

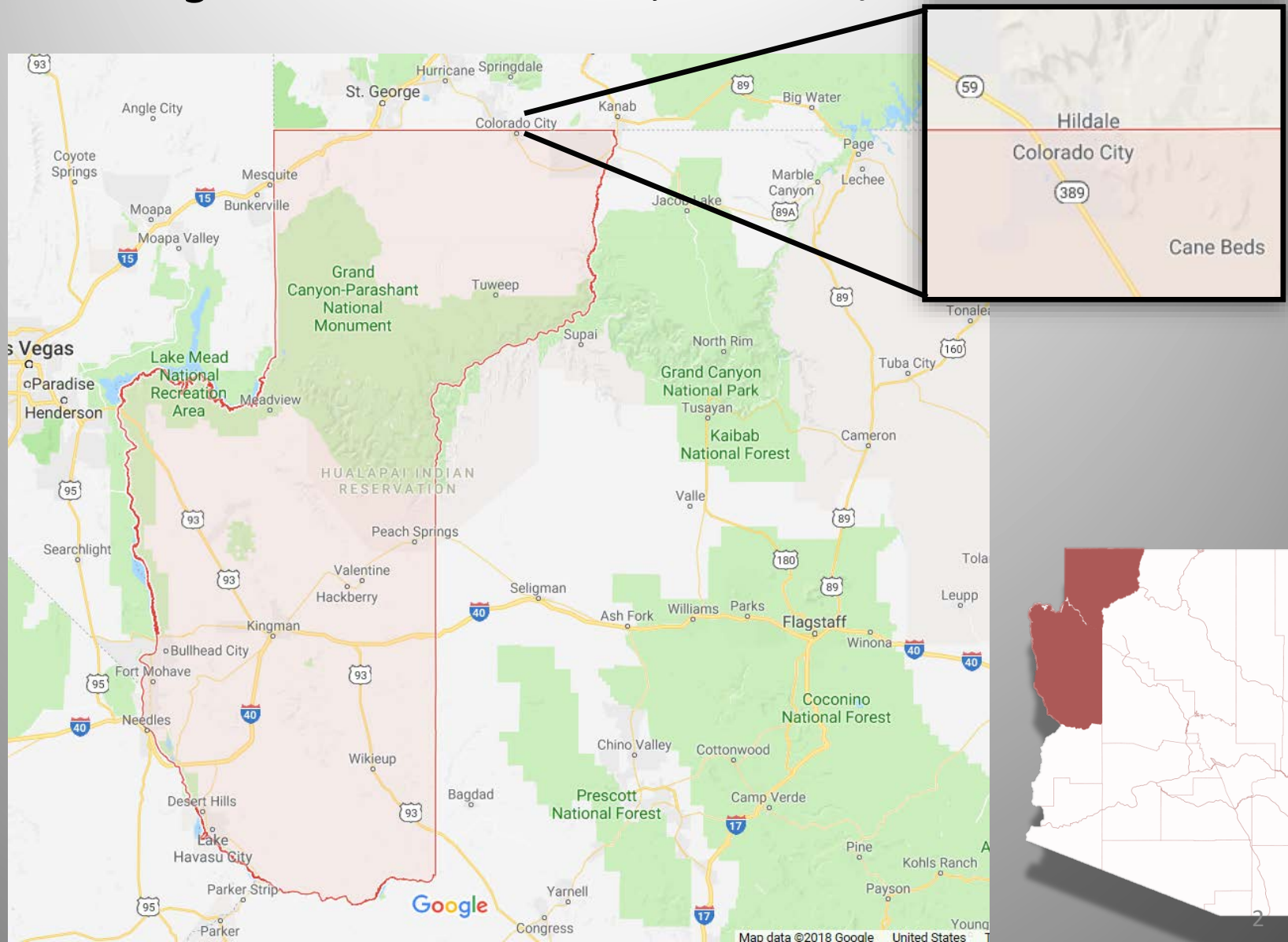
Outbreak of *Escherichia coli* O157:H7 in Short Creek, Arizona/Utah

Anna Scherzer

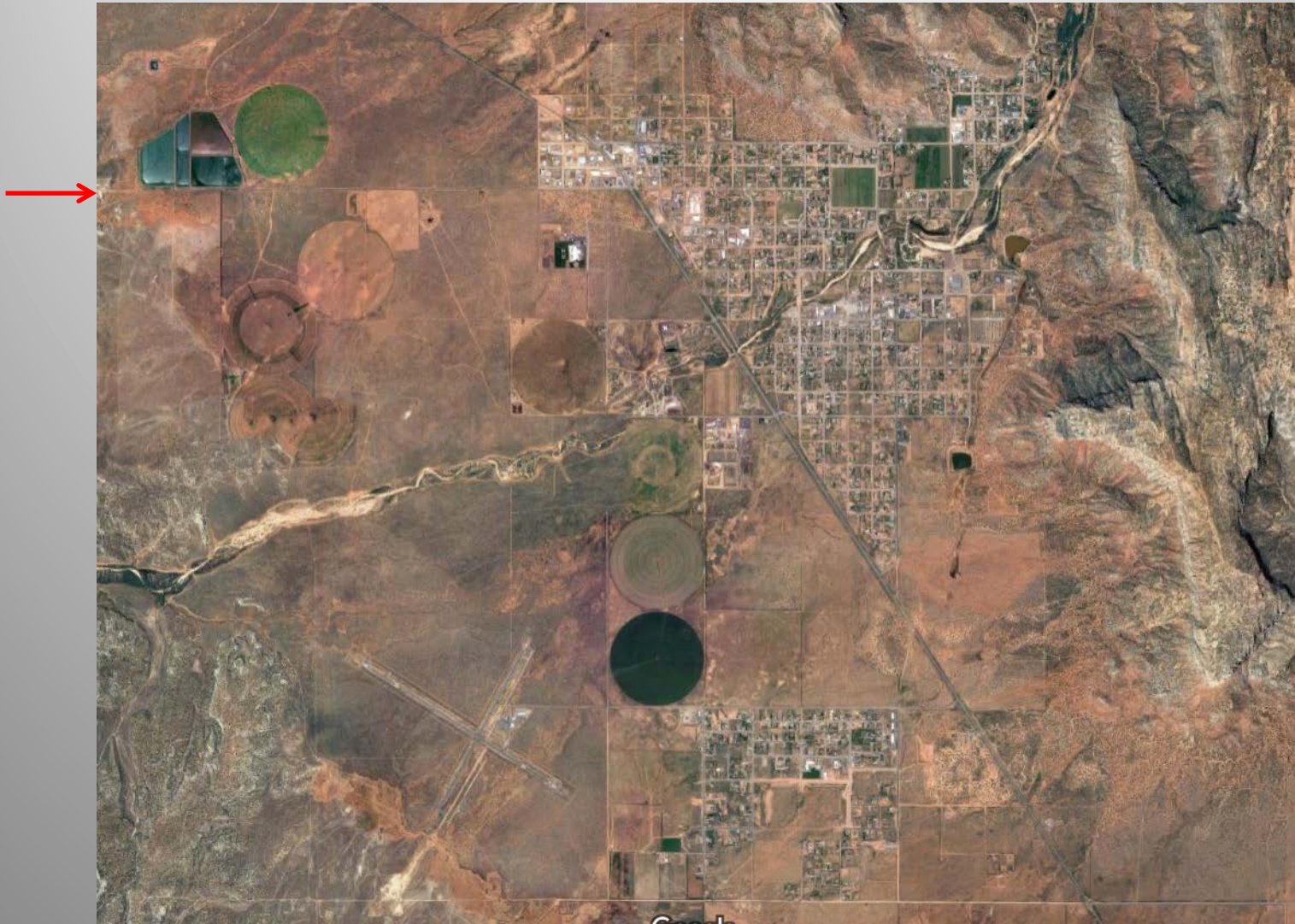
(AZID, 2018)



Background: Short Creek, Arizona/Utah



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- “Country,” rural, down-to-earth lifestyle is common
- Unique religious/cultural history with many recent changes
- Very large households are possible
- Several previous outbreaks of enteric illness and vaccine preventable illness
- All post office boxes are in Arizona
- Road names and addresses do not necessarily match “official” designations
- Nearest ER is St. George, Utah

Background: *E. coli* O157

265,000 Shiga toxin-producing *E. coli* (STEC) infections*

3,600 hospitalizations

30 deaths

In Utah:

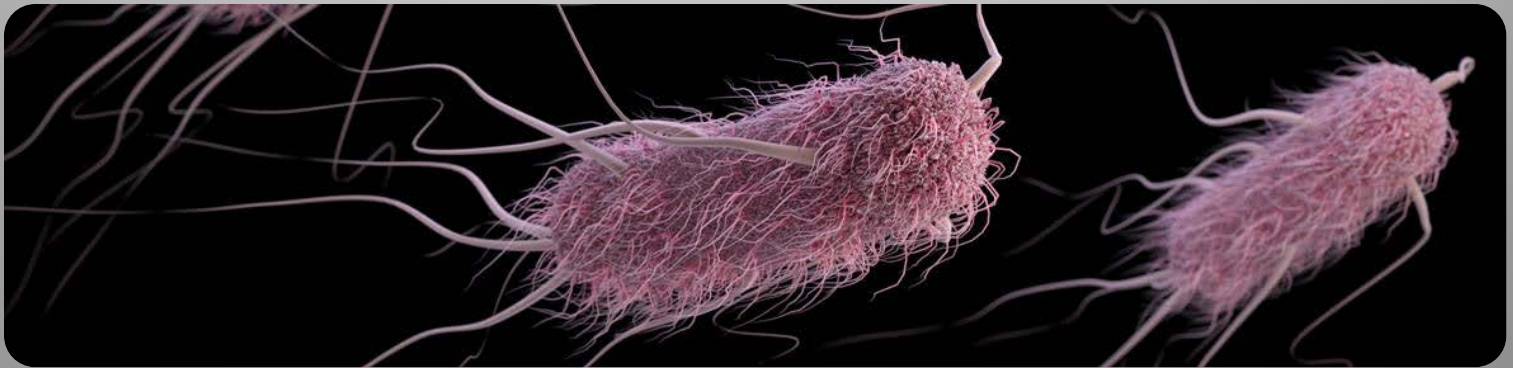
- 91 infections
- 20 hospitalizations
- 0 deaths



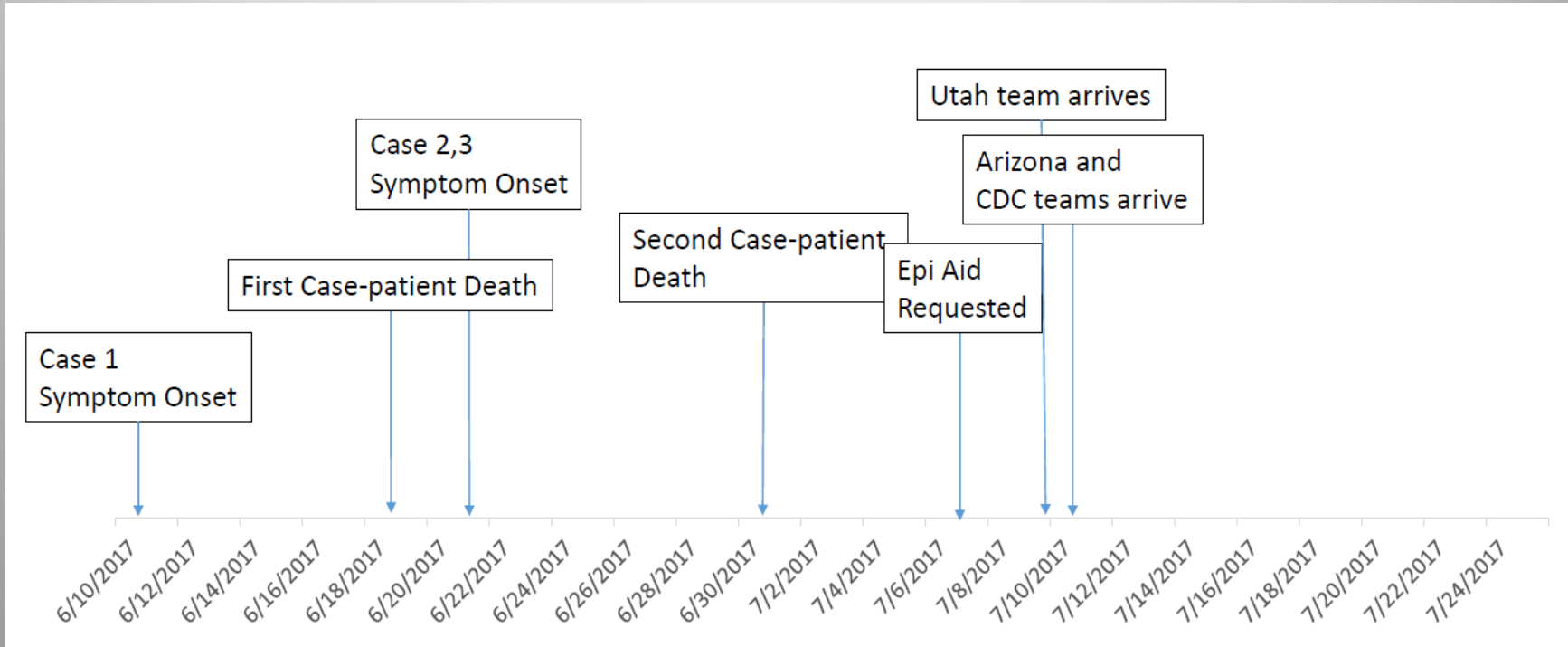
* *E. coli* O157 causes about 36% of these infections

Background: E. coli O157

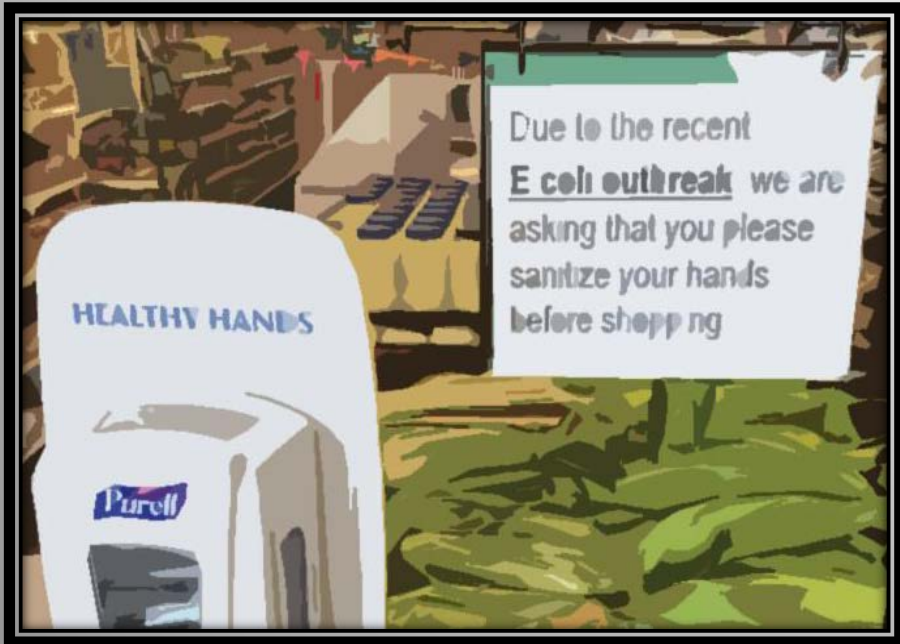
- Symptoms: diarrhea (often bloody) and abdominal cramps
- Incubation Period: 2-10 days with a median of 3-4 days



Timeline:



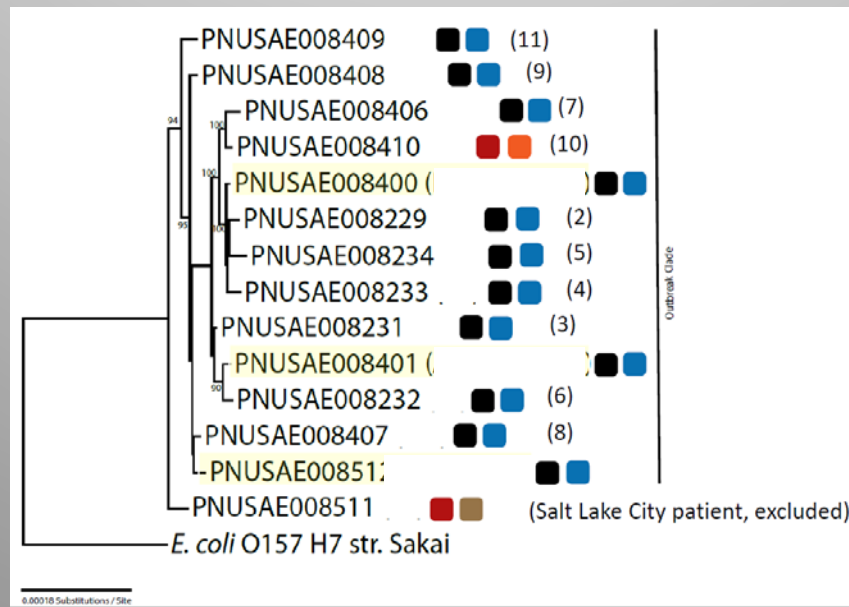
Objectives of the Epi-Aid



1. Determine the scope and severity of the outbreak
2. Identify the ultimate source of the infections in this outbreak
3. Determine risk factors for infection with *E. coli* in Utah and Arizona
4. Develop public health recommendations to stop the current outbreak and prevent additional illnesses

Historical PFGE Pattern Information

- *E. coli* O157 PFGE patterns:
 - EXHX01.6797/EXHX26.0332
 - EXHX01.6818/EXHX26.0332
 - EXHX01.6817/EXHX26.0332
- No previous isolates reported in the United States
- 11 clinical isolates from case-patients in this investigation



Case Definitions

Confirmed:

- An illness in a resident of or individual with an epidemiologic link to the Hildale/Colorado City/Centennial Park community with onset of diarrhea after June 1
- **AND** with culture-confirmed *E. coli* O157:H7 with one of the three novel PFGE pattern combinations
- **OR** with doctor-diagnosed post-diarrheal hemolytic uremic syndrome (HUS)

Probable:

- An illness in a resident of or individual with an epidemiologic link to the Hildale/Colorado City/Centennial Park community with onset of diarrhea after June 1 AND positive PCR *E. coli* O157
- **AND** no PFGE/culture performed pattern
- **OR** PFGE pending

Case Definitions

Suspect:

- An illness in a resident of or individual with an epidemiologic link to the Hildale/Colorado City/Centennial Park community with onset of diarrhea after June 1
- **AND** the absence of a negative PCR or culture for E. coli O157
- **AND** no other diagnosis

Secondary case:

- A case-patient with onset date 3 days or more after contact with another case-patient.

Case Finding

Confirmed:

- Primary: 7
- Secondary: 5



Demographic Information

State	No. of cases
UT	5
AZ	7
Total	12

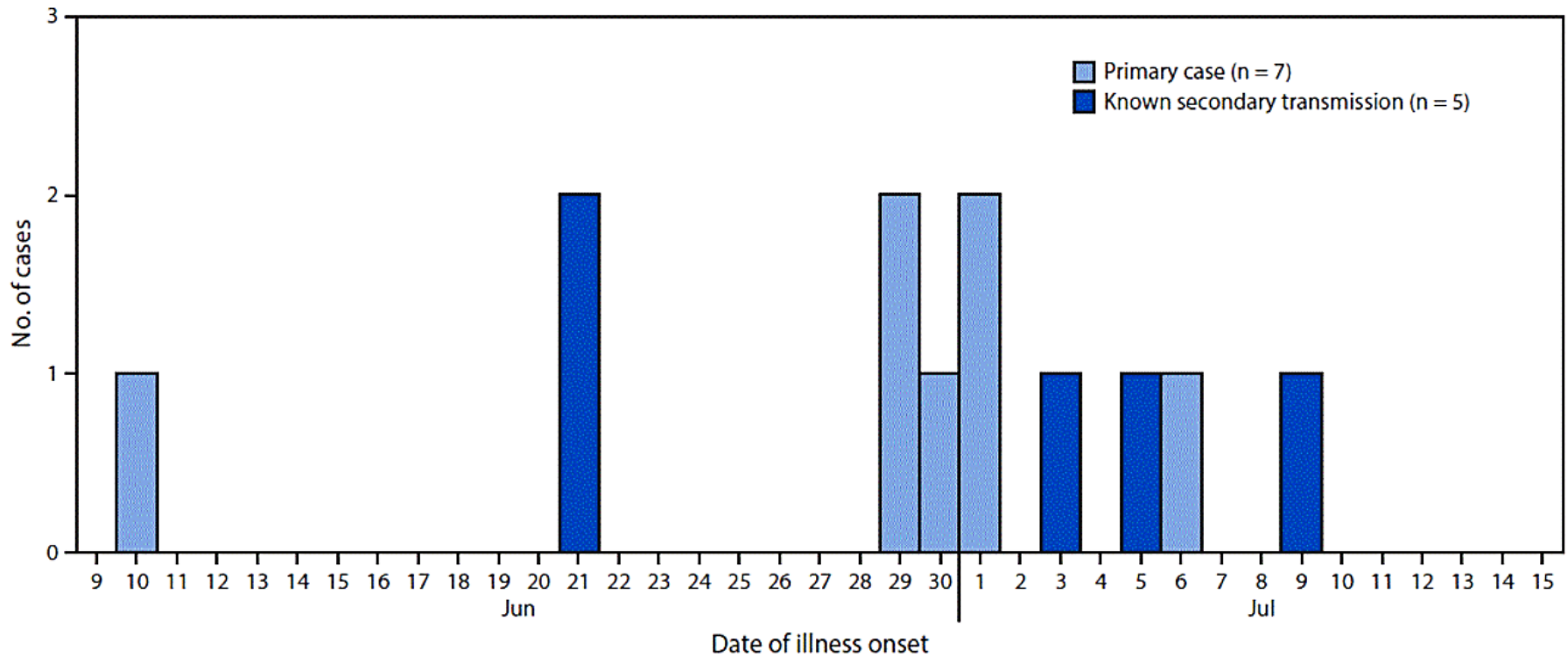
(8 households)

Outcomes	n (%)
Hospitalized	9 (75)
HUS	4 (33)
Died	2 (17)

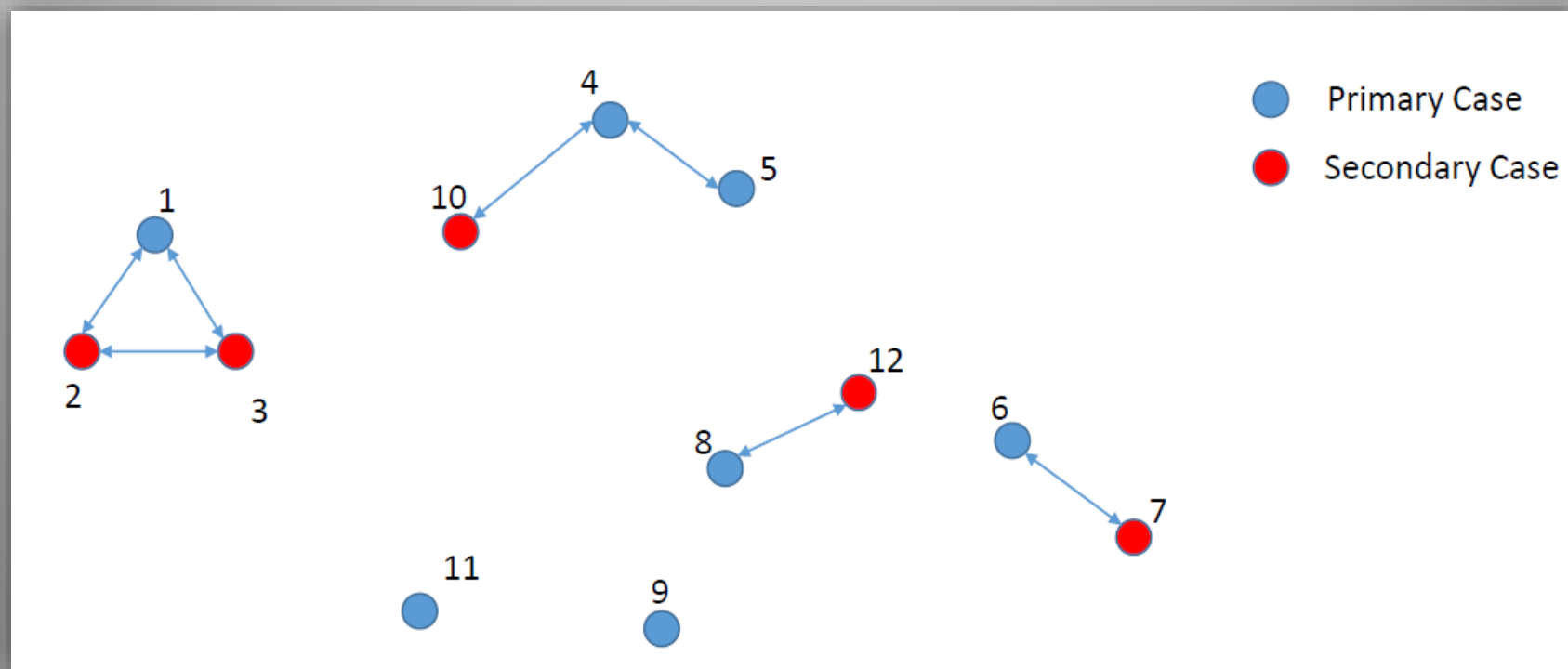
Demographics	
Age range (median)	1-28 yrs (3)
Age categories in years	n (%)
<5	10 (83)
5-17	1 (8)
18-59	1 (8)
≥60	0 (0)
Sex	n (%)
Female	5 (42)
Male	7 (58)

Epi-curve:

FIGURE 1. Number of cases of Shiga toxin-producing *Escherichia coli* O157:H7 infection, by date of illness onset – Centennial Park/Colorado City/Hildale community, Arizona and Utah, June–July 2017



Initial Contact Diagram of Case-Patients:



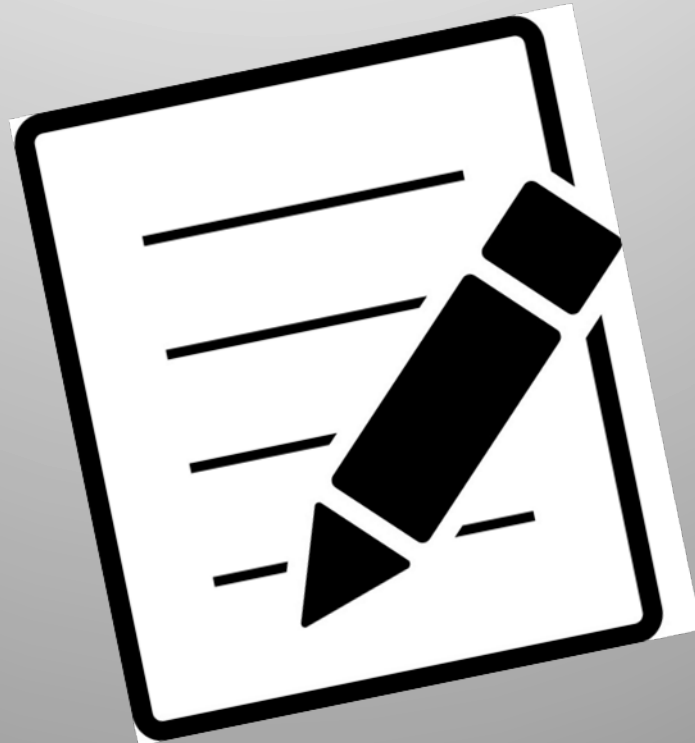
Methods

- Hypothesis Generation
- Focus Group Discussion
- Case-Control Study
- Contact Tracing
- Environmental Investigation



Hypothesis Generation

- 11 case-patients or guardians had been interviewed with the Arizona or Utah state STEC questionnaire



Preliminary Hypotheses:

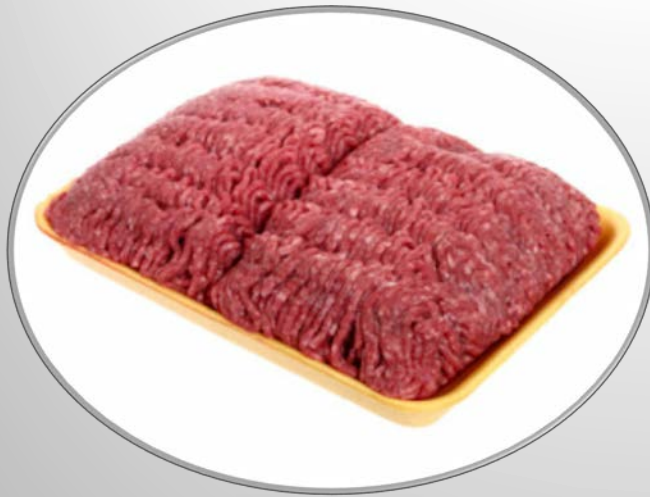
- Food
- Water
- Animal Contact
- Shopping at Local Store
- Person-to-person

- Food



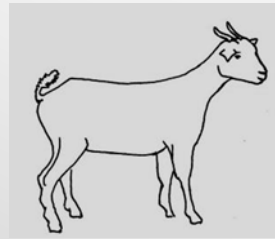
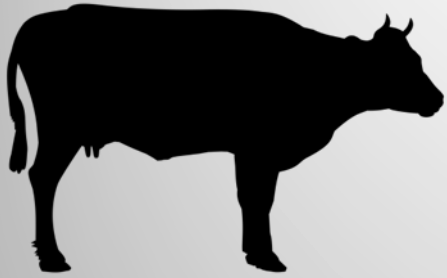
- Water



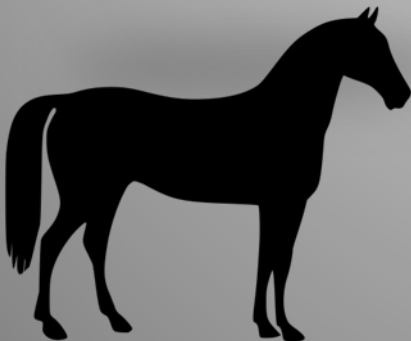


- Shopping at Local Store





- Animal Contact

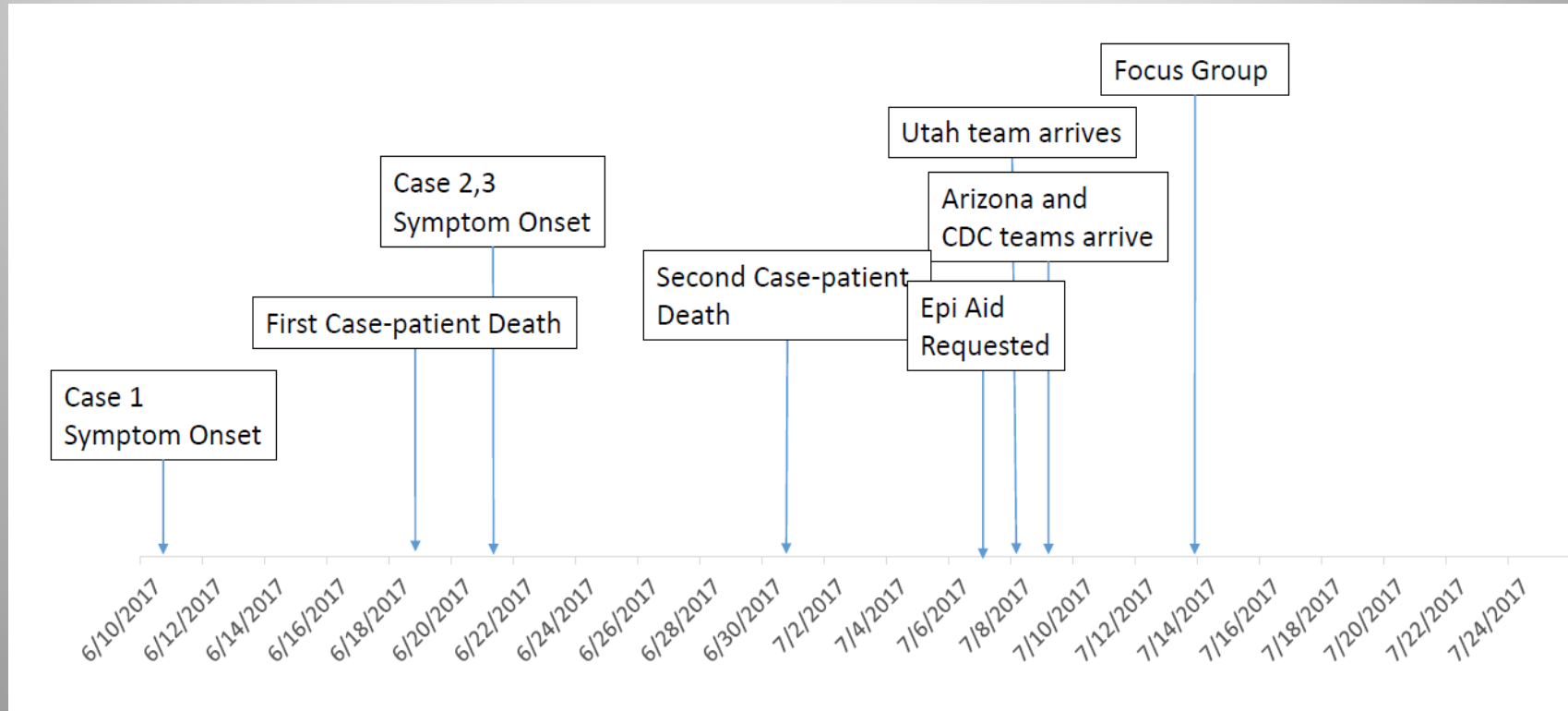




- Person-to-person



Timeline:



Focus Group discussion:

After the focus group, we honed in on meat and animal contact for the case-control study.

Exposures:

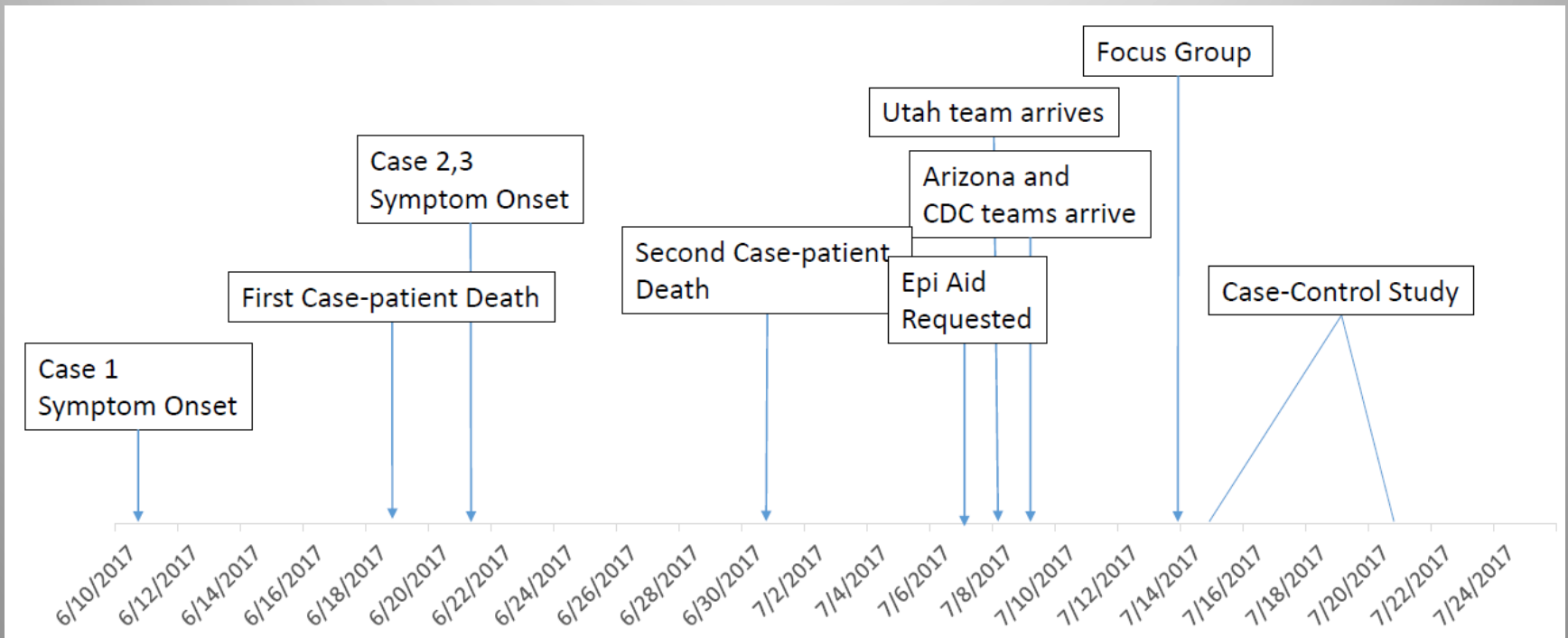
- Meat
- Produce
- Raw milk & dairy
- Drinking water
- Animal contact
- Hygiene practices

Exposures:

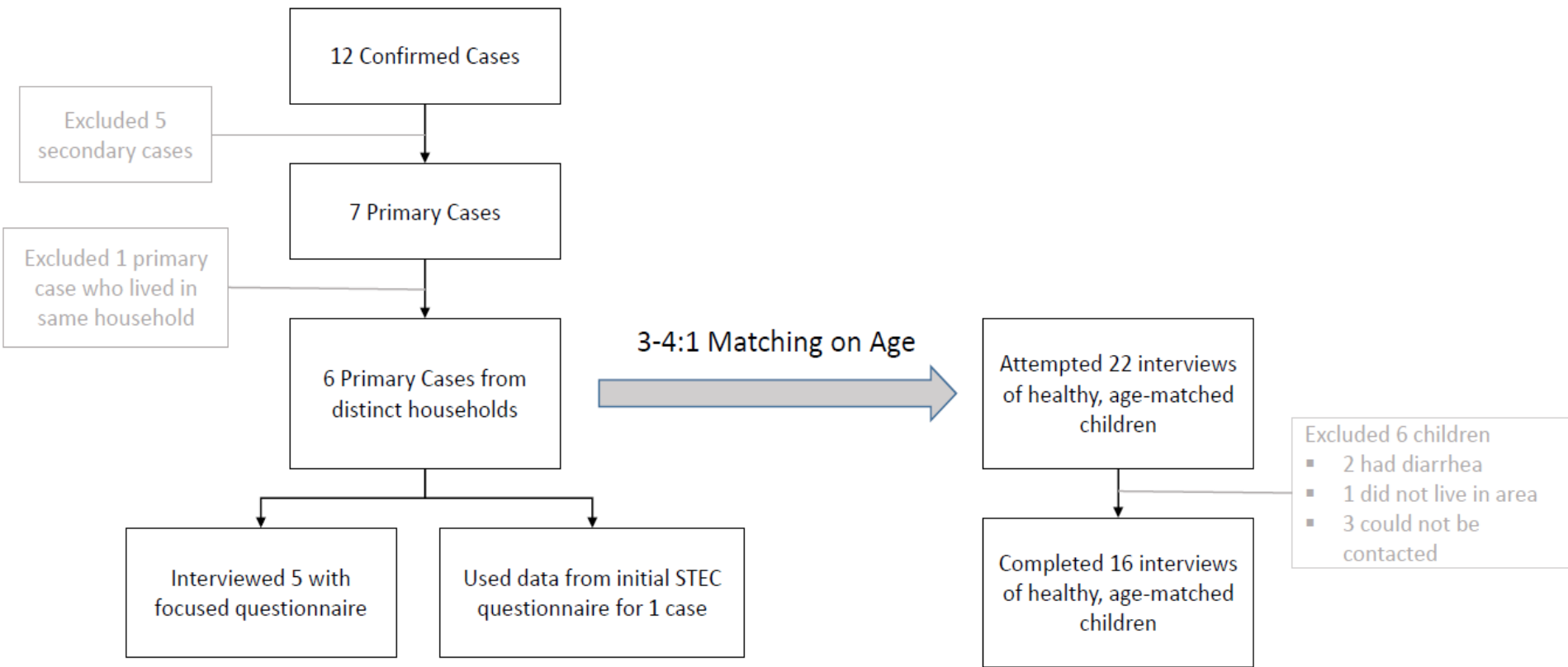
- **Meat**
- Produce
- Raw milk & dairy
- Drinking water
- **Animal contact**
- Hygiene practices



Timeline:



Case-Control Study



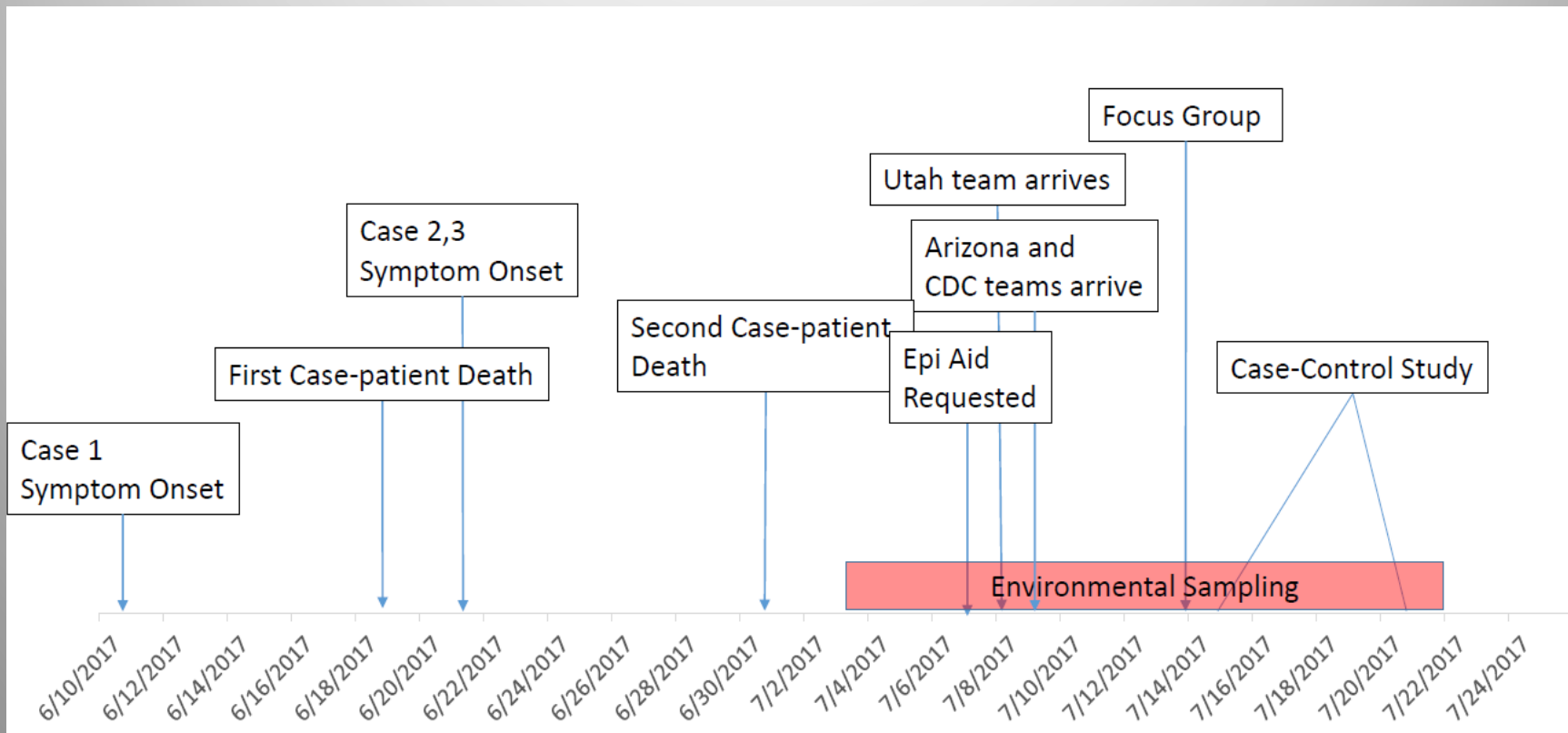
Results of Case-Control Study

Table 1: Frequencies and matched odds ratios for certain exposures.

Exposure	Cases Exposed (%)	Controls Exposed (%)	Matched Odds Ratio (95% CI)
Played in area with animal manure	4 (67%)	3 (19%)	7.67 (0.82-71.32)
Touched cow	2 (33%)	1 (6%)	5.27 (0.47-58.71)
Dogs wandered on property	4 (80%)	7 (44%)	4.05 (0.43-37.97)
Drank municipal water	3 (50%)	3 (19%)	3.13 (0.51-19.34)
Swimming	5 (83%)	10 (63%)	2.41 (0.27-21.27)
Consumed beef prepared at home	3 (50%)	12 (75%)	0.27 (0.03-2.82)
Consumed watermelon	5 (100%)	10 (63%)	--



Timeline:



Results: Environmental Investigation

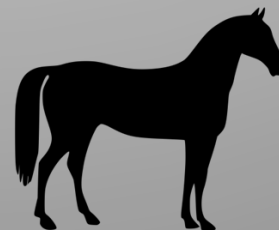
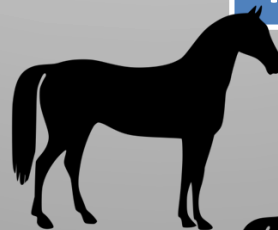
Samples were collected from:

- Local Store
- Affected households
- Water sources
- Animals
- Other environments

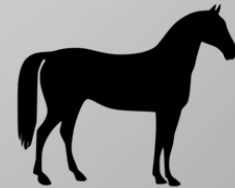
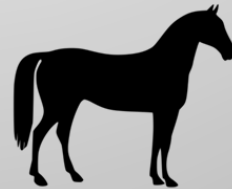
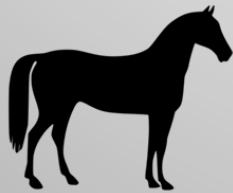
143 samples



3 culture-confirmed & PFGE-matched



Positive environmental samples:



Collected July 3, 2017

Positive environmental samples:



Collected July 3, 2017

Resulted July 12, 2017

Positive environmental samples:



Collected July 12, 2017

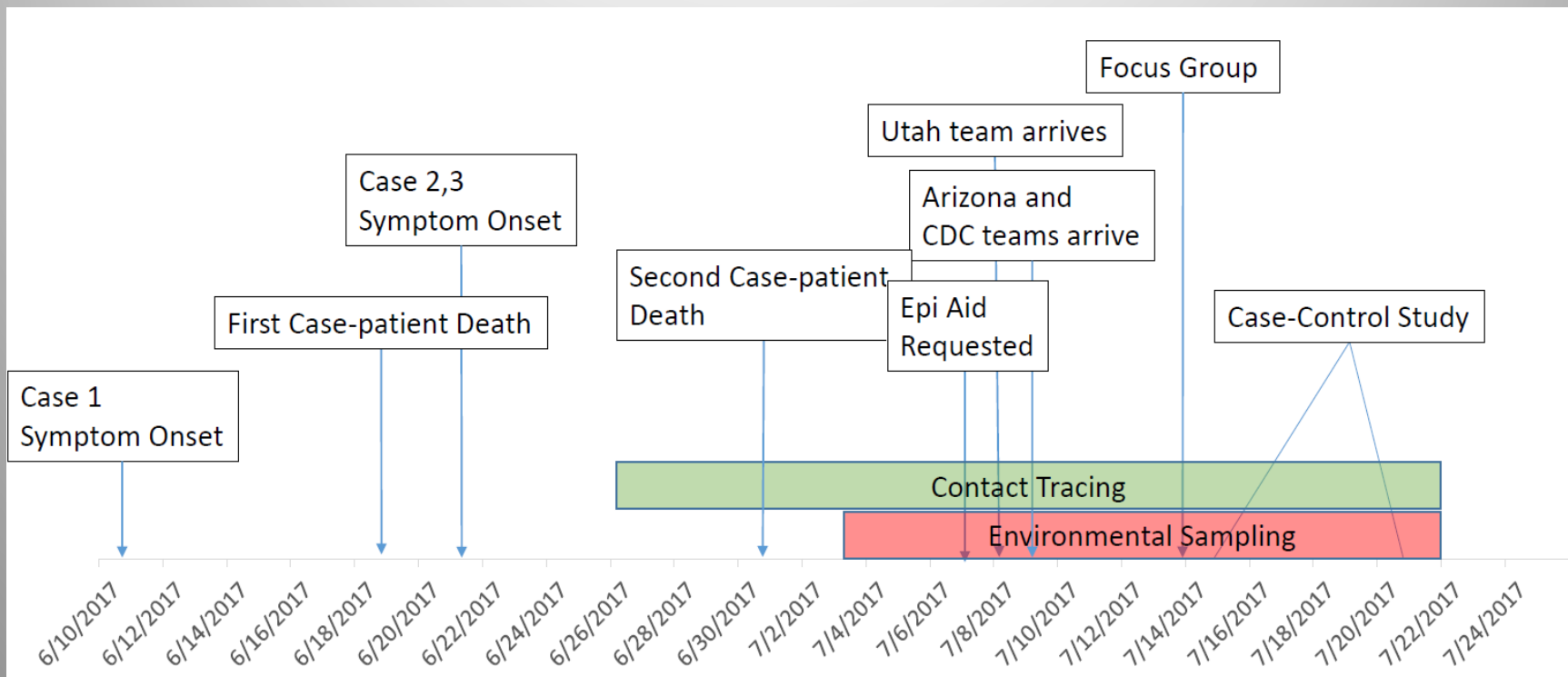
Positive environmental samples:



Collected July 12, 2017

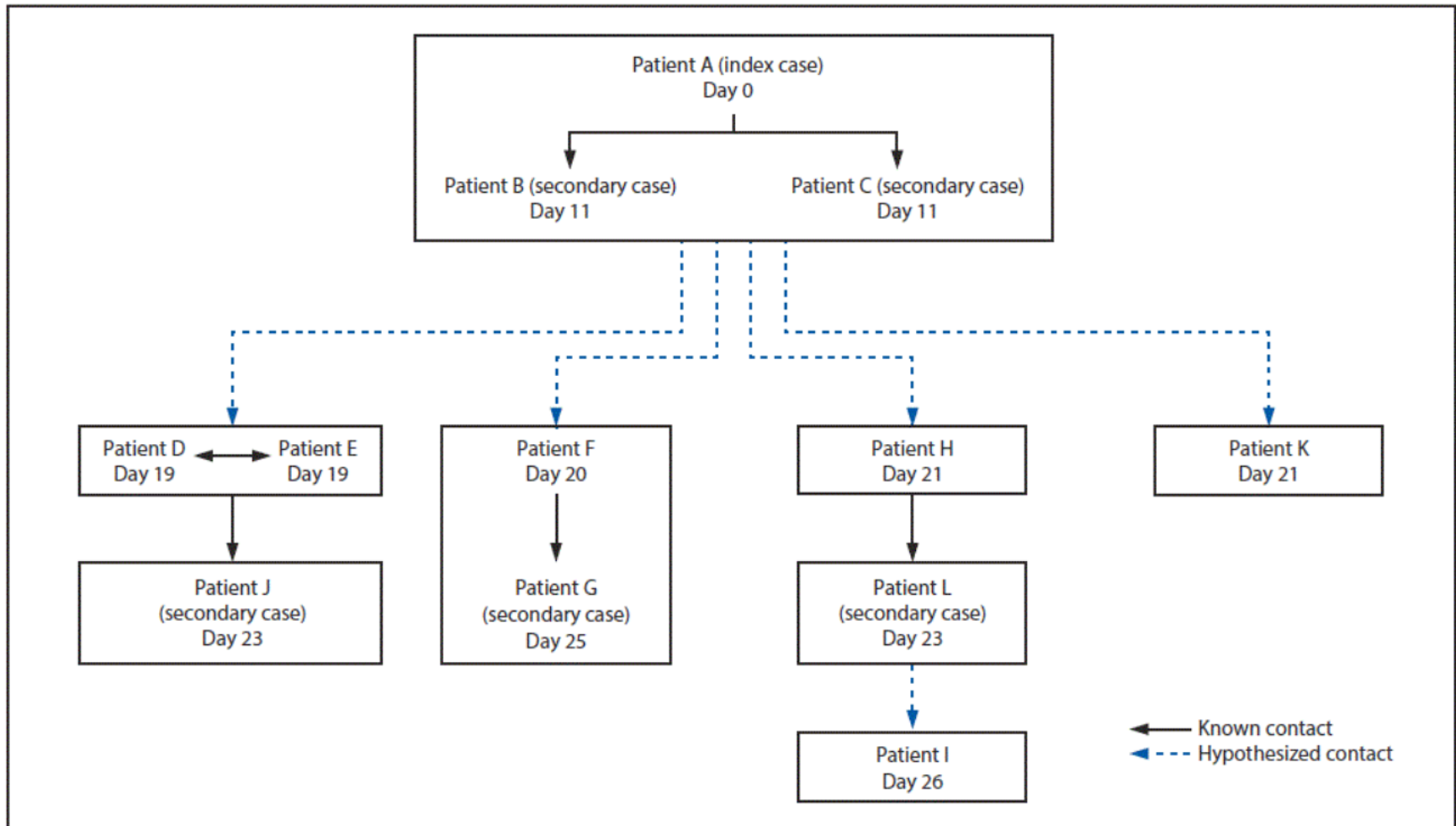
Resulted July 14, 2017

Timeline:



Contact tracing: Household Contact Diagram

FIGURE 2. Number of cases of Shiga toxin-producing *Escherichia coli* O157:57 infection, by type of case and numbered day in the outbreak – Centennial Park/Colorado City/Hildale community, Arizona and Utah, June–July 2017*



* Boxes represent households.

Summary:

- No food vehicle was identified
- The case-control study highlighted exposure to manure, cows, dogs, and municipal water as potential risks of infection
- Isolates with PFGE patterns matching the outbreak strain were found in three (3) animals that lived in close proximity of the first five cases
- Contact tracing illustrated the possibility of person-to-person transmission

The conclusion...

- “Contact with animal manure was the hypothesized source of the initial illnesses, with further spread via secondary person-to-person transmission.”



Recommendations:

- Create and promote community-specific manure management guidelines
- Promote proper sanitation and hand-washing practices as they pertain to animal and manure exposures



MANURE MANAGEMENT GUIDELINE

Livestock can be an important part of our communities. Livestock waste contains many microorganisms such as bacteria, viruses, and protozoa. Some of these microorganisms do not cause sickness in animals or humans. Others are pathogens, meaning they are capable of causing disease in animals and/or humans. The purpose of this guideline is to provide livestock owners with tools to help control pathogens.

PATHOGEN REDUCTION – THE ANIMAL

- Some animals appear healthy but are “carrier” exposed to disease-causing microorganisms when they feel stressed or uncomfortable.
- Simple management practices such as vaccination, appropriate space allowance, temperature and good animal husbandry practices can be used to reduce pathogens in their manure management system.
- Keep pets and stray dogs out of the manure

12 CASES

- Mostly children under 5 years
- 9 Hospitalizations
- 2 deaths

NO NEW CASES SINCE JULY 9th

E. coli Outbreak Investigation, 2017

What was done:

- Patients (or parents) were interviewed to look for things they did or ate in common.
- A focus group discussion with patients (or parents) further probed for specific exposures they had in common.
- An analytic study was conducted using what was learned in the interviews and focus group. Parents were re-interviewed with new questions as well as children who were NOT ill.

What we learned:

When compared to children who remained healthy, the sick patients were more likely to report one or more of the following:

- Cleaning up or playing in an area with manure
- A cow on their property
- Dogs wandering on to other properties
- Drinking municipal water

No local business establishment, community event or food item was implicated as the source of this outbreak. Ground beef was not determined to be the source. Several local livestock animals were found to be infected with the same bacteria that was making people sick.

Over 140 samples were collected from the environment (water, food, composting, animal manure, etc.) and tested to see if they had the outbreak strain of bacteria.



Conclusions:
The likely source of this outbreak was infected livestock animals and person-to-person spread (through diaper-changing, food preparation, baby bottle preparation, etc.). Those infected with the bacteria did not necessarily touch the infected animals directly or knowingly touch their manure. Transmission could have occurred via small amounts of manure or contaminated dirt tracked in on shoes or boots, or carried via vehicle tire treads. There is the possibility that “wandering dogs” could have inadvertently tracked infected manure into new places or yards.

One of the most enduring questions about this outbreak is, “Why did this happen *here*?” Unfortunately, this question remains unanswered. Livestock ownership and close family relationships are longstanding within this community. How this summer was any “different” from past years and what specifically drove this outbreak to happen when it did remains unclear.

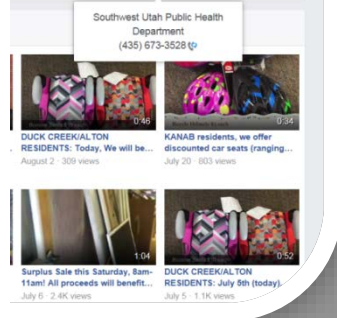
LOOKING AHEAD:

Although this outbreak ended in July, disease outbreaks are unpredictable and can occur at any time and in any community. It is, therefore, paramount to share what was learned this summer, and to remain vigilant with recommendations that might help prevent similar outbreaks in the future.

The respective owners of infected livestock were contacted during this outbreak and provided recommendations and guidelines on disposing and/or remediate potentially infected manure. For more information on manure remediation, please visit: <https://www.utah.gov/health/nutrition-food-safety-health/preventing-a-calf-from-garden-to-plate-9-589/>

Hand washing is recommended right after touching animals or their manure, after visiting or working in areas where they live or roam, and after removing shoes and clothes that were worn around livestock and the places they live and roam. People should avoid eating, drinking and hand-to-mouth behaviors (such as thumb-sucking) around animals and the places they live and roam. Because of the potential of unintentional contamination, people are strongly advised against consuming raw (unpasteurized) milk and raw dairy products and reminded to cook meats thoroughly and avoid cross-contamination in food preparation areas. For information on E. coli infections, outbreaks and prevention recommendations, visit: <https://www.cdc.gov/e coli/>

The local and state health departments involved in this investigation will continue to monitor disease activity within the community. For further information on the outbreak or information consistent within this flyer, please contact the Mohave County Department of Public Health Office in Colorado City at (928) 873-8960.



Acknowledgements:

- Southwest Utah Public Health Department
- Utah Department of Health
- Utah Public Health Laboratory
- Arizona Department of Health Services
- Arizona State Public Health Laboratory
- Mohave County Department of Public Health
- La Paz County Health Department
- CDC Outbreak Response and Prevention Branch
- CDC Enteric Diseases Laboratory Branch

- *The leaders, healthcare providers and residents of Hildale, Utah; Colorado City, Arizona; and Centennial Park, Arizona*



Luna S, Krishnasamy V, Saw L, et al. Outbreak of *E. coli* O157:H7 Infections Associated with Exposure to Animal Manure in a Rural Community — Arizona and Utah, June–July 2017. *MMWR Morb Mortal Wkly Rep* 2018;67:659–662.

The image shows a screenshot of the CDC's Morbidity and Mortality Weekly Report (MMWR) website. The page features the CDC logo and tagline at the top left, a search bar at the top right, and a navigation menu. The main title of the article is "Outbreak of *E. coli* O157:H7 Infections Associated with Exposure to Animal Manure in a Rural Community — Arizona and Utah, June–July 2017". Below the title, there is a "Format: Select One" dropdown menu. The article is dated "Weekly / June 15, 2018 / 67(23);659–662". A list of authors is provided, including Sarah Luna, Vikram Krishnasamy, Louise Saw, Lori Smith, Jennifer Wagner, Jenna Weigand, Mackenzie Tewell, Marilee Kellis, Roumen Penev, Laine McCullough, Jeffrey Eason, Keegan McCaffrey, Cindy Burnett, Kelly Oakeson, Melissa Dimond, Allyn Nakashima, Deidre Barlow, Anna Scherzer, Melanie Sarino, Morgan Schroeder, Rashida Hassan, Colin Basler, Matthew Wise, and Laura Gieraltowski. A "View suggested citation" link is present. The article text begins with "On June 26, 2017, a hospital in southern Utah notified the Utah Department of Health of Shiga toxin-producing *Escherichia coli* (STEC) O157:H7 infections in two children from a small community on the Arizona-Utah border. Both children developed hemolytic uremic syndrome, characterized by hemolytic anemia, acute kidney failure, and thrombocytopenia and died within a few days of illness onset. Over the next few days, several more STEC-associated illnesses were reported in residents of the community. A joint investigation by local and state health agencies from Arizona and Utah and CDC was initiated to identify the outbreak source and prevent additional cases; a total of 12 cases were identified, including the two children who died. Investigators initially explored multiple potential sources of illness: epidemiologic and environmental". On the right side, there is an "Article Metrics" section with an "Altmetric" chart showing 34 mentions across News (1), Twitter (36), Facebook (1), and Mendeley (7). Below this, it shows "Citations: 0" and "Views: 2,613" with a note that "Views equals page views plus PDF downloads".

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Outbreak of *E. coli* O157:H7 Infections Associated with Exposure to Animal Manure in a Rural Community — Arizona and Utah, June–July 2017

Weekly / June 15, 2018 / 67(23);659–662

Format: Select One

Sarah Luna, PhD¹; Vikram Krishnasamy, MD¹; Louise Saw, MPH^{2,4}; Lori Smith³; Jennifer Wagner, MS³; Jenna Weigand, MPH⁴; Mackenzie Tewell, MA⁵; Marilee Kellis⁵; Roumen Penev, PhD⁵; Laine McCullough, MPH²; Jeffrey Eason, MPH²; Keegan McCaffrey; Cindy Burnett, MPH²; Kelly Oakeson, PhD³; Melissa Dimond, MPH²; Allyn Nakashima, MD²; Deidre Barlow⁶; Anna Scherzer, MS⁶; Melanie Sarino, MPH⁷; Morgan Schroeder, MPH^{8,9}; Rashida Hassan, MSPH^{8,9}; Colin Basler, DVM⁹; Matthew Wise, PhD⁹; Laura Gieraltowski, PhD⁹ [View author affiliations](#)

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On June 26, 2017, a hospital in southern Utah notified the Utah Department of Health of Shiga toxin-producing *Escherichia coli* (STEC) O157:H7 infections in two children from a small community on the Arizona-Utah border. Both children developed hemolytic uremic syndrome, characterized by hemolytic anemia, acute kidney failure, and thrombocytopenia and died within a few days of illness onset. Over the next few days, several more STEC-associated illnesses were reported in residents of the community. A joint investigation by local and state health agencies from Arizona and Utah and CDC was initiated to identify the outbreak source and prevent additional cases; a total of 12 cases were identified, including the two children who died. Investigators initially explored multiple potential sources of illness: epidemiologic and environmental

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