Team # __KEY____

# Disease Detectives
## Battle at Valley Forge
## January 8, 2011

Part I

A. 10 pts Each of the cases below was due to bacterial contamination. For each, indicate:
   a. What type of bacteria caused the illness?
   b. What practices contribute to contamination by this bacteria in the marketplace?
   c. How should a consumer handle food to avoid food poisoning from this bacteria?

Case I: The Bon Vivant soup company sold canned vichyssoise, a potato soup which is served cold. In 1971, a man died and his wife became ill. The FDA closed the canning plant and found 5 cans of the same batch contained a toxin.

a. **Clostridium botulinum**

b. **Insufficient heating in canning**

c. **Avoid cans with bulges since C. botulinum is an anaerobe; boiling destroys the toxin**.

Case II: Two Iowa egg producers shipped eggs to 14 states, with over 2000 illnesses reported between May and July, 2010.

a. **Salmonella**

b. **unsanitary conditions in henhouses; antibiotic use and crowding**

c. **don't eat foods containing raw eggs, wash hands, etc.**

Case III: In 1993, 4 children died after eating hamburgers from Jack-In-The-Box, and hundreds were sick in Seattle and several western states.

a. **E. coli (specifically strain O157:H7, but not required)**

b. **similar to eggs; also unsanitary conditions in slaughterhouses**

c. **cook thoroughly, hygienic handling of knives and surfaces**

d. What common practice in modern food production has contributed to this increasingly common problem in the U.S.? **overuse of antibiotics in cattle**

B. 6 pts (tie-breaker) This year, Science Olympiad has concentrated on food-borne illnesses for Disease Detectives. Provide at least three other modes of transmission and give an example for each. **Terms other than those below may be used:**

**person-to-person spread (influenza, chicken pox, etc)**
**air-borne: influenza, meningitits, tuberculosis, etc.**
**water-borne: cholera, ecoli, legionnaires, leptospirosis, salmonella,typhoid, vibrio**
**vector-borne: lyme, plague, many encephalitis, yellow fever, dengue, malaria**

Part II

1. What term should be used in each case? (Terms are meant to be unique to one statement.) 11 pts

a. Blankets from smallpox victims were distributed among American Indians to spread the deadly disease. The blankets were ____**fomites**_____.

b. Mosquitoes spread malaria, tsetse flies spread sleeping sickness. These insects are _____**vectors**_____.

c. Toxoplasmosis is common in cats. Humans can be infected, so this is an example of _____**zoonosis**_____.

d. "Cancer alley" is the name given to an area near Baton Rouge. The unusual incidence of cancers is commonly blamed on industrial toxins to explain this ____**cluster**_____.

e. The Spanish flu of 1918 is a classic case of a(n) _____**pandemic**_____.

f. There were several ____**outbreaks**_____ of H1N1 cases in 2011.

g. Health officials feared that cases would spread acoss the US in a full-fledged _____**epidemic**_____.

h. 2 pts. Compare the terms you used in a and b. **fomite: object spreads disease; vector: an organism spreads disease**

i. 2 pts. Compare the terms you used in e and g. **epidemic is widespread disease, but not as much as a pandemic, which can be worldwide**

2. 15 pts Pick three of the following microbes can cause foodborne diseases, and give the following information: type of microbe (bacteria, virus, fungus), typical incubation period, symptoms, length of illness expected, methods of diagnosis, and treatments. You may choose from *Salmonella, Campylobacter, Escherichia coli, Norovirus,* or *Listeria.*

**Salmonella: bacteria, 12-72 hr, abdominal cramp, diarrhea, fever, 4-7 days, lab tests from stool samples, fluids or IV, sometimes antibiotics if spread.**

**Campylobacter: bacteria, 2-5 days, abdominal discomfort, fever, diarrhea (poss. bloody), cramping, nausea & vomiting possible, lasts one week, lab test from stool sample, fluids & sometimes antibiotics.**

**E.coli: bacteria, 3-4 days but could be little as 1 or as much as 10 days (it varies), severe stomach cramps, diarrhea (often bloody), vomiting, if fever it is low, lasts avg. 7 days getting worse from day 1, lab tests from stool sample, rehydrate patient, but antibiotics/anti-diarrheals should NOT be used!**

**Norovirus: virus, 24-48 hr or early as 12 hr, nausea, vomiting, diarrhea, and some stomach cramping, possible low fever, chills, headache, muscle aches,**

**lethargy (whew! sometimes mistaken for the "flu"), lasts 1-2 days, lab tests (RT-PCR) from stool sample, treatment: rehydrate (fluids).**

**Listeria: bacteria, ranges from one-eight weeks, muscle aches, nausea, diarrhea. If infection spreads to the nervous system: headache, stiff neck, loss of balance, confusion, obtundation (decreased consciousness) or convulsions. If pregnant: can lead to miscarriage, infection of the newborn, or even stillbirth, blood or spinal fluid tests (spinal tap), may last 7-10 days, various antibiotics will help.**

Part III

| Food | Exposed | Control | Exposed Patients a | Exposed Well c | Control Patients b | Control Well d | Odds Ratio |
|---|---|---|---|---|---|---|---|
| Chicken | 212 | 288 | 44 | 168 | 72 | 216 | 0.78 |
| Roast beef | 191 | 309 | 27 | 164 | 89 | 220 | 0.41 |
| Vegetable lasag | 97 | 403 | 45 | 52 | 71 | 332 | 4.05 |
| Pot de crème | 92 | 408 | 80 | 8 | 36 | 372 | 103.33 |
| Apple pie | 125 | 375 | 12 | 113 | 104 | 271 | 0.28 |
| Chocolate cake | 283 | 217 | 24 | 259 | 92 | 125 | 0.12 |

The inspector marked the menus of patients and tallied the numbers. He found that of 212 people who ordered chicken, 44 were ill; of 191 choosing beef, 27 were ill; of 97 ordering lasagna, 45 were ill. For the desserts, the numbers were: 92 for pot de crème, 80 were ill; for 125 ordering apple pie, 12 were ill; and from 283 choosing chocolate cake, 24 were ill.

a. What kind of study will this be? **Case control**

b. What equation will you use to analyze this information? **a/c/b/d or ad/cb**
Clearly state the meaning of the variables. **see above**

c. What foods, if any, are likely sources of food poisoning? **Pot de crème and lasagna**
**Explanation: salmonella-contaminated eggs. Lasagna slightly undercooked, but dessert is uncooked.**

d. What are some errors or limitations associated with this data? Give at least two.
**Passengers may not have eaten what they ordered, may have shared or switched dishes. Passengers already nauseous may not have eaten at all.**

e. What other data could be collected to address these flaws?
**Interviews would confirm what was eaten; passengers are all available to be surveyed.**

f. What additional data should the inspector collect to confirm his conclusions?
**He can collect samples from the kitchen.**
**He can conduct interviews with passengers and crew, and get more data on symptoms. Stool and other samples can be collected for testing.**

g. Should the ship be kept quarantined? Justify your answer. **No, food poisoning looks highly likely. Or quarantine can be brief to see if symptoms abate and whether new cases arise. Transmission would be reason for quarantine. Other rationales possible.**

Part IV

2 pts List 5 states from different areas of the country with the highest rates of melanoma.
**Connecticut, Delaware, Idaho, Kentucky, Maine, Minnesota, New Hampshire, New Jersey, Oklahoma, Oregon, Utah, Vermont, Washington**

4 pts Suggest 2 unrelated reasons for high rates of melanoma, and relate those possible factors to a specific state or region.
**High elevation→ thin ozone: mountainous areas (Pacific northwest, Idaho, Utah)**
**Sun exposure: coastal areas, warmer areas (Southern states) or sunny (Utah)**
**Skin color: Caucasians more likely than others (Minnesota, New England states)**
3 pts What data would you collect to test your hypotheses for causes of melanoma in a region? Specifically address your ideas in the previous part.
**Connect to above:**
**Skin color: collect racial demographics of cases and local populations**
**At any location, compare light- and dark-skinned rates**
**Survey population and cases for outdoor activities, employment indoor/outdoor, use of sunscreen**
**Within states, compare high and low elevation; shore vs. inland.**

1 pt Compare the incidence of melanoma in Minnesota and in Louisiana:
**Minnesota highest rate: 22.2-28.1**
**Louisiana lowest rate interval: 8.6-16.7, so rate is about twice as high in Minnesota**

1 pt Compare the death rate from melanoma in Minnesota and in Louisiana, using the map below: **Death rates are the same: 1.5-2.6**

2 pts Make a statement relating the reported incidence and death rates in Louisiana and Minnesota. **Despite the higher incidence in MN, the death rate in the states is the same.**

4 pts (tie-breaker) Reported incidence of and reported death from melanoma depends on many factors, but for tie-breaker grading, make one inference from these data and explain your reasoning. Then describe what data you would collect to test your hypothesis.
**Incidence in LA is under-reported, possibly due to differences in access to health care.**
**Gather data on stage of cancer when reported, expecting more advanced stages in LA.**
**Compare reported incidence for those with and without insurance.**

**Other inferences with corresponding data collection possible.**