Disease Detectives 201

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Session Goals

- Tell how Disease Detectives events are developed
- Give examples of the types of questions that students are likely to encounter in regional, state and national competitions in both Divisions.
- Tell where competitors can go to get sample competitions and answer keys.
- Explain the appropriate use descriptive and analytic statistics in Division C competitions.
- Tell how to set up, organize and use a “cheat-sheet” for a regional, state and national competition

The “Truth” about Disease Detectives Events


1
BASIC SET
WITH INTRODUCTORY MODULE
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Difference between Competition and Exam

- Events are generally developed by event supervisors: some are “better” than others
- NSO has a question file that can be used in a pinch
- Events are often shared
- Look very similar but have fundamental differences
- Someone must come in first and someone must come in last - no ties
- Events are seldom passed back in actual competitions
- Tiebreaker questions
- Many objective low point vs fewer subjective high point questions
- Cycling topics – Foodborne, Environment, Population
- Competitors should be given disease- or pathogen-specific information and be able to use it.

Approaches

- Straight questions
- “Word” problems
- “Mini” case studies
- Case studies

Regional Competition

Regional Competitions

- Should focus on basic concepts but include a few challenges
- Do competitors have basic skills?
- Not a list of pathogens and diseases

MS Straight Question

(4 pts) Time is one of the three characteristics epidemiologists use in describing disease patterns. What are the other two?

Person and Place (2 pt each)

(1 pt) As mentioned above, food may become contaminated during growing, slaughtering, butchering or processing. Listeriosis is caused by a bacteria that infects cattle and is spread to humans through contaminated milk. Which of the below terms refers to an infection that is spread from animals to humans?

a.) Vectorborne
b.) Zoonoses
c.) Chronic
d.) Acute
e.) None of the above

MS Word problem

The Notifiable Disease Reporting System (NRDS) is one way disease detectives know about outbreaks of illness in the community. Salmonella is one of the many diseases that is included in this system. Salmonella infections are spread by fecal-oral transmission and often result in outbreaks of diarrheal illness. West Nile Virus infection is also monitored by the NRDS. This virus is transmitted through mosquito bites.

- List two other disease-causing organisms (virus, bacteria or protistan) that are spread by fecal-oral transmission and tell whether each is a virus, bacteria or protistan.

Calculation problem

Table 2. Illness and food histories among students attending school picnic

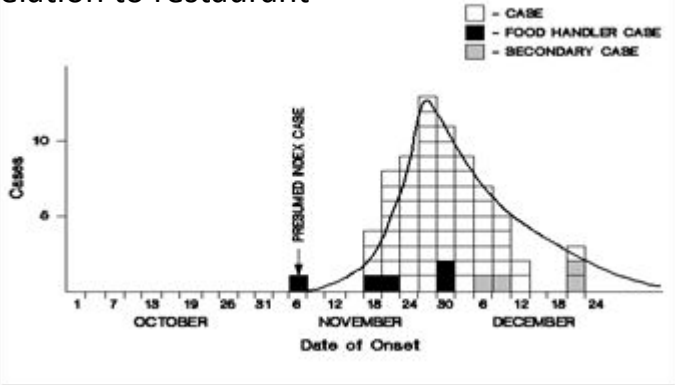
	Ate				Did not eat			
	Ill	Well	Total	Attack Rate	Ill	Well	Total	Attack Rate
				A				B
Hot dogs	20	45	60	**33.3**	15	25	40	**37.5**
Hamburgers	15	40	55	**27.3**	20	25	45	**44.4**
Cole slaw	5	20	25	**20.0**	30	45	75	**40.0**
Potato salad	22	45	67	**33.3**	13	20	33	**33.4**
Baked beans	19	26	45	**42.2**	16	39	55	**29.0**
Chocolate Cake	10	50	60	**16.7**	25	15	40	**62.5**
Coconut cream pie	30	15	45	**66.6**	5	50	55	**9.1**
Milk	34	56	90	**37.8**	1	9	10	**10**
Water	30	45	75	**40.0**	5	10	15	**33.3**

1. (18 pts) Calculate the attack rates for illness among those ate and did not eat each food item in Table 1. Enter your results in the Attack Rate columns (A for ate, B for Did not eat). If you do not have a calculator - set up the problem for partial credit.

Graphic Interpretation

You graph the date of onset of illness among cases of hepatitis A involved in a foodborne outbreak at one of your local restaurants and get the curve shown in Figure 1.

Figure 1. Number of cases of illness associated with hepatitis A outbreak at La Maison du Ptomaine by date of onset of symptoms and relation to restaurant



(4pts) What is an index case and why is it important in this example?

The index case is the first person known to have become ill in an outbreak. (2 pts) In this example, the index case is the most likely source of infection for the other people. (2 pts)

Mini Case Study

One of the first steps in an outbreak investigation is determining if the event is really an outbreak. Many local and state health departments consider reports of possible foodborne illness to represent a probable outbreak and be worthy of further investigation if they involve reports of similar illness from two or more unrelated persons within a one week period. "Unrelated persons" is usually taken to mean persons who live in separate households.

Read each of the following stories, tell if it represents a possible outbreak and explain why or why not.

Even she did not feel well, Mrs. Smith went out for lunch with her friend, Mrs. Brown at their favorite restaurant, La Maison du Ptomaine. Later that evening Mrs. Smith developed severe stomach cramps and vomiting. The next day she had diarrhea. She later spoke with Mrs. Brown who said she had been fine.

(1 pt) Does this represent a probable outbreak of foodborne illness?

(2 pts) Why or why not?

Mr and Mrs Jones celebrated their 25th wedding anniversary by going for supper at their favorite restaurant, La Maison du Ptomaine. The next evening both of the Jones developed stomach cramps. Mrs Jones was up all night with vomiting and diarrhea.

(1 pt) Considering only the information from the Jones, does this represent a probable outbreak of foodborne illness?

(2 pts) Why or why not?

(1 pt) Considering all the above information about Mrs Smith and the Jones, does this represent a probable foodborne outbreak?

(2 pts) Why or why not?

The health department conducts an investigation of La Maison du Ptomaine and identifies 4 more people who became ill after eating there. They interview all 7 people and ask when they ate and when they became ill. The data is shown in Table 2.

Initials	Date of Meal	Time of Meal	Date of Onset	Time of Onset
LS	1/14	12:15 PM*	1/14	8:30 PM
MJ	1/14	6:30 PM	1/15	11:30 PM
SJ	1/14	6:30 PM	1/15	10:00 PM
FC	1/13	5:15 PM	1/14	11:30 PM
JK	1/14	11:30 AM	1/15	5:00 PM
SH	1/15	1:00 PM	1/16	4:30 PM
RC	1/15	1:00 PM	1/16	7:15 PM

- (4 pts) Calculate the mean incubation period for the illness experienced by the above 7 persons. Show your work.

- (2 pts) What is the range for the above incubation period?

- (2 pts) Considering all the above information, give 2 reasons why Ms Smith may not be part of this outbreak.

State Competition

State Competitions

- Can competitors use what they know
- Mix of basic concepts and problem solving
- Include short case-studies
- Include some decision making, study design

2017 GA State Middle School

(2 points) What term is used for the time interval between exposure to and infection with a particular pathogen and the onset of symptoms resulting from that infection?

(1 point) Foodborne illnesses are most often the result of which of the below modes of transmission? (select the best answer)

a. Direct aerosol
b. Direct contact
c. Indirect airborne
d. Vector-borne
e. Vehicle-borne

2017 GA State Middle School

On May 8, 2007, the Pennsylvania Department of Public Health (PADOH) reported three cases of Salmonella Schwarzengrund infection with DNA fingerprints suggesting that all came from the same source. On June 9, 2007, similar cases were identified in Ohio and other states and CDC's OutbreakNet team was notified of a potential multistate outbreak of S. Schwarzengrund infections.

(1 point) Which of the below best describes why this represents a potential outbreak? (select the best answer)

a. There were three cases of Salmonella Schwarzengrund infection with DNA fingerprints suggesting that all came from the same source.
b. Multiple states were involved.
c. This is more than would be expected.
d. All the above

National Competition

National Competition

- Try to emphasize decision-making, evaluation and critical thinking
- Historically based on two case studies – one infectious and one non-infectious
- More than 50% of space taken up with narrative and tables

According to author Eric Klinenberg, “On the first day of the heat wave, Thursday, July 13, the temperature hit 106 degrees, and the heat index—a combination of heat and humidity that measures the temperature a typical person would feel—rose above 120. For a week, the heat persisted, running between the 90s and low 100s. The night temperatures, in the low to mid-80s, were unusually high and didn't provide much relief. Chicago's houses and apartment buildings baked like ovens. The city set new records for energy use, which then led to the failure of some power grids—at one point, 49,000 households had no electricity. Many Chicagoans swarmed the city's beaches, but others took to the fire hydrants. More than 3,000 hydrants around Chicago were opened, causing some neighborhoods to lose water pressure on top of losing electricity. When emergency crews came to seal the hydrants, some people threw bricks and rocks to keep them away. The heat made the city's roads buckle. Train rails warped, causing long commuter and freight delays. City workers watered bridges to prevent them from locking when the plates expanded. Children riding in school buses became so dehydrated and nauseous that they had to be hosed down by the Fire Department. Hundreds of young people were hospitalized with heat-related illnesses. But the elderly, and especially the elderly who lived alone, were most vulnerable to the heat wave.” In addition to dying from overheating (hyperthermia), previous studies had suggested that heat waves led to an increased number of deaths from cardiovascular disease.

Although the exact number of persons who died as a result of the 1995 Chicago heat wave will never be known, Disease Detectives launched a number of investigations to determine risk factors for death due to this heat wave.

(2 pts) Disease Detectives generally conduct investigations in order to determine the cause of a particular problem. However, in this instance the cause was fairly obvious and a study was unnecessary for that purpose. Give one other reason why Disease Detectives studied this problem.

Describe the extent of the problem

Identify those at risk of dying from heat

Develop interventions to prevent people from dying

(2 pts) Investigations of communicable disease outbreaks generally study people with a particular infection. What was studied in this investigation?

Risk factors for deaths due to the heat wave

2008 Div C National Exam

By mid-day Monday, July 26th, 11 persons had died. Disease Detectives from the CDC and Pennsylvania Department of Health were notified of a possible outbreak of pneumonia among Legionnaires attending the convention in Philadelphia.

The Pennsylvania Medical Society, Pennsylvania Osteopathic Association and Hospital Association of Pennsylvania were notified of a potential statewide epidemic of pneumonia. Public health nurses searched hospitals in their areas for possible cases.

Describe two groups of cases likely to be missed by the above case-finding.

Any 2 of the following:

- Persons who did not seek medical attention.
- Persons who sought medical attention outside Pennsylvania.
- Persons who did not become ill.
- Persons who developed symptoms other than pneumonia.

2008 Div C National Exam

Five months after the outbreak, disease detectives interviewed 56 Legionnaires who became ill and survived their illness and 56 control persons, matched with the cases by age, who had not become ill. One of the questions asked dealt with smoking at the convention. The results of that investigation are shown in Table 2.

Table 2 History of cigarette smoking among Legionnaires' disease among matched case and control pairs at the American Legion Convention, Philadelphia, July, 1976

Table 2 History of cigarette smoking among Legionnaires' disease among matched case and control pairs at the American Legion Convention, Philadelphia, July, 1976

Cases	Controls		
	Smoker	Nonsmoker	Total
Smoker	14	17	31
Nonsmoker	5	16	21
	19	33	52

(1 pt) What term do Disease Detectives use for the study design?

matched case-control study

(4 pts) Calculate the odds ratio or relative risk (whichever is appropriate) for illness associated with smoking at the convention (Show your work in the space below – carry answer to 2 decimal places).

Odds ratio = (31*33)/(21*19) = 2.6 (note – this gives the same answer as dividing by the cross products of the above table)

2014 Division C

(4 points) The sensitivity of the laboratory test for crypto is 75%, the true prevalence of infection is 20%, and you screen 100 children. If the specificity is 100%, how many infections will you miss? (Show your calculations.)

Sensitivity = .75% Sensitivity = TP/(TP+FN) Prevalence = 20% of 100 = 20 = TP+FN

.75 = TP/20 TP=.75X20=15 FN=20-15=5

2014 Division C

If you were to screen each child twice and consider a child to be infected if either specimen is positive, what would be the sensitivity of the test? (Show your calculations.)

Sensitivity = TP/(TP+FN) = .75 = .75/1 FN = 1-.75 = .25 = probability of being FN on one test, probability of being FN on two tests = .252

Sensitivity of two tests = 1-.252 = .9375

Statistics and Division C

Purpose of Statistics in Disease Detectives

Descriptive and analytic statistical methods are important in the life and health sciences and it is reasonable to expect competitors at the high school level to demonstrate a basic competency in these methods in events such as Disease Detectives. However, statistics is not a major component of the event and should not define the event. Many competitors will not have had statistics and event supervisors should use it like a habanero, sparingly if at all but with purpose. One or two short, well-placed questions are adequate.

Key Principles

- Competitors should be able to use statistics – not do statistics. Technology should reflect real life
- Interpret printouts, use intermediate statistics to calculate test statistics or tell how changes in the value of intermediate statistics would affect final results.
- Students should be provided formulas for all calculations and tables
- Interpretation and translation of statistics into plain language is a valid competency that fits easily into a multiple choice format.
- Select a test or tell what test they would use to test a particular hypothesis
- Part of a larger scenario so that competitors can see how they fit into the larger analysis.
- Free-standing questions on statistics just for the sake of including statistics into the competition are contrary to the intent of the event.

The “Cheat Sheet”

Cheat Sheet Tips & Tricks

Before test day:

- Make early and edit often
- Color code!
- Organize
- Font Size Matters
- Make use of every inch of space – even the “unprintable” margins

On test day:

- Write down questions or topics you didn’t understand on your cheat sheet to study later/add to the cheat sheet for the next exam

Topics to Include on Your Cheat Sheet

- Definitions
- Formulas
  - Division C: Statistics Formulas
- 10 Steps of an Outbreak Investigation
- Pros and Cons of Study Design
- Types of Epi Curves

Event Supervisor Perspective

- We made major changes in our approach once they were allowed
- Two single-sided sheets do not equal one double-sided sheet
- Are a crutch
- Every second spent looking at a cheat sheet is a second not spent on the event
- Individual vs Team gaps
- Should ideally change as teams move up the ladder (regional-state-national)

Additional questions, concerns, or thoughts?

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov