

## 2020 DISEASE DETECTIVES – SAMPLE TOURNAMENT

### PART ONE: BACKGROUND AND SURVEILLANCE

#### General Questions

Unless instructed otherwise, choose **ALL** correct answers for each question.

1. In the definition of epidemiology, “distribution” refers to:
  - A. Who
  - B. When
  - C. Where
  - D. Why
  
2. In the definition of epidemiology, “determinants” generally includes:
  - E. Agents
  - F. Causes
  - G. Control measures
  - H. Risk factors
  - I. Sources
  
3. John Snow's investigation of cholera is considered a model for epidemiologic field investigations because it included a:
  - J. Biologically plausible hypothesis
  - K. Comparison of a health outcome among exposed and unexposed groups
  - L. Multivariate statistical model
  - M. Spot map
  - N. Recommendation for public health action
  
4. Public health surveillance includes which of the following activities:
  - O. Diagnosing whether a case of encephalitis is actually due to West Nile virus infection
  - P. Soliciting case reports of persons with symptoms compatible with SARs from local hospitals
  - Q. Creating graphs of the number of dog bites by week and neighborhood
  - R. Writing a report on trends in seat belt use to share with the state legislature
  - S. Disseminating educational materials about ways people can reduce their risk of Lyme disease
  
5. Epidemiologists define disease occurrence in terms of:
  - A. Agent
  - B. Host
  - C. Environment
  
6. Which of the following factors play a key role in likelihood of infectious disease acquisition?
  - A. Genetic profile
  - B. Human behavior
  - C. Environmental conditions

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7. The study of the distribution and determinants of health-related states in human populations and use of information from those studies to prevent and control disease refers to
- A. public health      B. clinical medicine      C. surveillance      D. epidemiology
8. Which of the below statements about epidemiology are true? (select all that apply)
- A. The diagnosis and treatment of illnesses in individual patients is an important part of epidemiology.  
 B. Epidemiologic methods are targeted at populations, communities and groups of individuals.  
 C. Epidemiologists are primarily concerned with individuals.  
 C. A goal of epidemiology is to prevent and control illness and injuries.
9. Epidemiology is often divided into two branches, descriptive epidemiology and analytic epidemiology. Which of these branches addresses person, place and time?
10. Which of the below is defined as a measure of the frequency with which new cases of illness, injury, or other health condition occur, expressed explicitly per a time frame?
- A. Incidence rate      B. Mortality rate      C. Prevalence rate      D. Proportionate morbidity ratio

11-20. Epidemiologists often refer to things that cause disease as “agents” and “agent/host/environment” is one of the famous triads (three-word groups) in public health. Agents may be biologic, chemical or physical.

The below table lists a number of diseases and agents that cause them.

In the column labelled “**Type**”, put a **B** for those agents that are Biologic, a **C** for those that are Chemical and a **P** for those that are Physical.

<b>Disease</b>	<b>Agent</b>	<b>Type</b>
Birth defect - Spina bifida	Folic acid deficiency	
Skin cancer	Ultraviolet radiation	
Food poisoning	Salmonella bacteria	
Hearing loss	Loud noise	
Birth defect - Microcephaly	Cytomegalovirus	
Traumatic Brain Injury (concussion)	Blow to the head	
Liver cancer	Hepatitis C virus	
Acute kidney failure	Ethylene glycol (antifreeze)	
Lung cancer	Tobacco smoke	
Mesothelioma	Asbestos	

7. The study of the distribution and determinants of health-related states in human populations and use of information from those studies to prevent and control disease refers to

- A. public health      B. clinical medicine      C. surveillance      **D. epidemiology**

8. Which of the below statements about epidemiology are true? (select all that apply)

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 C. Epidemiologists are primarily concerned with individuals.  
**D. A goal of epidemiology is to prevent and control illness and injuries.**

9. Epidemiology is often divided into two branches, descriptive epidemiology and analytic epidemiology. Which of these branches addresses person, place and time?

**Descriptive epidemiology**

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Disease	Agent	Type
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Skin cancer	Ultraviolet radiation	<b>P</b>
Food poisoning	Salmonella bacteria	<b>B</b>
Hearing loss	Loud noise	<b>P</b>
Birth defect - Microcephaly	Cytomegalovirus	<b>B</b>
Traumatic Brain Injury (concussion)	Blow to the head	<b>P</b>
Liver cancer	Hepatitis C virus	<b>B</b>
Acute kidney failure	Ethylene glycol (antifreeze)	<b>C</b>
Lung cancer	Tobacco smoke	<b>C</b>
Mesothelioma	Asbestos	<b>C</b>

21-25. Match the below patterns of disease occurrence with the scenario presented in the table.

Endemic  
Sporadic

Outbreak  
Epidemic

Pandemic

Pattern of Occurrence	Scenario
	Community X has had 10 or fewer cases of Disease C per year for the last 20 years. Last month 1 case of Disease C was reported.
	Community X has experienced a range of 10-20 cases of Disease B each month for the last 20 years. Last month 45 cases of Disease B were reported.
	Community X has experienced a range of 5-10 cases of Disease D each month for the last 20 years. Last month 25 cases of Disease D were reported. Neighboring communities and surrounding states are reporting similar increases
	Community X has experienced a range of 10-20 cases of Disease A each month for the last 20 years. Last month 15 cases of Disease A were reported.
	For the last 20 years Community X has experienced a range of 5-10 cases per month of Disease E during the months of November through February. It is mid-January and 75 cases of Disease E have reported. There has been a similar increase nationwide and in countries in both Europe and Asia.

26. Investigators reviewed hospital records and selected a group of patients who were admitted for a variety of reasons but became infected with Methicillin resistant *Staphylococcus aureus* (MRSA) while in the hospital. They then selected a group of patients who were admitted for the same reasons and became infected with regular *Staphylococcus aureus*. They compared death rates among the two groups of patients. This is an example of which of the below study types? (select all that apply)

A. Experimental

B. Observational

C. Cohort

D. Case-control

E. Clinical trial

27. Measles is a highly contagious disease and is spread from person-to-person by respiratory droplet nuclei that may remain infectious and suspended in the air for as long as 30 minutes after the source has left the area. This represents which of the below modes of transmission? (select all that apply)

A. Direct

B. Direct contact

C. Droplet spread

D. Indirect

E. Vehicle borne

F. Vector borne

G. Airborne

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<b>Epidemic</b>	Community X has experienced a range of 5-10 cases of Disease D each month for the last 20 years. Last month 25 cases of Disease D were reported. Neighboring communities and surrounding states are reporting similar increases
<b>Endemic</b>	Community X has experienced a range of 10-20 cases of Disease A each month for the last 20 years. Last month 15 cases of Disease A were reported.
<b>Pandemic</b>	For the last 20 years Community X has experienced a range of 5-10 cases per month of Disease E during the months of November through February. It is mid-January and 75 cases of Disease E have reported. There has been a similar increase nationwide and in countries in both Europe and Asia.

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## PART TWO: OUTBREAK INVESTIGATION

### Scenario

The below was adapted from an article that appeared in [MMWR vol. 63 no. 17](#) week ending May 2, 2014.

On October 12, 2012, public health officials at the Nellis Air Force Base near Las Vegas, Nevada, were notified by a local emergency department of three active-duty military patients who went to the ED during October 10–12 with fever, vomiting, and hemorrhagic diarrhea. Initial interviews by clinical staff members indicated that all three patients had participated October 6–7 in a long-distance obstacle adventure race on a cattle ranch in Beatty, Nevada, in which competitors frequently fell face first into mud or had their heads submerged in surface water.

#### Initial Epidemiologic Investigation

Because of the three cases of hemorrhagic diarrhea and the suspected source of infection reported to Nellis Public Health by ED staff members on October 12, definitions were developed to identify additional cases. A probable case was defined as diarrhea (three or more loose stools in a 24-hour period), any episode of bloody diarrhea, or a combination of other gastrointestinal illness symptoms (e.g., abdominal cramps, nausea, or vomiting) in a person who participated in the obstacle adventure race during October 6–7. A confirmed case was defined as a probable case in a patient who also had laboratory isolation of *Campylobacter* from a stool specimen.

1.-4. The below table has information from 4 different persons who were reported to investigators. Based only on the information in the table, indicate which would be a confirmed case (CC), which would be a probable case (PC) and which would not be considered a case (NC).

Case Category	Case Description
	A 26 year-old woman who developed bloody diarrhea, nausea and vomiting on October 15. No stool culture was done. She was the wife of an airman who participated in the race but did not participate herself.
	A 29 year-old airman who reported having severe diarrhea along with nausea and vomiting that started on October 10. No stool culture was done. He reported participating in the obstacle race.
	A 32 year-old civilian contractor who reported having a fever, cramping and nausea that started on October 9. He had a stool culture positive for <i>Campylobacter</i> and reported participating in the obstacle race.
	A 20 year-old airman who participated in the obstacle race and reported gastrointestinal illness including diarrhea and vomiting but had a stool culture negative for <i>Campylobacter</i> .

An additional 19 patients, including both military and civilian personnel, were identified through active reporting, a retrospective review of ED logs from October 6–16, and announcements to the community that encouraged self-identification. These efforts resulted in the identification of a total of 18 probable and four confirmed cases of illness. The investigation was limited to the population of the local community, primarily because of the short incubation period for *Campylobacter*, the time lags between the event, symptom onset, and investigative findings, and the lack of additional cases reported by civilian health-care providers.

Among the 22 patients, the mean time from exposure to illness was 3.3 days (range = 1–9 days) (Figure). The most common symptoms were diarrhea (18 of 19 patients), cramps (14 of 18 patients), fever (10 of 18 patients), and nausea (10 of 17 patients) (Table 1). Twenty of the 22 patients sought medical care, and two reported their illness directly to Nellis Public Health without seeking care. One person with chronic gastrointestinal illness was hospitalized and treated with supportive care and intravenous antibiotics. All 22 patients made a full recovery.

5. What term do epidemiologists use to refer to the time from exposure to illness?

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5. What term do epidemiologists use to refer to the time from exposure to illness?

**Incubation period**



To obtain information about the outbreak source, a 72-hour food and drinking water history questionnaire, which included questions on surface water exposure, was used to interview the ill persons. An analysis of the questionnaire data indicated that muddy surface water was a possible source of infection.

The following study was conducted to identify the source of infection. Twenty-four healthy individuals consisting of both military personnel and civilians who had been race participants were identified through contact investigation of the 22 case-patients. Nellis Public Health developed a new questionnaire for this investigation and administered it by telephone.

6. The questionnaire asked the 46 persons about water consumption, food consumption, and environmental water exposure during the October 6–7 obstacle race.

What type of study was this? (select all that apply)

- a. Experimental
- b. Observational
- c. Cohort
- d. Case-control
- e. Clinical trial

7. What is the appropriate measure of risk for this study design?

The results of this investigation are shown in Table 4.

Table 4. Comparison of case-patients with *Campylobacter coli* infection and control subjects among participants in a long-distance obstacle adventure race, by food and water exposures — Nevada, October 2012\*

Exposure	Case-patients (n = 22)	Controls (n = 24)
Inadvertent swallowing of muddy water while competing	89	30
Consumption of potable drinking water provided by race organizers	100	100
Consumption of food provided by race organizers	93	74
Full body submersion in surface water	94	96
Exposure of eyes or mouth to surface water or mud	100	74

\* Denominator values varied as a result of nonreporting by some participants.

8-15. Fill in the boxes in the below figure to set up a two-by-two table for testing the association between illness and Inadvertent swallowing of muddy water while competing. Assume that 18 case patients and 23 controls answered this question.


16-20.. Calculate the appropriate measure of risk for this study design

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**Odds ratio**

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8-15. Fill in the boxes in the below figure to set up a two-by-two table for testing the association between illness and Inadvertent swallowing of muddy water while competing. Assume that 18 case patients and 23 controls answered this question.

	<b>Exposed</b>	<b>Not Exposed</b>
<b>Cases</b>	<b>=.89X18=<u>16</u></b>	<b>=.11X18=<u>2</u></b>
<b>Controls</b>	<b>=.30X23=<u>7</u></b>	<b>=.70X23=<u>16</u></b>

16-20. Calculate the appropriate measure of risk for this study design

$$\text{Odds ratio} = AD/BC = (16 \times 16) / (2 \times 7) = 18.3$$

2 pts for formula, and 2 pts for right answer

Nellis Public Health requested stool specimens from all 22 patients and recommended cultures for Shigella, Campylobacter, Salmonella, and Escherichia coli 0157:H7, plus testing for Shiga toxin and a search for ova and parasites. Initially, four stool specimens were obtained and each tested negative for all organisms, including Campylobacter. Persistence in obtaining seven additional stool specimens resulted in four laboratory-confirmed cases positive for Campylobacter. Further characterization of the four C. coli isolates by pulsed-field gel electrophoresis and antimicrobial susceptibility testing at CDC, identified all four as the same strain.

**21-23.** Give 3 reasons why the first four stool specimens obtained each tested negative for all organisms, including Campylobacter.

Because commercial obstacle adventure races often are marketed to military personnel, Nellis Public Health provided educational outreach to the base population regarding the risk for disease when competing in such events.

**24-25.** Give two educational messages, points or things you would tell the base population that should do to protect themselves.

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**21-23.** Give 3 reasons why the first four stool specimens obtained each tested negative for all organisms, including Campylobacter.

**Patients were infected but stopped excreting Campy,**

**Patients were infected with something else-not detected by test.**

**Specimens were improperly collected/submitted.**

**There was a problem with the test.**

Because commercial obstacle adventure races often are marketed to military personnel, Nellis Public Health provided educational outreach to the base population regarding the risk for disease when competing in such events.

**24-25.** Give two educational messages, points or things you would tell the base population that should do to protect themselves.

**Avoid swallowing muddy water**

**Wash hands**

**PART THREE: PATTERNS, CONTROL AND PREVENTION**

**Crude Death Rates for Ten Leading Causes by Race and Sex  
Michigan Residents, 2001**

Cause of Death	All Races		White			Black			
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Heart Disease	271.4	268.5	274.0	277.8	272.7	282.8	261.0	271.1	252.1
Cancer	198.8	211.7	186.5	205.2	216.6	194.3	178.6	200.7	159.1
Stroke	57.4	45.7	68.6	59.7	46.5	72.4	50.0	45.4	54.0
Chronic Lower Respiratory Diseases	41.9	42.4	41.4	46.1	45.9	46.3	21.9	25.4	18.9
Unintentional Injuries	32.9	42.8	23.5	32.8	42.5	23.4	35.1	46.9	24.7
Diabetes Mellitus	26.8	24.2	29.2	26.7	24.5	28.7	29.0	24.4	33.1
Pneumonia/Influenza	20.9	19.8	22.0	21.5	19.8	23.2	19.6	21.5	17.9
Alzheimer's Disease	18.2	11.3	24.8	20.7	12.8	28.2	6.5	3.6	9.1
Kidney Disease	15.6	14.9	16.2	14.8	14.5	15.1	21.4	19.1	23.5
Septicemia	8.9	8.0	9.7	7.7	6.7	8.6	16.1	16.6	15.7
All Other Causes	181.6	189.2	174.3	176.0	177.3	174.7	226.9	274.7	184.7
<b>Total</b>	<b>874.4</b>	<b>878.7</b>	<b>870.3</b>	<b>889.0</b>	<b>879.8</b>	<b>897.8</b>	<b>866.2</b>	<b>949.5</b>	<b>792.7</b>

**Note:** Rates are per 100,000 population.

1. What was the second leading cause of death in all Races in Michigan in 2001?
2. What race and sex had the highest incidence of Diabetes Mellitus in 2001?
3. What % of the deaths in Michigan in 2001 were from a stroke?
4. Compare the occurrence of septicemia in relation to race.
5. What % of the male deaths in 2001 were due to heart disease?

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Chronic Lower Respiratory Diseases	41.9	42.4 41.4	46.1	45.9	46.3	21.9	25.4	18.9
Unintentional Injuries	32.9	42.8 23.5	32.8	42.5	23.4	35.1	46.9	24.7
Diabetes Mellitus	26.8	24.2 29.2	26.7	24.5	28.7	29.0	24.4	33.1
Pneumonia/Influenza	20.9	19.8 22.0	21.5	19.8	23.2	19.6	21.5	17.9
Alzheimer's Disease	18.2	11.3 24.8	20.7	12.8	28.2	6.5	3.6	9.1
Kidney Disease	15.6	14.9 16.2	14.8	14.5	15.1	21.4	19.1	23.5
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**Note:** Rates are per 100,000 population.

1. What was the second leading cause of death in all Races in Michigan in 2001?  
**CANCER**
2. What race and sex had the highest incidence of Diabetes Mellitus in 2001?  
**BLACK FEMALES**
3. What % of the deaths in Michigan in 2001 were from a stroke?  
 **$57.4/878.7 \times 100 = 6.56\%$**
4. Compare the occurrence of septicemia in relation to race. **The occurrence of septicemia is higher among the black population.**
5. What % of the male deaths in 2001 were due to heart attack?  **$268.5/878.7 \times 100 = 30.6\%$**

**Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO 11 February 2009**

Country	2003		2004		2005		2006		2007		2008		2009		Total	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths
Azerbaijan	0	0	0	0	0	0	8	5	0	0	0	0	0	0	8	5
Bangladesh	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Cambodia	0	0	0	0	4	4	2	2	1	1	1	0	0	0	8	7
China	1	1	0	0	8	5	13	8	5	3	4	4	7	4	38	25
Djibouti	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Egypt	0	0	0	0	0	0	18	10	25	9	8	4	4	0	55	23
Indonesia	0	0	0	0	20	13	55	45	42	37	24	20	0	0	141	115
Iraq	0	0	0	0	0	0	3	2	0	0	0	0	0	0	3	2
Lao People's Democratic Republic	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	2
Myanmar	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Nigeria	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1
Pakistan	0	0	0	0	0	0	0	0	3	1	0	0	0	0	3	1
Thailand	0	0	17	12	5	2	3	3	0	0	0	0	0	0	25	17
Turkey	0	0	0	0	0	0	12	4	0	0	0	0	0	0	12	4
Viet Nam	3	3	29	20	61	19	0	0	8	5	6	5	1	0	108	52
Total	4	4	46	32	98	43	115	79	88	59	44	33	12	4	407	254

Total number of cases includes number of deaths.  
 WHO reports only laboratory-confirmed cases.  
 All dates refer to onset of illness.

6. What is the total mortality rate of confirmed Influenza H5N1 from 2003-2009?

7.-15. Construct an epicurve of H5N1 cases in Egypt for the years of 2003-2009

16. Which country has the most cases of confirmed H5N1 infection from 2003-2009?

17-18. The most populous nation in the world, China, has less H5N1 cases than Vietnam.  
Give 2 explanations about this finding? (Hint: this table shows lab-confirmed cases)

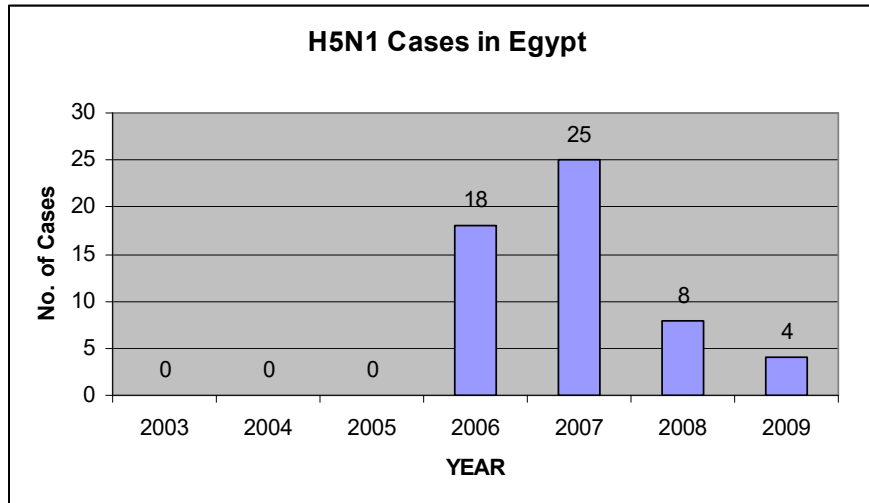
19-20. As the Epidemiologist on the case, give 3 specific recommendations to stop the spread of this disease.



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**Total Mortality Rate=  $245/407 \times 100= 62.4\%$**

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Give 2 explanations about this finding? (Hint: this table shows lab-confirmed cases)

**inadequate reporting**

**lower exposure to sick birds**

**few access to medical care so cases go undiagnosed**

19-20. As the Epidemiologist on the case, give 3 specific recommendations to stop the spread of this disease.

**destroy all sick & exposed birds**

**change how domesticated birds are kept to minimize exposures to wild birds infected with H5N1**

**educate at-risk population about mode of disease transmission & signs/symptoms to watch out for**

**use safety masks and other precautions when handling sick birds**

21. How are infectious diseases, such as colds and influenza, most commonly spread?
- A. Breathing viruses in air
  - B. Hand-to-face contact
  - C. Drinking infected water
  - D. Eating contaminated food
22. Chronic stress has been linked to which of these health problems?
- A. Headaches
  - B. Constipation
  - C. Depression
  - D. All of the above
23. "Sleep hygiene" refers to the promotion of regular sleep. Which of these can help you develop healthy sleep habits?
- A. Eat a big meal late in the day
  - B. Go to bed and get up at the same time every day
  - C. Cut back on the amount of exercise you get
  - D. All of the above

24-29. For each of the following Modes of Disease Transmission, give two ways to prevent the spread of disease

Droplet Spread

Mosquito-Borne

Food-Borne

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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**