

# Salmonella Reading Illness Outbreak Associated with Turkey, 2017–2019

## After-Action Review Report 2018-05

October 14, 2020

The purpose of this report is to share lessons learned from the outbreak with industry and public health partners to help prevent illness and improve response.

### Overview

During December 2017–May 2019, public health officials in multiple states, the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), the Food Safety and Inspection Service (FSIS), the Animal and Plant Health Inspection Service (APHIS), and the National Turkey Federation (NTF) investigated an outbreak of 356 reported *Salmonella* Reading illnesses associated with turkey. The outbreak was linked to human and pet food products that contained turkey, as well as to turkey production and processing environments. One death was reported from California. The outbreak strain of *S. Reading* was isolated from a variety of turkey products and from live turkeys. In contrast to many other foodborne outbreaks that are associated with a specific brand or source of product, evidence suggested that this outbreak was linked to multiple producers of turkey products and that the outbreak strain was spread throughout the turkey industry. The investigation spurred two voluntary recalls of FSIS-regulated turkey products (for human consumption) and three voluntary recalls of FDA-regulated turkey pet food, though these recalled products did not account for all of the reported human illnesses in this outbreak. This outbreak response, in which government and industry worked together toward their shared goal to protect consumers, has been used as a model for government-industry collaboration in subsequent outbreak investigations. In response to this outbreak, NTF published [best practices](#) for reducing *Salmonella* in turkeys and turkey products.

### Epidemiology

- During this investigation, investigators used pulsed-field gel electrophoresis (PFGE) and whole genome sequencing, which are both molecular subtyping techniques, to assess the relatedness of *S. Reading* isolates and identify the outbreak strain.
- On December 19, 2017, FSIS began monitoring a cluster of *S. Reading* infections in four people, all of whom reported contact with turkey products prior to illness. Bacterial isolates from these people were indistinguishable by PFGE from each other and from *S. Reading* found in eight FSIS turkey samples collected from multiple FSIS-regulated establishments. In January 2018, multiple states, CDC, and FSIS started investigating the cluster.
- Additional people infected with the outbreak strain of *S. Reading* were reported (356 total cases; see Table 1 for epidemiologic details).
  - Officials investigated subclusters of ill people to determine factors that may have contributed to illness. Two subclusters in Minnesota were associated with raw turkey pet food. Two other subclusters, one each in the District of Columbia and Iowa, were linked to events where a variety of foods, including turkey, were served.
- Among 198 ill people with available exposure information, 132 (67%) reported direct or indirect contact with turkey in the week before illness; 123 prepared or consumed various turkey products that had been purchased raw, 4 lived in homes where pets consumed raw ground turkey pet food, and 5 worked or lived with someone who worked in a turkey production or processing facility.
  - No common brand or type was identified among the turkey products that ill people reported consuming.
- Public health partners in [Canada](#) concurrently investigated poultry-associated illnesses in people from which the outbreak strain of *S. Reading* had been isolated.
- Since the close of the outbreak investigation, additional human infections with the outbreak strain of *S. Reading* have been reported, though at a lower frequency than during the outbreak period.

**Table 1.** Case characteristics—*Salmonella* Reading illness outbreak associated with turkey, 2017–2019 (as of March 31, 2019).

Total number of cases and states of residence	356 cases from 42 states and the District of Columbia (see <a href="#">CDC map of reported cases</a> )
Illness onset (known or estimated) date range	November 20, 2017–March 31, 2019 (see <a href="#">CDC timeline of reported cases</a> )
Age range (median) in years	<1–101 (42)
Percent female	48
Number of reported hospitalizations	132
Number of reported deaths	1 (California resident)

## Traceback

- Investigators conducted traceback investigations for products to which ill people reported exposure. Numerous product brands, types, and manufacturers were reported; a single, common source was not identified.

## Product Sampling

### Turkey Products for Human Consumption

- The outbreak strain of *S. Reading* was isolated from 178 samples of raw turkey products from 38 FSIS-regulated establishments collected via routine FSIS sampling during November 2017–March 2019.
- Michigan officials collected two samples of raw turkey products in unopened packaging and three in opened packaging from ill people's homes; the outbreak strain of *S. Reading* was isolated from one unopened package and one opened package.
- Arizona officials isolated the outbreak strain of *S. Reading* from a sample of a raw turkey product in unopened packaging collected from an ill person's home.
- Per its [Policy on Use of Results from Non-FSIS Laboratories](#) (FSIS Directive 10,000.1), FSIS assessed and accepted the above results from Michigan and Arizona.

### Turkey Pet Food

- Minnesota officials collected seven samples of raw turkey pet food from ill people's homes; five of these samples—produced by two different manufacturers—were positive for the outbreak strain of *S. Reading*.
- FDA officials collected and tested raw turkey pet food in response to a consumer complaint; *S. Reading* was isolated from this sample, but not the outbreak strain.

### Live Turkeys

- APHIS reported that the outbreak strain of *S. Reading* was isolated from 10 samples from live turkeys in 5 states; these samples had not been collected as part of this investigation.

### Pets

- Minnesota officials tested six pet dogs and one pet cat as part of investigations of illnesses associated with raw turkey pet food. Of these, one dog tested positive for the outbreak strain of *S. Reading* and three other dogs and the cat tested positive for strains of *Salmonella* not related to the outbreak. According to their owners, none of the tested pets had shown signs of illness.
- FDA officials tested six pet dogs as part of raw turkey pet food investigations; one dog, which did not appear to be ill, tested positive for *Salmonella* (a strain not related to the outbreak) after having been fed raw turkey pet food that tested positive for the outbreak strain of *S. Reading*.

## Environmental Assessment

- Minnesota officials investigated two subclusters of illnesses associated with raw ground turkey pet food and found that ill people may have been exposed to the outbreak strain of *S. Reading* by contact with contaminated food, the container in which it was served, or with the household's pet dog after it had consumed the contaminated food.

- District of Columbia and Iowa officials assessed turkey preparation practices related to the illness subclusters and found that improper cooking or handling were likely contributing factors.
- NTF worked with government and industry partners to assess factors that may have contributed to the outbreak and the widespread presence of the outbreak strain in the turkey industry, but was not able to determine the ultimate source of the pathogen or explanation for its spread.

## Industry, Public Health, and Regulatory Actions

- FSIS [announced](#) on July 19, 2018 that it was monitoring this outbreak.
- Isolation of *S.* Reading from product samples triggered five voluntary recalls, two of FSIS-regulated raw, ground turkey products for human consumption ([November 15, 2018](#) and [December 21, 2018](#)) and three of FDA-regulated raw turkey pet food ([February 5, 2018](#); [January 28, 2019](#); and [March 26, 2019](#)); however, given the diversity of the types of turkey exposure noted among ill people, these products did not account for all of the illnesses in this outbreak.
- CDC published an [Investigation Notice](#) about this outbreak investigation on July 19, 2018 (updated November 8, 2018; November 16, 2018; December 21, 2018; February 15, 2019; final update April 30, 2019).
- CDC published a *Morbidity and Mortality Weekly Report* (MMWR) [article](#) about this outbreak investigation on November 22, 2019.

## Lessons Learned and Related Policy Actions

### Proper Cooking and Handling of Turkey Products

- Investigations of illness subclusters linked to human and pet food showed that improper cooking and handling of turkey products likely contributed to this outbreak. Food preparers should follow these four food safety steps: [clean, separate, cook, and chill](#). Adequate handwashing is essential after handling raw poultry or after touching pets, their food, or their waste. Turkey products should be cooked to a safe minimum internal temperature of [165°F](#) as measured by a food thermometer before consumption.

### One Health in Action: Collaborating to Respond to a Unique Outbreak

- The [One Health](#) concept acknowledges the link between the health of people, animals, and their shared environment, as well as the need for diverse partners from multiple sectors to collaborate to solve health challenges. This complex outbreak and its multi-sectoral response exemplified One Health, as follows:

#### *Humans, Animals, and the Environment*

- People and pets were exposed to the pathogen through a variety of turkey products. The turkey production and processing environments likely were also sources of infection. Persistent epidemiologic evidence and sampling results from turkey products and live turkeys indicated that the outbreak strain was widespread in the turkey industry.

#### *Novel Response and Surveillance Tools*

- Unlike many other foodborne outbreaks that are associated with a specific brand or source of product, this outbreak was linked to many types of raw turkey products. This unique outbreak situation prompted changes in public communication and outbreak surveillance.
  - For the first time, CDC employed a new public communication tool called the [Investigation Notice](#). This tool is used when an investigation is either in its early stages and a food item has not been identified, or when an outbreak is linked to a general food category but not to a specific brand. The tool has been used by CDC in subsequent investigations.
  - Based on this and other outbreaks, agencies involved in foodborne illness investigations are exploring ways to track pathogen strains that persistently cause illness for which a specific food vehicle has not been identified.

#### *Collaboration between Government and Industry Partners*

- Most foodborne outbreaks feature a single food vehicle regulated either by FDA or by FSIS. In contrast, this outbreak was associated with turkey products regulated by both FDA (turkey pet food) and FSIS (turkey products for human consumption). Effective collaboration between agencies at all levels of government helped partners detect and respond to this cross-jurisdictional outbreak.
- Given the evidence that the outbreak was related to turkeys and turkey products, and that the strain was widespread in the turkey industry, FSIS and CDC collaborated with NTF during this investigation. Government and industry share a goal to protect consumers and, as this investigation demonstrated, can appropriately and effectively collaborate on efforts to prevent foodborne illness. This outbreak response has been used as a model for government-industry collaboration in subsequent outbreak investigations. In response to this outbreak, NTF:

- Published a document containing [best practices](#) for reducing *Salmonella* in turkeys and turkey products, including potential on-farm activities. This document is posted on the NTF website and will be reviewed and updated as needed.
- Routinely hosts industry meetings on *Salmonella* reduction efforts.
- Continues to support messaging that promotes the awareness of proper handling and cooking of turkey products.
- To reduce the risk associated with raw turkey pet food, recommended that its member companies not sell turkey products to pet food producers without an intervention that would inactivate *Salmonella*.

#### Research, Control, and Monitoring

- Academia, government, and industry partners are collaborating to investigate the [emergence](#) of this outbreak strain of *S. Reading*. Additional research into the emergence, transmission, and control of this *S. Reading* strain and other pathogens in food animals is warranted.
- FSIS continues to monitor the recovery of *S. Reading* from turkey samples to detect and respond to any concerning trends.
- Research to identify ways to further reduce *Salmonella* in live turkeys and turkey products is also ongoing.

#### **References/Helpful Links**

- Recalls of FSIS-regulated raw, ground turkey products for human consumption
  - [Recall 112-2018, November 15, 2018](#)
  - [Recall 124-2018, December 21, 2018](#)
- Recalls of FDA-regulated raw turkey pet food
  - [Recall](#) , February 5, 2018
  - [Recall](#) , January 28, 2019
  - [Recall](#) , March 26, 2019
- CDC Investigation Notice ([final update April 30, 2019](#) )
- CDC MMWR [article](#) , November 22, 2019
- [FSIS Directive 10,000.1, Policy on Use of Results from Non-FSIS Laboratories](#)
- [FSIS Safe Minimum Internal Temperature Chart](#)
- [4 Steps to Food Safety](#) (clean, separate, cook, and chill)
- NTF *Salmonella* reduction [best practices](#) , November 2018
- Research study on the [emergence](#) of this *S. Reading* strain
- Canada Public Health Notice ([final update February 21, 2020](#) )

*Last Modified Oct 14, 2020*