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Salmonellosis Outbreaks

The bacterial family Enterobacteriaceae includes a number of agents pathogenic for humans. Among these are *Escherichia coli*, *Klebsiella*, *Shigella*, *Salmonella* and *Yersinia*. One of the most common causes of foodborne outbreaks in this country are various kinds of *Salmonella*.

Salmonella

Salmonella were identified microscopically in the late 19th century during investigations of typhoid fever. That disease is considered separately for reporting purposes and is not included in the reporting category for salmonellosis.

Illustration of Salmonella
Source: CDC

Strains of *Salmonella* were initially distinguished by serotyping, using antisera developed from animals injected with the target organism. The antisera could be directed at a specific O antigen, determined by the outer lipopolysaccharide layer, or at the H antigen, reflecting the flagellar proteins. Based on modern DNA hybridization methods the genus has two species: *S. enterica* and *S. bongori*. Familiar causes of salmonellosis are included in *S. enterica*, such as *Salmonella enterica* serovar Typhimurium, generally called *Salmonella* Typhimurium.

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About 1,500 *S. enterica* serotypes (serovars) have been recognized. These were often named for the geographic location of first identification (e.g., country, city, street, university, hospital); a large number were named for sites in Germany (*S.* Heidelberg), the United Kingdom (*S.* Dublin), or the United States (*S.* Ohio). Other names indicate symptoms or usual host (*S. abortus-equi*).

DNA-based whole genome sequencing is more discriminatory than serotyping. In the past year, sequencing technology has replaced serotyping for identifying *Salmonella* serotypes and strains within a serotype. This change has improved identification and investigation of outbreaks.

Sources of Exposure

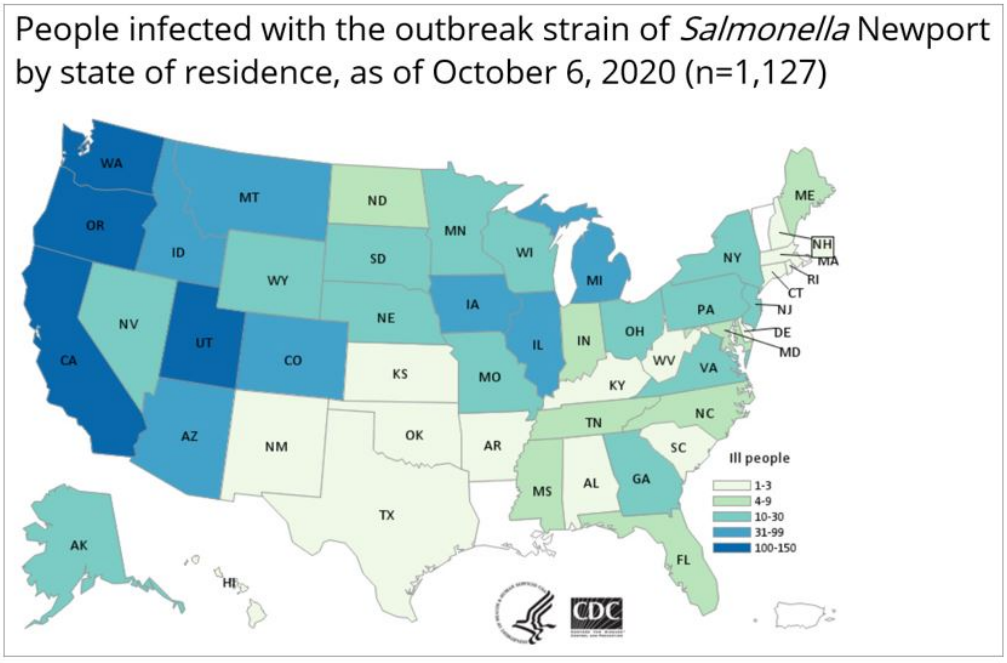
Poultry, cattle, pigs, dogs, cats, rodents, wild birds, and reptiles are among animals known to carry *Salmonella* as a natural component of their intestinal flora. Contamination of food with feces from these animals can result in foodborne outbreaks. Commonly recognized sources of foodborne exposure are dairy products, eggs, and poultry products; and the risks of raw milk, cracked eggs, and undercooked turkey have long been recognized.

Contamination can occur at any step during food production, known as 'farm to table' or 'farm to fork'. There can be surface or internal *Salmonella* of eggs during the laying process, fecal contamination of poultry products during slaughter, lack of refrigeration and undercooking of pooled eggs in restaurants, or cross-contamination in a home kitchen with raw poultry juices. Other potential sources of contamination include wild animal feces in a field or storage warehouse, use of ditch or field water to wash produce or to make ice used to cool produce, or preparing produce such as melons without first washing off surface contamination.

To identify sources of exposure, detailed case information is needed. Standardized and detailed hypothesis-generating interviews used by multiple states can be used to find potential common exposures for cases infected with the same strain of *Salmonella*. Further interviews and trace-back to the product with laboratory testing can contribute to the outbreak investigation.

Surveillance and Outbreaks

During 2020 several national foodborne outbreaks of salmonellosis have been identified. There was a large outbreak of *S.* Newport infections occurred due to whole onions sold to restaurants and consumers and to commercial foods made with uncooked onions, such as cheese dips, salsa, and chicken salad. Washington was among 48 states affected, reporting 150 of the 1,127 cases identified nationally. Canada also reported cases associated with onions.



Also in 2020 wood ear mushrooms (kikurage) distributed to restaurants were linked to *S.* Stanley cases and peaches to *S.* Enteritidis cases. In 2019 national foodborne salmonellosis outbreaks were linked to cut fruit (*S.* Javiana and *S.* Carrau), ground beef (*S.* Dublin, a particularly invasive type resulting in 13 cases with nine hospitalizations and one death), papayas (*S.* Uganda), tahini (*S.* Concord), frozen raw tuna (*S.* Newport), and turkey (*S.* Schwarzengrund).

National surveillance for agents such as *Salmonella* that cause foodborne diseases is conducted through a series of systems:

- Laboratory-based Enteric Disease Surveillance (LEDS)
- National Notifiable Diseases Surveillance System (NNDSS)
- Foodborne Disease Active Surveillance Network (FoodNet)
- National Molecular Subtyping Network for Foodborne Disease Surveillance (PulseNet)
- National Antimicrobial Resistance Monitoring System (NARMS)
- Foodborne Disease Outbreak Surveillance System (FDOSS)

Washington State Department of Health (DOH) contributes to these surveillance systems. Each year in Washington, around 650 to 1,000 salmonellosis cases are reported (10-15 cases per 100,000 population) with several associated deaths. The cases are also reported through NNDSS.

The DOH supports the ORCA (Outbreak Response and Collaborative Action) student team which can assist local health jurisdictions in foodborne disease surveillance activities including:

- Interviewing lab-confirmed salmonellosis and Shiga toxin-producing *E. coli* (STEC) cases with hypothesis generating questionnaires (HGQ)
- Conducting additional interviews as needed (initial and supplemental questionnaires)
- Doing data entry and analysis

A DOH activity related to outbreak investigations is the Washington State Integrated Food Safety Center of Excellence (WA CoE), established last year as a collaboration between the Washington State Department of Health and the University of Washington. The WA CoE works to identify best practices in foodborne disease surveillance and outbreak response, and supports other state and local public health professionals in implementing these practices.

Stay tuned for registration information about an upcoming WA CoE webinar series in November for state and local epidemiologists and for environmental health professionals new to the foodborne outbreak and investigation role. Webinar topics will include:

WASHINGTON Integrated Food Safety Center of Excellence

- Foodborne outbreak and investigation refresher
- The role of environmental health in a foodborne outbreak
- ATG, GAC, what can sequencing do for me? WGS for Epidemiologists

Resources

CDC yearly reports of salmonellosis outbreaks: https://www.cdc.gov/salmonella/outbreaks.html

CDC *Salmonella* surveillance: https://www.cdc.gov/salmonella/reportspubs/surveillance.html

Washington Integrated Food Safety Center of Excellence: http://foodsafety.uw.edu/