

# *E. coli* O157 outbreak in Saint Louis County

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Communicable Disease Investigators



**SAINT LOUIS COUNTY**  
Missouri

# *E. Coli* O157: Overview

- One of hundreds of strains of the bacterium *Escherichia coli*
- Most strains do not cause illness
  - O157 strain produces a powerful toxin that can cause severe illness
- Symptoms: severe abdominal cramping, diarrhea (often bloody)
- Avg. Incubation period: 2 to 5 days
- Avg. Duration 7 to 10 days



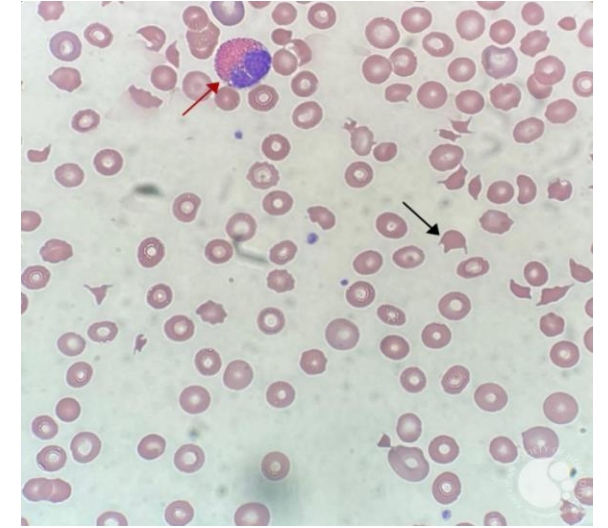
Images: <https://www.foodsafetynews.com/2024/07/publishers-platform-what-you-need-to-know-about-e-coli-during-and-outbreak/>

# *E. Coli* 0157:

## Overview

### Hemolytic Uremic Syndrome (HUS)

- Occurs when small blood vessels become damaged and inflamed, causing clots to form in the vessels throughout the body and damaging organs
- Can lead to kidney failure
- Most common in young children and the elderly
- Occurs in 2% to 7% of *E. coli* O157 infections; ~5% to 10% of HUS cases are fatal



# *E. Coli* O157: Overview

People become infected through:

- Eating contaminated food (commonly undercooked beef or raw produce)
- Drinking unpasteurized milk, juice or cider
- Swallowing recreational water contaminated with *E. coli* O157
- Contact with farm animals or pets
- Touching contaminated surfaces/objects and then putting fingers/objects into the mouth
- Not washing hands after using the bathroom or changing diapers and then eating.

Images: <https://www.nm.org/healthbeat/healthy-tips/What-Is-E-coli>

# *E. Coli*: Overview

## Treatment

- Most people recover on their own
- Preventing dehydration
- Antibiotics increase the risk of HUS and should not be given
- HUS requires hospitalization and careful attention



# Cast of Characters

## Within DPH

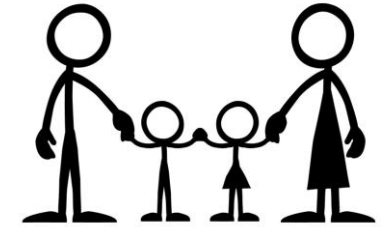
- CD investigators and epidemiologists
- CD School Liaison
- Environmental health inspectors and leadership
- Public Information Officer/Media Liaison
- CD response team
- Administration
- EP team

## Outside DPH

- Affected families
- School district
- Missouri Department of Health and Senior Services epidemiologists
- Missouri State Public Health Laboratory
- Hospital labs and Infection Preventionists
- County-level Public Information Officer, legal

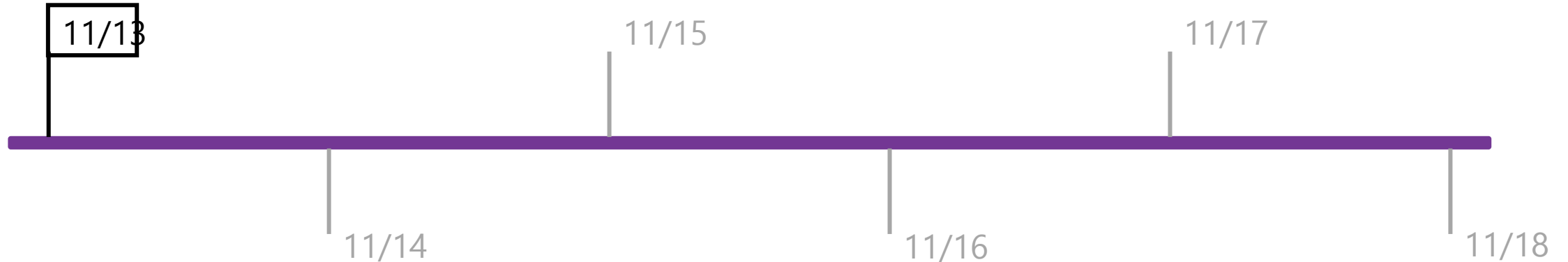


SAINT LOUIS COUNTY  
Public Health



Images: School Clip Art | Free Download Clip Art | Free Clip Art | on Clipart Library, <https://tse2.mm.bing.net/th?id/OIP.tkQIL2cKX1S7-5kygVif-QHaHE7rs=1&pid=ImgDetMain>, <https://th.bing.com/th/id/R.c722b3900224718dfbca7b8cea5c188d7rik=cKwvx8A%2fdEicA&riu=http%3a%2f%2fimages.clipartpanda.com%2fstick-family-of-4-clip-art-stick-family.jpg&ehk=8PPTn9Kfe3svY4MenzODFAqQMaGLA97ww8b4FUarNM%3d&rsi=-8&pid=ImgRaw&r=0>, <https://tse2.mm.bing.net/th?id/OIP.yGYp63HZi0xKXNfuZbWEgHaGt7rs=1&pid=ImgDetMain>

# Timeline of Events



830AM: Receive three *E. coli* O157 cases

- Two are sisters, all attend High School B, may have attended a school banquet

9AM: School liaison calls school district lead nurse

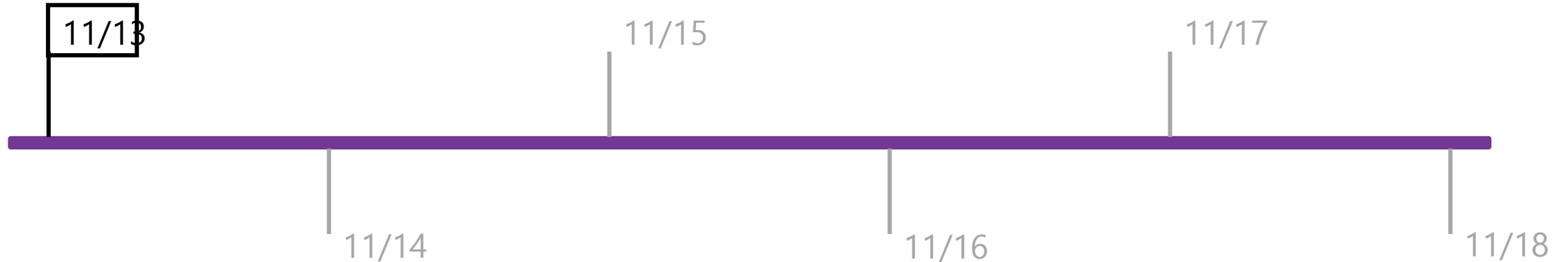
- All three cases are in the band and attended a band banquet on 11/7

930AM: Lead nurse reports several other students from the band also out sick

11AM: CD notifies Environmental team

1130AM: Receive list of absent band students /event menu; begin calling students; work with lead nurse on notification for families

# Timeline of Events



12PM: Notify DPH leadership, MDHSS

1230PM: Environmental conducts first inspection of the facility

1PM: School sends notice to band families (avoid antibiotics)

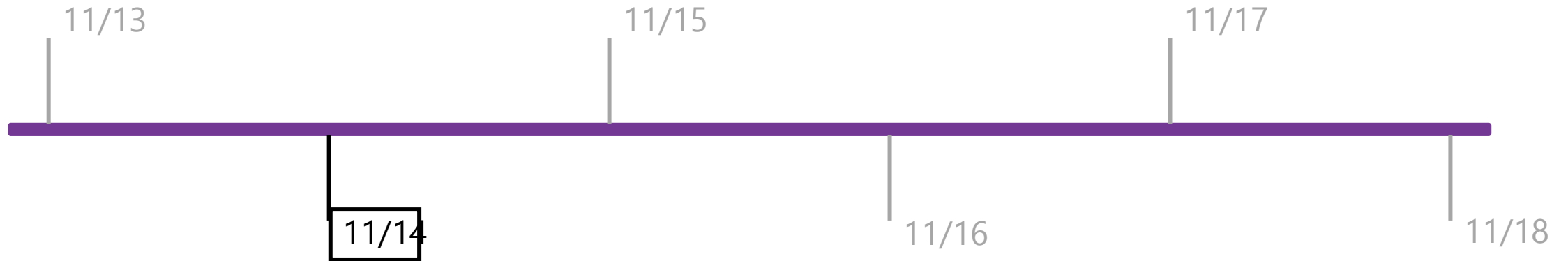
- 115PM: First family reaches out to DPH

2PM: 9 probable cases, request REDCap project, notify hospital IPs

6PM: 19 probable cases (4 lab confirmed), including 1 parent; all attended banquet; 5 hospitalized; REDCap survey written; media statement drafted along with the school; possible second event



# Timeline of Events



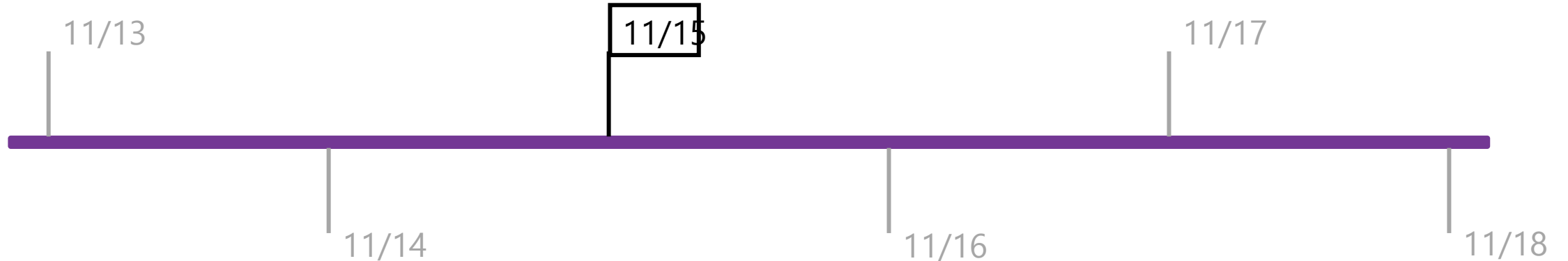
## AM activities

- Verify illnesses at a second event (Veterans Day lunch), held at High School B on 11/8 and catered by the same facility
- REDCap survey distributed to families at both events

## PM activities

- Media interviews
- Confirmed case at third event (band banquet for High School A), held 11/6 at the same facility
- 24 total cases

# Timeline of Events



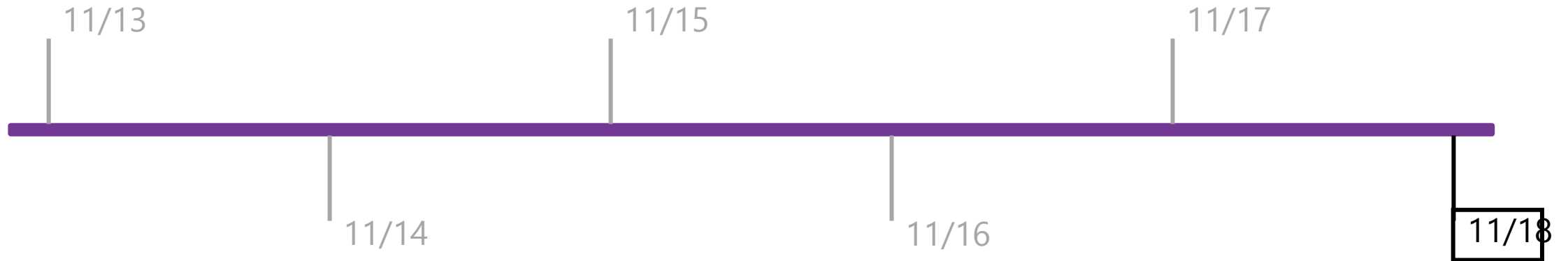
## AM activities

- Over 100 survey responses from the two events at High School B
- Enough evidence to confidently identify salad as the likely source
  - Environmental returns to the facility to embargo lettuce

## PM activities

- More media interviews, issue press release
- Learn of a likely fourth event (funeral lunch), held 11/8 at the same facility
- 69 total cases

# Timeline of Events



11/18

- State collects lettuce samples for testing
- Issue health advisory and updated press release, 94 total cases

Beyond

- Lettuce results negative
- Worked to get excluded cases back to work
- WGS results show all lab-confirmed cases are a match
  - Additional WGS matches in STLCO who did not attend event
- WGS matches to another subcluster in MO, several other states – lettuce identified as source

# Outbreak Case definition



## **Clinical criteria**

One or more of the following symptoms: bloody diarrhea, watery diarrhea, abdominal cramping

## **Laboratory criteria**

### Confirmatory laboratory evidence:

Isolation of *E. coli* O157 from a clinical specimen and WGS match to the outbreak strain

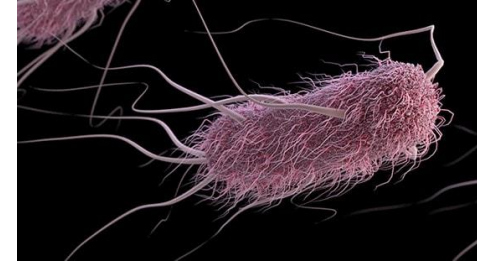
### Supportive laboratory evidence:

Identification of an elevated antibody titer against a known Shiga toxin-producing serogroup of *E. coli*  
OR

Detection of Shiga toxin or Shiga toxin genes in a clinical specimen using a culture-independent diagnostic test (CIDT) and no known isolation of *Shigella* from a clinical specimen

Image: [https://static.vecteezy.com/system/resources/previews/007/173/065/non\\_2x/cute-little-boy-suffering-from-stomach-ache-diarrhea-abdominal-pain-gastritis-or-food-poisoning-holding-his-belly-vector.jpg](https://static.vecteezy.com/system/resources/previews/007/173/065/non_2x/cute-little-boy-suffering-from-stomach-ache-diarrhea-abdominal-pain-gastritis-or-food-poisoning-holding-his-belly-vector.jpg)

# Outbreak Case definition



## Case classification

### **Confirmed**

A person who:

- Has clinically compatible illness with symptom onset from 11/8/24 to 11/16/24
- Meets confirmatory laboratory evidence
- Attended one of the events of interest\*

### **Probable**

A person who:

- Has clinically compatible illness with symptom onset from 11/8/24 to 11/16/24
- Meets supportive laboratory evidence OR did not have any positive laboratory test for *E. coli* O157
- Attended one of the events of interest\*

\* Events of interest: HS A Band Banquet on 11/6, HS B Band Banquet on 11/7, HS B Veterans Day lunch on 11/8, Funeral Meal on 11/8

Image: <https://www.cdc.gov>

# Overall case counts

- Exposed: 700 to 775 people
  - Exposed from High School B: 400 to 425
- Survey responses: 325
  - Survey responses from High School B: 314
- Case counts
  - Confirmed: 31
    - Hospitalized: 13
    - HUS: 3
  - Probable: 84
    - Hospitalized: 4
    - HUS: 0
  - No deaths



image: [https://www.flaticon.com/free-icon/case-study\\_5214704](https://www.flaticon.com/free-icon/case-study_5214704)

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  - Probable: 84
    - Hospitalized: 4
    - HUS: 0
  - No deaths

**Response rate HS B:  
74 to 79%**



**Attack rate HS B:  
35% (range 27 to 50%)**

# Event 1: 11/6/24 Band Banquet, High School A

- Attendees: ~250 to 300 (never confirmed)
- Survey responses: 3
  - ~1% response rate
- Case counts
  - Confirmed: 2
    - Hospitalized: 1
    - HUS: 0
  - Probable: 0
    - Hospitalized: 0
    - HUS: 0
- Menu
  - Salad
  - Rolls with butter
  - Roast beef
  - Grilled chicken parm
  - Mashed potatoes
  - Green beans
  - Brownies
  - Sodas with ice



Image: <https://clipground.com/images/marching-band-clipart-images-5.jpg>



# Event 1: 11/6/24 Band Banquet, High School A

- Attendees: ~250 to 300 (never confirmed)
- Survey responses: 3
  - ~1% response rate
- Case counts
  - Confirmed: 2
    - Hospitalized: 1
    - HUS: 0
  - Probable: 0
    - Hospitalized: 0
    - HUS: 0

- **Menu**

- **Salad**
- **Rolls with butter**
- **Roast beef**
- Grilled chicken parm
- Mashed potatoes
- Green beans
- Brownies
- Sodas with ice



Image: <https://clipground.com/images/marching-band-clipart-images-5.jpg>

# Event 1: 11/6/24 Band Banquet, High School A

- Attendees: ~250 to 300 (never confirmed)
- Survey responses: 3
  - ~1% response rate
- Case counts
  - Confirmed: 2
    - Hospitalized: 1
    - HUS: 0
  - Probable: 0
    - Hospitalized: 0
    - HUS: 0

- **Menu**

- **Salad**
- **Rolls with butter**
- **Roast beef**
- Grilled chicken parm
- Mashed potatoes
- Green beans
- Brownies
- Sodas with ice

**1 out of 2 sick people  
reported eating salad**

**Respondent who was not  
sick reported eating salad**



Image: <https://clipground.com/images/marching-band-clipart-images-5.jpg>

# Event 2: 11/7/24 Band Banquet, High School B

- Attendees: ~250
- Survey responses: 177
  - ~70% response rate
- Case counts
  - Confirmed: 21
    - Hospitalized: 7
    - HUS: 3
  - Probable: 43
    - Hospitalized: 1
    - HUS: 0

- Menu
  - Salad (no onions)
  - Rolls with butter
  - Roast beef
  - Breaded chicken parm
  - Pasta con broccoli
  - Italian potatoes
  - Sheet cake (outside vendor)
  - Brownies
  - Sodas with ice

Reserve Tables	Disposables	Cake: Andre's	Own
Entertainment	Time in to Decorate	Time in to Decorate	Time in to Decorate
Easel	Projector	LED Lights Color	White
<b>Entrees</b>	<b>Accompaniments</b>	<b>Trays</b>	
Top Round of Beef w/ Au Jus	Pasta <u>con Broccoli</u>	Dinner Rolls w/ Butter	
Top Round - Hand Carved	Mac & Cheese	Soft Shell Tacos	
Chicken Marsala	Garlic Mashed Potatoes	<b>Toasts:</b>	
Chicken <u>PARM BREADED</u>	Parsley Buttered Potatoes	Best Man	
Cod w/ Lemon Dill	Italian Potatoes w/ Garlic	Maid of Honor	
Oven Roasted Turkey Breast	Red Skin Smashers	Blessing	
Pineapple Glazed Ham	Roasted Red Skins	Ceremony Minister	
Beef Tenderloin	Baked Beans	# of Chairs on Dance Floor	
Rosemary Roasted Pork Loin	Cole Slaw		
BBQ Pulled Pork	Green Beans Almondine	<b>Platinum Package</b>	
Cannelloni w/ Meat Sauce	Amaretto Carrots	Water Goblets	
Beef	Fresh Season Veggies	Extra Fork for Salad	
<b>Salads Served</b>	Corn & Peppers	Bottle Beer	
Italian Salad	Mexican Rice	Floor Length Cloths	
Pasta Salad / Potato Salad	Lettuce	Glassware @ Bar	
<b>Dessert</b>	Shredded Cheese	Premium Liquor	
Apple Crumb	Sour Cream	Mirrored Tiles	
Brownies	Salsa		
Appetizers: 1. _____ 2. _____ 3. _____			
4. _____ 5. _____ Cheeseball & Crackers			
Serve Time _____			
Bussers: _____	Bartenders: _____	Room Set: <u>29</u> @ <u>10</u>	
		Maitre'D _____	

## Event 2: 11/7/24 Band Banquet, High School B

	Ate Food			Did not eat food					
Food Item	Ill	Not ill	AR	Ill	Not ill	AR	AR diff	OR	RR
Salad	40	58	40.8%	4	35	10.3%	30.5%	3.98	6.03
Bread	26	60	30.2%	18	33	35.3%	-5.1%	0.86	0.79
Butter	18	42	30.0%	26	51	33.8%	-3.8%	0.89	0.84
Roast beef	19	47	28.8%	25	46	35.2%	-6.4%	0.82	0.74
Chicken marsala	21	40	34.4%	23	53	30.3%	4.1%	1.14	1.21
Pasta con broccoli	32	47	40.5%	12	46	20.7%	19.8%	1.96	2.61
Green beans	24	57	29.6%	20	36	35.7%	-6.1%	0.83	0.76
Cake	11	33	25.00%	33	60	35.5%	-10.5%	0.70	0.61

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Cake	11	33	25.00%	33	60	35.5%	-10.5%	0.70	0.61

# Event 3: 11/8/24 Veterans Day Lunch, High School B

- Attendees: ~150 to 175
- Survey responses: 137
  - ~80 to 90% response rate
- Case counts
  - Confirmed: 8
    - Hospitalized: 1
    - HUS: 0
  - Probable: 32
    - Hospitalized: 2
    - HUS: 0



- Menu
  - Salad
  - Rolls with butter
  - Roast beef
  - Chicken marsala
  - Pasta con broccoli
  - Green beans
  - Sheet cake from outside vendor
  - Sodas with ice



Image: [https://clipart-library.com/newhp/best-pom-poms-illustrations-royalty-free-vector-graphics-clip-pom-pom-clip-art-612\\_501.jpg](https://clipart-library.com/newhp/best-pom-poms-illustrations-royalty-free-vector-graphics-clip-pom-pom-clip-art-612_501.jpg)

# Event 3: 11/8/24 Veterans Day Lunch, High School B

	Ate food			Did NOT eat food					
Food Item	Ill	Not ill	AR	Ill	Not ill	AR	AR diff	OR	RR
Salad	62	86	41.9%	2	27	6.9%	35.0%	9.73	5.66
Bread	58	101	36.5%	6	12	33.3%	3.1%	1.15	0.73
Butter	47	84	35.9%	17	29	37.0%	-1.1%	0.95	0.61
Roast beef	24	39	38.1%	40	74	35.1%	3.0%	1.14	0.70
Chicken parm	33	58	36.3%	31	55	36.0%	0.2%	1.01	0.64
Italian Potatoes	35	79	30.7%	29	34	46.0%	-15.3%	0.52	0.36
Pasta con broccoli	50	85	37.0%	14	28	33.3%	3.7%	1.18	0.74
Brownies	41	72	36.3%	23	41	35.9%	0.3%	1.02	0.65



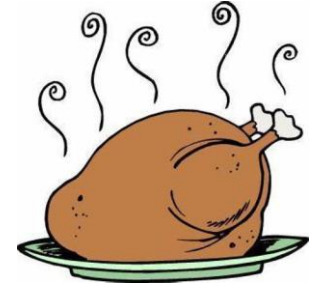
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Bread	58	101	36.5%	6	12	33.3%	3.1%	1.15	0.73
Butter	47	84	35.9%	17	29	37.0%	-1.1%	0.95	0.61
Roast beef	24	39	38.1%	40	74	35.1%	3.0%	1.14	0.70
Chicken parm	33	58	36.3%	31	55	36.0%	0.2%	1.01	0.64
Italian Potatoes	35	79	30.7%	29	34	46.0%	-15.3%	0.52	0.36
Pasta con broccoli	50	85	37.0%	14	28	33.3%	3.7%	1.18	0.74
Brownies	41	72	36.3%	23	41	35.9%	0.3%	1.02	0.65

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Roast beef	24	39	38.1%	40	74	35.1%	3.0%	1.14	0.70
Chicken parm	33	58	36.3%	31	55	36.0%	0.2%	1.01	0.64
Italian Potatoes	35	79	30.7%	29	34	46.0%	-15.3%	0.52	0.36
Pasta con broccoli	50	85	37.0%	14	28	33.3%	3.7%	1.18	0.74
Brownies	41	72	36.3%	23	41	35.9%	0.3%	1.02	0.65

# Event 4: 11/8/24 Funeral Lunch



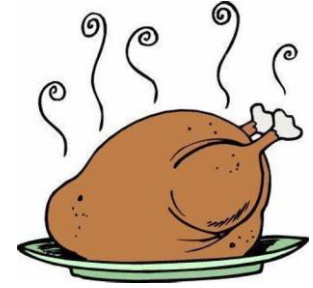
- Attendees: ~50
- Survey responses: 8
  - ~16% response rate
- Case counts
  - Confirmed: 0
    - Hospitalized: 0
    - HUS: 0
  - Probable: 5
    - Hospitalized: 1
    - HUS: 0

- Menu
  - Salad
  - Rolls with butter
  - Roast beef
  - Turkey
  - Pasta carbonara
  - Mashed potatoes
  - Green beans
  - Coffee
  - Sodas with ice



Image: <https://tse1.mm.bing.net/th?id/OIP.92KYHQ639K277Zo89EU2VgHaHK?rs=1&pid=ImgDetMain>, <https://tse3.mm.bing.net/th?id/OIP.3YIRF-QsawD5jr9K3iuMGAHaFX?rs=1&pid=ImgDetMain>

# Event 4: 11/8/24 Funeral Lunch



- Attendees: ~50
- Survey responses: 8
  - ~16% response rate
- Case counts
  - Confirmed: 0
    - Hospitalized: 0
    - HUS: 0
  - Probable: 5
    - Hospitalized: 1
    - HUS: 0

- Menu
  - Salad
  - Rolls with butter
  - Roast beef
  - Turkey
  - Pasta carbonara
  - Mashed potatoes
  - Green beans
  - Coffee
  - Sodas with ice

**100% of respondents ate salad;  
62.5% AR**



Image: <https://tse1.mm.bing.net/th/id/OIP.92KYHQ639K277Zo89EU2VgHaHK?rs=1&pid=ImgDetMain>, <https://tse3.mm.bing.net/th/id/OIP.3YIRF-QsawD5jr9K3iuMGAHaFX?rs=1&pid=ImgDetMain>

# Exclusions

- High-risk settings: work or attend
  - Daycare
  - Food handling
  - Healthcare
- Nine people excluded
- Two options for exclusion:
  - Return to work after being symptom free for 30 days
  - Produce one negative stool sample with testing conducted by MSPHL
- By 12/17/2024, all people excluded were released back to work.



image: <https://www.istockphoto.com/illustrations/exclusion-work>

# Environmental Investigation

- What does an environmental food inspection look like?
  - Routine inspections: Occur between 1-4 times a year depending on the risk level of a restaurant. Involves a thorough assessment of the restaurant to check for proper food safety practices, staff hygiene, establishment cleanliness, and temperature control of food and equipment.
  - Complaint Inspections: Occur whenever a complaint notification is received from a citizen or DPH communicable disease staff member regarding a specific establishment. Often times, this type of inspection involves a thorough check of what was mentioned in the complaint that was received.
  - Unexpected
  - Education provided to the establishment owner/manager to help them correct any violations found while onsite

# Environmental Investigation

Our Environmental Health team took several visits to the facility to complete food inspections:

- 1st Visit, 11/13: Conducted a routine health and food complaint inspection, determined a comprehensive food menu and details on how each food dish was prepared that was served at the banquets, read over the facility's employee health policy, and checked for properly working equipment
- 2nd Visit, 11/15: Salad ingredients were embargoed to ensure that they were not served at events being held at the facility over the weekend
- 3rd Visit, 11/18: Representatives from Missouri DHSS took samples of the embargoed lettuce for testing at SPHL, DPH environmental staff instructed the facility to destroy all remaining lettuce and released all other salad ingredients from the embargo



# National outbreak data -- Difference in our part of outbreak vs rest of WGS cases

- There were 89 cases from 15 states
- Leafy greens was a notable exposure in all states and among all subclusters.
- Isolation dates range from 11/7/2024 to 11/17/2024, and symptom onset dates range from 11/4/2024 to 11/14/2024. Cases range in age from 4 to 90 years (median:47). More than a third of cases were hospitalized, there were 7 cases of HUS, and 1 death.
- Clinical isolates are highly related within 0-1 alleles by cgMLST and 0-2 (average: 0) SNPs in NCBI.
- No other cluster of outbreak had near as many cases. To date, the St. Louis County cases associated with the banquet hall represents the largest subcluster *by far*.
- Per the Missouri State Public Health Lab, there were 25 cases associated with the banquet hall who are matches through Whole Genome Sequencing (WGS). St. Louis County also has 2 additional WGS matches who are not associated with the facility.

Source: <https://www.nbcnews.com/news/us-news/ecoli-bacteria-lettuce-outbreak-rcna200236>



# FDA 2022 Food Code

(1) **"Time/temperature control for safety food"** means a FOOD that requires time/temperature control for safety (TCS) to limit pathogenic microorganism growth or toxin formation.

(2) **"Time/temperature control for safety food"** includes:

(a) An animal FOOD that is raw or heat-treated; a plant FOOD that is heat-treated or consists of raw seed sprouts, cut melons, cut leafy greens, cut tomatoes or mixtures of cut tomatoes that are not modified in a way so that they are unable to support pathogenic microorganism growth or toxin formation, or garlic-in-oil mixtures that are not modified in a way so that they are unable to support pathogenic microorganism growth or toxin formation; and

## 3-501.16 Time/Temperature Control for Safety Food, Hot and Cold Holding.

(A) *Except during preparation, cooking, or cooling, or when time is used as the public health control as specified under §3-501.19, and except as specified under ¶ (B) and in ¶ (C) of this section, TIME/TEMPERATURE CONTROL FOR SAFETY FOOD shall be maintained:*

(1) *At 57°C (135°F) or above, except that roasts cooked to a temperature and for a time specified in ¶ 3-401.11(B) or reheated as specified in ¶ 3-403.11(E) may be held at a temperature of 54°C (130°F) or above; <sup>P</sup> or*

(2) *At 5°C (41°F) or less. <sup>P</sup>*

(B) EGGS that have not been treated to destroy all viable **Salmonellae** shall be stored in refrigerated EQUIPMENT that maintains an ambient air temperature of 7°C (45°F) or less. <sup>P</sup>

(C) TIME/TEMPERATURE CONTROL FOR SAFETY FOOD in a homogenous liquid form may be maintained outside of the temperature control requirements, as specified under ¶ (A) of this section, while contained within specially designed EQUIPMENT that complies with the design and construction requirements as specified under ¶ 4-204.13(E).

Source: <https://www.fda.gov/food/fda-food-code/food-code-2022>

# St. Louis County 2005 Food Code

## **Potentially Hazardous Food (Time/Temperature Control for Safety Food).**

(1) **"Potentially hazardous food (time/temperature control for safety food)"** means a FOOD that requires time/temperature control for safety (TCS) to limit pathogenic microorganism growth or toxin formation.

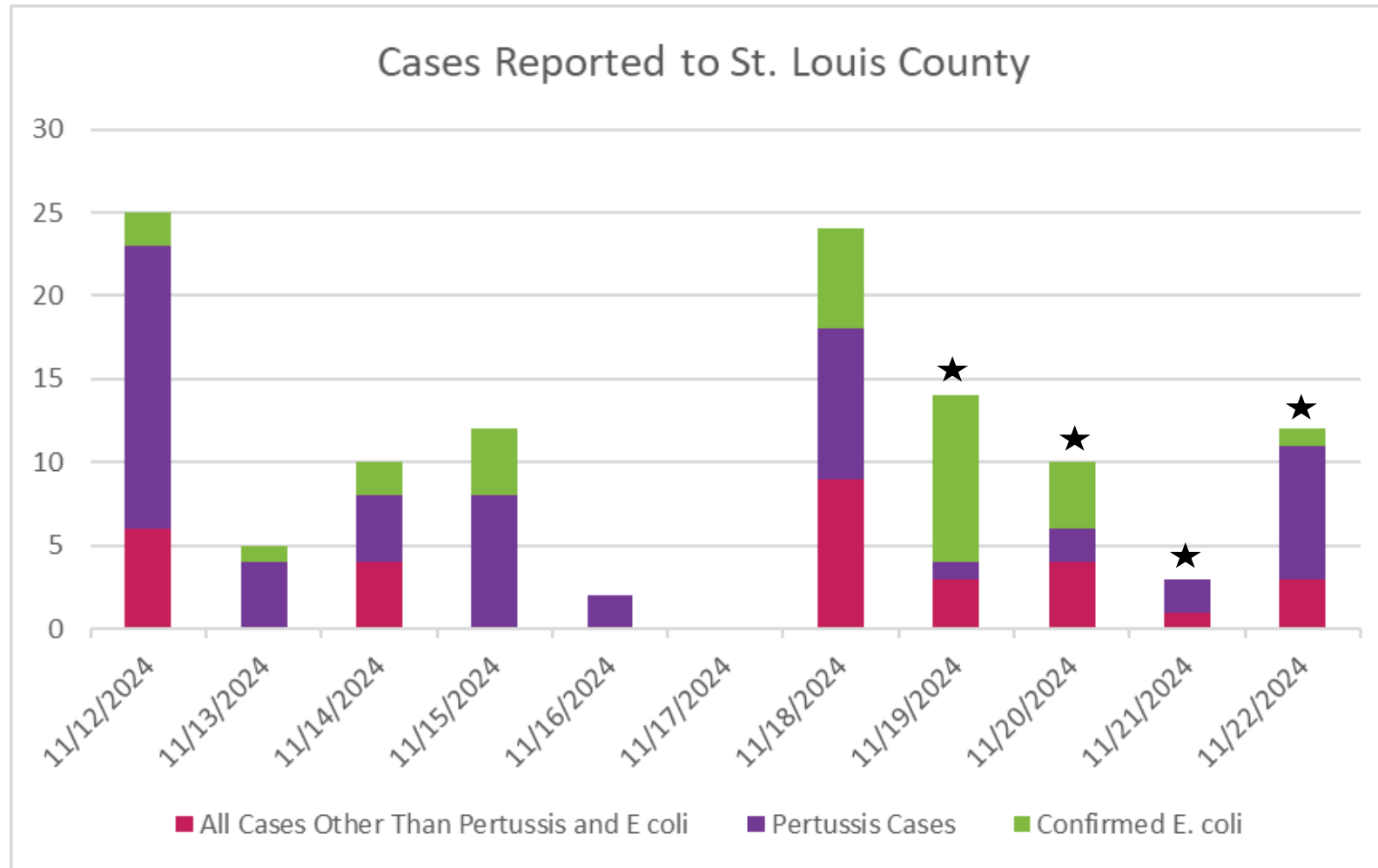
(2) **"Potentially hazardous food (time/temperature control for safety food)"** includes:

(a) An animal FOOD that is raw or heat-treated; a plant FOOD that is heat-treated or consists of raw seed sprouts, cut melons, or garlic-in-oil mixtures that are not modified in a way that results in mixtures that do not support pathogenic microorganism growth or toxin formation; and

(b) Except as specified in Subparagraph (3)(d) of this definition, a FOOD that because of the interaction of its  $A_w$  and PH values is designated as Product Assessment Required (PA) in Table A or B of this definition:

Source: <https://stlouiscountymo.gov/st-louis-county-departments/public-health/food-and-restaurants/additional-resources/st-louis-county-food-code/>

# Case Investigations at time of Outbreak



Probable *E. coli* cases

11/19: 40

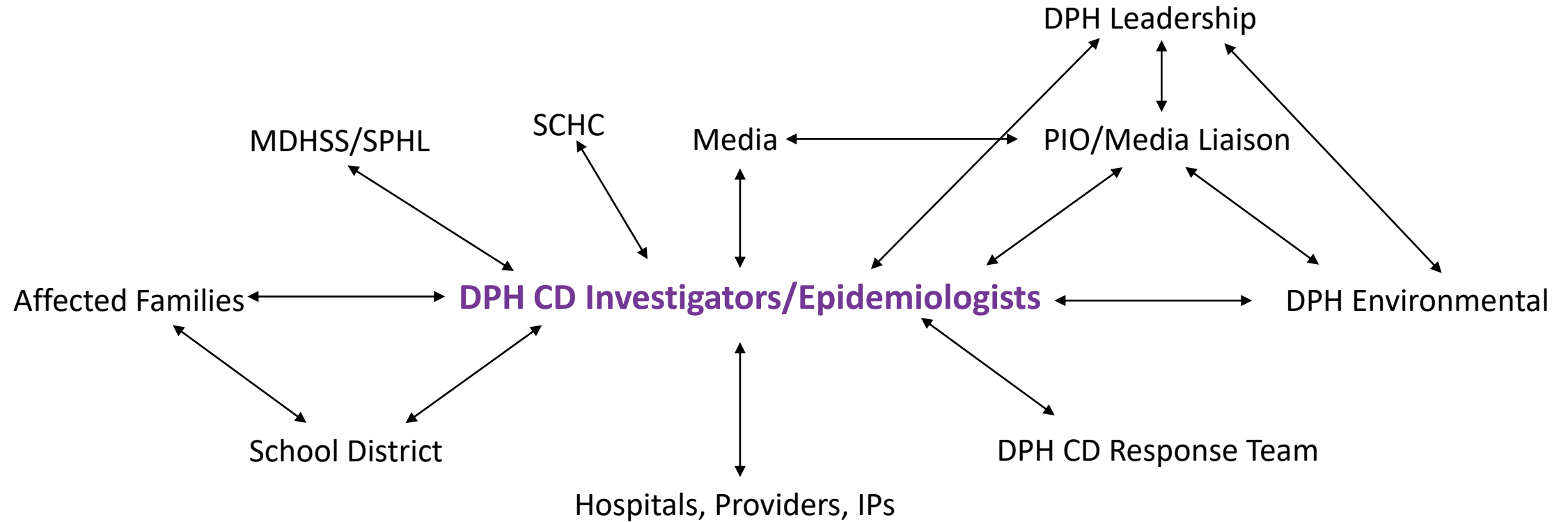
11/20: 6

11/21: 10

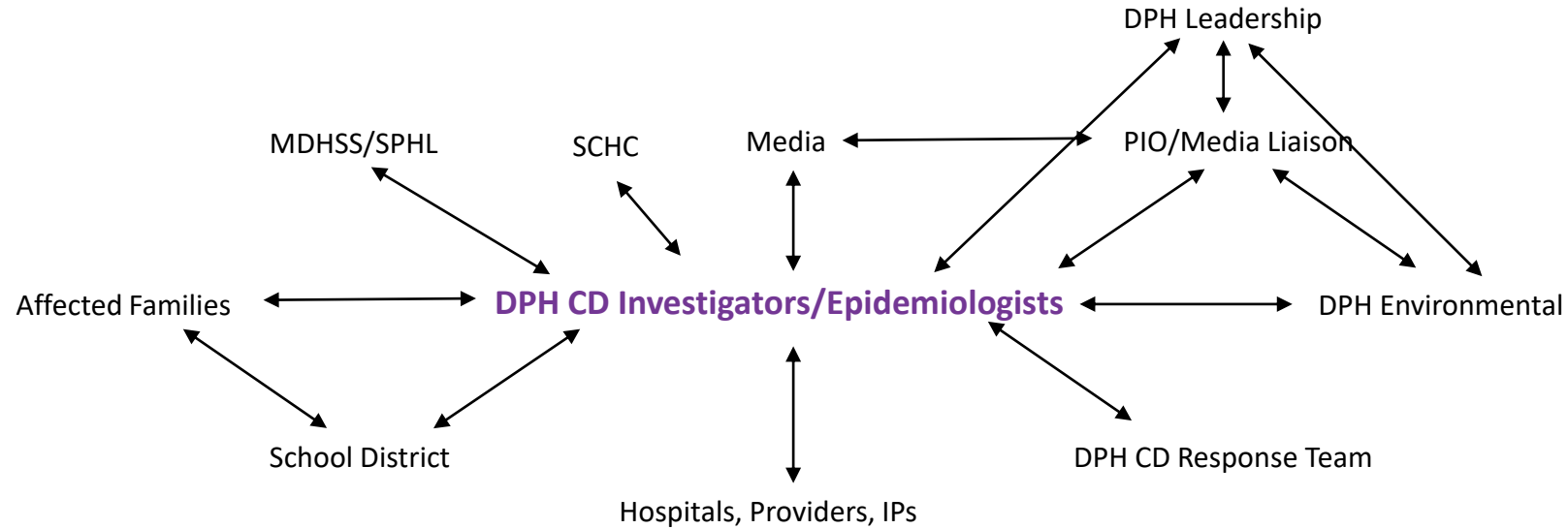
11/22: 1



# What worked: Relationships



# What worked: Relationships



- Good cooperation → high survey response rates → confidence in results
- Experience with REDCap
  - Epis during COVID, CD investigators during prior enteric outbreaks

# Challenges

- Working with the facility
- Working with the families in High School A
- Working in 2 different data bases
  - Red Cap and WebSurv
- Administrative policies
- Constant need for updated numbers
- Families looking for information we either don't have or aren't able to share
- Sharing information internally
  - Some felt this went very smoothly, others felt it could have been improved

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## School District

Lead Nurse School B  
District  
Communication  
Officer School B  
High School B staff  
Affected families

## MDHSS

Joyce Chou  
Thomas Pratt  
Audrey Toler  
Ashley Wiggington  
SPHL staff  
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## DPH Environmental

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Jennifer Western

## DPH Administration

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## DPH CD Response

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# Thank you

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**SAINT LOUIS COUNTY**  
Missouri