Epidemiologic Inference in Public Health I

340.721.81

January 31, 2018
LiveTalk

Overview of LiveTalk

1. Announcements
2. Review of Activity: Outbreak Investigation
3. Question and Answer session
   - Please post to General Chat (we will not respond to Private Chats)

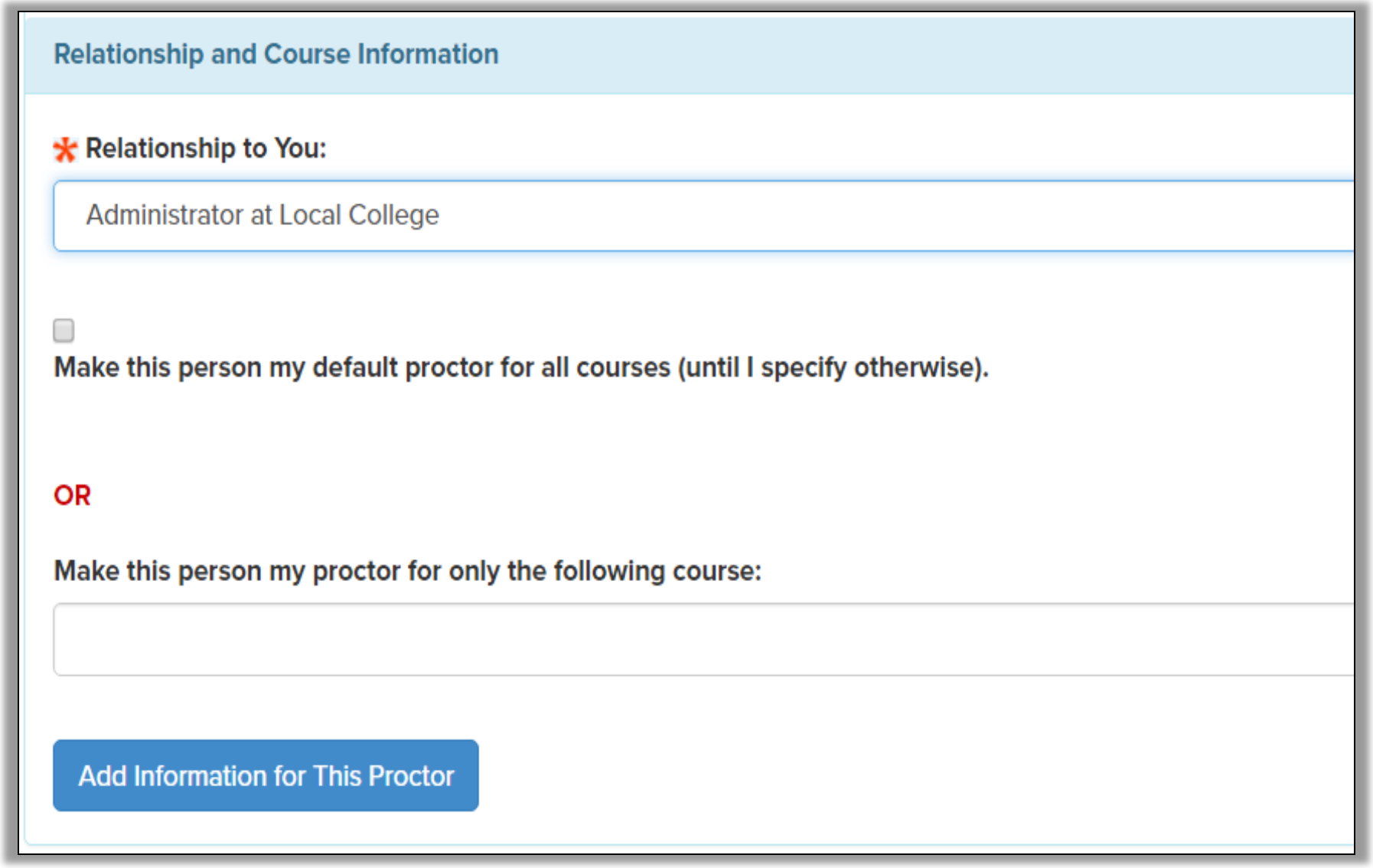
Announcements

- Pre-Activity (Measuring Disease Frequency) due to CoursePlus on **Wed, Feb 7** by **4:00PM** Eastern Time
- We will discuss the Activity on Measuring Disease Frequency at the LiveTalk Wed, Feb 7 4:00-5:30PM Eastern Time

Announcements

- Please don't forget to identify a Proctor for the midterm exam in CoursePlus by **Mon, Feb 5,** 11:59pm.
- A random 5% of the proctors will be contacted via phone after the exam

Recall…from last week's LiveTalk



Recall…from last week's LiveTalk

Relationship and Course Information

Relationship to You:

Administrator at Local College

Make this person my default proctor for all courses (until I specify otherwise).

OR

Mak

Relationship and Course Information

Relationship to You:

Administrator at Local College

Administrator at Local College
Clergy
Corporate Education Director
Faculty at Local College
JHSPH On-Campus Proctor
Library Worker
Supervisor
Testing Center Administrator
Other - Approved by course faculty

Allyn Arnold
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Activity

Outbreak Investigation

Plan for the LiveTalk Today

- We will review the answers to the Activity question by question
- Questions were assigned to Groups last week
- When it's time for your group to present, if you are the spokesperson for your group, please raise your hand and we will call on you to answer your assigned questions

Activity 1

- Epidemiologists are often involved in outbreak investigations to try to identify the cause(s) of the outbreak in order to prevent another outbreak
- In Activity 1, you are an epidemiologist investigating an outbreak of diarrhea following a conference on food safety (the Food Safety Summit) that took place at the Baltimore Convention Center April 8-10, 2014

Food Safety Summit

- *"a solution-based conference and expo designed to meet the educational and informational needs of the food industry including growers, processors, retailers, distributors, foodservice operators, regulators and academia. The Summit provides a 3-day comprehensive educational program to learn from subject matter experts, trainers, exchange ideas and find solutions to your current job challenges."*

http://www.foodsafetysummit.com/

News

Twist of fate gives food safety event a food poisoning outbreak

March 4, 2015
by Lab Canada

Baltimore, MD – Organizers of this year's 2015 Food Safety Summit are tackling a foodborne illness problem from last year's summit head-on.

In an ironic twist of fate, attendees at the 2014 conference were hit with an outbreak of food poisoning. Summit organizers immediately followed up with the local departments of health and attendees to determine the cause and extent of the outbreak. Investigative methods included contacting all attendees via an internet survey, an epidemiologic investigation, environmental investigation and laboratory analyses. After a final report was received, organizers developed a 2015 Food Oversight Plan to avoid a repetition of the problems that led to the outbreak. The plan will be in effect for this year's event, which takes place at the same venue.

The organizers say the outbreak at the 2014 summit showed that such an outbreak can happen at any time, anywhere, and at any event.

http://www.labcanada.com/laboratory/twist-of-fate-gives-food-safety-event-a-food-poisoning-outbreak/1003508110/

Key Concepts

STEPS IN OUTBREAK INVESTIGATION:

1. Define the epidemic (case definition, population at risk, attack rates).
2. Examine the distribution of cases by time and place (epidemic curves, median incubation period)
3. Look for combinations of relevant variables (food-specific attack rates, cross-tabulation).
4. Develop hypotheses.
5. Test hypotheses
6. Recommend control measures

Key Concepts

In the Activity and during the LiveTalk we will:

- Utilize principles for case definition
- Draw an epidemic curve
- Calculate an incubation period
- Calculate attack rate
- Calculate risk difference
- Calculate relative risk
- Compose a cross-tabulation

Food Safety Summit 2014

- Approximately 1,300 people attended, exhibited at, or spoke at the conference.
- Caterer A supplied food for the entire conference and all food was served buffet style.
- Food was also available for purchase at vendors and concession stands in the convention center.

Food Safety Summit 2014

- Attendees became ill with diarrhea between April 8th and April 10th
- First reports of illness to the Baltimore City Health Department (BCHD) on April 11th

Food Safety Summit 2014

- On April 16, 2014 the BCHD, in collaboration with the Maryland Department of Health and Mental Hygiene, initiated an outbreak investigation to develop a hypothesis about what caused the outbreak
- Their methods included an epidemiologic investigation, environmental investigation, and laboratory analysis

Question 1 (Group 7)

- Imagine you were the lead epidemiologist on the BCHD outbreak investigation team. What information would you need to collect in order to develop a hypothesis about what caused the outbreak? (*Hint*: Make sure to include person, place, and time characteristics)

Food Safety Summit 2014

- Information collected by the BCHD about the outbreak:
  - Open-ended interviews with several conference attendees
  - Created an online survey for all conference participants.
  - Obtained a food menu from Caterer A
  - Obtained a list of sessions and activities from the conference's website

Question 2 (Group 7)

- The online survey response rate among conference participants was 51% (669/1,300 = 0.51*100% = 51%).
- What concerns might you have about whether the group who responded to the survey is representative of everyone who was at risk of becoming ill?
- Can you think of ways that you could assess the representativeness of survey respondents?

Recall, from the PRE-Activity… Calculating Response Rates

Table 1. Summary of Response to the Questionnaire for Members and Guests

	Members	**Guests**
Number of people to whom questionnaires were sent	90	As many as possible (Assume ~800)
Number of responses from attendees	86	67
Number of responses from attendees who ate	85	67
Number of people who reported sore throat	60	57
Number of people who reported sore throat and fever	41	48

Table 1. Summary of Response to the Questionnaire for Members and Guests

	Members	Guests
Number of people to whom questionnaires were sent	90	As many as possible (Assume ~800)
Number of responses from attendees	86	67
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Number of people who reported sore throat and fever	41	48

$$\text{Response rate} = \frac{\text{\# of members that completed the questionnaire}}{\text{\# of members who were asked to complete the questionnaire}} = \frac{86}{90} = 0.96, \text{or } 96\%$$

Question 3 (from the PRE-Activity)

What is the response rate for guests?

a. 8%

b. 46%

c. 72%

d. 85%

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$$\text{Response rate}_{\text{Guests}} = \frac{67}{800}$$

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$$\text{Response rate}_{\text{Guests}} = \frac{67}{800} = 0.084 = 8\%$$

Question 2

- The online survey response rate among conference participants was 51% (669/1,300 *100).
- What concerns might you have about whether the group who responded to the survey is representative of everyone who was at risk of becoming ill?
- Can you think of ways that you could assess the representativeness of survey respondents?

Question 2

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- What concerns might you have about whether the group who responded to the survey is representative of everyone who was at risk of becoming ill?
- Can you think of ways that you could assess the representativeness of survey respondents?

What do we mean by “representative”?

- To be representative, persons who respond to the survey should be (on average) similar to persons who did not respond to the survey with respect to whether or not they became ill and to factors related to whether or not they became ill (i.e., the foods they ate)

Recall…from the PRE-Activity
An example

(NOTE: Are you wondering why you were asked to calculate the response rate? Compare the response rate you calculated for guests in Question 3 to the 96% response for members. Are they similar or different? What are some possible reasons why?

If you are unable to obtain measurements on everyone, a more practical goal is to obtain measurements from *a representative group* of all the people at risk of becoming ill. Based on the response rates, which group do you think is more representative – members or guests?)

Using information provided in the PRE-Activity…

Response Rates of Members and Guests

	Members	Guests
Questionnaires Sent	Complete List	As Many As Possible
Responses From Attendees	86/90 (96%)	67/800 (8%)
Illness Among Responders who ate (case = sore throat)	60/85 (71%)	57/67 (85%)

Question 2

- The online survey response rate among conference participants was 51% (669/1,300 *100).
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Using information from the PRE-Activity…

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Question 3 (Group 14)

- Based on the information provided, what is the (1) total number of cases and (2) total number of well individuals (i.e., non-cases) that should be included in the BCHD's analysis? Please justify your answer

(*Hint*: Think about who is at-risk of becoming ill)

A brief aside about case definitions…

Per CDC - Case definition for outbreak investigation

Purpose of a case definition:

Development of a clear case definition is critical to effective investigation of an outbreak. Use of a common case definition allows for standardization of the cases of interest both within an ongoing outbreak investigation and possibly between outbreak investigations that differ over time or geographic location.

https://www.cdc.gov/urdo/downloads/casedefinitions.pdf

Per CDC - Case definition for outbreak investigation

Developing outbreak case definitions:

A case definition includes criteria for person, place, time, and clinical features. These should be specific to the outbreak under investigation.

"Person" describes key characteristics the patients share in common. For example, this description may include: age, sex, race, occupation and exclusion criteria (e.g., “persons with no history of X disease”).

"Place" typically describes a specific geographic location (state, county) or facility associated with the outbreak (X nursing home, Y high school).

"Time" is used to delineate a period of time associated with illness onset for the cases under investigation. Limiting the time period enables exclusion of similar illnesses which are unrelated to the outbreak of interest.

Initially, "clinical features" should be simple and objective (e.g., sudden onset of fever and cough). The clinical criteria may later be characterized by the presence of specific laboratory findings.

https://www.cdc.gov/urdo/downloads/casedefinitions.pdf

From CDC outbreak investigation materials

Examples of a case definition:

"Student attending X High School who has onset of fever and cough between January 4 and 24, 2007."

"A resident of, or visitor to, Rapid City, South Dakota who was diagnosed by a physician, either clinically or radiographically, with community-acquired pneumonia (CAP) with symptom onset after May 1, 2005 and who had laboratory confirmation of Legionnaires' disease by culture of *Legionella*, by urinary antigen test for *Legionella pneumophila* serogroup 1 (*Lp*1), by a four-fold or greater rise in serum antibody titer to *Lp*1, or detection of specific *Legionella* antigen by direct fluorescent antibody staining."

https://www.cdc.gov/urdo/downloads/casedefinitions.pdf

Case Definition from our Activity

Case Definition and Exposure Assessment:

Based on information obtained from preliminary reports and open-ended interviews, the BCHD established the following case definition:

> **Diarrhea or vomiting in a person who attended the Food Safety Summit Conference, with an onset up to 72 hours after the conference.**

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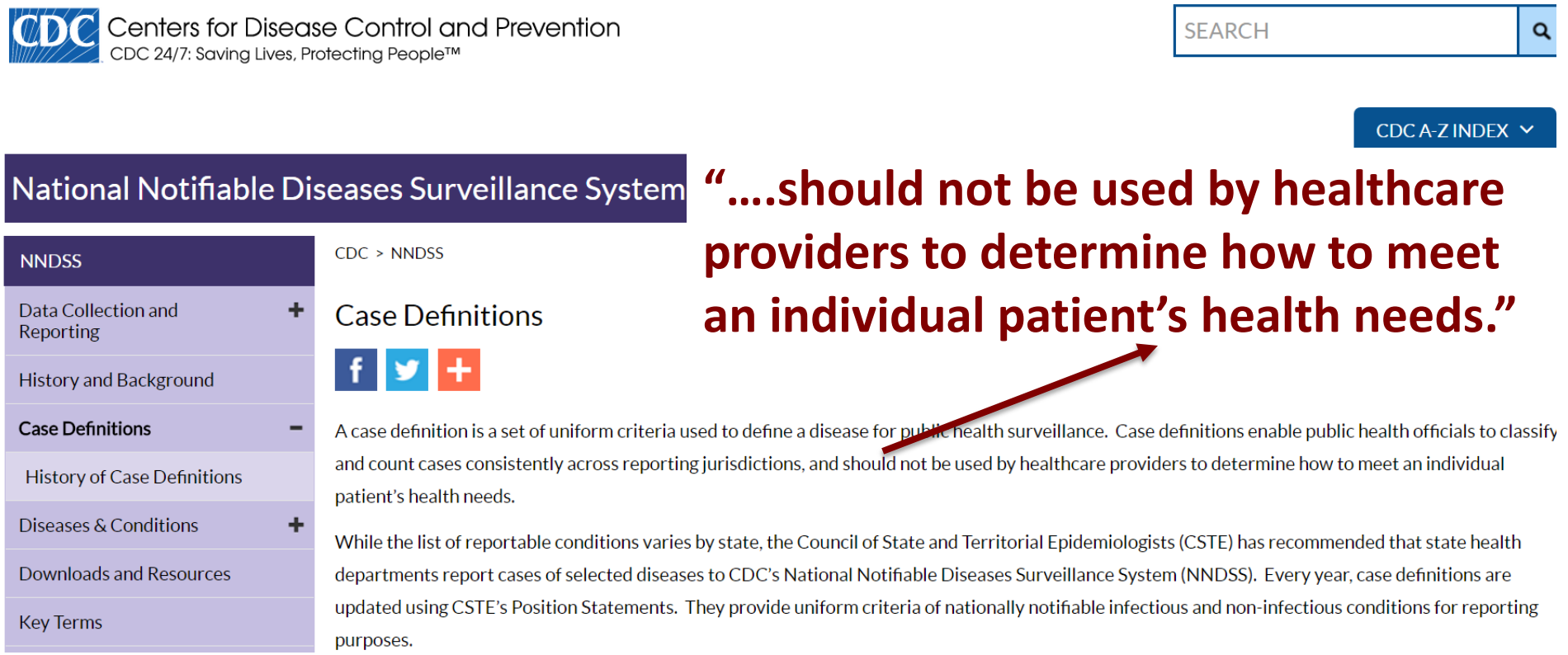
> **Diarrhea or vomiting in a person who attended the Food Safety Summit Conference, with an onset up to 72 hours after the conference.**

Person, place, time?

Per CDC - Case definition for ongoing surveillance



"....should not be used by healthcare providers to determine how to meet an individual patient's health needs."

http://wwwn.cdc.gov/nndss/script/casedefDefault.aspx

In general, in developing a case definition

- The goal is to include as many "true" cases and as few "false" cases as possible.

- Each definition will differ in its ability to properly classify those who are truly sick and those who are truly not sick.
  - *(Sound familiar? Think back to the PRE-Activity. Further discussion to come in Lecture 6…)*

Recall…from the PRE-Activity

A more strict definition would require more symptoms to be included in the definition of a case. For example, a case might be defined as people who report sore throat AND fever AND vomiting. Conversely, a less strict definition would require fewer symptoms (for example, only headaches). Each definition will differ in its ability to properly classify those individuals who are truly sick and those individuals who are truly *not* sick. For example, when using a *more* strict case definition, fewer individuals will be identified as cases. This means that you are likely to miss some cases among those individuals who were truly ill, but also that more individuals who truly are *not* ill will be correctly counted as non-cases. The case definition should match the goal of the investigation. In this Activity, the goal of the investigation is to include as many "true" cases and as few "false" cases as possible.

Question 1

Which of the following statements is(are) true of using a **less strict** case definition as compared to a more strict case definition? (SELECT ALL THAT APPLY)

a. More individuals who truly are ill will be counted as cases
b. More individuals who truly are ill will be counted as non-cases
c. More individuals who truly are *not* ill will be counted as non-cases
d. More individuals who truly are *not* ill will be counted as cases

Recall…from the PRE-Activity

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Question 3

- Based on the information provided, what is the (1) total number of cases and (2) total number of well individuals (i.e., non-cases) that should be included in the BCHD's analysis? Please justify your answer

(*Hint*: Think about who is at-risk of becoming ill)

Question 3

Case Definition and Exposure Assessment:

Based on information obtained from preliminary reports and open-ended interviews, the BCHD established the following case definition:

> **Diarrhea or vomiting in a person who attended the Food Safety Summit Conference, with an onset up to 72 hours after the conference.**

Of the 1,300 conference participants, a total of 669 individuals responded to the online survey administered by the BCHD and of those, 246 reported feeling ill around the time of the conference. Of the 246 ill respondents, 2 reported onsets more than 72 hours after the conference took place. An additional 14 of the 246 ill respondents reported feeling unwell, but did not have diarrhea or vomiting, and another 14 respondents reported an onset of illness before attending the conference. A total of 35 respondents were missing information on illness symptoms and/or food consumed.

Question 3

669 responded to the survey

- 35 missing data

634

- 30 who were sick did not meet case definition
  - 2 sick >72 hours after the conference
  - 14 did not have vomiting or diarrhea
  - 14 sick prior to the conference

604

216 Sick

388 Not Sick

Question 3

669 responded to the survey

- 35 missing data

634

- 30 did not meet case definition
  - 2 sick >72 hours after the conference
  - 14 did not have vomiting or diarrhea
  - 14 sick prior to the conference

604

CASES

216 Sick

NON-CASES

388 Not Sick

Question 4 (Group 14)

- What is the purpose of calculating attack rates and RR's? Of calculating attack rates and RR's by session?

The BCHD calculated the relative risk (RR) of developing illness for each session, activity, and food item. Data from each session are summarized in Table 1 below.

	Sick		Well		Attack Rate Yes	Attack Rate No	RR
	Yes	No	Yes	No			
Attended 4/7	22	179	24	364	22/(22+24) = 48%	179/(179+364)= 33%	0.48/0.33 = 1.45
Attended 4/8	159	42	232	156	41%	21%	1.92
Attended 4/9	171	3	344	44	33%	6%	5.20
Attended 4/10	31	9	287	101	10%	8%	1.19

Question 4

- What is the purpose of calculating attack rates and RR's? Of calculating attack rates and RR's by session?

First, let's walk through Table 1.

Session Dates

The BCHD calculated the relative risk (RR) of developing illness for each session, activity, and food item. Data from each session are summarized in Table 1 below.

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Includes participants who met the case definition for illness

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Includes participants who met the case definition for illness

Session Dates

Includes participants who did not meet the case definition for illness

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Includes participants who met the case definition for illness

Attended on 4/7

Session Dates

Did not attend on 4/7

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What's an attack rate?

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Question 4

Recall…from the PRE-Activity

ATTACK RATES

The *attack rate* is an example of a measure of disease frequency. It is calculated as the number of people at risk in whom a certain illness develops divided by the total number of people *at risk*.

$$\text{Attack Rate} = \frac{\text{Number of people at risk in whom a certain illness develops}}{\text{Total number of people at risk}}$$

Recall…from the textbook…

$$\text{Attack Rate} = \frac{\text{Number of people at risk in whom a certain illness develops}}{\text{Total number of people at risk}}$$

$$\text{Food-specific Attack Rate} = \frac{\text{Number of people who ate a certain food in whom a certain illness develops}}{\text{Total number of people who ate the food}}$$

- But here, “at risk” means attended on a specific day (similar to in a food-specific attack rate, at risk means “ate the specific food”)

"Attendance-specific" Attack Rate = $\frac{\text{Number of people who attended on a given day in whom a certain illness develops}}{\text{Total number of people attended on that day}}$

The BCHD calculated the relative risk (RR) of developing illness for each session, activity, and food item. Data from each session are summarized in Table 1 below.

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Total number of people at risk who get sick (numerator)

Total number of people at risk (denominator)

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$$\frac{22}{(22+24)} = \frac{22}{46} = 0.478 = 48\%$$

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(One more slide on case definitions…)

ATTACK RATES

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$$\text{Attack Rate} = \frac{\text{Number of people at risk in whom a certain illness develops}}{\text{Total number of people at risk}}$$

CASE DEFINITION

What is a relative risk (RR)?

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A relative risk = ratio of 2 risks (in this case, attack rates)

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48 / 33 = 1.45

Question 4

- What is the purpose of calculating attack rates and RR's? Of calculating attack rates and RR's by session?

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Question 5 (Group 14)

- As the lead epidemiologist on the BCHD outbreak investigation team, you suspect that exposure likely occurred on April 9th. How would you interpret the RR of 5.20 to your colleagues?

The BCHD calculated the relative risk (RR) of developing illness for each session, activity, and food item. Data from each session are summarized in Table 1 below.

	Sick		Well		Attack Rate Yes	Attack Rate No	RR
	Yes	No	Yes	No			
Attended 4/7	22	179	24	364	22/(22+24) = 48%	179/(179+364)= 33%	0.48/0.33 = 1.45
Attended 4/8	159	42	232	156	41%	21%	1.92
Attended 4/9	171	3	344	44	33%	6%	5.20
Attended 4/10	31	9	287	101	10%	8%	1.19

Interpreting a RR

- RR=1 ⇨ No association
  (null association)
- RR>1 ⇨ Risk in exposed > risk in unexposed
  (positive association)
- RR<1 ⇨ Risk in exposed < risk in unexposed
  (inverse association)

Question 6 (Group 20)

- Based on the information presented in Table 2, you suspect that the chicken marsala is the contaminated food (RR = 3.46). Some of your colleagues argue that other foods (such as honey and the grilled vegetable lasagna) might be contaminated because they also have RR's >1.0. Describe to your colleagues a potential reason why these food items could have RR's that are >1.0, even if they are not the contaminated food source.

Table 2. Attack Rates and Relative Risks for Respondents who Did and Did Not Eat Food Served at the Conference Lunch on 4/9

	Ill			Well			Attack Rate Ate	Attack Rate Did not eat	RR
	Yes (Ate)	No (Did not eat)	% Ate the food	Yes (Ate)	No (Did not eat)	% Ate the food			
Spring lettuce salad	120	37	76%	157	63	71%	43%	37%	1.17
Tomato and mozzarella	113	44	72%	148	72	67%	43%	38%	1.14
Chicken Marsala	146	11	93%	153	67	70%	49%	14%	3.46
Grilled vegetable white lasagna	115	42	73%	139	81	63%	45%	34%	1.33
Roasted Italian vegetables	106	51	68%	139	81	63%	43%	39%	1.12
Roll	53	104	34%	85	135	39%	38%	44%	0.88
Focaccia	36	121	23%	44	176	20%	45%	41%	1.10
Butter	37	120	24%	50	170	23%	43%	41%	1.03
Tiramisu cake	87	70	55%	104	116	47%	46%	38%	1.21
Iced tea	77	80	49%	113	107	51%	41%	43%	0.95
Coffee	27	130	17%	45	175	20%	38%	43%	0.88
Water	76	81	48%	95	125	43%	44%	39%	1.13
Creamer	15	142	10%	25	195	11%	38%	42%	0.89
Sugar	18	139	11%	15	205	7%	55%	40%	1.35
Sweetener	17	140	11%	21	199	10%	45%	41%	1.08
Honey	3	154	2%	2	218	1%	60%	41%	1.45
Lemon	12	145	8%	10	210	5%	55%	41%	1.34

Question 7 (Group 20)

- To illustrate the point you made in Question 6, show your colleagues how they could use cross-tabulation to calculate the attack rates and RR's and determine which food is the likely cause of the outbreak, using the information in the following table:

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169		
Ate lasagna only	43	81	124		
Ate both chicken marsala and lasagna	72	58	130		
Didn't eat either food	53	148	201		

[*Hint*: Recall how we organized attack rates for the cross-tabulation in the Assignment (Tables 3b and 4b)]

Question 7

First let's calculate Attack Rates for each food (i.e., food-specific attack rates)

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169		
Ate lasagna only	43	81	124		
Ate both chicken marsala and lasagna	72	58	130		
Didn't eat either food	53	148	201		

[*Hint*: Recall how we organized attack rates for the cross-tabulation in the Assignment (Tables 3b and 4b)]

Question 7

Total number of people who ate the food who get sick (numerator)

Total number of people who ate the food (denominator)

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169		
Ate lasagna only	43	81	124		
Ate both chicken marsala and lasagna	72	58	130		
Didn't eat either food	53	148	201		

Question 7: Attack rates

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169	74/169=0.438=**43.8%**	
Ate lasagna only	43	81	124	43/124=0.347=**34.7%**	
Ate both chicken marsala and lasagna	72	58	130	72/130=0.554=**55.4%**	
Didn't eat either food	53	148	201	53/201=0.264=**26.4%**	

What do these attack rates tell us?

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169	74/169=0.438=**43.8%**	
Ate lasagna only	43	81	124	43/124=0.347=**34.7%**	
Ate both chicken marsala and lasagna	72	58	130	72/130=0.554=**55.4%**	
Didn't eat either food	53	148	201	53/201=0.264=**26.4%**	

What do these attack rates tell us? Looking ahead to Lecture 4…

Rates vs. Proportions

Rates - How fast is the disease occurring?

$$\frac{\text{number of events (e.g., new cases)}}{\text{population-time}}$$

Proportions - What proportion of the population is affected?

$$\frac{\text{number of people affected}}{\text{total population}}$$

What do these attack rates tell us?
Looking ahead to Lecture 4…

Rates vs. Proportions

Attack “rates” are actually proportions

Proportions - What proportion of the population is affected?

$$\frac{\text{number of people affected}}{\text{total population}}$$

Question 7

Next, let's talk about the question we are asking (and how we organize the data to help us answer it)

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169	74/169=0.438=**43.8%**	
Ate lasagna only	43	81	124	43/124=0.347=**34.7%**	
Ate both chicken marsala and lasagna	72	58	130	72/130=0.554=**55.4%**	
Didn't eat either food	53	148	201	53/201=0.264=**26.4%**	

[*Hint*: Recall how we organized attack rates for the cross-tabulation in the PRE-Activity (Tables 3b and 4b)]

Why cross-tabulation?

- People who ate the chicken marsala may also have eaten the lasagna and vice versa which makes it difficult to determine which food was responsible for the outbreak.
- With cross-tabulation, we are trying to get separate estimates of the risk associated with each food.

Goal of the cross-tabulation

- To compare attack rates in persons who ate a given food *independent* of other foods in order to determine which food was likely the cause of the outbreak

Question 7

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169	74/169=0.438=**43.8%**	
Ate lasagna only	43	81	124	43/124=0.347=**34.7%**	
Ate both chicken marsala and lasagna	72	58	130	72/130=0.554=**55.4%**	
Didn't eat either food	53	148	201	53/201=0.264=**26.4%**	

In a cross-tabulation, we calculate the ratio of 2 attack rates.
We call this ratio a "relative risk" (RR)

Question 7

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169	43.8%	43.8/26.4=**1.66**
Ate lasagna only	43	81	124	34.7%	34.7/26.4=**1.31**
Ate both chicken marsala and lasagna	72	58	130	55.4%	55.4/26.4=**2.10**
Didn't eat either food	53	148	201	26.4%	26.4/26.4=**1.0**

Question 7

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169	43.8%	43.8/26.4=**1.66**
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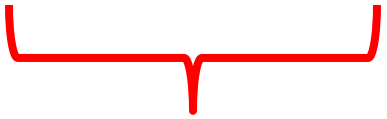


Where did these numbers come from?

Question 7

	Number Sick	Number Well	Total	Attack Rate	RR
Ate chicken marsala only	74	95	169	43.8%	43.8/26.4=**1.66**
Ate lasagna only	43	81	124	34.7%	34.7/26.4=**1.31**
Ate both chicken marsala and lasagna	72	58	130	55.4%	55.4/26.4=**2.10**
Didn't eat either food	53	148	201	26.4%	26.4/26.4=**1.0**

Where did these numbers come from?

Remember the hint:

[*Hint*: Recall how we organized attack rates for the cross-tabulation in the PRE-Activity (Tables 3b and 4b)]

Question 7

Recall…from the PRE-Activity

Table 3b. Cross-tabulation Table of Attack Rates for Members with Sore Throat

		Ate Egg Salad	
		Yes	**No**
Ate Tuna Salad	**Yes**	0.87	0.30
	No	0.67	0.30

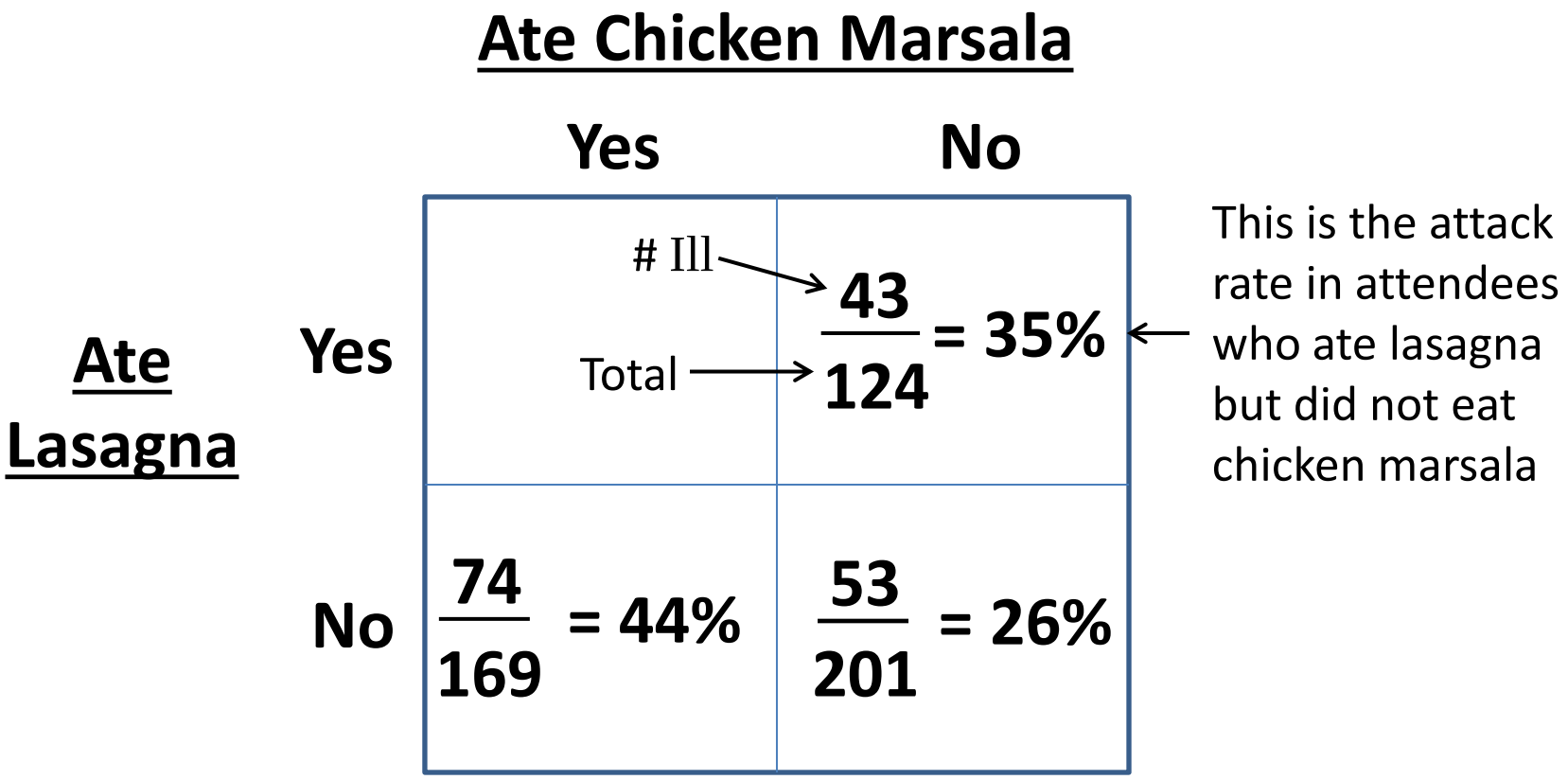
Table 4b. Cross-tabulation Table of Attack Rates for Members with Sore Throat

		Ate Egg Salad	
		Yes	**No**
Ate Tuna Salad	**Yes**		
	No		

Question 7

Cross-Tabulation

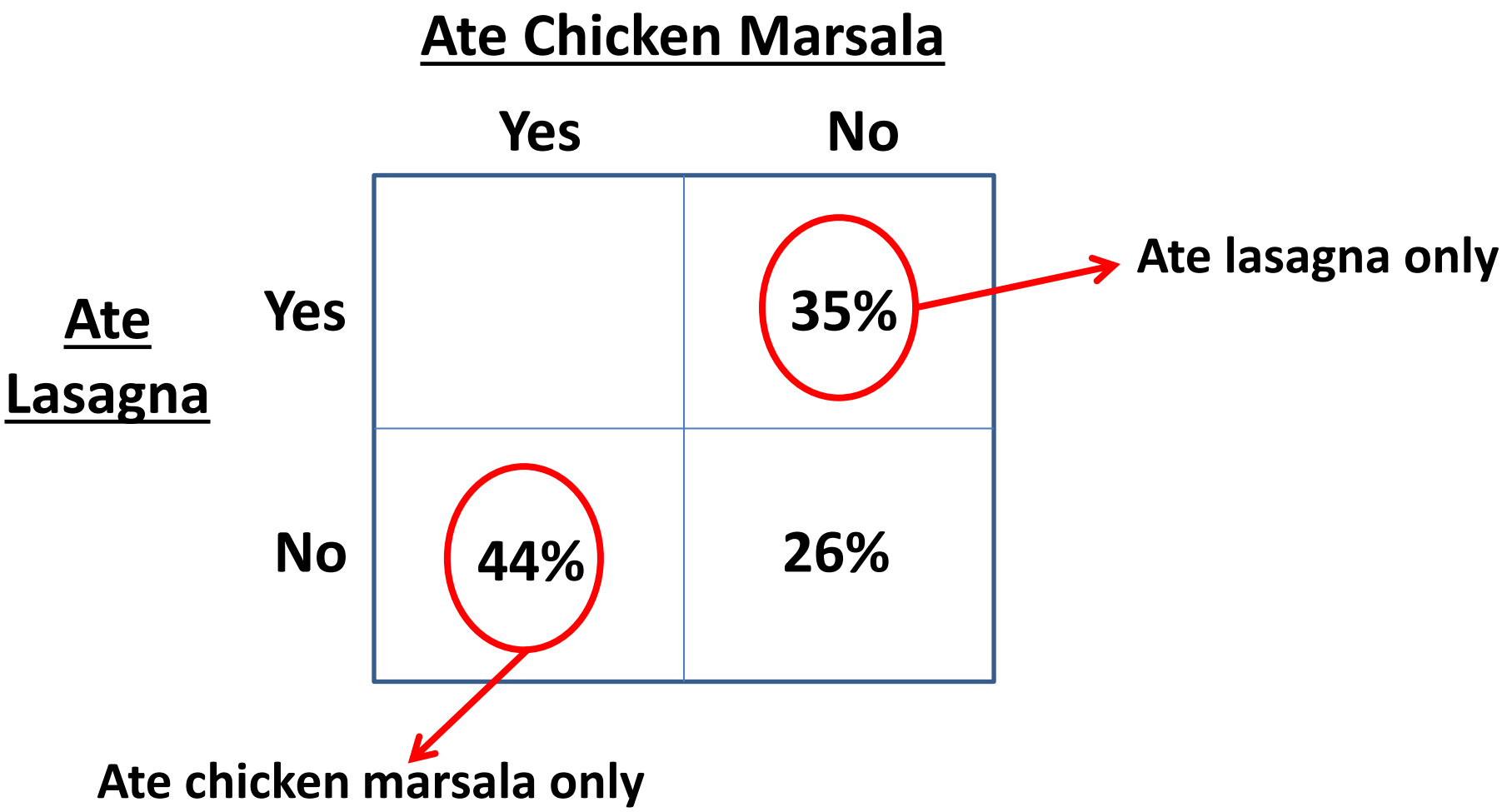
- Let's organize that data in a different way:



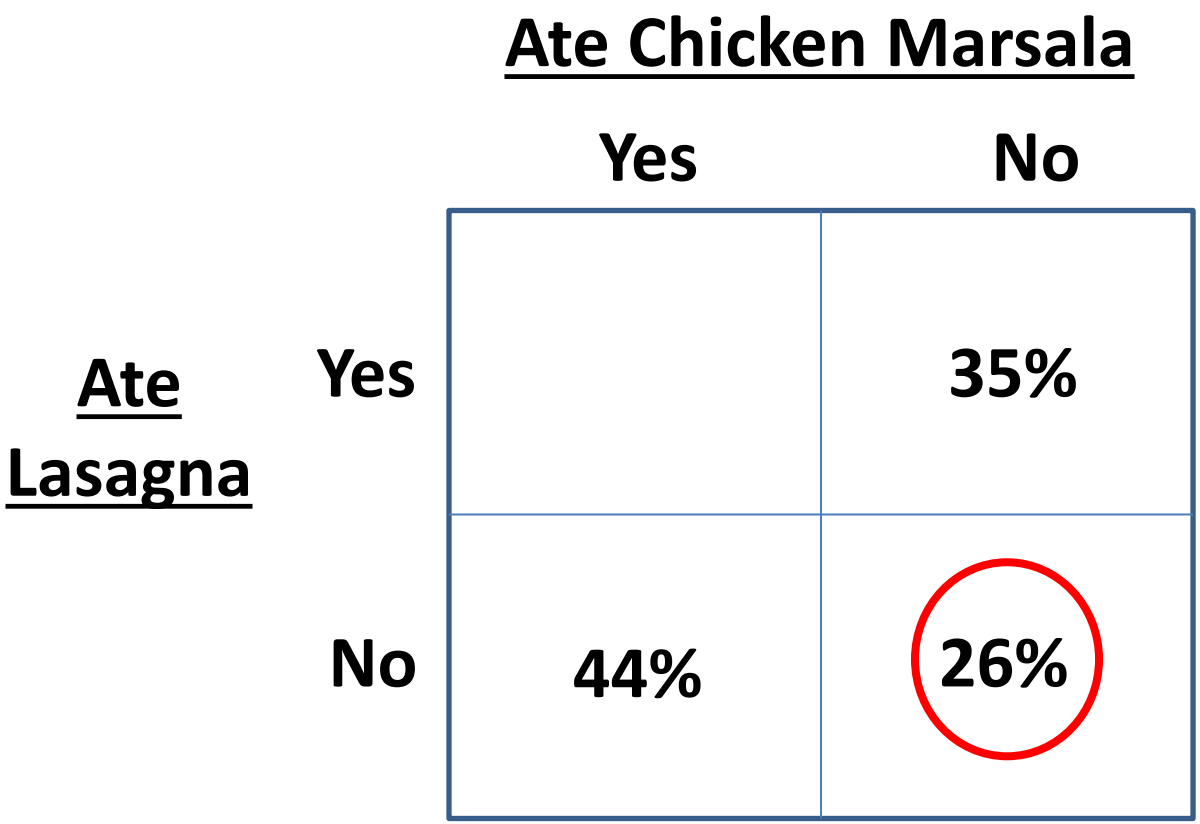
Recall…goal of the cross-tabulation

- To compare attack rates in persons who ate a given food *independent* of other foods in order to determine which food was likely the cause of the outbreak

Question 7


Ate Chicken Marsala
Yes
No
Ate Lasagna
Yes
No
35%
44%
26%
Ate lasagna only
Ate chicken marsala only

Question 7



What does this number represent?

Question 7

Ate Lasagna	Ate Chicken Marsala: Yes	Ate Chicken Marsala: No
Yes		35%
No	44%	26%

$$\frac{\text{Attack rate in those who ate only } \textbf{\textit{lasagna}}}{\text{Attack rate in those who ate } \textbf{\textit{neither}} \text{ food}} = \frac{35\%}{26\%} = \boxed{1.3}$$

$$\frac{\text{Attack rate in those who ate only } \textbf{\textit{chicken marsala}}}{\text{Attack rate in those who ate } \textbf{\textit{neither}} \text{ food}} = \frac{44\%}{26\%} = \boxed{1.7}$$

Question 7

$$\frac{\text{Attack rate in those who ate only } \textbf{\textit{lasagna}}}{\text{Attack rate in those who ate } \textbf{\textit{neither}} \text{ food}} = \frac{35\%}{26\%} = 1.3$$

$$\frac{\text{Attack rate in those who ate only } \textbf{\textit{chicken marsala}}}{\text{Attack rate in those who ate } \textbf{\textit{neither}} \text{ food}} = \frac{44\%}{26\%} = 1.7$$

	Number Sick	Number Well	Total	Attack Rate	RR
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Report: Chicken on Menu at 2014 Food Safety Summit was Contaminated

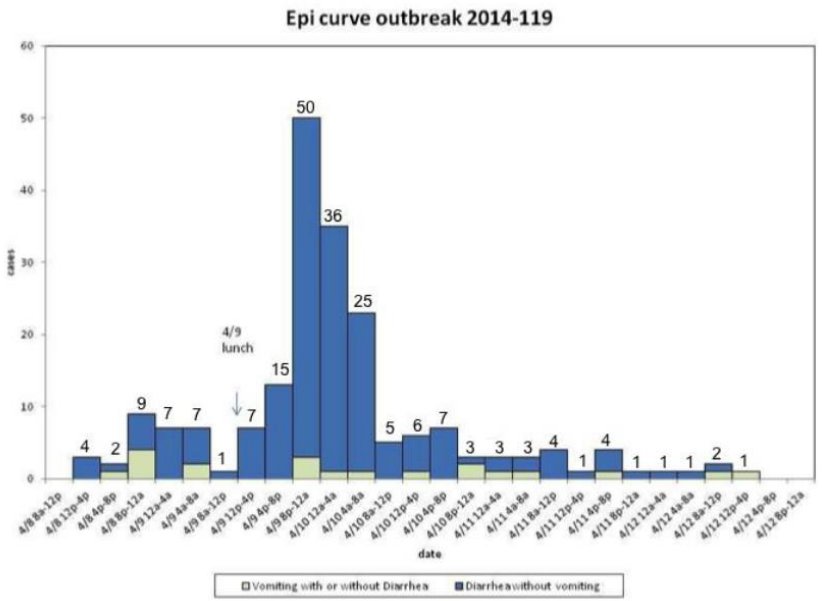
BY DAN FLYNN | SEPTEMBER 25, 2014

The pan-seared breast of Chicken Marsala served by the Baltimore Convention Center's exclusive caterer was the food item most commonly consumed by the 216 attendees sickened by the lunch served last April 9 at the Food Safety Summit's annual conference.

http://www.foodsafetynews.com/2014/09/c-perfringens-in-c/#.VqZkatKrTDc

Question 8 (Group 10)

Using the epidemic curve, calculate the estimated median incubation period for the onset of illness (defined as diarrhea *without* vomiting)? Assume that exposure occurred at 12pm on 4/9 .



Question 8

Using the epidemic curve, calculate the estimated median incubation period for the onset of illness (defined as diarrhea *without* vomiting)? Assume that exposure occurred at 12pm on 4/9 .

- Median =

  The middle number (in a sorted list of numbers).

  To find the Median, place the numbers you are given in value order and find the middle number.

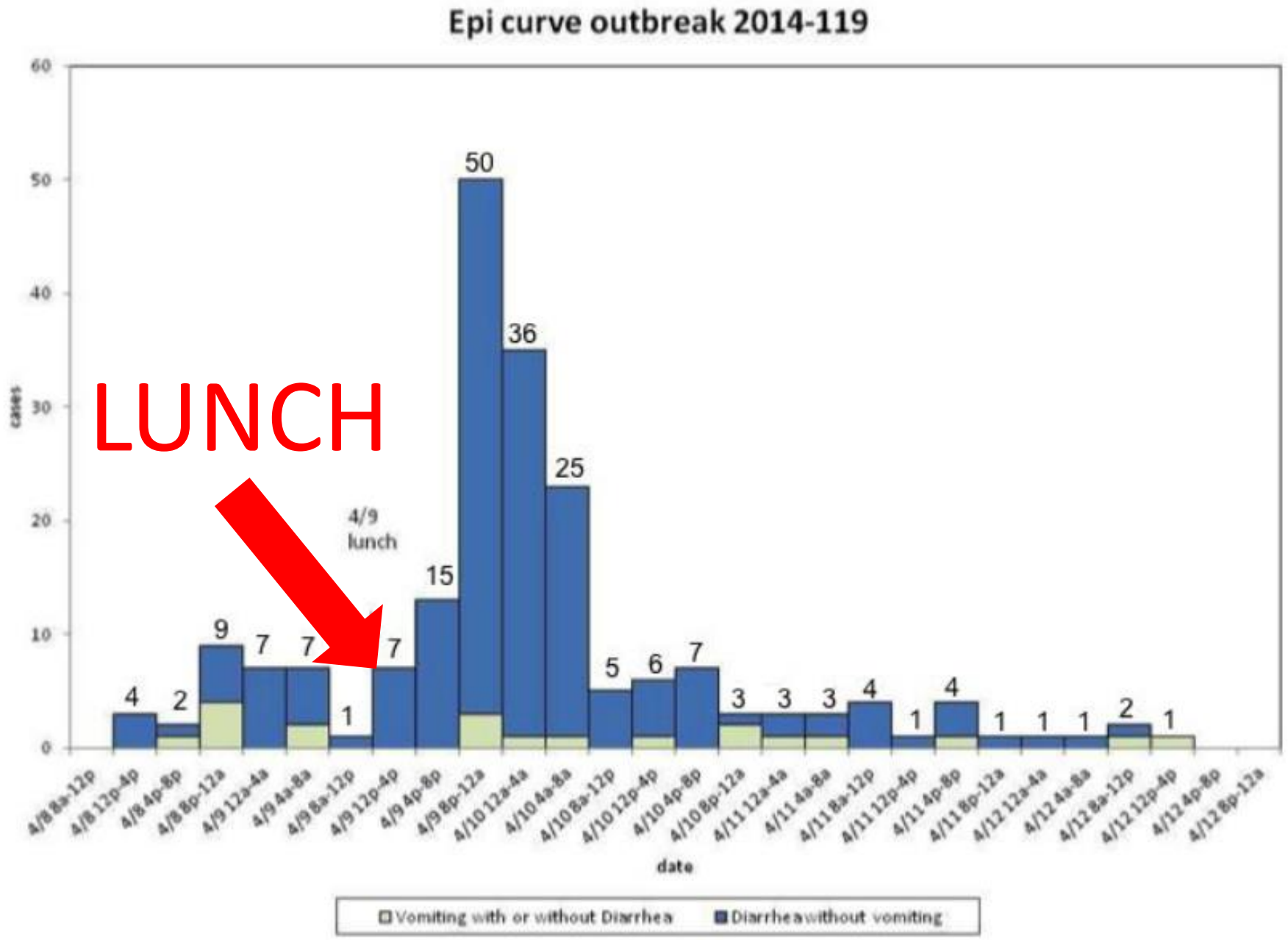
  Example: find the Median of {13, 23, 11, 16, 15, 10, 26}.

  Put them in order: {10, 11, 13, 15, 16, 23, 26}

  The middle number is 15, so the median is 15.

  (If there are two middle numbers, you average them.)

http://www.mathsisfun.com/definitions/median.html


Epi curve outbreak 2014-119
LUNCH
4/9
lunch
cases
date
Vomiting with or without Diarrhea
Diarrhea without vomiting
0
10
20
30
40
50
60
4
2
9
7
7
1
7
15
50
36
25
5
6
7
3
3
3
4
1
4
1
1
1
2
1
4/8 8a-12p
4/8 12p-4p
4/8 4p-8p
4/8 8p-12a
4/9 12a-4a
4/9 4a-8a
4/9 8a-12p
4/9 12p-4p
4/9 4p-8p
4/9 8p-12a
4/10 12a-4a
4/10 4a-8a
4/10 8a-12p
4/10 12p-4p
4/10 4p-8p
4/10 8p-12a
4/11 12a-4a
4/11 4a-8a
4/11 8a-12p
4/11 12p-4p
4/11 4p-8p
4/11 8p-12a
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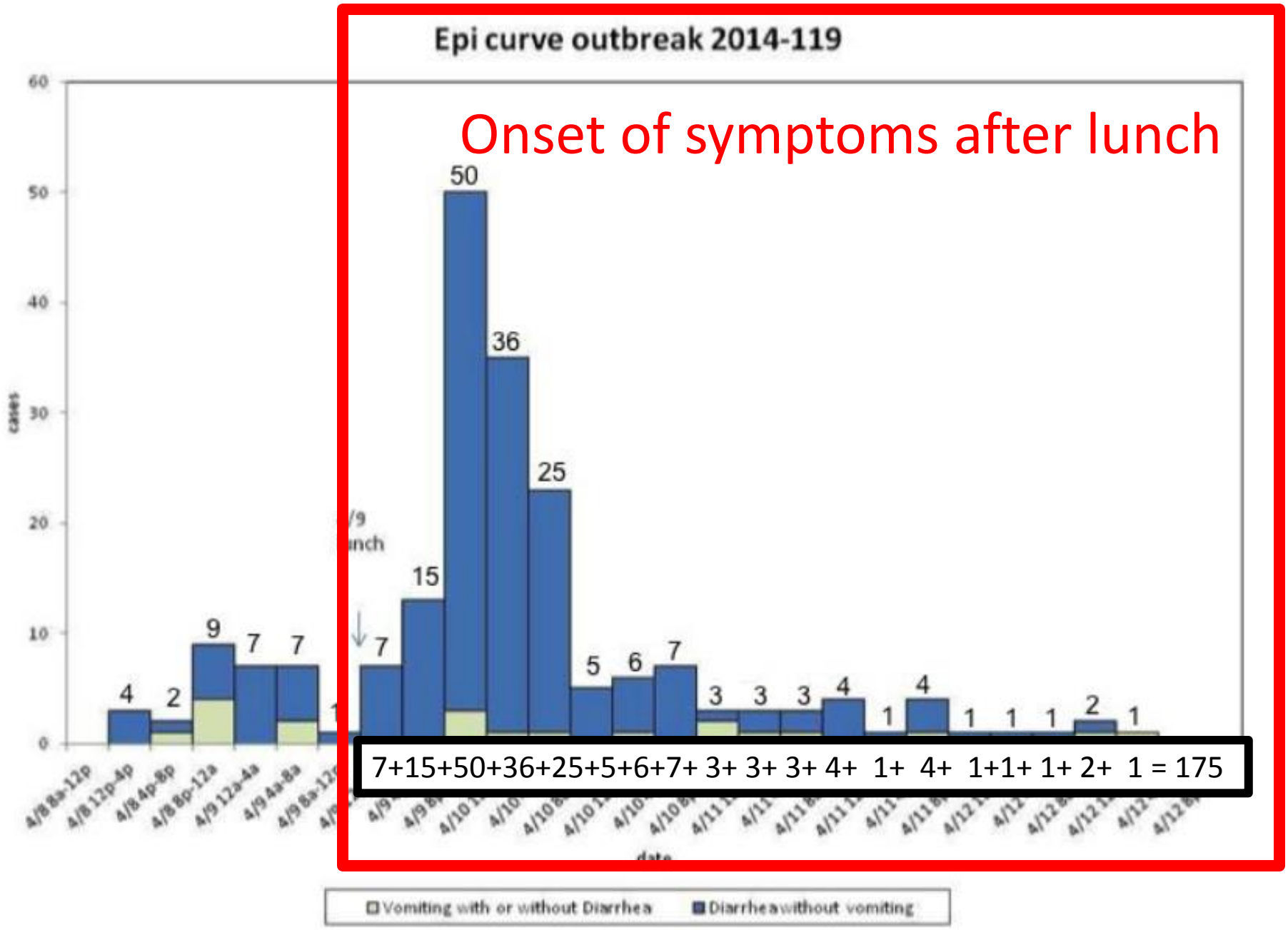
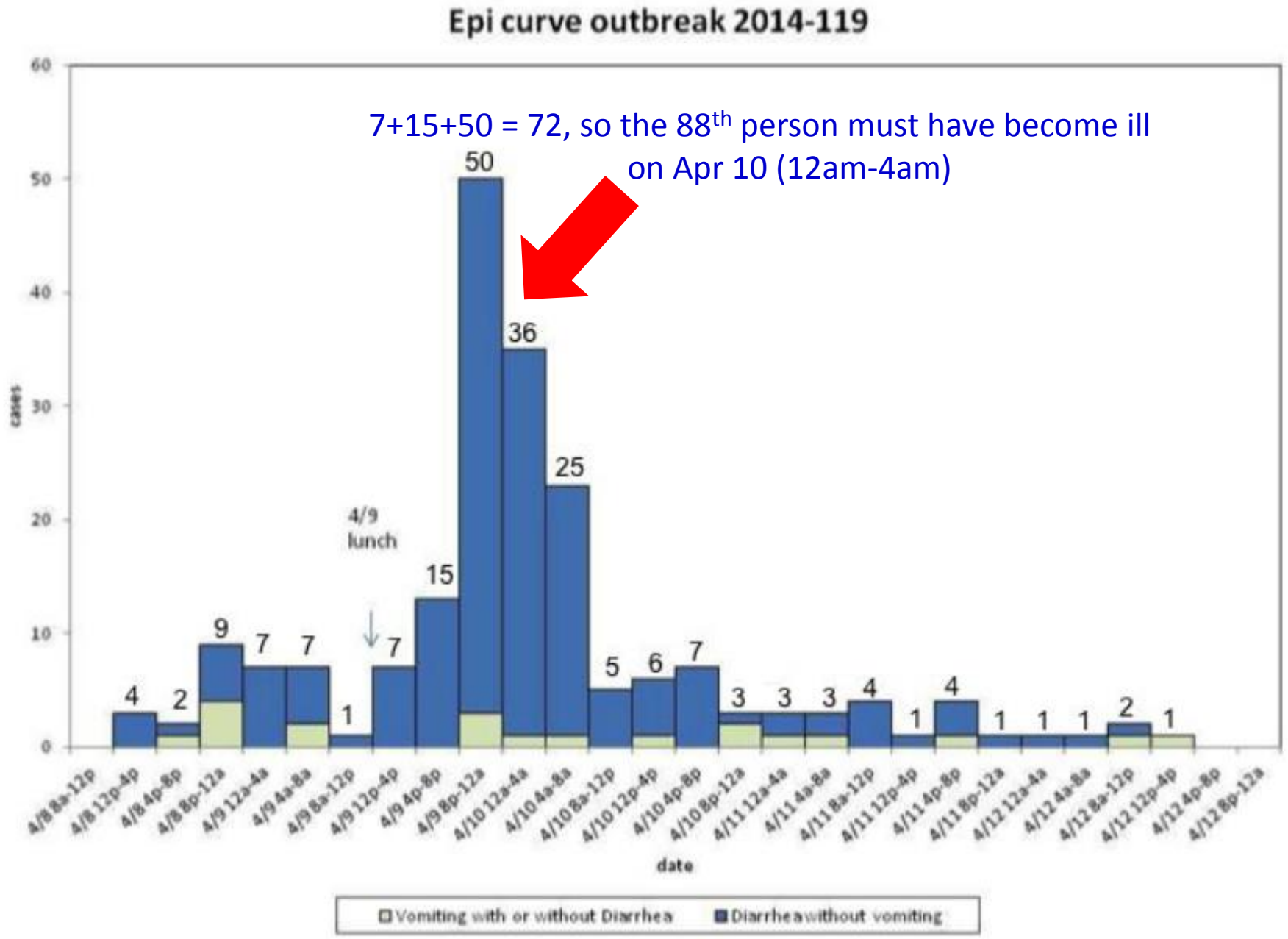
4/12 4p-8p
4/12 8p-12a


Epi curve outbreak 2014-119
Onset of symptoms after lunch
7+15+50+36+25+5+6+7+ 3+ 3+ 3+ 4+ 1+ 4+ 1+1+ 1+ 2+ 1 = 175
Vomiting with or without Diarrhea
Diarrhea without vomiting

Median incubation period

- 175 attendees became ill after 12:00pm on April 9 (when lunch was served)
- Median person to become ill = (175+1)/2=88


Epi curve outbreak 2014-119
7+15+50 = 72, so the 88th person must have become ill on Apr 10 (12am-4am)
4/9 lunch
cases
date
Vomiting with or without Diarrhea
Diarrhea without vomiting

Median incubation period

- Median person become ill on Apr 10 (12am-4am)
  - For simplicity, can assume 2am (the midpoint)
  - We could make more complicated assumptions

- April 9 12pm until April 10 2am = 14 hours

Median incubation period

- Median person become ill on Apr 10 (12am-4am)
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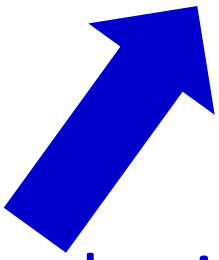

Approximate median incubation period

Question 9 (Group 10)

Based on the information presented in Table 3 and the median incubation period estimated from the epidemic curve (Question 8), what is the likely agent associated with this outbreak? Please justify your answer.

Table 3. Possible Etiologic Agents Associated with Outbreak

Agent	Symptoms	Median Incubation Period	Source
Salmonella	Diarrhea, fever, abdominal cramps, vomiting	12 to 72 hours	Eggs, poultry, meat, unpasteurized dairy, raw produce
Shigella	Abdominal cramping, fever watery/bloody diarrhea, nausea and vomiting	1 to 3 days	Salads and sandwiches that involve a lot of contact in their preparation
E. coli	Severe diarrhea that is often bloody, abdominal pain and vomiting	1 to 10 days	Undercooked contaminated ground beef, unpasteurized dairy, contaminated water
Campylobacter	Diarrhea, cramps, fever, and vomiting	2 to 5 days	Raw and undercooked poultry, unpasteurized milk
C. perfringens	Diarrhea and abdominal cramps	6 to 24 hours	Beef, poultry, gravies
Norovirus	Diarrhea, vomiting, nausea and stomach pain	12 to 48 hours	Produce, shellfish, ready-to-eat foods

Source: http://www.foodsafety.gov/poisoning/causes/bacteriaviruses/index.html

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The pan-seared breast of Chicken Marsala served by the Baltimore Convention Center's exclusive caterer was the food item most commonly consumed by the 216 attendees sickened by the lunch served last April 9 at the Food Safety Summit's annual conference. It was likely contaminated with Clostridium perfringens (C. perfringens), a spore-forming gram-positive bacterium commonly found on raw meat and poultry.

Attendees at the popular conference were from 42 states, Canada, Mauritius and Costa Rica. The local health department learned of the illnesses not from the organizers of the event, the convention center, or the caterer, but from calls by attendees to the city's 311 service.

http://www.foodsafetynews.com/2014/09/c-perfringens-in-c/#.VqZkatKrTDc

Question 9
Some additional information

- 17 specimens were sent for laboratory testing, and *C. perfringens* was found in 10/17 specimens.
- Two cases were positive for norovirus, although not likely associated with outbreak (could represent background levels of norovirus circulating in the community)

Question 10 (Group 38)

Recall that a case was originally defined as: "diarrhea *or* vomiting in a person who attended Conference A, with an onset of up to 72 hours after the conference". However, in the epidemic curve, a case was defined as, "diarrhea *without* vomiting". What is the difference between the two case definitions? [Hint: Think about Question 1 in the PRE-Activity.] Why do you think the investigators changed their case definition during the course of an outbreak investigation?

Recall…from the PRE-Activity

A more strict definition would require more symptoms to be included in the definition of a case. For example, a case might be defined as people who report sore throat AND fever AND vomiting. Conversely, a less strict definition would require fewer symptoms (for example, only headaches). Each definition will differ in its ability to properly classify those individuals who are truly sick and those individuals who are truly *not* sick. For example, when using a *more* strict case definition, fewer individuals will be identified as cases. This means that you are likely to miss some cases among those individuals who were truly ill, but also that more individuals who truly are *not* ill will be correctly counted as non-cases. The case definition should match the goal of the investigation. In this Activity, the goal of the investigation is to include as many "true" cases and as few "false" cases as possible.

Question 1

Which of the following statements is(are) true of using a **less strict** case definition as compared to a more strict case definition? (SELECT ALL THAT APPLY)

a. More individuals who truly are ill will be counted as cases
b. More individuals who truly are ill will be counted as non-cases
c. More individuals who truly are *not* ill will be counted as non-cases
d. More individuals who truly are *not* ill will be counted as cases

Question 11 (Group 38)

As the lead epidemiologist on the BCHD outbreak investigation team, briefly summarize the outbreak for public health officials at the BCHD. Are there other groups of individuals who should be informed about this outbreak? How might your summary differ depending on your audience?

Question 11

As the lead epidemiologist on the BCHD outbreak investigation team, briefly summarize the outbreak for public health officials at the BCHD. Are there other groups of individuals who should be informed about this outbreak? How might your summary differ depending on your audience?

Person, place, time!

Key Concepts

STEPS IN OUTBREAK INVESTIGATION:

1. Define the epidemic (case definition, population at risk, attack rates).
2. Examine the distribution of cases by time and place (epidemic curves, median incubation period)
3. Look for combinations of relevant variables (food-specific attack rates, cross-tabulation).
4. Develop hypotheses.
5. Test hypotheses
6. Recommend control measures

Recommend control measures

Food Safety Summit

Update on Reported Illness at the Baltimore Convention Center

On September 25th, 2014, The Food Safety Summit received a comprehensive and detailed investigation report from the Office of Infectious Disease and Outbreak Response at the Maryland Department of Health and Mental Hygiene (DHMH) stating the case findings and exposure assessment from the illness outbreak at the 2014 Food Safety Summit which took place at the Baltimore Convention Center April 8-10, 2014. The DHMH conducted a retrospective cohort study of conference attendees to develop a hypothesis about what caused the outbreak. Their investigation methods included an epidemiologic investigation, environmental investigation and laboratory analyses.

After months of waiting we received the final report (see link below) and we are now working very closely with the Maryland Health Department, the Baltimore Convention Center and Centerplate, the exclusive caterer of the Covention Center, to ensure that all steps and procedures regarding the prep and serve foodservice process before and during the 2015 Food Safety Summit will be done with active managerial control experts in the kitchens and serving areas. **Read a detailed outline of the 2015 Foodservice Oversight plan here.**

http://www.foodsafetysummit.com/index.php/8-general/303-update-on-reported-illness-at-the-baltimore-convention-center

Leading experts to discuss the role of foodborne disease outbreak investigations at 2015 Food Safety Summit Conference

March 18, 2015

Industry News

KEYWORDS food safety / food safety summit

Reprints

No Comments

Foodservice Oversight Plan has been developed for the 2015 Food Safety Summit

The foodborne disease outbreak at the 2014 Food Safety Summit showed the industry that an outbreak can happen at any time, anywhere, and at any event. The outbreak and the subsequent investigation process by the Maryland Dept. of Health and Mental Hygiene will be used as a case study on the role of outbreak investigations at the 2015 Summit.

A distinguished panel of speakers moderated by Hal King, Ph.D., Director, Food and Product Safety, Chick-fil-A and Founder/CEO, Public Health Innovations LLC will discuss why outbreak investigations by local, state, and federal agencies are important, what we can learn from them, and how to use this valuable information to implement improved food safety management systems to prevent future outbreaks. Speakers on the panel will include state, national, and industry experts in the investigation of foodborne disease outbreaks. The lead

http://www.provisioneronline.com/articles/101649-leading-experts-to-discuss-the-role-of-foodborne-disease-outbreak-investigations-at-2015-food-safety-summit-conference

Key Concepts

In the Activity and LiveTalk we:

- Utilized principles for case definition
- Drew an epidemic curve
- Calculated an incubation period
- Calculated attack rate
- Calculated relative risk
- Calculated risk difference
- Composed a cross-tabulation

Thank you to our presenters!

Questions?