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Surveillance for Foodborne-Disease Outbreaks — United States, 1998–2002

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Surveillance for Foodborne-Disease Outbreaks — United States, 1998–2002

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Abstract

Problem/Condition: Since 1973, CDC has maintained a collaborative surveillance program for collection and periodic reporting of data on the occurrence and causes of foodborne-disease outbreaks (FBDOs) in the United States.

Reporting Period Covered: 1998–2002.

Description of System: The Foodborne Disease Outbreak Surveillance System reviews data on FBDOs, defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food. State and local public health departments have primary responsibility for identifying and investigating FBDOs. State, local, and territorial health departments use a standard form to report these outbreaks to CDC. In 1998, CDC implemented enhanced surveillance for FBDOs by increasing communication with state, local, and territorial health departments and revising the outbreak report form. Since 2001, reports of FBDOs are submitted through a web application on the Internet called the electronic Foodborne Outbreak Reporting System (eFORS).

Results: During 1998–2002, a total of 6,647 outbreaks of foodborne disease were reported (1,314 in 1998, 1,343 in 1999, 1,417 in 2000, 1,243 in 2001, and 1,330 in 2002). These outbreaks caused a reported 128,370 persons to become ill. Among 2,167 (33%) outbreaks for which the etiology was determined, bacterial pathogens caused the largest percentage of outbreaks (55%) and the largest percentage of cases (55%). Among bacterial pathogens, *Salmonella* serotype Enteritidis accounted for the largest number of outbreaks and outbreak-related cases; *Listeria monocytogenes* accounted for the majority of deaths of any pathogen. Viral pathogens, predominantly norovirus, caused 33% of outbreaks and 41% of cases; the proportion of outbreaks attributed to viral agents increased from 16% in 1998 to 42% in 2002. Chemical agents caused 10% of outbreaks and 2% of cases, and parasites caused 1% of outbreaks and 1% of cases.

Interpretation: Following implementation of measures to enhance outbreak surveillance, the annual number of FBDOs reported to CDC increased during this period compared with previous years. Viral pathogens accounted for an increased proportion of outbreaks each year during this reporting period and a higher proportion of outbreaks of known etiology during this reporting period than preceding reporting periods, probably reflecting the increased availability of improved viral diagnostic tests. *S. Enteritidis* continued to be a major cause of illness and *L. monocytogenes* was a major cause of death. In addition, multistate outbreaks caused by contaminated produce and outbreaks caused by *Escherichia coli* O157:H7 remained prominent.

Public Health Actions: Methods to detect FBDOs are improving, and several changes to improve the ease and timeliness of reporting FBDO data have been implemented (e.g., a revised form to simplify FBDO reporting by state health departments and improved electronic reporting methods). State and local health departments continue to investigate and report FBDOs as part of efforts to better understand and define the epidemiology of foodborne disease in the United States. At the regional and national levels, surveillance data provide an indication of the etiologic agents, vehicles of transmission, and contributing factors associated with FBDOs and help direct public health actions to reduce illness and death caused by FBDOs.

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Introduction

The reporting of foodborne and waterborne diseases in the United States began approximately 80 years ago when state and territorial health officers, concerned about the high morbidity and mortality caused by typhoid fever and infantile diarrhea, recommended that cases of “enteric fever” be investigated and reported. The purpose of investigating and reporting these cases was to obtain information about the role of food, milk, and water in outbreaks of intestinal illness as the basis for public health action. Beginning in 1925, the U.S. Public Health Service (PHS) published summaries of outbreaks of gastrointestinal illness attributed to milk (1). In 1938, PHS added summaries of outbreaks caused by all foods. These early surveillance efforts led to the enactment of important public health measures (e.g., the Pasteurized Milk Ordinance) that resulted in decreased incidence of enteric diseases, particularly those transmitted by milk and water (2).

During 1951–1960, the National Office of Vital Statistics reviewed reports of outbreaks of foodborne illness and published annual summaries in *Public Health Reports*. In 1961, CDC assumed responsibility for publishing reports about foodborne illness. During 1961–1965, CDC stopped publishing annual reviews but reported pertinent statistics and detailed individual investigations in *MMWR*.

The current system of surveillance for outbreaks of foodborne and waterborne diseases began in 1966, when reports of enteric disease outbreaks attributed to microbial or chemical contamination of food or water were incorporated into an annual summary. Since 1966, the quality of investigative reports has improved greatly, with more active participation by state and federal epidemiologists in outbreak investigations. Outbreaks of waterborne diseases and foodborne diseases have been reported in separate annual summaries since 1978 because of increased interest and activity in surveillance for waterborne diseases. Previous summaries of data reported to the Foodborne Disease Outbreak Surveillance System were published for 1983–1987 (3), 1988–1992 (4), and 1993–1997 (5). Outbreak surveillance has served three purposes:

- **Disease prevention and control.** The investigation of foodborne disease outbreaks leads to prevention and control measures in the food industry. Public health officials identify critical control points in the path from farm to table that can be monitored to reduce contamination by foodborne pathogens. Changes at all levels of food production (e.g., farm, slaughterhouse, and production plant) have contributed to less contamination in the food supply. Summarizing these investigations illustrates the burden of the outbreaks and the efforts needed to control them.
- **Knowledge of disease causation.** Outbreak investigations are a critical means of identifying new and emerging pathogens and maintaining awareness about ongoing problems. However, the pathogen is not identified in many outbreaks because of delayed or incomplete laboratory investigation, inadequate laboratory capacity, or inability to recognize a pathogen as a cause of foodborne disease. Prompt and thorough investigations of foodborne outbreaks aid in the timely identification of etiologic agents and lead to appropriate prevention and control measures. Summarizing the results provides an index of the relative importance and impact of specific pathogens.
- **Administrative guidance.** By analyzing several years of data on foodborne disease outbreaks, public health authorities can monitor trends over time in the prevalence of outbreaks caused by specific etiologic agents, the food that is the vehicle for the agent, and common errors in food handling. This information provides the basis for regulatory and other changes to improve food safety. Analysis of specific subsets of outbreaks can illustrate the challenges associated with specific pathogens, food vehicles, and settings and has helped define linkages between specific pathogens and foods.

This report summarizes epidemiologic data on FBDOs reported to CDC during 1998–2002.

Methods

Sources of Data for the Foodborne Disease Outbreak Surveillance System

Agencies use a standard form (CDC form 52.13, Investigation of a Foodborne Outbreak) to report FBDOs to CDC. In 1998, CDC increased communication with state, local, and territorial health departments to enhance surveillance for FBDOs, including formal confirmation procedures to finalize reports from each state each year. This led to a substantial increase in the number of reports, resulting in a surveillance discontinuity during 1997–1998. A revised form became effective in 1999. The revised form expanded the range of food items, places, and contributing factors that could be reported. In 2001, state, local, and territorial health departments began submitting reports through a web-based version of this form. This web-based outbreak surveillance system is called the Electronic Foodborne Outbreak Reporting System (eFORS). This report summarizes data collected with both the paper and web-based forms (Appendix A). The majority of reports are submitted by state, local, and territorial health departments; however, they also can be submitted by federal agencies and

other sources. Reporting officials use published criteria to determine whether a specific etiologic agent has been confirmed for an outbreak (Appendix B) and submit reasons that reported food vehicles were implicated. Implicated food vehicles for all reasons are included in this report.

Definition of Terms

An FBDO is defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a food in common. Laboratory or clinical guidelines for confirming an etiology of a FBDO outbreak vary for bacterial, chemical, parasitic, and viral agents (Appendix B). An outbreak in which more than one etiologic agent was confirmed is categorized as attributable to multiple etiologies. Food vehicles identified in outbreak investigations that can be classified into a single commodity are classified into one of 12 major food commodity categories. Some reported food vehicles cannot be categorized in a single commodity category and are listed as unclassifiable. Outbreaks in which more than one implicated food is reported or the implicated food contains ingredients from multiple commodities are classified as attributable to complex food vehicles.

Exclusions from and Limitations of the Surveillance System

The findings in this report are subject to at least four limitations. First, several types of outbreaks are excluded from the Foodborne Disease Outbreak Surveillance System, such as outbreaks that occur on cruise ships (these are summarized and published periodically in scientific publications) (6); outbreaks in which the food was eaten outside the United States, even if the illness occurred within the United States; and outbreaks that are traced to water intended for drinking (these are reported to the Waterborne Disease Outbreak Reporting System). In addition, FBDOs are excluded from the surveillance system if the route of transmission from the contaminated food to the infected persons is indirect. For example, in 1988, chitterlings (pig intestines) were the ultimate source of a cluster of *Yersinia enterocolitica* infections among several infants; however, this outbreak was not included because the infants did not eat the chitterlings (7). Similarly, outbreaks that occur as result of direct contact with animals are excluded.

Second, for many reports, information on certain aspects of the outbreak, such as the etiology, the implicated food vehicle, or the factors that might have contributed to the outbreak, is missing or incomplete. The category of “unknown etiology” is broad. Outbreaks with some etiologic information might not meet guidelines for confirmation and are pre-

sented in this report as “unknown etiology.” Clinical and descriptive epidemiologic information that suggests etiologic categories for outbreaks of unknown etiology have not been used in this report (8).

Third, food vehicles are reported by investigating agencies as individual food items in varying levels of details (e.g., milk, 2% milk, pasteurized 2% milk). A particular reported food item with multiple ingredients could be classified under several food commodity categories; however, in this surveillance summary, the reported food item for each outbreak is classified under only one food commodity category. Food items that cannot be classified under one food commodity category are counted as unclassifiable. As a result, the reported number of outbreaks attributed to one food vehicle category might not include all outbreaks attributable to a particular food ingredient in that food.

Finally, no standard criteria exist for classifying a death as being FBDO-related. This determination is made by the reporting agency.

How Data Are Presented

In this report, 1998–2002 data on foodborne-disease outbreaks are presented as follows:

- Reported outbreak reports, by years, 1993–2002 (Figure 1).
- Outbreaks, by state, for each of the 5 years (Figures 2–6).
- Outbreaks, cases, and deaths, by etiology, for the 5-year period combined (Table 1).
- Outbreaks, cases, and deaths, by etiology, for each of the 5 years (Tables 2–6).
- Outbreaks, by etiology and month of occurrence, for the 5-year period combined (Table 7).
- Outbreaks, by etiology and place where food was eaten, for the 5-year period combined (Table 8).
- Outbreaks, cases, and deaths, by vehicle of transmission, for each of the 5 years (Tables 9–13).
- Outbreaks, by etiology and vehicle of transmission, for each of the 5 years (Tables 14–18).
- Outbreaks, by etiology and contributing factors, for the 5-year period combined (Table 19).

Results

During 1998–2002, the annual number of reported outbreaks ranged from 1,243 to 1,417 (Tables 2–6). The average annual number of outbreaks reported during this period (1,329) was substantially greater than the average annual number of outbreaks reported during 1993–1997 (550) (Figure 1). The average number of cases per outbreak during 1998–

2002 (19) was lower than the average number of cases per outbreak during 1993–1997 (31). During 1998–2002, a total of 2,167 (33%) of the 6,647 outbreaks reported to CDC had a known etiology; these outbreaks accounted for 68,981 (54%) of 128,370 illnesses (Table 1). Of the 2,167 outbreaks with a known etiology, 55% (55% of illnesses) were caused by bacterial pathogens, 33% (41% of illnesses) by viruses, 10% (2% of illnesses) by chemical agents, and 1% (1% of illnesses) by parasites. The proportion of outbreaks with known etiology attributable to viruses increased from 16% in 1998 to 42% in 2002. In the majority (67%) of outbreaks, the etiology was not determined. However, the proportion of outbreaks for which an etiology was determined increased during the reporting period, from 28% in 1998 to 37% in 2002.

Local investigators might report factors they believe contributed to the outbreak. These factors are grouped into those that investigators believed led to contamination of the food, those that allowed proliferation of the pathogen in the food, and those that contributed to survival of the pathogen in the food. During 1998–2002, at least one contributing factor was reported in 3,072 (46%) outbreaks. The most commonly reported contamination factor that contributed to FBDOs was “bare-handed contact by handler/worker/preparer” (Table 19). For outbreaks caused by bacterial pathogens “raw product/ingredient contaminated by pathogens from animal or environment” was the most commonly reported contamination factor. The most commonly reported proliferation factor was “allowing foods to remain at room or warm outdoor temperature for several hours”; the most common survivability factor was “insufficient time and/or temperature during initial cooking/heat processing.”

In the majority of foodborne outbreaks during this period, food was eaten outside the home (Table 8). Restaurants were the most commonly reported place where food was eaten. Many outbreaks caused by *Salmonella* or norovirus occurred at a school or nursing home. In outbreaks caused by ciguatoxin and *L. monocytogenes*, food was more commonly reported to have been eaten at a private home.

During this period, notable outbreaks were reported that were caused by ground beef contaminated with *E. coli* O157:H7 (9) and fresh produce contaminated with *Salmonella*, *E. coli* O157:H7, *Cyclospora cayetanensis*, or hepatitis A (Tables 14–18). Multidrug-resistant strains of *Salmonella* caused outbreaks linked to unpasteurized milk and ground beef. A large multistate outbreak of listeriosis caused by contaminated deli meat led to one of the largest food recalls in the United States (10). Scombrototoxin (fish-derived histaminic agent) caused the majority of outbreaks attributable to a chemical etiology. The majority of these outbreaks was associated with tuna, although several were associated with

nonscombroidae fish, including 10 outbreaks associated with escolar. Unexpected vehicles of transmission (e.g., dry cereal [11], parsley [12], and mangoes [13]) also were reported.

During 1998–2002, norovirus caused 657 (30%) of the 2,167 FBDOs with a known etiology and 39% of all outbreak-related cases in these outbreaks. *S. Enteritidis*, the most frequently reported bacterial cause of FBDOs, caused 204 outbreaks, accounting for 9% of outbreaks for which an etiology was determined. Eggs caused more *S. Enteritidis* outbreaks than any other food vehicle. *L. monocytogenes* resulted in 38 outbreak-related deaths among 256 cases, more deaths, and a higher case-fatality rate (15%) than any other pathogen.

Discussion

Foodborne-Disease Outbreaks, 1998–2002

The annual number of FBDOs reported to CDC increased during this period compared with previous years, following implementation of measures to enhance outbreak surveillance (3–5). Certain observations suggest that the increase in outbreak reports probably represents the effect of enhanced surveillance rather than a true increase in the occurrence of FBDOs. First, after a marked increase during 1997–1998 with implementation of enhanced surveillance, the number of reported outbreaks remained within a relatively narrow range. Second, the number of cases of foodborne infections identified through routine surveillance, of which outbreak cases are a part, decreased or remained stable during this period (14). Finally, the average size of reported outbreaks during 1998–2002 was smaller than the average size of outbreaks during 1993–1997, indicating that a substantial portion of the increase in reported outbreaks might be caused by smaller outbreaks that were not reported in previous years. Because of this increased reporting, comparisons of the number of reported FBDOs attributable to a specific etiology or vehicle of transmission between this period and previous reporting periods are difficult to make. Comparisons of the proportion of FBDOs related to specific causes are less likely to be influenced by the effect of enhanced surveillance but should be made with caution.

As in previous years, bacterial pathogens caused the majority of outbreaks and infections among outbreaks with a known etiology (3–5). Viral pathogens accounted for a much greater proportion of outbreaks and infections than in previous years, probably because of the increased availability of methods to diagnose viral agents. Although 67% of reported FBDOs during 1998–2002 were of unknown etiology, the propor-

tion of outbreaks of unknown etiology decreased during 1998–2002. Much of this decrease is attributed to increased norovirus diagnostic capacity in state health department laboratories (15) and improved strategies to obtain diagnostic specimens (16). With continued improvements in epidemiologic and laboratory investigations, the proportion of outbreaks of unknown etiology might decrease further.

Of FBDOs with a known etiology, multistate outbreaks caused by contaminated produce and outbreaks caused by *E. coli* O157:H7 remained prominent. Investigation of several multistate outbreaks attributed to *L. monocytogenes*, detected by linking information from molecular subtyping of isolates from several states, led to recalls of implicated products (10,17,18). Although *S. Enteritidis* continued to be a major cause of illness and death, it caused a much smaller proportion of outbreaks for which an etiology was known than in the past. The decrease in outbreaks attributed to *S. Enteritidis* parallels the decrease in *S. Enteritidis* infections reported to the National *Salmonella* Surveillance System and might reflect the role of Egg Quality Assurance Programs and other public health interventions in reducing the incidence of *S. Enteritidis* infection (19). Persons can decrease their risk for egg-associated infections caused by *S. Enteritidis* by not eating raw or undercooked eggs. Nursing homes, hospitals, and commercial kitchens should use pasteurized egg products for all recipes requiring pooled or lightly cooked eggs (20).

Interpretation of Data from the Foodborne Disease Outbreak Surveillance System

Foodborne diseases cause an estimated 76 million illnesses and 5,000 deaths in the United States each year (21). Although foodborne diseases are common, only a fraction of these illnesses are routinely reported to CDC because a complex chain of events must occur before a foodborne infection is reported; a break at any point in the chain will result in a case not being reported. In addition, the majority of reported foodborne illnesses are sporadic; only a small number are identified as being part of an outbreak and reported through the Foodborne Disease Outbreak Surveillance System. For example, *Salmonella* infection causes an estimated 1.4 million foodborne illnesses annually (22). However, during 1998–2002, a total of 164,044 *Salmonella* infections (approximately 32,000 annually) were reported through the National *Salmonella* Surveillance System (23–27), which is a passive, public health laboratory-based system. During the same period, 585 recognized outbreaks of *Salmonella* infection resulting in 16,821 illnesses were reported through the Foodborne Disease Outbreak Surveillance System, not all of which were necessarily

culture-confirmed. Therefore, the system represents only a fraction of the burden of foodborne disease.

The number of outbreaks summarized in this report represents a small proportion of the outbreaks that actually occurred during the surveillance period. Some outbreaks are never recognized, and those that are recognized frequently go unreported. The likelihood that public health authorities are alerted about an outbreak depends on many factors, including its size and the severity of illnesses; consumer and physician awareness, interest, and motivation to report the incident; and the resources and disease surveillance activities of state and local public health and environmental agencies. Outbreaks that are most likely to be brought to the attention of public health authorities include those that are large, interstate, or restaurant-associated or that can cause serious illness, hospitalization, or death. The degree of underreporting might vary by etiology; therefore, this report provides limited information about the absolute or relative incidence of foodborne-disease outbreaks related to specific causes. For example, foodborne diseases characterized by short incubation periods (e.g., those caused by a chemical agent or staphylococcal enterotoxin) are more likely to be recognized as common source FBDOs than are diseases with longer incubation periods (e.g., hepatitis A). Outbreaks involving less commonly identified pathogens (e.g., *Bacillus cereus*, enterotoxigenic *E. coli*, or *Giardia intestinalis*) are less likely to have a confirmed etiology because these organisms are not always considered in clinical, epidemiologic, and laboratory investigations of FBDOs.

The objective of this report is to present simple analyses of the data on outbreaks of foodborne disease reported during 1998–2002. These data will continue to be analyzed in detail, along with other relevant data, to answer specific questions of public health importance, and findings will be published in the scientific literature. Specifically, a more detailed analysis of outbreak data to estimate the attribution of illness to specific food commodities would take into account the burden of illness attributed to specific etiologies and the attributable portion of those illnesses caused by particular food commodities. The simple frequencies of outbreaks caused by certain food commodities presented here do not, by themselves, provide a good measure of the burden of illness associated with one food commodity compared with another.

Future Directions

Methods to detect FBDOs continue to improve. For example, two tools that have enhanced detection of FBDOs are the Statistical Outbreak Detection Algorithm (SODA) and the National Molecular Subtyping Network for Foodborne Disease Surveillance (PulseNet). SODA applies a statistical

algorithm to data reported through CDC's National *Salmonella*, *Shigella*, and *E. coli* Surveillance Systems to identify substantial increases over a historical baseline for any given serotype (28). This technology can be used to help identify clusters or outbreaks. PulseNet is a national network of public health laboratories that perform pulsed-field gel electrophoresis (PFGE) analysis on bacteria that might be foodborne (29). PulseNet was initiated in four states in 1996 and reached full participation of all 50 states and several large cities by 2001. This network permits rapid comparison of PFGE patterns through an electronic database at CDC; closely related PFGE patterns suggest a common source. PulseNet has helped in the detection and investigation of outbreaks, particularly those that involve multiple states. An assessment of the impact of introducing PulseNet PFGE subtyping in one state indicated that it increased the number of detected outbreaks of *E. coli* O157:H7 by 40% (30).

Several changes have improved the ease and timeliness of reporting. In October 1999, CDC issued a revised FBDO reporting form to simplify reporting by state health departments. In addition, eFORS was implemented in 2001 to help improve the timeliness of foodborne disease outbreak reporting. Upcoming versions of eFORS will include an automated search algorithm for more ready access to foodborne outbreak surveillance data. An annual listing of foodborne disease outbreaks reported to CDC is available at http://www.cdc.gov/foodborneoutbreaks/outbreak_data.htm.

The investigation and reporting of FBDOs by state and local health departments are important steps in efforts to better understand and define the epidemiology of foodborne disease in the United States. At the regional and national levels, surveillance data provide an indication of the etiologic agents, vehicles of transmission, and contributing factors associated with FBDOs and help direct public health actions.

Acknowledgments

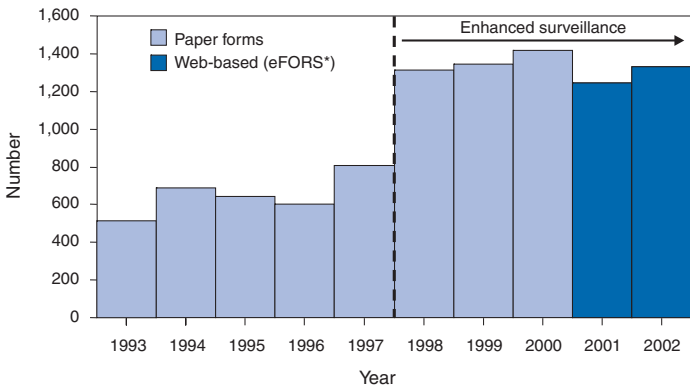
The authors would like to thank all State and Territorial Epidemiologists and, in particular, members of the Foodborne Disease Outbreak reporting network, who contributed reports of foodborne outbreak investigations included in this summary.

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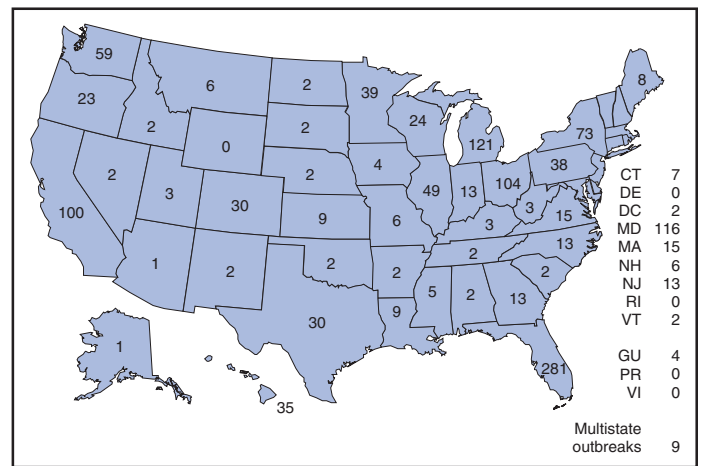
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FIGURE 1. Number of reported foodborne-disease outbreaks, 1993–2002



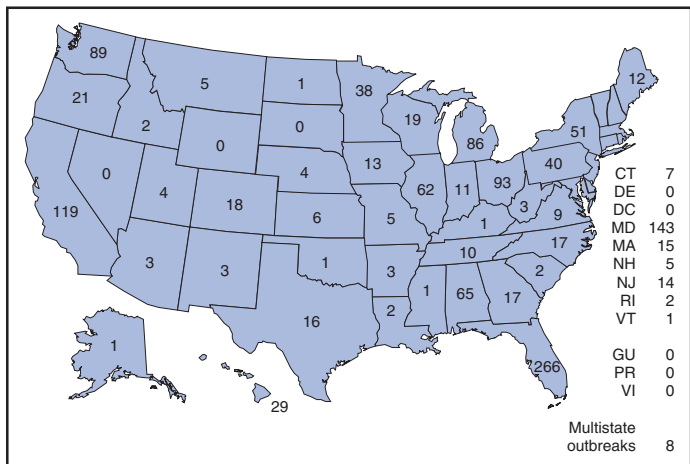
* Electronic Foodborne Outbreak Reporting System.

FIGURE 2. Number of reported foodborne-disease outbreaks, by state — United States,* 1998



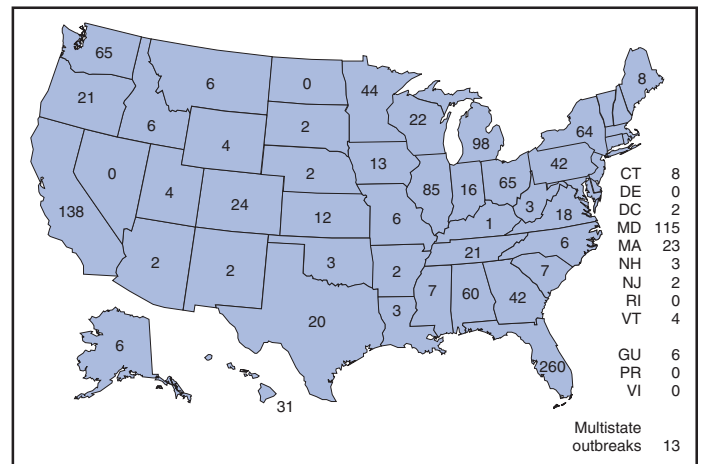
* Includes Guam, Puerto Rico, and the U.S. Virgin Islands.

FIGURE 3. Number of reported foodborne-disease outbreaks, by state — United States,* 1999



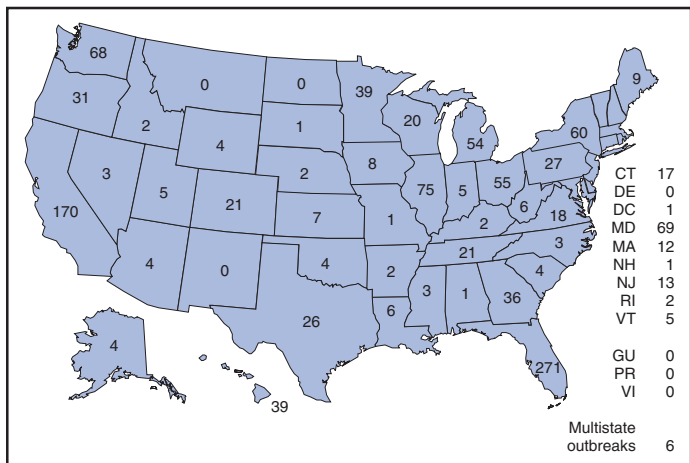
* Includes Guam, Puerto Rico, and the U.S. Virgin Islands.

FIGURE 4. Number of reported foodborne-disease outbreaks, by state — United States,* 2000



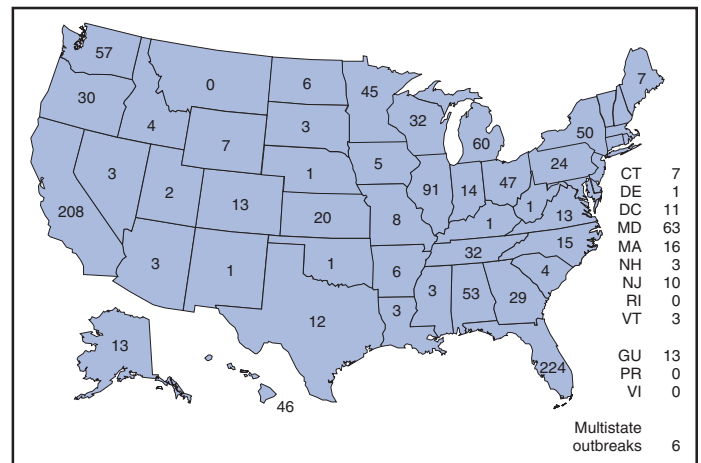
* Includes Guam, Puerto Rico, and the U.S. Virgin Islands.

FIGURE 5. Number of reported foodborne-disease outbreaks, by state — United States,* 2001



* Includes Guam, Puerto Rico, and the U.S. Virgin Islands.

FIGURE 6. Number of reported foodborne-disease outbreaks, by state — United States,* 2002



* Includes Guam, Puerto Rico, and the U.S. Virgin Islands.

TABLE 1. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 1998-2002

Etiology	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Bacterial						
<i>Bacillus cereus</i>	37	(0.6)	571	(0.4)	0	(0.0)
<i>Brucella</i>	1	(0.0)	4	(0.0)	0	(0.0)
<i>Campylobacter</i>	61	(0.9)	1,440	(1.1)	0	(0.0)
<i>Clostridium botulinum</i>	12	(0.2)	52	(0.0)	1	(1.1)
<i>Clostridium perfringens</i>	130	(2.0)	6,724	(5.2)	4	(4.5)
<i>Escherichia coli</i> *	140	(2.1)	4,854	(3.8)	4	(4.5)
<i>Listeria monocytogenes</i>	11	(0.2)	256	(0.2)	38	(43.2)
<i>Salmonella</i>	585	(8.8)	16,821	(13.1)	20	(22.7)
<i>Shigella</i>	67	(1.0)	3,677	(2.9)	1	(1.1)
<i>Staphylococcus aureus</i>	101	(1.5)	2,766	(2.2)	2	(2.3)
<i>Streptococcus</i>	1	(0.0)	4	(0.0)	0	(0.0)
<i>Vibrio cholerae</i> †	3	(0.0)	12	(0.0)	0	(0.0)
<i>Vibrio parahemolyticus</i>	25	(0.4)	613	(0.5)	0	(0.0)
<i>Vibrio</i> , other	1	(0.0)	2	(0.0)	0	(0.0)
<i>Yersinia enterocolitica</i>	8	(0.1)	87	(0.1)	0	(0.0)
Other bacterial	1	(0.0)	4	(0.0)	0	(0.0)
Total bacterial	1,184	(17.8)	37,887	(29.5)	70	(79.5)
Chemical						
Ciguatoxin	84	(1.3)	315	(0.2)	1	(1.1)
Heavy metals	2	(0.0)	23	(0.0)	0	(0.0)
Mushroom toxin	2	(0.0)	6	(0.0)	0	(0.0)
Scombrototoxin	118	(1.8)	463	(0.4)	0	(0.0)
Shellfish toxin	5	(0.1)	36	(0.0)	0	(0.0)
Other chemical	10	(0.2)	297	(0.2)	0	(0.0)
Total chemical	221	(3.3)	1,140	(0.9)	1	(1.1)
Parasitic						
<i>Anisakis</i>	1	(0.0)	14	(0.0)	0	(0.0)
<i>Cryptosporidium parvum</i>	4	(0.1)	139	(0.1)	0	(0.0)
<i>Cyclospora cayetanensis</i>	9	(0.1)	325	(0.3)	0	(0.0)
<i>Giardia intestinalis</i>	3	(0.0)	119	(0.1)	0	(0.0)
<i>Trichinella spiralis</i>	6	(0.1)	33	(0.0)	0	(0.0)
Total parasitic	23	(0.3)	630	(0.5)	0	(0.0)
Viral						
Astrovirus	1	(0.0)	14	(0.0)	0	(0.0)
Hepatitis A	50	(0.8)	981	(0.8)	4	(4.5)
Norovirus	657	(9.9)	27,171	(21.2)	1	(1.1)
Rotavirus	1	(0.0)	108	(0.1)	0	(0.0)
Total viral	709	(10.7)	28,274	(22.0)	5	(5.7)
Multiple etiologies	30	(0.5)	1,050	(0.8)	0	(0.0)
Confirmed etiology	2,167	(32.6)	68,981	(53.7)	76	(86.4)
Unknown etiology	4,480	(67.4)	59,389	(46.2)	12	(13.6)
Total 1998–2002	6,647	(100.0)	128,370	(100.0)	88	(100.0)

* Enterohemorrhagic (132 outbreaks), Enterotoxigenic (7), Enteroaggregative (1)

† Serotype O1 (1 outbreak), Serotype non-O1, non-O139 (1), serotype unspecified (1)

TABLE 2. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 1998

Etiology	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Bacterial						
<i>Bacillus cereus</i>	10	(0.8)	213	(0.8)	0	(0.0)
<i>Brucella</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Campylobacter</i>	12	(0.9)	483	(1.8)	0	(0.0)
<i>Clostridium botulinum</i>	3	(0.2)	8	(0.0)	0	(0.0)
<i>Clostridium perfringens</i>	24	(1.8)	1,328	(4.9)	0	(0.0)
<i>Escherichia coli</i>	32	(2.4)	1,613	(5.9)	0	(0.0)
<i>Listeria monocytogenes</i>	2	(0.2)	105	(0.4)	21	(65.6)
<i>Salmonella</i>	125	(9.5)	2,731	(10.0)	6	(18.8)
<i>Shigella</i>	17	(1.3)	1,266	(4.6)	0	(0.0)
<i>Staphylococcus aureus</i>	15	(1.1)	615	(2.3)	0	(0.0)
<i>Streptococcus</i>	1	(0.1)	4	(0.0)	0	(0.0)
<i>Vibrio cholerae</i>	1	(0.1)	6	(0.0)	0	(0.0)
<i>Vibrio parahemolyticus</i>	13	(1.0)	532	(2.0)	0	(0.0)
<i>Vibrio</i> , other	1	(0.1)	2	(0.0)	0	(0.0)
<i>Yersinia enterocolitica</i>	1	(0.1)	9	(0.0)	0	(0.0)
Other bacterial	1	(0.1)	4	(0.0)	0	(0.0)
Total bacterial	258	(19.6)	8,919	(32.7)	27	(84.4)
Chemical						
Ciguatoxin	16	(1.2)	73	(0.3)	0	(0.0)
Heavy metals	0	(0.0)	0	(0.0)	0	(0.0)
Mushroom toxin	1	(0.1)	2	(0.0)	0	(0.0)
Scombrototoxin	27	(2.1)	124	(0.5)	0	(0.0)
Shellfish toxin	1	(0.1)	6	(0.0)	0	(0.0)
Other chemical	3	(0.2)	124	(0.5)	0	(0.0)
Total chemical	48	(3.7)	329	(1.2)	0	(0.0)
Parasitic						
<i>Anisakis</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Cryptosporidium parvum</i>	1	(0.1)	88	(0.3)	0	(0.0)
<i>Cyclospora cayetanensis</i>	1	(0.1)	17	(0.1)	0	(0.0)
<i>Giardia intestinalis</i>	1	(0.1)	3	(0.0)	0	(0.0)
<i>Trichinella spiralis</i>	0	(0.0)	0	(0.0)	0	(0.0)
Total parasitic	4	(0.3)	116	(0.4)	0	(0.0)
Viral						
Astrovirus	0	(0.0)	0	(0.0)	0	(0.0)
Hepatitis A	13	(1.0)	293	(1.1)	1	(3.1)
Norovirus	47	(3.6)	2,563	(9.4)	0	(0.0)
Rotavirus	0	(0.0)	0	(0.0)	0	(0.0)
Total viral	60	(4.6)	2,856	(10.5)	1	(3.1)
Multiple etiologies	2	(0.2)	31	(0.1)	0	(0.0)
Confirmed etiology	372	(28.3)	12,251	(44.9)	28	(87.5)
Unknown etiology	942	(71.7)	15,007	(55.1)	4	(12.5)
Total 1998	1,314	(100.0)	27,258	(100.0)	32	(100.0)

TABLE 3. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 1999

Etiology	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Bacterial						
<i>Bacillus cereus</i>	7	(0.5)	194	(0.8)	0	(0.0)
<i>Brucella</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Campylobacter</i>	5	(0.4)	85	(0.3)	0	(0.0)
<i>Clostridium botulinum</i>	1	(0.1)	3	(0.0)	0	(0.0)
<i>Clostridium perfringens</i>	22	(1.6)	1,166	(4.7)	1	(10.0)
<i>Escherichia coli</i>	28	(2.1)	842	(3.4)	0	(0.0)
<i>Listeria monocytogenes</i>	5	(0.4)	28	(0.1)	2	(20.0)
<i>Salmonella</i>	111	(8.3)	3,463	(13.9)	2	(20.0)
<i>Shigella</i>	14	(1.0)	221	(0.9)	0	(0.0)
<i>Staphylococcus aureus</i>	19	(1.4)	353	(1.4)	0	(0.0)
<i>Streptococcus</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Vibrio cholerae</i>	1	(0.1)	2	(0.0)	0	(0.0)
<i>Vibrio parahemolyticus</i>	3	(0.2)	14	(0.1)	0	(0.0)
<i>Vibrio</i> , other	0	(0.0)	0	(0.0)	0	(0.0)
<i>Yersinia enterocolitica</i>	1	(0.1)	32	(0.1)	0	(0.0)
Other bacterial	0	(0.0)	0	(0.0)	0	(0.0)
Total bacterial	217	(16.2)	6,403	(25.7)	5	(50.0)
Chemical						
Ciguatoxin	12	(0.9)	47	(0.2)	1	(10.0)
Heavy metals	1	(0.1)	2	(0.0)	0	(0.0)
Mushroom toxin	0	(0.0)	0	(0.0)	0	(0.0)
Scombrototoxin	21	(1.6)	67	(0.3)	0	(0.0)
Shellfish toxin	0	(0.0)	0	(0.0)	0	(0.0)
Other chemical	1	(0.1)	2	(0.0)	0	(0.0)
Total chemical	35	(2.6)	118	(0.5)	1	(10.0)
Parasitic						
<i>Anisakis</i>	1	(0.1)	14	(0.1)	0	(0.0)
<i>Cryptosporidium parvum</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Cyclospora cayetanensis</i>	2	(0.1)	153	(0.6)	0	(0.0)
<i>Giardia intestinalis</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Trichinella spiralis</i>	0	(0.0)	0	(0.0)	0	(0.0)
Total parasitic	3	(0.2)	167	(0.7)	0	(0.0)
Viral						
Astrovirus	0	(0.0)	0	(0.0)	0	(0.0)
Hepatitis A	12	(0.9)	387	(1.6)	0	(0.0)
Norovirus	98	(7.3)	4,745	(19.1)	1	(10.0)
Rotavirus	0	(0.0)	0	(0.0)	0	(0.0)
Total viral	110	(8.2)	5,132	(20.6)	1	(10.0)
Multiple etiologies	5	(0.4)	267	(1.1)	0	(0.0)
Confirmed etiology	370	(27.6)	12,087	(48.6)	7	(70.0)
Unknown etiology	973	(72.4)	12,807	(51.4)	3	(30.0)
Total 1999	1,343	(100.0)	24,894	(100.0)	10	(100.0)

TABLE 4. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 2000

Etiology	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Bacterial						
<i>Bacillus cereus</i>	8	(0.6)	61	(0.2)	0	(0.0)
<i>Brucella</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Campylobacter</i>	15	(1.1)	205	(0.8)	0	(0.0)
<i>Clostridium botulinum</i>	2	(0.1)	5	(0.0)	1	(4.8)
<i>Clostridium perfringens</i>	22	(1.6)	791	(3.0)	0	(0.0)
<i>Escherichia coli</i>	32	(2.3)	1,392	(5.3)	2	(9.5)
<i>Listeria monocytogenes</i>	2	(0.1)	41	(0.2)	7	(33.3)
<i>Salmonella</i>	127	(9.0)	2,850	(10.9)	2	(9.5)
<i>Shigella</i>	12	(0.8)	866	(3.3)	1	(4.8)
<i>Staphylococcus aureus</i>	23	(1.6)	657	(2.5)	2	(9.5)
<i>Streptococcus</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Vibrio cholerae</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Vibrio parahemolyticus</i>	4	(0.3)	37	(0.1)	0	(0.0)
<i>Vibrio</i> , other	0	(0.0)	0	(0.0)	0	(0.0)
<i>Yersinia enterocolitica</i>	0	(0.0)	0	(0.0)	0	(0.0)
Other bacterial	0	(0.0)	0	(0.0)	0	(0.0)
Total bacterial	247	(17.4)	6,905	(26.4)	15	(71.4)
Chemical						
Ciguatoxin	12	(0.8)	46	(0.2)	0	(0.0)
Heavy metals	1	(0.1)	21	(0.1)	0	(0.0)
Mushroom toxin	0	(0.0)	0	(0.0)	0	(0.0)
Scombrototoxin	20	(1.4)	81	(0.3)	0	(0.0)
Shellfish toxin	3	(0.2)	9	(0.0)	0	(0.0)
Other chemical	2	(0.1)	36	(0.1)	0	(0.0)
Total chemical	38	(2.7)	193	(0.7)	0	(0.0)
Parasitic						
<i>Anisakis</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Cryptosporidium parvum</i>	1	(0.1)	8	(0.0)	0	(0.0)
<i>Cyclospora cayetanensis</i>	2	(0.1)	73	(0.3)	0	(0.0)
<i>Giardia intestinalis</i>	1	(0.1)	82	(0.3)	0	(0.0)
<i>Trichinella spiralis</i>	2	(0.1)	6	(0.0)	0	(0.0)
Total parasitic	6	(0.4)	169	(0.6)	0	(0.0)
Viral						
Astrovirus	0	(0.0)	0	(0.0)	0	(0.0)
Hepatitis A	12	(0.8)	135	(0.5)	1	(4.8)
Norovirus	163	(11.5)	6,969	(26.7)	0	(0.0)
Rotavirus	1	(0.1)	108	(0.4)	0	(0.0)
Total viral	176	(12.4)	7,212	(27.6)	1	(4.8)
Multiple etiologies	3	(0.2)	22	(0.1)	0	(0.0)
Confirmed etiology	470	(33.2)	14,501	(55.5)	16	(76.2)
Unknown etiology	947	(66.8)	11,621	(44.5)	5	(23.8)
Total 2000	1,417	(100.0)	26,122	(100.0)	21	(100.0)

TABLE 5. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 2001

Etiology	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Bacterial						
<i>Bacillus cereus</i>	5	(0.4)	61	(0.2)	0	(0.0)
<i>Brucella</i>	1	(0.1)	4	(0.0)	0	(0.0)
<i>Campylobacter</i>	16	(1.3)	317	(1.3)	0	(0.0)
<i>Clostridium botulinum</i>	3	(0.2)	22	(0.1)	0	(0.0)
<i>Clostridium perfringens</i>	31	(2.5)	1,232	(4.9)	3	(27.3)
<i>Escherichia coli</i>	22	(1.8)	521	(2.1)	0	(0.0)
<i>Listeria monocytogenes</i>	1	(0.1)	28	(0.1)	0	(0.0)
<i>Salmonella</i>	111	(8.9)	3,141	(12.5)	7	(63.6)
<i>Shigella</i>	15	(1.2)	1,006	(4.0)	0	(0.0)
<i>Staphylococcus aureus</i>	23	(1.9)	646	(2.6)	0	(0.0)
<i>Streptococcus</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Vibrio cholerae</i>	1	(0.1)	4	(0.0)	0	(0.0)
<i>Vibrio parahemolyticus</i>	3	(0.2)	19	(0.1)	0	(0.0)
<i>Vibrio</i> , other	0	(0.0)	0	(0.0)	0	(0.0)
<i>Yersinia enterocolitica</i>	3	(0.2)	33	(0.1)	0	(0.0)
Other bacterial	0	(0.0)	0	(0.0)	0	(0.0)
Total bacterial	235	(18.9)	7,034	(28.0)	10	(90.9)
Chemical						
Ciguatoxin	24	(1.9)	81	(0.3)	0	(0.0)
Heavy metals	0	(0.0)	0	(0.0)	0	(0.0)
Mushroom toxin	0	(0.0)	0	(0.0)	0	(0.0)
Scombrototoxin	29	(2.3)	132	(0.5)	0	(0.0)
Shellfish toxin	0	(0.0)	0	(0.0)	0	(0.0)
Other chemical	1	(0.1)	15	(0.1)	0	(0.0)
Total chemical	54	(4.3)	228	(0.9)	0	(0.0)
Parasitic						
<i>Anisakis</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Cryptosporidium parvum</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Cyclospora cayetanensis</i>	2	(0.2)	42	(0.2)	0	(0.0)
<i>Giardia intestinalis</i>	1	(0.1)	34	(0.1)	0	(0.0)
<i>Trichinella spiralis</i>	2	(0.2)	14	(0.1)	0	(0.0)
Total parasitic	5	(0.4)	90	(0.4)	0	(0.0)
Viral						
Astrovirus	0	(0.0)	0	(0.0)	0	(0.0)
Hepatitis A	6	(0.5)	116	(0.5)	1	(9.1)
Norovirus	150	(12.1)	6,335	(25.2)	0	(0.0)
Rotavirus	0	(0.0)	0	(0.0)	0	(0.0)
Total viral	156	(12.6)	6,451	(25.7)	1	(9.1)
Multiple etiologies	9	(0.7)	190	(0.8)	0	(0.0)
Confirmed etiology	459	(36.9)	13,993	(55.7)	11	(100.0)
Unknown etiology	784	(63.1)	11,137	(44.3)	0	(0.0)
Total 2001	1,243	(100.0)	25,130	(100.0)	11	(100.0)

TABLE 6. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 2002

Etiology	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Bacterial						
<i>Bacillus cereus</i>	7	(0.5)	42	(0.2)	0	(0.0)
<i>Brucella</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Campylobacter</i>	13	(1.0)	350	(1.4)	0	(0.0)
<i>Clostridium botulinum</i>	3	(0.2)	14	(0.1)	0	(0.0)
<i>Clostridium perfringens</i>	31	(2.3)	2,207	(8.8)	0	(0.0)
<i>Escherichia coli</i>	26	(2.0)	486	(1.9)	2	(14.3)
<i>Listeria monocytogenes</i>	1	(0.1)	54	(0.2)	8	(57.1)
<i>Salmonella</i>	111	(8.3)	4,636	(18.6)	3	(21.4)
<i>Shigella</i>	9	(0.7)	318	(1.3)	0	(0.0)
<i>Staphylococcus aureus</i>	21	(1.6)	495	(2.0)	0	(0.0)
<i>Streptococcus</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Vibrio cholerae</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Vibrio parahemolyticus</i>	2	(0.2)	11	(0.0)	0	(0.0)
<i>Vibrio</i> , other	0	(0.0)	0	(0.0)	0	(0.0)
<i>Yersinia enterocolitica</i>	3	(0.2)	13	(0.1)	0	(0.0)
Other bacterial	0	(0.0)	0	(0.0)	0	(0.0)
Total bacterial	227	(17.1)	8,626	(34.6)	13	(92.9)
Chemical						
Ciguatoxin	20	(1.5)	68	(0.3)	0	(0.0)
Heavy metals	0	(0.0)	0	(0.0)	0	(0.0)
Mushroom toxin	1	(0.1)	4	(0.0)	0	(0.0)
Scombrototoxin	21	(1.6)	59	(0.2)	0	(0.0)
Shellfish toxin	1	(0.1)	21	(0.1)	0	(0.0)
Other chemical	3	(0.2)	120	(0.5)	0	(0.0)
Total chemical	46	(3.5)	272	(1.1)	0	(0.0)
Parasitic						
<i>Anisakis</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Cryptosporidium parvum</i>	2	(0.2)	43	(0.2)	0	(0.0)
<i>Cyclospora cayetanensis</i>	2	(0.2)	40	(0.2)	0	(0.0)
<i>Giardia intestinalis</i>	0	(0.0)	0	(0.0)	0	(0.0)
<i>Trichinella spiralis</i>	1	(0.1)	5	(0.0)	0	(0.0)
Total parasitic	5	(0.4)	88	(0.4)	0	(0.0)
Viral						
Astrovirus	1	(0.1)	14	(0.1)	0	(0.0)
Hepatitis A	7	(0.5)	50	(0.2)	1	(7.1)
Norovirus	199	(15.0)	6,559	(26.3)	0	(0.0)
Rotavirus	0	(0.0)	0	(0.0)	0	(0.0)
Total viral	207	(15.6)	6,623	(26.5)	1	(7.1)
Multiple etiologies	11	(0.8)	540	(2.2)	0	(0.0)
Confirmed etiology	496	(37.3)	16,149	(64.7)	14	(100.0)
Unknown etiology	834	(62.7)	8,817	(35.3)	0	(0.0)
Total 2002	1,330	(100.0)	24,966	(100.0)	14	(100.0)

TABLE 7. Number of reported foodborne-disease outbreaks, by etiology and month of occurrence — United States, 1998–2002

Etiology	Month of occurrence												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Bacterial													
<i>Bacillus cereus</i>	3	3	2	5	5	7	4	3	1	1	1	2	37
<i>Brucella</i>	—	—	—	—	—	—	1	—	—	—	—	—	1
<i>Campylobacter</i>	4	5	5	4	7	13	3	9	4	1	5	1	61
<i>Clostridium botulinum</i>	3	—	—	1	—	1	3	1	1	1	—	1	12
<i>Clostridium perfringens</i>	3	9	6	17	14	8	8	11	8	13	15	18	130
<i>Escherichia coli</i>	—	1	3	8	19	18	24	21	15	19	10	2	140
<i>Listeria monocytogenes</i>	—	—	—	—	1	1	1	2	1	2	1	2	11
<i>Salmonella</i>	32	22	31	43	50	88	80	76	61	33	39	30	585
<i>Shigella</i>	8	3	2	5	4	11	3	6	11	6	5	3	67
<i>Staphylococcus aureus</i>	4	6	9	8	11	13	5	7	9	13	6	10	101
<i>Streptococcus</i>	—	—	1	—	—	—	—	—	—	—	—	—	1
<i>Vibrio cholerae</i>	1	—	—	—	—	1	—	—	1	—	—	—	3
<i>Vibrio parahaemolyticus</i>	1	—	1	2	2	8	5	5	1	—	—	—	25
<i>Vibrio, other</i>	—	—	—	—	—	—	—	—	—	—	1	—	1
<i>Yersinia enterocolitica</i>	2	1	—	—	—	—	—	—	1	—	3	1	8
Other bacterial	—	—	—	—	1	—	—	—	—	—	—	—	1
Total bacterial	61	50	60	93	114	169	137	141	114	89	86	70	1,184
Chemical													
Ciguatoxin	4	2	4	8	12	6	17	6	10	8	5	2	84
Heavy metals	—	—	—	1	—	—	—	—	—	—	—	1	2
Mushroom toxin	—	—	—	—	—	—	1	—	—	1	—	—	2
Scombrototoxin	7	6	5	14	11	12	11	12	10	12	7	11	118
Shellfish toxin	1	—	—	—	—	—	—	3	—	1	—	—	5
Other chemical	—	—	1	—	4	—	—	1	—	1	1	2	10
Total chemical	12	8	10	23	27	18	29	22	20	23	13	16	221
Parasitic													
<i>Anisakis</i>	—	1	—	—	—	—	—	—	—	—	—	—	1
<i>Cryptosporidium parvum</i>	—	—	—	1	—	—	—	—	2	1	—	—	4
<i>Cyclospora cayetanensis</i>	3	—	—	—	3	2	1	—	—	—	—	—	9
<i>Giardia intestinalis</i>	—	—	—	1	—	—	—	1	—	1	—	—	3
<i>Trichinella spiralis</i>	—	—	—	1	1	—	—	2	1	—	1	—	6
Total parasitic	3	1	0	3	4	2	1	3	3	2	1	0	23
Viral													
Astrovirus	1	—	—	—	—	—	—	—	—	—	—	—	1
Hepatitis A	4	2	9	4	—	5	3	3	4	10	2	4	50
Norovirus	46	51	64	60	70	49	43	42	28	47	66	91	657
Rotavirus	—	—	1	—	—	—	—	—	—	—	—	—	1
Total viral	51	53	74	64	70	54	46	45	32	57	68	95	709
Multiple etiologies	1	2	1	5	3	1	3	5	3	4	2	—	30
Confirmed etiology	128	114	145	188	218	244	216	216	172	175	170	181	2,167
Unknown etiology	329	355	422	425	462	394	349	334	267	316	377	450	4,480
Total 1998–2002	457	469	567	613	680	638	565	550	439	491	547	631	6,647

TABLE 8. Number of reported foodborne-disease outbreaks, by etiology and place where food was eaten* — United States, 1998–2002

Etiology	Place where food was eaten								
	Private residence	Restaurant or Delicatessen	Grocery	School	Daycare center	Workplace cafeteria	Picnic	Church	Camp
Bacterial									
<i>Bacillus cereus</i>	7	13	—	2	—	2	—	—	—
<i>Brucella</i>	1	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	16	25	—	2	—	—	1	1	2
<i>Clostridium botulinum</i>	10	—	—	—	—	1	—	1	—
<i>Clostridium perfringens</i>	15	36	—	11	—	10	2	6	1
<i>Escherichia coli</i>	40	41	1	9	2	2	7	5	6
<i>Listeria monocytogenes</i>	9	2	2	—	—	—	—	—	—
<i>Salmonella</i>	169	271	2	21	5	7	12	20	9
<i>Shigella</i>	10	39	—	5	2	—	3	2	—
<i>Staphylococcus aureus</i>	20	26	1	10	2	8	4	9	3
<i>Streptococcus</i>	—	—	1	—	—	—	—	—	—
<i>Vibrio cholerae</i>	1	2	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	4	17	—	—	—	—	—	—	—
<i>Vibrio, other</i>	—	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	4	1	—	—	—	1	—	—	—
Other bacterial	—	—	—	—	—	—	—	—	—
Total bacterial	306	473	7	60	11	31	29	44	21
Chemical									
Ciguatoxin	73	7	—	—	—	—	1	—	2
Heavy metals	1	—	—	1	—	—	—	—	—
Mushroom toxin	2	—	—	—	—	—	—	—	—
Scombrototoxin	14	84	2	1	—	3	—	—	—
Shellfish toxin	4	—	—	—	—	—	—	—	—
Other chemical	2	3	—	2	—	1	—	—	—
Total chemical	96	94	2	4	—	4	1	0	2
Parasitic									
<i>Anisakis</i>	1	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	2	—	—	—	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	2	2	—	—	—	—	—	—	—
<i>Giardia intestinalis</i>	1	1	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	3	—	—	—	—	—	1	—	1
Total parasitic	9	3	—	—	—	—	1	—	1
Viral									
Astrovirus	—	1	—	—	—	—	—	—	—
Hepatitis A	5	29	—	2	1	3	2	—	—
Norovirus	83	279	—	51	1	30	11	17	12
Rotavirus	—	—	—	1	—	—	—	—	—
Total viral	88	309	—	54	2	33	13	17	12
Multiple etiologies	7	8	1	2	1	—	2	—	1
Confirmed etiology	506	887	10	120	14	68	46	61	37
Unknown etiology	791	2,447	6	165	10	133	45	54	29
Total 1998–2002	1,297	3,334	16	285	24	201	91	115	66

* More than one place might be reported per outbreak.

TABLE 8. (Continued) Number of reported foodborne-disease outbreaks, by etiology and place where food was eaten* — United States, 1998–2002

Etiology	Place where food was eaten						Total	
	Fair or festival	Hospital	Nursing home	Prison	Other	Known place		Unknown place
Bacterial								
<i>Bacillus cereus</i>	—	—	—	—	8	33	4	37
<i>Brucella</i>	—	—	—	—	—	1	—	1
<i>Campylobacter</i>	1	—	—	1	13	57	4	61
<i>Clostridium botulinum</i>	—	—	—	—	—	11	1	12
<i>Clostridium perfringens</i>	—	4	—	10	33	125	5	130
<i>Escherichia coli</i>	3	—	1	7	20	127	13	140
<i>Listeria monocytogenes</i>	—	2	1	—	2	11	—	11
<i>Salmonella</i>	7	4	19	10	68	540	45	585
<i>Shigella</i>	—	—	—	—	4	64	3	67
<i>Staphylococcus aureus</i>	4	1	1	1	18	96	5	101
<i>Streptococcus</i>	—	—	—	—	—	1	—	1
<i>Vibrio cholerae</i>	—	—	—	—	—	3	—	3
<i>Vibrio parahaemolyticus</i>	—	—	—	—	2	23	2	25
<i>Vibrio</i> , other	—	—	—	—	—	—	1	1
<i>Yersinia enterocolitica</i>	—	—	—	—	1	7	1	8
Other bacterial	—	—	—	—	—	—	1	1
Total bacterial	15	11	22	29	169	1,099	85	1,184
Chemical								
Ciguatoxin	—	—	—	—	2	82	2	84
Heavy metals	—	—	—	—	—	2	—	2
Mushroom toxin	—	—	—	—	—	2	—	2
Scombrototoxin	—	1	1	—	8	113	5	118
Shellfish toxin	—	—	—	—	1	4	1	5
Other chemical	—	—	—	—	1	9	1	10
Total chemical	—	1	1	—	12	212	9	221
Parasitic								
<i>Anisakis</i>	—	—	—	—	—	1	—	1
<i>Cryptosporidium parvum</i>	—	—	—	—	2	4	—	4
<i>Cyclospora cayetanensis</i>	—	—	—	—	4	7	2	9
<i>Giardia intestinalis</i>	—	—	—	—	1	3	—	3
<i>Trichinella spiralis</i>	—	—	—	—	3	6	—	6
Total parasitic	—	—	—	—	10	21	2	23
Viral								
Astrovirus	—	—	—	—	—	1	—	1
Hepatitis A	—	—	—	—	4	42	8	50
Norovirus	5	7	21	6	148	636	21	657
Rotavirus	—	—	—	—	—	1	—	1
Total viral	5	7	21	6	152	680	29	709
Multiple etiologies	1	—	1	4	3	29	1	30
Confirmed etiology	21	19	45	39	346	2,041	126	2,167
Unknown etiology	23	32	23	20	576	4,222	258	4,480
Total 1998–2002	44	51	68	59	922	6,263	384	6,647

* More than one place might be reported per outbreak.

TABLE 9. Number of reported foodborne-disease outbreaks, cases, and deaths, by vehicle of transmission — United States, 1998

Vehicle of transmission	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Beef	26	(2.0)	805	(3.0)	0	(0.0)
Dairy	18	(1.4)	492	(1.8)	0	(0.0)
Eggs	7	(0.5)	48	(0.2)	0	(0.0)
Game	2	(0.2)	13	(0.0)	0	(0.0)
Pork	29	(2.2)	610	(2.2)	0	(0.0)
Poultry	62	(4.7)	876	(3.2)	0	(0.0)
Vegetables	27	(2.1)	1,299	(4.8)	2	(6.3)
Fruits and nuts	17	(1.3)	586	(2.1)	0	(0.0)
Grains	9	(0.7)	306	(1.1)	0	(0.0)
Oils and sugars	1	(0.1)	4	(0.0)	0	(0.0)
Finfish	69	(5.3)	493	(1.8)	0	(0.0)
Shellfish	38	(2.9)	880	(3.2)	0	(0.0)
Unclassifiable vehicle	41	(3.1)	632	(2.3)	2	(6.3)
Complex vehicle	432	(32.9)	10,851	(39.8)	23	(71.9)
Known vehicle	778	(59.2)	17,895	(65.7)	27	(84.4)
Unknown vehicle	536	(40.8)	9,363	(34.3)	5	(15.6)
Total 1998	1,314	(100.0)	27,258	(100.0)	32	(100.0)

TABLE 10. Number of reported foodborne-disease outbreaks, cases, and deaths, by vehicle of transmission — United States, 1999

Vehicle of transmission	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Beef	62	(4.6)	1,332	(5.4)	0	(0.0)
Dairy	15	(1.1)	199	(0.8)	0	(0.0)
Eggs	25	(1.9)	762	(3.1)	0	(0.0)
Game	0	(0.0)	0	(0.0)	0	(0.0)
Pork	26	(1.9)	559	(2.2)	0	(0.0)
Poultry	74	(5.5)	947	(3.8)	0	(0.0)
Vegetables	43	(3.2)	1,273	(5.1)	0	(0.0)
Fruits and nuts	19	(1.4)	629	(2.5)	0	(0.0)
Grains	19	(1.4)	139	(0.6)	0	(0.0)
Oils and sugars	5	(0.4)	135	(0.5)	0	(0.0)
Finfish	64	(4.8)	322	(1.3)	1	(10.0)
Shellfish	28	(2.1)	253	(1.0)	0	(0.0)
Unclassifiable vehicle	37	(2.8)	1,513	(6.1)	0	(0.0)
Complex vehicle	372	(27.7)	7,189	(28.9)	5	(50.0)
Known vehicle	789	(58.7)	15,252	(61.3)	6	(60.0)
Unknown vehicle	554	(41.3)	9,642	(38.7)	4	(40.0)
Total 1999	1,343	(100.0)	24,894	(100.0)	10	(100.0)

TABLE 11. Number of reported foodborne-disease outbreaks, cases, and deaths, by vehicle of transmission — United States, 2000

Vehicle of transmission	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Beef	43	(3.0)	696	(2.7)	1	(4.8)
Dairy	22	(1.6)	300	(1.1)	0	(0.0)
Eggs	25	(1.8)	620	(2.4)	0	(0.0)
Game	0	(0.0)	0	(0.0)	0	(0.0)
Pork	27	(1.9)	610	(2.3)	0	(0.0)
Poultry	61	(4.3)	829	(3.2)	7	(33.3)
Vegetables	41	(2.9)	872	(3.3)	2	(9.5)
Fruits and nuts	21	(1.5)	1,527	(5.8)	1	(4.8)
Grains	28	(2.0)	434	(1.7)	0	(0.0)
Oils and sugars	1	(0.1)	27	(0.1)	0	(0.0)
Finfish	63	(4.4)	267	(1.0)	0	(0.0)
Shellfish	25	(1.8)	134	(0.5)	0	(0.0)
Unclassifiable vehicle	51	(3.5)	959	(3.6)	0	(0.0)
Complex vehicle	455	(32.1)	9,525	(36.5)	9	(42.9)
Known vehicle	863	(60.9)	16,800	(64.3)	20	(95.2)
Unknown vehicle	554	(39.1)	9,322	(35.7)	1	(4.8)
Total 2000	1,417	(100.0)	26,122	(100.0)	21	(100.0)

TABLE 12. Number of reported foodborne-disease outbreaks, cases, and deaths, by vehicle of transmission — United States, 2001

Vehicle of transmission	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Beef	33	(2.6)	525	(2.1)	1	(9.1)
Dairy	21	(1.7)	536	(2.1)	0	(0.0)
Eggs	12	(1.0)	465	(1.9)	0	(0.0)
Game	5	(0.4)	45	(0.2)	0	(0.0)
Pork	30	(2.4)	560	(2.2)	0	(0.0)
Poultry	73	(5.9)	1,010	(4.0)	0	(0.0)
Vegetables	37	(3.0)	1,997	(7.9)	0	(0.0)
Fruits and nuts	21	(1.7)	585	(2.3)	2	(18.2)
Grains	11	(0.9)	92	(0.4)	0	(0.0)
Oils and sugars	4	(0.3)	95	(0.4)	0	(0.0)
Finfish	75	(6.0)	330	(1.3)	0	(0.0)
Shellfish	33	(2.7)	291	(1.2)	0	(0.0)
Unclassifiable vehicle	51	(4.1)	1,182	(4.7)	1	(9.1)
Complex vehicle	384	(31.0)	8,112	(32.3)	1	(9.1)
Known vehicle	790	(63.6)	15,825	(63.0)	5	(45.5)
Unknown vehicle	453	(36.4)	9,305	(37.0)	6	(54.5)
Total 2001	1,243	(100.0)	25,130	(100.0)	11	(100.0)

TABLE 13. Number of reported foodborne-disease outbreaks, cases, and deaths, by vehicle of transmission — United States, 2002

Vehicle of transmission	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
Beef	44	(3.3)	831	(3.3)	3	(21.4)
Dairy	16	(1.2)	704	(2.8)	0	(0.0)
Eggs	14	(1.1)	317	(1.3)	0	(0.0)
Game	3	(0.2)	33	(0.1)	0	(0.0)
Pork	26	(2.0)	360	(1.4)	0	(0.0)
Poultry	75	(5.6)	1,325	(5.3)	8	(57.1)
Vegetables	44	(3.3)	1,596	(6.4)	0	(0.0)
Fruits and nuts	9	(0.7)	169	(0.7)	0	(0.0)
Grains	14	(1.1)	177	(0.7)	0	(0.0)
Oils and sugars	1	(0.1)	4	(0.0)	0	(0.0)
Finfish	66	(5.0)	280	(1.1)	0	(0.0)
Shellfish	27	(2.0)	200	(0.8)	0	(0.0)
Unclassifiable vehicle	52	(3.9)	1,049	(4.2)	0	(0.0)
Complex vehicle	436	(32.8)	9,369	(37.5)	1	(7.1)
Known vehicle	827	(62.2)	16,414	(65.7)	12	(85.7)
Unknown vehicle	503	(37.8)	8,552	(34.3)	2	(14.3)
Total 2002	1,330	(100.0)	24,966	(100.0)	14	(100.0)

TABLE 14. Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 1998

Etiology	Vehicle of transmission								
	Beef	Dairy	Eggs	Game	Pork	Poultry	Vegetables	Fruits and nuts	Grains
Bacterial									
<i>Bacillus cereus</i>	—	—	—	—	—	—	—	—	—
<i>Brucella</i>	—	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	2	—	—	—	1	1	—	—
<i>Clostridium botulinum</i>	—	—	—	—	—	—	—	—	—
<i>Clostridium perfringens</i>	4	—	—	—	3	2	—	—	—
<i>Escherichia coli</i>	1	2	—	—	—	—	2	1	—
<i>Listeria monocytogenes</i>	—	—	—	—	—	—	—	—	—
<i>Salmonella</i>	—	3	3	1	2	6	3	1	2
<i>Shigella</i>	—	—	—	—	—	1	1	—	—
<i>Staphylococcus aureus</i>	1	—	—	—	2	1	—	—	—
<i>Streptococcus</i>	—	—	—	—	—	1	—	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	—	—	—	—	—	1	—	—	—
<i>Vibrio, other</i>	—	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	—	—	—	—	—
Other bacterial	—	—	—	—	—	—	—	—	—
Total bacterial	6	7	3	1	7	13	7	2	2
Chemical									
Ciguatoxin	—	—	—	—	—	—	—	—	—
Heavy metals	—	—	—	—	—	—	—	—	—
Mushroom toxin	—	—	—	—	—	—	1	—	—
Scombrotxin	—	—	—	—	—	—	—	—	—
Shellfish toxin	—	—	—	—	—	—	—	—	—
Other chemical	—	—	—	—	—	—	1	—	—
Total chemical	—	—	—	—	—	—	2	—	—
Parasitic									
<i>Anisakis</i>	—	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	—	—	—	—
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	1	—	—	—	—	—
Total parasitic	—	—	—	1	—	—	—	—	—
Viral									
Astrovirus	—	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	—	—	—	—	2	—
Norovirus	—	1	—	—	1	—	1	2	—
Rotavirus	—	—	—	—	—	—	—	—	—
Total viral	—	1	—	—	1	—	1	4	—
Multiple etiologies									
Confirmed etiology	6	8	3	2	8	13	10	6	2
Unknown etiology	20	10	4	—	21	49	17	11	7
Total 1998	26	18	7	2	29	62	27	17	9

TABLE 14. (Continued) Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 1998

Etiology	Vehicle of transmission						Total	
	Oils and sugars	Finfish	Shellfish	Unclassifiable vehicle	Complex vehicle	Known vehicle		Unknown vehicle
Bacterial								
<i>Bacillus cereus</i>	—	—	1	—	7	8	2	10
<i>Brucella</i>	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	—	1	—	2	7	5	12
<i>Clostridium botulinum</i>	—	2	—	—	1	3	—	3
<i>Clostridium perfringens</i>	—	—	—	—	12	21	3	24
<i>Escherichia coli</i>	—	—	—	—	12	18	14	32
<i>Listeria monocytogenes</i>	—	—	—	—	2	2	—	2
<i>Salmonella</i>	—	1	1	4	35	62	63	125
<i>Shigella</i>	—	1	—	—	4	7	10	17
<i>Staphylococcus aureus</i>	—	—	—	—	9	13	2	15
<i>Streptococcus</i>	—	—	—	—	—	1	—	1
<i>Vibrio cholerae</i>	—	—	1	—	—	1	—	1
<i>Vibrio parahaemolyticus</i>	—	—	11	—	—	12	1	13
<i>Vibrio</i> , other	—	—	1	—	—	1	—	1
<i>Yersinia enterocolitica</i>	—	—	—	—	1	1	—	1
Other bacterial	—	—	—	—	1	1	—	1
Total bacterial	—	4	16	4	86	158	100	258
Chemical								
Ciguatoxin	—	16	—	—	—	16	—	16
Heavy metals	—	—	—	—	—	—	—	—
Mushroom toxin	—	—	—	—	—	1	—	1
Scombrot toxin	—	27	—	—	—	27	—	27
Shellfish toxin	—	—	1	—	—	1	—	1
Other chemical	—	1	—	—	1	3	—	3
Total chemical	—	44	1	—	1	48	—	48
Parasitic								
<i>Anisakis</i>	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	1	—
<i>Cyclospora cayentanensis</i>	—	—	—	—	—	—	1	—
<i>Giardia intestinalis</i>	—	—	—	—	1	1	—	—
<i>Trichinella spiralis</i>	—	—	—	—	—	1	—	1
Total parasitic	—	—	—	—	1	2	2	1
Viral								
Astrovirus	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	—	—	2	11	13
Norovirus	—	—	1	3	17	26	21	47
Rotavirus	—	—	—	—	—	—	—	—
Total viral	—	—	1	3	17	28	32	60
Multiple etiologies	—	—	—	—	1	1	1	2
Confirmed etiology	—	48	18	6	107	237	135	372
Unknown etiology	1	21	20	35	325	541	401	942
Total 1998	1	69	38	41	432	778	536	1,314

TABLE 15. Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 1999

Etiology	Vehicle of transmission								
	Beef	Dairy	Eggs	Game	Pork	Poultry	Vegetables	Fruits and nuts	Grains
Bacterial									
<i>Bacillus cereus</i>	—	—	—	—	—	—	—	—	3
<i>Brucella</i>	—	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	1	—	—	—	1	—	—	—
<i>Clostridium botulinum</i>	—	—	—	—	—	—	—	—	—
<i>Clostridium perfringens</i>	4	—	1	—	—	3	1	—	—
<i>Escherichia coli</i>	12	—	—	—	—	—	5	—	—
<i>Listeria monocytogenes</i>	1	—	—	—	—	—	—	—	—
<i>Salmonella</i>	3	2	19	—	3	15	7	5	—
<i>Shigella</i>	—	—	1	—	—	—	—	—	—
<i>Staphylococcus aureus</i>	2	—	—	—	6	—	1	—	—
<i>Streptococcus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	1	—	—	—	—
Other bacterial	—	—	—	—	—	—	—	—	—
Total bacterial	22	3	21	0	10	19	14	5	3
Chemical									
Ciguatoxin	—	—	—	—	—	—	—	—	—
Heavy metals	—	—	—	—	—	—	—	—	—
Mushroom toxin	—	—	—	—	—	—	—	—	—
Scombrotxin	—	—	—	—	—	—	—	—	—
Shellfish toxin	—	—	—	—	—	—	—	—	—
Other chemical	—	—	—	—	—	—	—	—	—
Total chemical	—	—	—	—	—	—	—	—	—
Parasitic									
<i>Anisakis</i>	—	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	—	1	1	—
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	—	—	—	—	—	—
Total parasitic	—	—	—	—	—	—	1	1	—
Viral									
Astrovirus	—	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	—	—	—	—	—	—
Norovirus	5	2	—	—	1	2	3	5	—
Rotavirus	—	—	—	—	—	—	—	—	—
Total viral	5	2	—	—	1	2	3	5	—
Multiple etiologies	—	—	—	—	—	1	—	—	1
Confirmed etiology	27	5	21	—	11	22	18	11	4
Unknown etiology	35	10	4	—	15	52	25	8	15
Total 1999	62	15	25	—	26	74	43	19	19

TABLE 15. (Continued) Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 1999

Etiology	Vehicle of transmission						Total	
	Oils and sugars	Finfish	Shellfish	Unclassifiable vehicle	Complex vehicle	Known vehicle		Unknown vehicle
Bacterial								
<i>Bacillus cereus</i>	—	—	—	—	3	6	1	7
<i>Brucella</i>	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	—	—	—	—	2	3	5
<i>Clostridium botulinum</i>	—	—	—	—	1	1	—	1
<i>Clostridium perfringens</i>	—	—	—	—	12	21	1	22
<i>Escherichia coli</i>	—	—	—	1	3	21	7	28
<i>Listeria monocytogenes</i>	—	—	—	—	3	4	1	5
<i>Salmonella</i>	—	—	—	1	21	76	35	111
<i>Shigella</i>	—	—	—	—	7	8	6	14
<i>Staphylococcus aureus</i>	—	—	—	—	7	16	3	19
<i>Streptococcus</i>	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	1	—	—	1	—	1
<i>Vibrio parahaemolyticus</i>	—	—	3	—	—	3	—	3
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	—	1	—	1
Other bacterial	—	—	—	—	—	—	—	—
Total bacterial	—	—	4	2	57	160	57	217
Chemical								
Ciguatoxin	—	12	—	—	—	12	—	12
Heavy metals	—	—	—	—	1	1	—	1
Mushroom toxin	—	—	—	—	—	—	—	—
Scombrototoxin	—	20	—	—	1	21	—	21
Shellfish toxin	—	—	—	—	—	—	—	—
Other chemical	1	—	—	—	—	1	—	1
Total chemical	1	32	—	—	2	35	—	35
Parasitic								
<i>Anisakis</i>	—	1	—	—	—	1	—	1
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	2	—	2
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	—	—	—	—	—
Total parasitic	—	1	—	—	—	3	—	3
Viral								
Astrovirus	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	1	5	6	6	12
Norovirus	1	—	2	3	29	53	45	98
Rotavirus	—	—	—	—	—	—	—	—
Total viral	1	—	2	4	34	59	51	110
Multiple etiologies	—	—	—	1	—	3	2	5
Confirmed etiology	2	33	6	7	93	260	110	370
Unknown etiology	3	31	22	30	279	529	444	973
Total 1999	5	64	28	37	372	789	554	1,343

TABLE 16. Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 2000

Etiology	Vehicle of transmission								
	Beef	Dairy	Eggs	Game	Pork	Poultry	Vegetables	Fruits and nuts	Grains
Bacterial									
<i>Bacillus cereus</i>	—	—	—	—	—	—	—	—	2
<i>Brucella</i>	—	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	10	—	—	—	—	1	—	—
<i>Clostridium botulinum</i>	—	—	—	—	—	—	2	—	—
<i>Clostridium perfringens</i>	3	—	—	—	2	4	—	—	1
<i>Escherichia coli</i>	11	—	—	—	—	2	1	2	—
<i>Listeria monocytogenes</i>	—	1	—	—	—	1	—	—	—
<i>Salmonella</i>	1	—	19	—	4	12	4	3	—
<i>Shigella</i>	—	—	—	—	1	—	—	—	—
<i>Staphylococcus aureus</i>	2	—	—	—	3	2	1	—	1
<i>Streptococcus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	—	—	—	—	—
Other bacterial	—	—	—	—	—	—	—	—	—
Total bacterial	17	11	19	—	10	21	9	5	4
Chemical									
Ciguatoxin	—	—	—	—	—	—	—	—	—
Heavy metals	—	—	—	—	—	—	—	1	—
Mushroom toxin	—	—	—	—	—	—	—	—	—
Scombrotxin	—	—	—	—	—	—	—	—	—
Shellfish toxin	—	—	—	—	—	—	—	—	—
Other chemical	—	—	—	—	—	—	—	—	—
Total chemical	—	—	—	—	—	—	—	1	—
Parasitic									
<i>Anisakis</i>	—	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	—	—	1	—
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	—	—	—	—	—	—
Total parasitic	—	—	—	—	—	—	—	1	—
Viral									
Astrovirus	—	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	—	—	—	1	1	—
Norovirus	1	—	—	—	2	1	8	6	—
Rotavirus	—	—	—	—	—	—	—	—	—
Total viral	1	—	—	—	2	1	9	7	—
Multiple etiologies	—	—	—	—	1	—	—	—	2
Confirmed etiology	18	11	19	—	13	22	18	14	6
Unknown etiology	25	11	6	—	14	39	23	7	22
Total 2000	43	22	25	—	27	61	41	21	28

TABLE 16. (Continued) Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 2000

Etiology	Vehicle of transmission						Total	
	Oils and sugars	Finfish	Shellfish	Unclassifiable vehicle	Complex vehicle	Known vehicle		Unknown vehicle
Bacterial								
<i>Bacillus cereus</i>	—	1	—	—	3	6	2	8
<i>Brucella</i>	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	—	—	—	—	11	4	15
<i>Clostridium botulinum</i>	—	—	—	—	—	2	—	2
<i>Clostridium perfringens</i>	—	—	—	1	9	20	2	22
<i>Escherichia coli</i>	—	—	—	2	4	22	10	32
<i>Listeria monocytogenes</i>	—	—	—	—	—	2	—	2
<i>Salmonella</i>	—	2	—	4	37	86	41	127
<i>Shigella</i>	—	—	—	2	6	9	3	12
<i>Staphylococcus aureus</i>	—	—	—	1	9	19	4	23
<i>Streptococcus</i>	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	—	—	3	—	1	4	—	4
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	—	—	—	—
Other bacterial	—	—	—	—	—	—	—	—
Total bacterial	—	3	3	10	69	181	66	247
Chemical								
Ciguatoxin	—	12	—	—	—	12	—	12
Heavy metals	—	—	—	—	—	1	—	1
Mushroom toxin	—	—	—	—	—	—	—	—
Scombrototoxin	—	20	—	—	—	20	—	20
Shellfish toxin	—	—	3	—	—	3	—	3
Other chemical	—	—	—	—	2	2	—	2
Total chemical	—	32	3	—	2	38	—	38
Parasitic								
<i>Anisakis</i>	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	1	1	—	1
<i>Cyclospora cayentanensis</i>	—	—	—	—	1	2	—	2
<i>Giardia intestinalis</i>	—	—	—	1	—	1	—	1
<i>Trichinella spiralis</i>	—	—	—	—	2	2	—	2
Total parasitic	—	—	—	1	4	6	—	6
Viral								
Astrovirus	—	—	—	—	—	—	—	—
Hepatitis A	—	—	1	1	5	9	3	12
Norovirus	—	1	2	4	49	74	89	163
Rotavirus	—	—	—	1	—	1	—	1
Total viral	—	1	3	6	54	84	92	176
Multiple etiologies	—	—	—	—	—	3	—	3
Confirmed etiology	—	36	9	17	129	312	158	470
Unknown etiology	1	27	16	34	326	551	396	947
Total 2000	1	63	25	51	455	863	554	1,417

TABLE 17. Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 2001

Etiology	Vehicle of transmission								
	Beef	Dairy	Eggs	Game	Pork	Poultry	Vegetables	Fruits and nuts	Grains
Bacterial									
<i>Bacillus cereus</i>	—	—	—	—	—	—	1	—	—
<i>Brucella</i>	—	1	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	2	—	1	—	2	—	1	—
<i>Clostridium botulinum</i>	—	—	—	1	—	—	—	—	—
<i>Clostridium perfringens</i>	10	—	—	—	—	4	1	—	—
<i>Escherichia coli</i>	—	1	—	—	—	—	1	1	—
<i>Listeria monocytogenes</i>	—	—	—	—	—	1	—	—	—
<i>Salmonella</i>	1	4	10	—	5	9	3	6	—
<i>Shigella</i>	1	—	—	—	—	1	2	—	—
<i>Staphylococcus aureus</i>	—	—	—	—	6	2	—	—	—
<i>Streptococcus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	2	—	—	—	—
Other bacterial	—	—	—	—	—	—	—	—	—
Total bacterial	12	8	10	2	13	19	8	8	—
Chemical									
Ciguatoxin	—	—	—	—	—	—	—	—	—
Heavy metals	—	—	—	—	—	—	—	—	—
Mushroom toxin	—	—	—	—	—	—	—	—	—
Scombrototoxin	—	—	—	—	—	—	—	—	—
Shellfish toxin	—	—	—	—	—	—	—	—	—
Other chemical	—	—	—	1	—	—	—	—	—
Total chemical	—	—	—	1	—	—	—	—	—
Parasitic									
<i>Anisakis</i>	—	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	—	1	—	—
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	1	—	—	—	—	—
Total parasitic	—	—	—	1	—	—	1	—	—
Viral									
Astrovirus	—	—	—	—	—	—	—	—	—
Hepatitis A	—	1	—	—	—	—	1	—	—
Norovirus	—	2	—	1	1	3	7	5	1
Rotavirus	—	—	—	—	—	—	—	—	—
Total viral	—	3	—	1	1	3	8	5	1
Multiple etiologies	1	—	—	—	1	1	—	—	—
Confirmed etiology	13	11	10	5	15	23	17	13	1
Unknown etiology	20	10	2	—	15	50	20	8	10
Total 2001	33	21	12	5	30	73	37	21	11

TABLE 17. (Continued) Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 2001

Etiology	Vehicle of transmission						Total	
	Oils and sugars	Finfish	Shellfish	Unclassifiable vehicle	Complex vehicle	Known vehicle		Unknown vehicle
Bacterial								
<i>Bacillus cereus</i>	—	—	—	—	4	5	—	5
<i>Brucella</i>	—	—	—	—	—	1	—	1
<i>Campylobacter</i>	—	—	—	—	5	11	5	16
<i>Clostridium botulinum</i>	—	1	—	—	1	3	—	3
<i>Clostridium perfringens</i>	—	—	—	—	11	26	5	31
<i>Escherichia coli</i>	—	—	—	1	6	10	12	22
<i>Listeria monocytogenes</i>	—	—	—	—	—	1	—	1
<i>Salmonella</i>	—	—	1	8	30	77	34	111
<i>Shigella</i>	—	—	2	—	4	10	5	15
<i>Staphylococcus aureus</i>	—	—	—	—	14	22	1	23
<i>Streptococcus</i>	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	1	—	—	1	—	1
<i>Vibrio parahaemolyticus</i>	—	—	1	—	2	3	—	3
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	—	2	1	3
Other bacterial	—	—	—	—	—	—	—	—
Total bacterial	—	1	5	9	77	172	63	235
Chemical								
Ciguatoxin	—	24	—	—	—	24	—	24
Heavy metals	—	—	—	—	—	—	—	—
Mushroom toxin	—	—	—	—	—	—	—	—
Scombrototoxin	—	29	—	—	—	29	—	29
Shellfish toxin	—	—	—	—	—	—	—	—
Other chemical	—	—	—	—	—	1	—	1
Total chemical	—	53	—	—	—	54	—	54
Parasitic								
<i>Anisakis</i>	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	—	—
<i>Cyclospora cayentanensis</i>	—	—	—	—	—	1	1	2
<i>Giardia intestinalis</i>	—	—	—	—	—	—	1	1
<i>Trichinella spiralis</i>	—	—	—	—	1	2	—	2
Total parasitic	—	—	—	—	1	3	2	5
Viral								
Astrovirus	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	2	—	4	2	6
Norovirus	1	1	8	10	40	80	70	150
Rotavirus	—	—	—	—	—	—	—	—
Total viral	1	1	8	12	40	84	72	156
Multiple etiologies	—	—	—	—	4	7	2	9
Confirmed etiology	1	55	13	21	122	321	139	459
Unknown etiology	3	20	20	30	262	470	314	784
Total 2001	4	75	33	51	384	791	453	1,243

TABLE 18. Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 2002

Etiology	Vehicle of transmission								
	Beef	Dairy	Eggs	Game	Pork	Poultry	Vegetables	Fruits and nuts	Grains
Bacterial									
<i>Bacillus cereus</i>	—	—	—	—	—	2	—	—	1
<i>Brucella</i>	—	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	4	—	—	—	2	1	—	—
<i>Clostridium botulinum</i>	—	—	—	—	—	—	—	—	—
<i>Clostridium perfringens</i>	8	—	1	—	2	5	—	—	—
<i>Escherichia coli</i>	6	—	—	—	—	—	3	—	1
<i>Listeria monocytogenes</i>	—	—	—	—	—	1	—	—	—
<i>Salmonella</i>	4	2	6	2	3	8	8	3	1
<i>Shigella</i>	—	—	—	—	—	—	1	—	—
<i>Staphylococcus aureus</i>	1	—	—	—	4	2	—	—	—
<i>Streptococcus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	1	—	—	—	—
Other bacterial	—	—	—	—	—	—	—	—	—
Total bacterial	19	6	7	2	10	20	13	3	3
Chemical									
Ciguatoxin	—	—	—	—	—	—	—	—	—
Heavy metals	—	—	—	—	—	—	—	—	—
Mushroom toxin	—	—	—	—	—	—	1	—	—
Scombrotxin	—	—	—	—	—	—	—	—	—
Shellfish toxin	—	—	—	—	—	—	—	—	—
Other chemical	—	1	—	—	—	1	—	—	—
Total chemical	—	1	—	—	—	1	1	—	—
Parasitic									
<i>Anisakis</i>	—	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	—	—	1	—
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	1	—	—	—	—	—
Total parasitic	—	—	—	1	—	—	—	1	—
Viral									
Astrovirus	—	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	—	—	—	—	—	—
Norovirus	4	2	—	—	—	2	11	1	—
Rotavirus	—	—	—	—	—	—	—	—	—
Total viral	4	2	—	—	—	2	11	1	—
Multiple etiologies	1	—	—	—	1	—	—	—	—
Confirmed etiology	24	9	7	3	11	23	25	5	3
Unknown etiology	20	7	7	—	15	52	19	4	11
Total 2002	44	16	14	3	26	75	44	9	14

TABLE 18. (Continued) Number of reported foodborne-disease outbreaks, by etiology and vehicle of transmission — United States, 2002

Etiology	Vehicle of transmission						Total	
	Oils and sugars	Finfish	Shellfish	Unclassifiable vehicle	Complex vehicle	Known vehicle		Unknown vehicle
Bacterial								
<i>Bacillus cereus</i>	—	—	—	—	4	7	—	7
<i>Brucella</i>	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	—	—	—	—	4	11	2	13
<i>Clostridium botulinum</i>	—	2	—	—	1	3	—	3
<i>Clostridium perfringens</i>	—	—	—	—	13	29	2	31
<i>Escherichia coli</i>	—	—	—	3	7	20	6	26
<i>Listeria monocytogenes</i>	—	—	—	—	—	1	—	1
<i>Salmonella</i>	—	1	—	3	34	75	36	111
<i>Shigella</i>	—	—	—	—	2	3	6	9
<i>Staphylococcus aureus</i>	—	—	—	—	13	20	1	21
<i>Streptococcus</i>	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	—	—	2	—	—	2	—	2
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	1	—	2	1	3
Other bacterial	—	—	—	—	—	—	—	—
Total bacterial	—	3	2	7	78	173	54	227
Chemical								
Ciguatoxin	—	20	—	—	—	20	—	20
Heavy metals	—	—	—	—	—	—	—	—
Mushroom toxin	—	—	—	—	—	1	—	1
Scombrototoxin	—	21	—	—	—	21	—	21
Shellfish toxin	—	1	—	—	—	1	—	1
Other chemical	—	—	—	1	—	3	—	3
Total chemical	—	42	—	1	—	46	—	46
Parasitic								
<i>Anisakis</i>	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	2	2
<i>Cyclospora cayentanensis</i>	—	—	—	—	1	2	—	2
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	—	—	1	—	1
Total parasitic	—	—	—	—	1	3	2	5
Viral								
Astrovirus	—	—	—	—	—	—	1	1
Hepatitis A	—	—	—	—	1	1	6	7
Norovirus	—	—	2	10	62	94	105	199
Rotavirus	—	—	—	—	—	—	—	—
Total viral	—	—	2	10	63	95	112	207
Multiple etiologies	—	—	—	—	5	7	4	11
Confirmed etiology	—	45	4	18	147	324	172	496
Unknown etiology	1	21	23	34	289	503	331	834
Total 2002	1	66	27	52	436	827	503	1,330

TABLE 19. Number of reported foodborne-disease outbreaks, by etiology and contributing factors*† — United States, 1998–2002

Etiology	Contamination factors								
	C1	C2	C3	C4	C5	C6	C7	C8	C9
Bacterial									
<i>Bacillus cereus</i>	—	—	—	—	—	3	—	—	—
<i>Brucella</i>	—	—	—	—	—	1	—	—	—
<i>Campylobacter</i>	—	—	—	—	—	18	7	—	10
<i>Clostridium botulinum</i>	—	—	—	—	—	5	1	—	—
<i>Clostridium perfringens</i>	—	—	—	—	—	14	1	—	5
<i>Escherichia coli</i>	—	1	—	—	—	33	4	1	14
<i>Listeria monocytogenes</i>	—	—	—	—	—	1	1	—	—
<i>Salmonella</i>	1	—	—	—	4	97	42	3	85
<i>Shigella</i>	—	—	—	—	—	1	—	—	1
<i>Staphylococcus aureus</i>	—	—	—	—	—	—	—	—	1
<i>Streptococcus</i>	—	—	—	—	—	—	—	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	1	1	—
<i>Vibrio parahaemolyticus</i>	1	—	—	—	—	7	4	2	2
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	—	—	—	—	2
Other bacterial	—	—	—	—	—	—	—	—	—
Total bacterial	2	1	—	—	4	180	61	7	120
Chemical									
Ciguatoxin	54	—	—	—	—	—	—	4	—
Heavy metals	—	—	1	—	—	1	—	—	—
Mushroom toxin	1	—	—	—	—	—	—	—	—
Scombrototoxin	43	—	—	—	—	1	1	—	1
Shellfish toxin	4	—	—	—	—	—	—	—	—
Other chemical	—	—	5	—	—	—	—	—	—
Total chemical	102	—	6	—	—	2	1	4	1
Parasitic									
<i>Anisakis</i>	—	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	1	1	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	5	3	—	—
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	—	—	1	3	—	—
Total parasitic	—	—	—	—	—	7	7	—	—
Viral									
Astrovirus	—	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	—	1	—	1	—	1
Norovirus	—	—	—	—	1	21	18	3	9
Rotavirus	—	—	—	—	—	—	—	—	—
Total viral	—	—	—	—	2	21	19	3	10
Multiple etiologies	—	—	—	—	—	2	3	1	—
Confirmed etiology	104	1	6	—	6	212	91	15	131
Unknown etiology	42	1	20	3	7	133	38	10	251
Total 1998–2002	146	2	26	3	13	345	129	25	382

* More than one contributing factor might be reported per outbreak

† See Appendix A for description of each factor.

TABLE 19. (Continued) Number of reported foodborne-disease outbreaks, by etiology and contributing factors*† — United States, 1998–2002

Etiology	Contamination factors						Outbreaks in which contamination factor reported
	C10	C11	C12	C13	C14	C15	
Bacterial							
<i>Bacillus cereus</i>	1	1	1	3	2	—	10
<i>Brucella</i>	—	—	—	—	—	—	1
<i>Campylobacter</i>	5	2	1	13	3	3	39
<i>Clostridium botulinum</i>	—	—	—	1	—	1	7
<i>Clostridium perfringens</i>	8	2	2	12	6	11	41
<i>Escherichia coli</i>	12	1	6	8	3	3	60
<i>Listeria monocytogenes</i>	—	—	—	1	—	3	6
<i>Salmonella</i>	37	4	64	82	17	23	260
<i>Shigella</i>	12	3	16	5	2	3	25
<i>Staphylococcus aureus</i>	17	5	30	9	5	6	50
<i>Streptococcus</i>	—	—	1	—	—	—	1
<i>Vibrio cholerae</i>	—	—	—	—	—	—	2
<i>Vibrio parahaemolyticus</i>	2	1	1	4	1	—	14
<i>Vibrio</i> , other	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	3	—	—	4
Other bacterial	—	—	—	1	—	—	1
Total bacterial	94	19	122	142	39	53	521
Chemical							
Ciguatoxin	—	—	—	—	—	—	58
Heavy metals	—	—	—	—	—	—	2
Mushroom toxin	—	—	—	—	—	—	1
Scombrototoxin	—	1	—	1	2	9	55
Shellfish toxin	—	—	—	—	—	—	4
Other chemical	—	—	—	—	1	1	6
Total chemical	—	1	—	1	3	10	126
Parasitic							
<i>Anisakis</i>	—	—	—	—	—	1	1
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	1
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	1	6
<i>Giardia intestinalis</i>	1	—	2	1	1	—	2
<i>Trichinella spiralis</i>	—	—	—	—	—	—	4
Total parasitic	1	—	2	1	1	2	14
Viral							
Astrovirus	—	—	—	—	—	—	—
Hepatitis A	13	4	16	1	—	3	25
Norovirus	129	30	202	40	7	28	312
Rotavirus	—	—	—	—	—	—	—
Total viral	142	34	218	41	7	31	337
Multiple etiologies	2	1	7	6	2	4	14
Confirmed etiology	239	55	349	191	52	100	1,012
Unknown etiology	526	132	251	477	122	191	1,365
Total 1998–2002	765	187	600	668	174	291	2,377

* More than one contributing factor might be reported per outbreak.

† See Appendix A for description of each factor.

TABLE 19. (Continued) Number of reported foodborne-disease outbreaks, by etiology and contributing factors*† — United States, 1998–2002

Etiology	Proliferation factors							
	P1	P2	P3	P4	P5	P6	P7	P8
Bacterial								
<i>Bacillus cereus</i>	16	1	4	4	—	3	—	—
<i>Brucella</i>	—	—	—	—	—	—	—	—
<i>Campylobacter</i>	6	1	4	—	—	1	—	—
<i>Clostridium botulinum</i>	7	—	—	1	—	—	3	—
<i>Clostridium perfringens</i>	53	50	20	27	—	39	—	—
<i>Escherichia coli</i>	12	2	7	3	—	6	—	—
<i>Listeria monocytogenes</i>	—	—	1	—	—	—	—	—
<i>Salmonella</i>	110	26	53	33	3	28	—	1
<i>Shigella</i>	3	1	5	1	—	—	—	—
<i>Staphylococcus aureus</i>	42	17	13	17	1	15	—	1
<i>Streptococcus</i>	—	—	—	—	—	1	—	—
<i>Vibrio cholerae</i>	—	—	—	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	5	—	—	2	—	—	—	—
<i>Vibrio</i> , other	—	—	—	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	—	—	—	—	—
Other bacterial	1	—	—	—	—	—	—	—
Total bacterial	255	98	107	88	4	93	3	2
Chemical								
Ciguatoxin	—	—	—	—	—	—	—	—
Heavy metals	—	—	—	—	—	—	—	—
Mushroom toxin	—	—	—	—	—	—	—	—
Scombrototoxin	21	—	18	1	—	—	—	—
Shellfish toxin	—	—	—	—	—	—	—	—
Other chemical	—	—	—	—	—	—	—	—
Total chemical	21	—	18	1	—	—	—	—
Parasitic								
<i>Anisakis</i>	—	—	—	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	—	—	—
<i>Giardia intestinalis</i>	—	—	—	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	—	—	—	—	—
Total parasitic	—	—	—	—	—	—	—	—
Viral								
Astrovirus	—	—	—	—	—	—	—	—
Hepatitis A	—	—	—	—	—	—	—	—
Norovirus	17	4	8	3	—	6	1	—
Rotavirus	—	—	—	—	—	—	—	—
Total viral	17	4	8	3	—	6	1	—
Multiple etiologies	9	4	3	2	—	3	—	—
Confirmed etiology	296	102	136	93	4	100	4	2
Unknown etiology	589	224	432	159	15	219	1	—
Total 1998–2002	894	330	571	254	19	322	5	2

* More than one contributing factor might be reported per outbreak.

† See Appendix A for description of each factor.

TABLE 19. (Continued) Number of reported foodborne-disease outbreaks, by etiology and contributing factors*† — United States, 1998–2002

Etiology	Proliferation factors				Outbreaks in which proliferation factor reported
	P9	P10	P11	P12	
Bacterial					
<i>Bacillus cereus</i>	—	—	—	—	21
<i>Brucella</i>	—	—	—	1	1
<i>Campylobacter</i>	—	—	1	4	14
<i>Clostridium botulinum</i>	—	1	—	1	11
<i>Clostridium perfringens</i>	4	—	—	5	103
<i>Escherichia coli</i>	—	—	—	3	24
<i>Listeria monocytogenes</i>	—	1	—	—	2
<i>Salmonella</i>	4	—	—	25	186
<i>Shigella</i>	—	—	—	3	10
<i>Staphylococcus aureus</i>	3	—	—	1	63
<i>Streptococcus</i>	—	—	—	—	1
<i>Vibrio cholerae</i>	—	—	—	—	—
<i>Vibrio parahaemolyticus</i>	—	—	—	—	6
<i>Vibrio</i> , other	—	—	—	—	—
<i>Yersinia enterocolitica</i>	—	—	—	1	1
Other bacterial	—	—	—	—	1
Total bacterial	11	2	1	44	444
Chemical					
Ciguatoxin	—	—	—	—	—
Heavy metals	—	—	—	—	—
Mushroom toxin	—	—	—	—	—
Scombrototoxin	—	—	—	3	31
Shellfish toxin	—	—	—	—	—
Other chemical	—	—	—	—	—
Total chemical	—	—	—	3	31
Parasitic					
<i>Anisakis</i>	—	—	—	—	—
<i>Cryptosporidium parvum</i>	—	—	—	—	—
<i>Cyclospora cayetanensis</i>	—	—	—	—	—
<i>Giardia intestinalis</i>	—	—	—	—	—
<i>Trichinella spiralis</i>	—	—	—	—	—
Total parasitic	—	—	—	—	—
Viral					
Astrovirus	—	—	—	—	—
Hepatitis A	—	—	—	1	1
Norovirus	—	—	—	1	28
Rotavirus	—	—	—	—	—
Total viral	—	—	—	2	29
Multiple etiologies	1	—	—	—	13
Confirmed etiology	11	2	1	50	511
Unknown etiology	41	—	4	40	1,133
Total 1998–2002	53	2	5	90	1,657

* More than one contributing factor might be reported per outbreak.

† See Appendix A for description of each factor.


TABLE 19. (Continued) Number of reported foodborne-disease outbreaks by etiology, and contributing factors*† — United States, 1998–2002

Etiology	Survival factors					Outbreaks in which survival factor reported	Outbreaks in which any contributing factor reported	Total
	S1	S2	S3	S4	S5			
Bacterial								
<i>Bacillus cereus</i>	—	3	—	—	1	4	24	37
<i>Brucella</i>	—	—	—	—	1	1	1	1
<i>Campylobacter</i>	15	—	—	1	6	21	39	61
<i>Clostridium botulinum</i>	5	1	2	—	4	10	12	12
<i>Clostridium perfringens</i>	33	41	—	5	4	61	102	130
<i>Escherichia coli</i>	20	2	—	3	4	27	68	140
<i>Listeria monocytogenes</i>	1	—	—	—	—	1	6	11
<i>Salmonella</i>	104	23	1	5	21	139	326	585
<i>Shigella</i>	—	—	—	—	4	4	27	67
<i>Staphylococcus aureus</i>	8	14	—	2	8	28	73	101
<i>Streptococcus</i>	—	—	—	—	—	—	1	1
<i>Vibrio cholerae</i>	—	—	—	—	—	—	2	3
<i>Vibrio parahaemolyticus</i>	3	—	—	—	1	4	15	25
<i>Vibrio</i> , other	—	—	—	—	—	—	—	1
<i>Yersinia enterocolitica</i>	—	—	—	—	1	1	4	8
Other bacterial	—	—	—	—	—	—	1	1
Total bacterial	189	84	3	16	55	301	695	1,184
Chemical								
Ciguatoxin	—	—	—	—	—	—	58	84
Heavy metals	—	—	—	—	—	—	2	2
Mushroom toxin	—	—	—	—	—	—	1	2
Scombrototoxin	1	—	—	—	3	4	74	118
Shellfish toxin	—	—	—	—	—	—	4	5
Other chemical	—	—	—	—	—	—	6	10
Total chemical	1	—	—	—	3	4	145	221
Parasitic								
<i>Anisakis</i>	—	—	—	—	—	—	1	1
<i>Cryptosporidium parvum</i>	—	—	—	—	—	—	1	4
<i>Cyclospora cayetanensis</i>	—	—	—	—	—	—	6	9
<i>Giardia intestinalis</i>	—	—	—	—	—	—	2	3
<i>Trichinella spiralis</i>	3	—	—	—	—	3	5	6
Total parasitic	3	—	—	—	—	3	15	23
Viral								
Astrovirus	—	—	—	—	—	—	—	1
Hepatitis A	—	—	—	—	—	—	25	50
Norovirus	5	4	—	—	10	18	319	657
Rotavirus	—	—	—	—	—	—	—	1
Total viral	5	4	—	—	10	18	344	709
Multiple etiologies	4	1	—	1	1	6	20	30
Confirmed etiology	198	88	3	16	69	327	1,238	2,167
Unknown etiology	171	161	2	16	74	369	1,834	4,480
Total 1998–2002	373	250	5	33	144	702	3,072	6,647

* More than one contributing factor might be reported per outbreak.

† See Appendix A for description of each factor.

APPENDIX A. CDC form 52.13 Investigation of a Foodborne Outbreak*

 Electronic Foodborne Outbreak Reporting System	Investigation of a Foodborne Outbreak This form is used to report foodborne disease outbreak investigations to CDC. A foodborne outbreak is defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food in the United States. This form has two parts: Part 1 asks for the minimum data needed and Part 2 asks for additional information. For this investigation to be counted in the CDC annual summary, Part 1 must be completed. We encourage you to complete as much as possible of Part 1 and Part 2 as you can.			CDC Use Only
				State Use Only
Part 1: Required Information				
1. Location of Exposure State: _____ Multi-state exposure Other State: _____ Country: _____ Multi-county exposure Other Countries: _____		2. Dates: Date first case became ill: _____ / _____ / _____ Month Day Year Date of first known exposure: _____ / _____ / _____ Month Day Year Date of last known exposure: _____ / _____ / _____ Month Day Year		3. Numbers of Cases Exposed: Lab-confirmed cases: _____ (A) Probable cases: _____ (B) Estimated total ill: _____ (if greater than sum of A+B)
4. Approximate Percentage of Total Cases in Each Age Group: <1 year _____% 20-49 yrs _____% 1-4 yrs _____% >50 yrs _____% 5-19 yrs _____%		5. Sex: (Estimated percent of total cases) Male: _____% Female: _____%	6. Investigation Methods: (Check all that apply) Interviews of cases only Investigation at factory or production plant Case-Control study Investigation at original source Cohort Study (farm, marine estuary, etc) Food preparation review Environment / food sample cultures Food product traceback	
7. Implicated Food(s): (Please provide known information.)				
Name of Food	Main Ingredients	Contaminated Ingredient(s)	Reason(s) Suspected (see below)	Method of Preparation (see list on page 2)
<i>e.g. lasagna</i>	<i>pasta, sauce, eggs, beef</i>	<i>eggs</i>	<i>4</i>	<i>M1</i>
1.)				
2.)				
3.)				
Food vehicle could not be determined				
Reason Suspected (Choose all that apply): 1 <input type="checkbox"/> Statistical evidence from epidemiological investigation 2 <input type="checkbox"/> Laboratory evidence (e.g., identification of agent in food) 3 <input type="checkbox"/> Compelling supportive information 4 <input type="checkbox"/> Other data (e.g., same phage type found on farm that supplied eggs) 5 <input type="checkbox"/> Specific evidence lacking but prior experience makes it likely source				
8. Etiology: (Name the bacteria, virus, parasite, or toxin. If available, include serotype and other characteristics such as phage type, virulence factors, molecular fingerprinting, antibiogram, metabolic profile.) Confirmation criteria available at http://www.cdc.gov/ncidod/dbmd/outbreak/ or MMWR2000/Vol 49/SS-1/Appendix B				
Etiology		Serotype (if available)	Other characteristics (if available)	
1.)	Confirmed Suspected			
2.)	Confirmed Suspected			
3.)	Confirmed Suspected			
Etiology undetermined				
Isolated / Identified from: (Check all that apply:)				
		Patient specimen(s) Food specimen(s)	Environment specimen(s) Food Worker specimen(s)	
<small>This questionnaire is authorized by law (Public Health Act, 42 USC §241). Although response to the questions asked is voluntary, cooperation of the patient is necessary to the study and control of disease. Public reporting burden for this collection of information is estimated to average 15 minutes per response. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to PHS Reports Clearance Officer, Rm 721-H, Humphrey Bg, 20 Independence Ave, SW, Washington, DC 20201; ATTN: PRA, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.</small>				

* This form is used to collect data for this report. Foodborne outbreak reporting is conducted through a web application. A revised form that reflects recent upgrades to this web application became effective November, 2005. Additional information is available at <http://www.cdc.gov/foodborneoutbreaks> or CDC's Enteric Diseases Epidemiology Branch (proposed), telephone 404-639-2206.

<p>9. Contributing Factors**: (See list on page 3, check all that apply)</p> <p>Contributing factors unknown _____</p> <p>Contamination Factor:</p> <p>C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 (describe in Comments) N/A</p> <p>Proliferation/Amplification Factor (bacterial outbreaks only):</p> <p>P1 P2 P3 P4 P5 P6 P7 P8 P9 P10 P11 P12 (describe in Comments) N/A</p> <p>Survival Factor (microbial outbreaks only):</p> <p>S1 S2 S3 S4 S5 (describe in Comments) N/A</p> <p>Was food-worker implicated as the source of contamination? Yes No If yes, please check only one of following: laboratory and epidemiologic evidence epidemiologic evidence (w/o lab confirmation) lab evidence (w/o epidemiologic evidence) prior experience makes this the likely source (please explain in Comments)</p>	<p>10. Agency reporting this outbreak:</p> <p>_____</p> <p>Contact Person:</p> <p>NAME: _____ TITLE: _____ PHONE NO: _____ FAX NO: _____ E-MAIL: _____</p> <p>Date of completion of this form:</p> <p>____/____/____ Month Day Year</p> <p>Initial Report Updated Report Final Report Additional data suggests this is not a foodborne outbreak</p>
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Part 2: Additional Information (Please complete as much as possible)

<p>11. Numbers of:</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:30%;">OUTCOME/SYMPTOM</th> <th style="width:30%;">Cases with Outcome / Symptom</th> <th style="width:40%;">Total cases for whom you have information available</th> </tr> </thead> <tbody> <tr><td>Healthcare Provider Visit</td><td></td><td></td></tr> <tr><td>Hospitalization</td><td></td><td></td></tr> <tr><td>Death</td><td></td><td></td></tr> <tr><td>Vomiting</td><td></td><td></td></tr> <tr><td>Diarrhea</td><td></td><td></td></tr> <tr><td>Bloody Stools</td><td></td><td></td></tr> <tr><td>Fever</td><td></td><td></td></tr> <tr><td>Abdominal Cramps</td><td></td><td></td></tr> <tr><td> </td><td></td><td></td></tr> <tr><td> </td><td></td><td></td></tr> <tr><td> </td><td></td><td></td></tr> <tr><td> </td><td></td><td></td></tr> </tbody> </table>	OUTCOME/SYMPTOM	Cases with Outcome / Symptom	Total cases for whom you have information available	Healthcare Provider Visit			Hospitalization			Death			Vomiting			Diarrhea			Bloody Stools			Fever			Abdominal Cramps															<p>12. Incubation Period:</p> <p>(circle appropriate units)</p> <p>Shortest: _____ (Hours, days) Longest: _____ (Hours, days) Median: _____ (Hours, days)</p> <p>Unknown _____</p>	<p>13. Duration of Acute Illness Among Those Who Recovered:</p> <p>(circle appropriate units)</p> <p>Shortest: _____ (Hours, days) Longest: _____ (Hours, days) Median: _____ (Hours, days)</p> <p>Unknown _____</p>
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<p>Use the following terms, if appropriate, to describe other common characteristics of cases:</p> <table style="width:100%; border: none;"> <tr> <td style="width:33%; vertical-align: top;"> anaphylaxis arthralgia bradycardia bullous skin lesions cough coma descending paralysis </td> <td style="width:33%; vertical-align: top;"> diplopia flushing headache hemolytic uremic syndrome (HUS) hypotension itching jaundice lethargy </td> <td style="width:33%; vertical-align: top;"> myalgia paresthesia septicemia sore throat tachycardia thrombocytopenia temperature reversal urticaria wheezing </td> </tr> </table>			anaphylaxis arthralgia bradycardia bullous skin lesions cough coma descending paralysis	diplopia flushing headache hemolytic uremic syndrome (HUS) hypotension itching jaundice lethargy	myalgia paresthesia septicemia sore throat tachycardia thrombocytopenia temperature reversal urticaria wheezing																																				
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14. If Cohort Investigation Conducted:
 Event-specific Attack Rate = $\frac{\text{# ill total}}{\text{# of persons for whom you have illness info.}} \times 100 = \text{_____} \%$

<p>15. Where was Food Prepared? (Check all that apply)</p> <table style="width:100%; border: none;"> <tr> <td style="width:50%;"> Restaurant or deli Day care center School Church, temple, etc Camp Caterer Grocery Store Hospital Workplace cafeteria </td> <td style="width:50%;"> Nursing home Prison, jail Private home Picnic Fair, festival, other temporary/ mobile services Contaminated food imported into U.S. Commercial product, served without further preparation Other (please describe) _____ </td> </tr> </table>	Restaurant or deli Day care center School Church, temple, etc Camp Caterer Grocery Store Hospital Workplace cafeteria	Nursing home Prison, jail Private home Picnic Fair, festival, other temporary/ mobile services Contaminated food imported into U.S. Commercial product, served without further preparation Other (please describe) _____	<p>16. Where was Food Eaten? (Check all that apply)</p> <table style="width:100%; border: none;"> <tr> <td style="width:50%;"> Restaurant or deli Day care center School Church, temple, etc. Camp Grocery Store Hospital Workplace cafeteria </td> <td style="width:50%;"> Nursing Home Prison, jail Private home Picnic Fair, festival, temporary/ mobile service Other (please describe) _____ </td> </tr> </table>	Restaurant or deli Day care center School Church, temple, etc. Camp Grocery Store Hospital Workplace cafeteria	Nursing Home Prison, jail Private home Picnic Fair, festival, temporary/ mobile service Other (please describe) _____
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<p>17. Other Available Info:</p> <p>Unpublished agency report (please attach) _____</p> <p>Epi-Aid _____</p> <p>Publication (please reference) _____</p> <p>Not available _____</p>	<p>18. Remarks: Briefly describe important aspects of the outbreak not covered above (e.g., restaurant closure, product recall, immunoglobulin administration, economic impact, etc)</p> <p>_____</p> <p>_____</p> <p>_____</p>
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State Health Departments: If you have not entered this information into EFORS (Electronic Foodborne Outbreak Reporting System), please send this document to the Foodborne and Diarrheal Disease Branch, Centers for Disease Control and Prevention, 1600 Clifton Road Mailstop A-38, Atlanta, GA 30333, Phone: 404-639-2206, Fax: 404-639-2205

****Contributing factor definitions:****Contamination Factors:**

- C1 - Toxic substance part of tissue (e.g., ciguatera)
- C2 - Poisonous substance intentionally added (e.g., cyanide or phenolphthalein added to cause illness)
- C3 - Poisonous or physical substance accidentally/incidentally added (e.g., sanitizer or cleaning compound)
- C4 - Addition of excessive quantities of ingredients that are toxic under these situations (e.g., niacin poisoning in bread)
- C5 - Toxic container or pipelines (e.g., galvanized containers with acid food, copper pipe with carbonated beverages)
- C6 - Raw product/ingredient contaminated by pathogens from animal or environment (e.g., *Salmonella enteritidis* in egg, Norwalk in shellfish, *E. coli* in sprouts)
- C7 - Ingestion of contaminated raw products (e.g., raw shellfish, produce, eggs)
- C8 - Obtaining foods from polluted sources (e.g., shellfish)
- C9 - Cross-contamination from raw ingredient of animal origin (e.g., raw poultry on the cutting board)
- C10 - Bare-handed contact by handler/worker/preparer (e.g., with ready-to-eat food)
- C11 - Glove-handed contact by handler/worker/preparer (e.g., with ready-to-eat food)
- C12 - Handling by an infected person or carrier of pathogen (e.g., *Staphylococcus* spp., *Salmonella* spp., Norwalk agent)
- C13 - Inadequate cleaning of processing/preparation equipment/utensils – leads to contamination of vehicle (e.g., cutting boards)
- C14 - Storage in contaminated environment – leads to contamination of vehicle (e.g., store room, refrigerator)
- C15 - Other source of contamination (*please describe in Comments*)

Proliferation Factors:

- P1 - Allowing foods to remain at room or warm outdoor temperature for several hours (e.g., during preparation or holding for service)
- P2 - Slow cooling (e.g., deep containers or large roasts)
- P3 - Inadequate cold-holding temperatures (e.g., refrigerator inadequate/not working, iced holding inadequate)
- P4 - Preparing foods a half day or more before serving (e.g., banquet preparation a day in advance)
- P5 - Prolonged cold storage for several weeks (e.g., permits slow growth of psychrophilic pathogens)
- P6 - Insufficient time and/or temperature during hot holding (e.g., malfunctioning equipment, too large a mass of food)
- P7 - Insufficient acidification (e.g., home canned foods)
- P8 - Insufficiently low water activity (e.g., smoked/salted fish)
- P9 - Inadequate thawing of frozen products (e.g., room thawing)
- P10 - Anaerobic packaging/Modified atmosphere (e.g., vacuum packed fish, salad in gas flushed bag)
- P11 - Inadequate fermentation (e.g., processed meat, cheese)
- P12 - Other situations that promote or allow microbial growth or toxic production (*please describe in Comments*)

Survival Factors:

- S1 - Insufficient time and/or temperature during initial cooking/heat processing (e.g., roasted meats/poultry, canned foods, pasteurization)
- S2 - Insufficient time and/or temperature during reheating (e.g., sauces, roasts)
- S3 - Inadequate acidification (e.g., mayonnaise, tomatoes canned)
- S4 - Insufficient thawing, followed by insufficient cooking (e.g., frozen turkey)
- S5 - Other process failures that permit the agent to survive (*please describe in Comments*)

APPENDIX B.

Guidelines for Confirmation of Foodborne-Disease Outbreaks

A foodborne disease outbreak (FBDO) is defined as an incident in which two or more persons experience a similar illness resulting from the ingestion of a common food.* The following table provides information about incubation periods, clinical syndromes, and criteria for confirming the etiology once an FBDO has been identified. The information on incubation periods and clinical syndromes is provided as a guideline and should not be included in the confirmation criteria. These guidelines might not include all etiologic agents and diagnostic tests.

FBDOs should be reported to the Foodborne and Diarrheal Diseases Branch at CDC through the Electronic

Foodborne Outbreak Reporting System (eFORS) using the web-based Form 52.13, Investigation of a Foodborne Outbreak, which was updated in October 1999. Provision of other documents describing the outbreak investigation also is encouraged. For information about collecting laboratory specimens and for additional information on viral agents, refer to other CDC publications (i.e., Recommendations for collection of laboratory specimens associated with outbreaks of gastroenteritis. MMWR 1990;39[No. RR-14] and Viral agents of gastroenteritis: public health importance and outbreak management. MMWR 1990;39[No. RR-5]).

* Before 1992, three exceptions existed to this definition; only one case of botulism, marine-toxin intoxication, or chemical intoxication was required to constitute an FBDO if the etiology was confirmed. The definition was changed in 1992 to require two or more cases to constitute an outbreak.

TABLE. Guidelines for confirmation of foodborne-disease outbreaks

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Bacterial			
1. <i>Bacillus cereus</i>			
a. Vomiting toxin	1–6 hrs	Vomiting; some patients with diarrhea; fever uncommon	Isolation of organism from stool of two or more ill persons and not from stool of control patients OR Isolation of 10 ⁵ organisms/g from epidemiologically implicated food, provided specimen is properly handled
b. Diarrheal toxin	6–24 hrs	Diarrhea, abdominal cramps, and vomiting in some patients; fever uncommon	Isolation of organism from stool of two or more ill persons and not from stool of control patients OR Isolation of 10 ⁵ organisms/g from epidemiologically implicated food, provided specimen is properly handled
2. <i>Brucella</i>	Several days to several months; usually >30 days	Weakness, fever, headache, sweats, chills, arthralgia, weight loss, and splenomegaly	Two or more ill persons and isolation of organism in culture of blood or bone marrow; greater than fourfold increase in standard agglutination titer (SAT) over several weeks, or single SAT 1:160 in person who has compatible clinical symptoms and history of exposure
3. <i>Campylobacter jejuni/coli</i>	2–10 days; usually 2–5 days	Diarrhea (often bloody), abdominal pain, and fever	Isolation of organism from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food

TABLE. (Continued) Guidelines for confirmation of foodborne-disease outbreaks

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Bacterial			
4. <i>Clostridium botulinum</i>	2 hours–8 days; usually 12–48 hrs	Illness of variable severity; common symptoms are diplopia, blurred vision, and bulbar weakness; paralysis, which is usually descending and bilateral, might progress rapidly	Detection of botulinum toxin in serum, stool, gastric contents, or implicated food OR Isolation of organism from stool or intestine
5. <i>Clostridium perfringens</i>	6–24 hrs	Diarrhea and abdominal cramps; vomiting and fever uncommon	Isolation of 10 ⁶ organisms/g from stool of two or more ill persons, provided specimen is properly handled OR Demonstration of enterotoxin in the stool of two or more ill persons OR Isolation of 10 ⁵ organisms/g from epidemiologically implicated food, provided specimen is properly handled
6. <i>Escherichia coli</i>			
a. Enterohemorrhagic (<i>E. coli</i> O157:H7 and others)	1–10 days; usually 3–4 days	Diarrhea (often bloody), abdominal cramps (often severe), and little or no fever	Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> from clinical specimen from two or more ill persons OR Isolation of <i>E. coli</i> O157:H7 or other Shiga-like toxin-producing <i>E. coli</i> from epidemiologically implicated food
b. Enterotoxigenic (ETEC)	6–48 hours	Diarrhea, abdominal cramps, and nausea; vomiting and fever less common	Isolation of organism of same serotype, demonstrated to produce heat-stable (ST) and/or heat-labile (LT) enterotoxin, from stool of two or more ill persons
c. Enteropathogenic (EPEC)	Variable	Diarrhea, fever, and abdominal cramps	Isolation of organism of same enteropathogenic serotype from stool of two or more ill persons
d. Enteroinvasive (EIEC)	Variable	Diarrhea (might be bloody), fever, and abdominal cramps	Isolation of same enteroinvasive serotype from stool of two or more ill persons
7. <i>Listeria monocytogenes</i>			
a. Invasive disease	2–6 weeks	Meningitis, neonatal sepsis, and fever	Isolation of organism from normally sterile site
b. Diarrheal disease	Unknown	Diarrhea, abdominal cramps, and fever	Isolation of organism of same serotype from stool of two or more ill persons exposed to food that is epidemiologically implicated or from which organism of same serotype has been isolated
8. Nontyphoidal <i>Salmonella</i>	6 hrs–10 days; usually 6–48 hours	Diarrhea, often with fever and abdominal cramps	Isolation of organism of same serotype from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food
9. <i>Salmonella</i> Typhi	3–60 days; usually 7–14 days	Fever, anorexia, malaise, headache, and myalgia; sometimes diarrhea or constipation	Isolation of organism from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food

TABLE. (Continued) Guidelines for confirmation of foodborne-disease outbreaks

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Bacterial			
10. <i>Shigella</i> spp.	12 hours–6 days; usually 2–4 days	Diarrhea (often bloody), often accompanied by fever and abdominal cramps	Isolation of organism of same serotype from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food
11. <i>Staphylococcus aureus</i>	30 minutes–8 hours; usually 2–4 hours	Vomiting and diarrhea	Isolation of organism of same phage type from stool or vomitus of two or more ill persons OR Detection of enterotoxin in epidemiologically implicated food OR Isolation of 10 ⁵ organisms/g from epidemiologically implicated food, provided specimen is properly handled
12. <i>Streptococcus</i> , group A	1–4 days	Fever, pharyngitis, scarlet fever, and upper-respiratory infection	Isolation of organism of same M- or T-type from throats of two or more ill persons OR Isolation of organism of same M- or T-type from epidemiologically implicated food
13. <i>Vibrio cholerae</i> a. O1 or O139	1–5 days	Watery diarrhea, often accompanied by vomiting	Isolation of toxigenic organism from stool or vomitus of two or more ill persons OR Significant rise in vibriocidal, bacterial-agglutinating, or antitoxin antibodies in acute- and early convalescent-phase sera among persons not recently vaccinated OR Isolation of toxigenic organism from epidemiologically implicated food
b. non-O1 and non-O139	1–5 days	Watery diarrhea	Isolation of organism of same serotype from stool of two or more ill persons
14. <i>Vibrio parahaemolyticus</i>	4–30 hours	Diarrhea	Isolation of Kanagawa-positive organism from stool of two or more ill persons OR Isolation of 10 ⁵ Kanagawa-positive organisms/g from epidemiologically implicated food, provided specimen is properly handled
15. <i>Yersinia enterocolitica</i>	1–10 days; usually 4–6 days	Diarrhea and abdominal pain (often severe)	Isolation of organism from clinical specimen from two or more ill persons OR Isolation of pathogenic strain of organism from epidemiologically implicated food

TABLE. (Continued) Guidelines for confirmation of foodborne-disease outbreaks

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Chemical			
1. Marine toxins			
a. Ciguatoxin	1–48 hours; usually 2–8 hours	Usually gastrointestinal symptoms, followed by neurologic symptoms (including paresthesia of lips, tongue, throat, or extremities) and reversal of hot and cold sensation	Demonstration of ciguatoxin in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten a type of fish previously associated with ciguatera fish poisoning (e.g., snapper, grouper, or barracuda)
b. Scombroid toxin (histamine)	1 minute–3 hours; usually <1 hour	Flushing, dizziness, burning of mouth and throat, headache, gastrointestinal symptoms, urticaria, and generalized pruritis	Demonstration of histamine in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten a type of fish previously associated with histamine fish poisoning (e.g., mahi-mahi or fish of order Scomboidei)
c. Paralytic or neurotoxic shellfish poison	30 minutes–3 hours	Paresthesia of lips, mouth or face, and extremities; intestinal symptoms or weakness, including respiratory difficulty	Detection of toxin in epidemiologically implicated food OR Detection of large numbers of shellfish-poisoning-associated species of dinoflagellates in water from which epidemiologically implicated mollusks are gathered
d. Puffer fish, tetrodotoxin	10 minutes–3 hours; usually 10–45 minutes	Paresthesia of lips, tongue, face, or extremities, often following numbness; loss of proprioception or floating sensations	Demonstration of tetrodotoxin in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten puffer fish
2. Heavy metals	5 minutes–8 hours; usually <1 hour	Vomiting, often metallic taste	Demonstration of high concentration of metal in epidemiologically implicated food
<ul style="list-style-type: none"> • Antimony • Cadmium • Copper • Iron • Tin • Zinc 			
3. Monosodium glutamate (MSG)	3 minutes–2 hours; usually <1 hour	Burning sensation in chest, neck, abdomen, or extremities; sensation of lightness and pressure over face or heavy feeling in chest	Clinical syndrome among persons who have eaten food containing MSG (e.g., usually 1.5 g MSG)
4. Mushroom toxins	2 hours	Usually vomiting and diarrhea; other symptoms differ with toxin	Clinical syndrome among persons who have eaten mushrooms identified as toxic type OR Demonstration of toxin in epidemiologically implicated mushrooms or food containing mushrooms
a. Shorter-acting toxins		<ul style="list-style-type: none"> • Muscimol • Muscarine • Psilocybin • <i>Coprinus artrementaris</i> • Ibotenic acid 	
b. Longer-acting toxins (e.g., <i>Amanita</i> spp.)	6–24 hours	Diarrhea and abdominal cramps for 24 hours, followed by hepatic and renal failure	Clinical syndrome among persons who have eaten mushrooms identified as toxic type OR Demonstration of toxin in epidemiologically implicated mushrooms or food containing mushrooms

TABLE. (Continued) Guidelines for confirmation of foodborne-disease outbreaks

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Parasitic			
1. <i>Cryptosporidium</i> spp.	2–28 days; median: 7 days	Diarrhea, nausea, vomiting, and fever	Demonstration of oocysts in stool or in small-bowel biopsy of two or more ill persons
2. <i>Cyclospora cayetanensis</i>	1–14 days; median: 7 days	Diarrhea, nausea, anorexia, weight loss, cramps, gas, fatigue, and low-grade fever; might be relapsing or protracted	Demonstration of the parasite by microscopy or molecular methods in stool or in intestinal aspirates or biopsy specimens from two or more ill persons OR Demonstration of the parasite in epidemiologically implicated food
3. <i>Giardia intestinalis</i>	3–25 days; median: 7 days	Diarrhea, gas, cramps, nausea, and fatigue	Demonstration of the parasite in stool or small-bowel biopsy specimen of two or more ill persons
4. <i>Trichinella</i> spp.	1–2 days for intestinal phase; 2–4 weeks for systemic phase	Fever, myalgia, periorbital edema, and high eosinophil count	Two or more ill persons and positive serologic test or demonstration of larvae in muscle biopsy
Viral			
1. Hepatitis A	15–50 days; median: 28 days	Jaundice, dark urine, fatigue, anorexia, and nausea	Detection of immunoglobulin M antibody to hepatitis A virus (IgM anti-HAV) in serum from two or more persons who consumed epidemiologically implicated food
2. Norovirus (NoV)	12–48 hours (median: 33 hours)	Diarrhea, vomiting, nausea, abdominal cramps, and low-grade fever	Detection of viral RNA in at least two bulk stool or vomitus specimens by real-time or conventional reverse transcriptase-polymerase chain reaction (RT-PCR) OR Visualization of viruses (NoV) with characteristic morphology by electron microscopy in at least two or more bulk stool or vomitus specimens OR Two or more stools positive by commercial enzyme immunoassay (EIA)
3. Astrovirus	12–48 hours	Diarrhea, vomiting, nausea, abdominal cramps, and low-grade fever	Detection of viral RNA in at least two bulk stool or vomitus specimens by real-time or conventional RT-PCR OR NoV with characteristic morphology by electron microscopy in at least two or more bulk stool or vomitus specimens OR Two or more stools positive by commercial EIA

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