INVESTIGATIONS OF MULTISTATE

Salmonella, Shiga toxin-producing Escherichia coli, and Listeria monocytogenes

OUTBREAKS

AND POSSIBLE OUTBREAKS

2016

Acknowledgments

We would like to thank local, state, and territorial health officials, officials at the Food and Drug Administration and US Department of Agriculture for their continued and dedicated work to investigate enteric disease outbreaks.

Suggested citation

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Purpose of this report

CDC's *Multistate Investigations of Salmonella, Shiga toxin-producing Escherichia coli, and Listeria monocytogenes infections—United States, 2016* summarizes all multistate outbreaks caused by these pathogens and their investigations coordinated by CDC during 2016. This report provides information for the public, researchers, and industry about CDC's investigation process for multistate enteric disease outbreaks and describes results of investigations, including who became sick and the foods and animals that were identified as outbreak sources. The information in this report, together with the companion *Morbidity and Mortality Report* (MMWR) article is intended to provide details about CDC's multistate investigation process and findings; provide data to inform policies and practices to make outbreaks less common; and help inform public health communications and food safety education.

Key findings

- After initial assessment, CDC investigated 118 possible multistate outbreaks of enteric illness. Ultimately, 50 were determined to be outbreaks: 39 had a possible source identified, and of these, 28 had the source confirmed.

- Sprouts were the source of more multistate outbreaks than any other food item in 2016, but multistate outbreaks linked to consumption of chicken resulted in most outbreak-associated illnesses.

- Multistate outbreaks linked to contact with backyard poultry caused more outbreak-associated illnesses than multistate outbreaks linked to chicken that was eaten in 2016, although reasons for this are unclear.

- Three foods were linked to Shiga toxin-producing *Escherichia coli* (STEC) or *Listeria* bacteria for the first time. These outbreaks also drew the most public interest on the web and social media: flour (STEC), frozen vegetables (*Listeria*), and bagged salad (*Listeria*).

- Investigating multistate outbreaks of enteric (intestinal) illness can be complex and challenging at each stage of the investigation.

Investigating and solving multistate outbreaks of *Salmonella*, STEC, and *Listeria* infections has substantial potential benefit

Illness caused by *Salmonella*, STEC, and *Listeria* bacteria occurs frequently and is costly. Each year in the United States, these three pathogens cause an estimated 1.49 million illnesses, 28,000 hospitalizations, and 700 deaths[1], at an estimated cost of more than $6 billion[2]. They are the leading causes of multistate foodborne outbreaks[3,4]. Although multistate outbreaks generally comprise only 3% of all foodborne outbreaks, they account for a third of hospitalizations and more than half of foodborne outbreak-related deaths[4]. Half of outbreaks linked to animal contact are multistate[5], and these outbreaks disproportionately affect young children, a population at increased risk for severe illness.

Responding to multistate outbreaks quickly and effectively can prevent additional outbreak-associated illnesses and save lives. Lessons learned during outbreak investigations about contamination sources, modes of transmission, and risk factors for infection provide information to help prevent future outbreaks, illnesses, and deaths.

1   Scallan E, Hoekstra RM, Angulo FJ, Tauxe RV, Widdowson MA, Roy SL, et al. Foodborne illness acquired in the United States--major pathogens. Emerg Infect Dis. 2011 Jan;17(1):7-15.

2   Hoffmann S, Batz MB, Morris Jr JG. Annual cost of illness and quality-adjusted life year losses in the United States due to 14 foodborne pathogens. Journal of Food Protection. 2012;75(7):1292-302.

3   Nguyen VD, Bennett SD, Mungai E, Gieraltowski L, Hise K, Gould LHJFp, et al. Increase in multistate foodborne disease outbreaks—United States, 1973–2010. Foodborne Pathog and Dis. 2015;12(11):867-72.

4   Crowe SJ MB, Vieira AR, Gould LH. Vital Signs: Multistate Foodborne Outbreaks — United States, 2010–2014. Morbidity and Mortality Weekly Report (MMWR). 2015 November 6, 2015;64(43):1221-5.

5   Marus JR, Magee MJ, Manikonda K, Nichols. Outbreaks of Salmonella enterica infections linked to animal contact: Demographic and outbreak characteristics and comparison to foodborne outbreaks-United States, 2009-2014. Zoonoses Public Health. 2019;66(4):370–376. doi:10.1111/zph.12569

CDC's role in investigating multistate foodborne and animal contact outbreaks

CDC leads a national network of local, state, and federal public health agencies that investigate multistate outbreaks of *Salmonella*, STEC, *Listeria*, and other enteric infections. CDC's primary role is to facilitate rapid and coordinated responses to multistate outbreaks. In this capacity, CDC works closely with state and local health officials, the US Food and Drug Administration (FDA), and the United States Department of Agriculture Food Safety and Inspection Service (USDA-FSIS) to do the following:

- Determine whether there is enough data to suggest that a group of illnesses constitutes an outbreak
- Identify the source of an outbreak
- Recommend actions to stop an outbreak
- Communicate findings with the public and industry when they can take action to prevent additional illnesses.

Where to find additional information on multistate investigations and outbreaks of *Salmonella*, STEC, and *Listeria* infections

For more information on CDC's multistate investigation process, including how outbreaks are detected, assessed, solved, and confirmed, refer to MMWR, or visit https://www.cdc.gov/foodsafety/outbreaks/multistate-outbreaks/cdc-role.html. Readers are encouraged to refer to the CDC role in multistate outbreak investigation page and MMWR for a discussion of important limitations related to this report. Of note, this report does not include outbreaks with illnesses occurring in a single state. Such outbreaks are primarily investigated by state or local health departments rather than CDC. For information on all enteric disease outbreaks transmitted by food or by animal contact that were reported to CDC, please visit the National Outbreak Reporting System (NORS) website at https://www.cdc.gov/nors/index.html.

For detailed **definitions** of terms used in the report, please view MMWR, and the definitions page of this report.

For questions or concerns on this report, please contact outbreakresponse@cdc.gov.

Possible Multistate Outbreaks

CDC is investigating possible multistate outbreaks of *Salmonella*, *Listeria*, and STEC infections 24/7.
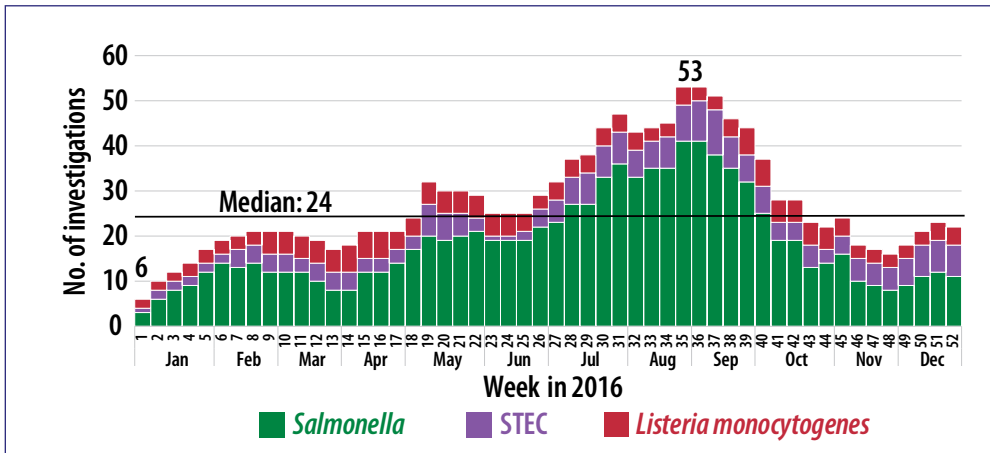
In any given week in 2016, CDC was coordinating and helped investigate 6 to 53 possible multistate outbreaks, with a median of 24. Most were possible *Salmonell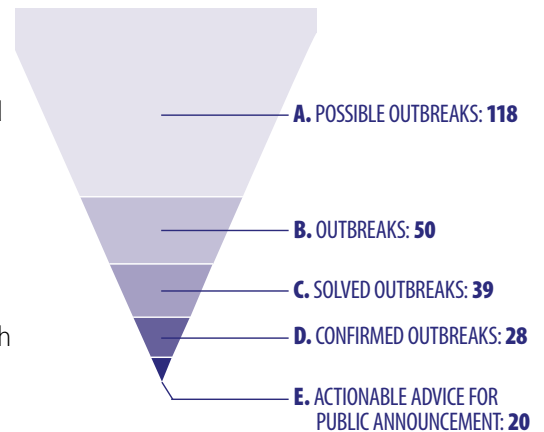a* outbreaks, followed by STEC and *Listeria* outbreaks. Outbreak investigations are often the best way to determine important sources of illnesses. Although recognized outbreaks represent only a small proportion of all foodborne illnesses, investigating and finding their sources can uncover gaps in food safety and lead to changes that ultimately increase the safety of our food supply.

Some possible multistate outbreaks are not determined to be outbreaks, and some multistate outbreaks are not solved.

A possible outbreak is a group of two or more people with a similar illness. An outbreak is a group of two or more people with a similar illness associated with a common exposure. Sometimes a group of people who have the same illness are not considered an outbreak. This can happen if investigators can't identify the common exposure that resulted in illness. Investigators in local and state health departments interview sick people and share that information with CDC. The interviews help identify what exposures sick people have in common, such as eating the same food or having contact with the same type of animal.

A. POSSIBLE OUTBREAKS: **118**

B. OUTBREAKS: **50**

C. SOLVED OUTBREAKS: **39**

D. CONFIRMED OUTBREAKS: **28**

E. ACTIONABLE ADVICE FOR PUBLIC ANNOUNCEMENT: **20**

In 2016, 230 possible multistate outbreaks were detected and information about them was sent to CDC for assessment; 174 were investigated, but 56 of these were excluded from this report because they were single state outbreaks or were due to international travel. CDC coordinated and helped investigate the remaining 118 possible multistate outbreaks. There was not enough data to determine whether more than half of these were outbreaks. Outbreaks were considered *solved* if a source was identified. A solved outbreak source was considered *confirmed* if it had at least two types of data to support it; otherwise, the outbreak source was considered *suspected*. Types of data include epidemiologic, traceback, and laboratory. CDC announced outbreaks on its website and social media channels when consumers could take immediate action to prevent illness. Investigators solved about three-quarters of the multistate outbreaks that they investigated in 2016.

42% OF POSSIBLE OUTBREAKS DETERMINED TO BE **OUTBREAKS**

78% OUTBREAKS WERE **SOLVED**

MULTISTATE POSSIBLE OUTBREAKS OF *SALMONELLA* WERE LARGER AND MORE FREQUENT THAN THOSE CAUSED BY STEC AND *LISTERIA*.

INVESTIGATIONS

84 *SALMONELLA*
24 STEC
10 *LISTERIA*
118 TOTAL

ILLNESSES

3,042 *SALMONELLA*
314 STEC
97 *LISTERIA*
3,480 TOTAL
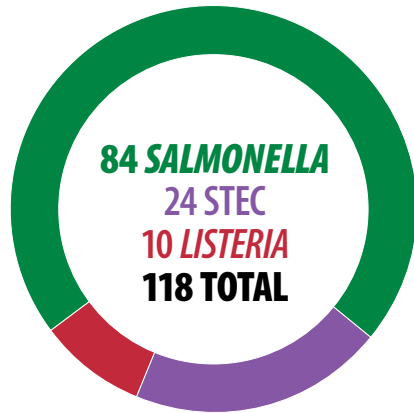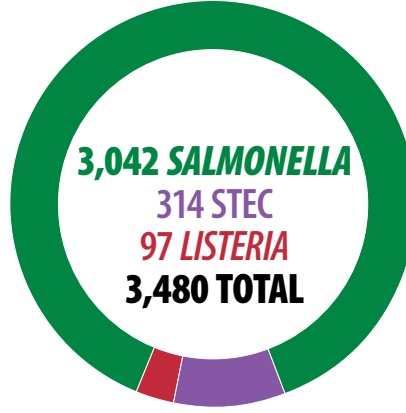
MEDIAN NUMBER OF ILLNESSES (RANGE)
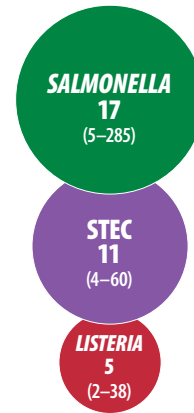
SALMONELLA
17
(5–285)

STEC
11
(4–60)

LISTERIA
5
(2–38)

ALTHOUGH POSSIBLE MULTISTATE OUTBREAKS CAUSED BY *LISTERIA* WERE SMALL, THEY WERE SEVERE.

Salmonella
Died 0.2%
Hospitalized 25%

STEC
Died 0%
Hospitalized 36%

Listeria monocytogenes
Died 18%
Hospitalized 100%

Multistate **Foodborne Outbreaks**
of *Salmonella*, STEC, and *Listeria monocytogenes* Infections in 2016
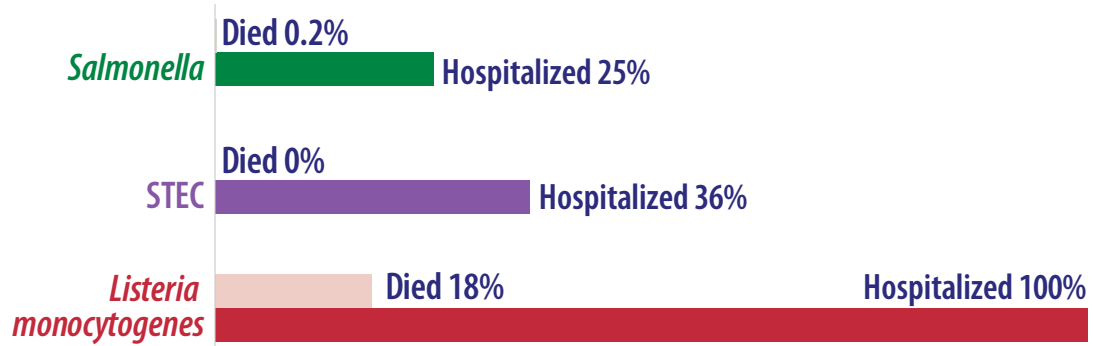
SALMONELLA

STEC

LISTERIA

Snapshot

MULTISTATE FOODBORNE OUTBREAKS	**28** OUTBREAKS	**171** PEOPLE HOSPITALIZED
	656 PEOPLE ILL	**8** PEOPLE DIED

Salmonella caused the most multistate foodborne outbreaks.

CDC investigated 50 multistate outbreaks in 2016; 28 were linked to contaminated foods. Among the foodborne outbreaks, 19 were caused by *Salmonella*, 5 by STEC, and 4 by *Listeria*. *Salmonella* bacteria also caused the most outbreak-related illnesses. Not all outbreak-related illnesses are captured by CDC's PulseNet, a national laboratory network that connects illnesses caused by bacteria with the same DNA fingerprints to each other to detect possible outbreaks. This is partly because many sick people may not seek care or get tested for a foodborne illness. Accordingly, the true number of people sickened in an outbreak is usually much higher than the number reported. For example, CDC estimates there are 29 cases of *Salmonella* for every 1 that is reported. In 2016, *Salmonella* disease outbreaks resulted in the highest number of outbreak-associated hospitalizations, while *Listeria* disease outbreaks had the highest proportion of people hospitalized.

OUTBREAK-RELATED ILLNESSES

515 *SALMONELLA*
102 STEC
39 *LISTERIA*

HOSPTALIZATIONS

98 *SALMONELLA*
37 STEC
36 *LISTERIA*
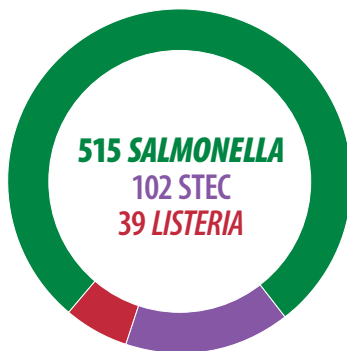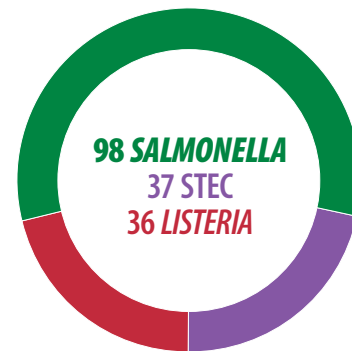
Investigations take time.

Overall, each investigation lasted a median of 70 days and each outbreak lasted a median of 81 days. *Listeria* disease outbreaks can persist for years when the bacteria inhabit manufacturing facilities and cause intermittent product contamination. Investigating *Listeria* disease outbreaks requires significant resources.

Salmonella
Investigation: 69 days median
Outbreak: 73 days median

STEC
Investigation: 39 days median
Outbreak: 65 days median
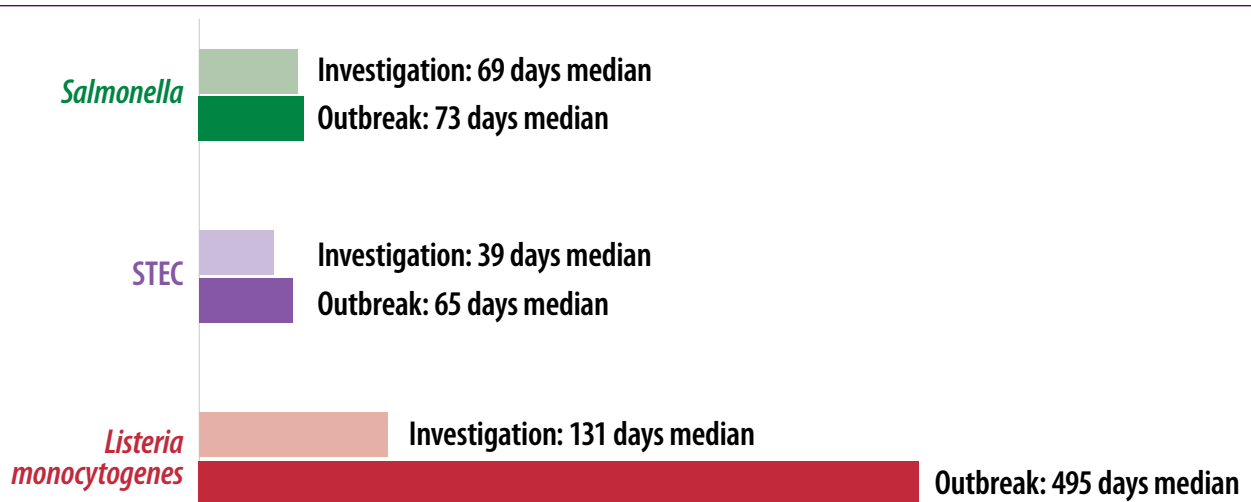
Listeria monocytogenes
Investigation: 131 days median
Outbreak: 495 days median

The duration of outbreaks and investigations varied, and sometimes outbreaks were over before investigations began.

Although outbreaks in 2016 were almost always longer than the investigations into them, sometimes outbreaks ended before the investigation began. This is shown by the gap between the gray bars and the other bars. Outbreaks may end before an investigation begins for a few reasons:

- It takes time to find outbreak cases. It can take several weeks from the day a person is tested to the day those testing results are available in the PulseNet database that CDC uses to identify cases.

- It takes time to detect outbreaks. A possible multistate outbreak is only discovered when more people than expected appear to have the same illness. People in different states may not eat contaminated food at the same time and therefore may not all become ill at the same time.

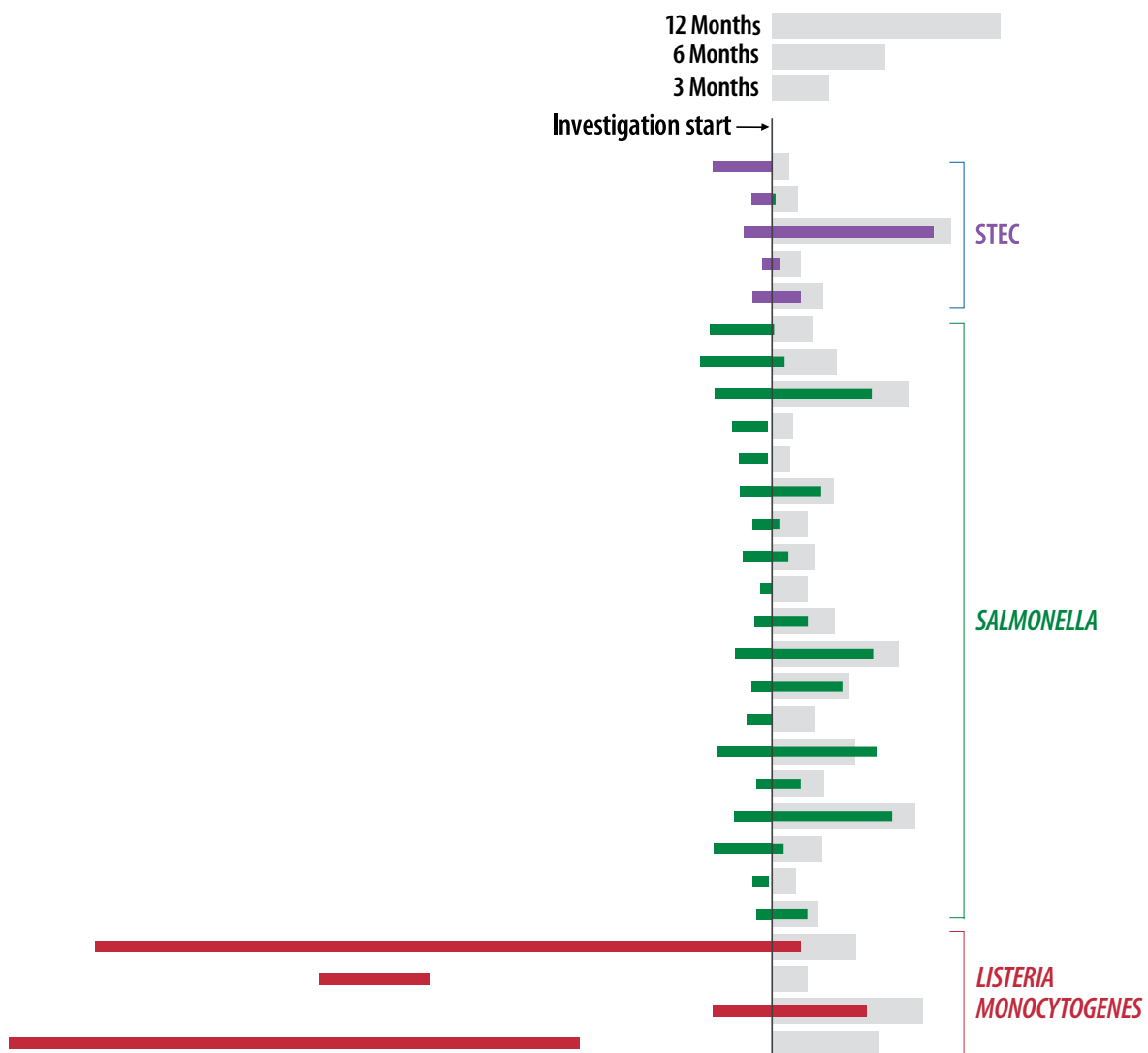- Some outbreaks can end quickly because the food involved has a short shelf life. Even when cases are identified quickly and an outbreak is rapidly detected, these contaminated foods may already be out of the marketplace.

- Some outbreaks can be prolonged because some bacteria persist for years when the bacteria inhabit manufacturing facilities and cause intermittent product contamination (e.g., *Listeria*).

Duration of investigation (gray bars) and outbreak (other bars) for solved **STEC**, *Salmonella*, and ***Listeria*** multistate outbreaks. Each investigation start date was normalized to a standard date (indicated by the arrow) to illustrate when outbreaks and their investigation began relative to one another.

The median age of someone sickened in a multistate foodborne outbreak in 2016 was 31.

70 YEARS

32 YEARS

20 YEARS

MEDIAN: 31 YEARS

SALMONELLA   STEC   LISTERIA
MONOCYTOGENES

People infected with outbreak-related STEC bacteria were younger than those infected with outbreak-related *Salmonella* bacteria. The median age for people with listeriosis was highest.
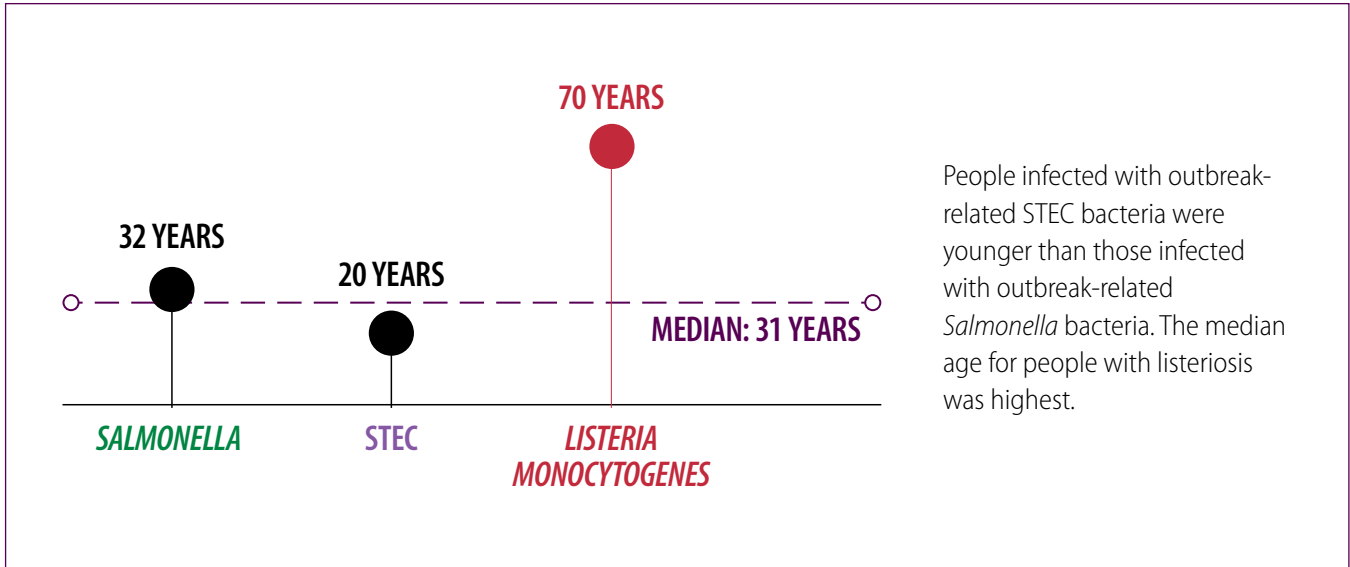
People sickened in *Listeria* disease outbreaks were older than people sickened in STEC and *Salmonella* disease outbreaks.

Among all multistate outbreak-related illnesses, 10% occurred in children younger than 5, and 13% among adults age 65 and older. Compared with those infected with *Salmonella* and STEC bacteria, a higher proportion of people with *Listeria* infections were age 65 and older. This is expected given that the risk of invasive listeriosis is higher for this age group. Although the majority of people sickened in outbreaks were female, the lowest proportion of people who were female was for outbreaks caused by STEC bacteria.

Demographic	*Salmonella*	STEC	*Listeria*
Children under 5	10%	10%	8%
People 65 and older	12%	9%	**61%**
Female	64%	**55%**	62%

Multistate foodborne outbreaks affected all 50 states.

States with one or more cases of *Salmonella*, STEC, or *Listeria* infections associated with a multistate outbreak linked to a contaminated food source are shown below. Multistate foodborne *Salmonella* disease outbreaks affected the greatest number of states (46), followed by STEC (30), while *Listeria* disease outbreaks affected the fewest (17).
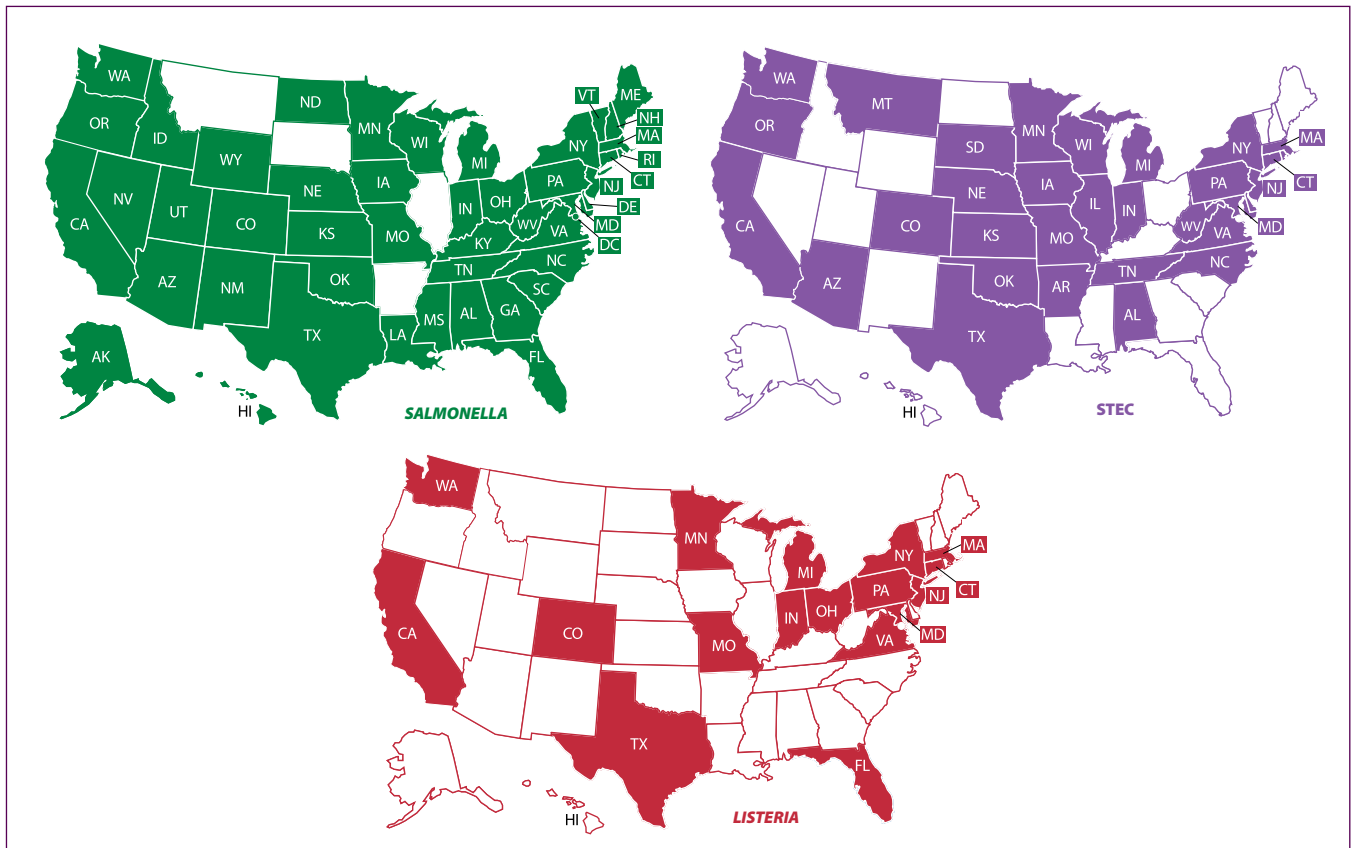
Most food confirmed as the source of a multistate outbreak was produced domestically.

Among the 18 multistate outbreaks with a confirmed food source, 12 were linked to a food product produced in the United States. Four multistate outbreaks were linked to imported food: three to food imported from Mexico and one to a food imported from an unknown location. Two outbreaks did not have information on where the food was produced.

Food produced in the US:
12 OUTBREAKS

Food imported from undetermined location:
1 OUTBREAK

Food imported from Mexico:
3 OUTBREAKS
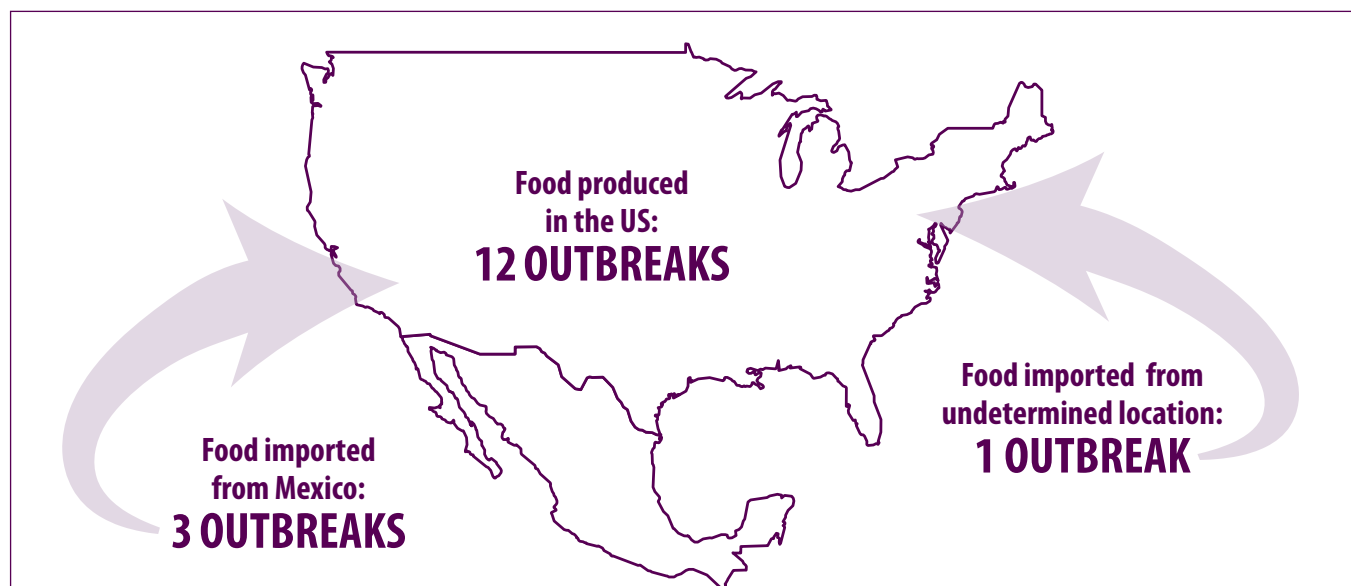
Confirmed or suspected food sources of multistate outbreaks of *Salmonella*, STEC, and *Listeria* infections, by pathogen, and food category, 2016 (n=28)

Food Categories follow Interagency Food Safety Analytics Collaboration categorization: https://www.cdc.gov/foodsafety/ifsac/projects/food-categorization-scheme.html

* = **Imported:** Melon, cucumbers, and hot peppers imported from Mexico, Persian cucumbers imported from unknown location

+ = **Recalled:** Both alfalfa sprout outbreaks resulted in a recall

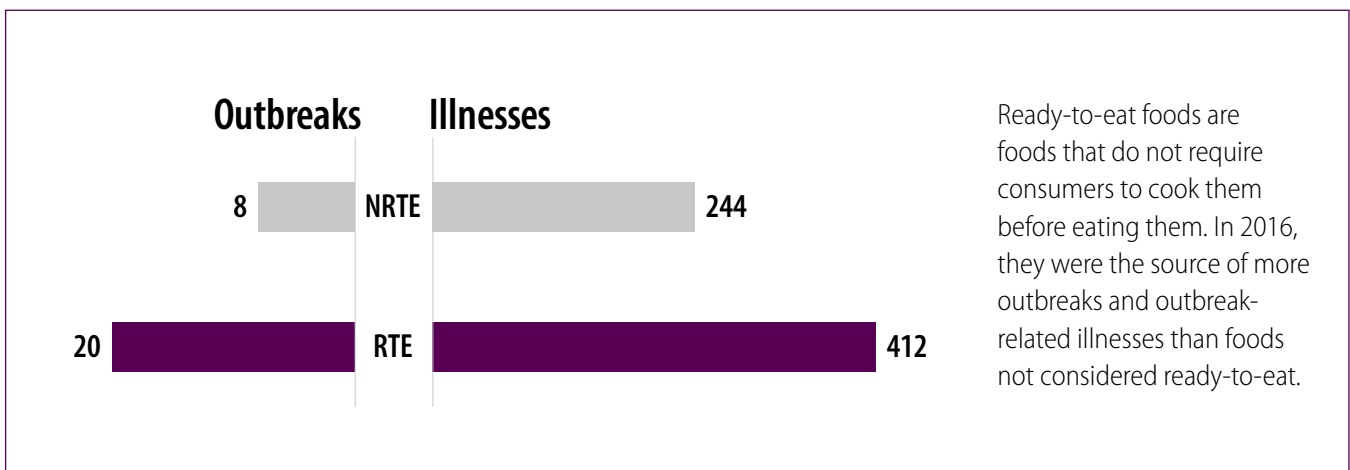| Food	*Salmonella* outbreaks	*Salmonella* illnesses	STEC outbreaks	STEC illnesses	*Listeria* outbreaks	*Listeria* illnesses	Total outbreaks	Total illnesses
Beef	**0**	**0**	**1**	**11**	**0**	**0**	**1 (4%)**	**11 (2%)**
Ground beef+	0	0	1	11	0	0	1	11
Chicken	**2**	**134**	**0**	**0**	**0**	**0**	**2 (7%)**	**134 (20%)**
Chicken	2	134	0	0	0	0	2	134
Dairy	**0**	**0**	**0**	**0**	**1**	**2**	**1 (4%)**	**2 (<1%)**
Raw milk	0	0	0	0	1	2	1	2
Eggs	**1**	**8**	**0**	**0**	**0**	**0**	**1 (4%)**	**8 (1%)**
Eggs+	1	8	0	0	0	0	1	8
Fruits	**2**	**69**	**0**	**0**	**0**	**0**	**2 (7%)**	**69 (11%)**
Avocado	1	59	0	0	0	0	1	59
Melon*	1	10	0	0	0	0	1	10
Grains-Beans	**0**	**0**	**2**	**69**	**0**	**0**	**2 (7%)**	**69 (11%)**
Flour+	0	0	1	56	0	0	1	56
Pizza dough	0	0	1	13	0	0	1	13
Herbs	**1**	**35**	**0**	**0**	**0**	**0**	**1 (4%)**	**35 (5%)**
Meal replacement shake+	1	35	0	0	0	0	1	35
Multiple	**1**	**28**	**0**	**0**	**3**	**37**	**4 (14%)**	**65 (10%)**
Salad mix	1	28	0	0	0	0	1	28
Bagged salad+	0	0	0	0	1	19	1	19
Frozen vegetables+	0	0	0	0	1	10	1	10
Hummus	0	0	0	0	1	8	1	8
Nuts-Seeds	**2**	**17**	**0**	**0**	**0**	**0**	**2 (7%)**	**17 (3%)**
Hazelnuts	1	6	0	0	0	0	1	6
Pistachios+	1	11	0	0	0	0	1	11
Pork	**1**	**12**	**0**	**0**	**0**	**0**	**1 (4%)**	**12 (2%)**
Pork	1	12	0	0	0	0	1	12
Root/Underground Vegetables	**1**	**29**	**0**	**0**	**0**	**0**	**1 (4%)**	**29 (4%)**
Onions	1	29	0	0	0	0	1	29
Seeded vegetables	**3**	**56**	**0**	**0**	**0**	**0**	**3 (11%)**	**56 (9%)**
Cucumbers*+	1	10	0	0	0	0	1	10
Hot peppers*	1	32	0	0	0	0	1	32
Persian cucumbers*	1	14	0	0	0	0	1	14
Sprouts	**4**	**120**	**1**	**11**	**0**	**0**	**5 (18%)**	**131 (20%)**
Alfalfa sprouts++	1	36	1	11	0	0	2	47
Bean sprouts	2	52	0	0	0	0	2	52
Sprouts	1	32	0	0	0	0	1	32
Vegetable row crops	**1**	**7**	**1**	**11**	**0**	**0**	**2 (7%)**	**18 (3%)**
Iceberg lettuce	0	0	1	11	0	0	1	11
Leafy greens	1	7	0	0	0	0	1	7
TOTAL	**19**	**516**	**5**	**106**	**4**	**39**	**28 (100%)**	**656 (100%)**

Sprouts were the most commonly implicated food in multistate foodborne outbreaks, followed by seeded vegetables.

Twenty-eight multistate outbreaks of **Salmonella**, **STEC**, and **Listeria** infections were linked to a confirmed or suspected food; sprouts were the most commonly implicated food (5 outbreaks) and were associated with the second-most outbreak-related illnesses (131). Although contaminated chicken was the source of fewer multistate outbreaks (2) than sprouts, it resulted in the most outbreak-related illnesses (134).
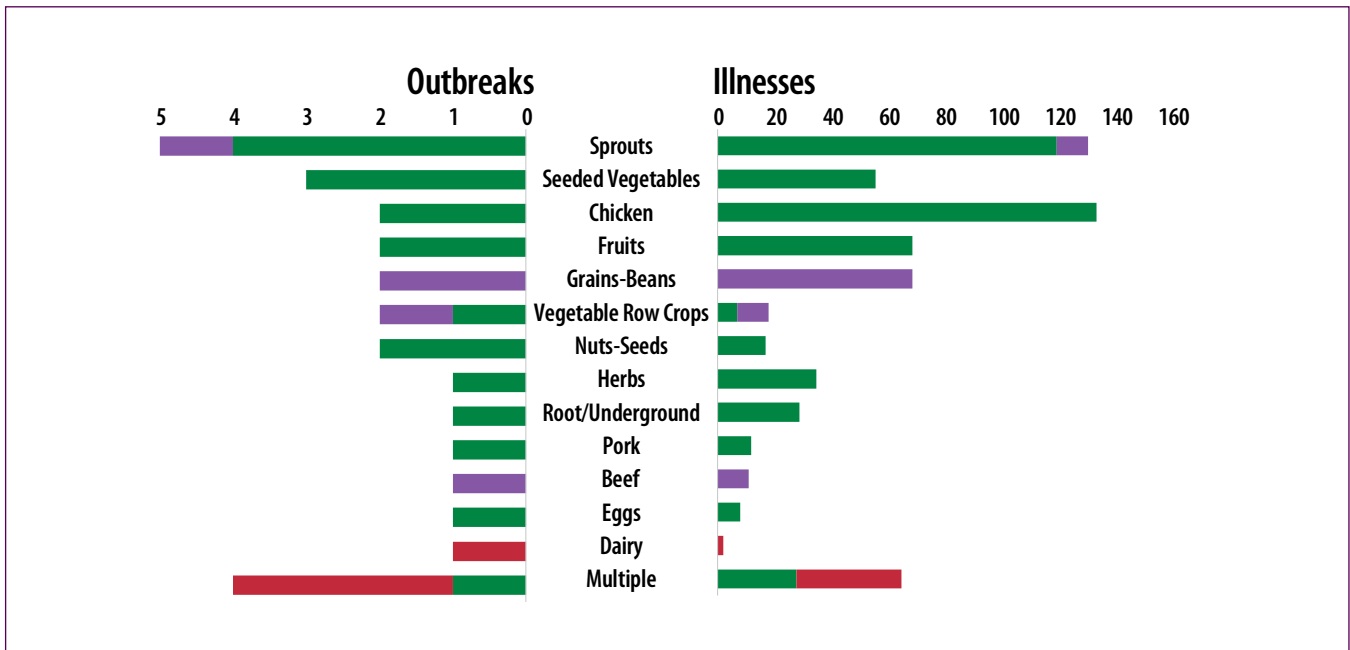
Ready-to-eat (RTE) foods were the source of more outbreaks and outbreak-related illnesses than foods that were not ready-to-eat (NRTE).

Ready-to-eat foods are foods that do not require consumers to cook them before eating them. In 2016, they were the source of more outbreaks and outbreak-related illnesses than foods not considered ready-to-eat.

Notable Multistate Foodborne Outbreaks

Persistent problems and new concerns.

Some of the most notable multistate outbreaks involved foods that hadn't previously been linked to outbreaks or persistent outbreak sources.

STEC 0121/026 and Flour

Why was the outbreak important? This was the first time a STEC outbreak was definitively linked to flour. Although investigators suspected that contaminated flour was the source of a 2009 outbreak linked to cookie dough, they did not have enough evidence to implicate it. Flour was suspected again in a 2016 outbreak linked to pizza dough, but again, there weren't enough data to implicate it.

What happened as a result of this outbreak? This outbreak reinforced the message that raw dough and batter, and other foods made with raw flour should not be eaten raw – even if just tasting. This outbreak raised awareness that children shouldn't play with raw dough. Although consumers may have known to avoid eating dough made with raw eggs, consumers may not have been aware of the risk from eating raw flour. Flour producers are researching ways to reduce risk of product contamination.

Listeria and Frozen Vegetables

Why was the outbreak important? This was the first time an outbreak of *Listeria* infections was linked to frozen produce. Frozen vegetables and fruits were not considered to be ready-to-eat. Consumers should cook frozen fruits and vegetables to a temperature high enough to kill pathogens before eating them, but many people do not know this.

What happened as a result of this outbreak? A very large amount of food was recalled, affecting 456 FDA-regulated products sold under 42 brands, and 47 million pounds of USDA-regulated meat and chicken products containing frozen produce. Preventing future outbreaks like this will need both consumer and industry changes. For consumers, this could include increasing awareness around risks associated with eating uncooked frozen produce, and educating on safely preparing, cooking, and storing frozen produce. For industry, this could include increased focus on sanitation, microbiological monitoring, and other ways to control *Listeria* bacteria in processing environments.

Listeria and Packaged Salad

Why was the outbreak important? This was the first outbreak of *Listeria* infections linked to packaged salads, which are widely eaten. *Listeria* outbreaks had previously been linked to other produce items and packaged salads have been linked to other foodborne pathogens like STEC and *Salmonella*.

What happened as a result of this outbreak? The packaged salad producer recalled all products made at the facility where the outbreak strain was identified. This recall cost the company $25.5 million, along with $85 million in lost revenue. Industry and academic partners are funding research on preventing *Listeria* contamination in facilities that process leafy greens. CDC did not recommend that pregnant women or older adults avoid packaged salads after this outbreak ended.

Salmonella and Sprouts

Why were these outbreaks important? Outbreaks linked to sprouts continue to occur. Sprouts were the most commonly implicated food in multistate foodborne outbreaks in 2016 and caused the second-highest number of outbreak-related illnesses. These outbreaks emphasized the importance of recent federal regulatory measures to improve sprout safety. In late 2015, the U.S. Food and Drug Administration (FDA) published the Produce Safety Rule. It requires sprout producers to treat seeds to reduce microorganisms, and to test water used to sprout seeds from each production batch. The Produce Safety Rule took effect in January 2016 and sprout operations were given 1-3 years to comply, depending on the size of the operation.

What happened after these outbreaks? CDC is working to analyze data on outbreaks linked to sprouts and is evaluating what more can be done to prevent illnesses. Despite the announcement of three outbreaks linked to sprouts in 2016, these outbreaks garnered little attention from consumers compared with other outbreaks. FDA issued draft guidance to help sprout operations comply with the new regulations in 2017. Sprout operations should adhere to the regulations and current guidance to improve the safety of sprouts.

Nearly three-quarters of multistate foodborne outbreaks with a confirmed source resulted in public health action.

Among the 18 multistate foodborne outbreaks with a confirmed source, 13 resulted in public health action that removed contaminated food from the market. This action included recalls for 10 outbreaks, market withdrawals for 2, and a Food Safety and Inspection Service (FSIS) public health alert for 1 outbreak.

▲ RECALL (FDA)

⬟ MARKET WITHDRAWAL (FDA)

■ HEALTH ALERT (FSIS)
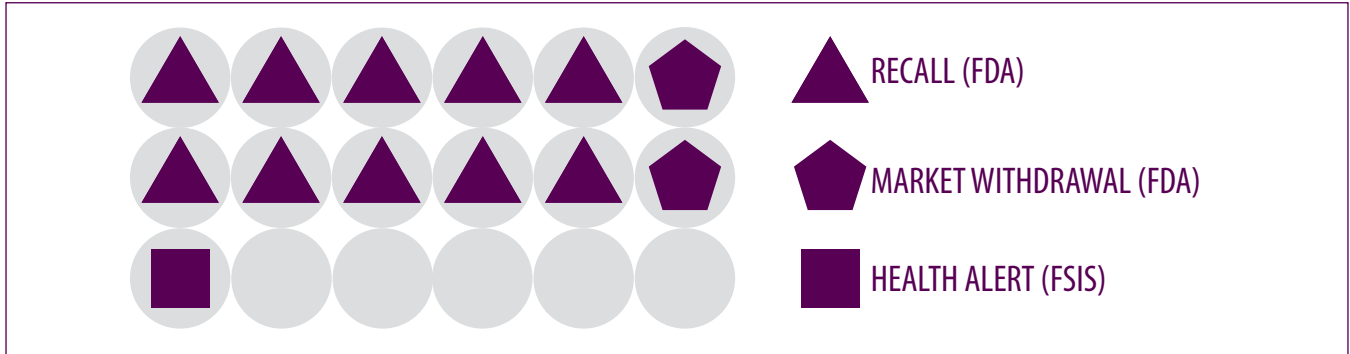
CDC announced 11 multistate foodborne outbreaks to the public.

Each of these 11 multistate foodborne outbreaks were posted on CDC's website, and had at least two postings and as many as four that updated the outbreak status, for a total of 28 postings. In all, there were 850,118 page views. Media advisories were also issued for most of these announced outbreaks.
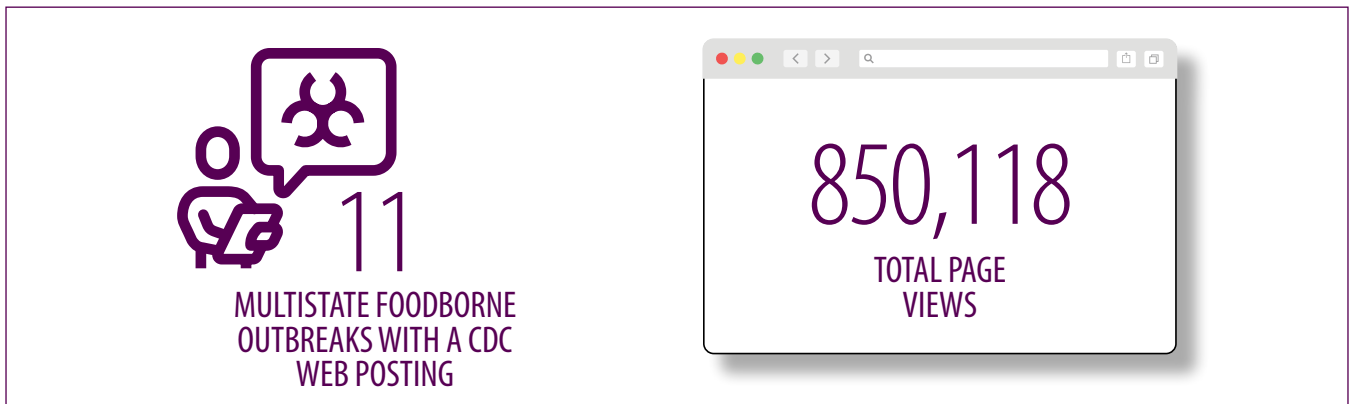
11
MULTISTATE FOODBORNE OUTBREAKS WITH A CDC WEB POSTING

850,118
TOTAL PAGE VIEWS

CDC web postings for *Listeria monocytogenes* disease outbreaks drew the most page views.

The median number of page views for STEC and *Salmonella* disease outbreaks was similar, but the median number of page views for *Listeria* disease outbreaks was more than 6 times higher. Page views for each post ranged from 13,234 to 384,613.

Median page views

Listeria monocytogenes	128,187
STEC	17,117
Salmonella	20,146
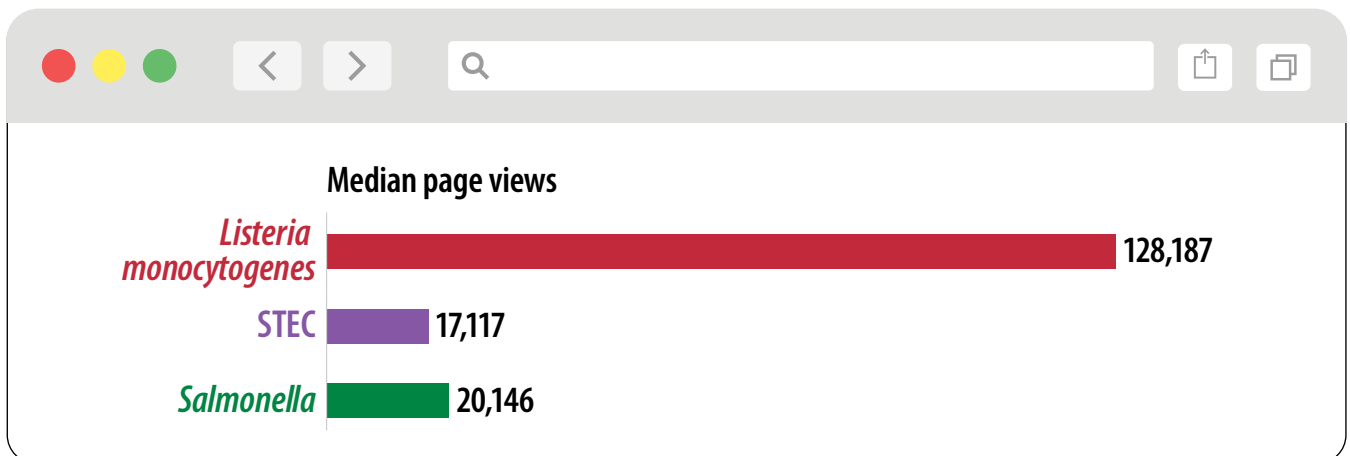
Communication Metrics

CDC used Facebook and Twitter to reach a wider audience.

CDC posted 28 messages on CDC's primary Facebook account for the 11 multistate foodborne outbreaks with public warnings. The postings had a total of 50,469 likes and 62,168 shares.

11 MULTISTATE FOODBORNE OUTBREAKS HAD FACEBOOK MESSAGES

50,469 TOTAL LIKES

62,168 TOTAL SHARES

CDC tweeted 39 times about the 11 multistate foodborne outbreaks, resulting in 5,171 retweets.
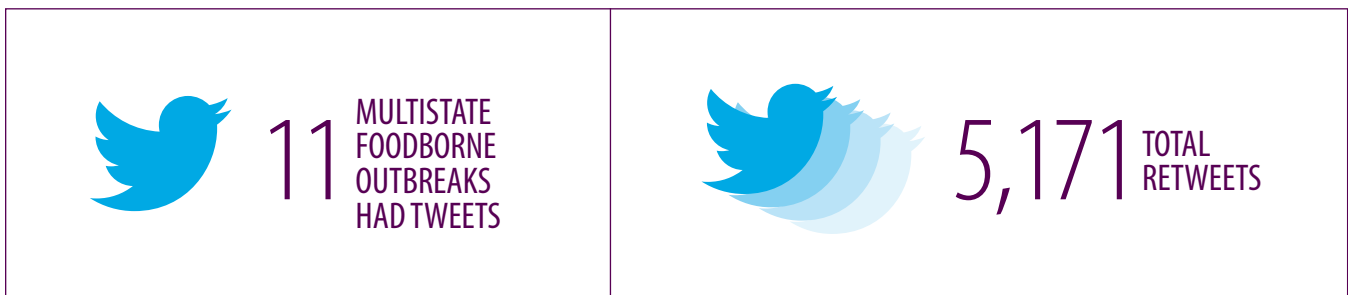
11 MULTISTATE FOODBORNE OUTBREAKS HAD TWEETS

5,171 TOTAL RETWEETS

CDC Facebook messages for *Listeria* disease outbreaks drew more shares and likes than postings for *Salmonella* and STEC disease outbreaks.

Multistate foodborne outbreaks of *Listeria* had more median shares and likes on Facebook than STEC and *Salmonella*.
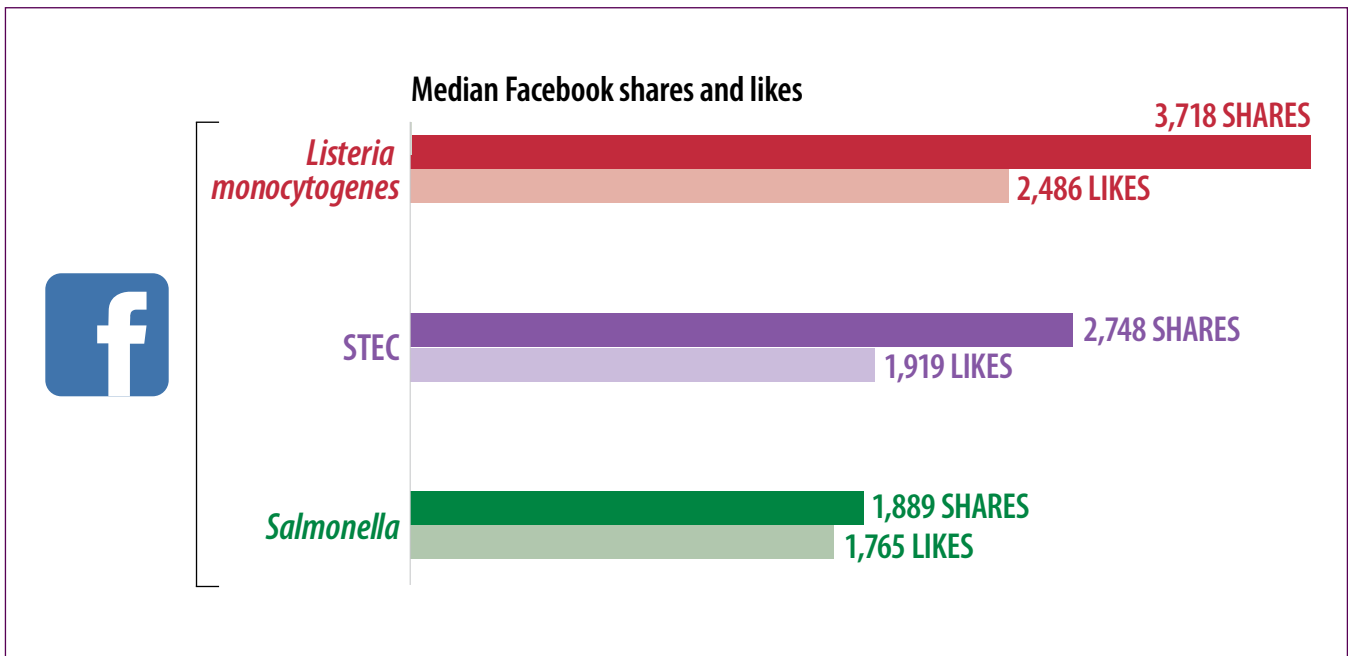
Median Facebook shares and likes

Listeria monocytogenes: 3,718 SHARES, 2,486 LIKES

STEC: 2,748 SHARES, 1,919 LIKES

Salmonella: 1,889 SHARES, 1,765 LIKES

CDC tweets for *Salmonella* disease outbreaks resulted in more retweets than for STEC and *Listeria monocytogenes* disease outbreaks.

The median number of retweets for multistate foodborne outbreaks caused by *Salmonella* was higher than STEC or *Listeria monocytogenes*.

Median Twitter retweets

Listeria monocytogenes	234
STEC	190
Salmonella	340

Outbreaks linked to new food sources drew the most attention.

Among the foodborne outbreaks that were announced via a web posting, *Listeria* disease outbreaks linked to bagged lettuce and frozen vegetables attracted the most page views, followed by the STEC disease outbreak linked to flour. All three foods were novel outbreak sources f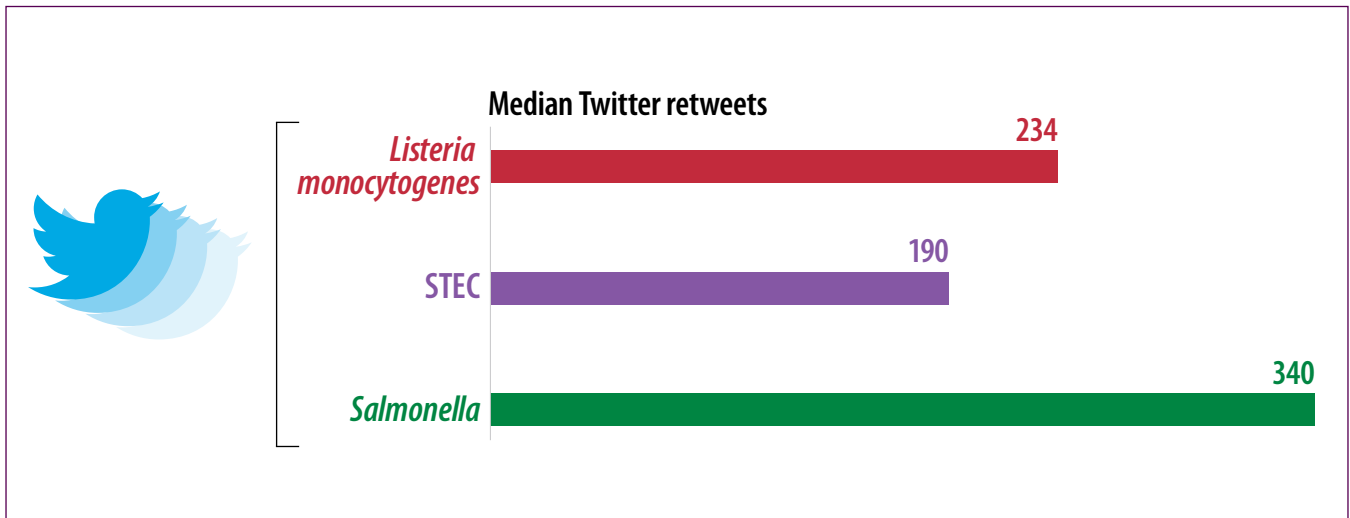or these pathogens, meaning that CDC had not previously identified outbreaks caused by these pathogens in these foods. The foodborne outbreaks with the least number of web page views were the three *Salmonella* disease outbreaks linked to sprouts.

Total page views

Bagged salad	384,613
Frozen vegetables	128,187
Flour	92,957
Pistachios	74,475
Meal replacement shakes	44,710
Raw milk	42,904
Eggs	20,146
Alfalfa sprouts	17,797
Ground Beef	17,177
Alfalfa sprouts	13,918
Sprouts	13,234
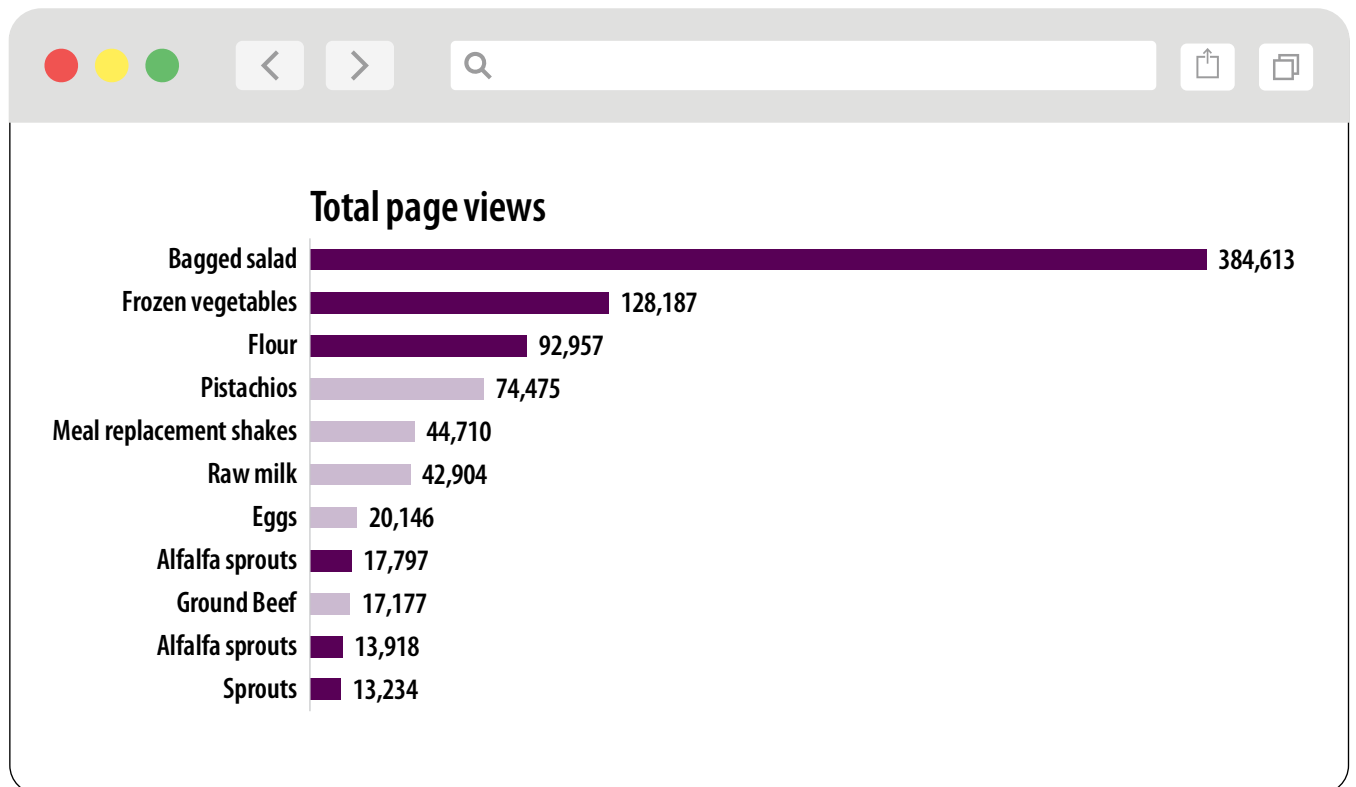
For each foodborne outbreak message on Facebook, there were more shares than likes, except for outbreaks linked to sprouts and raw milk. Social media warnings like these can result in the public warning their friends and contacts by sharing information. The *Listeria* disease outbreak linked to bagged salad drew the most likes, shares, and comments on Facebook. Outbreaks linked to flour and meal replacement shakes also saw high engagement with Facebook messages.

	Total LIKES on Facebook	Total COMMENTS on Facebook	Total SHARES on Facebook
Bagged salad	21,641	26,408	10,985
Flour	9,597	12,867	3,171
Meal replacement shakes	6,917	8,036	2,818
Frozen vegetables	2,486	3,718	1,154
Sprouts	2,006	1,889	317
Ground Beef	1,919	2,748	687
Pistachios	1,765	3,246	849
Raw milk	1,702	1,112	721
Alfalfa sprouts	1,524	1,112	268
Eggs	472	621	124
Alfalfa sprouts	440	411	91
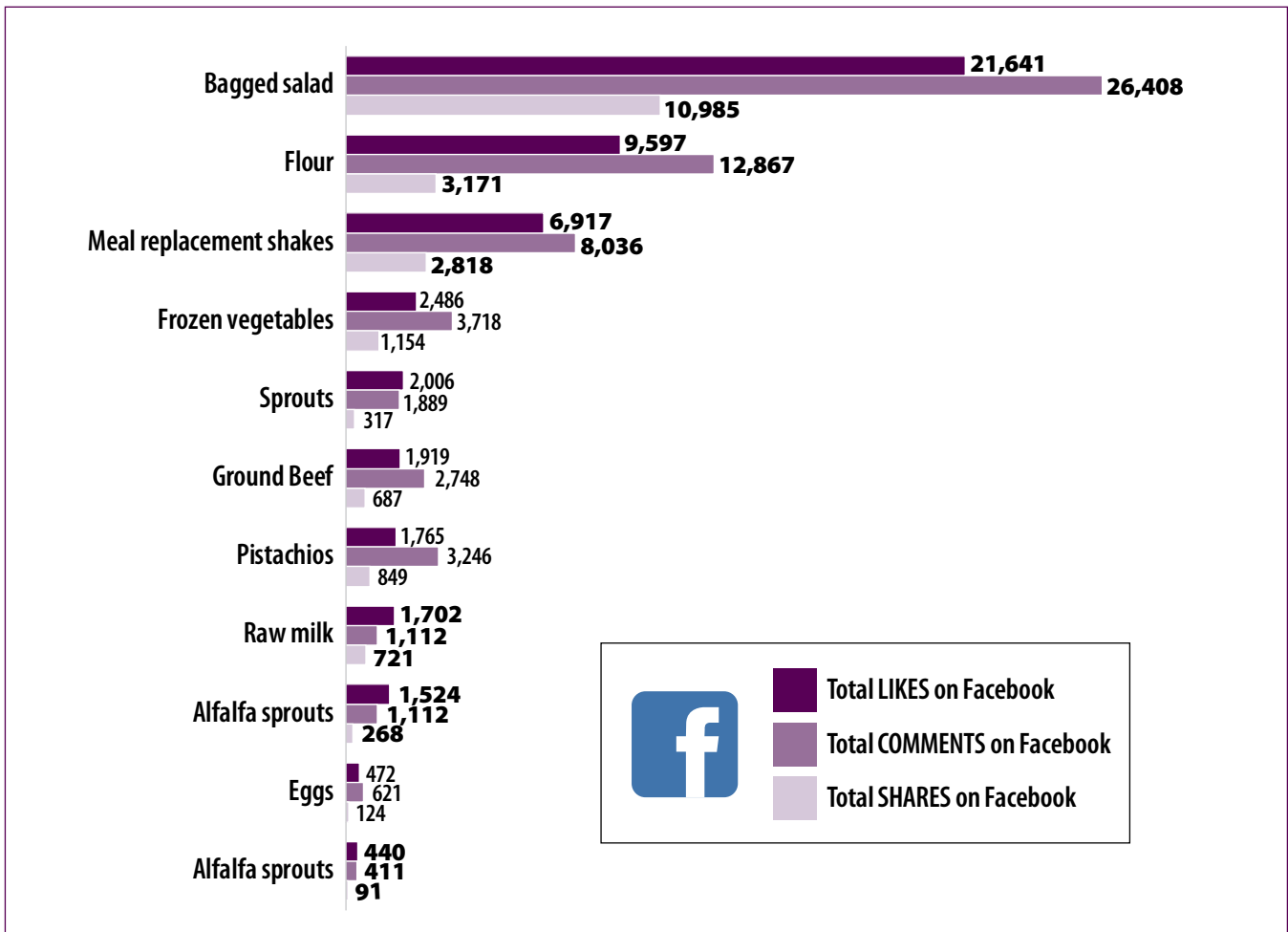
The outbreaks linked to packaged salad, meal replacement shakes, and flour had the most retweets and highest engagement levels with the public. Of note, outbreaks linked to sprouts received comparatively more attention on Twitter vs. other platforms.

Total retweets

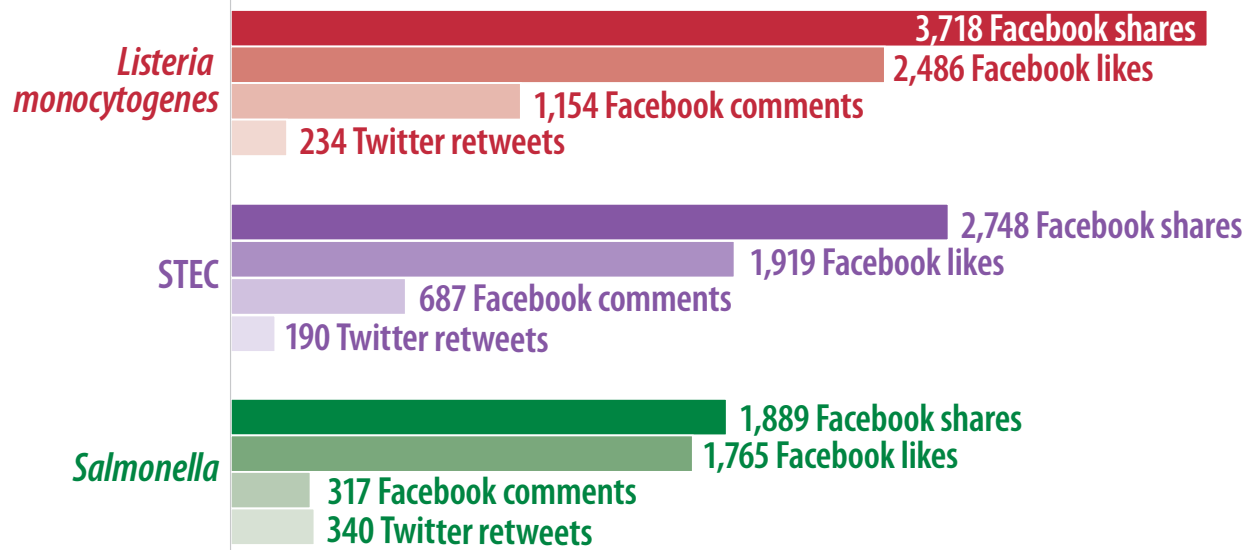|	
Bagged salad	1,124
Meal replacement shakes	1,059
Flour	989
Sprouts	515
Pistachios	340
Alfalfa sprouts	277
Frozen vegetables	234
Raw milk	233
Alfalfa sprouts	190
Ground Beef	111
Eggs	99
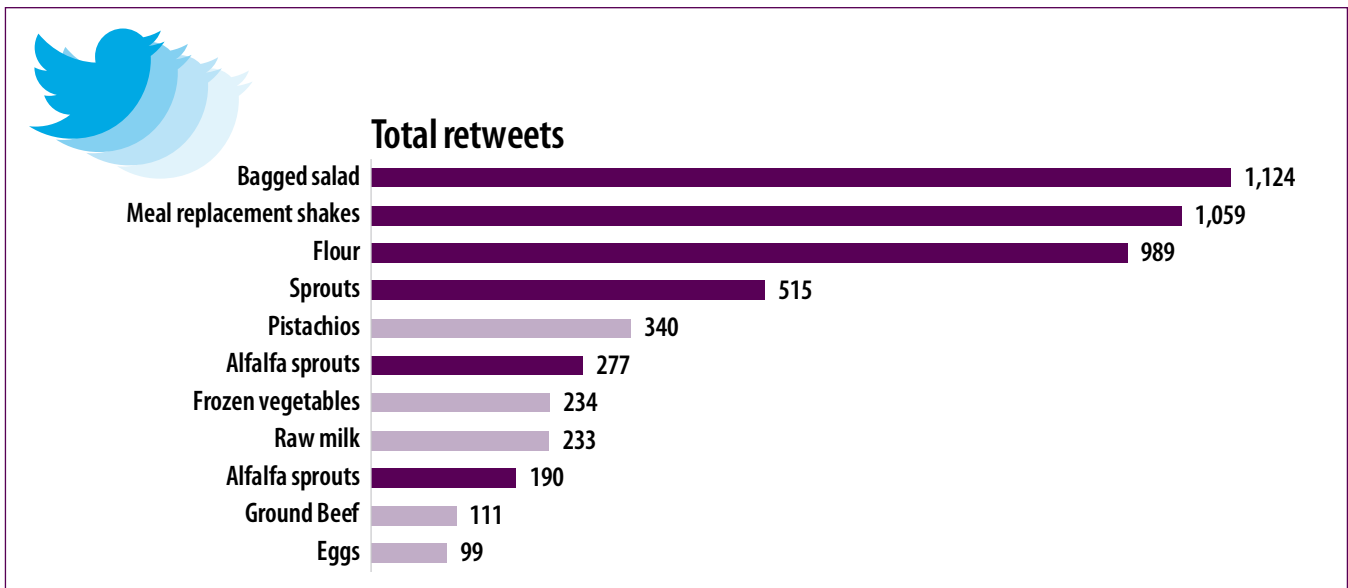
The public interacted more with CDC's posts on Facebook than on Twitter.

Among all multistate foodborne outbreaks that were communicated via social media, there was more interaction on Facebook than on Twitter across all pathogens.

Median Facebook shares, likes, comments, and Twitter retweets

Listeria monocytogenes
- 3,718 Facebook shares
- 2,486 Facebook likes
- 1,154 Facebook comments
- 234 Twitter retweets

STEC
- 2,748 Facebook shares
- 1,919 Facebook likes
- 687 Facebook comments
- 190 Twitter retweets

Salmonella
- 1,889 Facebook shares
- 1,765 Facebook likes
- 317 Facebook comments
- 340 Twitter retweets

VERSES

Multistate **Foodborne Outbreaks** of
Salmonella, STEC, and *Listeria monocytogenes* infections in 2016

SALMONELLA

STEC

LISTERIA

By Food Category

RAW GROUND BEEF FROM SINGLE SLAUGHTERHOUSE (Confirmed)

- **PATHOGEN(S):**
  E. coli O157
- **RECALL:** Yes*
- **CDC WEB POST:** Yes**

1 MULTISTATE OUTBREAK

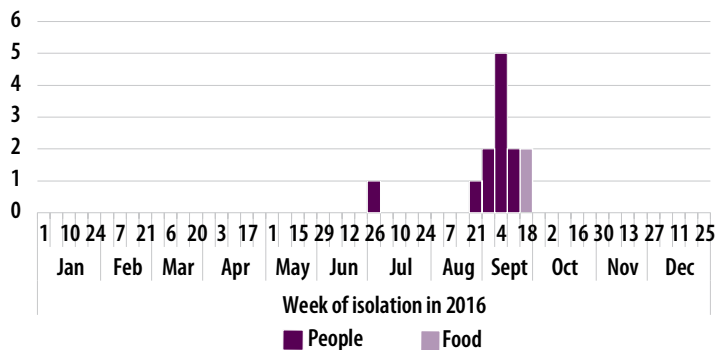**7** PEOPLE HOSPITALIZED

11 PEOPLE SICK WITH OUTBREAK STRAIN

0 PEOPLE DIED

*Recall announcement: https://www.fsis.usda.gov/wps/portal/fsis/topics/recalls-and-public-health-alerts/recall-case-archive/archive/2016/recall-087-2016-release
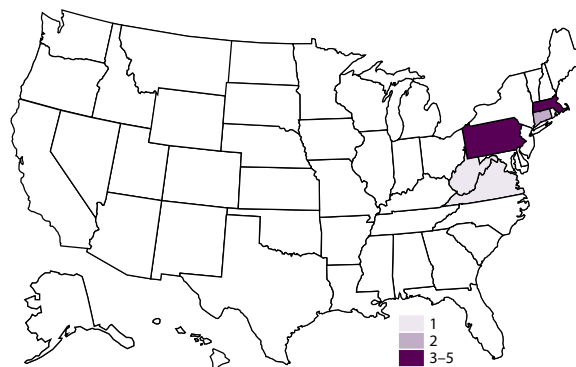**CDC outbreak posting: https://www.cdc.gov/ecoli/2016/o157h7-09-16/index.html

WHEN DID THE OUTBREAK OCCUR?

Number of people infected with the outbreak strain and other samples with the outbreak strain, by week of isolation.
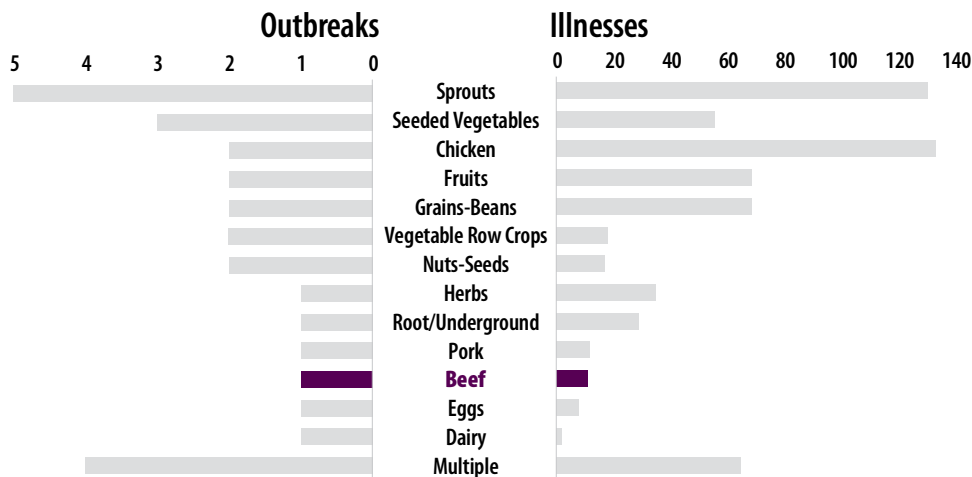
Week of isolation in 2016

■ People ■ Food

HOW WIDESPREAD WAS THIS OUTBREAK?

People linked to the outbreak, by state of residence.

1
2
3–5

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO BEEF COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016,
contaminated beef was the source of 4% of outbreaks and 2% of outbreak-related illnesses.

Outbreaks

5 4 3 2 1 0

Illnesses

0 20 40 60 80 100 120 140

- Sprouts
- Seeded Vegetables
- Chicken
- Fruits
- Grains-Beans
- Vegetable Row Crops
- Nuts-Seeds
- Herbs
- Root/Underground
- Pork
- **Beef**
- Eggs
- Dairy
- Multiple

Chicken

RAW CHICKEN, READY-TO-EAT ROTISSERIE CHICKEN, AND ROTISSERIE CHICKEN SALAD (Confirmed); RAW CHICKEN (Suspected)

- **PATHOGEN(S):**
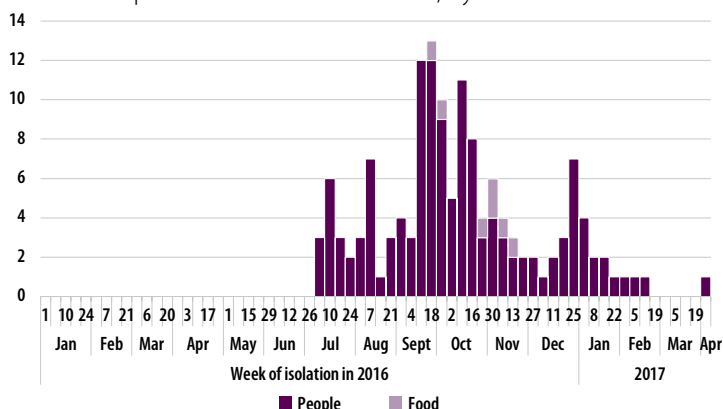 *Salmonella* I 4,5,12:i- (1), Saintpaul (1)
- **RECALL:** Yes (1)*
- **CDC WEB POST:** No

2 MULTISTATE OUTBREAKS

22 PEOPLE HOSPITALIZED

134 PEOPLE SICK WITH OUTBREAK STRAINS

0 PEOPLE DIED

*Recall announcement: https://www.fsis.usda.gov/wps/portal/fsis/newsroom/news-releases-statements-transcripts/news-release-archives-by-year/archive/2016/pha-100916
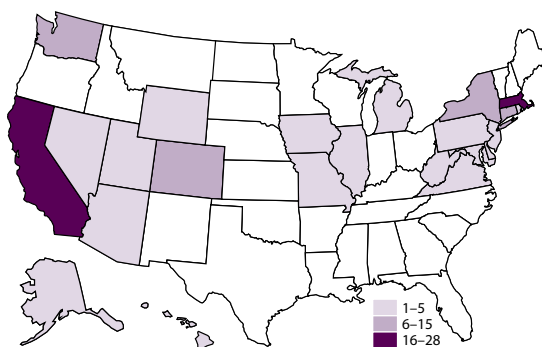
WHEN DID THE OUTBREAKS OCCUR?

Number of people infected with the outbreak strains and other samples with the outbreak strain, by week of isolation.

Week of isolation in 2016 — 2017

Legend: People, Food

HOW WIDESPREAD WERE THESE OUTBREAKS?

People linked to the outbreaks, by state of residence.

Legend: 1–5, 6–15, 16–28

HOW DO THE NUMBER OF OUTBREAKS AND ILLNESSES LINKED TO CHICKEN COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated chicken was the source of 7% of outbreaks and 20% of outbreak-related illnesses.

Outbreaks (scale: 5 4 3 2 1 0) — Illnesses (scale: 0 20 40 60 80 100 120 140)

Categories: Sprouts, Seeded Vegetables, Chicken, Fruits, Grains-Beans, Vegetable Row Crops, Nuts-Seeds, Herbs, Root/Underground, Pork, Beef, Eggs, Dairy, Multiple

PORK (Suspected)

- **PATHOGEN(S):**
  Salmonella Goldcoast
- **RECALL:** No
- **CDC WEB POST:** No

1 MULTISTATE OUTBREAK

1 PERSON HOSPITALIZED

12 PEOPLE SICK WITH OUTBREAK STRAIN

0 PEOPLE DIED

WHEN DID THE OUTBREAK OCCUR?

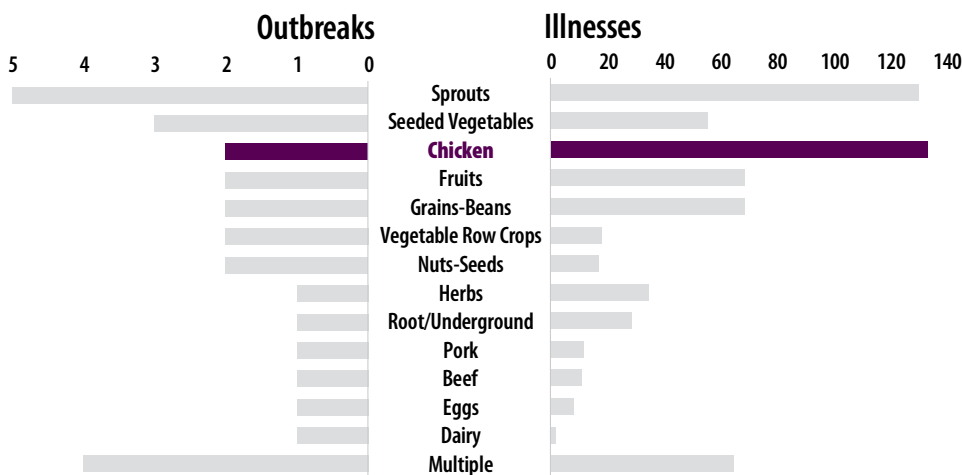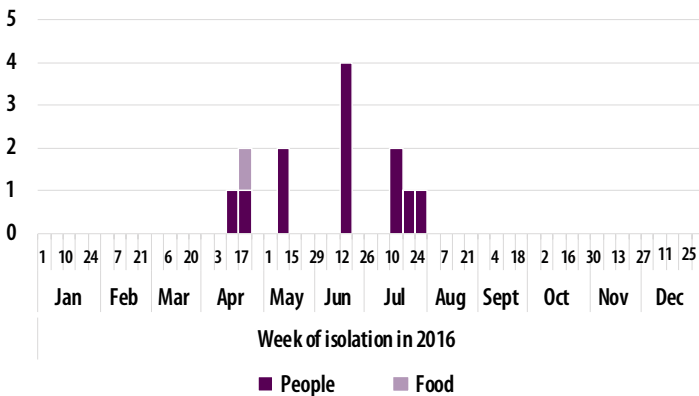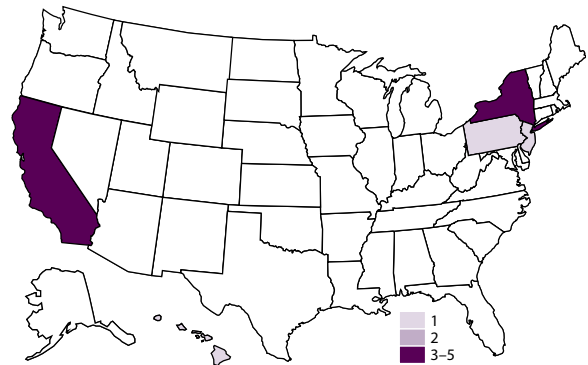Number of people infected with the outbreak strain and other samples with the outbreak strain, by week of isolation.
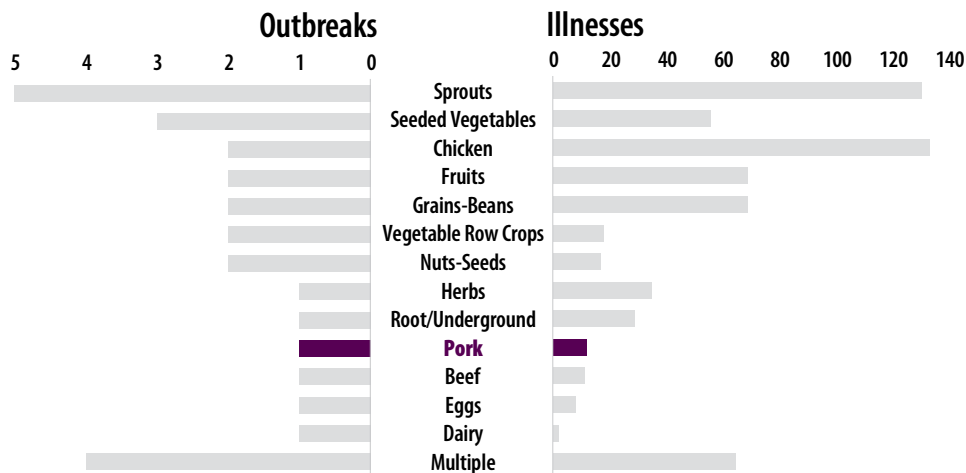
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
	1 10 24	7 21	6 20	3 17	1 15 29	12 26	10 24	7 21	4 18	2 16 30	13 27	11 25

Week of isolation in 2016

■ People ■ Food

HOW WIDESPREAD WAS THIS OUTBREAK?

People linked to the outbreak, by state of residence.

1
2
3–5

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO PORK COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated pork was the source of 4% of outbreaks and 2% of outbreak-related illnesses.

Outbreaks

5 4 3 2 1 0

Illnesses

0 20 40 60 80 100 120 140

- Sprouts
- Seeded Vegetables
- Chicken
- Fruits
- Grains-Beans
- Vegetable Row Crops
- Nuts-Seeds
- Herbs
- Root/Underground
- **Pork**
- Beef
- Eggs
- Dairy
- Multiple

Dairy

UNPASTEURIZED RAW MILK FROM A SINGLE PRODUCER (Confirmed)

- **PATHOGEN(S):** *Listeria*
- **RECALL:** No
- **CDC WEB POST:** Yes*

1 MULTISTATE OUTBREAK

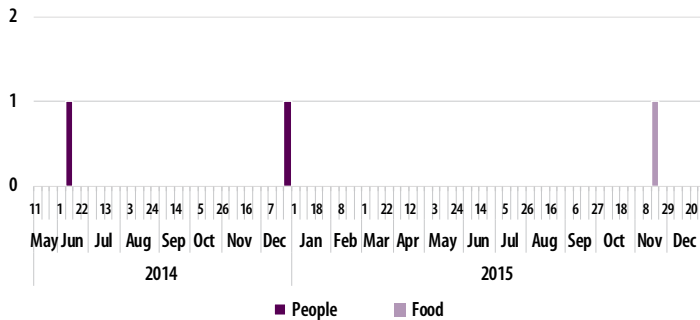**2** PEOPLE HOSPITALIZED

2 PEOPLE SICK WITH OUTBREAK STRAIN

1 PERSON DIED

*CDC outbreak posting:
https://www.cdc.gov/listeria/outbreaks/raw-milk-03-16/index.html

WHEN DID THE OUTBREAK OCCUR?

Number of people infected with the outbreak strain and other samples with the outbreak strain, by week of isolation.
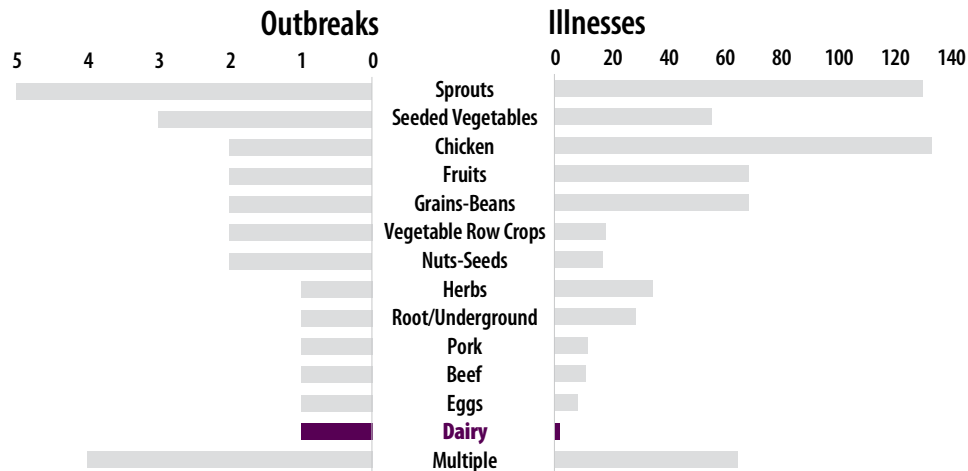
11 1 22 13	3 24 14 5 26 16	7 1 18 8 1 22 12 3 24 14 5 26 16 6 27 18 8 29 20
May Jun Jul Aug	Sep Oct Nov Dec	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
2014		2015

■ People   ■ Food

HOW WIDESPREAD WAS THIS OUTBREAK?

People linked to the outbreak, by state of residence.

■ 1

HOW DO THE NUMBER OF OUTBREAKS AND ILLNESSES LINKED TO DAIRY COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated unpasteurized dairy was the source of 4% of outbreaks and <1% of outbreak-related illnesses.

Outbreaks   **Illnesses**

Outbreaks	Category	Illnesses
5 4 3 2 1 0		0 20 40 60 80 100 120 140
	Sprouts	
	Seeded Vegetables	
	Chicken	
	Fruits	
	Grains-Beans	
	Vegetable Row Crops	
	Nuts-Seeds	
	Herbs	
	Root/Underground	
	Pork	
	Beef	
	Eggs	
	Dairy	
	Multiple	

SHELL EGGS FROM SINGLE COMPANY (Confirmed)

- **PATHOGEN(S):**
  Salmonella Oranienburg
- **RECALL:** Yes*
- **CDC WEB POST:** Yes**

1 MULTISTATE OUTBREAK

**2** PEOPLE HOSPITALIZED

8 PEOPLE SICK WITH OUTBREAK STRAIN

0 PEOPLE DIED

*Recall announcement: http://web.archive.org/web/20161007194845/http://www.fda.gov/safety/recalls/ucm523727.htm
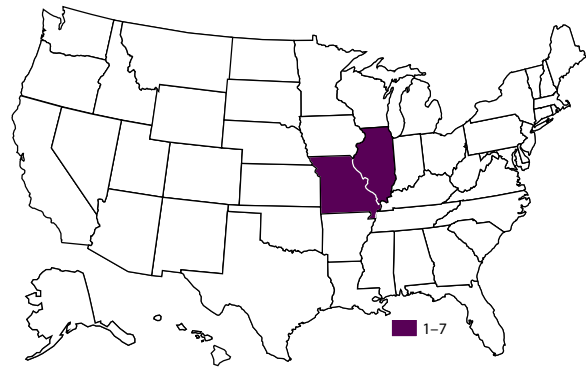**CDC outbreak posting: https://www.cdc.gov/salmonella/oranienburg-10-16/

WHEN DID THE OUTBREAK OCCUR?

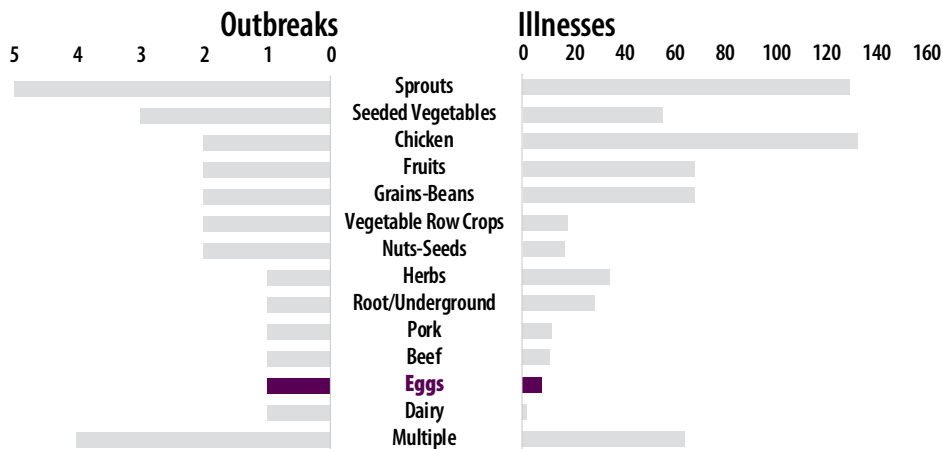Number of people infected with the outbreak strain and other samples with the outbreak strain, by week of isolation.

Week of isolation in 2016
■ People   ■ Environment
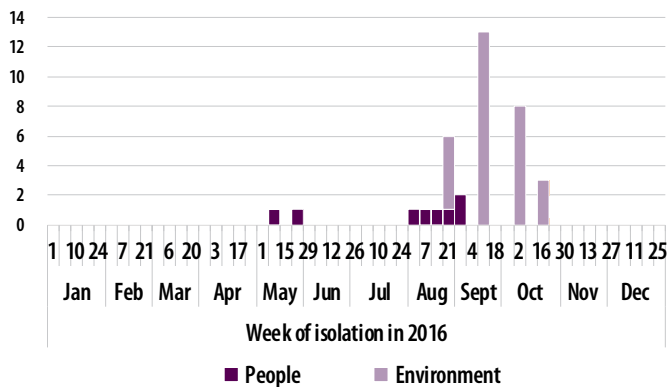
HOW WIDESPREAD WAS THIS OUTBREAKS?

People linked to the outbreak, by state of residence.

■ 1–7

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO EGGS COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated eggs were the source of 4% of outbreaks and 1% of outbreak-related illnesses.

Outbreaks
5   4   3   2   1   0

Illnesses
0   20   40   60   80   100   120   140   160

- Sprouts
- Seeded Vegetables
- Chicken
- Fruits
- Grains-Beans
- Vegetable Row Crops
- Nuts-Seeds
- Herbs
- Root/Underground
- Pork
- Beef
- Eggs
- Dairy
- Multiple

ALFALFA SPROUTS (2, Confirmed), BEAN SPROUTS (2, Suspected), UNSPECIFIED SPROUTS (1, Confirmed)

- **PATHOGEN(S):** *Salmonella* Abony and Reading (1), Braenderup (1), Enteritidis (1), Muenchen (1), *E. coli* O157 (1)
- **RECALL:** Yes (2)*
- **CDC WEB POST:** Yes (3)**

5 MULTISTATE OUTBREAKS

29 PEOPLE HOSPITALIZED
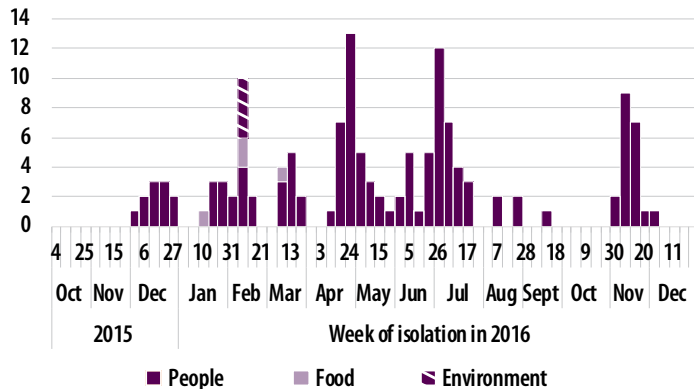
131 PEOPLE SICK WITH OUTBREAK STRAINS

1 PERSON DIED

*Recall announcements: https://www.fda.gov/Food/RecallsOutbreaksEmergencies/Outbreaks/ucm515300.htm, https://wayback.archive-it.org/7993/20170723003943/https://www.fda.gov/Safety/Recalls/ucm488347.htm
**CDC outbreak postings: http://www.cdc.gov/salmonella/muenchen-02-16/index.html, http://www.cdc.gov/salmonella/reading-08-16/index.html, https://www.cdc.gov/ecoli/2016/o157-02-16/index.html

WHEN DID THE OUTBREAKS OCCUR?

Number of people infected with the outbreak strains and other samples with the outbreak strains, by week of isolation.

Legend: People, Food, Environment

HOW WIDESPREAD WERE THESE OUTBREAKS?

People linked to the outbreaks, by state of residence.

Legend: 1–5, 6–10, 11–17

HOW DO THE NUMBER OF OUTBREAKS AND ILLNESSES LINKED TO SPROUTS COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated sprouts were the source of 18% of outbreaks and 20% of outbreak-related illnesses.

Outbreaks / Illnesses by food category: Sprouts, Seeded Vegetables, Chicken, Fruits, Grains-Beans, Vegetable Row Crops, Nuts-Seeds, Herbs, Root/Underground, Pork, Beef, Eggs, Dairy, Multiple

ICEBERG LETTUCE (Suspected), UNSPECIFIED LEAFY GREENS (Suspected)

- **PATHOGEN(S):**
  E. coli O157 (1), *Salmonella* Enteritidis (1)
- **RECALL:** No
- **CDC WEB POST:** No

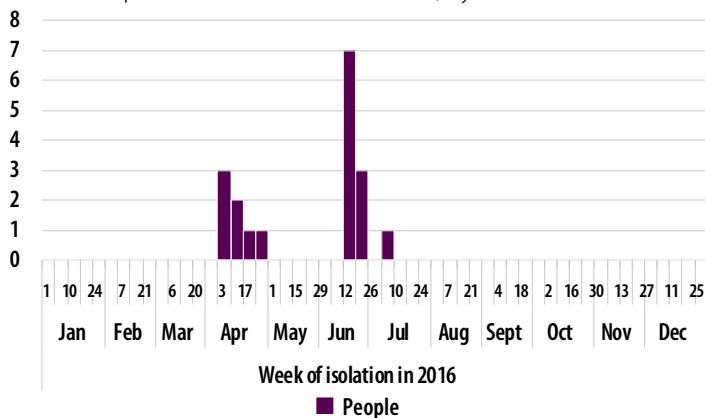**2** MULTISTATE OUTBREAKS

5 PEOPLE HOSPITALIZED

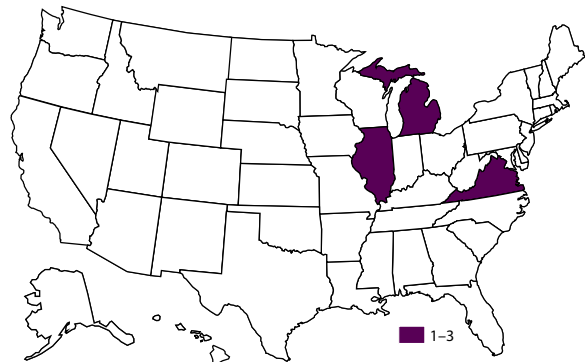**18** PEOPLE SICK WITH OUTBREAK STRAINS

0 PEOPLE DIED

WHEN DID THE OUTBREAKS OCCUR?

Number of people infected with the outbreak strains and other samples with the outbreak strains, by week of isolation.
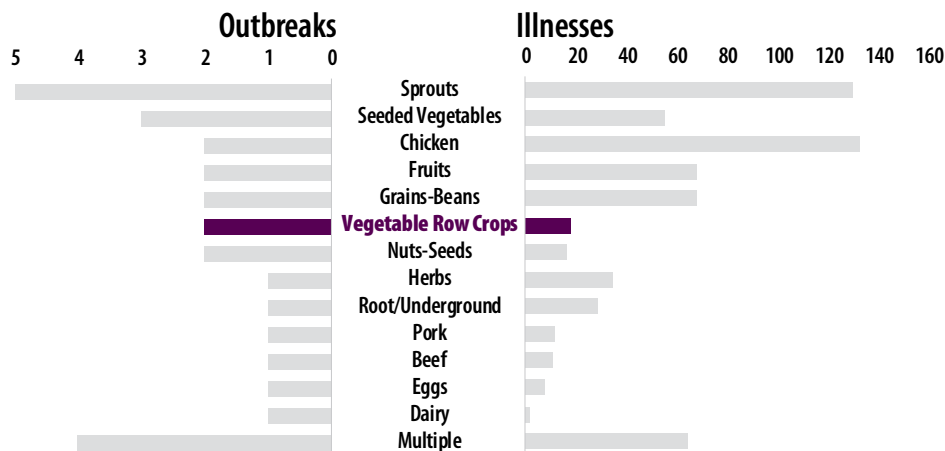
Week of isolation in 2016

■ People

HOW WIDESPREAD WERE THESE OUTBREAKS?

People linked to the outbreaks, by state of residence.

■ 1–3

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO VEGETABLE ROW CROPS COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated vegetable row crops were the source of 7% of outbreaks and 3% of outbreak-related illnesses.

Outbreaks | **Illnesses**

Sprouts
Seeded Vegetables
Chicken
Fruits
Grains-Beans
Vegetable Row Crops
Nuts-Seeds
Herbs
Root/Underground
Pork
Beef
Eggs
Dairy
Multiple

CUCUMBERS (Confirmed), PERSIAN CUCUMBERS (Confirmed), HOT PEPPERS (Confirmed)

- **PATHOGEN(S):**
  Salmonella Saintpaul (1), Oslo (1), Anatum (1)
- **RECALL:** Yes (1)
- **CDC WEB POST:** No

3 MULTISTATE OUTBREAKS

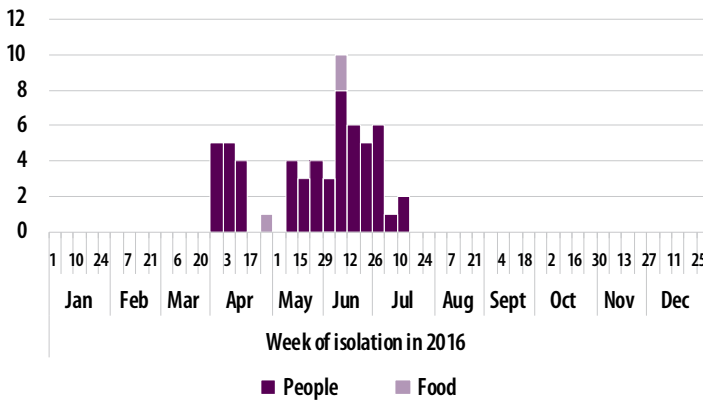**14** PEOPLE HOSPITALIZED

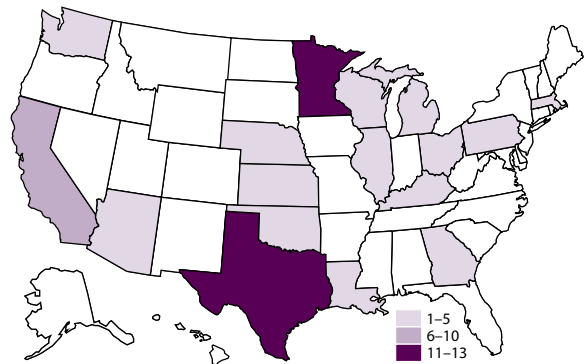**56** PEOPLE SICK WITH OUTBREAK STRAINS

0 PEOPLE DIED

WHEN DID THE OUTBREAKS OCCUR?

Number of people infected with the outbreak strains and other samples with the outbreak strains, by week of isolation.
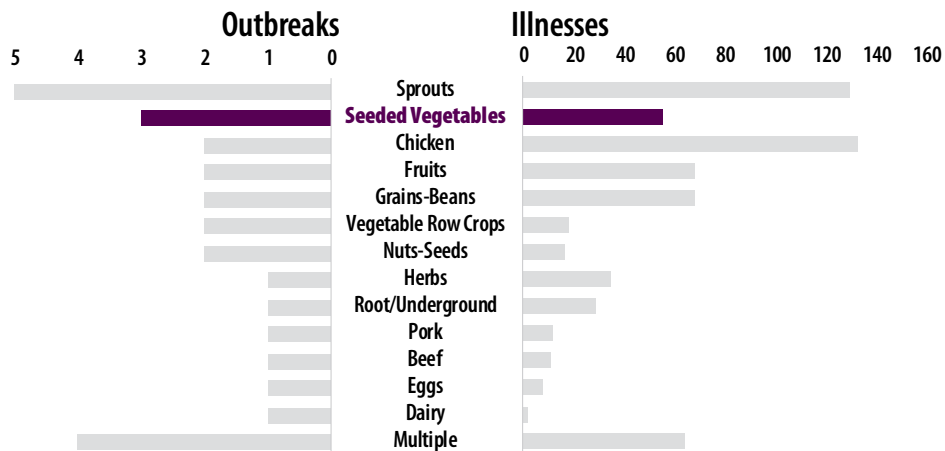
Week of isolation in 2016

■ People ■ Food

HOW WIDESPREAD WERE THESE OUTBREAKS?

People linked to the outbreaks, by state of residence.

1–5
6–10
11–13

HOW DO THE NUMBER OF OUTBREAKS AND ILLNESSES LINKED TO SEEDED VEGETABLES COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated seeded vegetables were the source of 11% of outbreaks and 9% of outbreak-related illnesses.

Outbreaks   **Illnesses**

	Outbreaks	Illnesses
Sprouts		
Seeded Vegetables		
Chicken		
Fruits		
Grains-Beans		
Vegetable Row Crops		
Nuts-Seeds		
Herbs		
Root/Underground		
Pork		
Beef		
Eggs		
Dairy		
Multiple		

RAW ONIONS (Suspected)

- **PATHOGEN(S):**
  Salmonella Javiana
- **RECALL:** No
- **CDC WEB POST:** No

1 MULTISTATE OUTBREAK

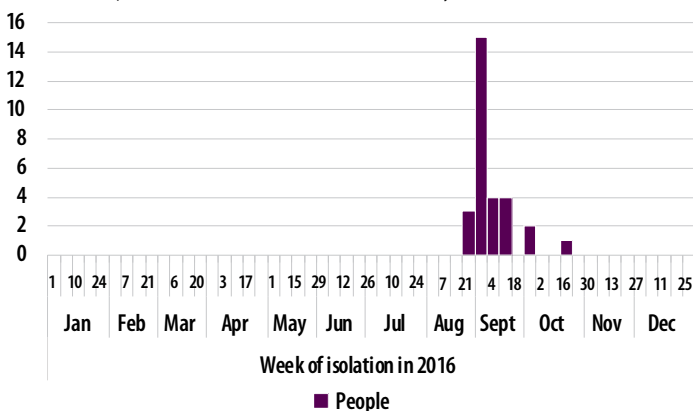**6** PEOPLE HOSPITALIZED

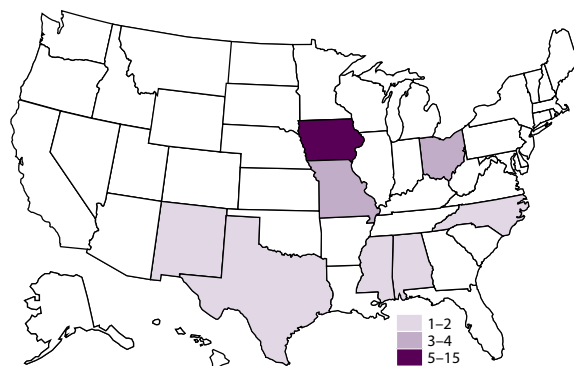**29** PEOPLE SICK WITH OUTBREAK STRAIN

0 PEOPLE DIED

WHEN DID THE OUTBREAK OCCUR?

Number of people infected with the outbreak strain and other samples with the outbreak strain, by week of isolation.
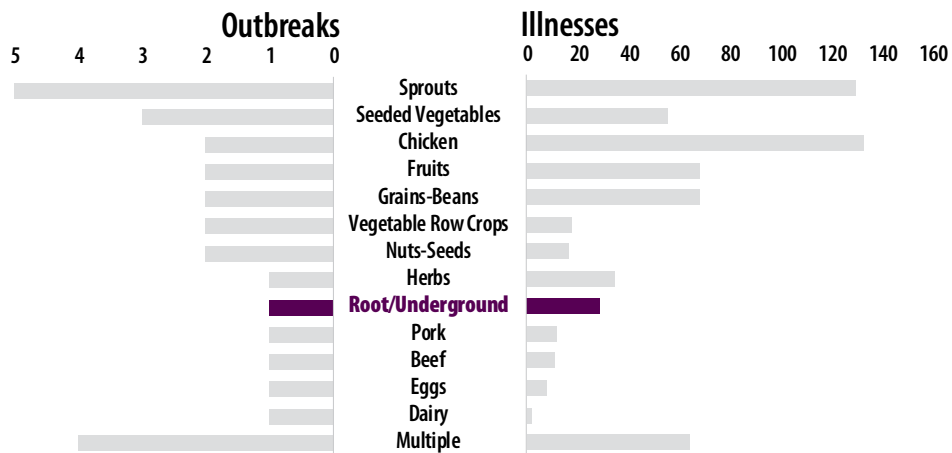
Week of isolation in 2016

■ People

HOW WIDESPREAD WAS THIS OUTBREAK?

People linked to the outbreak, by state of residence.

1–2
3–4
5–15

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO ROOT/UNDERGROUND VEGETABLES COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated root/underground vegetables were the source of 4% of outbreaks and 4% of outbreak-related illnesses.

Outbreaks

5 4 3 2 1 0

Illnesses

0 20 40 60 80 100 120 140 160

- Sprouts
- Seeded Vegetables
- Chicken
- Fruits
- Grains-Beans
- Vegetable Row Crops
- Nuts-Seeds
- Herbs
- Root/Underground
- Pork
- Beef
- Eggs
- Dairy
- Multiple

MORINGA LEAF IN MEAL REPLACEMENT POWDER (Confirmed)

- **PATHOGEN(S):** *Salmonella* Virchow
- **RECALL:** Yes*
- **CDC WEB POST:** Yes**

1 MULTISTATE OUTBREAK

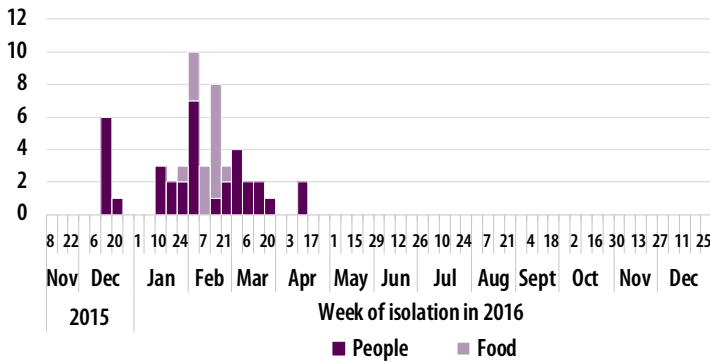**6** PEOPLE HOSPITALIZED

35 PEOPLE SICK WITH OUTBREAK STRAIN

0 PEOPLE DIED

*Recall announcement: https://www.gardenoflife.com/content/important-raw-meal-announcement/
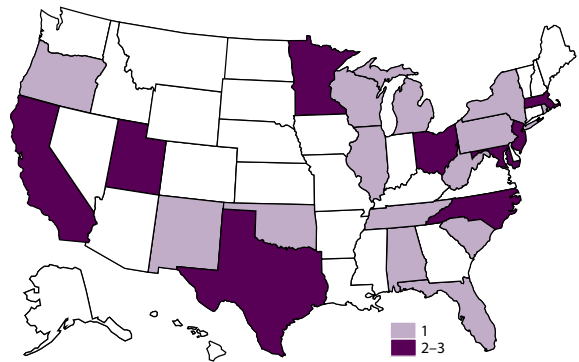**CDC outbreak posting: http://www.cdc.gov/salmonella/virchow-02-16/index.html

WHEN DID THE OUTBREAK OCCUR?

Number of people infected with the outbreak strain and other samples with the outbreak strain, by week of isolation.
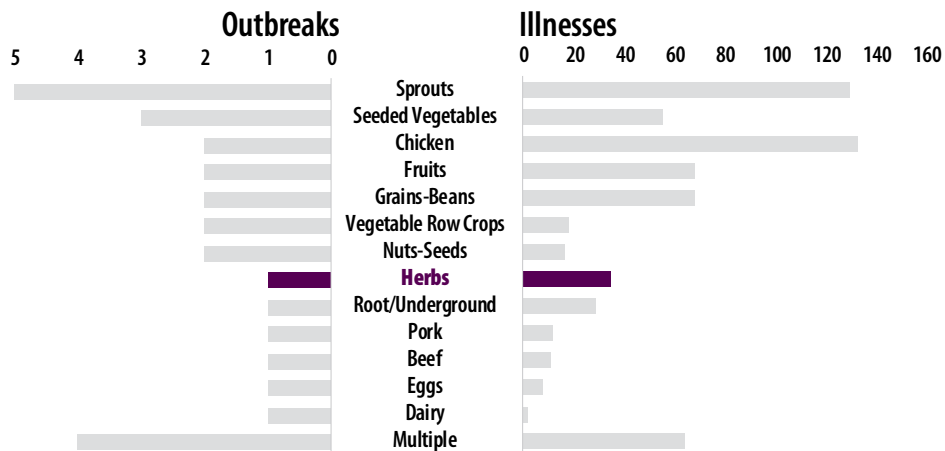

Week of isolation in 2016

■ People ■ Food

HOW WIDESPREAD WAS THIS OUTBREAK?

People linked to the outbreak, by state of residence.

1
2–3

HOW DO THE NUMBER OF OUTBREAKS AND ILLNESSES LINKED TO HERBS COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated herbs were the source of 4% of outbreaks and 5% of outbreak-related illnesses.

Outbreaks: 5 4 3 2 1 0
Illnesses: 0 20 40 60 80 100 120 140 160

Sprouts
Seeded Vegetables
Chicken
Fruits
Grains-Beans
Vegetable Row Crops
Nuts-Seeds
Herbs
Root/Underground
Pork
Beef
Eggs
Dairy
Multiple

Nuts/Seeds

HAZELNUTS (Confirmed), **PISTACHIOS** (Confirmed)

- **PATHOGEN(S):**
  Salmonella Typhimurium (1), Montevideo (1)
- **RECALL:** Yes (1)*
- **CDC WEB POST:** Yes (1)**

2 MULTISTATE OUTBREAKS

2 PEOPLE HOSPITALIZED

17 PEOPLE SICK WITH OUTBREAK STRAINS

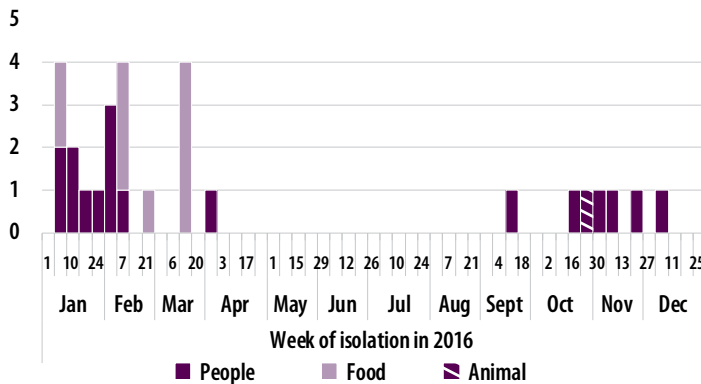**0** PEOPLE DIED

*Recall announcement: http://www.wonderful.com/press/wonderful-pistachios-voluntarily-recalls-limited-product-due.html
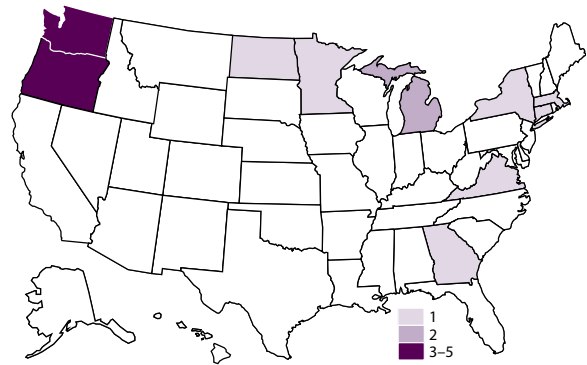**CDC outbreak posting: http://www.cdc.gov/salmonella/montevideo-03-16/index.html

WHEN DID THE OUTBREAKS OCCUR?

Number of people infected with the outbreak strains and other samples with the outbreak strains, by week of isolation.

Week of isolation in 2016

■ People ■ Food ◰ Animal

HOW WIDESPREAD WERE THESE OUTBREAKS?

People linked to the outbreaks, by state of residence.

1
2
3–5

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO NUTS/SEEDS COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated nuts/seeds were the source of 7% of outbreaks and 3% of outbreak-related illnesses.

Outbreaks

5 4 3 2 1 0

Illnesses

0 20 40 60 80 100 120 140 160

Sprouts
Seeded Vegetables
Chicken
Fruits
Grains-Beans
Vegetable Row Crops
Nuts-Seeds
Herbs
Root/Underground
Pork
Beef
Eggs
Dairy
Multiple

AVOCADO (Suspected), MELON (Confirmed)

- **PATHOGEN(S):**
  Salmonella Enteritidis (1), Minnesota (1)
- **RECALL:** No
- **CDC WEB POST:** No

2 MULTISTATE OUTBREAKS

10 PEOPLE HOSPITALIZED

69 PEOPLE SICK WITH OUTBREAK STRAINS

0 PEOPLE DIED

WHEN DID THE OUTBREAKS OCCUR?

Number of people infected with the outbreak strains and other samples with the outbreak strains, by week of isolation.
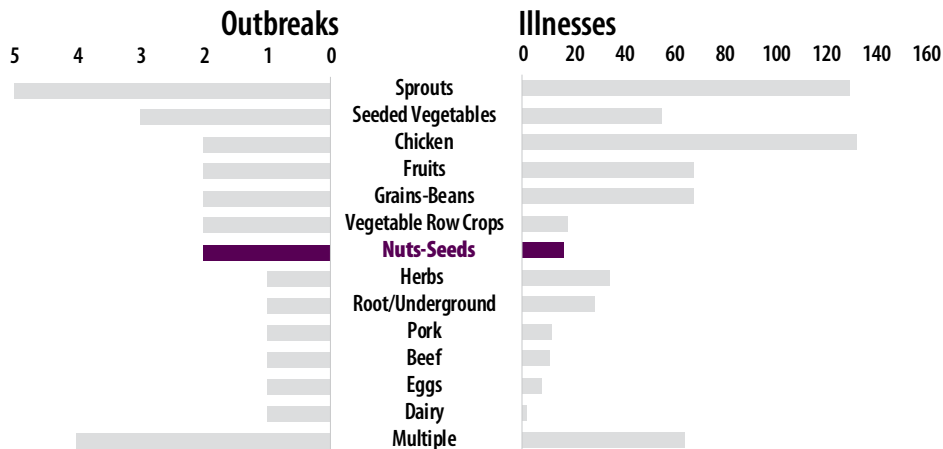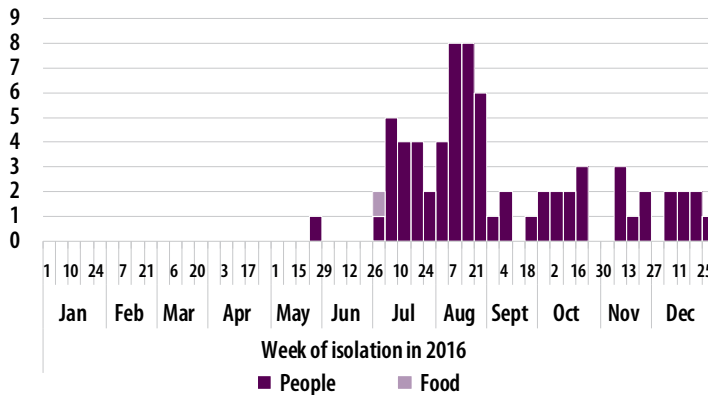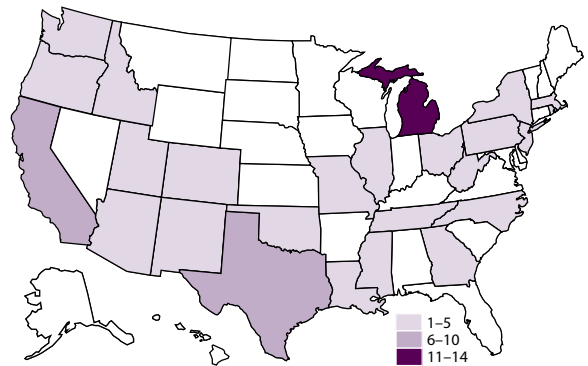
Week of isolation in 2016

■ People ■ Food

HOW WIDESPREAD WERE THESE OUTBREAKS?

People linked to the outbreaks, by state of residence.

1–5
6–10
11–14

HOW DO THE NUMBER OF OUTBREAKS AND ILLNESSES LINKED TO FRUITS COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated fruit was the source of 7% of outbreaks and 11% of outbreak-related illnesses.

Outbreaks	Illnesses
Sprouts	
Seeded Vegetables	
Chicken	
Fruits	
Grains-Beans	
Vegetable Row Crops	
Nuts-Seeds	
Herbs	
Root/Underground	
Pork	
Beef	
Eggs	
Dairy	
Multiple	

FLOUR (Confirmed), RAW PIZZA DOUGH IN RESTAURANTS (Suspected)

- **PATHOGEN(S):** *E. coli* O121 and O26 (1), O157 (1)
- **RECALL:** Yes (1)*
- **CDC WEB POST:** Yes (1)**

2 MULTISTATE OUTBREAKS

24 PEOPLE HOSPITALIZED

69 PEOPLE SICK WITH OUTBREAK STRAINS

0 PEOPLE DIED

*Recall announcement: https://wayback.archive-it.org/7993/20171103033501/https://www.fda.gov/Safety/Recalls/ucm504235.htm
**CDC outbreak posting: http://www.cdc.gov/ecoli/2016/o121-06-16/index.htmlv

WHEN DID THE OUTBREAKS OCCUR?

Number of people infected with the outbreak strains and other samples with the outbreak strains, by week of isolation.
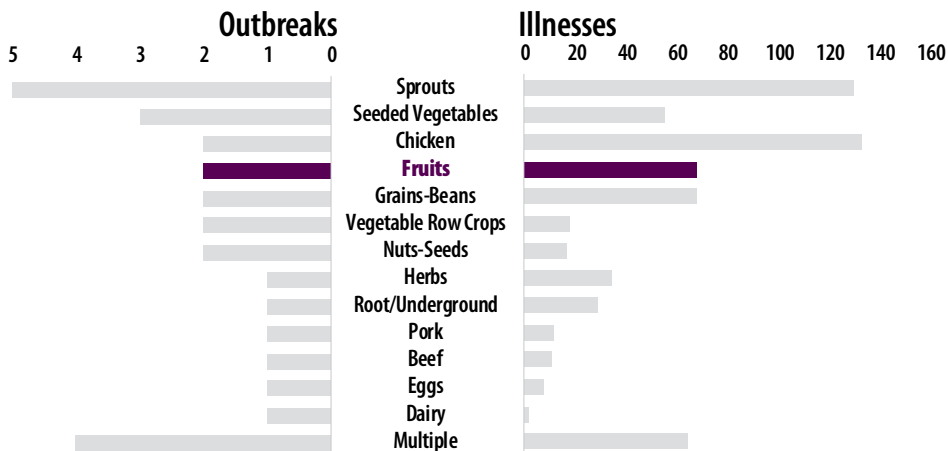

Week of isolation in 2016
■ People ■ Food

HOW WIDESPREAD WERE THESE OUTBREAKS?

People linked to the outbreaks, by state of residence.

1–2
3–5
6–12

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO GRAINS/BEANS COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated grains/beans were the source of 7% of outbreaks and 11% of outbreak-related illnesses.

Outbreaks: 5 4 3 2 1 0

Illnesses: 0 20 40 60 80 100 120 140 160

- Sprouts
- Seeded Vegetables
- Chicken
- Fruits
- **Grains-Beans**
- Vegetable Row Crops
- Nuts-Seeds
- Herbs
- Root/Underground
- Pork
- Beef
- Eggs
- Dairy
- Multiple

BAGGED SALAD (Confirmed), FROZEN VEGETABLES (Confirmed), HUMMUS (Suspected), SALAD MIX (Confirmed)

- **PATHOGEN(S):**
  Listeria (3),
  Salmonella Enteritidis (1)
- **RECALL:** Yes (3)*
- **CDC WEB POST:** Yes (2)**

4 MULTISTATE OUTBREAKS

41 PEOPLE HOSPITALIZED
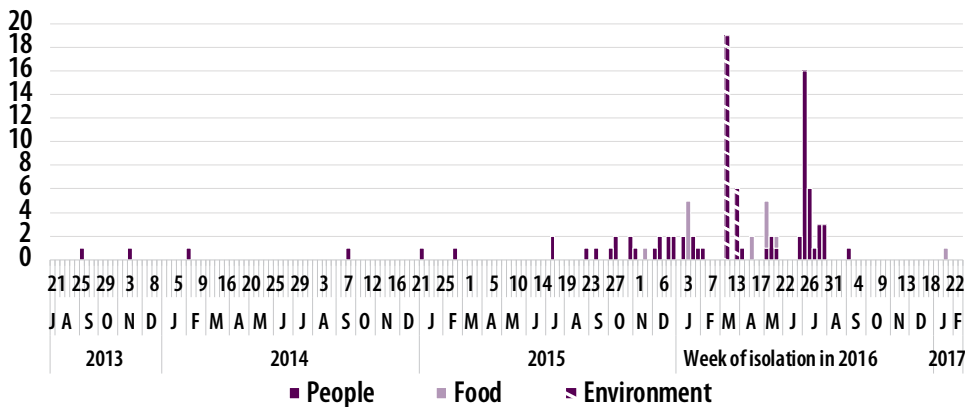
65 PEOPLE SICK WITH OUTBREAK STRAINS

6 PEOPLE DIED

*Recall announcement: https://www.fda.gov/Safety/Recalls/ucm482822.htm, https://www.fda.gov/Safety/Recalls/ucm497297.htm, https://www.fda.gov/Safety/Recalls/ucm529967.htm
**CDC outbreak posting: http://www.cdc.gov/listeria/outbreaks/bagged-salads-01-16/, http://www.cdc.gov/listeria/outbreaks/frozen-vegetables-05-16/index.html

WHEN DID THE OUTBREAKS OCCUR?

People infected with the outbreak strains, and foods with the outbreak strains, by week of isolation.

■ **People** ■ **Food** ▨ **Environment**

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO MULTIPLE FOOD CATEGORIES COMPARE WITH OTHER FOODS?

Among 28 multistate foodborne outbreaks in 2016, contaminated multiple food categories were the source of 14% of outbreaks and 10% of outbreak-related illnesses.

Multistate **Animal Contact Outbreaks** of *Salmonella* infections in 2016

Snapshot

ENTERIC DISEASE ANIMAL CONTACT OUTBREAKS

11 OUTBREAKS

248 PEOPLE HOSPITALIZED

1,068 PEOPLE ILL

3 PEOPLE DIED

Multistate outbreaks linked to animal contact caused more illnesses than multistate outbreaks linked to contaminated food in 2016.

CDC identified 11 multistate outbreaks linked to animal contact, which resulted in 1,068 illnesses. This was less than half the number of multistate foodborne outbreaks but nearly double the number of illnesses related to foodborne outbreaks. All multistate animal contact outbreaks were caused by *Salmonella*.

Outbreak-related illnesses
- 1,068
- 656

Outbreaks
- 11
- 28

Legend:
- **Animal contact**
- **Foodborne**
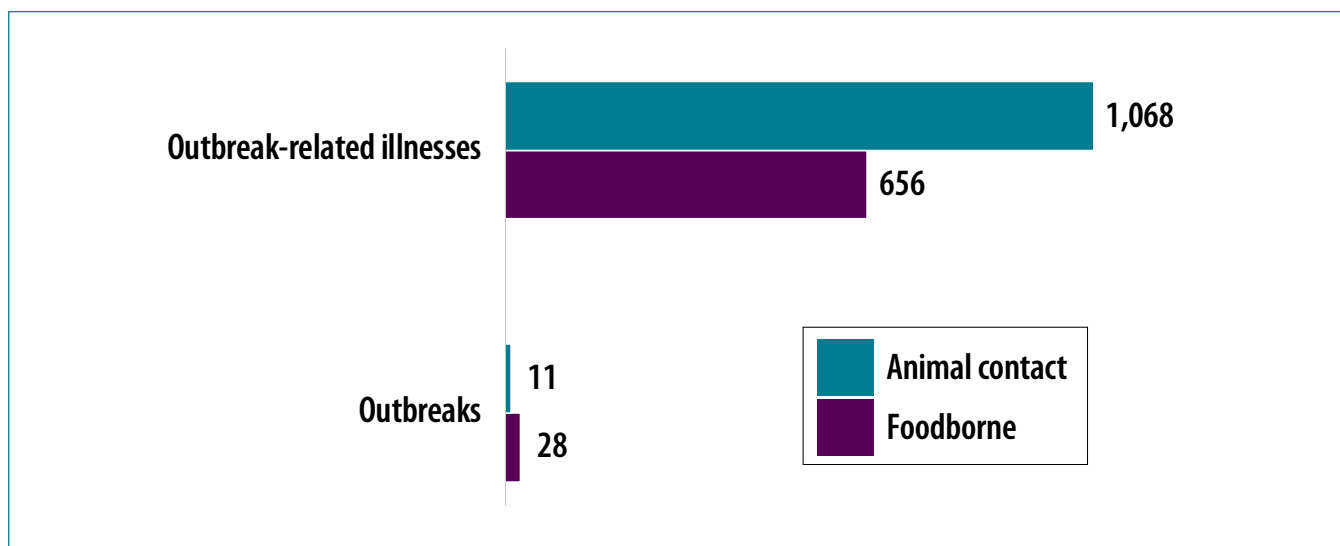
## A record number of illnesses were linked to contact with backyard poultry.

The 10 *Salmonella* disease outbreaks linked to contact with backyard poultry resulted in 930 outbreak-related illnesses.

Illnesses

| Year	Illnesses (0–1000 scale)
2016	~930
2015	~250
2014	~370
2013	~155
2012	~330
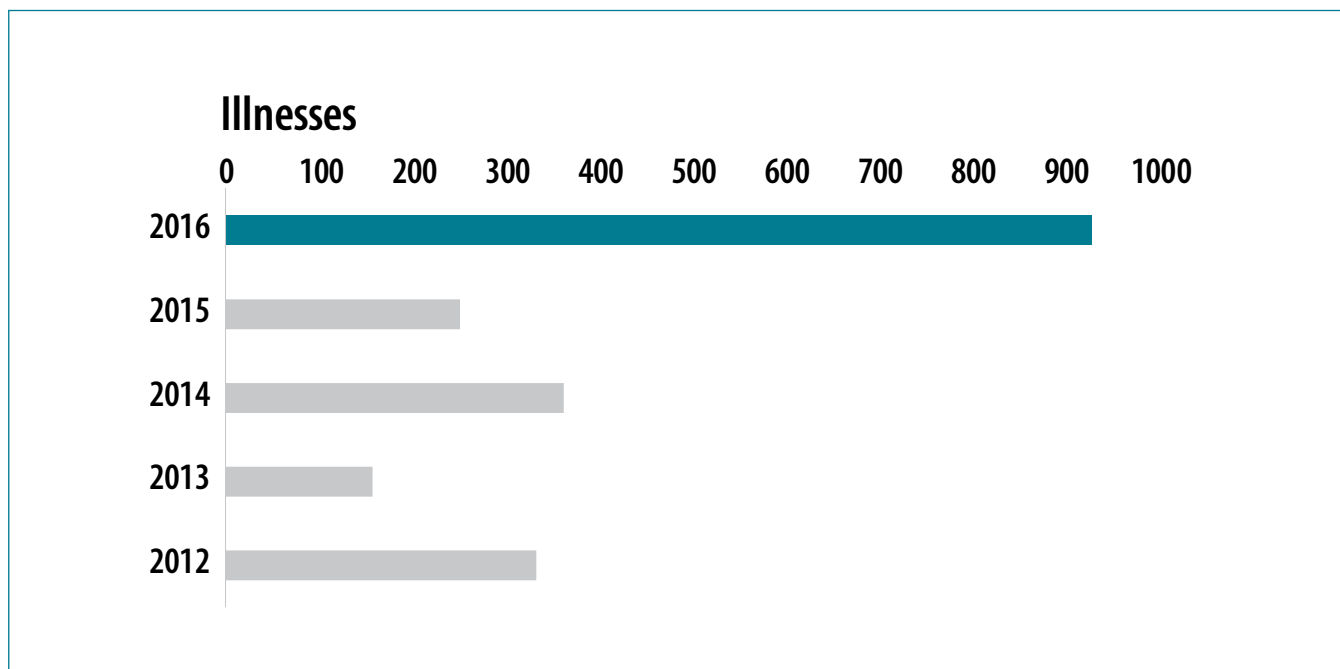
Investigations take time.

Overall, the median duration of investigations of possible multistate *Salmonella* disease outbreaks linked to animal contact was 141 days. The median duration of these possible outbreaks was 160 days.

SALMONELLA

Investigation: 141 Days

Outbreak: 160 Days
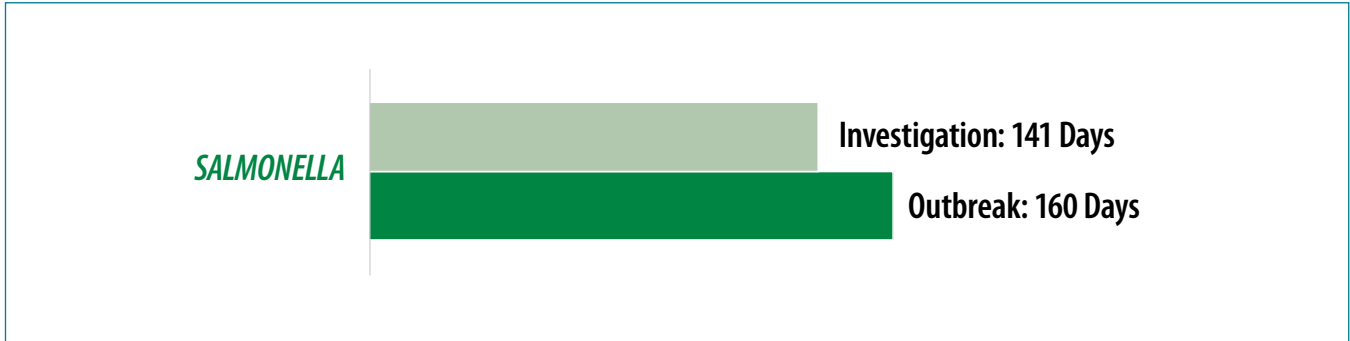
## The duration of outbreaks and investigations varied.

Among the 11 outbreaks with a suspected or confirmed animal source, outbreaks almost always lasted longer than the investigation itself. One outbreak ended before the investigation began, as shown by the gap between the green (outbreak) and gray (investigation) bars.

Investigation start

SALMONELLA

Investigation

12 Months

6 Months
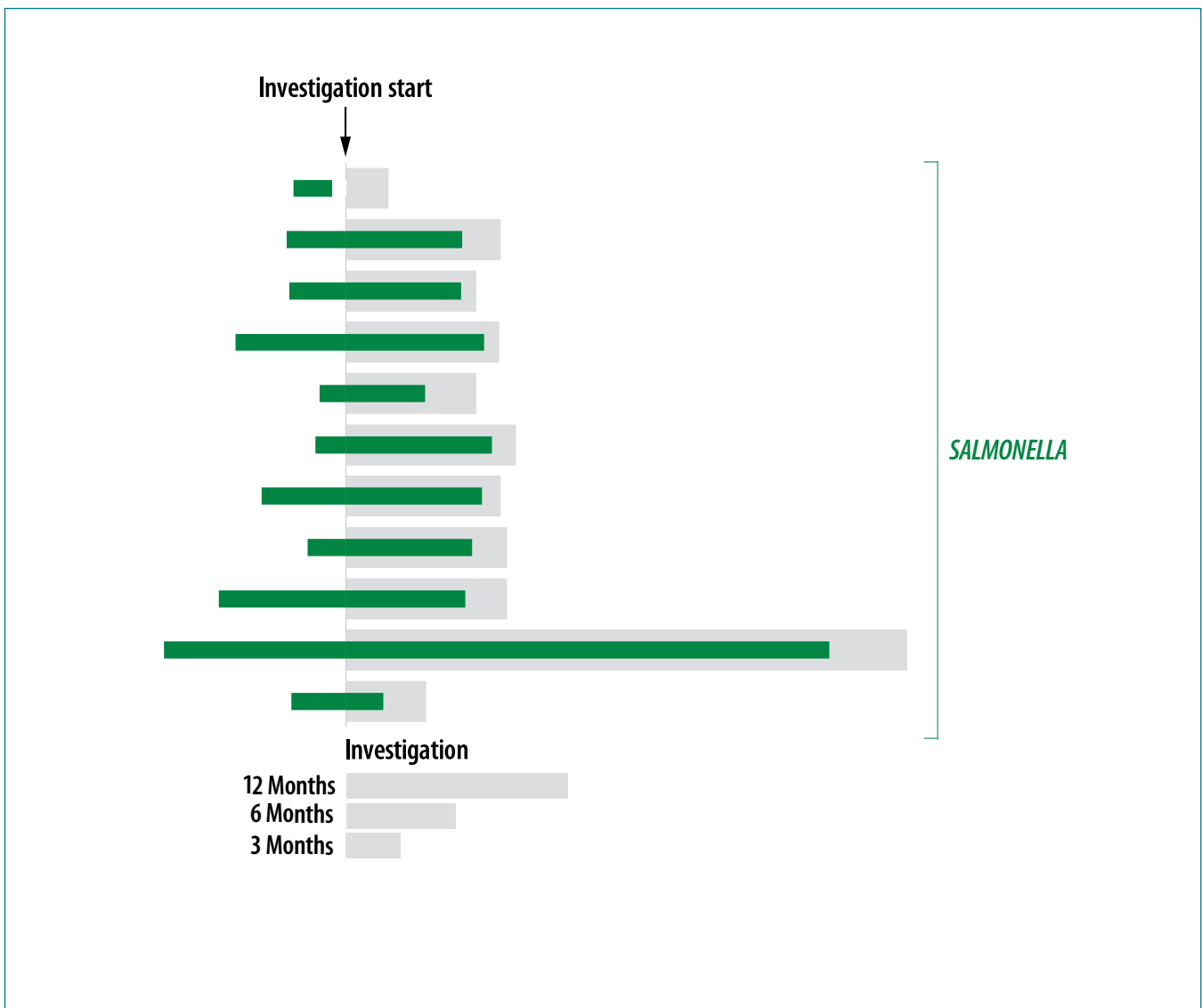
3 Months

More than a quarter of ill people were hospitalized during each multistate animal contact outbreak.

Among all multistate animal contact outbreaks, the median percentage of people hospitalized per outbreak was 28%, with a range of 11 to 40 people hospitalized per outbreak.
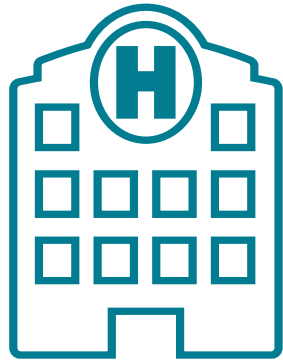
28% MEDIAN PERCENTAGE **HOSPITALIZED** PER OUTBREAK

11—40 RANGE OF SICK PEOPLE **HOSPITALIZED** PER OUTBREAK

The median age of a person sickened in a multistate animal contact outbreak was 25.

Among multistate animal contact outbreak-related illnesses, 37% occurred in children younger than 5, and 12% in adults age 65 and older, and 53% were female. The proportion of ill children under 5 was higher for multistate animal contact *Salmonella* outbreaks than for multistate foodborne *Salmonella* outbreaks (37% vs. 10%).

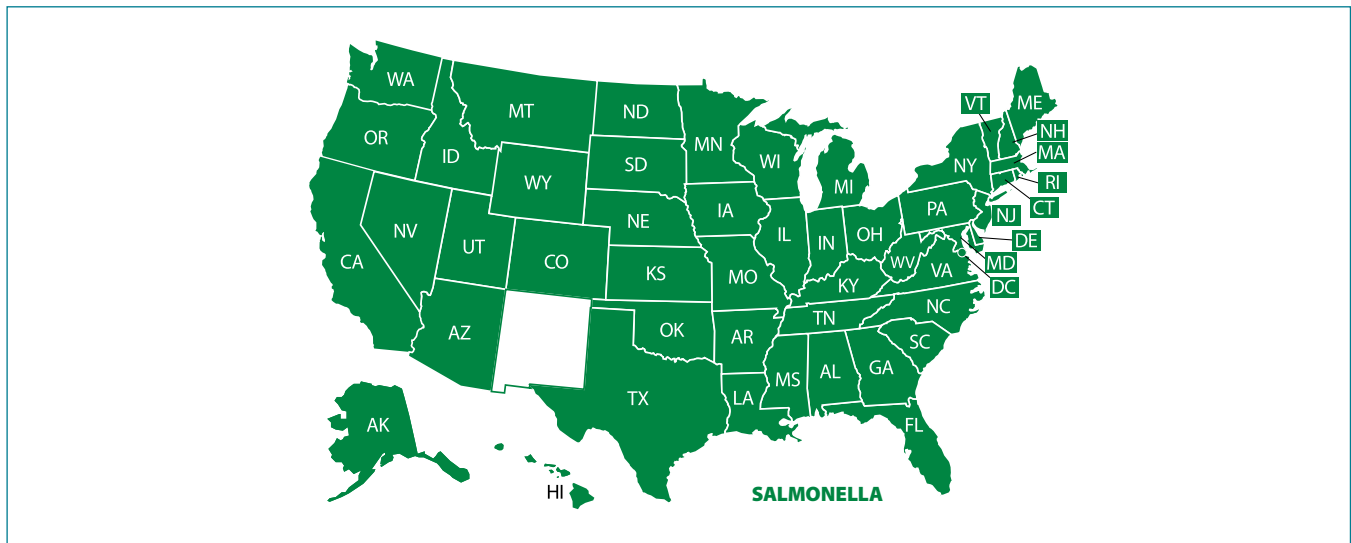### Demographics and the animal contact outbreaks

| Demographic	*Salmonella*
Children under 5	37%
People 65 and older	12%
Female	53%

Multistate animal contact outbreaks investigated by CDC with state and local health departments affected all but one state.

States with one or more cases of *Salmonella* infection associated with a multistate animal contact *Salmonella* disease outbreak are shown below (n=1,068). New Mexico was the only state that did not report one or more outbreak-related cases.

WA MT ND MN WI MI NY VT ME NH MA RI CT NJ DE MD DC
OR ID SD IA PA
NV WY NE IL IN OH WV VA
CA UT CO KS MO KY NC
AZ OK AR TN SC
TX LA MS AL GA
AK FL
HI

SALMONELLA

Almost all multistate animal contact outbreaks and most outbreak-related illnesses were associated with live poultry.

Multistate animal contact outbreaks and illnesses by animal source are shown below. Contact with backyard poultry was the source of 10 multistate outbreaks and 930 illnesses. Contact with tiny turtles, with shells less than 4 inches long, was responsible for one outbreak and 138 illnesses.

	Outbreaks		Illnesses
Backyard poultry	10		930
Tiny turtles	1		138
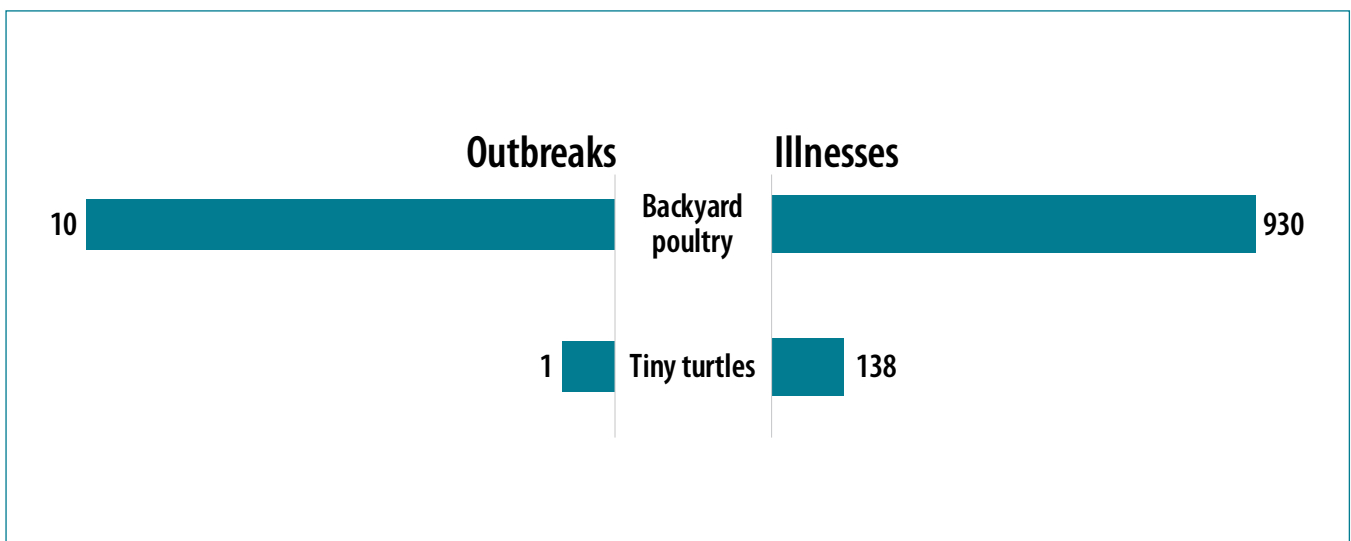
Persistent problems and new concerns.

Contact with backyard poultry and tiny turtles continue to be sources of outbreaks.

Salmonella and backyard poultry

Why was the outbreak important? More illnesses were linked to contact with live poultry in 2016 than in any previous year. Poultry came from multiple hatcheries, suggesting opportunities for prevention within the backyard poultry industry.

What happened as a result of this outbreak? CDC continued to strengthen partnerships with the backyard poultry industry to reduce the burden of *Salmonella* bacteria in poultry and educate backyard flock owners how to stay safe around their birds. Several businesses and hatcheries use CDC flyers on poultry shipping boxes or distribute them with every poultry purchase. These flyers educate on safe ways to care for backyard poultry, including not letting poultry roam indoors; keeping a dedicated pair of shoes to wear in the coop; and always washing hands after touching poultry.

Salmonella and Tiny Turtles
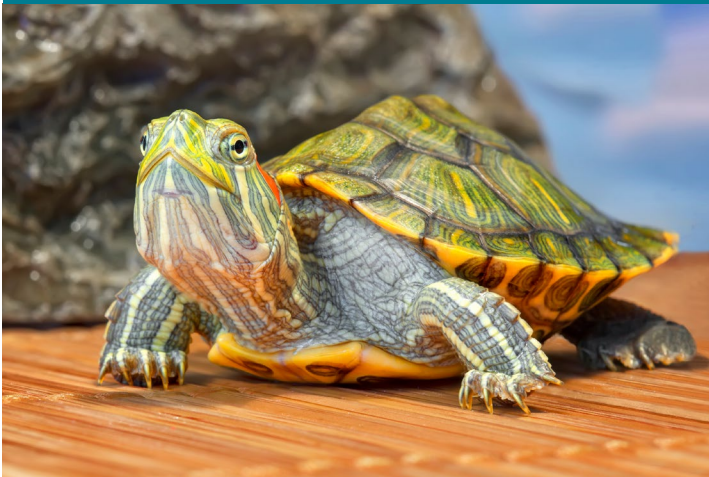
Why was the outbreak important? The sale of tiny turtles (shells less than 4 inches in length) for pets was banned in the 1970s in the United States due to their link with *Salmonella* illnesses. However, outbreaks linked to tiny turtles continued to occur. The 2016 outbreak highlighted the risk of illness associated with small pet turtles and underscored the need for education on infection prevention among reptile owners.

What happened as a result of this outbreak? CDC alerted the World Health Organization (WHO) about the outbreak and the risk of *Salmonella* infection from pet turtles exported to other countries from the United States. WHO posted a Disease Outbreak News notice to inform the international health community about the investigation, risks associated with small pet turtles, and the need for education.

CDC announced nine multistate animal contact outbreak investigations to the public.

These nine multistate animal contact outbreaks were posted on CDC's website; eight backyard poultry outbreaks were combined into a single outbreak announcement. The backyard poultry outbreaks had two postings updating the outbreak status, and the tiny turtle outbreak had 3 postings, for a total of 5 postings. In all, there were 61,509 page views.
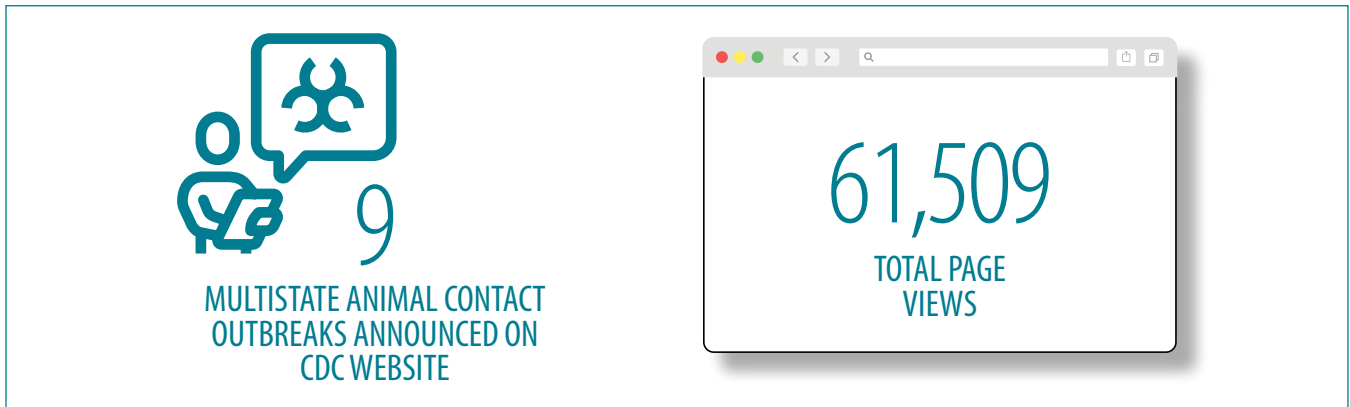
9

MULTISTATE ANIMAL CONTACT
OUTBREAKS ANNOUNCED ON
CDC WEBSITE

61,509

TOTAL PAGE
VIEWS

CDC web postings for animal contact outbreaks linked to backyard poultry drew the most page views.

The web postings for outbreaks linked to backyard poultry attracted more than 12 times as many page views than web postings for an outbreak linked to tiny turtles.

Page views

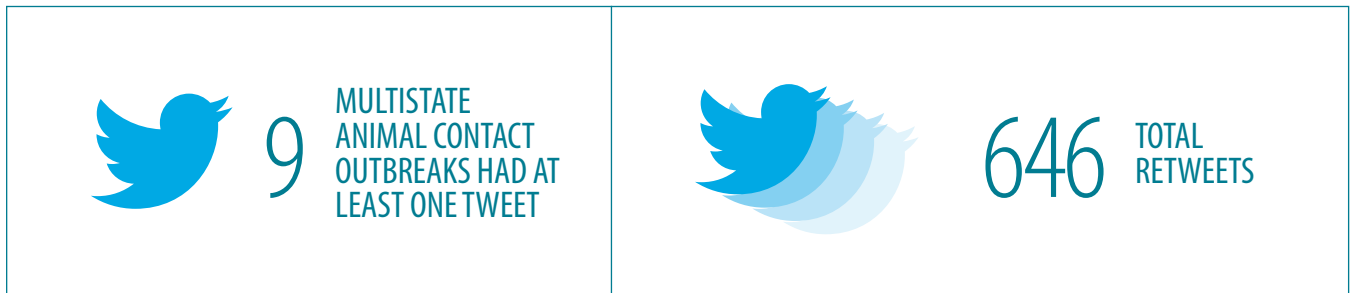Backyard poultry: 56,927

Tiny turtles: 4,582

Lo
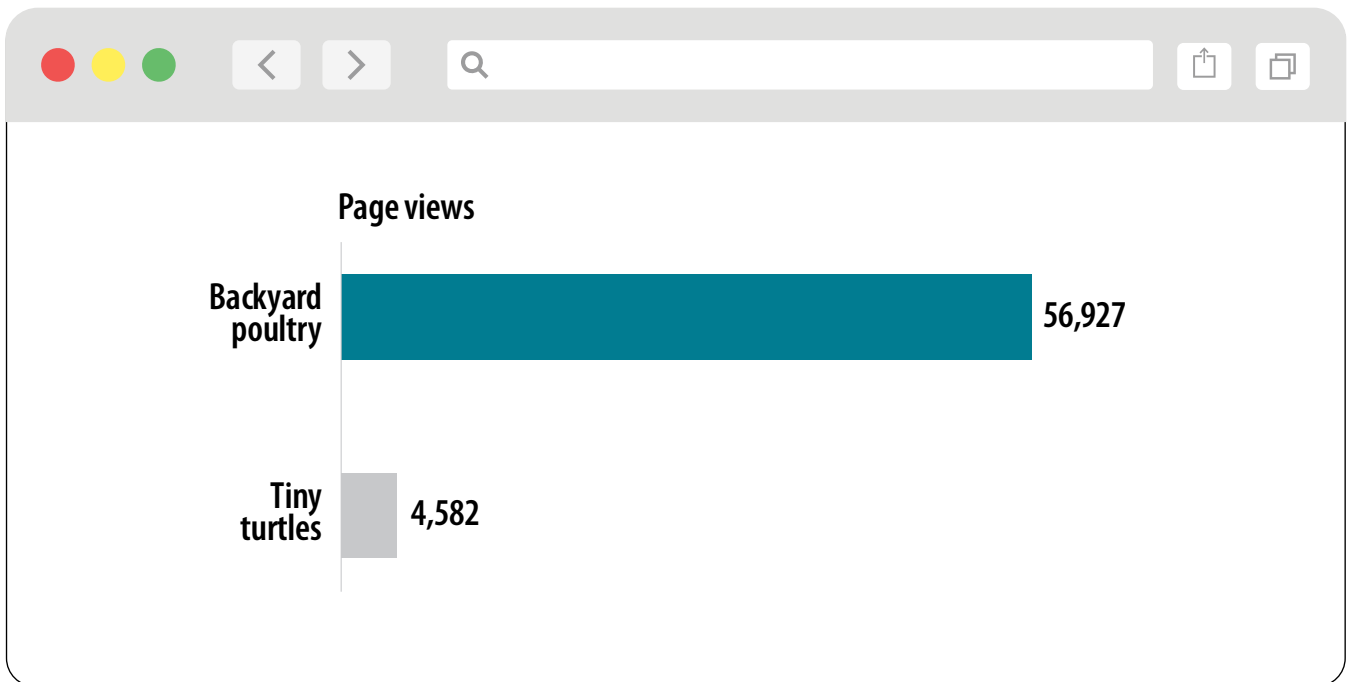
CDC used Facebook and Twitter to reach a wider audience for animal contact outbreaks.

CDC posted five Facebook messages for the 9 multistate animal contact outbreaks with public warnings, resulting in 4,388 likes and 4,036 shares.
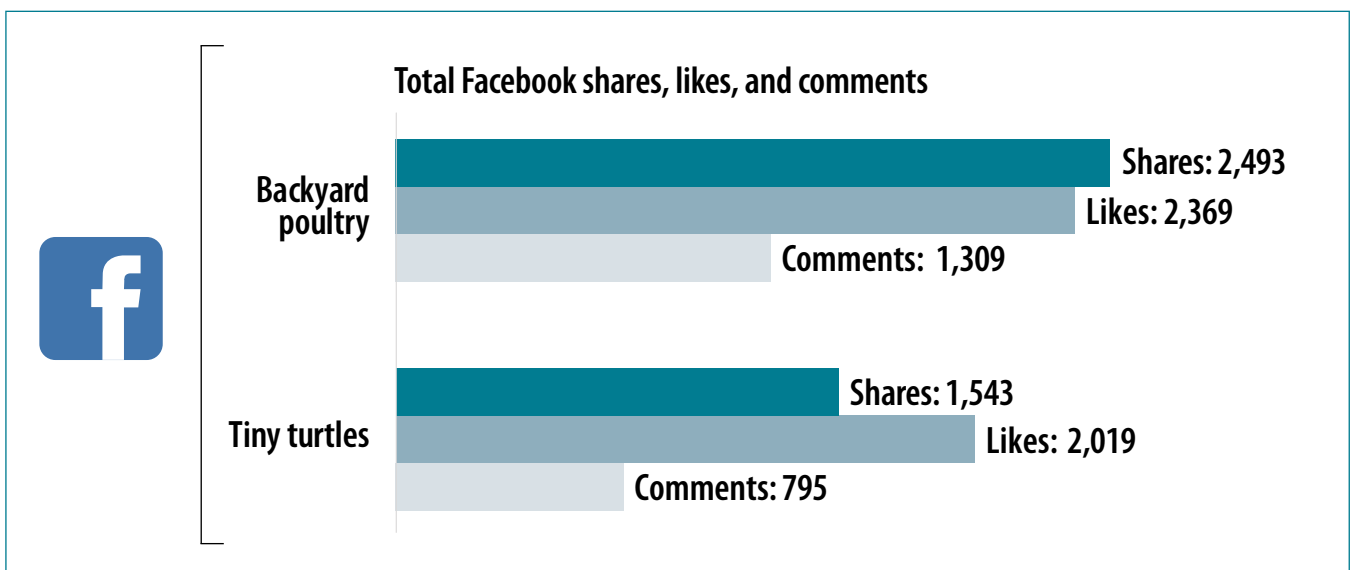
9 MULTISTATE ANIMAL CONTACT OUTBREAKS HAD FACEBOOK MESSAGES

4,388 TOTAL LIKES

4,036 TOTAL SHARES

CDC tweeted 13 times about the 9 animal contact outbreaks, resulting in 646 retweets.

9 MULTISTATE ANIMAL CONTACT OUTBREAKS HAD AT LEAST ONE TWEET

646 TOTAL RETWEETS

Facebook postings for backyard poultry outbreaks drew more shares and comments than the tiny turtle outbreak but had a similar number of total likes.

CDC Facebook postings associated with backyard poultry had a total of 2,493 shares, 2,369 likes, and 1,309 comments. For tiny turtles, there were 1,543 shares, 2,019 likes, and 795 comments.

Total Facebook shares, likes, and comments

Backyard poultry
- Shares: 2,493
- Likes: 2,369
- Comments: 1,309

Tiny turtles
- Shares: 1,543
- Likes: 2,019
- Comments: 795

Tweets for backyard poultry outbreaks drew twice as many retweets than those for tiny turtles.

The outbreaks linked to backyard poultry had the most retweets and highest engagement levels with the public.

Total retweets

Backyard poultry	434
Tiny turtles	212
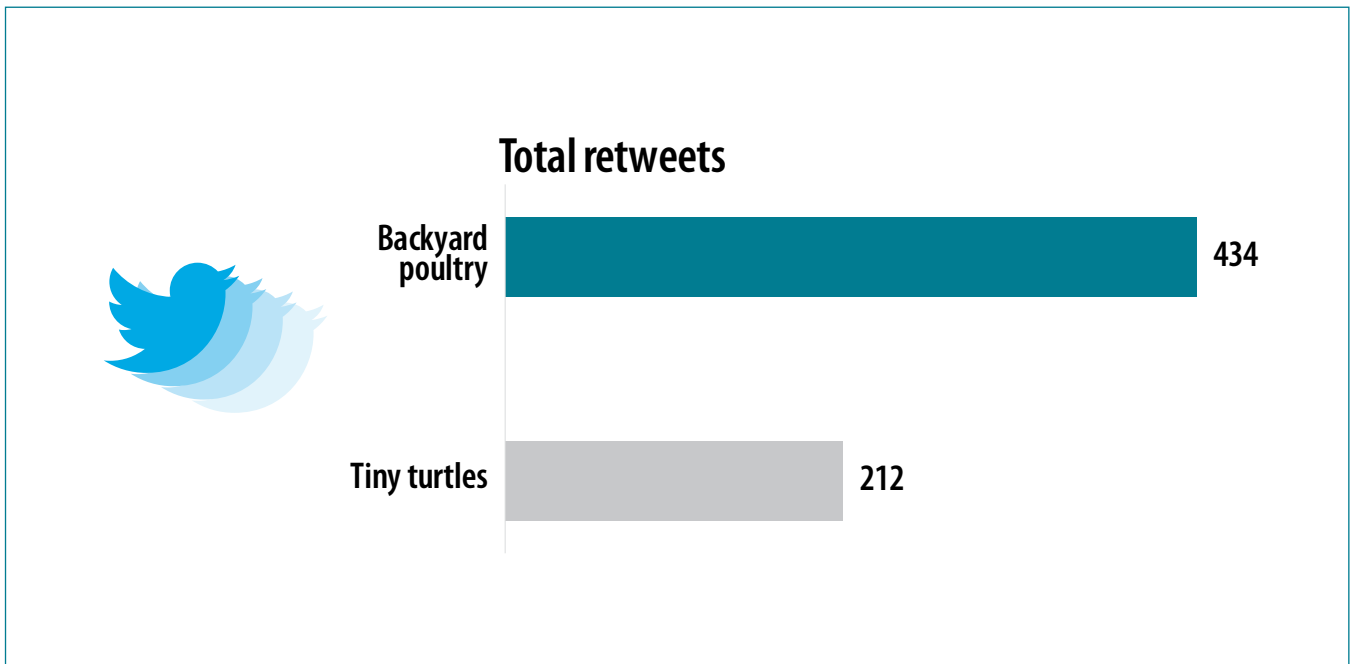
Multistate Animal Contact Outbreaks of *Salmonella* infections in 2016

SALMONELLA

By Animal Category

CHICKS AND DUCKLINGS (Confirmed), CHICKS AND DUCKLINGS (Suspected)

- **PATHOGEN(S):**
  Salmonella Braenderup (2), Infantis (2), Muenster (1), Hadar (1), Enteritidis (1), Indiana (1), Mbandaka (1), Ohio (1)
- **CDC WEB POST:** Yes (8)**

10 MULTISTATE OUTBREAKS

**212** PEOPLE HOSPITALIZED

930 PEOPLE SICK WITH OUTBREAK STRAINS

3 PEOPLE DIED

*Even though food isolates were identified with the same PFGE strains, they were not determined to be a source of illness for the outbreak
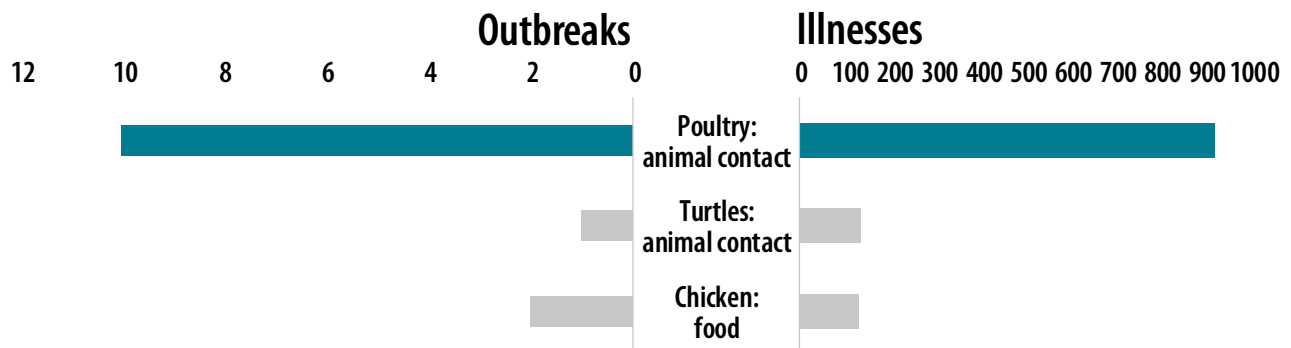**CDC outbreak posting: https://www.cdc.gov/salmonella/live-poultry-05-16/

WHEN DID THE OUTBREAKS OCCUR?

People and animals infected with the outbreak strains and foods* with the outbreak strain, by week of isolation.

Week of isolation in 2016

- People
- Animals
- Environment
- Food
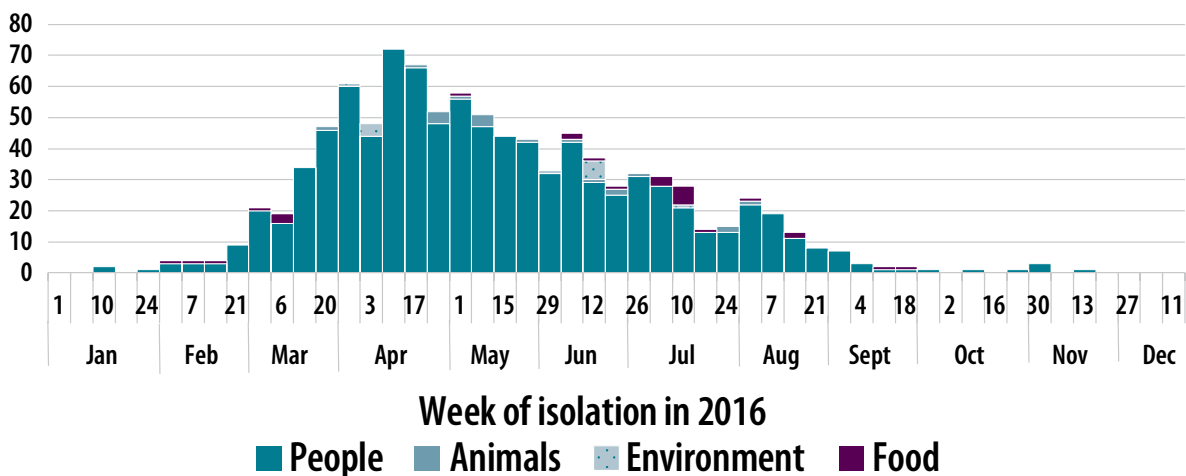
HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO BACKYARD POULTRY COMPARE WITH OTHER FOOD AND ANIMALS?

Among 11 multistate animal contact outbreaks in 2016, backyard poultry were the source of 91% of outbreaks and 87% of outbreak-related illnesses. Among all 12 multistate outbreaks linked to poultry (10 animal contact, 2 foodborne), contact with live poultry in backyard flocks was the source of 83% of outbreaks and 87% of outbreak-related illnesses.

Outbreaks

12 10 8 6 4 2 0

Illnesses

0 100 200 300 400 500 600 700 800 900 1000

- Poultry: animal contact
- Turtles: animal contact
- Chicken: food

TINY TURTLES (Confirmed)

- **PATHOGEN(S):**
  Salmonella Poona, Pomona, and I,4,[5],12,b-
- **CDC WEB POST:** Yes(1)*

1 MULTISTATE OUTBREAK

36 PEOPLE HOSPITALIZED

138 PEOPLE SICK WITH OUTBREAK STRAIN

0 PEOPLE DIED

*CDC outbreak posting:
https://www.cdc.gov/salmonella/small-turtles-10-15/

WHEN DID THE OUTBREAK OCCUR?

People infected with the outbreak strain and animals with the outbreak strain, by week of isolation.

2015

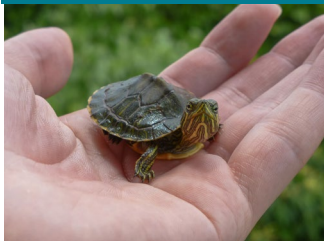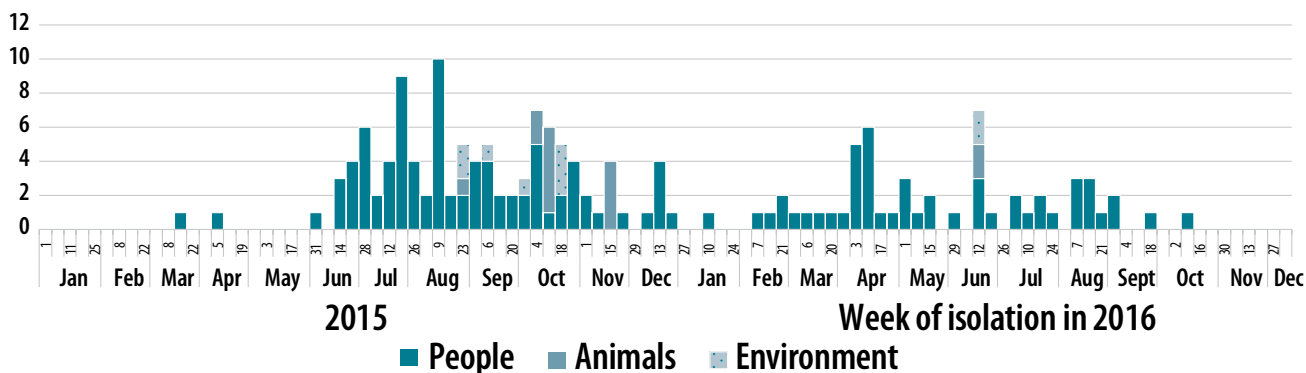**Week of isolation in 2016**

■ **People**　■ **Animals**　⣿ **Environment**

HOW DO THE NUMBER OF MULTISTATE OUTBREAKS AND ILLNESSES LINKED TO TINY TURTLES COMPARE WITH OTHER ANIMALS?

Among 11 multistate enteric disease animal contact outbreaks in 2016, contact with tiny turtles was the source of 9% of outbreaks and 13% of outbreak-related illnesses.

Outbreaks

12　10　8　6　4　2　0

Illnesses

0　100　200　300　400　500　600　700　800　900　1000

Poultry: animal contact

Turtles: animal contact
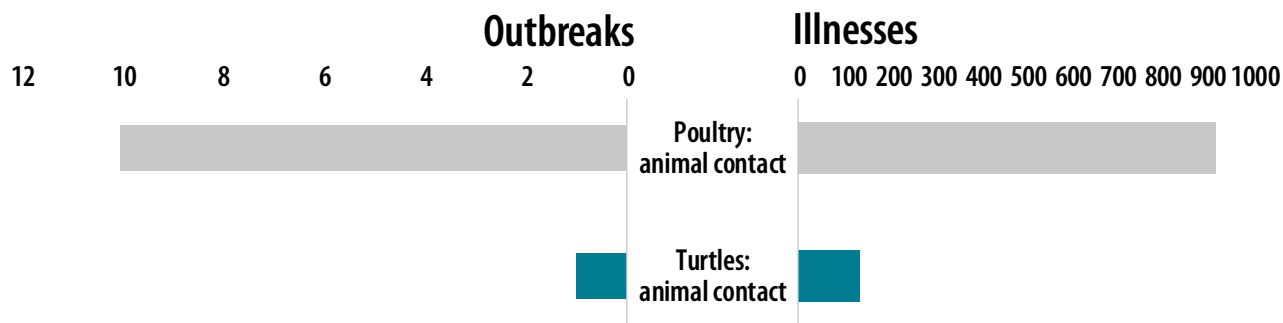
Definitions of terms frequently used in this report

Possible outbreak: A group of two or more people with similar illnesses.

Outbreak: A group of two or more people with a similar illness resulting from exposure to a common source.

Solved outbreak: An outbreak where a specific kind of food or animal was implicated (that is, confirmed or suspected) as the source.

Confirmed outbreak: An outbreak with two or more types of data supporting a link to an outbreak source. This often includes epidemiologic, traceback or laboratory data.

Suspect outbreak: An outbreak with a single type of data supporting a link to an outbreak source. This often only includes epidemiologic data.

Epidemiologic data: Information collected during interviews with sick people indicating their illness came from the same source. This includes a higher-than-expected proportion of ill people with who ate the same food or had contact with the same animals before they became sick; and two or more unrelated ill people who ate at the same restaurant, shopped at the same grocery store, or attended the same event.

Traceback data: Shipping, purchase, or other information that suggests a common point of contamination in the distribution chain of food products or animals.

Laboratory data: Culturing the outbreak strain from a suspected outbreak source (a food or animal) or the environment around the source (environment in which the animal lives or area where food was grown, processed, or sold).

Outbreak duration: The number of days between the first and last dates the outbreak strain was cultured from sick people.

Investigation duration: The number of days between CDC identification of a possible outbreak and when the CDC investigation ended.

Food categories: determined by the Interagency Food Safety Analytics Collaboration schema

Recall: A company's removal of product from commerce to protect the public from adverse health consequences.

Market withdrawal: A company's removal of product from commerce when the product has minor quality issues or a minor regulatory violation.

Public health alert: Public notification by a regulatory agency about a product that may be associated with human illnesses when a recall could not be recommended, or a firm was unwilling to perform a recall.

Page 6

CDC is investigating possible multistate outbreaks of *Salmonella*, *Listeria*, and STEC infections 24/7.
This bar chart shows the number of multistate investigations coordinated by CDC for each pathogen each week in 2016. CDC coordinated and helped investigate a median of 24 possible outbreaks a week, with a low of 6 possible outbreaks per week in early January and peaking at 53 possible outbreaks each week in late August and early September. (page 6)

Some possible multistate outbreaks are not determined to be outbreaks, and some multistate outbreaks are not solved.
This inverted triangle shows that CDC investigated 118 possible multistate outbreaks, of which 50 were determined to be outbreaks. Investigators solved 39 outbreaks, of which 28 had a confirmed outbreak source. Among the 28 with a confirmed outbreak source, 20 resulted in actionable advice for the public. (page 6)

Page 7

Multistate possible outbreaks of *Salmonella* were larger and more frequent than those caused by STEC and *Listeria*.
The first donut chart shows 118 investigations of possible multistate outbreaks, including 84 for *Salmonella*, 24 for STEC, and 10 for *Listeria*. The second donut chart shows 3,480 total illnesses linked to possible multistate outbreaks, including 3,042 *Salmonella* illnesses, 314 STEC illnesses, and 97 *Listeria* illnesses. The third volume bubble chart show the number of *Salmonella* illnesses ranges from 5 to 285 with a median of 17, the number of STEC illnesses ranges from 4 to 6 with a median of 11, and the number of *Listeria* illnesses ranges from 2 to 38 with a median of 5. (page 7)

Although possible multistate outbreaks caused by *Listeria* were small, they were severe.
This bar chart shows the percentage of ill people who died and were hospitalized for each pathogen. For *Salmonella*, 0.2% died and 25% were hospitalized. For STEC, 0% died and 36% were hospitalized. For *Listeria* monocytogenes, 18% died and 100% were hospitalized. (page 7)

Page 9

***Salmonella* caused the most multistate foodborne outbreaks.**
The first donut chart shows 515 outbreak-related illnesses for *Salmonella*, 102 for STEC, and 39 for *Listeria*. The second donut chart shows 98 hospitalizations for *Salmonella*, 37 for STEC, and 36 for *Listeria*. (page 9)

Investigations take time.
This bar chart shows how long investigations and outbreaks last. For *Salmonella*, outbreaks last a median of 73 days and investigations took a median of 69 days. For STEC, outbreaks last a median of 65 days and investigations took a median of 39 days. For *Listeria*, outbreaks last a median of 495 days and investigations took a median of 131 days. (page 9)

Page 10

The duration of outbreaks and investigations varied, and sometimes outbreaks were over before investigations began.
This bar chart shows solved multistate STEC and *Salmonella* outbreaks were typically ongoing for less than 3 months prior to investigations being initiated; however, solved multistate *Listeria* outbreaks sometimes occurred for years prior to investigations being initiated. Outbreaks for all 3 pathogens frequently continued during the investigations, which varied in duration from approximately 1 month to approximately 9 months. (page 10)

The median age of someone sickened in a multistate foodborne outbreak in 2016 was 31.

This lollipop chart shows the median age of people linked to a foodborne outbreak. The median age of ill people in *Salmonella* outbreaks is 32 years, the median age of ill people in STEC outbreaks is 20 years, and the median age of ill people in *Listeria* outbreaks is 70 years. Overall, the median age of ill people for all outbreaks is 31 years.

People sickened in *Listeria* disease outbreaks were older than people sickened in STEC and *Salmonella* disease outbreaks.

This table shows the demographics of ill people. In *Salmonella* outbreaks, 10% of ill people were children under 5, 12% were people 65 and older, and 64% were female. In STEC outbreaks, 10% of ill people were children under 5, 9% were people 65 and older, and 55% were female. In *Listeria* outbreaks, 8% of ill people were children under 5, 61% were people 65 and older, and 62% were female.

Multistate foodborne outbreaks affected all 50 states.

These U.S. maps show states with one or more illnesses in multistate foodborne outbreaks.

- *Salmonella* outbreaks affected 46 states: AK, AL, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, TN, TX, UT, VA, VT, WA, WI, WV, WY.
- STEC outbreaks affected 30 states: AL, AR, AZ, CA, CO, CT, IA, IL, IN, KS, MA, MD, MI, MN, MO, MT, NC, NE, NJ, NY, OK, OR, PA, SD, TN, TX, VA, WA, WI, WV.
- *Listeria* outbreaks affected 17 states: CA, CO, CT, FL, IN, MA, MD, MI, MN, MO, NJ, NY, OH, PA, TX, VA, WA.

Ready-to-eat (RTE) foods were the source of more outbreaks and outbreak-related illnesses than foods that were not ready-to-eat (NRTE).

This bar chart shows that not ready-to-eat foods were the source of 8 outbreaks that resulted in 244 illnesses, while ready-to-eat foods were the source of 20 outbreaks that resulted in 412 illnesses.

CDC web postings for *Listeria monocytogenes* disease outbreaks drew the most page views.

This bar chart shows the median page views of CDC web postings for each pathogen: 128,187 for *Listeria* outbreak web posts, 20,146 for *Salmonella* outbreak web posts, and 17,117 for STEC outbreak web posts.

CDC Facebook messages for *Listeria* disease outbreaks drew more shares and likes than postings for *Salmonella* and STEC disease outbreaks.

This bar chart shows the median number of likes and shares on Facebook for each pathogen. *Listeria* outbreak Facebook posts had a median of 3,718 shares and 2,486 likes. STEC outbreak Facebook posts had a median of 2,748 shares and 1,919 likes. *Salmonella* outbreak Facebook posts had a median of 1,889 shares and 1,765 likes.

CDC tweets for *Salmonella* disease outbreaks resulted in more retweets than for STEC and *Listeria* monocytogenes disease outbreaks.
This bar chart shows the median number of retweets on Twitter for each pathogen: 340 for *Salmonella*, 234 for *Listeria*, and 190 for STEC. (page 19)

Outbreaks linked to new food sources drew the most attention – total page views.
This bar chart shows the total page views for outbreak web post. The top three web posts are for the *Listeria* outbreak linked to bagged salad (384,613 page views), the *Listeria* outbreak linked to frozen vegetables (128,187 page views), and the STEC outbreak linked to flour (92,957 page views). (page 19)

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Outbreaks linked to new food sources drew the most attention—total engagement on Facebook.
This bar chart shows the total number of likes, comments, and shares on Facebook for each outbreak. The top three Facebook posts are for the *Listeria* outbreak linked to bagged salad (21,641 likes, 26,408 comments, and 10,985 shares), the STEC outbreak linked to flour (9,597 likes, 12,867 comments, and 3, 171 shares), and the *Salmonella* outbreak linked to meal replacement shakes (6,917 likes, 8,036 comments, and 2,818 shares). (page 20)

Outbreaks linked to new food sources drew the most attention – total retweets on Twitter.
This bar chart shows the total number of retweets on Twitter for each outbreak. The top three tweets are for the *Listeria* outbreak linked to bagged salad (1,124 retweets), the *Salmonella* outbreak linked to meal replacement shakes (1,059 retweets), and the STEC outbreak linked to flour (989 retweets). (page 20)

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The public interacted more with CDC's posts on Facebook than on Twitter.
This bar chart shows the median Facebook shares, likes, comments, and Twitter retweets for each pathogen. Social media messages on *Listeria* outbreaks had a median of 3,718 Facebook shares, 2,486 Facebook likes, 1,154 Facebook comments, and 234 Twitter retweets. Social media messages on STEC outbreaks had a median of 2,748 Facebook shares, 1,919 Facebook likes, 687 Facebook comments, and 190 Twitter retweets. Social media messages on *Salmonella* outbreaks had 1,889 Facebook shares, 1,765 Facebook likes, 317 Facebook comments, and 340 Twitter retweets. (page 21)

Page 23

When did the outbreak linked to beef occur?
This bar chart shows that bacteria samples were isolated from ill people and food from the week of July 26, 2016, to the week of September 18, 2016. The number of samples peaked during the week of Sept 4, 2016. (page 23)

How widespread was this outbreak linked to beef?
This U.S. map shows that 3-5 ill people lived in MA and PA, 2 ill people lived in CT, 1 ill person lived in VA, and 1 ill person lived in WV. (page 23)

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When did the outbreaks linked to chicken occur?
This bar chart shows that bacteria samples were isolated from ill people and food from the week of July 10, 2016, to the week of March 26, 2017. The number of samples peaked during the week of September 18, 2016. (page 24)

How widespread were these outbreaks linked to chicken?
This U.S. map shows that 16-28 ill people lived in CA and MA, 6-15 ill people lived in CO, CT, NY, WA, and 1-5 ill people lived in AZ, DE, IA, IL, MD, MI, MO, NJ, NV, PA, RI, UT, VA, WV, WY. (page 24)

When did this outbreak linked to pork occur?

This bar chart shows that bacteria samples were isolated from ill people and food from the week of April 10, 2016, to the week of July 24, 2016. The number of samples peaked during the week of June 12, 2016. (page 25)

How widespread was this outbreak linked to pork?

This U.S. map shows that 3-5 ill people lived in CA and NY, 1 ill person lived in NJ, and 1 ill person lived in PA. (page 25)

When did this outbreak linked to dairy occur?

This bar chart shows that bacteria samples were isolated from ill people and food from the week of June 8, 2014, to the week of November 15, 2015. The number of samples peaked during the weeks June 8, 2014, December 21, 2014, and November 15, 2015. (page 26)

How widespread was this outbreak linked to dairy?

This U.S. map shows that 1 ill person lived in CA and 1 ill person lived in FL. (page 26)

When did this outbreak linked to eggs occur?

This bar chart shows that bacteria samples were isolated from ill people and the environment from the week of May 8, 2016, to the week of October 16, 2016. The number of samples peaked during the week of September 11, 2016. (page 27)

How widespread was this outbreak linked to eggs?

This U.S. map shows that 1-7 ill people lived in IL and MO. (page 27)

When did the outbreaks linked to sprouts occur?

This bar chart shows that bacteria samples were isolated from ill people, food, and the environment from the week of November 29, 2015, to the week of November 27, 2016. The number of samples peaked during the week of April 24, 2016. (page 28)

How widespread were these outbreaks linked to sprouts?

This U.S. map shows that 11-17 ill people lived in CO, KS, MA, and NY, 6-10 ill people lived in MN, PA, RI, and VA, and 1-5 ill people lived in CT, DE, FL, GA, IL, MD, ME, MO, NC, ND, NE, NH, NJ, OH, OK, OR, TX, VT, WA, WI, and WY. (page 28)

When did the outbreaks linked to vegetable row crops occur?

This bar chart shows that bacteria samples were isolated from ill people from the week of April 3, 2016, to the week of July 3, 2016. The number of samples peaked during the week of June 12, 2016. (page 29)

How widespread were these outbreaks linked to vegetable row crops?

This U.S. map shows that 1-3 ill people lived in IL, MI, and VA. (page 29)

When did the outbreaks linked to seeded vegetables occur?

This bar chart shows that bacteria samples were isolated from ill people and food from the week of March 27, 2016, to the week of July 10, 2016. The number of samples peaked during the week of June 5, 2016. (page 30)

How widespread were these outbreaks linked to seeded vegetables?

This U.S. map shows that 11-13 ill people lived in MN and TX, 6-10 ill people lived in CA, and 1-5 ill people lived in AZ, GA, IL, KS, KY, LA, MA, MI, NE, OH, OK, PA, WA, and WI. (page 30)

When did this outbreak linked to root/underground vegetables occur?

This bar chart shows that bacteria samples were isolated from ill people from the week of August 21, 2016, to the week of October 16, 2016. The number of samples peaked during the week of August 28, 2016.

How widespread was this outbreak linked to root/underground vegetables?

This U.S. map shows that 5-15 ill people lived in IA, 3-4 ill people lived in MO and OH, and 1-2 ill people lived in AL, MS, NC, NM, and TX.

When did this outbreak linked to herbs occur?

This bar chart shows that bacteria samples were isolated from ill people and food from the week of December 13, 2015, to the week of April 10, 2016. The number of samples peaked during the week of January 31, 2016.

How widespread was this outbreak linked to herbs?

This U.S. map shows that 2-3 ill people lived in CA, MA, MD, MN, NC, NJ, OH, TX, and UT and 1 ill person lived in each of the following states: AL, FL, IL, MI, NM, NY, OK, OR, PA, RI, SC, TN, WI, and WV.

When did the outbreaks linked to nuts/seeds occur?

This bar chart shows that bacteria samples were isolated from ill people, food, and an animal from the week of January 3, 2016, to the week of December 4, 2016. The number of samples peaked during the weeks of January 3, 2016, February 7, 2016, and March 13, 2016.

How widespread were these outbreaks linked to nuts/seeds?

This U.S. map shows that 3-5 ill people lived in OR and WA, 2 ill people lived in MI, and 1 ill person lived in each of the following states: CT, GA, MA, MN, ND, NY, and VA.

When did the outbreaks linked to fruits occur?

This bar chart shows that bacteria samples were isolated from ill people and food from the week of May 22, 2016, to the week of December 25, 2016. The number of samples peaked during the weeks of August 7, 2016 and August 14, 2016.

How widespread were these outbreaks linked to fruits?

This U.S. map shows that 11-14 ill people lived in MI, 6-10 ill people lived in CA and TX, and 1-5 ill people lived in AZ, CO, GA, ID, IL, LA, MA, MO, MS, NC, NJ, NM, NY, OH, OK, OR, PA, RI, TN, UT, WA, and WV.

When did the outbreaks linked to grains/beans occur?

This bar chart shows that bacteria samples were isolated from ill people and food from the week of December 6, 2015, to the week of September 4, 2016. The number of samples peaked during the week of June 5, 2016.

How widespread were these outbreaks linked to grains/beans?

This U.S. map shows that 6-12 ill people lived in MN, 3-5 ill people lived in AZ, CO, IA, IL, MI, NY, OK, VA, WA, and WI, and 1-2 ill people lived in AL, AR, CA, KS, MA, MD, MO, MT, NC, NE, NJ, OR, PA, SD, TN, and TX.

When did the outbreaks linked to multiple food categories occur?

This bar chart shows that bacteria samples were isolated from ill people, food, and the environment from the week of September 1, 2013, to the week of January 15, 2017. The number of samples peaked during the week of March 6, 2016.

Multistate outbreaks linked to animal contact caused more illnesses than multistate outbreaks linked to contaminated food in 2016.
This bar chart shows that 11 animal-contact outbreaks resulted in 1,068 outbreak-related illnesses, while 28 foodborne outbreaks resulted in 656 outbreak-related illnesses. (page 38)

A record number of illnesses were linked to contact with backyard poultry.
This bar chart shows the number of illnesses per year in outbreaks linked to contact with backyard poultry: over 900 illnesses in 2016, over 200 illnesses in 2015, over 300 illnesses in 2014, over 100 illnesses in 2013, and over 300 illnesses in 2012. (page 38)

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Investigations take time.
This bar chart shows that investigations of *Salmonella* outbreaks linked to animal contact outbreaks take a median of 141 days, and the outbreaks last a median of 160 days. (page 39)

The duration of outbreaks and investigations varied.
This bar chart shows that investigations of *Salmonella* outbreaks with a suspected or confirmed animal source varied in duration (approximately 2 months to 2.5 years), and the length of the outbreaks also varied in duration (approximately 2 months to 3 years). (page 39)

Page 43

CDC web postings for animal contact outbreaks linked to backyard poultry drew the most page views.
This bar chart shows that the web post for the outbreak linked to backyard poultry had 56,927 page views and the outbreak linked to tiny turtles had 4,582 page views. (page 43)

Page 45

Tweets for backyard poultry outbreaks drew twice as many retweets than those for tiny turtles.
This bar chart shows that the tweet on outbreaks linked to backyard poultry had 434 retweets and the tweet on the outbreak linked to tiny turtles had 212 retweets. (page 45)

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When did the outbreaks linked to backyard poultry occur?
This bar chart shows that bacteria samples were isolated from ill people, animal, food, and the environment from the week of January 10, 2016, to the week of October 30, 2016. The number of samples peaked during the week of April 10, 2016. (page 47)

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When did the outbreak linked to tiny turtles occur?
This bar chart shows that bacteria samples were isolated from ill people, animals, and environment from the week of March 15, 2015, to the week of October 9, 2016. The number of samples isolated from humans peaked in 2015 during the week of August 9 and in 2016 during the week of April 10. (page 48)

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