2010 what was the annual growth rate in less developed countries?

57. Answer the following questions based on the statistics for a hypothetical population in a region from July 1, 2000 to June 30, 2001. (2 points for each)

Total population for the year	160,000
Number of live births	3,300
Number of maternal deaths	5
Total deaths	1,444
Population of women 15 – 49 years of age	40,000
Population of those 55 years of age and older	44,000
Number of infant deaths (0 – 1 year of age)	88
Number of persons diagnosed with heart disease	5,600
Number of deaths from heart disease	133

A Crude mortality rate
B Maternal mortality rate
C Infant mortality rate
D Cause specific mortality rate for heart disease

SECTION D (Case Scenarios)

58. In a longitudinal survey of adolescent health, for adolescents who had said they had "been involved in a serious physical fight", researchers reported the following results:

Risky behavior	Proportion of tattooed adolescents engaging in risky behavior	Proportion of non-tattooed adolescents engaging in risky behavior
"been involved in a serious physical fight"	139/269 (51.7%)	1,731/5,561 (31.1%)

a. What is the exposure being studied in the above table? (1 point))

b. What is the outcome being studied? (1 point)

c. Calculate the relative risk for the outcome being measured. Show your work. (2 points)

d. Explain your answer in a sentence for the relative risk. (2 points)

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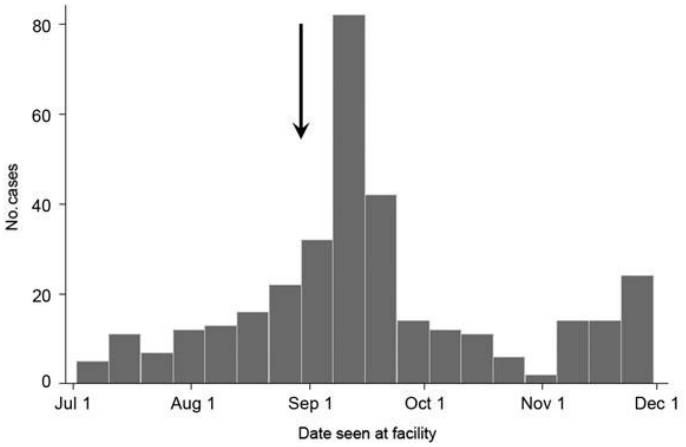
59. The refugee camp in Dadaab, Kenya has existed since 1991 and is one of the largest refugee camps in the world. Dadaab is composed of 5 smaller camps: Dagahaley, Hagadera, Ifo, Ifo II, and Kambioos. As of December 2012, a total of 460,000 refugees, mainly Somalians, were living in the camps. In July 2012, able bodied refugees discovered an abandoned convoy with several partially exposed food containers. On August 15, 2012, the US Centers for Disease Control and Prevention (CDC) in Nairobi, Kenya, was notified of an outbreak of an illness in these camps. Affected individuals complained of fever, nausea, vomiting, jaundice and loss of appetite.

A. Write a case definition based on the information above. (3 points)

Investigators from the CDC constructed a graph using the case definition.



B. What type of curve does this represent and why? (2 points)

C. What are the dependent and independent variables? (2 points)

D. How many cases were present at peak? (1 point)

No cases of Acute Jaundice Syndrome (AJS) had been reported for several years among Somali refugees. During July 2–November 30, 2012, a total of 339 AJS cases were reported from the camps and 2 nearby villages of whom ten died.

E. What is the incidence of AJS. (1 point)

F. What is the case fatality rate? (1 point)

Serum samples were obtained from 170 of the cases and specific tests identified Hepatitis E Virus as the cause of the outbreak. A line listing of 5 cases is given below.

Classify the following cases as healthy, suspected, possible, probable or confirmed.

Question #	Fever	GI symptoms	Bilirubin level	Ig M for Hepatitis E Virus (HEV)	Case Classification
G	No	No	Normal	No	
H	Yes	No	Pending	Results Pending	
I	Yes	Yes	Elevated	Yes	
J	No	Yes	Elevated	Results Pending	
K	Yes	Yes	Normal	Not done	

L. What is the route of transmission of Hepatitis E? (1 point)

M. As a CDC team member recommend at least two control measures? (2 points)

Childhood Obesity is an important problem in industrialized nations. Obesity is the result of "caloric imbalance"— too few calories expended for the amount of calories consumed — and are affected by various genetic, behavioral, and environmental factors.

60. Name at least 4 health effects of obesity on adolescents. (4 points)

61. Among children more than 2 years of age, Obesity is defined as having a Body Mass Index (BMI) that was greater than _____.

1) 30 kg/sq meters 2) 25 kg/sq meters (1 point)
2) 3) 75th percentile of weight 4) 95th percentile of weight

Data from the National Health and Nutrition Examination Survey (NHANES) regarding the prevalence of obesity in the US among age groups 2 years to 19 years is shown below.

Age in years	1976 – 1980 (%)	2003-2004 (%)	2011-2012 (%)
2 – 19	5.5	17.1	16.9
2 – 5	5.0	13.9	8.4
6 – 11	6.5	18.8	17.7
12 – 19	5.0	17.4	20.5
➢ 20		32.2	34.9

Using the data in the table above, mark the statements below as True or False: (1 point each)

62. Those who are obese in childhood are likely to be obese in adolescence and adulthood.

63. There is an approximately 40% relative increase in the prevalence of obesity among 2-5 year olds between 1980 and 2012.

64 Childhood obesity has quadrupled among adolescents (12-19 years) in the past 25 to 30 years.

65. In 2012 more than 1/3 of the total adult US population was obese.

Most US children aged 2 to 18 years snack regularly; snacks account for 27% of total calorie intake and are frequently composed of desserts, salty foods, and sugar-sweetened beverages, which increase the risk of obesity. So Snacks are an important target area for improving children's diets and potentially reducing childhood obesity. Researchers proceeded to do an experimental study at Washington, Lincoln, Jefferson and Madison schools. All desserts and sugar sweetened beverages were removed from the meals program and the cafeteria at Lincoln and Madison and substituted with healthy nutrient rich snacks. No change was made at Washington and Jefferson school menu or cafeteria. At Lincoln and Washington schools, researchers also educated students about the link between obesity and the various foods.
They weighed a random sample of 200 children (6 – 11 years) and 200 adolescents (12 – 19 years) from each school at the beginning of the study and again one year after the above intervention was carried out.

No of schoolchildren in various categories in different schools.

	Lincoln	Washington	Jefferson	Madison
Initial BMI < 25 6 – 11 years old	179	176	178	176
Final BMI < 25 6 – 11 years old	190	173	168	180
Initial BMI > 25 12 - 19 years old	38	37	32	34
Final BMI > 25 12 - 19 years old	36	38	36	32

66. What is the percentage decrease in Obesity among schools where desserts and Sugar-sweetened beverages were removed among 6 -11 year olds? (1 point)

67. What is the percentage increase in Obesity among schools where education was not provided to 6 – 11 year olds? (1 point)

68. What is the percentage decrease in Obesity among schools where the desserts and sugar sweetened beverages were removed among 12-19 year olds? (1 point)

69. Which group saw the maximum increase in Obesity? (1 point)

70. What is your conclusion regarding the effect of education and removal of desserts and sugar sweetened beverages on Obesity? (1 point)

Q 71) Asthma is a disease that affects the lungs, causing repeated episodes of wheezing, breathlessness, chest tightness, and nighttime or early morning coughing. These episodes, or "asthma attacks" as they are often called, occur when the sides of the airways in the lungs become inflamed and swollen. Muscles around the airways tighten, and less air passes in and out of the lungs. Excess mucus forms in the airways and clogs them even more.

In 2001, 20.3 million Americans had asthma, and 12 million had had an asthma attack in the previous year. From 1993 through 1998, more than 5,000 Americans died from asthma each year. The cost of asthma in the US in 2000 is estimated at $13.8 billion. Although family history contributes to susceptibility to asthma, the cause is unknown in most cases. Environmental "triggers", such as cockroaches, dust mites, furry pets, mold, tobacco smoke, and certain chemicals, are thought to trigger asthma attacks among sensitive individuals.

Disease detectives have obtained much of their information on the occurrence of asthma and asthma attacks in the US from the National Health Interview Survey which is based on a probability sample of the country's civilian, non-institutionalized population. People who answered, "Yes" to the question, "During the past 12 months, have you had asthma?" were counted as having the condition.

In 1997, THE NHIS began collecting information on asthma from a randomly selected child and a randomly selected adult from every household. Those who answered "yes" to the question, "has a doctor or other healthcare professional ever told you that you had asthma" were counted as having had asthma in their lifetime. The cervix also asked, "during the past 12 months have you had an episode of asthma R an asthma attack?" Information on children was collected from adult proxies.

Prevalence of self-reported asthma and often asthma episode or attack during the preceding 12 months by race gender and age group

Characteristics	**Self-reported Asthma prevalence during preceding 12 months**		**Asthma episodes or attacks during the preceding 12 months**	
	1995	**1996**	**1998**	**1999**
Race				
White	**54.5**	**53.6**	**37.5**	**37.6**
Black	**64.8**	**65.5**	**46.7**	**42.7**
Other	**44.4**	**43.2**	**33.7**	**38.9**
Age group (yrs)				
0-4	**60.5**	**40.1**	**46.4**	**42.1**
5-14	**82**	**69.8**	**57.8**	**56.4**
15-34	**57.8**	**67.2**	**37.5**	**42.2**
Gender				
Male	**48.6**	**43**	**31.7**	**31.6**
Female	**61.1**	**65.5**	**44.4**	**44.5**
TOTAL				

A. Using the introductory information develop a case definition for asthma (3 points)
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B. Define prevalence (2 points)

C. Which groups had the greatest prevalence of asthma in 1999 (2 points)

D. Which group in each category of characteristics had the greatest prevalence of asthma in 1996 (3 points)