

Case-based Gaming for Foodborne Diseases

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Foodborne Diseases: Investigating Outbreaks

ANFS 230

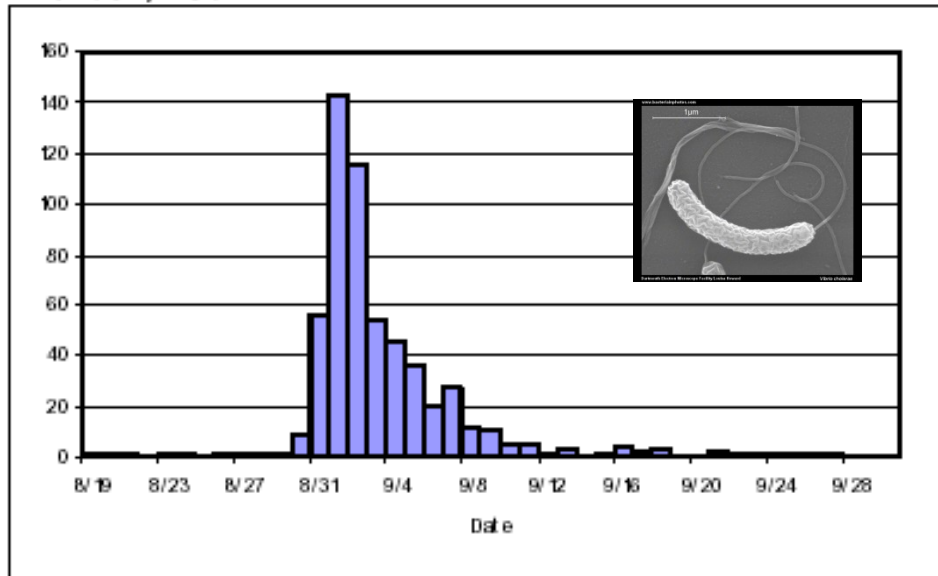
- Course developed in 2004...continually evolving
- Required course for Food Science majors
- Meets Department (Animal Science, Pre-Vet majors) and College requirements
- General Education Natural Science course across the University
- Popular course – restricted to 30 for years, now capped at 50
 - Students across many majors and levels
 - Grown from 5 to 12 groups with game play over 2 days
- **Epidemiology, Basics of Microbiology Basics, Basics of Food Science**



Figure 1.14. Snow's map of the 1854 Golden Square cholera outbreak. Each horizontal line represents a cholera death (e.g., = represents 3 deaths). Public water pumps are shown as enclosed dots (•). The Broad Street pump is in the center of the map. (Source: Snow, 1855, 1936 reprint, pp. 44 and 45.)



Figure 1. Cholera deaths in the Golden Square Section of London, 1854



Foods that sickened people in 915 outbreaks (2008-2012)



Source: CDC's National Outbreak Reporting System, 2008-2012

WASHINGTON, August 3, 2011 – Cargill Meat Solutions Corporation recalling ~36 million pounds of ground turkey products that may be contaminated with a multi-drug resistant strain of *Salmonella* Heidelberg



Course Student Learning Outcomes:

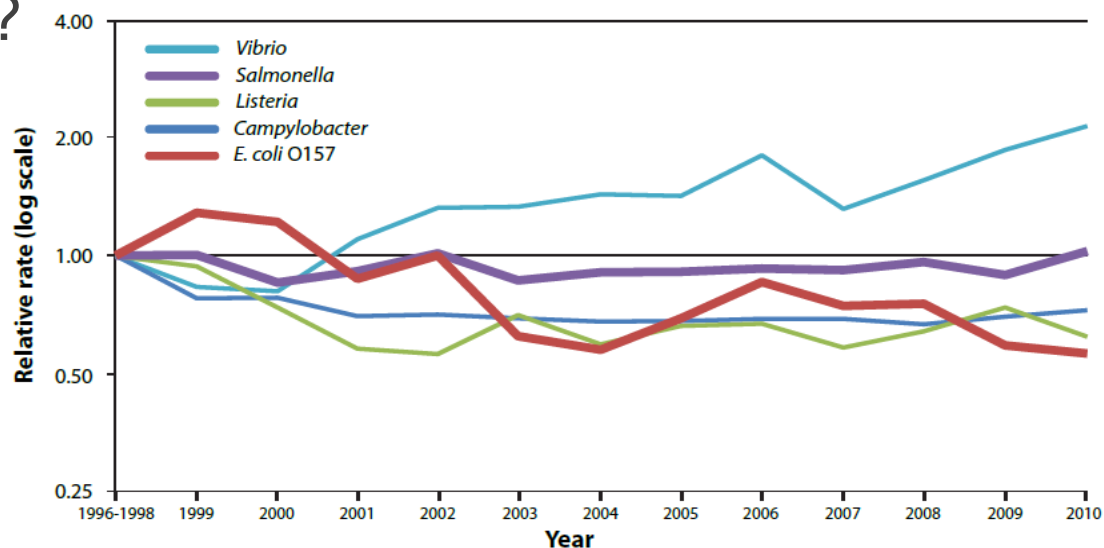
- Have an understanding of the **complex processes involved in outbreak investigation** and be familiar with the **epidemiology and traceback** techniques used to resolve an outbreak.
- Be more familiar with many of the organisms responsible for current foodborne illnesses.
- Gain an **increased awareness** of outbreaks of foodborne illness and be able to **critically evaluate the coverage of foodborne illness by popular media**.

Program Student Learning Outcomes (abbreviated):

- Develop **critical thinking and reasoning skills used in developing food safety risk assessment** and in evaluating the epidemiological and environmental investigations (*ANFS Critical Thinking Goal, Gen Ed Goal 2*).
- **Develop intellectual curiosity concerning truth and bias behind contemporary media in communication of scientific principles** (*ANFS Communications Goal, Gen Ed Goal 6*).
- Demonstrate successful and effective **written and oral communication skills** by writing literature reviews and investigation reports and by participating in course discussions (*ANFS Communications Goal, Gen Ed Goal 1*).
- Develop **team-working skills and leadership** in the development of a board game and in the presentation of that game (*ANFS Communications Goal, Gen Ed Goal 1 & 3*).

Food Related Illness and Death in the US

- 48 million cases
- 128,000 hospitalizations
- 3,000 deaths
- Majority caused by unknown agents – 38.4 million
- Are numbers meaningful?
 - Baseline data
 - Underreporting
 - mild disease
 - Scallan et al., 2011(CDC)



Outbreak Investigations

- Learn from historical and current outbreaks
- Case-based learning!
- Interactive stories that often unfold during the semester

- Intertwine Epidemiology, Surveillance, Laboratory Analysis, Traceback, Economic & Social Issues
 - Following an introduction the course is arranged based on outbreaks caused by specific microorganisms: *Clostridium botulinum*, *Salmonella*, *Listeria monocytogenes*, Shiga-toxigenic *E. coli*, Norovirus, Hepatitis A virus, Ebola, and more



~16 outbreaks!
August-
December
2015

Flow of an Investigation

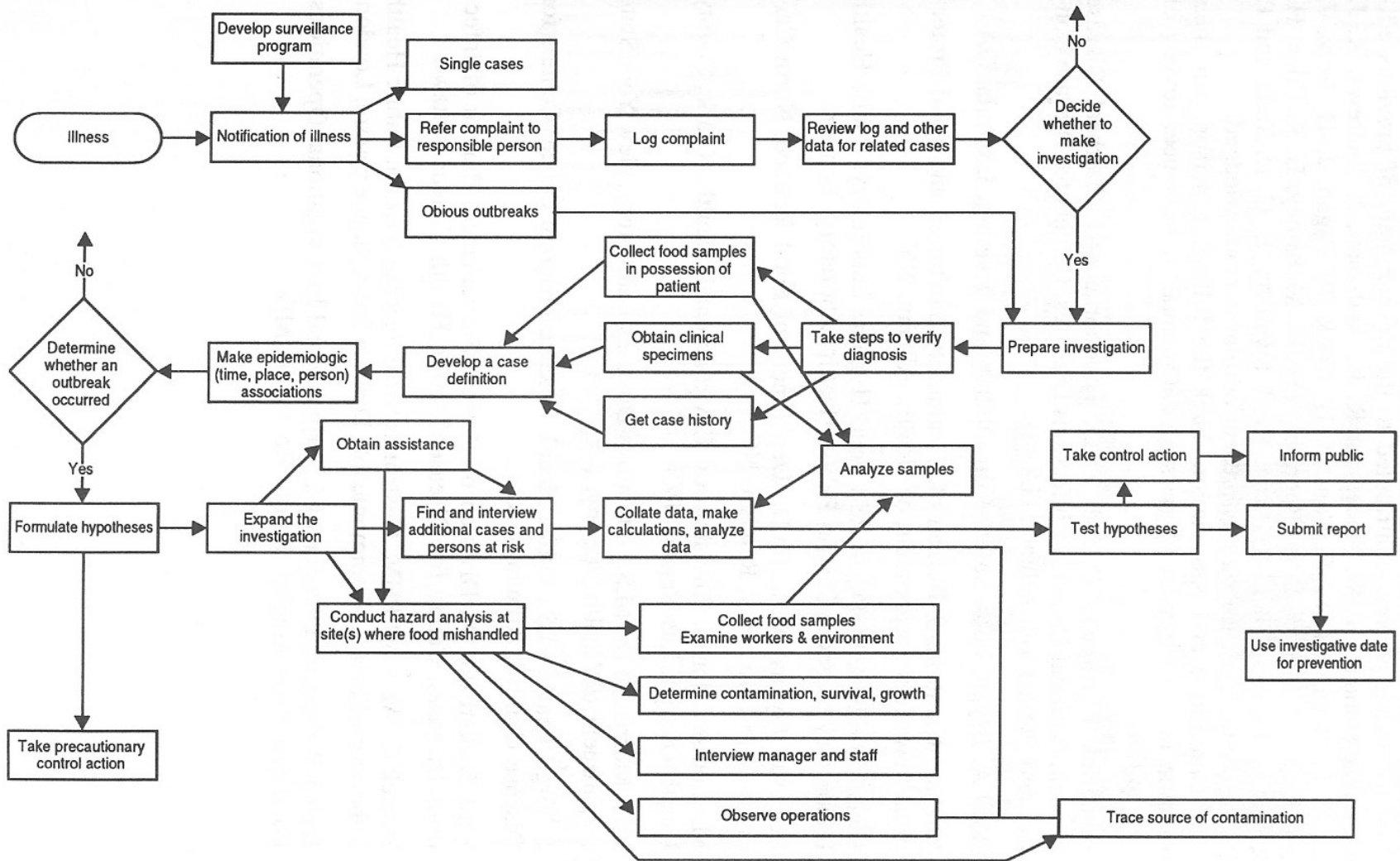


Figure A. Sequence of events in investigating a typical outbreak of foodborne illness.

Outbreaks in North America were linked to eating Guatemalan raspberries. We conducted a study in health-care facilities and among raspberry farm worker. 126 (2.3%) of 5,552 surveillance specimens tested positive; prevalence peaked in June (6.7%). Infection was most common among children 1.5 to 9 years old and among persons with gastroenteritis. Among 182 raspberry farm workers and family members monitored from April 6 to May 29, six had been infected. In the case-control analysis, 62 (91%) of 68 persons with the illness reported drinking untreated water in the 2 weeks before illness, and their illness lasted nearly 3 weeks! Wild Boars who drank from the same water source did not have the illness.

Investigations of foodborne outbreaks naturally lend themselves to game development and game play

The following clues describe an illness...

- Onset of sickness approximately 2 days after consumption of food
- Continental breakfast at hotel is the common meal shared by those affected by illness
- Employee managing breakfast claimed that eggs served were discarded only at the end of the shift
- Cut melon, honey, and jam were all served
- Three weeks after the buffet, infectious material was found on a stain in the carpet

The following clues describe an illness...

- There were 3 friends that died in this outbreak
- For graduation they decided to backpack through Europe in 2000
- They ate lots of culturally diverse food and were able to enter and eat in every country
- When they got back from their trip in 2001 they had enough stories for a lifetime
- The beginning of 2002 one of the friends started to act funny and passed away shortly after that
- Two months later the second friend could no longer walk and passed

Capstone-Board game development

- Final project is worth 12% of final grade
 - Group game project and presentation 10%
 - Peer evaluation 2%
- Groups of 4-6 students created early in semester, used for small in-class discussions
- Grading rubric of 9 elements



Assessment

- Used for Curricular Assessment for IFT Program and Course-Learning Outcomes (for 2 years now)
- Programmatic goal of **Synthesis of Information/Critical Thinking Goal**
 - 3 artifacts assessed using Inquiry and Analysis Rubric
 - Topic Selection
 - Existing Knowledge, Research, and/or Views
 - Analysis

Class Grading Rubric

Outbreak well established:

Outbreak is plausible:

Displays all players and regulatory agencies as necessary:

Surveillance:

Epidemiological investigation:

(could include descriptive epidemiology, case histories, epidemic curves, and collected samples)

Analytical epidemiology / Laboratory studies:

(could include data analysis and relative risk)

Environmental investigation:

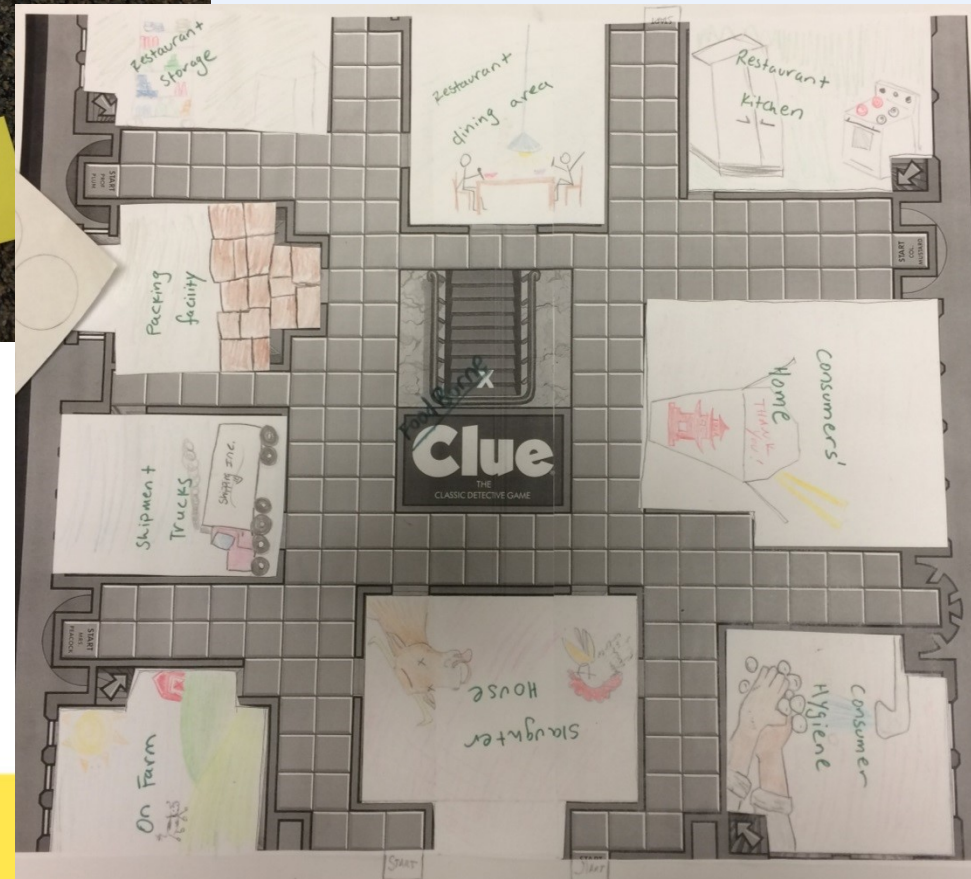
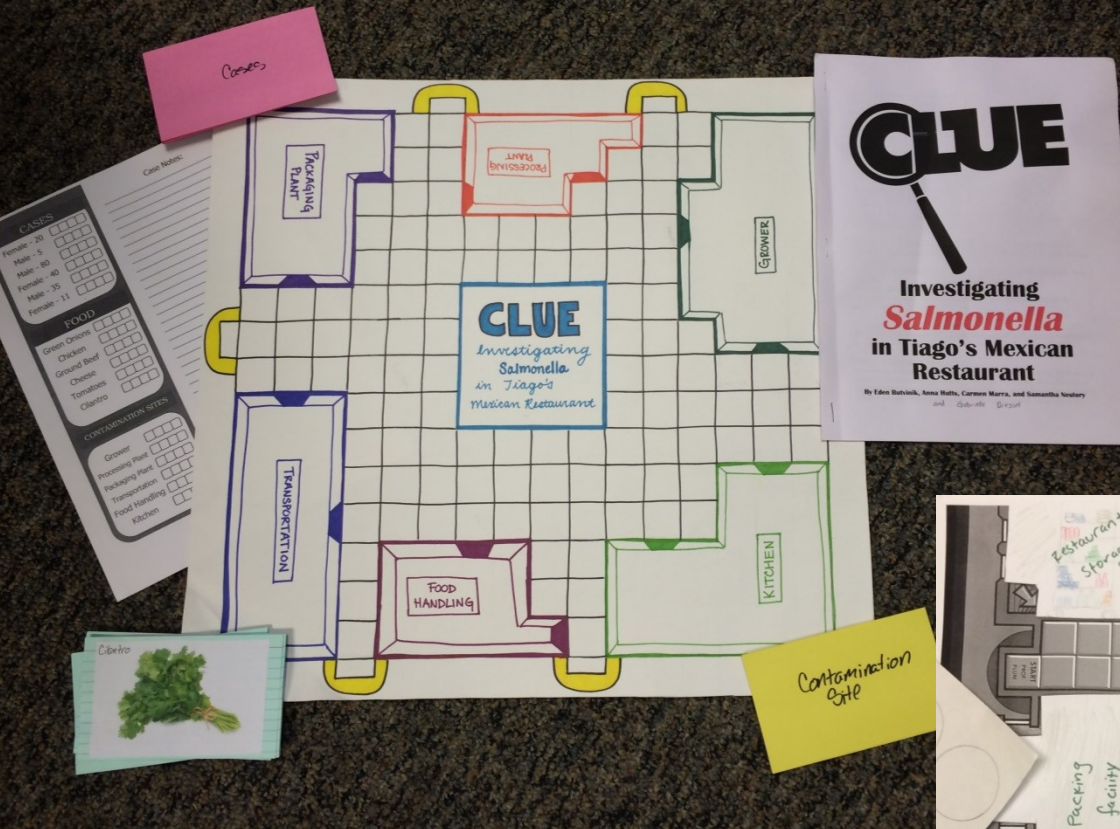
(could include on-site investigation, hazard analysis, and collected samples)

Control and prevention:

Communication with the public:

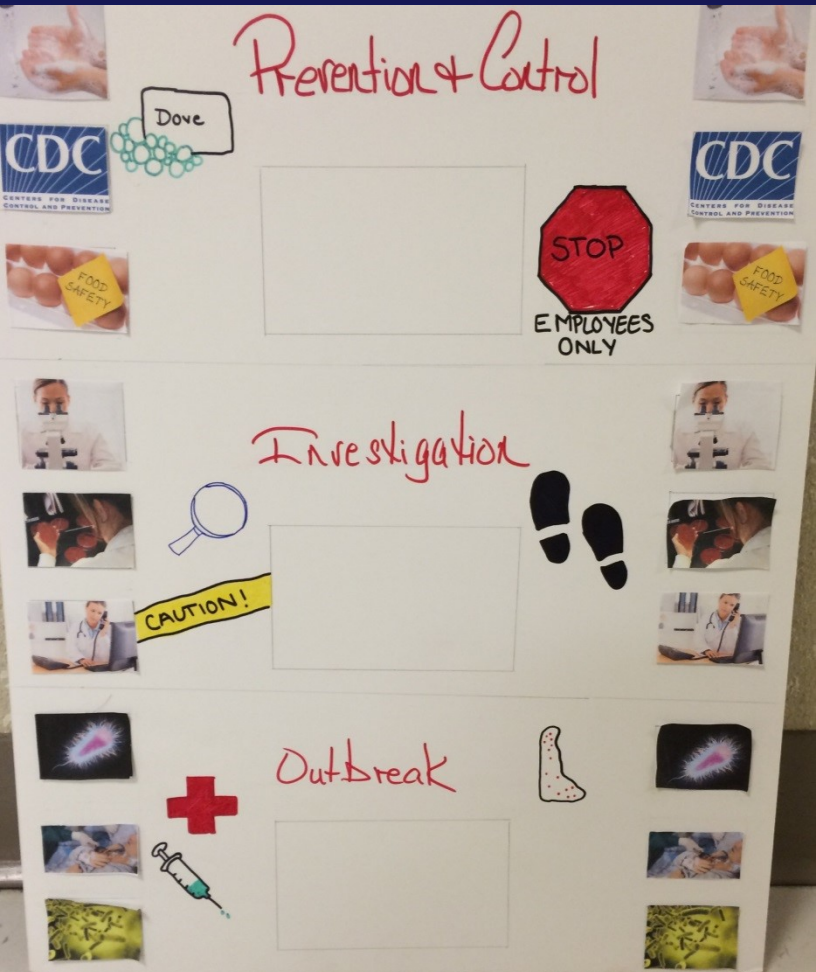
Participation from all group members:

Games!

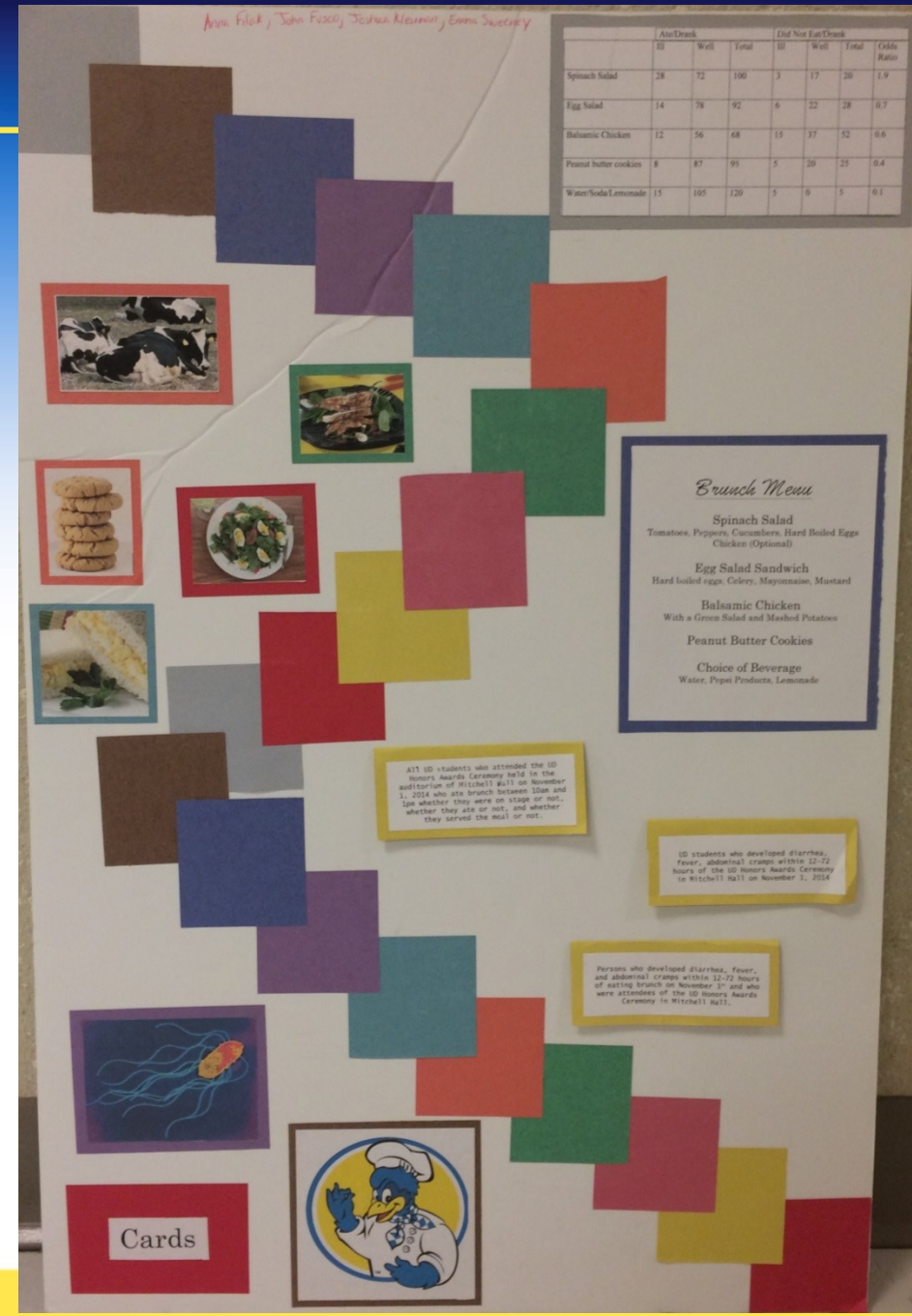


Games take all formats:

- Traditional board games
- Card games
- Computer-based

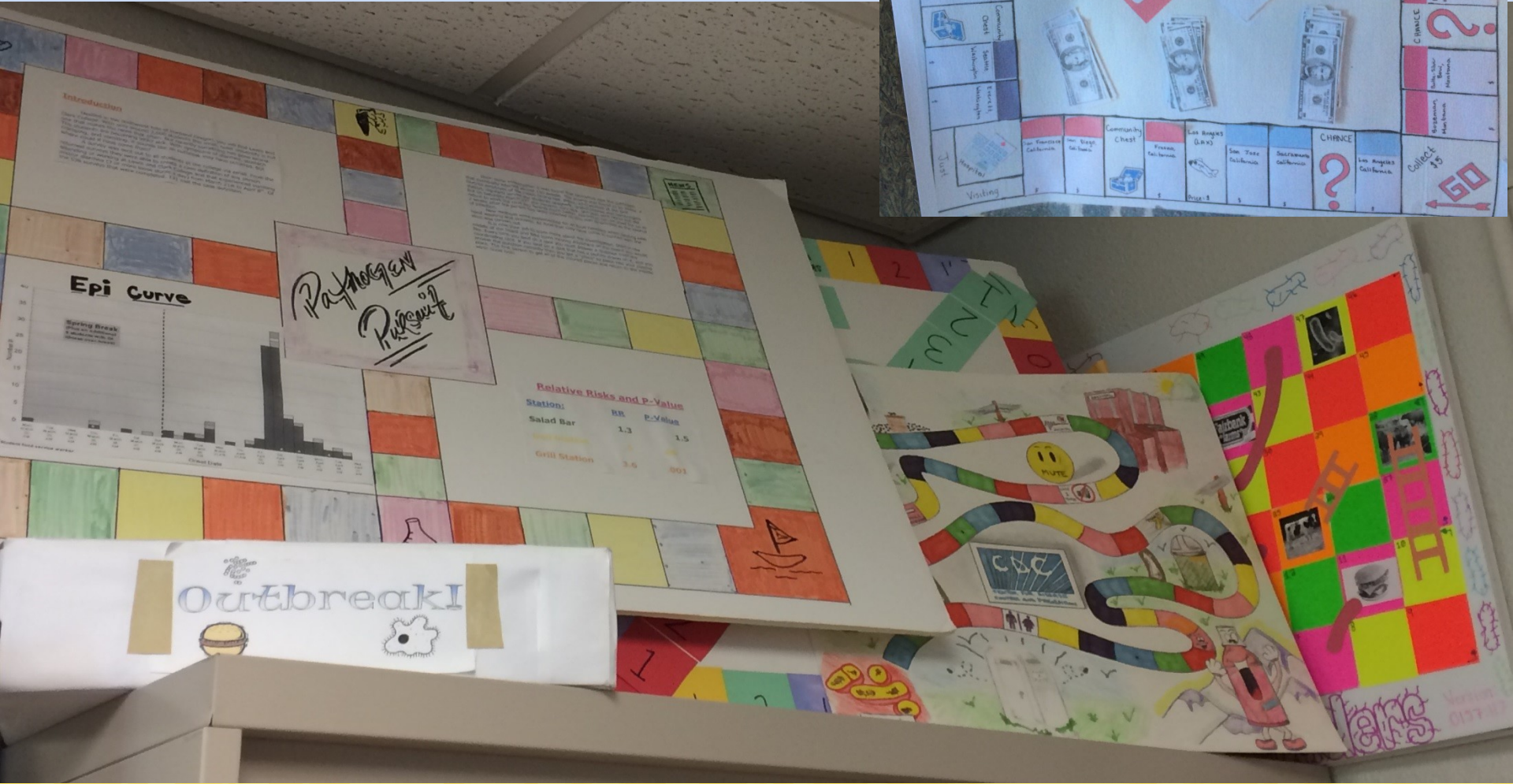
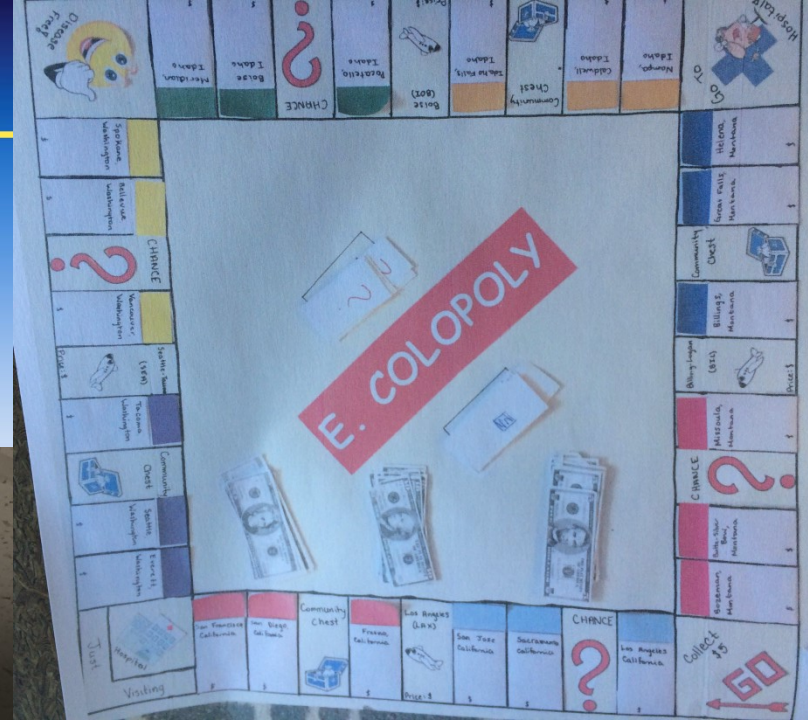


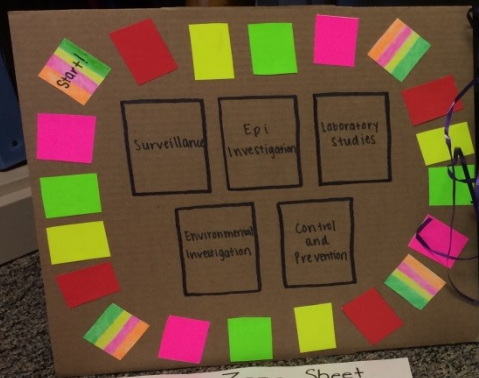
Most often game from perspective of the investigation, but sometimes a game is designed from the perspective of the infectious agent getting into our food supply



All games include detailed directions that are unique to the game play

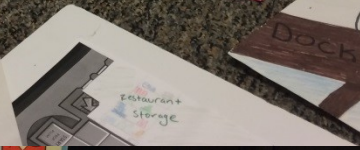
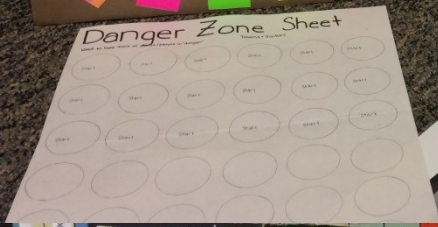
- For example- *E. colopoly* had different directions than Monopoly





How to track Bacterial Pursuit

Control and Prevention



OUTBREAK TO OUTBREAK

OUTBREAK TO OUTBREAK

OUTBREAK TO OUTBREAK

OUTBREAK TO OUTBREAK

Different Types of Surveillance

Traceback

WANTED: Norovirus

Cookie Dough

Continuous contamination

Poor Handwashing

Epidemiological investigation

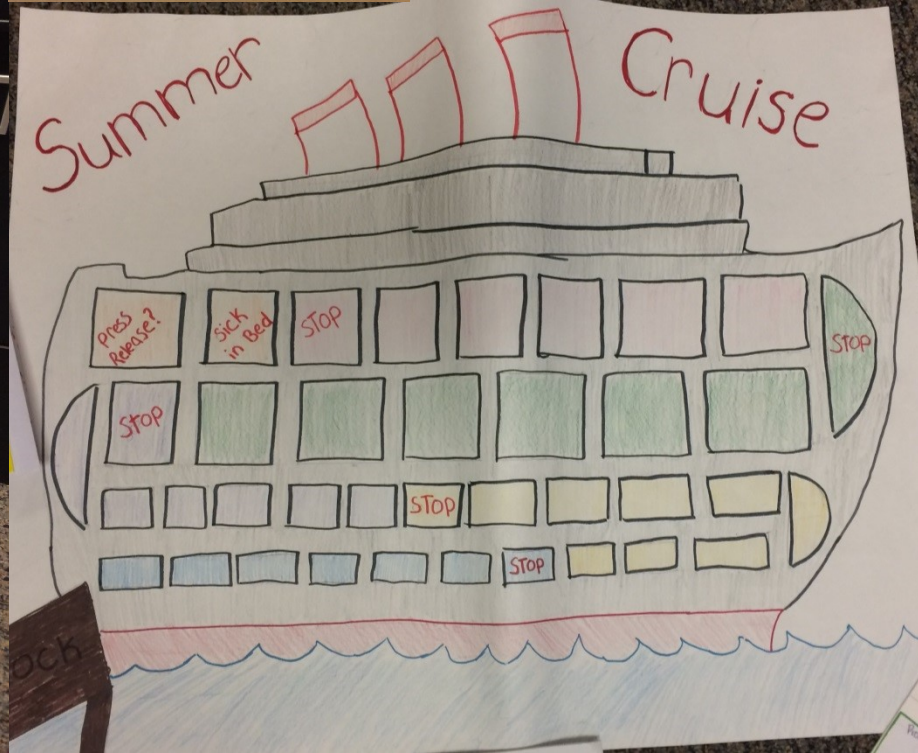
Case Definition

Reservoirs

John Snow

Improper Canning

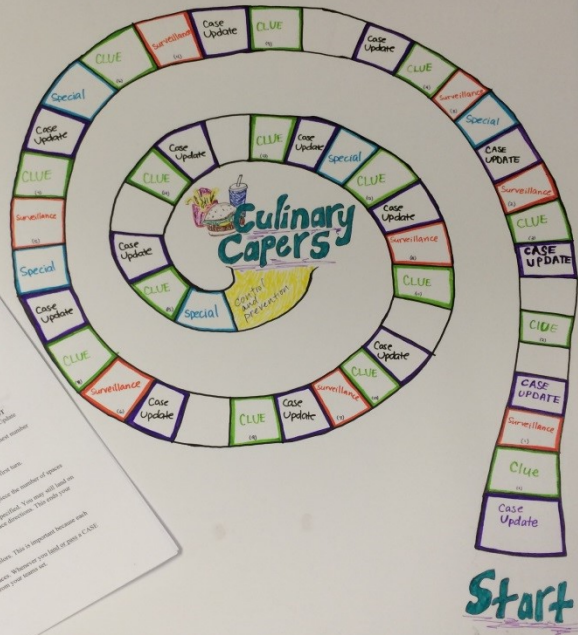
Broad Street Pump



Control and Prevention Bonus Round

Once each team reaches the end of the game board, the bonus round will begin. Write down as much as you can in two minutes. Then compare your results with the other team's.

1. What steps would you take to control the outbreak?
2. Should *Everything but the Moo Inc.* be shut down?
3. What control and prevention measures should be taken by the company and its employees?



Culinary Capers
Instructions

Setting Up

- 1. Divide into 4-6 teams. One for each table. Each team should have one 4th-10th grade student.
- 2. Divide into 4-6 teams. One for each table. Each team should have one 4th-10th grade student.
- 3. Each team should have a designated leader. The team with the highest number of correct answers will win.

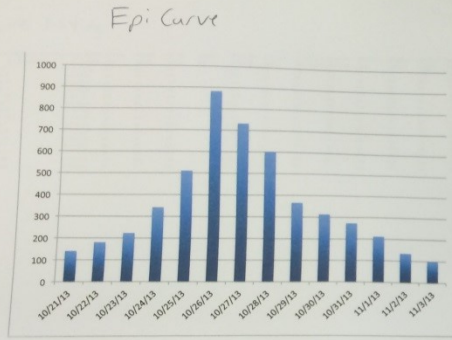
Game Play

Each group will get the die. The team with the lowest number rolls the die first.

When you roll the die, you will be able to see the table. There are 7 cases shown. The number of cases shown will be the number of cases you will see. You will see the number of cases you will see. You will see the number of cases you will see.

The goal:

As you move your game piece, when the number is 1, you will see a clue. When you see a clue, you will see a clue. When you see a clue, you will see a clue.



Group 1

NYC Food and Wine Festival Menu:

	ILL	WELL	TOTAL
Mashed Potatoes	600	3452	4052
Ground Beef	4025	374	4399
Cheeseburgers			
Beef Hotdogs	3886	521	4407
French Fries	765	3321	4086
Fried Dough	587	3386	3973
Steak Sandwiches	4734	236	4970
Pizza	557	3567	4124
Popcorn	124	4871	4995
Caramel Apples	198	3879	4077
Robert Mondavi Merlot	834	3489	4323
Redwood Creek Chardonnay	965	3537	4502
Salad	3471	497	3968
Balsamic Vinaigrette Dressing	3404	528	3932
Macaroni Salad	1072	2756	3828

line listing

Group 1

id	date	time	location	status	notes
1	10/21/13	12:00	NYC	Ill	
2	10/21/13	12:00	NYC	Well	
3	10/21/13	12:00	NYC	Ill	
4	10/21/13	12:00	NYC	Well	
5	10/21/13	12:00	NYC	Ill	
6	10/21/13	12:00	NYC	Well	
7	10/21/13	12:00	NYC	Ill	
8	10/21/13	12:00	NYC	Well	
9	10/21/13	12:00	NYC	Ill	
10	10/21/13	12:00	NYC	Well	
11	10/21/13	12:00	NYC	Ill	
12	10/21/13	12:00	NYC	Well	
13	10/21/13	12:00	NYC	Ill	
14	10/21/13	12:00	NYC	Well	
15	10/21/13	12:00	NYC	Ill	
16	10/21/13	12:00	NYC	Well	
17	10/21/13	12:00	NYC	Ill	
18	10/21/13	12:00	NYC	Well	
19	10/21/13	12:00	NYC	Ill	
20	10/21/13	12:00	NYC	Well	

Grass Fed Menu

	ILL	WELL	TOTAL	ODDS RATIO
Ruta 22 Shiraz	600	3452	4052	.17
Ecco Domani	657	3591	4248	.18
Pinot Grigio				
Apple Walnut Salad	986	2356	3342	.42
Apple Vinaigrette	865	2321	3186	.37
Strip Steak	3345	754	4099	4.4
Filet Mignon	3734	236	3970	14.1
Asparagus	557	3567	4124	.16
Green Bean Almondine	324	4171	4495	.08
Steak Thai Noodle Salad	4031	393	4424	10.3
Quinoa Risotto	834	3489	4323	.24
Grilled Salmon	965	2537	3502	.38

Games often contain a great deal of student-generated original data

Play!
Learn!
Demonstrate!



Thoughts from the students on games

- Volunteered responses to open-ended questions (n=93):
 - 49% volunteered synthesis of course material and reinforced learning
 - 46% particularly noted creativity as a favorite aspect
 - 100% indicated it was a fun/enjoyable project

“Refreshing way to review course material”

“My favorite part was thinking outside the box to choose a game”

“This game helped me understand outbreak investigations better”

“I was surprised that I was able to play the games without having to reference information slides”

What's next?

Unanswered questions

- Is learning optimized from a specific platform?
- Quantify learning through the capstone project
- Movement to computerized games?



- Measure specific learning outcomes through game development and playing.
- Add to assessment rubric using specifics related to game play.

Thank You!