

# Surveillance for Foodborne Disease Outbreaks United States, 2015: Annual Report



National Center for Emerging and Zoonotic Infectious Diseases  
Division of Foodborne, Waterborne, and Environmental Diseases



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A photograph of a buffet table with various dishes. In the foreground, there are two large glass bowls filled with salads: one with tomatoes, cucumbers, and green onions, and another with a creamy dressing and vegetables. Behind them is a wooden cutting board with bread, cheese, and vegetables. Further back, there are trays of meats, a large pineapple, and stacks of white plates. A person's hand is visible on the right side, using a fork to take food from a tray.

**Surveillance for  
Foodborne Disease Outbreaks  
United States  
2015 Annual Report**

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## Main Findings

- In 2015, there were 902 foodborne disease outbreaks reported, resulting in 15,202 illnesses, 950 hospitalizations, 15 deaths, and 20 food product recalls.
- Norovirus was the most common cause of confirmed, single-etiology outbreaks, accounting for 164 (37%) outbreaks and 3,893 (39%) illnesses. *Salmonella* was the next most common cause, accounting for 149 (34%) outbreaks and 3,944 (39%) illnesses, followed by Shiga toxin-producing *Escherichia coli*, which caused 27 (6%) confirmed single-etiology outbreaks and 302 (3%) illnesses.
- Fish (34 outbreaks), chicken (22), and pork (19) were the most common single food categories implicated. The most outbreak-associated illnesses were from seeded vegetables (e.g., cucumbers or tomatoes, 1,121 illnesses), pork (924), and vegetable row crops (e.g., leafy vegetables, 383).
- As reported in previous years, restaurants (469 outbreaks, 60% of outbreaks reporting a single location of preparation), specifically restaurants with sit-down dining (373, 48%), were the most commonly reported locations of food preparation associated with outbreaks.

## Background

Foodborne diseases due to known pathogens are estimated to cause 9.4 million illnesses each year in the United States.<sup>1</sup> Although relatively few of these illnesses occur in the setting of a recognized outbreak, data collected during outbreak investigations provide insight into the pathogens and foods that cause illness. Public health officials, regulatory agencies, and the food industry can use these data to create control strategies along the farm-to-table continuum that target specific pathogens and foods.

An outbreak of foodborne disease is defined as the occurrence of two or more cases of a similar illness resulting from ingestion of a common food. Foodborne disease outbreaks are a nationally notifiable condition (<http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/CSTENotifiableConditionListA.pdf>). CDC conducts surveillance of foodborne disease

outbreaks in the United States through the Foodborne Disease Outbreak Surveillance System. Public health agencies in all 50 states, the District of Columbia, and U.S. territories voluntarily submit reports of outbreaks investigated by their agencies using a Web-based reporting platform, the National Outbreak Reporting System (NORS) (<http://www.cdc.gov/nors/>). NORS also collects reports of enteric disease outbreaks with other transmission modes, including water, animal contact, person-to-person contact, environmental contamination, and unidentified modes.

Agencies use a standard form (<https://www.cdc.gov/nors/downloads/form-52-13.pdf>) to report foodborne disease outbreaks. Data requested for each outbreak include: the reporting state; date of first illness onset; number of illnesses, hospitalizations, and deaths; etiology; implicated food(s) and ingredient(s); locations of food preparation; and factors contributing to food contamination (see appendix). The reporting form also allows for reporting the reason(s) a particular food is suspected as the source; five choices are provided (<http://www.cdc.gov/nors/downloads/guidance.pdf>). All foods implicated are included in analyses, regardless of the reasons suspected. Implicated foods in multistate outbreaks are further classified as confirmed or suspected based on epidemiologic, traceback, and laboratory evidence. A food is considered the confirmed source if two types of evidence are obtained, while a food is considered suspected if only one type of evidence is available. Reports of outbreaks on cruise ships that dock in both U.S. and international ports and those in which the food was eaten outside the United States, even if the illness occurred in the United States, are excluded from the Foodborne Disease Outbreak Surveillance System.

This report includes foodborne disease outbreaks reported by October 20, 2016, in which the first illness onset occurred in 2015. Etiologic agents were reported as confirmed if predefined criteria were met;<sup>2</sup> otherwise, they were reported as suspected. In some outbreaks the etiologic agent is unknown. For outbreaks caused by a single confirmed or suspected etiology, etiologies were grouped as bacterial, chemical and toxin, parasitic, or viral. Multistate outbreaks were defined as outbreaks

in which exposure to the implicated food occurred in more than one state or territory. Population-based outbreak reporting rates were calculated for each state using U.S. Census estimates of the 2015 state populations (<http://www.census.gov/popest>). Multistate outbreaks were included in state population-based outbreak reporting rates by assigning one outbreak to each state that reported a case in the outbreak. Implicated foods were classified into 1 of 24 single-food categories if a single contaminated ingredient was identified or if all ingredients belonged to that category.<sup>3</sup> Outbreaks attributed to foods that could not be assigned to one of these categories, or for which the report contained insufficient information for category assignment, were not attributed to any category.

## Findings

### States and Rates

During 2015, there were 902 foodborne disease outbreaks reported (Table 1), resulting in 15,202 illnesses, 950 hospitalizations, and 15 deaths. Outbreaks were reported by public health officials from 50 states, Puerto Rico, and Washington D. C. (Figure). The median rate per million population was 3.5 outbreaks; rates ranged from 0.6 in Mississippi to 14.1 in Kansas.

### Etiologic Agents

A single etiologic agent was confirmed in 443 (49%) outbreaks (Table 1), which resulted in 10,008 (66%) illnesses. Bacteria caused the most outbreaks (238 outbreaks, 54%), followed by viruses (168, 38%), chemicals (33, 7%), and parasites (4, 1%). Norovirus was the most common cause of confirmed, single-etiology outbreaks, accounting for 164 (37%) outbreaks and 3,893 (39%) illnesses. *Salmonella* was the next most common cause, accounting for 149 (34%) outbreaks and 3,944 (39%) illnesses. Among the 146 confirmed *Salmonella* outbreaks with a serotype reported, Enteritidis was the most common (51 outbreaks, 35%), followed by I 4,[5],12:i:- (15, 10%), Newport (8, 6%), and Braenderup (7, 5%). Shiga toxin-producing *Escherichia coli* (STEC) caused 27 confirmed, single-etiology outbreaks, of which 17 (63%) were caused by serogroup O157, 3 (11%) by O26, 2 (7%) by O103,

1 (4%) by O45, 1 (4%) by O111, 1 (4%) by O121, 1 (4%) by O145, and 1 (4%) by multiple serogroups.

### Illnesses, Hospitalizations, and Deaths

Of the 10,008 outbreak-associated illnesses caused by a single confirmed etiologic agent, 896 (9%) resulted in hospitalization (Table 1). Among confirmed, single-etiology outbreaks, *Salmonella* caused the most outbreak-associated hospitalizations (573 hospitalizations, 64%), followed by STEC (106, 12%) and *Shigella* (53, 6%). Outbreaks caused by *Clostridium botulinum* resulted in the highest proportion of ill persons hospitalized (97%), followed by *Listeria monocytogenes* (90%) and Hepatitis A virus (38%). Among the 15 deaths reported, 14 (93%) were attributed to bacterial etiologies (*Salmonella* [9], *Clostridium botulinum* [2], *Clostridium perfringens* [1], *Listeria monocytogenes* [1], and *Vibrio vulnificus* [1]). One death was attributed to norovirus.

### Food Categories Implicated

A food was reported for 360 (40%) outbreaks. In 194 (54%) of these outbreaks, the food could be classified into 1 of the 24 categories (Table 2a); the categories most commonly implicated were fish (34 outbreaks, 18%), chicken (22, 11%), pork (19, 10%), and dairy (18, 9%). Pasteurization information was reported for 14 of the dairy outbreaks and 13 (93%) of these involved unpasteurized products. The most outbreak-associated illnesses were from seeded vegetables (e.g., cucumbers or tomatoes, 1,121 illnesses), pork (924), vegetable row crops (e.g., leafy vegetables, 383), and chicken (333).

### Etiologic Agents and Food Category Pairs

The pathogen-food category pairs responsible for most outbreaks with a single confirmed etiologic agent were ciguatoxin in fish (20 outbreaks), scombroid toxin (histamine) in fish (10), and *Salmonella* in chicken (9) (Table 2b). The pathogen-food category pairs responsible for the most illnesses in outbreaks with a single confirmed etiologic agent were *Salmonella* in seeded vegetables (1,048 illnesses), *Salmonella* in pork (615), and *Salmonella* in vegetable row crops (263). The pathogen-food category pairs responsible

for the most hospitalizations in outbreaks with a single confirmed etiologic agent were *Salmonella* in seeded vegetables (225 hospitalizations), *Salmonella* in pork (70), and *Staphylococcus aureus* enterotoxin in chicken (31). Deaths were reported for the following pathogen-food category pairs: *Salmonella* in seeded vegetables (6 deaths), *Clostridium botulinum* in root and underground vegetables (2); *Clostridium perfringens* in beef, *Listeria monocytogenes* in vegetable row crops, *Salmonella* in pork, *Salmonella* in sprouts, and *Vibrio vulnificus* in mollusks (1 each).

## Location of Food Preparation

Among the 779 outbreaks and 12,054 illnesses with a reported single location where food was prepared, 469 outbreaks (60%) and 4,757 associated illnesses (39%) were attributed to foods prepared in a restaurant (Table 3a, Table 3b, and Table 3c). Among these outbreaks, sit-down dining-style was the type of restaurant most commonly reported as the location where food was prepared (373 outbreaks, 48%).

## Recalls

Twenty outbreaks resulted in product recalls. The foods recalled in outbreaks in which exposure occurred in one state were apple cider, bread, chicken, drink mix, ground beef, muffins, pork, raw tuna, roast beef, and unpasteurized milk (1 each). Alfalfa seeds and sprouts, celery, chicken, cucumber, flour, lettuce, moringa leaf powder, pork, raw tuna, and sprouted nut butter (1 each) were recalled in multistate outbreaks.

## Multistate Outbreaks

Thirty multistate outbreaks (3% of all outbreaks) were reported (Table 4), resulting in 1,947 illnesses (12% of illnesses), 411 (42% of hospitalizations), and 7 deaths (50% of deaths). Outbreaks involved a median of 7.5 states (range: 2–40). Seventeen outbreaks were caused by *Salmonella*; the serotypes were Newport (3 outbreaks); multiple serotypes (3); Enteritidis (2); Paratyphi B (2); Bareilly, Braenderup, Hartford, Java, Javiana, Poona, and Virchow (1 each). Ten multistate outbreaks were caused by STEC (serogroups O157 [4 outbreaks], O103 [2], O26 [2], O145 [1], and multiple serogroups [1]). One

outbreak was caused by *Cyclospora cayetanensis*, one by *Listeria*, and one by *Vibrio parahaemolyticus*. The foods implicated or suspected as sources for multistate *Salmonella* outbreaks were tomatoes (2 outbreaks), tuna sushi (1 confirmed, 1 suspected), alfalfa seeds and sprouts, chicken, cucumber, Latin-style soft cheese (suspected), moringa leaf powder, pork, raw oysters (suspected), raw tuna, sprouted nut butter, sushi (suspected), truffle oil puree, and an unidentified food (1 each). For STEC, implicated foods were celery and onion (serogroup O157), flour (O26 and O121), pizza dough mix (suspected) (O157), pre-packaged leafy greens (suspected) (O145), pre-packaged salad (suspected) (O157), romaine lettuce (suspected) (O157), and unidentified foods (serogroups O103 [2 outbreaks] and O26 [2 outbreaks]). The food implicated in the *Cyclospora cayetanensis* multistate outbreak was cilantro. Raw clams and raw oysters were implicated in the *Vibrio parahaemolyticus* outbreak, and contaminated lettuce was implicated in the *Listeria* outbreak.

## Multistate Outbreaks Spanning Multiple Years

Four multistate outbreaks investigated in 2015 are not included in the 2015 tally because the first outbreak-associated illness occurred before 2015. Three were caused by *Listeria*; the implicated foods were ice cream (first illness in 2010), caramel apples (first illness in 2014), and cheese made with pasteurized milk (first illness in 2014). One was caused by *Salmonella*; the implicated food was cashews (first illness in 2014).

## Limitations

The findings in this report have at least three limitations. First, only a small proportion of foodborne illnesses that occur each year are identified as being associated with outbreaks. The extent to which the distribution of food vehicles and locations of preparation implicated in outbreaks reflect the same vehicles and locations as sporadic foodborne illnesses is unknown. Similarly, not all outbreaks are identified, investigated, or reported. Second, many outbreaks had an unknown etiology, an unknown food vehicle, or both, and conclusions drawn from outbreaks with a confirmed etiology or food vehicle might not apply to other

outbreaks. Finally, CDC's outbreak surveillance system is dynamic. Agencies can submit new reports and change or delete reports as information becomes available. Therefore, the results of this analysis might differ from those in other reports.

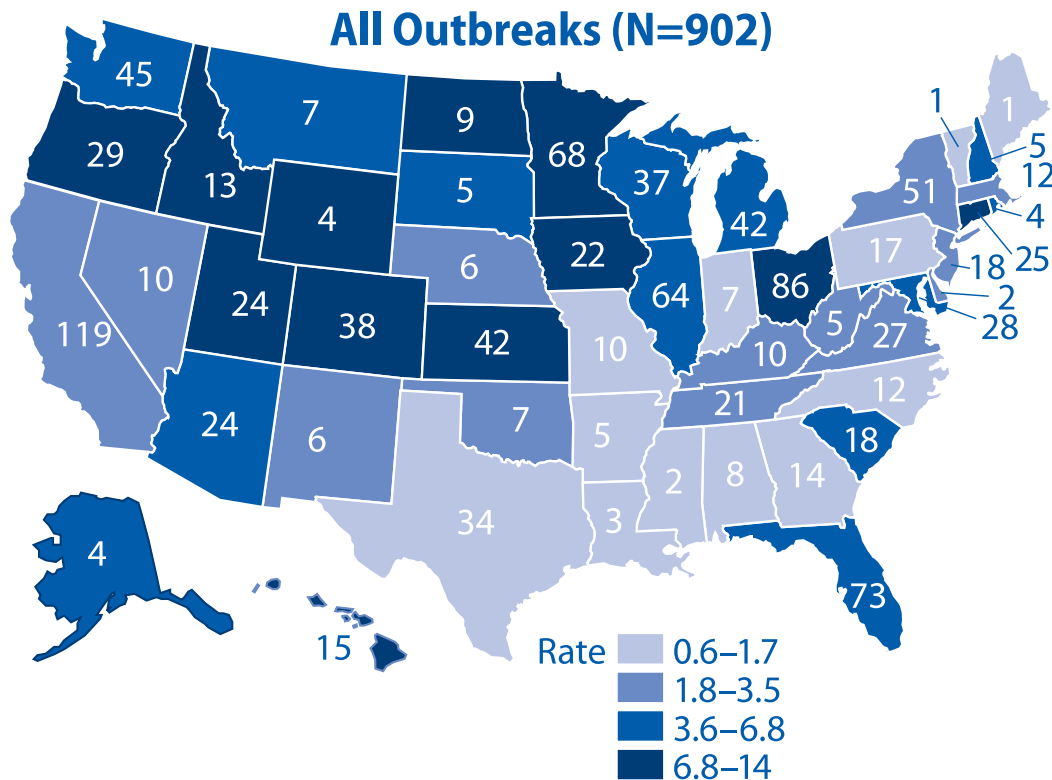
### Additional Information

Public health, regulatory, and food industry professionals can use this information to target prevention efforts aimed at pathogens and foods that cause the most outbreaks. Learn more about how outbreaks are reported and tracked at <http://www.cdc.gov/foodsafety/fdoss/>.

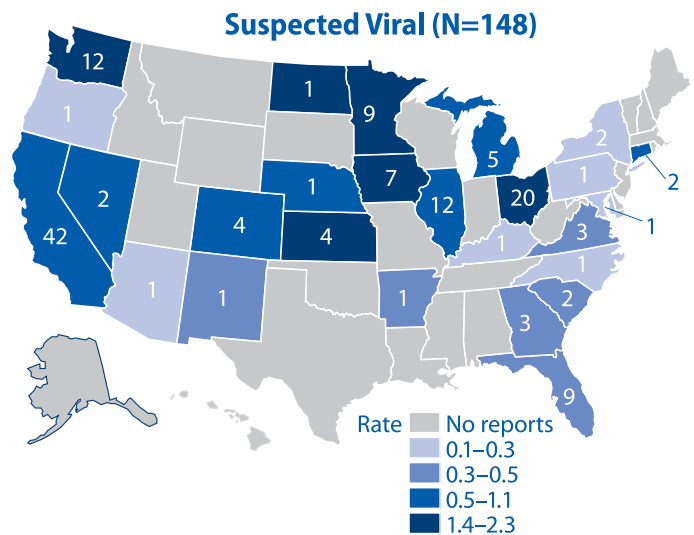
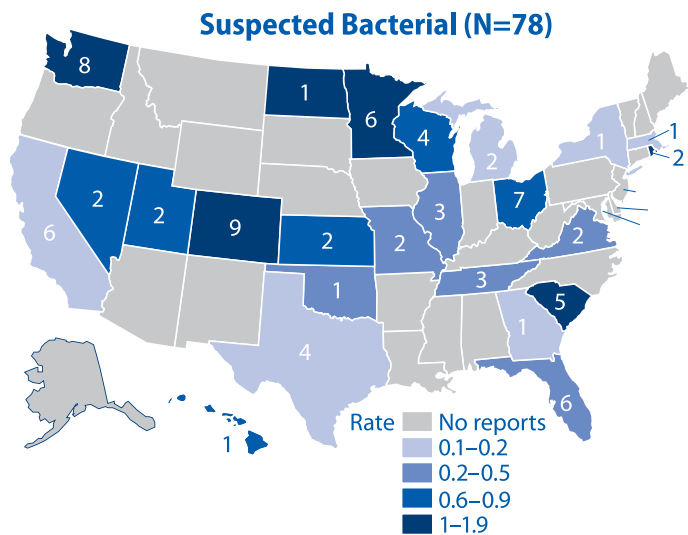
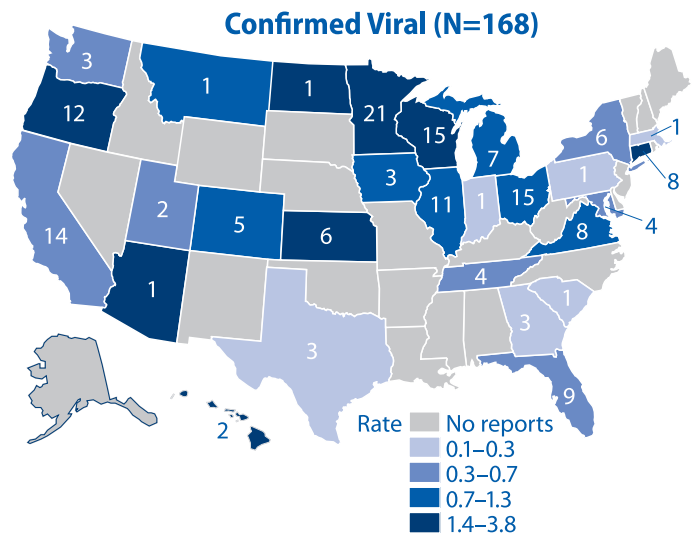
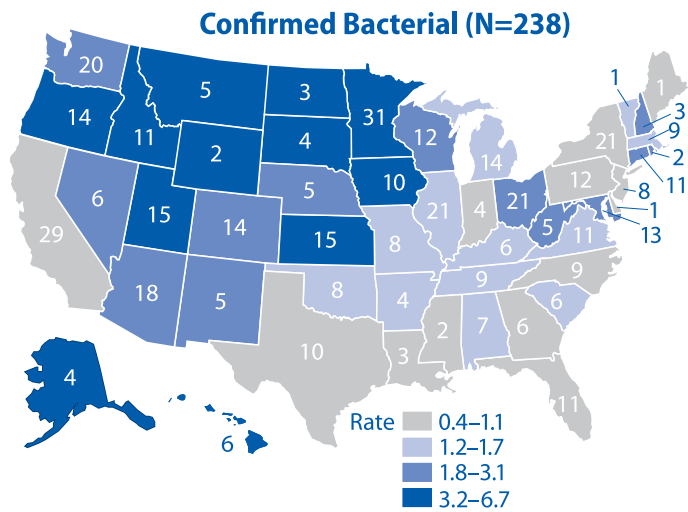
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3. Interagency Food Safety Analytics Collaboration (IFSAC): Completed Projects. Available at: <http://www.cdc.gov/foodsafety/ifsac/projects/completed.html>. Accessed October 13, 2016.

**Figure:** Rate of reported foodborne disease outbreaks per 1 million population\* and number of outbreaks,<sup>†</sup> by state<sup>‡</sup> and confirmed and suspected etiology<sup>§</sup>—Foodborne Disease Outbreak Surveillance System, United States, 2015.







\* Cut points for outbreak rate categories determined using quartiles. Legend differs for each map.

† Reported outbreaks in each state. Puerto Rico reported 2 outbreaks and Washington D. C. reported 3 outbreaks (not shown).

‡ Includes 30 multistate outbreaks (i.e., outbreaks in which exposure occurred in more than one state) assigned as an outbreak to each state involved. Multistate outbreaks involved a median of 7.5 states (range: 2-40).

§ If at least one etiology was confirmed based on defined criteria ([http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming\\_diagnosis.html](http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming_diagnosis.html)), the outbreak was considered to have a confirmed etiology. If an etiology was reported but not confirmed, the outbreak was considered to have a suspected etiology.

**Table 1:** Foodborne disease outbreaks, outbreak-associated illnesses, and hospitalizations, by etiology (confirmed or suspected)\* —Foodborne Disease Outbreak Surveillance System, United States, 2015.

Etiology	No. Outbreaks				No. Illnesses				No. Hospitalizations			
	CE	SE	Total	%	CE	SE	Total	%	CE	SE	Total	%
<b>Bacterial</b>												
<i>Salmonella</i> <sup>†</sup>	149	9	158	23	3944	91	4035	33	573	1	574	62
<i>Clostridium perfringens</i>	17	21	38	6	686	342	1028	8	0	0	0	0
<i>Escherichia coli</i> , Shiga toxin-producing (STEC) <sup>§</sup>	27	7	34	5	302	48	350	3	106	9	115	12
<i>Campylobacter</i> <sup>‡</sup>	21	12	33	5	212	46	258	2	16	3	19	2
<i>Staphylococcus aureus</i> enterotoxin	5	8	13	2	236	55	291	2	31	0	31	3
<i>Bacillus cereus</i>	2	6	8	1	25	28	53	0	0	0	0	0
<i>Vibrio parahaemolyticus</i>	4	2	6	1	49	5	54	0	1	0	1	0
<i>Shigella</i> <sup>¶</sup>	4	2	6	1	234	8	242	2	53	1	54	6
<i>Staphylococcus spp</i>	1	3	4	1	5	10	15	0	0	0	0	0
<i>Clostridium botulinum</i>	4	0	4	1	36	0	36	0	35	0	35	4
<i>Listeria monocytogenes</i>	2	0	2	0	21	0	21	0	19	0	19	2
<i>Vibrio vulnificus</i>	0	1	1	0	0	2	2	0	0	1	1	0
<i>Streptococcus</i> , Group A	0	1	1	0	0	40	40	0	0	0	0	0
<i>Escherichia coli</i> , Enteropathogenic	1	0	1	0	30	0	30	0	0	0	0	0
<i>Yersinia enterocolitica</i>	1	0	1	0	2	0	2	0	0	0	0	0
Other	0	6	6	1	0	40	40	0	0	0	0	0
<b>Subtotal</b>	<b>238</b>	<b>78</b>	<b>316</b>	<b>47</b>	<b>5782</b>	<b>715</b>	<b>6497</b>	<b>52</b>	<b>834</b>	<b>15</b>	<b>849</b>	<b>91</b>
<b>Chemical and toxin</b>												
Ciguatoxin	19	2	21	3	63	10	73	1	6	0	6	1
Scombroid toxin/Histamine	9	1	10	1	23	2	25	0	0	0	0	0
Puffer fish tetrodotoxin	1	0	1	0	5	0	5	0	2	0	2	0
Other	4	3	7	1	24	12	36	0	0	0	0	0
<b>Subtotal</b>	<b>33</b>	<b>6</b>	<b>39</b>	<b>6</b>	<b>115</b>	<b>24</b>	<b>139</b>	<b>1</b>	<b>8</b>	<b>0</b>	<b>8</b>	<b>1</b>
<b>Parasitic</b>												
<i>Cryptosporidium</i>	2	0	2	0	105	0	105	1	0	0	0	0
<i>Trichinella</i>	1	0	1	0	6	0	6	0	0	0	0	0
<i>Cyclospora</i>	1	0	1	0	90	0	90	1	3	0	3	0
<b>Subtotal</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>1</b>	<b>201</b>	<b>0</b>	<b>201</b>	<b>2</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>
<b>Viral</b>												
Norovirus	164	147	311	46	3893	1652	5545	45	46	17	63	7
Hepatitis A virus	3	0	3	0	13	0	13	0	5	0	5	1
Sapovirus	1	1	2	0	4	3	7	0	0	0	0	0
<b>Subtotal</b>	<b>168</b>	<b>148</b>	<b>316</b>	<b>47</b>	<b>3910</b>	<b>1655</b>	<b>5565</b>	<b>45</b>	<b>51</b>	<b>17</b>	<b>68</b>	<b>7</b>
<b>Single etiology**</b>	<b>443</b>	<b>232</b>	<b>675</b>	<b>75</b>	<b>10008</b>	<b>2394</b>	<b>12402</b>	<b>82</b>	<b>896</b>	<b>32</b>	<b>928</b>	<b>98</b>
<b>Multiple etiologies</b>	<b>8</b>	<b>10</b>	<b>18</b>	<b>2</b>	<b>283</b>	<b>184</b>	<b>467</b>	<b>3</b>	<b>11</b>	<b>1</b>	<b>12</b>	<b>1</b>
<b>Unknown etiology<sup>††</sup></b>	<b>0</b>	<b>209</b>	<b>209</b>	<b>23</b>	<b>2333</b>	<b>2333</b>	<b>2333</b>	<b>15</b>	<b>0</b>	<b>10</b>	<b>10</b>	<b>1</b>
<b>Total</b>	<b>451</b>	<b>451</b>	<b>902</b>	<b>100</b>	<b>10335</b>	<b>4867</b>	<b>15202</b>	<b>100</b>	<b>907</b>	<b>43</b>	<b>950</b>	<b>100</b>

**Abbreviations:** CE = confirmed etiology; SE = suspected etiology.

\* If at least one etiology was confirmed based on defined criteria ([http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming\\_diagnosis.html](http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming_diagnosis.html)), the outbreak was considered to have a confirmed etiology. If an etiology was reported but not confirmed, the outbreak was considered to have a suspected etiology.

<sup>†</sup> *Salmonella* serotypes causing more than five outbreaks were Enteritidis (53 outbreaks), I 4,[5],12:i:- (17), Newport (8), Braenderup (7), and Typhimurium (6).

<sup>‡</sup> *Campylobacter jejuni* (20 outbreaks), *Campylobacter* unknown species (12), and *Campylobacter* multiple species (1).

<sup>§</sup> STEC serogroups O157 (21 outbreaks), O26 (4), O103 (2), O111 (1), O145 (1), O121 (1), O45 (1), multiple serogroups (1), and unknown serogroup (2).

<sup>¶</sup> *Shigella sonnei* (6 outbreaks).

\*\* The denominator for the individual etiology percentages is the single etiology total. The denominator for the single etiology, multiple etiologies, and unknown etiology is the total of all outbreaks. Because of rounding, numbers might not add up to the single etiology total or the total of all outbreaks.

<sup>††</sup> An etiologic agent was not confirmed or suspected based on clinical, laboratory, or epidemiologic information.

**Table 2a:** Foodborne disease outbreaks and outbreak-associated illnesses, by food category\*—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Food Category*	No. Outbreaks		No. Illnesses	
	Total	%	Total	%
<b>Aquatic animals</b>				
Crustaceans	2	1	11	0
Mollusks†	16	8	164	4
Fish	34	18	176	4
Other aquatic animals	2	1	8	0
<b>Subtotal</b>	<b>54</b>	<b>28</b>	<b>359</b>	<b>8</b>
<b>Land animals</b>				
Dairy‡	18	9	116	3
Eggs	6	3	76	2
Beef	15	8	225	5
Pork	19	10	924	21
Chicken	22	11	333	8
Turkey	7	4	137	3
Other poultry	1	1	2	0
Game	1	1	6	0
<b>Subtotal</b>	<b>89</b>	<b>46</b>	<b>1819</b>	<b>42</b>
<b>Plants</b>				
Sprouts	1	1	34	1
Root and other underground vegetables§	4	2	83	2
Seeded vegetables¶	8	4	1121	26
Herbs	3	2	132	3
Vegetable row crops**	10	5	383	9
Fruits††	6	3	62	1
Grains and beans††	7	4	111	3
Nuts and seeds§§	1	1	13	0
<b>Subtotal</b>	<b>40</b>	<b>21</b>	<b>1939</b>	<b>44</b>
<b>Other</b>	<b>11</b>	<b>6</b>	<b>247</b>	<b>6</b>
<b>Food reported, attributed to a single food category¶¶</b>	<b>194</b>	<b>22</b>	<b>4364</b>	<b>29</b>
<b>Food reported with ingredients that belong to &gt;1 food category</b>	<b>166</b>	<b>18</b>	<b>2889</b>	<b>19</b>
<b>No food reported</b>	<b>542</b>	<b>60</b>	<b>7949</b>	<b>52</b>
<b>Total¶¶</b>	<b>902</b>	<b>100</b>	<b>15202</b>	<b>100</b>

\* Interagency Food Safety Analytics Collaboration (IFSAC) food categorization scheme: <http://www.cdc.gov/foodsafety/ifsac/projects/completed.html>.

† Bivalve mollusks (16 outbreaks).

‡ Unpasteurized dairy products (13 outbreaks), pasteurization unknown (4), and pasteurized dairy products (1).

§ Roots (2 outbreaks) and tubers (2).

¶ Solanaceous seeded vegetables (3 outbreaks), vine-grown seeded vegetables (3), legumes (1), and other seeded vegetables (1).

\*\* Leafy vegetables (10 outbreaks).

†† Pome fruits (4 outbreaks) and fruits not further classified (2).

‡‡ Grains (6 outbreaks) and beans (1).

§§ Nuts (1 outbreak).

¶¶ The denominator for the food category percentages is the "food reported, attributed to a single food category" total. The denominator for the "food reported attributed to a single food category", "food reported, not attributed to a single food category", and "No food reported" is the total. Because of rounding, numbers might not add up to the "food reported, attributed to a single food category" total or the total.

**Table 2b:** Most common confirmed pathogen-food category pairs resulting in outbreaks, outbreak-associated illnesses, hospitalizations, and deaths—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Top 5 pathogen-food category pairs resulting in outbreaks					
Etiology	Food Category*	No. Outbreaks	No. Illnesses	No. Hospitalizations	No. Deaths
<i>Ciguatoxin</i>	Fish	20	71	6	0
<i>Scombroid toxin/Histamine</i>	Fish	10	25	0	0
<i>Salmonella</i>	Chicken	9	62	9	0
<i>Salmonella</i>	Pork	8	615	70	1
<i>Campylobacter</i>	Dairy	8	38	8	0

Top 5 pathogen-food category pairs resulting in outbreak-associated illnesses					
Etiology	Food Category*	No. Outbreaks	No. Illnesses	No. Hospitalizations	No. Deaths
<i>Salmonella</i>	Seeded vegetables	4	1048	225	6
<i>Salmonella</i>	Pork	8	615	70	1
<i>Salmonella</i>	Vegetable row crops	2	263	2	0
Norovirus	Other	6	225	1	0
<i>Clostridium perfringens</i>	Pork	5	217	0	0

Top 5 pathogen-food category pairs resulting in outbreak-associated hospitalizations					
Etiology	Food Category*	No. Outbreaks	No. Illnesses	No. Hospitalizations	No. Deaths
<i>Salmonella</i>	Seeded vegetables	4	1048	225	6
<i>Salmonella</i>	Pork	8	615	70	1
<i>Staphylococcus aureus enterotoxin</i>	Chicken	2	102	31	0
<i>Clostridium botulinum</i>	Root and other underground vegetables	2	31	30	2
<i>Escherichia coli, Shiga toxin-producing</i>	Grains and beans	2	76	26	0

Pathogen-food category pairs resulting in outbreak-associated deaths					
Etiology	Food Category*	No. Outbreaks	No. Illnesses	No. Hospitalizations	No. Deaths
<i>Salmonella</i>	Seeded Vegetables	4	1048	225	6
<i>Clostridium botulinum</i>	Root and other underground vegetables	2	31	30	2
<i>Salmonella</i>	Pork	8	615	70	1
<i>Clostridium perfringens</i>	Beef	3	134	0	1
<i>Salmonella</i>	Sprouts	1	34	11	1
<i>Listeria monocytogenes</i>	Vegetable row crops	1	19	19	1
<i>Vibrio vulnificus</i>	Mollusks	1	2	1	1

\* Interagency Food Safety Analytics Collaboration (IFSAC) food categorization scheme: <http://www.cdc.gov/foodsafety/ifsac/projects/completed.html>.

**Table 3a:** Foodborne disease outbreaks and outbreak-associated illnesses, by location of food preparation—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Location	No. Outbreaks		No. Illnesses	
	Total	%	Total	%
<b>Restaurant</b>	469	60	4757	39
<b>Sit-down dining</b>	373	48	3632	30
<b>Fast-food</b>	62	8	651	5
<b>Buffet</b>	8	1	65	1
<b>Other or unknown type</b>	23	3	303	3
<b>Multiple types</b>	11	1	171	1
<b>Catering or banquet facility</b>	112	14	2880	24
<b>Private home</b>	73	9	873	7
<b>Institutional location</b>	42	5	1932	16
<b>School</b>	16	2	622	5
<b>Prison or jail</b>	11	1	988	8
<b>Camp</b>	6	1	104	1
<b>Day Care</b>	2	0	94	1
<b>Office or indoor workplace</b>	5	1	58	0
<b>Other</b>	2	0	66	1
<b>Other location</b>	8	1	239	2
<b>Other commercial location</b>	45	6	855	7
<b>Grocery store</b>	23	3	572	5
<b>Fair, festival, or temporary mobile service</b>	5	1	104	1
<b>Farm or dairy</b>	9	1	140	1
<b>Other</b>	8	1	39	0
<b>Hospital or nursing home</b>	11	1	328	3
<b>Nursing home</b>	9	1	313	3
<b>Hospital</b>	2	0	15	0
<b>Other private location</b>	6	1	95	1
<b>Place of worship</b>	4	1	45	0
<b>Other</b>	2	0	50	0
<b>Hotel or motel</b>	4	1	27	0
<b>Ship or boat</b>	1	0	3	0
<b>Single location*</b>	779	86	12054	79
<b>Multiple locations</b>	56	6	1552	10
<b>Unknown location</b>	67	7	1596	10
<b>Total</b>	<b>902</b>	<b>100</b>	<b>15202</b>	<b>100</b>

\*The denominator for the location percentages is the single location total. The denominator for the single location, multiple locations, and unknown location is the total. Because of rounding, numbers might not add up to the single location total or the total.

**Table 3b:** Foodborne disease outbreaks and outbreak-associated illnesses, by confirmed\* etiology and location of food preparation†—Foodborne Disease Outbreak Surveillance System, United State, 2015.

Etiology	Catering or banquet facility		Restaurant		Other commercial location		Hospital or nursing home		Institutional location		Private home		Other private location		Other location	
	NO	NI	NO	NI	NO	NI	NO	NI	NO	NI	NO	NI	NO	NI	NO	NI
<b>Bacterial</b>																
<i>Salmonella</i>	10	191	61	1102	9	402	1	3	5	282	21	259	1	10	3	60
<i>Clostridium perfringens</i>	2	44	4	92	1	57	–	–	<sup>3</sup>	221	3	120	–	–	–	–
<i>Escherichia coli</i> , Shiga toxin-producing	–	–	11	120	4	25	–	–	–	–	3	8	–	–	1	25
<i>Campylobacter</i>	2	24	6	29	3	9	–	–	2	74	4	36	–	–	–	–
<i>Staphylococcus aureus</i> enterotoxin	1	45	–	–	–	–	–	–	2	144	1	31	1	16	–	–
<i>Bacillus cereus</i>	1	22	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Vibrio parahaemolyticus</i>	–	–	1	3	–	–	–	–	–	–	1	2	–	–	–	–
<i>Shigella</i>	–	–	3	226	–	–	–	–	–	–	1	8	–	–	–	–
<i>Staphylococcus spp</i>	–	–	1	5	–	–	–	–	–	–	–	–	–	–	–	–
<i>Clostridium botulinum</i>	–	–	–	–	–	–	–	–	–	–	3	34	–	–	–	–
<i>Listeria monocytogenes</i>	–	–	–	–	–	–	–	–	–	–	1	2	–	–	–	–
<i>Vibrio vulnificus</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Streptococcus</i> , Group A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Escherichia coli</i> , Enteropathogenic	–	–	1	30	–	–	–	–	–	–	–	–	–	–	–	–
<i>Yersinia enterocolitica</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>16</b>	<b>326</b>	<b>88</b>	<b>1607</b>	<b>17</b>	<b>493</b>	<b>1</b>	<b>3</b>	<b>12</b>	<b>721</b>	<b>38</b>	<b>500</b>	<b>2</b>	<b>26</b>	<b>4</b>	<b>85</b>
<b>Chemical and toxin</b>																
Ciguatoxin	–	–	3	13	–	–	–	–	–	–	15	47	–	–	1	3
Scombroid toxin/Histamine	–	–	6	15	1	2	–	–	–	–	1	4	–	–	–	–
Puffer fish tetrodotoxin	–	–	–	–	–	–	–	–	–	–	1	5	–	–	–	–
Other	–	–	2	15	2	9	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>11</b>	<b>43</b>	<b>3</b>	<b>11</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>17</b>	<b>56</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>3</b>
<b>Parasitic</b>																
<i>Cryptosporidium</i>	–	–	–	–	1	103	–	–	–	–	–	–	–	–	–	–
<i>Trichinella</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Cyclospora</i>	–	–	1	90	–	–	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>90</b>	<b>1</b>	<b>103</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Viral</b>																
Norovirus	30	964	96	1489	6	137	2	96	7	499	3	110	3	29	3	143
Hepatitis A virus	–	–	2	5	–	–	–	–	–	–	–	–	–	–	–	–
Sapovirus	–	–	1	4	–	–	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>30</b>	<b>964</b>	<b>99</b>	<b>1498</b>	<b>6</b>	<b>137</b>	<b>2</b>	<b>96</b>	<b>7</b>	<b>499</b>	<b>3</b>	<b>110</b>	<b>3</b>	<b>29</b>	<b>3</b>	<b>143</b>
<b>Single etiology</b>	<b>46</b>	<b>1290</b>	<b>199</b>	<b>3238</b>	<b>27</b>	<b>744</b>	<b>3</b>	<b>99</b>	<b>19</b>	<b>1220</b>	<b>58</b>	<b>666</b>	<b>5</b>	<b>55</b>	<b>8</b>	<b>231</b>
<b>Multiple etiologies</b>	<b>1</b>	<b>10</b>	<b>3</b>	<b>50</b>	<b>3</b>	<b>45</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>178</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Total</b>	<b>47</b>	<b>1300</b>	<b>202</b>	<b>3288</b>	<b>30</b>	<b>789</b>	<b>3</b>	<b>99</b>	<b>20</b>	<b>1398</b>	<b>58</b>	<b>666</b>	<b>5</b>	<b>55</b>	<b>8</b>	<b>231</b>

**Abbreviations:** NO = number of outbreaks; NI = number of illnesses.

\* If at least one etiology was confirmed based on defined criteria ([http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming\\_diagnosis.html](http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming_diagnosis.html)), the outbreak was considered to have a confirmed etiology. If an etiology was reported but not confirmed, the outbreak was considered to have a suspected etiology.

† Reported locations were grouped as follows: catering or banquet facility, restaurant, other commercial location, hospital or nursing home, other institutional location, private home, other private location, and other location (includes Hotel or motel and Ship or boat) (see Table 3a).

‡ No outbreaks in the data reported fall into this category.

**Table 3c:** Foodborne disease outbreaks and outbreak-associated illnesses, by suspected\* etiology and location of food preparation†—Foodborne Disease Outbreak Surveillance System, United State, 2015.

Etiology	Catering or banquet facility		Restaurant		Other commercial location		Hospital or nursing home		Institutional location		Private home		Other private location		Other location	
	NO	NI	NO	NI	NO	NI	NO	NI	NO	NI	NO	NI	NO	NI	NO	NI
<b>Bacterial</b>																
<i>Salmonella</i>	2	35	1	24	–	–	–	–	1	4	1	5	–	–	1	7
<i>Clostridium perfringens</i>	6	150	9	80	–	–	–	–	2	36	3	64	–	–	–	–
<i>Escherichia coli</i> , Shiga toxin-producing	1	16	1	5	–	–	–	–	3	17	–	–	–	–	–	–
<i>Campylobacter</i>	–	–	6	17	2	8	–	–	1	10	1	2	–	–	–	–
<i>Staphylococcus aureus</i> enterotoxin	1	21	6	28	–	–	–	–	–	–	1	6	–	–	–	–
<i>Bacillus cereus</i>	–	–	6	28	–	–	–	–	–	–	–	–	–	–	–	–
<i>Vibrio parahaemolyticus</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Shigella</i>	–	–	2	8	–	–	–	–	–	–	–	–	–	–	–	–
<i>Staphylococcus spp</i>	–	–	2	5	–	–	–	–	–	–	–	–	–	–	–	–
<i>Clostridium botulinum</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Listeria monocytogenes</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Vibrio vulnificus</i>	–	–	1	2	–	–	–	–	–	–	–	–	–	–	–	–
<i>Streptococcus</i> , Group A	–	–	–	–	–	–	–	–	1	40	–	–	–	–	–	–
<i>Escherichia coli</i> , Enteropathogenic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Yersinia enterocolitica</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other	2	17	2	12	1	5	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>12</b>	<b>239</b>	<b>36</b>	<b>209</b>	<b>3</b>	<b>13</b>	<b>–</b>	<b>–</b>	<b>8</b>	<b>107</b>	<b>6</b>	<b>77</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>7</b>
<b>Chemical and toxin</b>																
Ciguatoxin	–	–	–	–	–	–	–	–	1	6	1	4	–	–	–	–
Scombroid toxin/Histamine	–	–	–	–	–	–	–	–	–	–	1	2	–	–	–	–
Puffer fish tetrodotoxin	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other	–	–	–	–	2	8	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>2</b>	<b>8</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>6</b>	<b>2</b>	<b>6</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Parasitic</b>																
<i>Cryptosporidium</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Trichinella</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Cyclospora</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Viral</b>																
Norovirus	15	471	106	648	3	12	3	85	5	229	3	39	–	–	–	–
Hepatitis A virus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sapovirus	–	–	1	3	–	–	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>15</b>	<b>471</b>	<b>107</b>	<b>651</b>	<b>3</b>	<b>12</b>	<b>3</b>	<b>85</b>	<b>5</b>	<b>229</b>	<b>3</b>	<b>39</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Single etiology</b>	<b>27</b>	<b>710</b>	<b>144</b>	<b>863</b>	<b>8</b>	<b>33</b>	<b>3</b>	<b>85</b>	<b>14</b>	<b>342</b>	<b>12</b>	<b>130</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>7</b>
<b>Multiple etiologies</b>	<b>2</b>	<b>45</b>	<b>5</b>	<b>36</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Unknown etiology<sup>§</sup></b>	<b>36</b>	<b>825</b>	<b>118</b>	<b>570</b>	<b>7</b>	<b>33</b>	<b>5</b>	<b>144</b>	<b>8</b>	<b>192</b>	<b>3</b>	<b>77</b>	<b>1</b>	<b>40</b>	<b>4</b>	<b>31</b>
<b>Total</b>	<b>65</b>	<b>1580</b>	<b>267</b>	<b>1469</b>	<b>15</b>	<b>66</b>	<b>8</b>	<b>229</b>	<b>22</b>	<b>534</b>	<b>15</b>	<b>207</b>	<b>1</b>	<b>40</b>	<b>5</b>	<b>38</b>

**Abbreviations:** NO = number of outbreaks; NI = number of illnesses.

\* If at least one etiology was confirmed based on defined criteria ([http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming\\_diagnosis.html](http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming_diagnosis.html)), the outbreak was considered to have a confirmed etiology. If an etiology was reported but not confirmed, the outbreak was considered to have a suspected etiology.

† Reported locations were grouped as follows: catering or banquet facility, restaurant, other commercial location, hospital or nursing home, other institutional location, private home, other private location, and other location (includes Hotel or motel and Ship or boat) (see Table 3a).

‡ No outbreaks in the data reported fall into this category.

§ An etiologic agent was not confirmed or suspected based on clinical, laboratory, or epidemiologic information.

**Table 4:** Multistate foodborne disease outbreaks, United States, 2015.

Month of first illness onset	Etiology	No. illnesses	No. hospitalizations	No. deaths	No. states involved	Implicated food*		
						Name	Confirmed	Recall
March	<i>Salmonella</i> serotype Paratyphi B	11	2	0	3	Lettuce	Yes	No
March	<i>Salmonella</i> serotypes Weltevreden and Paratyphi B	69	12	0	11	Raw tuna	Yes	Yes
March	Shiga toxin-producing <i>E. coli</i> O103	6	0	0	3	No food reported	-	No
March	<i>Salmonella</i> serotype Newport	25	3	0	10	Latin-style soft cheese	No	No
March	Shiga toxin-producing <i>E. coli</i> O157:H7	16	10	0	8	Romaine lettuce	No	No
April	<i>Salmonella</i> serotype Enteritidis	15	4	0	7	Chicken	Yes	Yes
April	Shiga toxin-producing <i>E. coli</i> O145	7	5	0	3	Prepackaged leafy greens	No	No
April	<i>Salmonella</i> serotypes Infantis and I 4,[5],12:i:-	192	30	0	5	Pork	Yes	Yes
May	<i>Salmonella</i> serotype Hartford	19	4	0	6	Tomatoes	No	No
May	<i>Cyclospora cayetanensis</i>	90	3	0	3	Cilantro	No	No
May	<i>Salmonella</i> serotype Paratyphi B	5	2	0	2	Tuna sushi	No	No
June	<i>Vibrio parahaemolyticus</i>	42	1	0	10	Raw oysters; raw clams	Yes	No
June	<i>Listeria monocytogenes</i>	19	19	1	9	Lettuce	Yes	Yes
June	<i>Salmonella</i> serotype Newport	15	2	0	8	Raw oysters	No	No
July	<i>Salmonella</i> serotype Poona	907	204	6	40	Cucumber	Yes	Yes
July	<i>Salmonella</i> serotype Java	13	0	0	10	Sprouted nut butter	Yes	Yes
July	<i>Salmonella</i> serotype Javiana	37	16	0	5	No food reported	-	No
August	<i>Salmonella</i> serotype Enteritidis	81	2	0	10	Truffle oil puree	Yes	No
August	<i>Salmonella</i> serotype Bareilly	8	0	0	8	Tuna sushi	Yes	No
August	<i>Salmonella</i> serotype Newport	119	17	0	2	Tomato	Yes	No
September	<i>Salmonella</i> serotype Braenderup	20	4	0	7	Sushi	No	No
October	Shiga toxin-producing <i>E. coli</i> O26	53	21	0	11	No food reported	-	No
October	Shiga toxin-producing <i>E. coli</i> O157:H7	5	3	0	4	Pre-packaged salad	No	No
October	Shiga toxin-producing <i>E. coli</i> O103	4	0	0	3	No food reported	-	No
October	Shiga toxin-producing <i>E. coli</i> O157:H7	19	3	0	7	Celery; onion	Yes	Yes
November	Shiga toxin-producing <i>E. coli</i> O26	5	1	0	3	No food reported	-	No
December	<i>Salmonella</i> serotypes Kentucky, Cubana, and Muenchen	34	11	1	14	Alfalfa sprouts; alfalfa sprout seeds	Yes	Yes
December	Shiga toxin-producing <i>E. coli</i> O26:NM and O121	63	17	0	24	Flour	Yes	Yes
December	<i>Salmonella</i> serotype Virchow	35	6	0	24	Moringa leaf powder	Yes	Yes
December	Shiga toxin-producing <i>E. coli</i> O157:H7	13	9	0	9	Pizza dough mix	No	No

\* Implicated foods in multistate outbreaks are further classified as confirmed or suspected based on epidemiologic, traceback, and laboratory evidence. A food is considered the confirmed source if two types of evidence are obtained, while a food is considered suspected if only one type of evidence is available.



**Appendix Table 1:** Foodborne disease outbreaks by confirmed etiology\* and contributing factors—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Etiology	Contamination Factors																No. outbreaks with reported contributing factors	Total No. outbreaks
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	≥1 factor reported		
<b>Bacterial</b>																		
<i>Salmonella</i>	–	–	–	–	1	17	13	2	26	5	3	4	1	9	8	61	71	149
<i>Clostridium perfringens</i>	1	–	–	–	–	4	–	–	1	–	–	–	–	1	1	6	14	17
<i>Escherichia coli</i> , Shiga toxin-producing	–	–	–	–	–	2	6	2	3	–	–	–	–	1	2	10	11	27
<i>Campylobacter</i>	–	–	–	–	–	4	4	–	2	–	–	–	–	–	1	10	13	21
<i>Staphylococcus aureus</i> enterotoxin	1	–	–	–	–	–	–	–	–	1	–	–	–	–	–	2	3	5
<i>Bacillus cereus</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2
<i>Vibrio parahaemolyticus</i>	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	2	3	4
<i>Shigella</i>	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	2	2	4
<i>Staphylococcus</i> spp	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	1	1
<i>Clostridium botulinum</i>	1	–	–	–	–	1	1	–	–	–	–	1	–	–	–	4	4	4
<i>Listeria monocytogenes</i>	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	1	2
<i>Vibrio vulnificus</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Streptococcus</i> , Group A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Escherichia coli</i> , Enteropathogenic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
<i>Yersinia enterocolitica</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>3</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>28</b>	<b>27</b>	<b>4</b>	<b>32</b>	<b>8</b>	<b>3</b>	<b>5</b>	<b>1</b>	<b>12</b>	<b>12</b>	<b>99</b>	<b>124</b>	<b>238</b>
<b>Chemical and toxin</b>																		
Ciguatoxin	18	–	–	–	–	–	–	–	–	–	–	–	–	–	1	19	19	19
Scombroid toxin/Histamine	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7	8	9
Puffer fish tetrodotoxin	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	1
Other	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	2	2	4
<b>Subtotal</b>	<b>26</b>	<b>–</b>	<b>2</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>29</b>	<b>30</b>	<b>33</b>
<b>Parasitic</b>																		
<i>Cryptosporidium</i>	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	1	2
<i>Trichinella</i>	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	1	1
<i>Cyclospora</i>	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	1	1
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>2</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>3</b>	<b>3</b>	<b>4</b>
<b>Viral</b>																		
Norovirus	–	–	–	–	–	–	6	–	3	34	24	22	11	2	6	83	86	164
Hepatitis A virus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Sapovirus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>6</b>	<b>–</b>	<b>3</b>	<b>34</b>	<b>24</b>	<b>22</b>	<b>11</b>	<b>2</b>	<b>6</b>	<b>83</b>	<b>86</b>	<b>168</b>
<b>Single etiology</b>	<b>29</b>	<b>–</b>	<b>2</b>	<b>–</b>	<b>1</b>	<b>29</b>	<b>35</b>	<b>4</b>	<b>35</b>	<b>42</b>	<b>27</b>	<b>27</b>	<b>12</b>	<b>14</b>	<b>19</b>	<b>214</b>	<b>243</b>	<b>443</b>
<b>Multiple etiologies</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>2</b>	<b>–</b>	<b>–</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>5</b>	<b>5</b>	<b>8</b>
<b>Total</b>	<b>29</b>	<b>–</b>	<b>2</b>	<b>–</b>	<b>1</b>	<b>29</b>	<b>37</b>	<b>4</b>	<b>35</b>	<b>44</b>	<b>28</b>	<b>28</b>	<b>13</b>	<b>14</b>	<b>19</b>	<b>219</b>	<b>248</b>	<b>451</b>

Appendices' footnotes are on page 19.

**Appendix Table 2:** Foodborne disease outbreaks by confirmed etiology\* and contributing factors—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Etiology	Proliferation/Amplification Factors													No. outbreaks with reported contributing factors	Total No. outbreaks
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	≥1 factor reported		
<b>Bacterial</b>															
<i>Salmonella</i>	22	13	1	1	8	5	8	8	1	–	1	1	42	71	149
<i>Clostridium perfringens</i>	5	5	–	1	2	1	7	7	–	–	–	3	14	14	17
<i>Escherichia coli</i> , Shiga toxin-producing	1	–	–	1	–	–	–	–	–	–	–	3	4	11	27
<i>Campylobacter</i>	3	–	–	3	–	–	1	–	–	–	–	–	6	13	21
<i>Staphylococcus aureus</i> enterotoxin	–	–	–	–	1	–	1	–	–	–	–	–	2	3	5
<i>Bacillus cereus</i>	–	–	–	–	–	1	1	1	–	–	–	1	1	1	2
<i>Vibrio parahaemolyticus</i>	–	–	–	–	–	–	–	–	–	–	–	1	1	3	4
<i>Shigella</i>	1	–	–	–	–	–	–	–	–	–	–	–	1	2	4
<i>Staphylococcus</i> spp	1	1	–	–	1	–	–	–	–	–	–	–	1	1	1
<i>Clostridium botulinum</i>	2	–	–	–	1	–	1	–	–	–	1	2	4	4	4
<i>Listeria monocytogenes</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2
<i>Vibrio vulnificus</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Streptococcus</i> , Group A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Escherichia coli</i> , Enteropathogenic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
<i>Yersinia enterocolitica</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Other	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>35</b>	<b>19</b>	<b>1</b>	<b>6</b>	<b>13</b>	<b>7</b>	<b>19</b>	<b>16</b>	<b>1</b>	<b>–</b>	<b>2</b>	<b>11</b>	<b>76</b>	<b>124</b>	<b>238</b>
<b>Chemical and toxin</b>															
Ciguatoxin	–	–	–	–	–	–	–	–	–	–	–	–	–	19	19
Scombroid toxin/Histamine	–	–	–	2	1	–	–	–	–	–	–	1	4	8	9
Puffer fish tetrodotoxin	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Other	–	–	–	–	–	–	–	–	–	–	–	–	–	2	4
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>2</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>4</b>	<b>30</b>	<b>33</b>
<b>Parasitic</b>															
<i>Cryptosporidium</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2
<i>Trichinella</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
<i>Cyclospora</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>3</b>	<b>4</b>
<b>Viral</b>															
Norovirus	2	1	–	1	2	–	1	–	–	–	–	–	5	86	164
Hepatitis A virus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Sapovirus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
<b>Subtotal</b>	<b>2</b>	<b>1</b>	<b>–</b>	<b>1</b>	<b>2</b>	<b>–</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>5</b>	<b>86</b>	<b>168</b>
<b>Single etiology</b>	<b>37</b>	<b>20</b>	<b>1</b>	<b>9</b>	<b>16</b>	<b>7</b>	<b>20</b>	<b>16</b>	<b>1</b>	<b>–</b>	<b>2</b>	<b>12</b>	<b>85</b>	<b>243</b>	<b>443</b>
<b>Multiple etiologies</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>2</b>	<b>5</b>	<b>8</b>
<b>Total</b>	<b>37</b>	<b>20</b>	<b>1</b>	<b>9</b>	<b>16</b>	<b>7</b>	<b>20</b>	<b>17</b>	<b>1</b>	<b>–</b>	<b>2</b>	<b>13</b>	<b>87</b>	<b>248</b>	<b>451</b>

Appendices' footnotes are on page 19.

**Appendix Table 3:** Foodborne disease outbreaks by confirmed etiology\* and contributing factors—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Etiology	Survival Factors						No. outbreaks with reported contributing factors	Total No. outbreaks
	S1	S2	S3	S4	S5	≥1 factor reported		
<b>Bacterial</b>								
<i>Salmonella</i>	23	9	1	5	10	39	71	149
<i>Clostridium perfringens</i>	4	6	1	–	5	13	14	17
<i>Escherichia coli</i> , Shiga toxin-producing	3	–	–	–	3	6	11	27
<i>Campylobacter</i>	5	1	–	–	1	7	13	21
<i>Staphylococcus aureus</i> enterotoxin	1	1	–	–	1	3	3	5
<i>Bacillus cereus</i>	–	1	–	–	1	1	1	2
<i>Vibrio parahaemolyticus</i>	–	–	–	–	–	–	3	4
<i>Shigella</i>	–	–	–	–	1	1	2	4
<i>Staphylococcus</i> spp	–	–	–	–	–	–	1	1
<i>Clostridium botulinum</i>	1	–	–	–	2	3	4	4
<i>Listeria monocytogenes</i>	–	–	–	–	–	–	1	2
<i>Vibrio vulnificus</i>	–	–	–	–	–	–	–	–
<i>Streptococcus</i> , Group A	–	–	–	–	–	–	–	–
<i>Escherichia coli</i> , Enteropathogenic	–	–	–	–	–	–	–	1
<i>Yersinia enterocolitica</i>	–	–	–	–	–	–	–	1
Other	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>37</b>	<b>18</b>	<b>2</b>	<b>5</b>	<b>24</b>	<b>73</b>	<b>124</b>	<b>238</b>
<b>Chemical and toxin</b>								
Ciguatoxin	–	–	–	–	–	–	19	19
Scombroid toxin/Histamine	–	–	–	–	1	1	8	9
Puffer fish tetrodotoxin	–	–	–	–	–	–	1	1
Other	–	–	–	–	–	–	2	4
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>1</b>	<b>30</b>	<b>33</b>
<b>Parasitic</b>								
<i>Cryptosporidium</i>	–	–	–	–	–	–	1	2
<i>Trichinella</i>	1	–	–	–	–	1	1	1
<i>Cyclospora</i>	–	–	–	–	–	–	1	1
<b>Subtotal</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>3</b>	<b>4</b>
<b>Viral</b>								
Norovirus	–	1	–	2	5	7	86	164
Hepatitis A virus	–	–	–	–	–	–	–	3
Sapovirus	–	–	–	–	–	–	–	1
<b>Subtotal</b>	<b>–</b>	<b>1</b>	<b>–</b>	<b>2</b>	<b>5</b>	<b>7</b>	<b>86</b>	<b>168</b>
<b>Single etiology</b>	<b>38</b>	<b>19</b>	<b>2</b>	<b>7</b>	<b>30</b>	<b>82</b>	<b>243</b>	<b>443</b>
<b>Multiple etiologies</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>8</b>
<b>Total</b>	<b>38</b>	<b>19</b>	<b>2</b>	<b>7</b>	<b>31</b>	<b>83</b>	<b>248</b>	<b>451</b>

Appendices' footnotes are on page 19.

**Appendix Table 4:** Foodborne disease outbreaks by suspected etiology\* and contributing factors—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Etiology	Contamination Factors															No. outbreaks with reported contributing factors	Total No. outbreaks	
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15			≥1 factor reported
<b>Bacterial</b>																		
<i>Salmonella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9
<i>Clostridium perfringens</i>	2	-	-	-	-	1	-	-	-	1	-	-	-	1	3	7	16	21
<i>Escherichia coli</i> , Shiga toxin-producing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
<i>Campylobacter</i>	-	-	-	-	-	2	2	-	-	-	-	-	-	-	-	4	6	12
<i>Staphylococcus aureus</i> enterotoxin	-	-	-	-	-	-	-	1	1	-	1	-	-	2	5	5	5	8
<i>Bacillus cereus</i>	-	-	-	-	-	-	-	-	1	-	-	-	1	-	2	3	3	6
<i>Vibrio parahaemolyticus</i>	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	2	2
<i>Shigella</i>	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	1	1	2
<i>Staphylococcus</i> spp	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	2	2	3
<i>Clostridium botulinum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Listeria monocytogenes</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Vibrio vulnificus</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1	1	1
<i>Streptococcus</i> , Group A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<i>Escherichia coli</i> , Enteropathogenic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Yersinia enterocolitica</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	6
<b>Subtotal</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>4</b>	<b>-</b>	<b>1</b>	<b>4</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>5</b>	<b>22</b>	<b>39</b>	<b>78</b>
<b>Chemical and toxin</b>																		
Ciguatoxin	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	2
Scombroid toxin/Histamine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Puffer fish tetrodotoxin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	3
<b>Subtotal</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>6</b>
<b>Parasitic</b>																		
<i>Cryptosporidium</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Trichinella</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Cyclospora</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Subtotal</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Viral</b>																		
Norovirus	-	-	-	-	-	2	1	3	23	13	8	2	2	15	46	51	51	147
Hepatitis A virus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sapovirus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<b>Subtotal</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>23</b>	<b>13</b>	<b>8</b>	<b>2</b>	<b>2</b>	<b>15</b>	<b>46</b>	<b>51</b>	<b>51</b>	<b>148</b>
<b>Single etiology</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>6</b>	<b>1</b>	<b>4</b>	<b>27</b>	<b>13</b>	<b>10</b>	<b>2</b>	<b>4</b>	<b>22</b>	<b>70</b>	<b>92</b>	<b>232</b>
<b>Multiple etiologies</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>10</b>
<b>Unknown etiology</b>	<b>1</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>3</b>	<b>-</b>	<b>11</b>	<b>9</b>	<b>3</b>	<b>4</b>	<b>-</b>	<b>15</b>	<b>18</b>	<b>44</b>	<b>54</b>	<b>209</b>
<b>Total</b>	<b>4</b>	<b>1</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>5</b>	<b>9</b>	<b>1</b>	<b>15</b>	<b>37</b>	<b>16</b>	<b>14</b>	<b>2</b>	<b>19</b>	<b>40</b>	<b>115</b>	<b>149</b>	<b>451</b>

Appendices' footnotes are on page 19.

**Appendix Table 5:** Foodborne disease outbreaks by suspected etiology\* and contributing factors—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Etiology	Proliferation/Amplification Factors													No. outbreaks with reported contributing factors	Total No. outbreaks
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	≥1 factor reported		
<b>Bacterial</b>															
<i>Salmonella</i>	–	–	–	–	1	–	–	–	–	–	–	–	1	1	9
<i>Clostridium perfringens</i>	7	4	1	–	2	–	9	6	–	–	–	1	16	16	21
<i>Escherichia coli</i> , Shiga toxin-producing	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7
<i>Campylobacter</i>	2	–	–	–	–	–	–	1	–	–	–	–	3	6	12
<i>Staphylococcus aureus</i> enterotoxin	–	3	–	1	1	–	2	1	–	–	–	–	5	5	8
<i>Bacillus cereus</i>	–	–	–	–	–	–	1	2	–	–	–	–	2	3	6
<i>Vibrio parahaemolyticus</i>	–	–	–	–	–	–	–	–	1	–	–	–	1	2	2
<i>Shigella</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2
<i>Staphylococcus spp</i>	2	1	–	–	1	–	–	1	–	–	–	–	2	2	3
<i>Clostridium botulinum</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Listeria monocytogenes</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Vibrio vulnificus</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
<i>Streptococcus</i> , Group A	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
<i>Escherichia coli</i> , Enteropathogenic	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Yersinia enterocolitica</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other	–	1	–	–	1	–	1	–	–	–	–	–	2	2	6
<b>Subtotal</b>	<b>11</b>	<b>9</b>	<b>1</b>	<b>1</b>	<b>6</b>	<b>–</b>	<b>13</b>	<b>11</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>32</b>	<b>39</b>	<b>78</b>
<b>Chemical and toxin</b>															
Ciguatoxin	1	1	–	–	–	–	–	–	–	–	–	1	1	1	2
Scombroid toxin/Histamine	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Puffer fish tetrodotoxin	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Other	–	–	–	–	–	–	–	–	–	–	–	–	–	1	3
<b>Subtotal</b>	<b>1</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>6</b>
<b>Parasitic</b>															
<i>Cryptosporidium</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Trichinella</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<i>Cyclospora</i>	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Viral</b>															
Norovirus	2	–	–	1	1	–	5	2	–	–	–	–	9	51	147
Hepatitis A virus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sapovirus	2	–	–	1	1	–	5	2	–	–	–	–	9	51	148
<b>Subtotal</b>	<b>14</b>	<b>10</b>	<b>1</b>	<b>2</b>	<b>7</b>	<b>–</b>	<b>18</b>	<b>13</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>2</b>	<b>42</b>	<b>92</b>	<b>232</b>
<b>Single etiology</b>	<b>2</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>10</b>
<b>Multiple etiologies</b>	<b>11</b>	<b>12</b>	<b>5</b>	<b>5</b>	<b>13</b>	<b>–</b>	<b>8</b>	<b>7</b>	<b>2</b>	<b>1</b>	<b>–</b>	<b>3</b>	<b>35</b>	<b>54</b>	<b>209</b>
<b>Unknown etiology</b>	<b>27</b>	<b>22</b>	<b>6</b>	<b>7</b>	<b>20</b>	<b>–</b>	<b>26</b>	<b>20</b>	<b>3</b>	<b>1</b>	<b>–</b>	<b>6</b>	<b>79</b>	<b>149</b>	<b>451</b>
<b>Total</b>	<b>23</b>	<b>17</b>	<b>5</b>	<b>18</b>	<b>31</b>	<b>3</b>	<b>27</b>	<b>25</b>	<b>2</b>	<b>–</b>	<b>–</b>	<b>7</b>	<b>87</b>	<b>156</b>	<b>398</b>

Appendices' footnotes are on page 19.

**Appendix Table 6:** Foodborne disease outbreaks by suspected etiology\* and contributing factors—Foodborne Disease Outbreak Surveillance System, United States, 2015.

Etiology	Survival Factors						No. outbreaks with reported contributing factors	Total No. outbreaks
	S1	S2	S3	S4	S5	≥1 factor reported		
<b>Bacterial</b>								
<i>Salmonella</i>	–	–	–	–	–	–	1	9
<i>Clostridium perfringens</i>	2	10	–	–	1	11	16	21
<i>Escherichia coli</i> , Shiga toxin-producing	–	–	–	–	–	–	–	7
<i>Campylobacter</i>	3	–	–	–	–	3	6	12
<i>Staphylococcus aureus</i> enterotoxin	–	1	–	–	–	1	5	8
<i>Bacillus cereus</i>	–	1	–	1	1	2	3	6
<i>Vibrio parahaemolyticus</i>	–	–	–	–	–	–	2	2
<i>Shigella</i>	–	–	–	–	–	–	1	2
<i>Staphylococcus spp</i>	1	–	–	–	–	1	2	3
<i>Clostridium botulinum</i>	–	–	–	–	–	–	–	–
<i>Listeria monocytogenes</i>	–	–	–	–	–	–	–	–
<i>Vibrio vulnificus</i>	–	–	–	–	–	–	1	1
<i>Streptococcus</i> , Group A	–	–	–	–	–	–	–	1
<i>Escherichia coli</i> , Enteropathogenic	–	–	–	–	–	–	–	–
<i>Yersinia enterocolitica</i>	–	–	–	–	–	–	–	–
Other	–	–	–	–	–	–	2	6
<b>Subtotal</b>	<b>6</b>	<b>12</b>	<b>–</b>	<b>1</b>	<b>2</b>	<b>18</b>	<b>39</b>	<b>78</b>
<b>Chemical and toxin</b>								
Ciguatoxin	–	–	–	–	–	–	1	2
Scombroid toxin/Histamine	–	–	–	–	–	–	–	1
Puffer fish tetrodotoxin	–	–	–	–	–	–	–	–
Other	–	–	–	–	–	–	1	3
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>2</b>	<b>6</b>
<b>Parasitic</b>								
<i>Cryptosporidium</i>	–	–	–	–	–	–	–	–
<i>Trichinella</i>	–	–	–	–	–	–	–	–
<i>Cyclospora</i>	–	–	–	–	–	–	–	–
<b>Subtotal</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>Viral</b>								
Norovirus	–	1	–	3	2	6	51	147
Hepatitis A virus	–	–	–	–	–	–	–	–
Sapovirus	–	–	–	–	–	–	–	1
<b>Subtotal</b>	<b>–</b>	<b>1</b>	<b>–</b>	<b>3</b>	<b>2</b>	<b>6</b>	<b>51</b>	<b>148</b>
<b>Single etiology</b>	<b>6</b>	<b>13</b>	<b>–</b>	<b>4</b>	<b>4</b>	<b>24</b>	<b>92</b>	<b>232</b>
<b>Multiple etiologies</b>	<b>–</b>	<b>1</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>1</b>	<b>3</b>	<b>10</b>
<b>Unknown etiology</b>	<b>4</b>	<b>5</b>	<b>–</b>	<b>2</b>	<b>6</b>	<b>17</b>	<b>54</b>	<b>209</b>
<b>Total</b>	<b>10</b>	<b>19</b>	<b>–</b>	<b>6</b>	<b>10</b>	<b>42</b>	<b>149</b>	<b>451</b>

Appendices' footnotes are on page 19.

## Appendix: Reported foodborne disease outbreaks, by confirmed and suspected etiology\* and contributing factors†—Foodborne Disease Outbreak Surveillance System, United States, 2015

\* If at least one etiology was laboratory-confirmed, the outbreak was considered to have a confirmed etiology. If no etiology was laboratory-confirmed but an etiology was reported based on clinical or epidemiologic features, the outbreak was considered to have a suspected etiology.

† Contributing factors are defined as risk factors that either enable an outbreak to occur or amplify an outbreak caused by other means. Contributing factors are classified into three categories: contamination factors (factors that introduce or otherwise permit contamination), proliferation/amplification factors (factors that allow proliferation or growth of the etiologic agent), and survival factors (factors that allow survival or fail to inactivate a contaminant). More than one contributing factor might be reported per outbreak.

‡ Contributing factors:

- C1: toxic substance part of the tissue
- C2: poisonous substance intentionally/deliberately added
- C3: poisonous substance accidentally/inadvertently added
- C4: addition of excessive quantities of ingredients that are toxic in large amounts
- C5: toxic container
- C6: contaminated raw product—food that was intended to be consumed after a kill step
- C7: contaminated raw product—food was intended to be consumed raw or undercooked/underprocessed
- C8: foods originating from sources shown to be contaminated or polluted (such as a growing field or harvest area)
- C9: cross-contamination of ingredients (cross-contamination does not include ill food workers)
- C10: bare-handed contact by a food handler/worker/preparer who is suspected to be infectious
- C11: glove-handed contact by a food handler/worker/preparer who is suspected to be infectious
- C12: other mode of contamination (excluding cross-contamination) by a food handler/worker/preparer who is suspected to be infectious
- C13: foods contaminated by non-food handler/worker/preparer who is suspected to be infectious
- C14: storage in a contaminated environment
- C15: other source of contamination
- P1: food preparation practices that support proliferation of pathogens (during food preparation)
- P2: no attempt was made to control the temperature of implicated food or the length of time food was out of temperature control (during food service or display of food)
- P3: improper adherence of approved plan to use Time as a Public Health Control
- P4: improper cold holding due to malfunctioning refrigeration equipment
- P5: improper cold holding due to an improper procedure or protocol
- P6: improper hot holding due to malfunctioning equipment
- P7: improper hot holding due to improper procedure or protocol
- P8: improper/slow cooling
- P9: prolonged cold storage
- P10: inadequate modified atmospheric packaging
- P11: inadequate processing (acidification, water activity, fermentation)
- P12: other situations that promoted or allowed microbial growth or toxin production
- S1: insufficient time and/or temperature control during initial cooking/heat processing
- S2: insufficient time and/or temperature during reheating
- S3: insufficient time and/or temperature control during freezing
- S4: insufficient or improper use of chemical processes designed for pathogen destruction
- S5: other process failures that permit pathogen survival

§No outbreaks in the data reported fall in this category.

\*An etiologic agent was not confirmed or suspected based on clinical, laboratory, or epidemiologic information.



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