

Surveillance for Foodborne Disease Outbreaks United States, 2012: Annual Report



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





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Foodborne Disease Outbreaks
United States**

2012 Annual Report

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Introduction

Foodborne diseases cause an estimated 48 million illnesses each year in the United States, including 9.4 million caused by known pathogens (1–2). Though only a small proportion of these illnesses occur in the setting of an outbreak, data collected during outbreak investigations can provide valuable insight into the pathogens and foods that cause illness. Public health officials, regulatory agencies, and the food industry can use this information to create targeted control strategies along the farm-to-table continuum to address specific pathogens and foods.

A foodborne disease outbreak 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://cymcdn.com/sites/www.cste.org/resource/resmgr/CSTENotifiableConditionListA.pdf>). CDC conducts foodborne disease outbreak surveillance in the United States through the Foodborne Disease Outbreak Surveillance System. Public health agencies in all 50 states, the District of Columbia, U.S. territories, and Freely Associated States 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 caused by other modes of transmission, including person-to-person contact, animal contact, water, environmental contamination, and unknown mode of transmission.

Investigating and reporting agencies use a standard outbreak reporting form (http://www.cdc.gov/nors/pdf/NORS_CDC_5213.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 and ingredients; locations of food preparation; and factors contributing to food contamination (see appendix). Outbreaks that are excluded from the Foodborne Disease Outbreak Surveillance System include those that occurred on

cruise ships with both US and international ports and those in which the food was eaten outside the United States, even if the illness occurred in the United States.

This report includes foodborne disease outbreaks that were reported to the Foodborne Disease Outbreak Surveillance System by October 17, 2013, in which the first illness occurred during 2012. Etiologic agents were reported as confirmed if they met pre-defined confirmation criteria (3); otherwise, they were reported as suspected. 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 United States Census estimates of the 2011 state populations (<http://www.census.gov/popest/>); multistate outbreaks were included in population-based outbreak reporting rates by assigning one outbreak to each state that reported cases in the outbreak. Implicated foods were classified into one of 24 single food categories if a single contaminated ingredient was identified or if all ingredients belonged to that category (4). Outbreaks attributed to foods that could not be assigned to one of these single food categories, or for which the report contained insufficient information for category assignment, were not attributed to any category.

Findings: Foodborne disease outbreaks, United States, 2012

During 2012, 831 foodborne disease outbreaks were reported (Table 1), resulting in 14,972 illnesses, 794 hospitalizations, and 23 deaths (Table 1). Outbreaks were reported by public health officials from all 50 states, the District of Columbia, and Puerto Rico (Figure 1). The median rate was 3.4 foodborne disease outbreaks per 1 million population; rates ranged from 1.0 outbreak per 1 million population in Mississippi to 11.4 outbreaks per 1 million population in Rhode Island.

A single confirmed or suspected etiologic agent was identified in 579 (69%) outbreaks (423 confirmed and 156 suspected) (Table 1). Among the 423 outbreaks with a single confirmed etiologic agent, bacteria caused the most outbreaks (208 outbreaks, 49%), followed by viruses (175, 41%), chemicals and toxins (36, 9%), and parasites (4, 1%). Norovirus was the most common cause of confirmed, single-etiology outbreaks and illnesses, accounting for 172 (41%) outbreaks and 4,679 (45%) illnesses. *Salmonella* was next, accounting for 106 (25%) outbreaks and 3,366 (33%) illnesses. Among the 101 confirmed *Salmonella* outbreaks with a serotype reported, Enteritidis was the most common (26 outbreaks, 26%), followed by Typhimurium (13, 13%), Newport (10, 10%), Javiana (7, 7%), and Heidelberg (6, 6%). Shiga toxin-producing *Escherichia coli* (STEC) caused 29 confirmed, single-etiology outbreaks, of which 24 (83%) were caused by serogroup O157; 2 outbreaks were caused by serogroup O145 and 1 outbreak each by O45, O111, and O121.

Of the 10,319 outbreak-related illnesses caused by a single confirmed etiologic agent, 701 (7%) resulted in hospitalization (Table 1). Among confirmed, single-etiology outbreaks, *Salmonella* caused the most outbreak-related hospitalizations (449 hospitalizations, 64%), followed by STEC (98, 14%) and norovirus (46, 7%). Outbreaks caused by *Clostridium botulinum* resulted in the highest proportion of ill persons hospitalized (100%). Among the 23 deaths reported, 17 (74%) were attributed to bacterial etiologies (*Listeria monocytogenes* [6], *Campylobacter* [4], STEC serogroups O157 [3] and O145 [1], *Salmonella* [2], and *Clostridium botulinum* [1]); 4 deaths were attributed to mycotoxins, 1 to another chemical or toxin, and 1 to norovirus.

A food vehicle was reported for 334 (40%) outbreaks. In 192 (57%) of these outbreaks, the food vehicle could be classified into one of the 24 single food categories (Table 2a); the categories most commonly implicated were fish (31 outbreaks, 16%), vegetable row crops (23, 12%), and dairy (19, 10%). Among the 17 dairy-associated outbreaks for which pasteurization information was reported,

12 (71%) involved unpasteurized products. The categories associated with the most outbreak-related illnesses were fruits (858 illnesses, 21%), fish (515, 12%), and chicken (509, 12%).

The pathogen-food category pairs responsible for the most outbreaks were scombroid toxin (histamine fish poisoning) in fish (17 outbreaks), *Campylobacter* in unpasteurized dairy (10), and *Vibrio parahaemolyticus* in mollusks (10) (Table 2b). The pathogen-food category pairs responsible for the most outbreak-related illnesses were *Salmonella* in fruits (446 illnesses), *Salmonella* in fish (425), and *Salmonella* in chicken (345). The pathogen-food category pairs responsible for the most hospitalizations were *Salmonella* in chicken (109 hospitalizations), *Salmonella* in fruits (55), and *Salmonella* in fish (55). Deaths were reported for the following pathogen-food category pairs: *Listeria* in dairy (5 deaths) and sprouts (1), *Campylobacter* in chicken (4), STEC in vegetable row crops (1), *Salmonella* in eggs (1) and fruits (1), other chemical or toxin in fish (1), *Clostridium botulinum* in root or other underground vegetable (1).

Twenty-four multistate outbreaks (3% of all outbreaks) were reported. They involved a median of 8 states (range: 3–23). Fifteen outbreaks were caused by *Salmonella*. Reported *Salmonella* serotypes were Typhimurium (4 outbreaks); Javiana, Newport, and multiple serotypes (2 each); Bredeney, Cubana, Enteritidis, Heidelberg, and Schwarzengrund (1 each). The remaining 9 outbreaks were caused by STEC (5 outbreaks; serogroups O157 [2], O45 [1], O121 [1], and O145 [1]), *Listeria* (2), *Campylobacter* (1), and *Vibrio parahaemolyticus* (1). Fourteen (93%) of 15 multistate outbreaks caused by *Salmonella* implicated a food vehicle; the foods were cantaloupes (4 outbreaks); ground beef and chicken (2 each); cucumbers, mangos, peanut butter, sprouts, romaine lettuce, and tuna (1 each). In the fifteenth, a food vehicle was not identified, but food was consumed at restaurants of a Mexican-style chain. Five multistate outbreaks were caused by STEC; it was transmitted in romaine lettuce (serogroup O157 [1]), prepackaged leafy greens (O157 [1]), an unspecified type of lettuce (O145 [1]),

frozen meals (O121 [1]), and sandwiches (O45 [1]). Two multistate outbreaks were caused by *Listeria* in pasteurized ricotta salata cheese and sprouts (1 outbreak each). Chicken livers were implicated in the *Campylobacter* outbreak and oysters were implicated in the *Vibrio parahaemolyticus* outbreak.

Among the 719 outbreaks and 12,657 illnesses with a reported single location where food was prepared, 433 outbreaks (60%) and 5,174 illnesses (41%) were associated with foods prepared in a restaurant (Table 3a). Among these outbreaks, sit-down dining-style was the type of restaurant most commonly reported as the location where food was prepared (358 outbreaks, 83%).

Twenty outbreaks resulted in product recalls; the foods recalled were ground beef (3 outbreaks); oysters and unpasteurized milk (2 each); multiple types of shellfish, raw tuna scrape and strips, pasteurized ricotta salata cheese, pasteurized milk and chocolate products, hog head cheese, pre-packaged leafy greens, cantaloupes, mangos, multiple fruits, peanut butter and other peanut products, tempeh, unpasteurized apple cider, and frozen meals (1 each).

Limitations

The findings in this report are subject to at least four limitations. First, only a small proportion of foodborne illnesses reported each year are identified as being associated with outbreaks. The extent to which the distribution of food vehicles and locations of preparation implicated in foodborne disease 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 or suspected

etiology or food vehicle might not apply to outbreaks with an unknown etiology or food vehicle. Third, CDC's outbreak surveillance system is dynamic; agencies can submit new reports and can change or delete previous reports as new information becomes available. Therefore, the results of this analysis might differ from those published earlier or from future reports. Finally, because of changes in the surveillance system implemented in 2009 and the use of a new food categorization scheme in 2011, comparisons with preceding years should be made with caution.

Main Findings and Comments

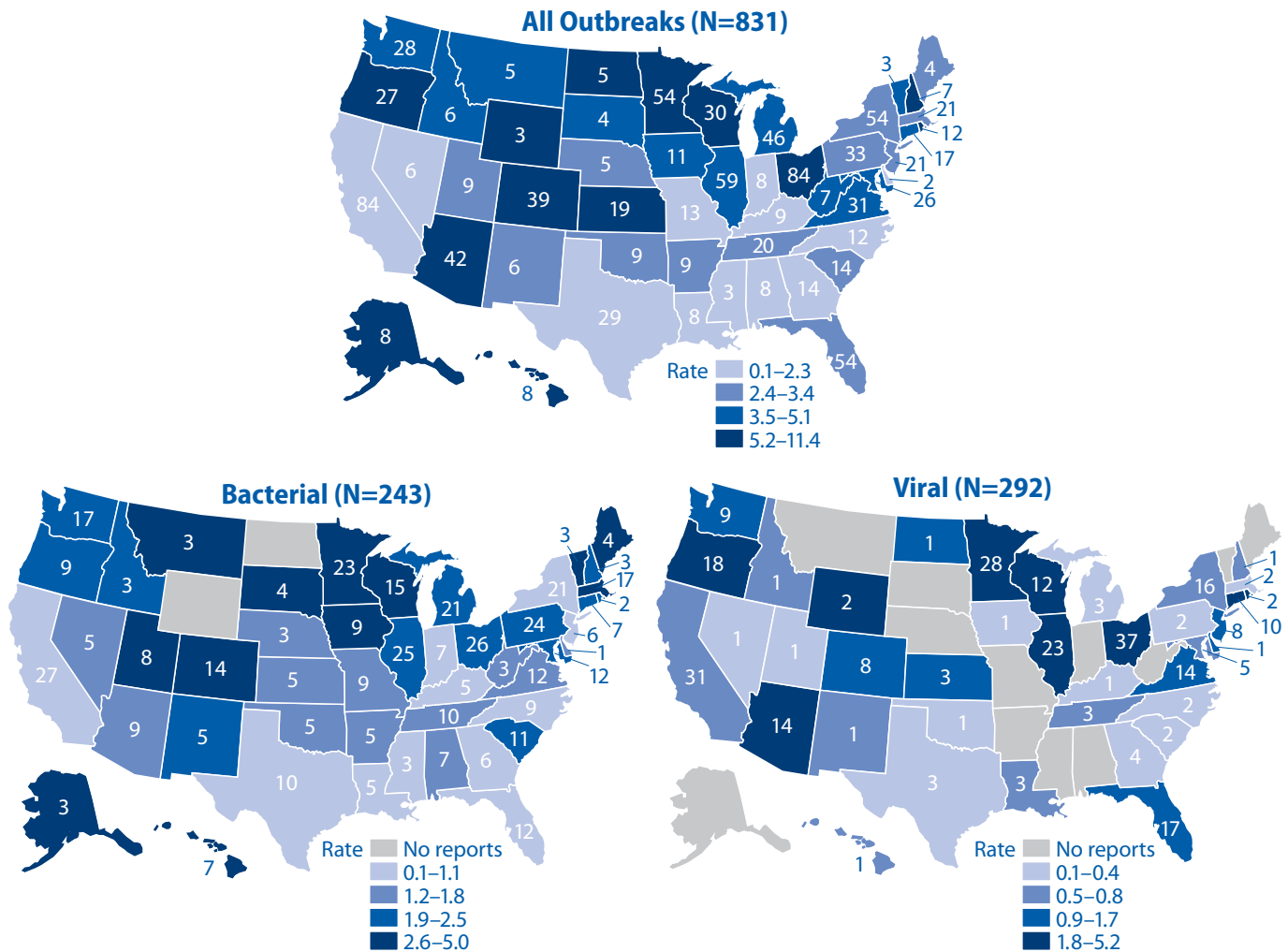
- In 2012, 831 foodborne disease outbreaks were reported, resulting in 14,972 illnesses, 794 hospitalizations, 23 deaths, and 20 food recalls.
- The number of outbreaks caused by *Campylobacter* increased from 25 in 2010 to 30 in 2011 and 37 in 2012. Among the 19 *Campylobacter* outbreaks with a known food vehicle in 2012, 10 (53%) were attributed to unpasteurized dairy products.
- Fish, vegetable row crops, and dairy were the most commonly implicated single food categories in outbreaks in which a single food category could be implicated.
- Restaurants, specifically sit-down dining-style restaurants, were most commonly reported as the location of food preparation.

Public health, regulatory, and food industry professionals use foodborne disease outbreak surveillance data to target prevention efforts related to pathogens and foods that cause foodborne disease outbreaks. Additional information on outbreaks and the Foodborne Disease Outbreak Online Database are available at <http://www.cdc.gov/foodsafety/fdoss/>.

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Figure: Rate of reported foodborne disease outbreaks per 1 million population* and number of outbreaks,† by state‡ and major etiology group§—Foodborne Disease Outbreak Surveillance System, United States, 2012



* Cutpoints for outbreak rate categories determined using quartiles. Legend differs for each map.

† Number of reported outbreaks in each state. In addition to the 50 states, Puerto Rico reported 14 outbreaks and the District of Columbia reported 1 outbreak.

‡ Includes 24 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 8 states (range: 3–23).

§ Includes outbreaks caused by both confirmed and suspected etiologies.

Table 1: Number of reported foodborne disease outbreaks, outbreak-associated illnesses, and hospitalizations, by etiology (confirmed or suspected)*—Foodborne Disease Outbreak Surveillance System, United States, 2012

Etiology	No. Outbreaks				No. Illnesses				No. Hospitalizations			
	CE	SE	Total	%	CE	SE	Total	%	CE	SE	Total	%
Bacterial												
<i>Salmonella</i> †	106	7	113	20	3,366	28	3,394	28	449	5	454	61
<i>Campylobacter</i> ‡	30	7	37	6	434	42	476	4	27	2	29	4
<i>Escherichia coli</i> , Shiga toxin-producing (STEC)§	29	0	29	5	500	0	500	4	98	0	98	13
<i>Clostridium perfringens</i>	18	7	25	4	989	73	1,062	9	4	0	4	1
<i>Vibrio parahaemolyticus</i>	8	3	11	2	54	12	66	1	4	1	5	1
<i>Clostridium botulinum</i>	5	1	6	1	19	2	21	0	19	2	21	3
<i>Listeria monocytogenes</i>	4	1	5	1	19	23	42	0	17	21	38	5
<i>Staphylococcus aureus</i> , enterotoxin	2	3	5	1	26	123	149	1	1	3	4	1
<i>Bacillus cereus</i>	1	1	2	0	10	14	24	0	0	0	0	0
<i>Shigella</i> ¶	2	0	2	0	18	0	18	0	3	0	3	0
<i>Yersinia enterocolitica</i>	1	1	2	0	2	4	6	0	0	0	0	0
<i>Streptococcus</i> , Group A	1	0	1	0	18	0	18	0	0	0	0	0
<i>Vibrio</i> other	1	0	1	0	3	0	3	0	1	0	1	0
Other	0	4	4	1	0	12	12	0	0	0	0	0
Subtotal	208	35	243	42	5,458	333	5,791	48	623	34	657	88
Chemical and toxin												
Scombroid toxin/Histamine	18	1	19	3	53	2	55	0	0	0	0	0
Ciguatoxin	7	1	8	1	17	3	20	0	6	3	9	1
Mycotoxins	6	0	6	1	21	0	21	0	17	0	17	2
Paralytic shellfish poison	2	0	2	0	11	0	11	0	4	0	4	1
Other	3	2	5	1	13	11	24	0	2	0	2	0
Subtotal	36	4	40	7	115	16	131	1	29	3	32	4
Parasitic												
<i>Giardia</i>	2	0	2	0	7	0	7	0	0	0	2	0
<i>Trichinella</i>	2	0	2	0	4	0	4	0	2	0	2	0
Subtotal	4	0	4	1	11	0	11	0	2	0	2	0
Viral												
Norovirus	172	115	287	50	4,679	1,330	6,009	50	46	12	58	8
Sapovirus	3	0	3	1	56	0	56	0	1	0	1	0
Astrovirus	0	1	1	0	0	22	22	0	0	0	0	0
Other	0	1	1	0	0	9	9	0	0	0	0	0
Subtotal	175	117	292	50	4,735	1,361	6,096	51	47	12	59	8
Single etiology**	423	156	579	70	10,319	1,710	12,029	80	701	49	750	94
Multiple etiologies	2	5	7	1	77	35	112	1	10	0	10	1
Unknown etiology††	0	245	245	29	0	2,831	2,831	19	0	34	34	4
Total**	425	406	831	100	10,396	4,576	14,972	100	711	83	794	100

Abbreviations: No. = Number; CE = confirmed etiology; SE = suspected etiology.

*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.

† *Salmonella* serotypes causing more than five outbreaks were Enteritidis (27 outbreaks), Typhimurium (13), Newport (10), Javiana (7), and Heidelberg (6).

‡ *Campylobacter jejuni* (25 outbreaks), *Campylobacter* multiple species (2), *Campylobacter* other species (1), and *Campylobacter* unknown species (8).

§ STEC serogroups O157 (24 outbreaks; 23 were H7 and 1 was nonmotile), O145 (2), O45 (1), O111:nonmotile (1), and O121 (1).

¶ *Shigella sonnei* (2 outbreaks).

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

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

Table 2a: Number of reported foodborne disease outbreaks and outbreak-associated illnesses, by food category*—Foodborne Disease Outbreak Surveillance System, United States, 2012

Food Category*	No. Outbreaks		No. Illnesses	
	Total	%	Total	%
Aquatic animals				
Crustaceans	1	1	3	0
Mollusks†	13	7	83	2
Fish	31	16	515	12
Other aquatic animals	0	0	0	0
Subtotal	45	23	601	15
Land animals				
Dairy‡	19	10	356	9
Eggs	8	4	85	2
Beef	11	6	232	6
Pork	10	5	340	8
Other meat (sheep, goat, etc.)	0	0	0	0
Chicken	18	9	509	12
Turkey	8	4	202	5
Other poultry	2	1	7	0
Game	2	1	5	0
Subtotal	79	41	1,736	42
Plants				
Oils and sugars	1	1	7	0
Fungi	5	3	15	0
Sprouts	2	1	25	1
Root and other underground vegetables§	5	3	34	1
Seeded vegetables¶	3	2	206	5
Herbs	0	0	0	0
Vegetable row crops**	23	12	377	9
Fruits††	16	8	858	21
Grains and beans‡‡	8	4	190	5
Nuts and seeds§§	1	1	42	1
Subtotal	63	33	1,754	42
Other	5	3	49	1
Food reported, attributed to a single food category¶¶	192	23	4,140	28
Food reported, not attributed to a single food category	142	17	3,212	21
No food reported	497	60	7,620	51
Total**	831	100	14,972	100

Abbreviations: No. = Number.

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

†Bi-valve mollusks (13 outbreaks).

‡Unpasteurized dairy products (12 outbreaks), pasteurized dairy products (5), and pasteurization unknown (2).

§Tubers (4 outbreaks) and root vegetables (1).

¶Solanaeous seeded vegetables (2 outbreaks) and vine-grown seeded vegetables (1).

**Leafy vegetables (20 outbreaks), stem vegetables (1), and vegetable row crops not further classified (1).

††Melons (4 outbreaks), small fruits (2), tropical fruits (1), and fruits not further classified (9).

‡‡Grains (4 outbreaks), beans (2), and grains-beans not further classified (2).

§§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 pathogen-food category pairs resulting in outbreaks, outbreaks-associated illnesses, hospitalizations, and deaths—Foodborne Disease Outbreak Surveillance System, United States, 2012

Top 5 pathogen-food category pairs resulting in outbreaks					
Etiology	Food Category*	No. Outbreaks	No. Illnesses	No. Hospitalizations	No. Deaths
<i>Scombrotoxin/Histamine</i>	Fish	17	50	0	0
<i>Campylobacter</i>	Dairy	10	201	13	0
<i>Vibrio parahaemolyticus</i>	Mollusks	10	60	5	0
<i>Salmonella</i>	Chicken	9	345	109	0
Norovirus	Vegetable row crops	8	154	2	0
<i>Escherichia coli</i> , Shiga toxin-producing (STEC)	Vegetable row crops	8	136	34	1
<i>Salmonella</i>	Eggs	7	58	11	1
Ciguatoxin	Fish	7	18	9	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>	Fruits	6	446	55	1
<i>Salmonella</i>	Fish	1	425	55	0
<i>Salmonella</i>	Chicken	9	345	109	0
<i>Clostridium perfringens</i>	Pork	4	286	1	0
Norovirus	Fruits	4	210	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>	Chicken	9	345	109	0
<i>Salmonella</i>	Fruits	6	446	55	1
<i>Salmonella</i>	Fish	1	425	55	0
<i>Salmonella</i>	Seeded vegetables	2	151	50	0
<i>Escherichia coli</i> , Shiga toxin-producing (STEC)	Vegetable row crops	8	136	34	1
<i>Listeria monocytogenes</i>	Dairy	1	23	21	5

Pathogen-food category pairs resulting in outbreak-associated deaths					
Etiology	Food Category*	No. Outbreaks	No. Illnesses	No. Hospitalizations	No. Deaths
<i>Listeria monocytogenes</i>	Dairy	1	23	21	5
<i>Campylobacter</i>	Chicken	4	37	3	4
<i>Escherichia coli</i> , Shiga toxin-producing (STEC)	Vegetable row crops	8	136	34	1
<i>Salmonella</i>	Eggs	7	58	11	1
<i>Salmonella</i>	Fruits	6	446	55	1
Other chemical or toxin	Fish	3	13	2	1
<i>Listeria monocytogenes</i>	Sprouts	1	6	4	1
<i>Clostridium botulinum</i>	Root and other underground vegetables	1	3	3	1

Abbreviations: No. = Number.

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

Table 3a: Number of reported foodborne disease outbreaks and outbreak-associated illnesses, by location of food preparation—Foodborne Disease Outbreak Surveillance System, United States, 2012

Location of food preparation	No. Outbreaks		No. Illnesses	
	Total	%	Total	%
Restaurant	433	60	5,174	41
Sit-down dining	358	50	4,518	36
Fast-food	53	7	425	3
Other or unknown type	20	3	204	2
Multiple types	2	0	27	0
Catering or banquet facility	100	14	3,000	24
Private home	90	13	1,577	12
Other institutional location	31	4	1,497	12
School	12	2	211	2
Prison or jail	11	2	1,119	9
Workplace cafeteria	4	1	59	0
Camp	2	0	44	0
Day care	1	0	54	0
Workplace, not cafeteria	1	0	10	0
Other location	26	4	466	4
Other commercial location	22	3	372	3
Grocery store	13	2	154	1
Fair, festival, or temporary mobile service	5	1	76	1
Farm or dairy	4	1	142	1
Hospital or nursing home	11	2	201	2
Nursing home	8	1	114	1
Hospital	3	0	87	1
Other private location	6	1	370	3
Place of worship	6	1	370	3
Single location*	719	87	12,657	85
Multiple locations	34	4	1,093	7
Unknown location	78	9	1,222	8
Total*	831	100	14,972	100

Abbreviations: No. = Number.

* 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: Number of reported foodborne disease outbreaks and outbreak-associated illnesses, by etiology (confirmed and suspected)* and location of food preparation†—Foodborne Disease Outbreak Surveillance System, United States, 2012

Etiology	Catering or banquet facility		Restaurant		Other commercial location		Hospital or nursing home		Other 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
Bacterial																
<i>Salmonella</i>	3	131	40	536	5	68	2	24	4	596	26	1,000	1	33	6	139
<i>Campylobacter</i>	4	99	9	63	4	142	—‡	—	2	10	8	55	1	3	2	40
<i>Escherichia coli</i> , Shiga toxin-producing (STEC)	—	—	7	59	1	17	—	—	1	8	7	101	—	—	1	16
<i>Clostridium perfringens</i>	10	514	7	44	1	20	1	6	1	108	2	91	2	270	1	9
<i>Vibrio parahaemolyticus</i>	—	—	7	26	—	—	—	—	—	—	3	12	—	—	—	—
<i>Clostridium botulinum</i>	—	—	—	—	—	—	—	—	2	12	3	7	—	—	1	2
<i>Listeria monocytogenes</i>	—	—	1	3	—	—	1	7	—	—	—	—	—	—	—	—
<i>Staphylococcus aureus</i> , enterotoxin	2	119	2	24	—	—	—	—	—	—	1	6	—	—	—	—
<i>Bacillus cereus</i>	—	—	2	24	—	—	—	—	—	—	—	—	—	—	—	—
<i>Shigella</i>	—	—	1	11	—	—	—	—	1	7	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	—	—	—	—	—	—	2	6	—	—	—	—
<i>Streptococcus</i> , Group A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Vibrio</i> other	—	—	—	—	—	—	—	—	—	—	1	3	—	—	—	—
Other	—	—	4	12	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	19	863	80	802	11	247	4	37	11	741	53	1,272	4	306	11	206
Chemical and toxin																
Scombroid toxin/Histamine	—	—	15	43	—	—	—	—	—	—	1	2	—	—	3	10
Ciguatoxin	—	—	2	5	—	—	—	—	—	—	6	15	—	—	—	—
Mycotoxins	—	—	—	—	—	—	1	6	—	—	4	13	—	—	—	—
Paralytic shellfish poison	—	—	—	—	—	—	—	—	—	—	1	7	—	—	—	—
Other	—	—	1	6	—	—	—	—	1	5	1	2	—	—	2	11
Subtotal	—	—	18	54	—	—	1	6	1	5	13	39	—	—	5	21
Parasitic																
<i>Giardia</i>	—	—	—	—	1	4	—	—	—	—	—	—	—	—	1	3
<i>Trichinella</i>	—	—	1	2	—	—	—	—	1	2	—	—	—	—	—	—
Subtotal	—	—	1	2	1	4	—	—	1	2	—	—	—	—	1	3
Viral																
Norovirus	51	1,497	184	3,229	1	10	4	73	12	527	9	99	1	25	3	97
Sapovirus	1	9	1	22	—	—	—	—	—	—	—	—	—	—	1	25
Astrovirus	1	22	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Other	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	53	1,528	185	3,251	1	10	4	73	12	527	9	99	1	25	4	122
Single etiology	72	2,391	284	4,109	13	261	9	116	25	1,275	75	1,419	5	331	21	352
Multiple etiologies	—	—	4	24	—	—	—	—	—	—	1	21	—	—	—	—
Unknown etiology[§]	28	609	145	1,041	9	111	2	85	6	222	14	137	1	39	5	114
Total	100	3,000	433	5,174	22	372	11	201	31	1,497	90	1,577	6	370	26	466

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

*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.

†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 (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.

Appendix: Number of reported foodborne disease outbreaks, by etiology (confirmed and suspected)* and contributing factors[†]—Foodborne Disease Outbreak Surveillance System, United States, 2012

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
Bacterial																		
<i>Salmonella</i>	— [‡]	—	—	—	—	19	4	—	9	7	2	3	—	—	3	36	44	113
<i>Campylobacter</i>	—	—	—	—	—	5	9	—	4	—	—	—	—	1	—	17	20	37
<i>Escherichia coli</i> , Shiga toxin-producing (STEC)	—	—	—	—	—	2	7	—	1	—	—	—	—	—	—	10	10	29
<i>Clostridium perfringens</i>	—	—	—	—	—	2	—	—	1	—	—	—	—	—	5	6	20	25
<i>Vibrio parahaemolyticus</i>	—	—	—	—	—	8	—	—	1	—	—	—	—	—	—	8	8	11
<i>Clostridium botulinum</i>	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	2	6	6
<i>Listeria monocytogenes</i>	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	2	2	5
<i>Staphylococcus aureus</i> , enterotoxin	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—	3	3	5
<i>Bacillus cereus</i>	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	2	2
<i>Shigella</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
<i>Yersinia enterocolitica</i>	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2
<i>Streptococcus</i> , Group A	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	1	1	1
<i>Vibrio</i> other	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	1	1
Other	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	4
Subtotal	1	—	—	—	—	30	30	—	19	10	3	5	—	1	9	89	121	243
Chemical and toxin																		
Scombroid toxin/Histamine	9	—	1	—	—	1	3	—	—	—	—	—	—	—	—	13	15	19
Ciguatoxin	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	7	8
Mycotoxins	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	5	6
Paralytic shellfish poison	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	1	2
Other	2	—	1	1	—	—	—	—	—	—	—	—	—	—	1	4	5	5
Subtotal	24	—	2	1	—	1	3	1	—	—	—	—	—	—	1	30	33	40
Parasitic																		
<i>Giardia</i>	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1	1	2
<i>Trichinella</i>	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	2	2	2
Subtotal	1	—	—	—	—	1	1	—	—	—	—	—	—	—	—	3	3	4
Viral																		
Norovirus	—	—	—	—	—	—	—	—	7	55	33	34	8	6	11	113	116	287
Sapovirus	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	1	3
Astrovirus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Other	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Subtotal	—	—	—	—	—	—	—	—	7	55	33	35	8	6	11	114	117	292
Single etiology	26	—	2	1	—	31	34	1	25	65	36	40	8	7	21	235	274	579
Multiple etiologies	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	3	7
Unknown etiology[§]	2	—	—	—	—	5	3	—	6	16	9	8	1	6	6	44	68	245
Total	28	—	2	1	—	37	37	1	31	81	45	48	9	13	27	280	344	831

Appendices' footnotes are on page 12.

Appendix: Number of reported foodborne disease outbreaks, by etiology (confirmed and suspected)* and contributing factors[†]—Foodborne Disease Outbreak Surveillance System, United States, 2012

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		
Bacterial															
<i>Salmonella</i>	17	5	2	2	4	1	3	— [‡]	1	—	1	3	29	44	113
<i>Campylobacter</i>	3	2	—	—	2	—	—	1	—	—	—	3	6	20	37
<i>Escherichia coli</i> , Shiga toxin-producing (STEC)	1	1	—	—	—	—	—	—	—	—	1	—	2	10	29
<i>Clostridium perfringens</i>	4	4	1	—	6	1	10	7	—	—	—	3	20	20	25
<i>Vibrio parahaemolyticus</i>	1	—	—	—	1	—	—	—	—	—	—	—	2	8	11
<i>Clostridium botulinum</i>	5	1	—	—	—	—	—	—	—	1	3	3	6	6	6
<i>Listeria monocytogenes</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	2	5
<i>Staphylococcus aureus</i> , enterotoxin	3	1	1	—	2	—	1	—	—	—	—	—	3	3	5
<i>Bacillus cereus</i>	—	—	1	—	—	—	—	—	—	—	—	—	1	2	2
<i>Shigella</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
<i>Yersinia enterocolitica</i>	1	—	—	—	—	—	—	—	—	—	—	—	1	1	2
<i>Streptococcus</i> , Group A	1	—	—	—	—	—	—	—	—	—	—	—	1	1	1
<i>Vibrio</i> other	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Other	1	1	1	1	—	—	1	—	—	—	—	—	2	2	4
Subtotal	37	15	6	3	15	2	15	8	1	1	5	12	73	121	243
Chemical and toxin															
Scombroid toxin/Histamine	1	1	1	—	—	—	—	—	—	—	—	2	5	15	19
Ciguatoxin	—	—	—	—	—	—	—	—	—	—	—	—	—	7	8
Mycotoxins	—	—	—	—	—	—	—	2	—	—	—	—	2	5	6
Paralytic shellfish poison	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
Other	—	—	—	—	—	—	—	—	—	—	1	—	1	5	5
Subtotal	1	1	1	—	—	—	—	2	—	—	1	2	8	33	40
Parasitic															
<i>Giardia</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
<i>Trichinella</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	3	4
Viral															
Norovirus	2	—	—	1	3	—	2	1	—	—	—	2	6	116	287
Sapovirus	—	—	—	—	—	—	—	—	—	—	—	—	—	1	3
Astrovirus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Other	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Subtotal	2	—	—	1	3	—	2	1	—	—	—	2	6	117	292
Single etiology	40	16	7	4	18	2	17	11	1	1	6	16	87	274	579
Multiple etiologies	1	1	—	—	1	—	1	2	—	—	—	—	2	3	7
Unknown etiology[§]	8	11	4	6	16	1	14	13	3	—	—	2	43	68	245
Total	49	28	11	10	35	3	32	26	4	1	6	18	132	344	831

Appendices' footnotes are on page 14.

Appendix: Number of reported foodborne disease outbreaks, by etiology (confirmed and suspected)* and contributing factors[†]—Foodborne Disease Outbreak Surveillance System, United States, 2011.

Etiology	Survival Factors‡						No. outbreaks with reported contributing factors	Total No. outbreaks
	S1	S2	S3	S4	S5	≥1 factor reported		
Bacterial								
<i>Salmonella</i>	13	1	—‡	2	7	21	44	113
<i>Campylobacter</i>	4	—	—	—	2	6	20	37
<i>Escherichia coli</i> , Shiga toxin-producing (STEC)	1	—	—	—	1	2	10	29
<i>Clostridium perfringens</i>	3	7	—	—	2	10	20	25
<i>Vibrio parahaemolyticus</i>	—	—	—	—	—	—	8	11
<i>Clostridium botulinum</i>	1	2	—	1	3	5	6	6
<i>Listeria monocytogenes</i>	—	—	—	—	—	—	2	5
<i>Staphylococcus aureus</i> , enterotoxin	—	2	—	—	—	2	3	5
<i>Bacillus cereus</i>	—	—	—	—	—	—	2	2
<i>Shigella</i>	—	—	—	—	—	—	—	2
<i>Yersinia enterocolitica</i>	1	—	—	—	—	1	1	2
<i>Streptococcus</i> , Group A	—	—	—	—	1	1	1	1
<i>Vibrio</i> other	—	—	—	—	—	—	1	1
Other	—	—	—	—	—	—	2	4
Subtotal	23	12	—	3	16	48	121	243
Chemical and toxin								
Scombroid toxin/Histamine	—	—	1	—	—	1	15	19
Ciguatoxin	—	—	—	—	—	—	7	8
Mycotoxins	—	—	—	—	—	—	5	6
Paralytic shellfish poison	—	—	—	—	—	—	1	2
Other	—	—	—	—	—	—	5	5
Subtotal	—	—	1	—	—	1	33	40
Parasitic								
<i>Giardia</i>	—	—	—	—	1	1	2	2
<i>Trichinella</i>	—	—	—	—	—	—	1	2
Subtotal	—	—	—	—	—	—	1	1
Viral								
Norovirus	2	1	—	3	5	9	116	287
Sapovirus	—	—	—	—	—	—	1	3
Astrovirus	—	—	—	—	—	—	—	1
Other	—	—	—	—	—	—	—	1
Subtotal	2	1	—	3	5	9	117	292
Single etiology	27	13	1	6	21	60	274	579
Multiple etiologies	1	2	—	—	—	3	3	7
Unknown etiology[§]	5	6	—	2	10	22	68	245
Total	33	21	1	8	31	85	344	831

Appendices' footnotes are on page 14.

Appendix Footnotes:

* 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) (Bryan FL, Guzewich JJ, Todd EC. Surveillance of Foodborne Diseases III. Summary and Presentation of Data on Vehicles and Contributory Factors: Their value and limitations. J Food Prot 1997;60(6):701 – 14). 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 / under-processed

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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