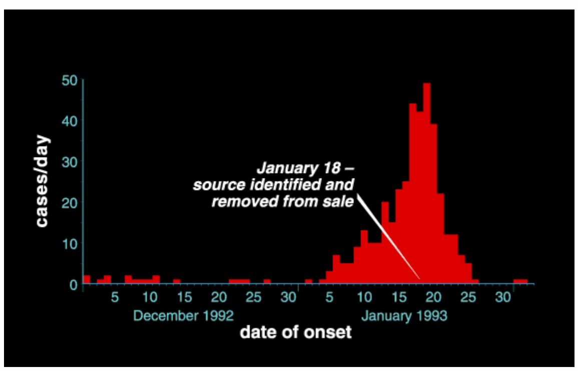
Epidemiology in Action
It takes a team

1

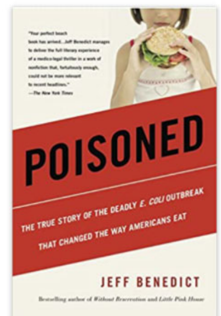
Shiga toxin-producing *E. coli*



Washington state cases N=501

- Age range 4 months-88 years, median 8 years
- 49% female

2



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Outbreak initiated actions

- *E. coli* O157:H7 was upgraded to become a national reportable disease
- The Food and Drug Administration (FDA) increased the recommended internal temperature for cooked hamburgers from 140 °F (60 °C) to 155 °F (68 °C)
- The United States Department of Agriculture(USDA) – Food Safety Inspection Service (FSIS) introduced safe food-handling labels for packaged raw meat and poultry retailed in supermarkets, testing for *E. coli* O157:H7 in ground meat

4

More actions

- USDA classified *E. coli* O157:H7 as an adulterant in raw meat
- USDA introduced the Pathogen Reduction and Hazard Analysis and Critical Control Point (PR/HACCP) program
- National Cattleman's Beef Association (NCBA) created a task force to fund research into the reduction of *E. coli* O157:H7 in cattle and slaughterhouses
- Jack in the Box completely overhauled and restructured their corporate operations around food safety priorities, setting new standards across the entire fastfood industry.

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Multi-state Outbreak of *E. coli* O157:H7

- 205 cases
- 26 states affected
- Onsets 8/1/06 - 9/15/06
- 141 (71%) female
- 103 (51%) hospitalized
  - 31 (16%) HUS
  - 3 deaths

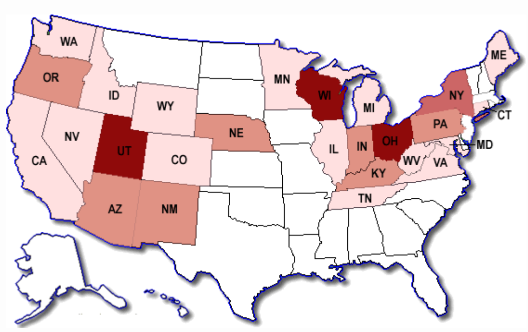

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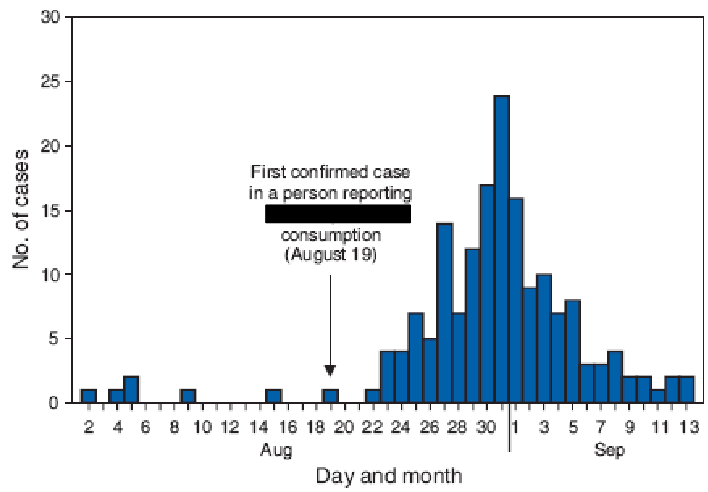
FIGURE 2. Number of confirmed cases (n = 171)* of *Escherichia coli* serotype O157:H7 infection, by date of illness onset — United States, August–September 2006



* Confirmed cases with known dates of illness onset reported as of 1:00 p.m. EDT on September 26, 2006.

Figure 1

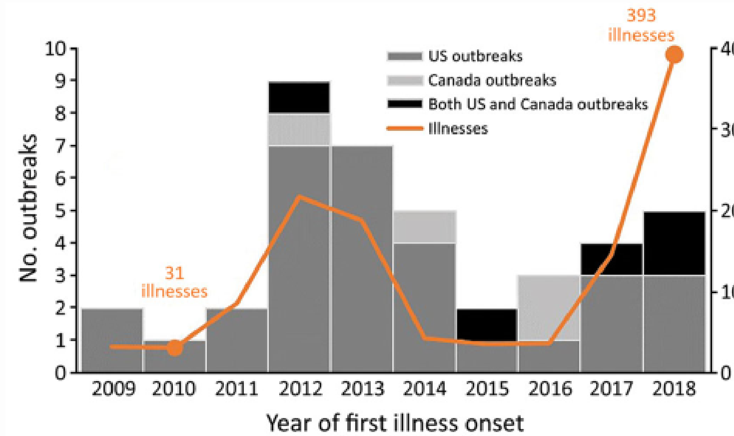


Figure 1. Number of Shiga toxin–producing Escherichia coli outbreaks (n = 4
to leafy greens in the United States, Canada, or both countries, and all outbr
related illnesses (n = 1,212), by year of first illness onset, 2009–2018.

Marshall KE, Hexemer A, Seelman SL, Fatica MK, Blessington T, Hajmeer M, et al. Lessons Learned from a Decade of Investigations of Shiga Toxin–Producing Escherichia coli Outbreaks Linked to Leafy Greens, United States and Canada. Emerg Infect Dis. 2020;26(10):2319-2328. https://doi.org/10.3201/eid2610.191418

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COMMODITY SPECIFIC FOOD SAFETY GUIDELINES FOR THE PRODUCTION AND HARVEST OF LETTUCE AND LEAFY GREENS

LGMA CALIFORNIA LEAFY GREEN PRODUCTS HANDLER MARKETING AGREEMENT

2.1. The Best Practices Are:

- A written Leafy Greens Compliance Plan which specifically addresses the Best Practices of this document shall be prepared. This plan shall address at least the following areas: water, soil amendments, environmental factors, work practices, and field sanitation.
- Handlers shall have an up to date growers list with contact and location information on file.
- The handler shall comply with the requirements of The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (farms are exempt from the Act) including those requirements for recordkeeping (traceability) and registration.
- Each grower and handler shall designate an individual responsible for their operation's food safety program. Twenty-four hour contact information shall be available for this individual in case of food safety emergencies.

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Leafy Greens STEC Action Plan

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Leafy greens outbreaks have a long history. From 2009 – 2018 there have been 40 Shiga toxin-producing *E. coli* (STEC) outbreaks linked to leafy greens accounting for 1,212 illnesses, 77 cases of hemolytic uremic syndrome, and 8 deaths. Of these, romaine accounted for 54% of these outbreaks – more than any other leafy green.[1] With two large romaine outbreaks, 2018 was a turning point in terms of the safety of leafy greens.

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U.S. FOOD & DRUG ADMINISTRATION

Leafy Greens STEC Action Plan

Prevention

1. Advance Agricultural Water Safety
2. Enhance Inspections, Audits and Certification Programs
3. Buyer Specifications
4. Leafy Greens Data Trust
5. Microbiological Surveys for STEC Detection and Enhanced Sampling Protocols
6. Increase Awareness and Address Concerns Around Adjacent and Nearby Land
7. Establish and Strengthen Regular Outreach and Communication Programs for Stakeholders in Growing Regions

Response

8. Investigation Reports
9. Conduct Follow-Up Surveillance During the Fall 2020 California Growing/ Harvest Season
10. Promote Tech-Enabled Traceability
11. Improve Utilization of Shopper Card Data
12. Accelerate Whole Genome Sequencing Data Submissions by States
13. Advance Root Cause Analysis Activities
14. Enhance Outbreak and Recall Communications

Addressing Knowledge Gaps

15. Longitudinal Studies
16. Data Mining and Analytics on Previous Outbreaks
17. Adjacent and Nearby Land Use
18. Compost Sampling Assignment with California

For more information about the Leafy Greens STEC Action Plan, click any link above or visit:
https://www.fda.gov/food/foodborne-pathogens/leafy-greens-stec-action-plan
https://www.fda.gov/food/foodborne-pathogens/leafy-greens-stec-action-plan-accomplishments

April 2021

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Agricultural water system(s)

Description	Additional Information and Examples
Location and nature of the water source (including whether it is ground water or surface water)	• Groundwater obtained from deep underground aquifers, with properly designed, located and constructed wells, generally yields water that is higher quality. Surface waters, which are more exposed to the environment and runoff, may be more susceptible to contamination.
Water distribution system used and whether it is open or closed to the environment	• Some water used for growing is conveyed through open distribution systems, such as canals and laterals, that can be subject to introduction of hazards from runoff, animal intrusion, direct discharge and seepage. • Other water might be distributed through a closed system, such as through piping, which, if it is constructed and functioning properly, can help protect water from the introduction of hazards. However, hazards can enter a closed system if the system is not maintained properly.
The degree to which the system is protected from possible sources of contamination, including: • **Other users** of the water system • **Animal impacts** (such as from grazing animals, working animals, and animal intrusion) • **Adjacent and nearby land uses** related to **animal activity**, the application of biological soil amendments of animal origin (**BSAAOs**), or the presence of **untreated or improperly treated human waste**	• **Other users:** a covered farm would consider the potential for known or reasonably foreseeable hazards to be introduced by other users of the water source or distribution system. For example, a farm that draws water for crop protection sprays from a pond that is also used for recreational swimming would need to consider whether the use of the source for recreational swimming could introduce hazards into the agricultural water system. • **Animal impacts:** Both wild and domesticated animals can be a source of pathogens that can contaminate produce. A farm may become aware of potential animal impacts on its pre-harvest agricultural water systems through inspections and maintenance performed on the water source or distribution system or through findings from visual observations. • **Animal activity on adjacent and nearby land*¹:** Animal activities that may introduce contamination into water sources or distribution systems include, but are not limited to, livestock feeding operations of any size, dairy production, fowl production, barnyards, or significant wildlife intrusion or wildlife habitat. - In evaluating adjacent and nearby land uses, a farm could, for example, consider the effects of any fencing, containment, or other measures employed to prevent animal access to water sources or distribution systems, or earthen diversion berms, ditches, or other barriers to help minimize the influence of runoff or airborne transmission (e.g. fugitive dust) on sources and distribution systems. - Information on adjacent and nearby land uses could be acquired through visual observations, discussions with local extension agents or associations, online resources or other means as appropriate.

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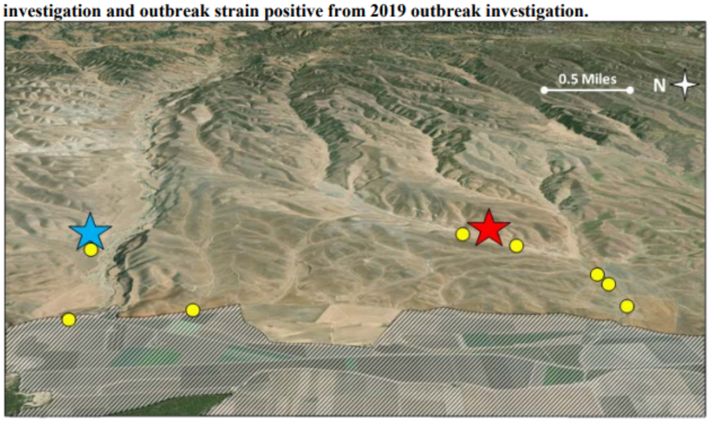
Figure 1. A geospatial subset of STEC positive investigation test results from 2020 outbreak investigation and outbreak strain positive from 2019 outbreak investigation.



Notes: 2020 outbreak strain match is represented by a red star; 2019 outbreak strain is represented by blue star; other samples yielding STEC positives from the 2020 outbreak investigation are represented by yellow circles. The shaded area represents produce farms and ranches. This map illustrates the samples matching the current and previous outbreak strain. Other samples yielding STEC positive samples from other non-contiguous sample sites were collected as part of this outbreak investigation (not pictured here); therefore, the number of total positive tests will not be represented in this figure.

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Shiga Toxin–Producing *Escherichia coli* Infections Associated With Romaine Lettuce—United States, 2018

Lyndsay Bottichio,[1,2] Amelia Keaton,[1] Deepam Thomas,[3] Tara Fulton,[3] Amanda Tiffany,[1,4] Anna Frick,[4] Mia Mattioli,[1] Amy Kahler,[1] Jennifer Murphy,[1] Mark Otto,[5] Adiam Tesfai,[5] Angela Fields,[5] Kelly Kline,[6] Jennifer Fiddner,[7] Jeffrey Higa,[8] Amber Barnes,[8] Francine Arroyo,[8] Annabelle Salvatierra,[9] April Holland,[10] Wendy Taylor,[10] June Nash,[11] Bozena M. Morawski,[1,12] Sarah Correll,[13] Rachel Hinnenkamp,[14] Jeffrey Havens,[14] Kane Patel,[1] Morgan N. Schroeder,[1] Lori Gladney,[1] Haley Martin,[1] Laura Whitlock,[1] Natasha Dowell,[1,15] Corinne Newhart,[5] Louise Francois Watkins,[1] Vincent Hill,[1] Susan Lance,[5] Stic Harris,[5] Matthew Wise,[1] Ian Williams,[1] Colin Basler,[1] and Laura Gieraltowski[1]

[1]Centers for Disease Control and Prevention, Atlanta, Georgia, USA, [2]CAITTA, Inc., Herndon, Virginia, USA, [3]New Jersey Department of Health, Trenton, New Jersey, USA, [4]Alaska Division of Public Health, Anchorage, Alaska, USA, [5]US Food and Drug Administration, College Park, Maryland, USA, [6]Pennsylvania Department of Health, Harrisburg, Pennsylvania, USA, [7]Allegheny County Health Department, Pittsburgh, Pennsylvania, USA, [8]California Department of Public Health, Sacramento, California, USA, [9]Solano County Public Health, Vallejo, California, USA, [10]County of Placer Health and Human Services, Placer, California, USA, [11]Sacramento County Public Health, Sacramento, California, USA, [12]Idaho Department of Health and Welfare, Boise, Idaho, USA, [13]Central District Health Department, Boise, Idaho, USA, [14]Montana Department of Public Health and Human Services, Helena, Montana, USA, and [15]Eagle Medical Services, LLC, San Antonio, Texas, USA

Background. Produce-associated outbreaks of Shiga toxin–producing *Escherichia coli* (STEC) were first identified in 1991. In April 2018, New Jersey and Pennsylvania officials reported a cluster of STEC O157 infections associated with multiple locations of a restaurant chain. The Centers for Disease Control and Prevention (CDC) queried PulseNet, the national laboratory network for foodborne disease surveillance, for additional cases and began a national investigation.

Methods. A case was defined as an infection between 13 March and 22 August 2018 with 1 of the 22 identified outbreak-associated *E. coli* O157:H7 or *E. coli* O61 pulsed-field gel electrophoresis pattern combinations, or with a strain STEC O157 that was closely related to the main outbreak strain by whole-genome sequencing. We conducted epidemiologic and traceback investigations to identify illness subclusters and common sources. A US Food and Drug Administration–led environmental assessment, which tested water, soil, manure, compost, and scat samples, was conducted to evaluate potential sources of STEC contamination.

Results. We identified 240 case-patients from 37 states; 104 were hospitalized, 28 developed hemolytic uremic syndrome, and 5 died. Of 179 people who were interviewed, 152 (85%) reported consuming romaine lettuce in the week before illness onset. Twenty subclusters were identified. Product traceback from subcluster restaurants identified numerous romaine lettuce distributors and growers; all lettuce originated from the Yuma growing region. Water samples collected from an irrigation canal in the region yielded the outbreak strain of STEC O157.

Conclusions. We report on the largest multistate leafy greens–linked STEC O157 outbreak in several decades. The investigation highlights the complexities associated with investigating outbreaks involving widespread environmental contamination.

Keywords. outbreak; Escherichia coli; Romaine Lettuce; foodborne illness; produce safety.

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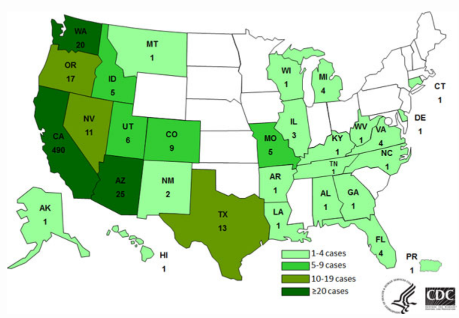
Persons infected with the outbreak strains of *Salmonella* Heidelberg, by State*

Oregon cases N=17

- Age range 2-55 years, median 21
- 59% female
- 38% of ill persons were hospitalized, and no deaths were reported.

- Most ill persons (77%) were reported from California.



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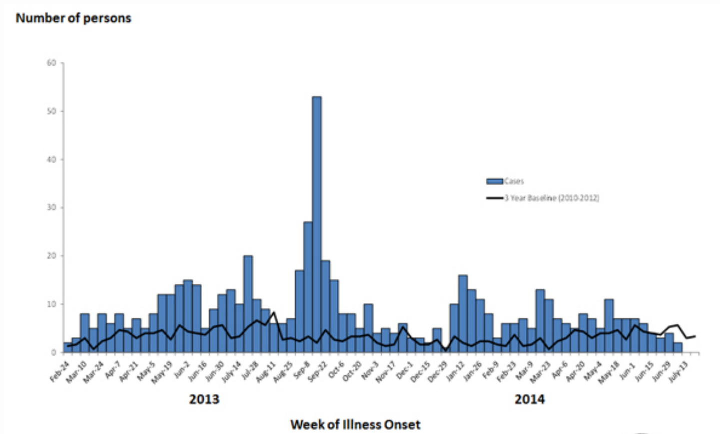
Persons infected with outbreak strain of *Salmonella* Heidelberg by week of illness onset*, 2013-2014, U.S.



n=633 for whom information was reported as of July 24, 2014

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USDA Proposes New Measures to Reduce *Salmonella* and *Campylobacter* in Poultry Products

SUMMARY:

The Food Safety and Inspection Service (FSIS or ‘‘the Agency’’) is announcing that it will begin assessing whether establishments meet the pathogen reduction performance standards for *Salmonella* and *Campylobacter* in raw chicken parts and not-ready-to-eat (NRTE) comminuted chicken and turkey products.

In 2015 new standards in ground chicken and turkey products

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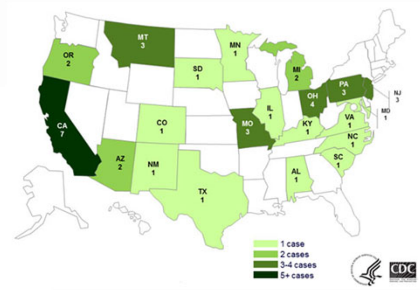
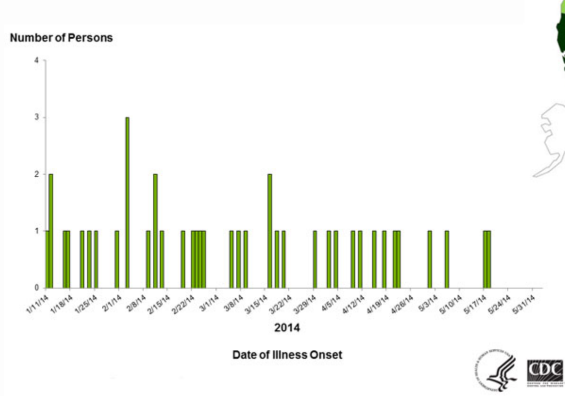
Multi-state Outbreak of *Salmonella* Typhimurium Infections

•41 ill in 21 states, 16% hospitalized, 0 deaths
•54% cases female,
•Age <1-69 years, median 21





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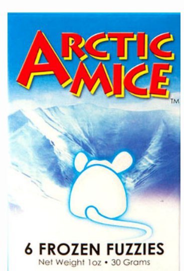
Multi-state Outbreak of Human *Salmonella* Typhimurium Infections Linked to Frozen Feeder Rodents



- 22 (61%) of 36 ill persons reported contact with multiple types of reptiles.
- 15 (88%) of 17 ill with information reported exposure to frozen feeder rodents.

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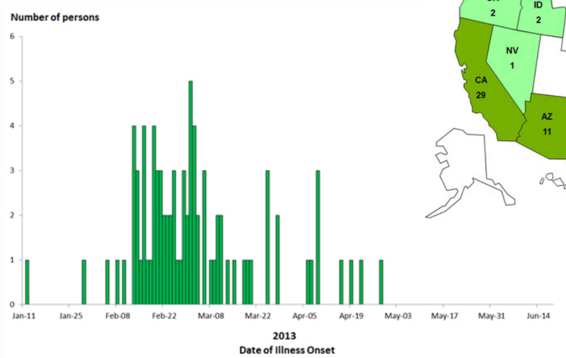
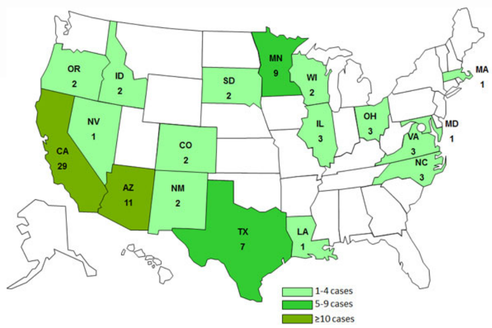
Multi-state Outbreak of *Salmonella* Saintpaul Infections

- 84 ill in 18 states, 28% hospitalized, 0 deaths
- 62% cases female,
- Age <1-89 years, median 27





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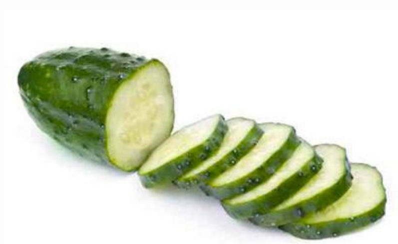
Multi-state Outbreak of *Salmonella* Saintpaul Infections Linked to Imported Cucumbers



- 34 (69%) of 49 ill persons reported eating various types of cucumbers purchased or consumed at multiple locations or restaurants.
- 44% general population reported eating cucumbers in the week before they were interviewed.

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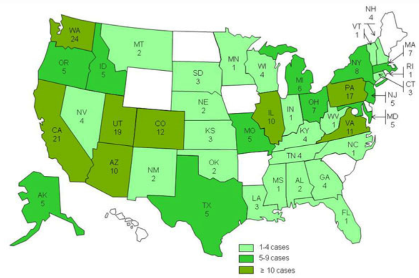
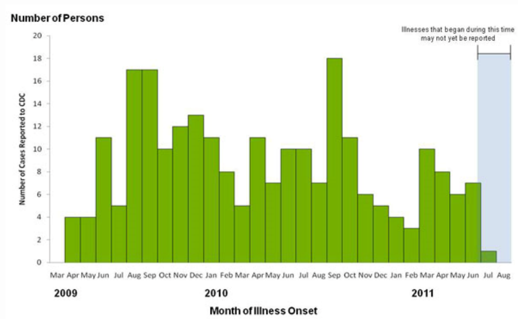
Multi-state Outbreak of *Salmonella* Typhimurium Infections

- Age range 0-76 years
- 69% <10 years;
- median age is 5 years old.
- 52% female
- 30% were hospitalized, no deaths





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Product trace-back

- Trace-back - African dwarf frogs breeder in Madera, California, Blue Lobster Farms.
- Environmental samples taken at Blue Lobster Farms in January and April 2010 and tested in CDC laboratories yielded isolates of *Salmonella* Typhimurium with DNA patterns matching the outbreak strain

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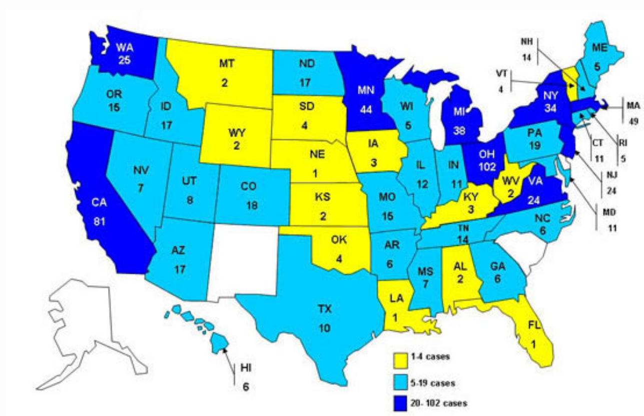
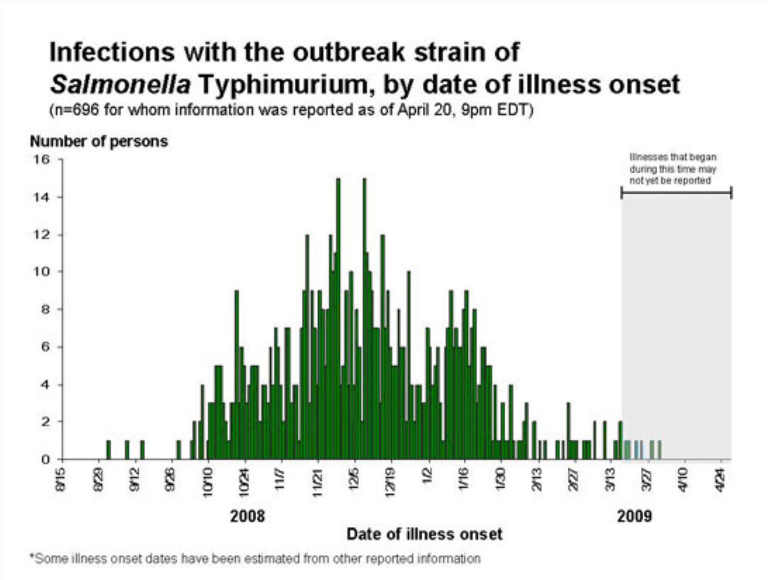
November 10th 2008

Salmonella Typhimurium isolates with an unusual DNA fingerprint or pulsed-field gel electrophoresis (PFGE) pattern reported from 12 states.

- < 1 to 98 years, median age of patients is 16 years
  - 21% are age < 5 years
  - 17% are > 59 years
- 48% of patients are female.
- 24% reported being hospitalized, 9 deaths

April 20, 2009, 714 persons infected with the outbreak strain of *Salmonella* Typhimurium have been reported from 46 states





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Actions – January 2009

- On January 28, 2009, PCA announced a voluntary recall of all peanuts and peanut products processed in its Blakely, Georgia facility since January 1, 2007 and reported that production of all peanut products had stopped. More than 2833 peanut-containing products produced by a variety of companies may have been made with the ingredients recalled by PCA.
- Peanut butter and peanut paste, the expanded recall includes roasted peanuts and other peanut products and was based in part on laboratory testing information from the company.

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(Photo: 2009 photo by H. Darr Beiser, USA TODAY)

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Former peanut company executive Stewart Parnell was hit with a virtual life prison term Monday for his 2014 conviction on crimes related to a salmonella outbreak blamed for killing nine and sickening hundreds.

A federal judge in Georgia sentenced the 61-year-old former head of Peanut Corporation of America to 28 years behind bars, imposing potentially the toughest punishment in U.S. history for a producer in a food-borne illness case.

U.S. District Judge W. Louis Sands also sentenced the former executive's brother, Michael Parnell, 56, to serve a 20-year prison term. The relative and co-defendant was a broker who provided food manufacturing giant Kellogg's with peanut paste from his brother's company.

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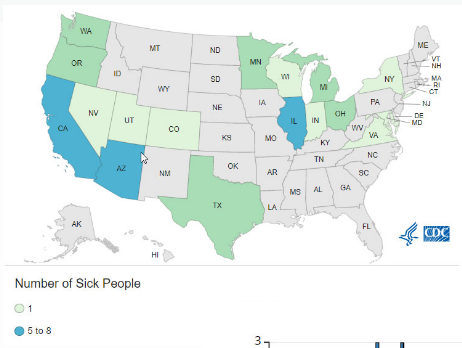

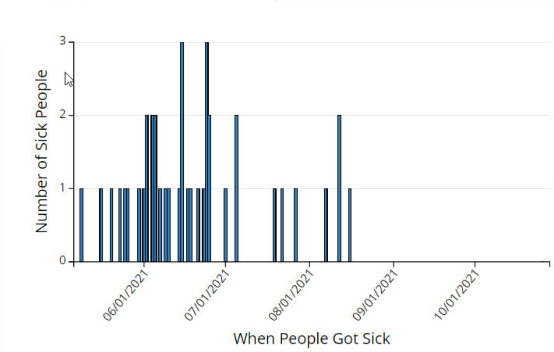

Age range 1-91 – median 41
51% male
12 hospitalizations
No deaths

Fratelli Beretta USA, Inc. Recalls Ready-to-Eat Uncured Antipasto Meat Products Due to Possible Salmonella Contamination

FRATELLI BERETTA USA, INC. →

QUANTITY RECOVERED
143,998 pounds

FSIS Announcement

WASHINGTON, Aug. 27, 2021 – Fratelli Beretta USA, Inc., a Mount Olive, N.J. establishment, is recalling approximately 862,000 pounds of uncured antipasto products that may be contaminated with *Salmonella* Infantis and/or *Salmonella* Typhimurium, the U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS) announced today.

The ready-to-eat (RTE) uncured antipasto meat trays were produced on February 28, 2021 through August 15, 2021. The following products are subject to recall [view labels]:

Good Manufacturing Practices

for

Fermented Dry & Semi-Dry Sausage Products

Control Principles

Salmonella are heat-sensitive and mild heat treatments, like those used for cooking meat (150-165°F, 65-74°C), rapidly kill large numbers of the organism. The pathogen-destroying effect of cooking is decreased by drying, as in dry sausage and semi-dry fermented sausage or pre-cooked roast beef. The humidity applied in these processes is important because increased humidity enhances the growth opportunities for *Salmonella*.

Refrigeration retards salmonellae growth, but is not an effective means of killing the organism. The growth of *Salmonella* is very slow below 50°F (10°C), although it can withstand freezing conditions. Salmonellae grow with or without oxygen and in a range of temperatures from 40-117°F (5-47°C). A pH of less than 4.6 prevents growth; pH values of 6.5-7.5 are ideal for growth. . USDA (1997) added *Salmonella* to its *S. aureus* enterotoxin monitoring program (Appendix C); monitoring will be greatest among those producers of dry and semi-dry fermented sausages who have failed to validate their processes for destructi

Salmonellosis can be prevented by proper cooking of food, avoid food, maintaining low storage temperatures, proper hygienic prac avoiding contamination of food, water, etc. from feces (i.e., diape precautions must be observed in order to prevent salmonellosis. held at temperatures conducive to the growth of *Salmonella* and exposure to raw foods or by poor employee hygiene, the risk of s increased (Oblinger, 1988).

J Food Prot. 2006 Apr;69(4):794-800. doi: 10.4315/0362-028x-69.4.794.

Validation of a traditional Italian-style salami manufacturing process for control of Salmonella and Listeria monocytogenes

K K Nightingale [1], H Thippareddi, R K Phebus, J L Marsden, A L Nutsch

Affiliations + expand

PMID: 16629021 DOI: 10.4315/0362-028x-69.4.794

In sausage manufacturing, fermentation must simultaneously decrease pH, decrease water activity and build up microbial flora (using starter cultures) to compete with or inhibit growth of *Salmonella*. If the fermentation process proceeds rapidly, *Salmonella* growth is more likely to be inhibited.

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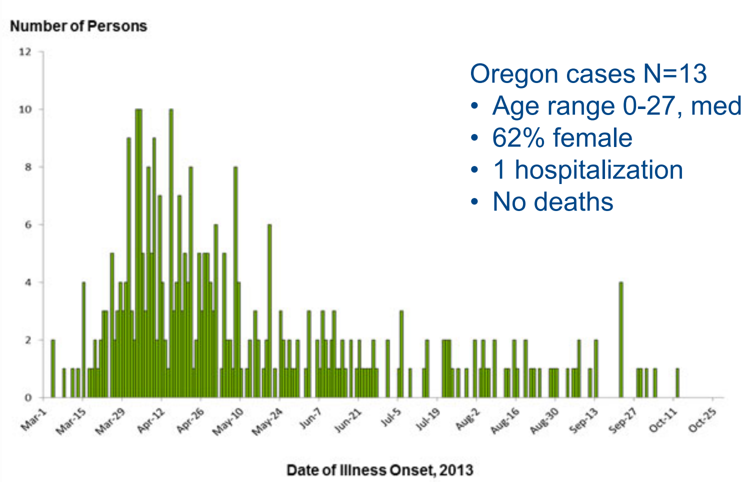
Epidemic curve, *Salmonella* Typhimurium



Oregon cases N=13

- Age range 0-27, median 2 years
- 62% female
- 1 hospitalization
- No deaths

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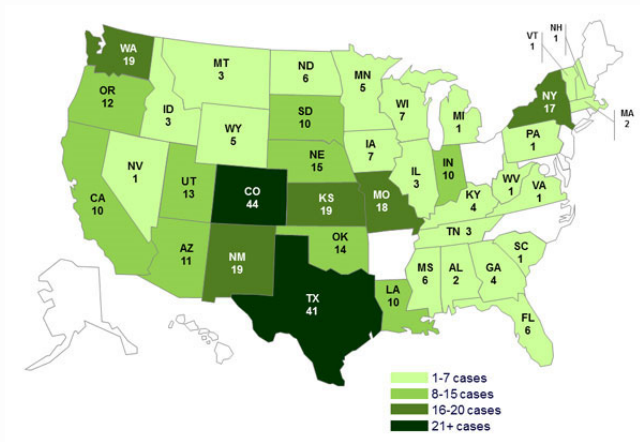
Persons infected with the outbreak strain of *Salmonella* Typhimurium, by State*



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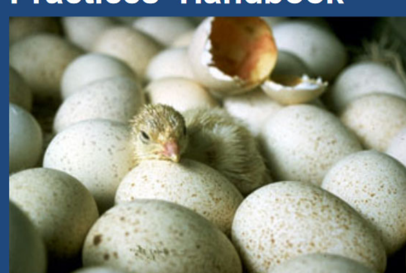
USDA

Best Management Practices Handbook



A Guide to the Mitigation of *Salmonella* Contamination at Poultry Hatcheries

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Vaccination coverage, Measles outbreak, France

Measles Elimination Efforts and 2008–2011 Outbreak, France

Denise Antona, Daniel Lévy-Bruhl, Claire Baudon, François Freymuth, Mathieu Lamy, Catherine Maine, Daniel Floret, and Isabelle Parent du Chatelet
Author affiliations: Author affiliations: Institut de Veille Sanitaire, Saint-Maurice, France (D. Antona, D. Lévy-Bruhl, C. Baudon, M. Lamy, C. Maine, I. Parent du Chatelet); National Reference Centre for Measles and Respiratory Paramyxoviridae, CHU Caen, France (F. Freymuth); Université Claude Bernard Lyon 1, Lyon, France (D. Floret)
Main Article

Figure 1

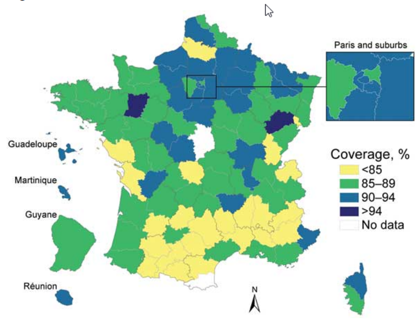

Figure 1. . . Coverage of initial measles-mumps-rubella vaccination (MMR1) listed in health certificates for children at 24 months of age, by district (département), France, 2003–2008. Data are latest available figures for the period. Sources: Institut de Veille Sanitaire, Ministry of Health statistical department.

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Measles cases by rash onset, France, 2008–2011

Measles Elimination Efforts and 2008–2011 Outbreak, France

Denise Antona, Daniel Lévy-Bruhl, Claire Baudon, François Freymuth, Mathieu Lamy, Catherine Maine, Daniel Floret, and Isabelle Parent du Chatelet
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Main Article

Figure 3

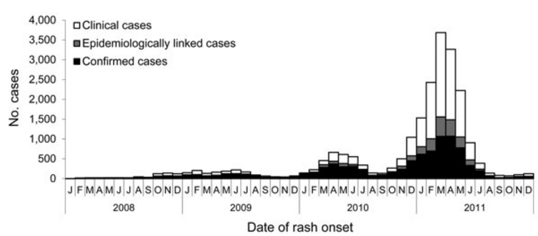

Figure 3. . . Number of notified measles cases per month, determined by date of rash onset, France, January 2008–December 2011.

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Measles Elimination Efforts and 2008–2011 Outbreak, France

Denise Antona, Daniel Lévy-Bruhl, Claire Baudon, François Freymuth, Mathieu Lamy, Catherine Maine, Daniel Floret, and Isabelle Parent du Chatelet

Author affiliations: Author affiliations: Institut de Veille Sanitaire, Saint-Maurice, France (D. Antona, D. Lévy-Bruhl, C. Baudon, M. Lamy, C. Maine, I. Parent du Chatelet); National Reference Centre for Measles and Respiratory Paramyxoviridae, CHU Caen, France (F. Freymuth); Université Claude Bernard Lyon 1, Lyon, France (D. Floret)

Main Article

Figure 4

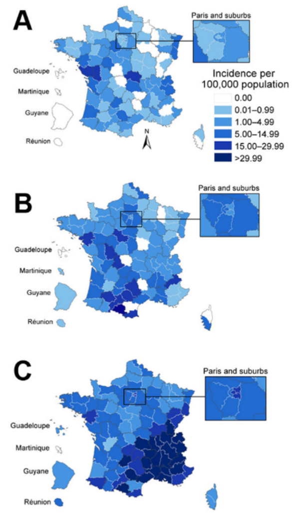

Figure 4. . . Evolution of geographic distribution of measles cases during 3 epidemic waves, France. A) October 2008–September 2009; B) October 2009–September 2010; C) October 2010–September 2011.

Geographic spread of measles, France, October 2008−September 2011

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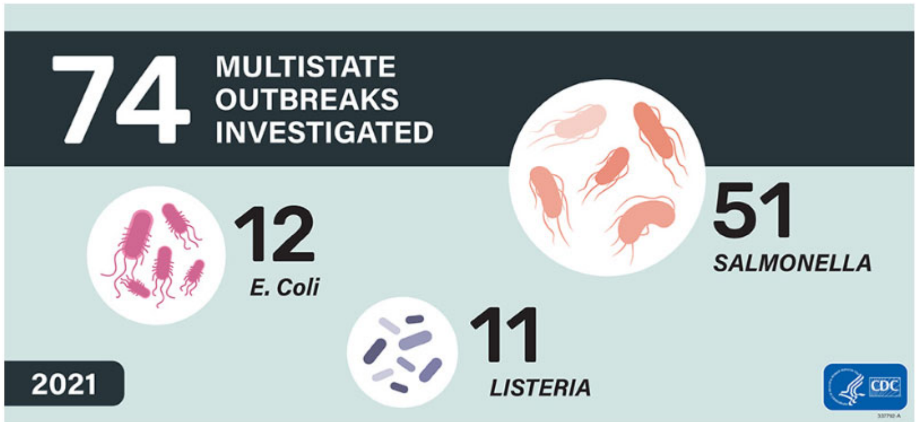
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MULTISTATE OUTBREAKS INVESTIGATED
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E. Coli
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SOLVED MULTISTATE OUTBREAKS
64%
MULTISTATE OUTBREAKS SOLVED
19
ANIMAL CONTACT
28
FOODBORNE
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Unpeeling the onion; an outbreak of *Salmonella*

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History

- Bacteria that came to be known as distinct genus *Salmonella* identified by Dr. Theobald Smith in the laboratory of Dr. Daniel E. Salmon in the USDA's Bureau of Animal Industry

Dr. Theobald Smith
1859-1934

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Reservoirs and Survival Techniques

- Many animal species: humans, pigs, reptiles, hedgehogs
  - ➢Some species specificity
  - ➢Chronic carriage in some
- Environmental sources - Can survive for >200 days in soil
- Resistant to drying, freezing

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Geographic Quirks

- Javiana: Georgia
- Weltevreden: Hawaii
- Dublin: Oregon, Washington
- Subspecies IIIa, IIIb: Southwest U.S.

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Infectious Dose

- Healthy volunteer studies: $>10^6$ needed to produce illness in 50%
- Some outbreaks with estimated contamination $<10^3$
- Few outbreaks suggesting person-to-person transmission
- Can be lowered by
  - high gastric pH
  - previous receipt of antibiotics
  - immune suppression

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Incubation Period

- ~~"[illegible] hours"~~

- 6 hours-10 days
  - Median in 1995-6 sprout outbreak: 12h-5d (median 4d)
  - Probably depends on inoculum

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OR(8)

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TABLE 2. *Number of outbreaks associated with the most commonly identified serotypes and the resulting percentage of all* S. enterica *outbreaks due to each serotype*

Serotype	No. of outbreaks	% of all *S. enterica* outbreaks
Enteritidis	702	29.1
Typhimurium	303	12.6
Newport	183	7.6
Heidelberg	164	6.8
Javiana	72	3.0
Braenderup	62	2.6
I 4,[5],12:i:−	60	2.5
Montevideo	54	2.2
Infantis	51	2.1
Muenchen	42	1.7
Oranienburg	32	1.3
Other	688	28.5
Total	2,413	100.0

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TABLE 5. *Most common serotypes associated with certain food vehicles*

Food vehicle	Total no. of outbreaks	Most common serotype, no. of outbreaks (%)	Second most common serotype, no. of outbreaks (%)	Third most common serotype, no. of outbreaks (%)
Beef	66	Typhimurium, 14 (21)	Enteritidis, 10, tie (15)	Newport, 10, tie (15)
Chicken	148	Enteritidis, 44 (30)	Heidelberg, 18 (12)	Typhimurium, 17 (11)
Dairy	36	Typhimurium, 17 (47)	Newport, 8 (22)	Montevideo, 3 (8)
Eggs	149	Enteritidis, 120 (81)	Heidelberg, 10 (7)	Typhimurium, 4 (3)
Fish[a]	18			
Fruits[b]	53	Newport, 8, tie (15)	Typhimurium, 8, tie (15)	
Nuts and seeds[c]	14	Enteritidis, 3 (21)		
Pork	78	Typhimurium, 15 (19)	Enteritidis, 10 (13)	I 4,[5],12:i:–, 9 (12)
Seeded vegetables	47	Newport, 18 (38)	Javiana, 7 (15)	Saintpaul, 5 (11)
Sprouts	36	Enteritidis, 7 (19)	Cubana, 5 (14)	Muenchen, 4 (11)
Turkey	61	Enteritidis, 12 (20)	Heidelberg, 8 (13)	Typhimurium, 7 (11)
Vegetable row crops	14	Typhimurium, 3 (21)	Enteritidis, 2, tie (14)	Javiana and Newport, 2, tie (14)

[a] Tie between Barranquilla, Enteritidis, Infantis, Javiana, Paratyphi B, Typhimurium, and Weltevreden (two outbreaks each), 11%.
[b] Tie for third most common between Enteritidis, Javiana, Poona, and Saintpaul (4), 8%.
[c] Tie between Bovismorbificans, Braenderup, Bredeney, Gaminara, Hartford, Java, Mbandaka, Montevideo, Newport, Oranienburg, Senftenberg, Stanley, Tennessee, Thompson, and Typhimurium (one outbreak each), 7%.

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> Epidemiol Infect. 2022 Nov 16:150:e199. doi: 10.1017/S0950268822001571.

Bi-national outbreak of *Salmonella* Newport infections linked to onions: the United States experience

Z D McCormic [1], K Patel [1 2], J Higa [3], J Bancroft [4], D Donovan [5], L Edwards [5], J Cheng [6], B Adcock [3], C Bond [3], E Pereira [7], M Doyle [7], M E Wise [1], L Gieraltowski [1 8]; Salmonella Newport Investigation Team

Affiliations + expand

PMID: 36382397 PMCID: PMC9987025 DOI: 10.1017/S0950268822001571

Free PMC article

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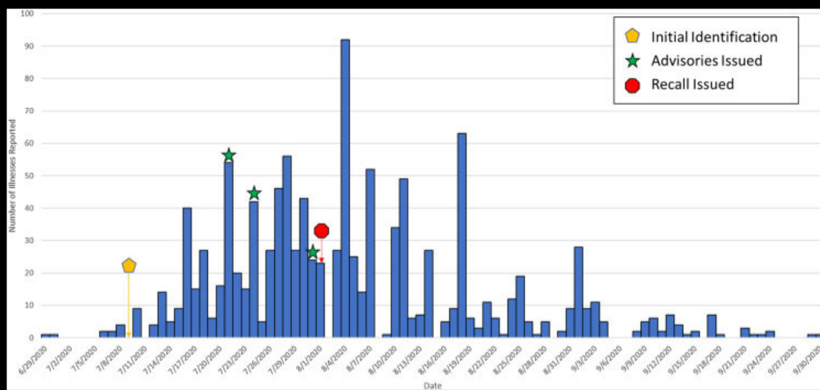

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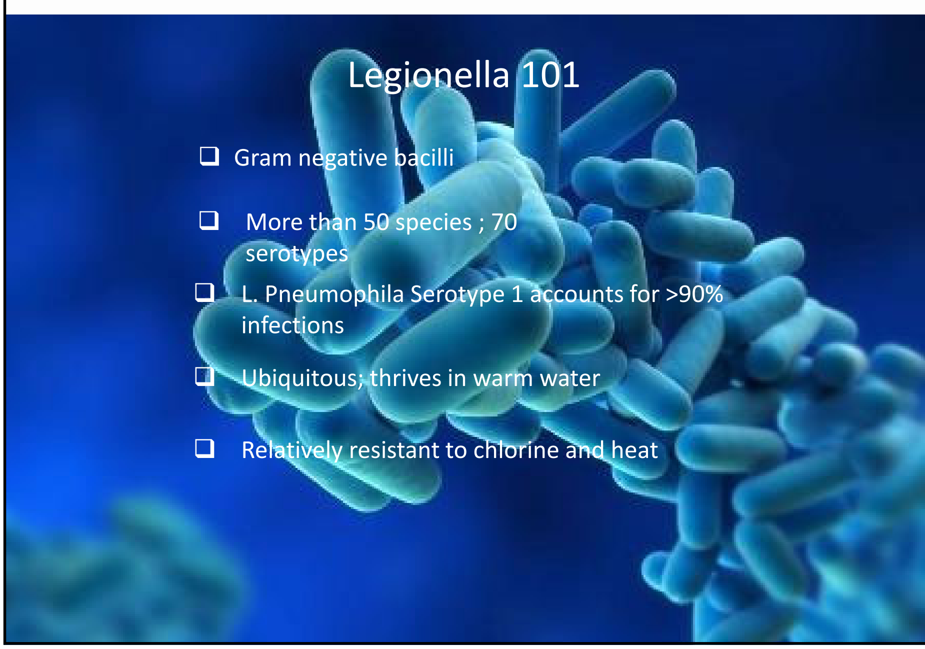

Legionella 101

- Gram negative bacilli
- More than 50 species ; 70 serotypes
- L. Pneumophila Serotype 1 accounts for >90% infections
- Ubiquitous; thrives in warm water
- Relatively resistant to chlorine and heat

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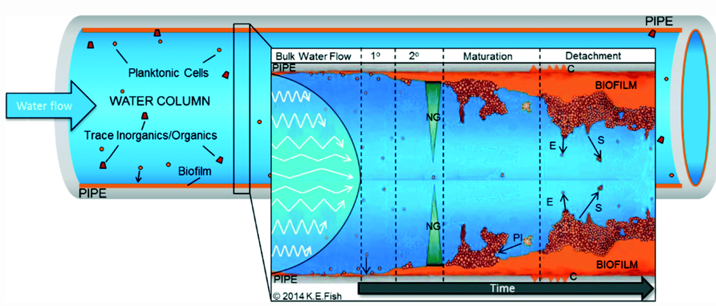
History

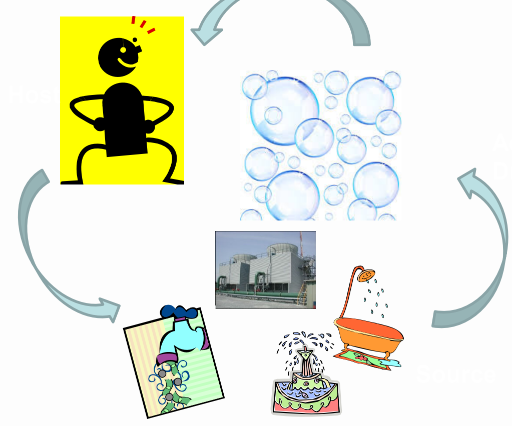
Legionella acquired its name after an outbreak in **1976** of a then-unknown "mystery disease" made 221 people sick and caused 34 deaths. The outbreak was first noticed among attendees at a convention of the American Legion —an association of U.S. military veterans.

The Bellevue-Stratford Hotel, site of the first known outbreak of Legionnaires' disease. The hotel closed in November 1976, four months after the outbreak.

Biofilms……..



Transmission



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Description of Illness

- Severity varies from mild febrile illness (Pontiac fever) to a potentially fatal form of pneumonia (Legionnaires' disease)
- Incubation period 2-10 days
- Presents with fever, malaise, myalgia, anorexia, headache
- Respiratory failure 15%
- Death 5-20%

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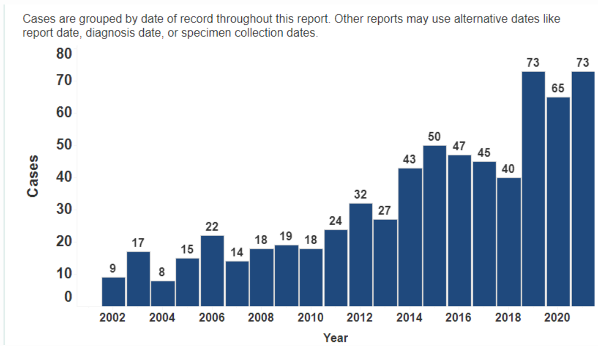
Legionella Case Counts, Oregon, 2002 – 2021



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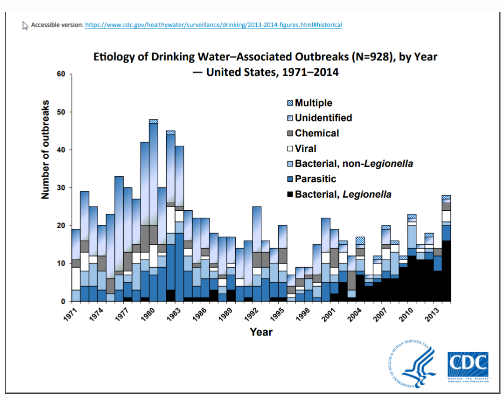
Etiology of 928 drinking water–associated outbreaks, by year, United States, 1971–2014



Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water — United States, 2013–2014, Weekly / November 10, 2017 / 66(44);1216–1221

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ABLE 1. Waterborne disease outbreaks associated with drinking water (N = 42), by state/jurisdiction and month of first case onset — Waterborne Disease nd Outbreak Surveillance System, United States, 2013–2014

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State/ Jurisdiction	Month	Year	Etiology*	Predominant illness†	No. of cases	No. of hospitalizations§	No. of deaths¶	Type of water system**	Water source	Setting
Alaska	Aug	2014	*Giardia duodenalis*††	AGI	5	0	0	Community	River/Stream	Community/Municipality
Arizona	Jan	2014	Norovirus (S)	AGI	4	0	0	Transient, noncommunity	Unknown	Camp/Cabin Setting
Florida	Sep	2013	*L. pneumophila* serogroup 1	ARI	4	4	0	Community	Well	Hospital/Health care
Florida	Nov	2013	*L. pneumophila* serogroup 1	ARI	4	4	0	Community	Other	Other§§
Florida	Apr	2014	*L. pneumophila* serogroup 1	ARI	2	2	0	Community	Well	Hotel/Motel/Lodge/Inn
Florida	Jun	2014	*L. pneumophila* serogroup 1	ARI	3	2	0	Community	Unknown	Long-term care facility
Florida	Aug	2014	*L. pneumophila* serogroup 1	ARI	6	4	0	Community	Unknown	Hotel/Motel/Lodge/Inn
Idaho	Sep	2014	*Giardia duodenalis*	AGI	2	0	0	Unknown	Unknown	Hotel/Motel/Lodge/Inn
Indiana	Jul	2013	*Cryptosporidium* sp.	AGI	7	0	0	Community	Unknown	Mobile home park
Indiana	Nov	2014	Unknown	AGI	3	0	0	Community	Unknown	Apartment/Condo
Kansas	June	2014	*L. pneumophila* serogroup 1	ARI	2	2	0	Community	Unknown	Hospital/Health care
Maryland	Nov	2012	*L. pneumophila* serogroup 1	ARI	2¶¶	2¶¶	0	Community	Well	Hotel/Motel/Lodge/Inn
Maryland	Feb	2013	Nitrite***	AGI, Neuro	14		0	Community	Lake/Reservoir/ Impoundment	Indoor workplace/Office
Maryland	Apr	2014	*L. pneumophila* serogroup 1	ARI	2	2	0	Community	Lake/Reservoir/	Apartment/Condo

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State/ Jurisdiction	Month	Year	Etiology	Predominant illness	No. of cases	No. of hospitalizations	No. of deaths	Type of water system	Water source	Setting
Maryland	Jul	2014	*L. pneumophila* serogroup 1	ARI	2	1	0	Community	Well	Hotel/Motel/Lodge/Inn
Maryland	Aug	2014	*L. pneumophila* serogroup 1	ARI	2	2	0	Community	River/Stream	Prison/Jail (Juvenile/Adult)
Michigan	Jun	2014	*L. pneumophila* serogroup 1	ARI	45	45	7	Community	River/Stream	Hospital/Health care, Community/Municipality†††
Montana	Jul	2014	Norovirus GII.Pe-GII.4 Sydney	AGI	62	0	0	Transient, noncommunity	Well	Hotel/Motel/Lodge/Inn
New York	Jul	2013	*L. pneumophila* serogroup 1	ARI	2	2	0	Community	Lake/Reservoir/ Impoundment	Hospital/Health care
New York	Jun	2014	*L. pneumophila* serogroup 1	ARI	2	2	0	Community	Well	Hospital/Health care
North Carolina	Dec	2013	*L. pneumophila* serogroup 1	ARI	3	2	0	Community	Unknown	Long-term care facility
North Carolina	Dec	2013	*L. pneumophila* serogroup 1	ARI	7	3	0	Community	Unknown	Long-term care facility
North Carolina	May	2014	*L. pneumophila* serogroup 1	ARI	7	6	1	Community	Other	Long-term care facility
North Carolina	Jun	2014	*L. pneumophila* serogroup 1	ARI	3	3	0	Community	Unknown	Long-term care facility
North Carolina	Jul	2014	*L. pneumophila* serogroup 1	ARI	3	2	1	Community	Unreported	Long-term care facility
Ohio	Apr	2013	*L. pneumophila*	ARI	2	2	1	Unknown	Unknown	Long-term care facility
Ohio§§§	Sep	2013	Cyanobacterial toxin¶¶¶	AGI	6	0	0	Community	Lake/Reservoir/ Impoundment	Community/Municipality

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Ohio	Jul	2014	*L. pneumophila* serogroup 1	ARI	14	4	0	Community	River/Stream	Long-term care facility
Ohio	Aug	2014	Cyanobacterial toxin[¶¶¶]	AGI	110			Community	Lake/Reservoir/ Impoundment	Community/Municipality
Ohio	Oct	2014	*Cryptosporidium* sp. (S)[****]	AGI	100	0	0	Individual	River/Stream	Farm/Agricultural setting
Ohio	Dec	2014	Viral, unknown (S)	AGI	2	0	0	Commercially bottled	Unknown	Private residence
Oregon	Jun	2013	*Cryptosporidium parvum* IIaA15G2R1	AGI	119	2	0	Community	Lake/Reservoir/ Impoundment	Community/Municipality
Oregon	Sep	2014	*L. pneumophila* serogroup 1	ARI	4	4	1	Community	Well	Apartment/Condo
Pennsylvania	Dec	2013	*L. pneumophila* serogroup 1	ARI	2	2	0	Unknown	Unknown	Hospital/Health care
Pennsylvania	Feb	2014	*L. pneumophila* serogroup 1	ARI	5	5	0	Community	River/Stream	Long-term care facility
Pennsylvania	Oct	2014	*L. pneumophila*	ARI	2	2	1	Community	Unknown	Long-term care facility
Rhode Island	Apr	2013	*L. pneumophila* serogroup 1	ARI	2	2	1	Community	Lake/Reservoir/ Impoundment	Hospital/Health care
Tennessee	Jul	2013	*Cryptosporidium parvum*	AGI	34	0	0	Transient, noncommunity[††††]	Spring	Camp/Cabin setting
Tennessee	Jun	2014	*Clostridium difficile* (S); *Escherichia coli*, Enteropathogenic (S)	AGI	12	0	0	Nontransient, noncommunity	Well	Camp/Cabin setting; Community/Municipality
Virginia	Jun	2013	*Cryptosporidium* sp.	AGI	19	0	0	Individual	Well	Farm/Agricultural setting
West Virginia	Jan	2014	4-Methylcyclo hexanemethanol (MCHM)[§§§§]	AGI	369	13	0	Community	River/Stream	Community/Municipality
Wisconsin	Aug	2014	*Giardia duodenalis*	AGI	3	0	0	Nontransient,	Other	National forest

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Disease Occurrence & Outbreaks

- Occurrence is worldwide
- 8,000 – 18,000 cases hospitalized in U.S.
- Outbreaks commonly occur in summer and autumn
- Almost all outbreaks in hotels, resorts, hospital, office building, cruises…..
- CDC reported an increase of 217% with 1,110 cases in 2000 and 3,522 in 2009
  - -- Deteriorating infrastructure
  - -- Energy conservation leading to lower water heater temps
  - -- Increased testing

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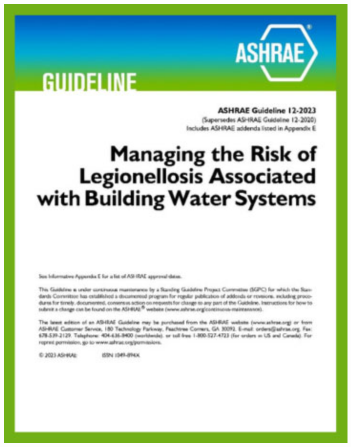
GUIDELINE

ASHRAE

ASHRAE Guideline 12-2023
(Supersedes ASHRAE Guideline 12-2020)
Includes ASHRAE addenda listed in Appendix E

Managing the Risk of Legionellosis Associated with Building Water Systems

See Informative Appendix E for a list of ASHRAE approval dates.

This Guideline is under continuous maintenance by a Standing Guideline Project Committee (SGPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Guideline. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

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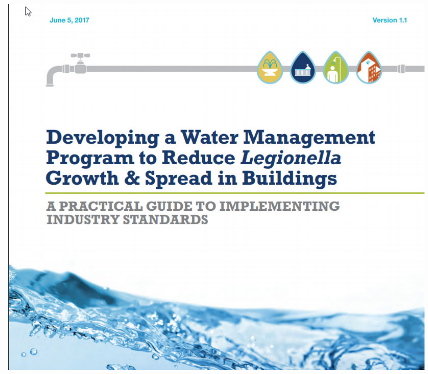
June 5, 2017 Version 1.1

Developing a Water Management Program to Reduce *Legionella* Growth & Spread in Buildings

A PRACTICAL GUIDE TO IMPLEMENTING INDUSTRY STANDARDS

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LEGIONNAIRES' DISEASE IN NURSING HOMES AND LONG-TERM CARE FACILITIES: AN EMERGING CATASTROPHE

Y.E. Lin[1,3], V.L. Yu[2]

1. Department of Civil and Environmental Engineering; 2. Department of Medicine, University of Pittsburgh, PA, USA; 3. National Kaohsiung Normal University, Kaohsiung, Taiwan, Corresponding author: Victor L. Yu, MD, University of Pittsburgh, 3520 Fifth Ave. Suite 205, Pittsburgh, PA 15261, USA, vly@pitt.edu

Abstract

Outbreaks of Legionnaires' diseases in nursing homes and longterm care facilities have become increasingly cited in newspaper and television reports especially when deaths are involved. News reports can lead to unsubstantiated rumors and widespread disruption of services. A sense of panic can lead to adoption by the facility of expensive, short-term measures that are unscientific and expensive. The worst case scenario is that the measures will also be found to be useless. We present an evidence-based approach that has been successful and cost-effective in longterm care facilities. Environmental cultures of the drinking water for Legionella within the nursing home and longterm care facility is a necessary first step. Infection control personnel should make the key decisions in management of the outbreak. Healthcare facility managers and outside water treatment consultants often make costly and expensive recommendations that will be proven ineffective over time.

Key words: Long-term care facilities, nursing homes, Legionella, Legionnaires' disease.

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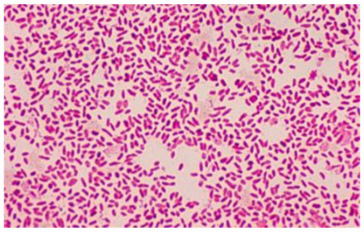

DISCOVERY OF CHOLERA ORGANISM

Cholera came to Florence in 1854 during the Asiatic Cholera Pandemic of 1846-63. Pacini became very interested in the disease. Immediately following the death of cholera patients, he performed an autopsy and with his microscope, conducted histological examinations of the intestinal mucosa. During such studies, Pacini first discovered a comma-shaped bacillus which he described as a Vibrio.

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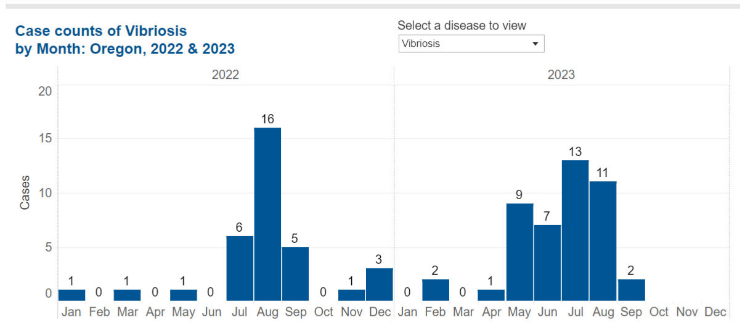
Vibriosis in Oregon, 2022-2023



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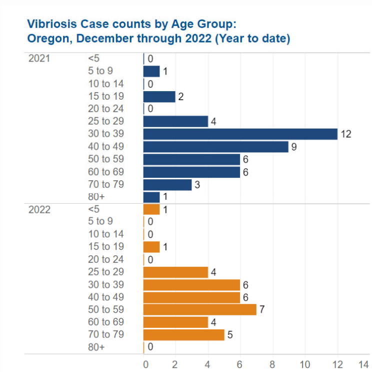
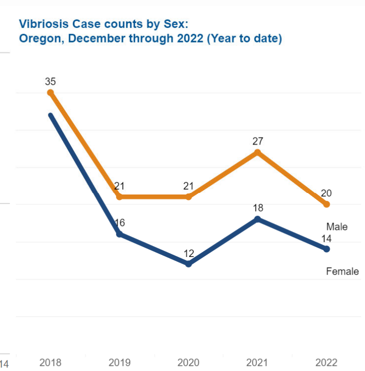
Descriptive Epidemiology – Vibriosis, Oregon, 2022





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2020-6519 **Vibrio parahaemolyticus** Unknown,

Exposure locations

unknown

Basics | Etiology | Cases | Methods | PFGE | Documentation | Vehicle

THANK YOU FOR NOT PUTTING IDENTIFYING INFO ABOUT CASES IN THE NARRATIVE SECTION!

Investigation Communication/Notes

Save

This cluster was originally posted by CDC on 09/02/2020.

Hello,

This cluster of Vibrio Parahaemolyticus posted by CDC has been given cluster code 2009ORK16-1. There are 6 clinical isoaltes from OR related within 0-5 SNPs. These isolates are related to REP code REPK1601. The line list is attached. Please let us know if you have helpful epi data.

I've attached 6 isolates that are clustering by 0-5 SNPs that are all from OR. These are also part of the REP strain REPK1601. I am monitoring this cluster to see if any other states start submitting related isolates, but for now we are not coding this since it is single state unless you need assistance in managing it.

Please let us know if you need any assistance!

Narrative Investigative Summary (*OK to cut-and-paste from report*)

Total of 14 cases that match by WGS. This is a genetic pattern that is common in the pacific Northwest. WA state does not do WGS on vibrio anymore because it has not been helpful

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Vibriosis and Whole Genome Sequencing - ????

We have traceback information for oysters from 42 cases. Twelve cases were traced to a single source:

- 5 traced to Hammersley Inlet, WA. Hammersley Inlet was closed 7/19 and reopened 8/14 after <10 MPN/g.
- 3 traced to various parts of Hood Canal, WA
- 2 traced back to Totten, WA
- 1 traced back to Nahcotta, WA
- 1 traced to British Columbia, Canada (14-8 Deep Bay)

The remaining 30 cases are multiple source. All cases included at least one WA source. Eleven of the multiple source cases were counted towards the Hammersley Inlet closure. Some cases also had seafood tags from harvest areas in VA (1), Prince Edward Island (PE) (4), MA (3), CA (1), OR (1), and MX (1).

This investigation began as a cluster of Vibrio cases that appear to be similar by WGS, and CDC lead the investigation. Oregon investigated all Oregon cases, and submitted COVIS forms to CDC. Traceback information was gathered whenever possible and shared with ODA, Washington Shellfish and CDC. All Oregon cases that were interviewed had eaten oysters, most of which traced back to Washington state growing areas.

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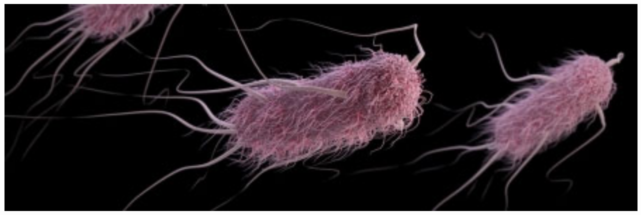

Kiyoshi Shiga in 1924

Shiga toxin-producing *E. coli*

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Shiga-Toxin-Producing *E. coli* (STEC) O157

- Common source of foodborne illness in United States
- Gram negative, facultative anaerobe
- Symptoms – diarrhea, often bloody, cramps
- Work and school restrictions
- Reservoirs: cattle, goats, sheep, elk, deer
- Fecal-oral transmission
  - Contaminated food, water
  - Direct animal contact, person-to-person

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Figure 1

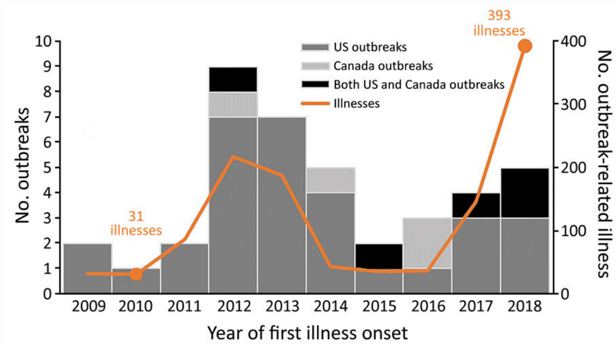

Figure 1. Number of Shiga toxin–producing Escherichia coli outbreaks (n = 40) linked to leafy greens in the United States, Canada, or both countries, and all outbreak-related illnesses (n = 1,212), by year of first illness onset, 2009–2018.

Marshall KE, Hexemer A, Seelman SL, Fatica MK, Blessington T, Hajmeer M, et al. Lessons Learned from a Decade of Investigations of Shiga Toxin–Producing Escherichia coli Outbreaks Linked to Leafy Greens, United States and Canada. Emerg Infect Dis. 2020;26(10):2319-2328. https://doi.org/10.3201/eid2610.191418

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Figure 3

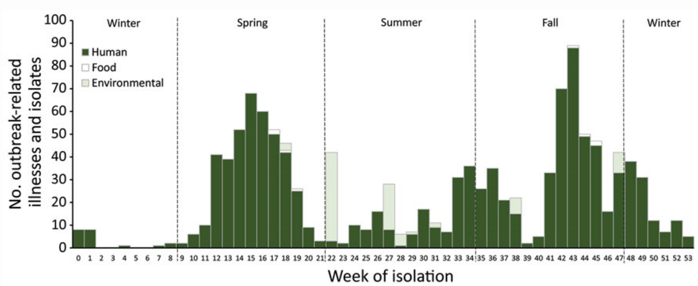

Figure 3. Outbreak-related Shiga toxin–producing Escherichia coli laboratory-confirmed illnesses (n = 1,124 illnesses for which information was available) and food (n = 8; spinach, romaine) and environmental isolates (n = 86; soil, water, sediment, scat) linked to leafy greens, by week of isolation, United States and Canada, 2009–2018.

Marshall KE, Hexemer A, Seelman SL, Fatica MK, Blessington T, Hajmeer M, et al. Lessons Learned from a Decade of Investigations of Shiga Toxin–Producing Escherichia coli Outbreaks Linked to Leafy Greens, United States and Canada. Emerg Infect Dis. 2020;26(10):2319-2328. https://doi.org/10.3201/eid2610.191418

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Leafy Greens STEC Action Plan

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Leafy greens outbreaks have a long history. From 2009 – 2018 there have been 40 Shiga toxin-producing *E. coli* (STEC) outbreaks linked to leafy greens accounting for 1,212 illnesses, 77 cases of hemolytic uremic syndrome, and 8 deaths. Of these, romaine accounted for 54% of these outbreaks – more than any other leafy green.[1] With two large romaine outbreaks, 2018 was a turning point in terms of the safety of leafy greens.

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U.S. FOOD & DRUG ADMINISTRATION

Leafy Greens STEC Action Plan

Prevention

1. Advance Agricultural Water Safety
2. Enhance Inspections, Audits and Certification Programs
3. Buyer Specifications
4. Leafy Greens Data Trust
5. Microbiological Surveys for STEC Detection and Enhanced Sampling Protocols
6. Increase Awareness and Address Concerns Around Adjacent and Nearby Land
7. Establish and Strengthen Regular Outreach and Communication Programs for Stakeholders in Growing Regions

Response

8. Investigation Reports
9. Conduct Follow-Up Surveillance During the Fall 2020 California Growing/ Harvest Season
10. Promote Tech-Enabled Traceability
11. Improve Utilization of Shopper Card Data
12. Accelerate Whole Genome Sequencing Data Submissions by States
13. Advance Root Cause Analysis Activities
14. Enhance Outbreak and Recall Communications

Addressing Knowledge Gaps

15. Longitudinal Studies
16. Data Mining and Analytics on Previous Outbreaks
17. Adjacent and Nearby Land Use
18. Compost Sampling Assignment with California

For more information about the Leafy Greens STEC Action Plan, click any link above or visit:
https://www.fda.gov/food/foodborne-pathogens/leafy-greens-stec-action-plan
https://www.fda.gov/food/foodborne-pathogens/leafy-greens-stec-action-plan-accomplishments

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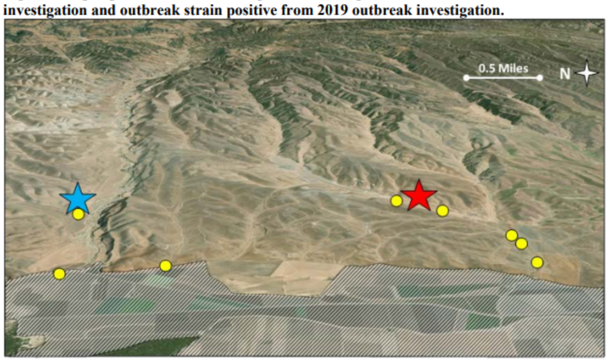
Agricultural water system(s)

Description	Additional Information and Examples
Location and nature of the water source (including whether it is ground water or surface water)	• Groundwater obtained from deep underground aquifers, with properly designed, located and constructed wells, generally yields water that is higher quality. Surface waters, which are more exposed to the environment and runoff, may be more susceptible to contamination.
Water distribution system used and whether it is open or closed to the environment	• Some water used for growing is conveyed through open distribution systems, such as canals and laterals, that can be subject to introduction of hazards from runoff, animal intrusion, direct discharge and seepage. • Other water might be distributed through a closed system, such as through piping, which, if it is constructed and functioning properly, can help protect water from the introduction of hazards. However, hazards can enter a closed system if the system is not maintained properly.
The degree to which the system is protected from possible sources of contamination, including: • **Other users** of the water system • **Animal impacts** (such as from grazing animals, working animals, and animal intrusion) • **Adjacent and nearby land uses** related to **animal activity**, the application of biological soil amendments of animal origin (**BSAAOs**), or the presence of **untreated or improperly treated human waste**	• **Other users:** a covered farm would consider the potential for known or reasonably foreseeable hazards to be introduced by other users of the water source or distribution system. For example, a farm that draws water for crop protection sprays from a pond that is also used for recreational swimming would need to consider whether the use of the source for recreational swimming could introduce hazards into the agricultural water system. • **Animal impacts:** Both wild and domesticated animals can be a source of pathogens that can contaminate produce. A farm may become aware of potential animal impacts on its pre-harvest agricultural water systems through inspections and maintenance performed on the water source or distribution system or through findings from visual observations. • **Animal activity on adjacent and nearby land*'**: Animal activities that may introduce contamination into water sources or distribution systems include, but are not limited to, livestock feeding operations of any size, dairy production, fowl production, barnyards, or significant wildlife intrusion or wildlife habitat. - In evaluating adjacent and nearby land uses, a farm could, for example, consider the effects of any fencing, containment, or other measures employed to prevent animal access to water sources or distribution systems, or earthen diversion berms, ditches, or other barriers to help minimize the influence of runoff or airborne transmission (e.g. fugitive dust) on sources and distribution systems. - Information on adjacent and nearby land uses could be acquired through visual observations, discussions with local extension agents or associations, online resources or other means as appropriate.

Figure 1. A geospatial subset of STEC positive investigation test results from 2020 outbreak investigation and outbreak strain positive from 2019 outbreak investigation.



Notes: 2020 outbreak strain match is represented by a red star; 2019 outbreak strain is represented by blue star; other samples yielding STEC positives from the 2020 outbreak investigation are represented by yellow circles. The shaded area represents produce farms and ranches. This map illustrates the samples matching the current and previous outbreak strain. Other samples yielding STEC positive samples from other non-contiguous sample sites were collected as part of this outbreak investigation (not pictured here); therefore, the number of total positive tests will not be represented in this figure.

Shiga Toxin–Producing *Escherichia coli* Infections Associated With Romaine Lettuce—United States, 2018

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Background. Produce-associated outbreaks of Shiga toxin–producing *Escherichia coli* (STEC) were first identified in 1991. In April 2018, New Jersey and Pennsylvania officials reported a cluster of STEC O157 infections associated with multiple locations of a restaurant chain. The Centers for Disease Control and Prevention (CDC) queried PulseNet, the national laboratory network for foodborne disease surveillance, for additional cases and began a national investigation.

Methods. A case was defined as an infection between 13 March and 22 August 2018 with 1 of the 22 identified outbreak-associated *E. coli* O157:H7 or *E. coli* O61 pulsed-field gel electrophoresis pattern combinations, or with a strain STEC O157 that was closely related to the main outbreak strain by whole-genome sequencing. We conducted epidemiologic and traceback investigations to identify illness subclusters and common sources. A US Food and Drug Administration–led environmental assessment, which tested water, soil, manure, compost, and scat samples, was conducted to evaluate potential sources of STEC contamination.

Results. We identified 240 case-patients from 37 states; 104 were hospitalized, 28 developed hemolytic uremic syndrome, and 5 died. Of 179 people who were interviewed, 152 (85%) reported consuming romaine lettuce in the week before illness onset. Twenty subclusters were identified. Product traceback from subcluster restaurants identified numerous romaine lettuce distributors and growers; all lettuce originated from the Yuma growing region. Water samples collected from an irrigation canal in the region yielded the outbreak strain of STEC O157.

Conclusions. We report on the largest multistate leafy greens–linked STEC O157 outbreak in several decades. The investigation highlights the complexities associated with investigating outbreaks involving widespread environmental contamination.

Keywords. outbreak; Escherichia coli; Romaine Lettuce; foodborne illness; produce safety.

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Wrap Up

- Post – Assessment: Scan the QR Code:

- Complete the course evaluation

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