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.


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.
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
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 presented 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, by etiology and 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). Scombrotxin (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 outbreak numbers 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.

References


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

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Outbreaks</th>
<th>%</th>
<th>Cases</th>
<th>%</th>
<th>Deaths</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacterial</strong>&lt;sup&gt;*&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacillus cereus</td>
<td>37 (0.6)</td>
<td></td>
<td>571 (0.4)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Brucella</td>
<td>1 (0.0)</td>
<td></td>
<td>4 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Campylobacter</td>
<td>61 (0.9)</td>
<td></td>
<td>1,440 (1.1)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Clostridium botulinum</td>
<td>12 (0.2)</td>
<td></td>
<td>52 (0.0)</td>
<td></td>
<td>1 (1.1)</td>
<td></td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>130 (2.0)</td>
<td></td>
<td>6,724 (5.2)</td>
<td></td>
<td>4 (4.5)</td>
<td></td>
</tr>
<tr>
<td>Escherichia coli&lt;sup&gt;‡&lt;/sup&gt;</td>
<td>140 (2.1)</td>
<td></td>
<td>4,854 (3.8)</td>
<td></td>
<td>4 (4.5)</td>
<td></td>
</tr>
<tr>
<td>Listeria monocytogenes</td>
<td>11 (0.2)</td>
<td></td>
<td>256 (0.2)</td>
<td></td>
<td>38 (43.2)</td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td>585 (8.8)</td>
<td></td>
<td>16,821 (13.1)</td>
<td></td>
<td>20 (22.7)</td>
<td></td>
</tr>
<tr>
<td>Shigella</td>
<td>67 (1.0)</td>
<td></td>
<td>3,677 (2.9)</td>
<td></td>
<td>1 (1.1)</td>
<td></td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>101 (1.5)</td>
<td></td>
<td>2,766 (2.2)</td>
<td></td>
<td>2 (2.3)</td>
<td></td>
</tr>
<tr>
<td>Streptococcus</td>
<td>1 (0.0)</td>
<td></td>
<td>4 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Vibrio cholerae†</td>
<td>3 (0.0)</td>
<td></td>
<td>12 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
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<tr>
<td>Vibrio parahemolyticus</td>
<td>25 (0.4)</td>
<td></td>
<td>613 (0.5)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
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<tr>
<td>Vibrio, other</td>
<td>1 (0.0)</td>
<td></td>
<td>2 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
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<tr>
<td>Yersinia enterocolitica</td>
<td>8 (0.1)</td>
<td></td>
<td>87 (0.1)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
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<tr>
<td>Other bacterial</td>
<td>1 (0.0)</td>
<td></td>
<td>4 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Total bacterial</strong></td>
<td><strong>1,184 (17.8)</strong></td>
<td></td>
<td><strong>37,887 (29.5)</strong></td>
<td></td>
<td><strong>70 (79.5)</strong></td>
<td></td>
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<tr>
<td><strong>Chemical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ciguatoxin</td>
<td>84 (1.3)</td>
<td></td>
<td>315 (0.2)</td>
<td></td>
<td>1 (1.1)</td>
<td></td>
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<tr>
<td>Heavy metals</td>
<td>2 (0.0)</td>
<td></td>
<td>23 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
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<tr>
<td>Mushroom toxin</td>
<td>2 (0.0)</td>
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<td>6 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
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<tr>
<td>Scombroidtoxin</td>
<td>118 (1.8)</td>
<td></td>
<td>463 (0.4)</td>
<td></td>
<td>0 (0.0)</td>
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<tr>
<td>Shellfish toxin</td>
<td>5 (0.1)</td>
<td></td>
<td>36 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
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<tr>
<td>Other chemical</td>
<td>10 (0.2)</td>
<td></td>
<td>297 (0.2)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Total chemical</strong></td>
<td><strong>221 (3.3)</strong></td>
<td></td>
<td><strong>1,140 (0.9)</strong></td>
<td></td>
<td><strong>1 (1.1)</strong></td>
<td></td>
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<tr>
<td><strong>Parasitic</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Anisakis</td>
<td>1 (0.0)</td>
<td></td>
<td>14 (0.0)</td>
<td></td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>4 (0.1)</td>
<td></td>
<td>139 (0.1)</td>
<td></td>
<td>0 (0.0)</td>
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<td>Cyclospora cayetanensis</td>
<td>9 (0.1)</td>
<td></td>
<td>325 (0.3)</td>
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<td>0 (0.0)</td>
<td></td>
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<tr>
<td>Giardia intestinalis</td>
<td>3 (0.0)</td>
<td></td>
<td>119 (0.1)</td>
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<td></td>
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<tr>
<td>Trichinella spiralis</td>
<td>6 (0.1)</td>
<td></td>
<td>33 (0.0)</td>
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<td>0 (0.0)</td>
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</tr>
<tr>
<td><strong>Total parasitic</strong></td>
<td><strong>23 (0.3)</strong></td>
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<td><strong>630 (0.5)</strong></td>
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<tr>
<td><strong>Viral</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Astrovirus</td>
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<td>14 (0.0)</td>
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<td>Hepatitis A</td>
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<td>Norovirus</td>
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<td>27,171 (21.2)</td>
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<td>Rotavirus</td>
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<td>108 (0.1)</td>
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<tr>
<td><strong>Total viral</strong></td>
<td><strong>709 (10.7)</strong></td>
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<td><strong>28,274 (22.0)</strong></td>
<td></td>
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<tr>
<td><strong>Multiple etiologies</strong></td>
<td>30 (0.5)</td>
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<td>1,050 (0.8)</td>
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<tr>
<td><strong>Confirmed etiology</strong></td>
<td>2,167 (32.6)</td>
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<td>68,981 (53.7)</td>
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<td>76 (86.4)</td>
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<tr>
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<td>59,389 (46.2)</td>
<td></td>
<td>12 (13.6)</td>
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</tr>
<tr>
<td><strong>Total 1998–2002</strong></td>
<td><strong>6,647 (100.0)</strong></td>
<td></td>
<td><strong>128,370 (100.0)</strong></td>
<td></td>
<td><strong>88 (100.0)</strong></td>
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</tr>
</tbody>
</table>

<sup>*</sup> Enterohemorrhagic (132 outbreaks), Enterotoxigenic (7), Enteroaggregative (1)

<sup>‡</sup> 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

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Outbreaks</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td><strong>Bacterial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacillus cereus</td>
<td>10 (0.8)</td>
<td>213 (0.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Brucella</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>12 (0.9)</td>
<td>483 (1.8)</td>
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</tr>
<tr>
<td>Clostridium botulinum</td>
<td>3 (0.2)</td>
<td>8 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>24 (1.8)</td>
<td>1,328 (4.9)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>32 (2.4)</td>
<td>1,613 (5.9)</td>
<td>0 (0.0)</td>
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<tr>
<td>Listeria monocytogenes</td>
<td>2 (0.2)</td>
<td>105 (0.4)</td>
<td>21 (65.6)</td>
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<tr>
<td>Salmonella</td>
<td>125 (9.5)</td>
<td>2,731 (10.0)</td>
<td>6 (18.8)</td>
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<tr>
<td>Shigella</td>
<td>17 (1.3)</td>
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<td>Staphylococcus aureus</td>
<td>15 (1.1)</td>
<td>615 (2.3)</td>
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<tr>
<td>Streptococcus</td>
<td>1 (0.1)</td>
<td>4 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio cholerae</td>
<td>1 (0.1)</td>
<td>6 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio parahemolyticus</td>
<td>13 (1.0)</td>
<td>532 (2.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio, other</td>
<td>1 (0.1)</td>
<td>2 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Yersinia enterocolitica</td>
<td>1 (0.1)</td>
<td>9 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Other bacterial</td>
<td>1 (0.1)</td>
<td>4 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total bacterial</strong></td>
<td>258 (19.6)</td>
<td>8,919 (32.7)</td>
<td>27 (84.4)</td>
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<tr>
<td><strong>Chemical</strong></td>
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</tr>
<tr>
<td>Ciguatoxin</td>
<td>16 (1.2)</td>
<td>73 (0.3)</td>
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<tr>
<td>Heavy metals</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Mushroom toxin</td>
<td>1 (0.1)</td>
<td>2 (0.0)</td>
<td>0 (0.0)</td>
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<td>Scombrotoxin</td>
<td>27 (2.1)</td>
<td>124 (0.5)</td>
<td>0 (0.0)</td>
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<tr>
<td>Shellfish toxin</td>
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<td>6 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
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<td>329 (1.2)</td>
<td>0 (0.0)</td>
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<tr>
<td><strong>Parasitic</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Anisakis</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>1 (0.1)</td>
<td>88 (0.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cyclospora cayetanensis</td>
<td>1 (0.1)</td>
<td>17 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Giardia intestinalis</td>
<td>1 (0.1)</td>
<td>3 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Trichinella spiralis</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total parasitic</strong></td>
<td>4 (0.3)</td>
<td>116 (0.4)</td>
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</tr>
<tr>
<td><strong>Viral</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Astrovirus</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>13 (1.0)</td>
<td>293 (1.1)</td>
<td>1 (3.1)</td>
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<tr>
<td>Norovirus</td>
<td>47 (3.6)</td>
<td>2,563 (9.4)</td>
<td>0 (0.0)</td>
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<tr>
<td>Rotavirus</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total viral</strong></td>
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<td>2,856 (10.5)</td>
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<td>0 (0.0)</td>
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<td>27,258 (100.0)</td>
<td>32 (100.0)</td>
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TABLE 3. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 1999

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Outbreaks</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td><strong>Bacterial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacillus cereus</td>
<td>7 (0.5)</td>
<td>194 (0.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Brucella</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Campylobacter</td>
<td>5 (0.4)</td>
<td>85 (0.3)</td>
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<td>Clostridium botulinum</td>
<td>1 (0.1)</td>
<td>3 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>22 (1.6)</td>
<td>1,166 (4.7)</td>
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</tr>
<tr>
<td>Escherichia coli</td>
<td>28 (2.1)</td>
<td>842 (3.4)</td>
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<tr>
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<td>5 (0.4)</td>
<td>28 (0.1)</td>
<td>2 (20.0)</td>
</tr>
<tr>
<td>Salmonella</td>
<td>111 (8.3)</td>
<td>3,463 (13.9)</td>
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<td>Shigella</td>
<td>14 (1.0)</td>
<td>221 (0.9)</td>
<td>0 (0.0)</td>
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<td>Staphylococcus aureus</td>
<td>19 (1.4)</td>
<td>353 (1.4)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Streptococcus</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio cholerae</td>
<td>1 (0.1)</td>
<td>2 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio parahemolyticus</td>
<td>3 (0.2)</td>
<td>14 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio, other</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Yersinia enterocolitica</td>
<td>1 (0.1)</td>
<td>32 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Other bacterial</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total bacterial</strong></td>
<td>217 (16.2)</td>
<td>6,403 (25.7)</td>
<td>5 (50.0)</td>
</tr>
<tr>
<td><strong>Chemical</strong></td>
<td></td>
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</tr>
<tr>
<td>Ciguatoxin</td>
<td>12 (0.9)</td>
<td>47 (0.2)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td>Heavy metals</td>
<td>1 (0.1)</td>
<td>2 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Mushroom toxin</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Scombrotxin</td>
<td>21 (1.6)</td>
<td>67 (0.3)</td>
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<tr>
<td>Shellfish toxin</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Other chemical</td>
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<td>2 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total chemical</strong></td>
<td>35 (2.6)</td>
<td>118 (0.5)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td><strong>Parasitic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anisakis</td>
<td>1 (0.1)</td>
<td>14 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cyclospora cayetanensis</td>
<td>2 (0.1)</td>
<td>153 (0.6)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Giardia intestinalis</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Trichinella spiralis</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total parasitic</strong></td>
<td>3 (0.2)</td>
<td>167 (0.7)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Viral</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astrovirus</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>12 (0.9)</td>
<td>387 (1.6)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Norovirus</td>
<td>98 (7.3)</td>
<td>4,745 (19.1)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total viral</strong></td>
<td>110 (8.2)</td>
<td>5,132 (20.6)</td>
<td>1 (10.0)</td>
</tr>
<tr>
<td><strong>Multiple etiologies</strong></td>
<td>5 (0.4)</td>
<td>267 (1.1)</td>
<td>0 (0.0)</td>
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<td>12,087 (48.6)</td>
<td>7 (70.0)</td>
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<tr>
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<tr>
<td><strong>Total 1999</strong></td>
<td>1,343 (100.0)</td>
<td>24,894 (100.0)</td>
<td>10 (100.0)</td>
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</table>
### TABLE 4. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 2000

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Outbreaks</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td><strong>Bacterial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bacillus cereus</em></td>
<td>8 (0.6)</td>
<td>61 (0.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Brucella</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Campylobacter</em></td>
<td>15 (1.1)</td>
<td>205 (0.8)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Clostridium botulinum</em></td>
<td>2 (0.1)</td>
<td>5 (0.0)</td>
<td>1 (4.8)</td>
</tr>
<tr>
<td><em>Clostridium perfringens</em></td>
<td>22 (1.6)</td>
<td>791 (3.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>32 (2.3)</td>
<td>1,392 (5.3)</td>
<td>2 (9.5)</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td>2 (0.1)</td>
<td>41 (0.2)</td>
<td>7 (33.3)</td>
</tr>
<tr>
<td><em>Salmonella</em></td>
<td>127 (9.0)</td>
<td>2,850 (10.9)</td>
<td>2 (9.5)</td>
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<tr>
<td><em>Shigella</em></td>
<td>12 (0.8)</td>
<td>866 (3.3)</td>
<td>1 (4.8)</td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>23 (1.6)</td>
<td>657 (2.5)</td>
<td>2 (9.5)</td>
</tr>
<tr>
<td><em>Streptococcus</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Vibrio cholerae</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Vibrio parahemolyticus</em></td>
<td>4 (0.3)</td>
<td>37 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Vibrio, other</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Yersinia enterocolitica</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Other bacterial</em></td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total bacterial</strong></td>
<td>247 (17.4)</td>
<td>6,905 (26.4)</td>
<td>15 (71.4)</td>
</tr>
<tr>
<td><strong>Chemical</strong></td>
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</tr>
<tr>
<td><em>Ciguatoxin</em></td>
<td>12 (0.8)</td>
<td>46 (0.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Heavy metals</em></td>
<td>1 (0.1)</td>
<td>21 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Mushroom toxin</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Scombrotxin</em></td>
<td>20 (1.4)</td>
<td>81 (0.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Shellfish toxin</em></td>
<td>3 (0.2)</td>
<td>9 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Other chemical</em></td>
<td>2 (0.1)</td>
<td>36 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total chemical</strong></td>
<td>38 (2.7)</td>
<td>193 (0.7)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Parasitic</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Anisakis</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Cryptosporidium parvum</em></td>
<td>1 (0.1)</td>
<td>8 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td><em>Cyclospora cayetanensis</em></td>
<td>2 (0.1)</td>
<td>73 (0.3)</td>
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<tr>
<td><em>Giardia intestinalis</em></td>
<td>1 (0.1)</td>
<td>82 (0.3)</td>
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<tr>
<td><em>Trichinella spiralis</em></td>
<td>2 (0.1)</td>
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<td>0 (0.0)</td>
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<td><strong>Total parasitic</strong></td>
<td>6 (0.4)</td>
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<tr>
<td><strong>Viral</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Astrovirus</em></td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><em>Hepatitis A</em></td>
<td>12 (0.8)</td>
<td>135 (0.5)</td>
<td>1 (4.8)</td>
</tr>
<tr>
<td><em>Norovirus</em></td>
<td>163 (11.5)</td>
<td>6,969 (26.7)</td>
<td>0 (0.0)</td>
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<td><em>Rotavirus</em></td>
<td>1 (0.1)</td>
<td>108 (0.4)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total viral</strong></td>
<td>176 (12.4)</td>
<td>7,212 (27.6)</td>
<td>1 (4.8)</td>
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<tr>
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<td><strong>Confirmed etiology</strong></td>
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<td>947 (66.8)</td>
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<td><strong>Total 2000</strong></td>
<td>1,417 (100.0)</td>
<td>26,122 (100.0)</td>
<td>21 (100.0)</td>
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### TABLE 5. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 2001

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<th>Etiology</th>
<th>Outbreaks</th>
<th>Cases</th>
<th>Deaths</th>
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<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
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<td></td>
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</tr>
<tr>
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<td>5 (0.4)</td>
<td>61 (0.2)</td>
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<tr>
<td>Brucella</td>
<td>1 (0.1)</td>
<td>4 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Campylobacter</td>
<td>16 (1.3)</td>
<td>317 (1.3)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Clostridium botulinum</td>
<td>3 (0.2)</td>
<td>22 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>31 (2.5)</td>
<td>1,232 (4.9)</td>
<td>3 (27.3)</td>
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<tr>
<td>Escherichia coli</td>
<td>22 (1.8)</td>
<td>521 (2.1)</td>
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<tr>
<td>Listeria monocytogenes</td>
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<td>28 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Salmonella</td>
<td>111 (8.9)</td>
<td>3,141 (12.5)</td>
<td>7 (63.6)</td>
</tr>
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<td>Shigella</td>
<td>15 (1.2)</td>
<td>1,006 (4.0)</td>
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<td>Staphylococcus aureus</td>
<td>23 (1.9)</td>
<td>646 (2.6)</td>
<td>0 (0.0)</td>
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<td>Streptococcus</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio cholerae</td>
<td>1 (0.1)</td>
<td>4 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Vibrio parahemolyticus</td>
<td>3 (0.2)</td>
<td>19 (0.1)</td>
<td>0 (0.0)</td>
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<tr>
<td>Vibrio, other</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Yersinia enterocolitica</td>
<td>3 (0.2)</td>
<td>33 (0.1)</td>
<td>0 (0.0)</td>
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<tr>
<td>Other bacterial</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td><strong>Total bacterial</strong></td>
<td>235 (18.9)</td>
<td>7,034 (28.0)</td>
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<tr>
<td><strong>Chemical</strong></td>
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<td></td>
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</tr>
<tr>
<td>Ciguatoxin</td>
<td>24 (1.9)</td>
<td>81 (0.3)</td>
<td>0 (0.0)</td>
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<tr>
<td>Heavy metals</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Mushroom toxin</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Scombrotoxin</td>
<td>29 (2.3)</td>
<td>132 (0.5)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Shellfish toxin</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Other chemical</td>
<td>1 (0.1)</td>
<td>15 (0.1)</td>
<td>0 (0.0)</td>
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<tr>
<td><strong>Total chemical</strong></td>
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<td>228 (0.9)</td>
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<tr>
<td><strong>Parasitic</strong></td>
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<tr>
<td>Anisakis</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cyclospora cayetanensis</td>
<td>2 (0.2)</td>
<td>42 (0.2)</td>
<td>0 (0.0)</td>
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<tr>
<td>Giardia intestinalis</td>
<td>1 (0.1)</td>
<td>34 (0.1)</td>
<td>0 (0.0)</td>
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<td>Trichinella spiralis</td>
<td>2 (0.2)</td>
<td>14 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total parasitic</strong></td>
<td>5 (0.4)</td>
<td>90 (0.4)</td>
<td>0 (0.0)</td>
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<tr>
<td><strong>Viral</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Astrovirus</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>6 (0.5)</td>
<td>116 (0.5)</td>
<td>1 (9.1)</td>
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<td>Norovirus</td>
<td>150 (12.1)</td>
<td>6,335 (25.2)</td>
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<td>Rotavirus</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td><strong>Total viral</strong></td>
<td>156 (12.6)</td>
<td>6,451 (25.7)</td>
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<td><strong>Confirmed etiology</strong></td>
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<td>13,993 (55.7)</td>
<td>11 (100.0)</td>
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<tr>
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<tr>
<td><strong>Total 2001</strong></td>
<td>1,243 (100.0)</td>
<td>25,130 (100.0)</td>
<td>11 (100.0)</td>
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TABLE 6. Number of reported foodborne-disease outbreaks, cases, and deaths, by etiology — United States, 2002

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Outbreaks</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>Bacterial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bacillus cereus</td>
<td>7 (0.5)</td>
<td>42 (0.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Brucella</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>13 (1.0)</td>
<td>350 (1.4)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Clostridium botulinum</td>
<td>3 (0.2)</td>
<td>14 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>31 (2.3)</td>
<td>2,207 (8.8)</td>
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<tr>
<td>Escherichia coli</td>
<td>26 (2.0)</td>
<td>486 (1.9)</td>
<td>2 (14.3)</td>
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<td>1 (0.1)</td>
<td>54 (0.2)</td>
<td>8 (57.1)</td>
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<td>Salmonella</td>
<td>111 (8.3)</td>
<td>4,636 (18.6)</td>
<td>3 (21.4)</td>
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<tr>
<td>Shigella</td>
<td>9 (0.7)</td>
<td>318 (1.3)</td>
<td>0 (0.0)</td>
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<tr>
<td>Staphylococcus aureus</td>
<td>21 (1.6)</td>
<td>495 (2.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Streptococcus</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Vibrio cholerae</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio parahemolyticus</td>
<td>2 (0.2)</td>
<td>11 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vibrio, other</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Yersinia enterocolitica</td>
<td>3 (0.2)</td>
<td>13 (0.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Other bacterial</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
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<tr>
<td><strong>Total bacterial</strong></td>
<td><strong>227 (17.1)</strong></td>
<td><strong>8,626 (34.6)</strong></td>
<td><strong>13 (92.9)</strong></td>
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<tr>
<td>Chemical</td>
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</tr>
<tr>
<td>Ciguatoxin</td>
<td>20 (1.5)</td>
<td>68 (0.3)</td>
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<td>Heavy metals</td>
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<td>0 (0.0)</td>
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<tr>
<td>Mushroom toxin</td>
<td>1 (0.1)</td>
<td>4 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Scombrotxin</td>
<td>21 (1.6)</td>
<td>59 (0.2)</td>
<td>0 (0.0)</td>
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<tr>
<td>Shellfish toxin</td>
<td>1 (0.1)</td>
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<td><strong>Total chemical</strong></td>
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<td><strong>272 (1.1)</strong></td>
<td><strong>0 (0.0)</strong></td>
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<tr>
<td>Parasitic</td>
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<tr>
<td>Anisakis</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>2 (0.2)</td>
<td>43 (0.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Cyclospora cayetanensis</td>
<td>2 (0.2)</td>
<td>40 (0.2)</td>
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<td>Giardia intestinalis</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Trichinella spiralis</td>
<td>1 (0.1)</td>
<td>5 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Total parasitic</strong></td>
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<td><strong>88 (0.4)</strong></td>
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<tr>
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<td></td>
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</tr>
<tr>
<td>Astrovirus</td>
<td>1 (0.1)</td>
<td>14 (0.1)</td>
<td>0 (0.0)</td>
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<tr>
<td>Hepatitis A</td>
<td>7 (0.5)</td>
<td>50 (0.2)</td>
<td>1 (7.1)</td>
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<tr>
<td>Norovirus</td>
<td>199 (15.0)</td>
<td>6,559 (26.3)</td>
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<td>Rotavirus</td>
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<td>0 (0.0)</td>
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<td><strong>Total viral</strong></td>
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<td><strong>Total 2002</strong></td>
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<td><strong>24,966 (100.0)</strong></td>
<td><strong>14 (100.0)</strong></td>
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TABLE 7. Number of reported foodborne-disease outbreaks, by etiology and month of occurrence — United States, 1998–2002

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<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total</th>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<td>3</td>
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<td>2</td>
<td>5</td>
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<td>7</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
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<tr>
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<td>4</td>
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<td>1</td>
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<td>—</td>
<td>1</td>
<td>—</td>
<td>3</td>
<td>1</td>
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<td>—</td>
<td>1</td>
<td>—</td>
<td>12</td>
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<td>9</td>
<td>6</td>
<td>17</td>
<td>14</td>
<td>8</td>
<td>8</td>
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<td>13</td>
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<td>3</td>
<td>8</td>
<td>19</td>
<td>18</td>
<td>24</td>
<td>21</td>
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<th>School</th>
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* 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

<table>
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<tr>
<th>Etiology</th>
<th>Fair or festival</th>
<th>Hospital</th>
<th>Nursing home</th>
<th>Prison</th>
<th>Other</th>
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<td>3</td>
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* 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

<table>
<thead>
<tr>
<th>Vehicle of transmission</th>
<th>Outbreaks</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
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<tbody>
<tr>
<td>Beef</td>
<td>26 (2.0)</td>
<td>805 (3.0)</td>
<td>0 (0.0)</td>
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<tr>
<td>Dairy</td>
<td>18 (1.4)</td>
<td>492 (1.8)</td>
<td>0 (0.0)</td>
</tr>
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<td>Eggs</td>
<td>7 (0.5)</td>
<td>48 (0.2)</td>
<td>0 (0.0)</td>
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<td>Game</td>
<td>2 (0.2)</td>
<td>13 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Pork</td>
<td>29 (2.2)</td>
<td>610 (2.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Poultry</td>
<td>62 (4.7)</td>
<td>876 (3.2)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Vegetables</td>
<td>27 (2.1)</td>
<td>1,299 (4.8)</td>
<td>2 (6.3)</td>
</tr>
<tr>
<td>Fruits and nuts</td>
<td>17 (1.3)</td>
<td>586 (2.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Grains</td>
<td>9 (0.7)</td>
<td>306 (1.1)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Oils and sugars</td>
<td>1 (0.1)</td>
<td>4 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Finfish</td>
<td>69 (5.3)</td>
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<td>Shellfish</td>
<td>38 (2.9)</td>
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<td>Unclassifiable vehicle</td>
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<td><strong>Total 1998</strong></td>
<td>1,314 (100.0)</td>
<td>27,258 (100.0)</td>
<td>32 (100.0)</td>
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</table>

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

<table>
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<th>Vehicle of transmission</th>
<th>Outbreaks</th>
<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
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<td>Beef</td>
<td>62 (4.6)</td>
<td>1,332 (5.4)</td>
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<td>Dairy</td>
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<td>Eggs</td>
<td>25 (1.9)</td>
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<td>Game</td>
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<td>0 (0.0)</td>
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<td>Pork</td>
<td>26 (1.9)</td>
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<td>74 (5.5)</td>
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<td>Grains</td>
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<td>0 (0.0)</td>
</tr>
<tr>
<td>Oils and sugars</td>
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<td>135 (0.5)</td>
<td>0 (0.0)</td>
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<td>Finfish</td>
<td>64 (4.8)</td>
<td>322 (1.3)</td>
<td>1 (10.0)</td>
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<td>Shellfish</td>
<td>28 (2.1)</td>
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<td>24,894 (100.0)</td>
<td>10 (100.0)</td>
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### TABLE 11. Number of reported foodborne-disease outbreaks, cases, and deaths, by vehicle of transmission — United States, 2000

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<th>Cases</th>
<th>Deaths</th>
</tr>
</thead>
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<td>696 (2.7)</td>
<td>1 (4.8)</td>
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<tr>
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<td>22 (1.6)</td>
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<td>Eggs</td>
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### TABLE 12. Number of reported foodborne-disease outbreaks, cases, and deaths, by vehicle of transmission — United States, 2001

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

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

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

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

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Vehicle of transmission
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* 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

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* 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

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* 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

<table>
<thead>
<tr>
<th>Etiology</th>
<th>P9</th>
<th>P10</th>
<th>P11</th>
<th>P12</th>
<th>Outbreaks in which proliferation factor reported</th>
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<td><em>Yersinia enterocolitica</em></td>
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<tr>
<td>Other bacterial</td>
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<td><em>Cyclospora cayetanensis</em></td>
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* 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

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<tr>
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<td>Total 1998–2002</td>
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<td>250</td>
<td>5</td>
<td>33</td>
</tr>
</tbody>
</table>

* More than one contributing factor might be reported per outbreak.
† See Appendix A for description of each factor.
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 Park 2 as you can.

**Electronic Foodborne Outbreak Reporting System**

### 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
   - Case-Control study
   - Cohort Study
   - Food preparation review
   - Food product traceback
   - Investigation at factory or production plant
   - Investigation at original source
   - (farm, marine estuary, etc)
   - Environment / food sample cultures

7. **Implicated Food(s)**: (Please provide known information.)
   - **Name of Food**
   - **Main Ingredients**
   - **Contaminated Ingredient(s)**
   - **Reason(s) Suspected**
   - **Method of Preparation**

<table>
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<th>e.g. lasagna</th>
<th>pasta, sauce, eggs, beef</th>
<th>eggs</th>
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<th>M1</th>
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<td>2.)</td>
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<tr>
<td>3.)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Food vehicle could not be determined

**Reason Suspected** (Choose all that apply):

1. Statistical evidence from epidemiological investigation
2. Laboratory evidence (e.g., identification of agent in food)
3. Compelling supportive information
4. Other data (e.g., same phage type found on farm that supplied eggs)
5. 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

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Serotype (if available)</th>
<th>Other characteristics (if available)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Confirmed</td>
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<td>2.)</td>
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</tr>
<tr>
<td>3.)</td>
<td>Confirmed</td>
<td></td>
</tr>
</tbody>
</table>

Etiology undetermined

**Isolated / Identified from**: (Check all that apply:)

- Patient specimen(s)
- Environment specimen(s)
- Food specimen(s)
- Food Worker specimen(s)

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 Bld; 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.

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*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.*
9. Contributing Factors*: (See list on page 3, check all that apply)
   Contributing factors unknown

   Contamination Factor:
   C1  C2  C3  C4  C5  C6  C7  C8  C9  C10  C11  C12  C13  C14  C15 (describe in Comments) N/A

   Proliferation/Amplification Factor (bacterial outbreaks only):
   P1  P2  P3  P4  P5  P6  P7  P8  P9  P10  P11  P12 (describe in Comments) N/A

   Survival Factor (microbial outbreaks only):
   S1  S2  S3  S4  S5 (describe in Comments) N/A

   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)

10. Agency reporting this outbreak:

   Contact Person:

   NAME: _______________________
   TITLE: ________________________
   PHONE NO: ____________________
   FAX NO: ______________________ 
   E-MAIL: _______________________

   Date of completion of this form:
   __ __/__ __/ __ __ __
   Month   Day   Year

   Initial Report
   Updated Report
   Final Report

   Additional data suggests this is not a foodborne outbreak

Part 2: Additional Information (Please complete as much as possible)

11. Numbers of:

   OUTCOME/SYMPOTOM
   Cases with
   Outcome / Symptom
   Total cases for
   whom you have
   information available
   Healthcare Provider Visit
   Hospitalization
   Death
   Vomiting
   Diarrhea
   Bloody Stools
   Fever
   Abdominal Cramps

12. Incubation Period:

   (circle appropriate units)
   Shortest: _______ (Hours, days)
   Longest: _______ (Hours, days)
   Median: _______ (Hours, days)
   Unknown

13. Duration of Acute Illness Among Those Who Recovered:

   (circle appropriate units)
   Shortest: _______ (Hours, days)
   Longest: _______ (Hours, days)
   Median: _______ (Hours, days)
   Unknown

   Use the following terms, if appropriate, to describe other common characteristics of cases:
   anaphylaxis  diplopia  myalgia
   arthralgia  flushing  paresthesia
   bradycardia  headache  septicemia
   bullous skin lesions  hemolytic uremic syndrome (HUS)
   cough  hypotension  sore throat
   coma  itching  tachycardia
   descending paralysis jaundice  thrombocytopenia
   lesions syndrome (HUS) tachycardia
   cough hypotension  temperature reversal
   leptargy  itching  urticaria
   nausea  itching  wheezing
   vomiting  itching  jaundice

14. If Cohort Investigation Conducted:

   Event-specific Attack Rate = _______ / _______ x 100 = _______ %
   # ill total # of persons for whom you have illness info.

15. Where was Food Prepared? (Check all that apply)

   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
   Commercial product, served without further preparation
   Other (please describe)

16. Where was Food Eaten? (Check all that apply)

   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, temporary/ mobile service
   Other (please describe)

17. Other Available Info:

   Unpublished agency report (please attach)
   Epi-Aid
   Publication (please reference)
   Not available

18. Remarks: Briefly describe important aspects of the outbreak not covered above
   (e.g., restaurant closure, product recall, immunoglobin administration, economic impact, etc)
   ____________________________________________
   ____________________________________________
   ____________________________________________
   ____________________________________________

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 enteriditis* 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** - Insufficient 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.

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**TABLE. Guidelines for confirmation of foodborne-disease outbreaks**

<table>
<thead>
<tr>
<th>Etiologic agent</th>
<th>Incubation period</th>
<th>Clinical syndrome</th>
<th>Confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacterial</strong></td>
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<td></td>
</tr>
<tr>
<td>1. <em>Bacillus cereus</em></td>
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<tr>
<td>a. Vomiting toxin</td>
<td>1–6 hrs</td>
<td>Vomiting; some patients with diarrhea; fever uncommon</td>
<td>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</td>
</tr>
<tr>
<td>b. Diarrheal toxin</td>
<td>6–24 hrs</td>
<td>Diarrhea, abdominal cramps, and vomiting in some patients; fever uncommon</td>
<td>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</td>
</tr>
<tr>
<td>2. <em>Brucella</em></td>
<td>Several days to several months; usually &gt;30 days</td>
<td>Weakness, fever, headache, sweats, chills, arthralgia, weight loss, and splenomegaly</td>
<td>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</td>
</tr>
<tr>
<td>3. <em>Campylobacter jejuni/coll</em></td>
<td>2–10 days; usually 2–5 days</td>
<td>Diarrhea (often bloody), abdominal pain, and fever</td>
<td>Isolation of organism from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food</td>
</tr>
<tr>
<td>Etiologic agent</td>
<td>Incubation period</td>
<td>Clinical syndrome</td>
<td>Confirmation</td>
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</tr>
<tr>
<td><strong>Bacterial</strong></td>
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<tr>
<td><strong>4. Clostridium botulinum</strong></td>
<td>2 hours–8 days; usually 12–48 hrs</td>
<td>Illness of variable severity; common symptoms are diplopia, blurred vision, and bulbar weakness; paralysis, which is usually descending and bilateral, might progress rapidly</td>
<td>Detection of botulinum toxin in serum, stool, gastric contents, or implicated food OR Isolation of organism from stool or intestine</td>
</tr>
<tr>
<td><strong>5. Clostridium perfringens</strong></td>
<td>6–24 hrs</td>
<td>Diarrhea and abdominal cramps; vomiting and fever uncommon</td>
<td>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</td>
</tr>
<tr>
<td><strong>6. Escherichia coli</strong></td>
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<td></td>
</tr>
<tr>
<td>a. Enterohemorrhagic (E. coli O157:H7 and others)</td>
<td>1–10 days; usually 3–4 days</td>
<td>Diarrhea (often bloody), abdominal cramps (often severe), and little or no fever</td>
<td>Isolation of E. coli O157:H7 or other Shiga-like toxin-producing E. coli from clinical specimen from two or more ill persons OR Isolation of E. coli O157:H7 or other Shiga-like toxin-producing E. coli from epidemiologically implicated food</td>
</tr>
<tr>
<td>b. Enterotoxigenic (ETEC)</td>
<td>6–48 hours</td>
<td>Diarrhea, abdominal cramps, and nausea; vomiting and fever less common</td>
<td>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</td>
</tr>
<tr>
<td>c. Enteropathogenic (EPEC)</td>
<td>Variable</td>
<td>Diarrhea, fever, and abdominal cramps</td>
<td>Isolation of organism of same enteropathogenic serotype from stool of two or more ill persons</td>
</tr>
<tr>
<td>d. Enteroinvasive (EIEC)</td>
<td>Variable</td>
<td>Diarrhea (might be bloody), fever, and abdominal cramps</td>
<td>Isolation of same enteroinvasive serotype from stool of two or more ill persons</td>
</tr>
<tr>
<td><strong>7. Listeria monocytogenes</strong></td>
<td></td>
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</tr>
<tr>
<td>a. Invasive disease</td>
<td>2–6 weeks</td>
<td>Meningitis, neonatal sepsis, and fever</td>
<td>Isolation of organism from normally sterile site</td>
</tr>
<tr>
<td>b. Diarrheal disease</td>
<td>Unknown</td>
<td>Diarrhea, abdominal cramps, and fever</td>
<td>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</td>
</tr>
<tr>
<td><strong>8. Nontyphoidal Salmonella</strong></td>
<td>6 hrs–10 days; usually 6–48 hours</td>
<td>Diarrhea, often with fever and abdominal cramps</td>
<td>Isolation of organism of same serotype from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food</td>
</tr>
<tr>
<td><strong>9. Salmonella Typhi</strong></td>
<td>3–60 days; usually 7–14 days</td>
<td>Fever, anorexia, malaise, headache, and myalgia; sometimes diarrhea or constipation</td>
<td>Isolation of organism from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food</td>
</tr>
<tr>
<td>Etiologic agent</td>
<td>Incubation period</td>
<td>Clinical syndrome</td>
<td>Confirmation</td>
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</tr>
<tr>
<td><strong>Bacterial</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10. <em>Shigella</em> spp.</td>
<td>12 hours–6 days; usually 2–4 days</td>
<td>Diarrhea (often bloody), often accompanied by fever and abdominal cramps</td>
<td>Isolation of organism of same serotype from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food</td>
</tr>
<tr>
<td>11. <em>Staphylococcus aureus</em></td>
<td>30 minutes–8 hours; usually 2–4 hours</td>
<td>Vomiting and diarrhea</td>
<td>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</td>
</tr>
<tr>
<td>12. <em>Streptococcus</em>, group A</td>
<td>1–4 days</td>
<td>Fever, pharyngitis, scarlet fever, and upper-respiratory infection</td>
<td>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</td>
</tr>
<tr>
<td>13. <em>Vibrio cholerae</em></td>
<td>1–5 days</td>
<td>Watery diarrhea, often accompanied by vomiting</td>
<td>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</td>
</tr>
<tr>
<td>a. O1 or O139</td>
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</tr>
<tr>
<td>b. non-O1 and non-O139</td>
<td>1–5 days</td>
<td>Watery diarrhea</td>
<td>Isolation of organism of same serotype from stool of two or more ill persons</td>
</tr>
<tr>
<td>14. <em>Vibrio parahaemolyticus</em></td>
<td>4–30 hours</td>
<td>Diarrhea</td>
<td>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</td>
</tr>
<tr>
<td>15. <em>Yersinia enterocolitica</em></td>
<td>1–10 days; usually 4–6 days</td>
<td>Diarrhea and abdominal pain (often severe)</td>
<td>Isolation of organism from clinical specimen from two or more ill persons OR Isolation of pathogenic strain of organism from epidemiologically implicated food</td>
</tr>
<tr>
<td>Etiologic agent</td>
<td>Incubation period</td>
<td>Clinical syndrome</td>
<td>Confirmation</td>
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<tr>
<td><strong>Chemical</strong></td>
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<tr>
<td>1. Marine toxins</td>
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<tr>
<td>a. Ciguatoxin</td>
<td>1–48 hours; usually 2–8 hours</td>
<td>Usually gastrointestinal symptoms, followed by neurologic symptoms (including paresthesia of lips, tongue, throat, or extremities) and reversal of hot and cold sensation</td>
<td>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)</td>
</tr>
<tr>
<td>b. Scombroid toxin (histamine)</td>
<td>1 minute–3 hours; usually &lt;1 hour</td>
<td>Flushing, dizziness, burning of mouth and throat, headache, gastrointestinal symptoms, urticaria, and generalized pruritis</td>
<td>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 Scomboidi)</td>
</tr>
<tr>
<td>c. Paralytic or neurotoxic shellfish poison</td>
<td>30 minutes–3 hours</td>
<td>Paresthesia of lips, mouth or face, and extremities; intestinal symptoms or weakness, including respiratory difficulty</td>
<td>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</td>
</tr>
<tr>
<td>d. Puffer fish, tetrodotoxin</td>
<td>10 minutes–3 hours; usually 10–45 minutes</td>
<td>Paresthesia of lips, tongue, face, or extremities, often following numbness; loss of proprioception or floating sensations</td>
<td>Demonstration of tetrodotoxin in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten puffer fish</td>
</tr>
<tr>
<td>2. Heavy metals</td>
<td>5 minutes–8 hours; usually &lt;1 hour</td>
<td>Vomiting, often metallic taste</td>
<td>Demonstration of high concentration of metal in epidemiologically implicated food</td>
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<tr>
<td>• Antimony</td>
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<td>• Cadmium</td>
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<td>• Copper</td>
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<td>• Iron</td>
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<td>• Tin</td>
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<tr>
<td>• Zinc</td>
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<tr>
<td>3. Monosodium glutamate (MSG)</td>
<td>3 minutes–2 hours; usually &lt;1 hour</td>
<td>Burning sensation in chest, neck, abdomen, or extremities; sensation of lightness and pressure over face or heavy feeling in chest</td>
<td>Clinical syndrome among persons who have eaten food containing MSG (e.g., usually 1.5 g MSG)</td>
</tr>
<tr>
<td>4. Mushroom toxins</td>
<td></td>
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</tr>
<tr>
<td>a. Shorter-acting toxins</td>
<td>2 hours</td>
<td>Usually vomiting and diarrhea; other symptoms differ with toxin</td>
<td>Clinical syndrome among persons who have eaten mushrooms identified as toxic type OR Demonstration of toxin in epidemiologically implicated mushrooms or food containing mushrooms</td>
</tr>
<tr>
<td>• Muscimol</td>
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<tr>
<td>• Muscarine</td>
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<tr>
<td>• Psilocybin</td>
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<tr>
<td>• Coprinus arretrataris</td>
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<tr>
<td>• Ibotenic acid</td>
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<tr>
<td>b. Longer-acting toxins (e.g., Amanita spp.)</td>
<td>6–24 hours</td>
<td>Diarrhea and abdominal cramps for 24 hours, followed by hepatic and renal failure</td>
<td>Clinical syndrome among persons who have eaten mushrooms identified as toxic type OR Demonstration of toxin in epidemiologically implicated mushrooms or food containing mushrooms</td>
</tr>
</tbody>
</table>
TABLE. (Continued) Guidelines for confirmation of foodborne-disease outbreaks

<table>
<thead>
<tr>
<th>Etiologic agent</th>
<th>Incubation period</th>
<th>Clinical syndrome</th>
<th>Confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parasitic</strong></td>
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<tr>
<td>1. <em>Cryptosporidium</em> spp.</td>
<td>2–28 days; median: 7 days</td>
<td>Diarrhea, nausea, vomiting, and fever</td>
<td>Demonstration of oocysts in stool or in small-bowel biopsy of two or more ill persons</td>
</tr>
<tr>
<td>2. <em>Cyclospora cayetanensis</em></td>
<td>1–14 days; median: 7 days</td>
<td>Diarrhea, nausea, anorexia, weight loss, cramps, gas, fatigue, and low-grade fever; might be relapsing or protracted</td>
<td>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</td>
</tr>
<tr>
<td>3. <em>Giardia intestinalis</em></td>
<td>3–25 days; median: 7 days</td>
<td>Diarrhea, gas, cramps, nausea, and fatigue</td>
<td>Demonstration of the parasite in stool or small-bowel biopsy specimen of two or more ill persons</td>
</tr>
<tr>
<td>4. <em>Trichinella</em> spp.</td>
<td>1–2 days for intestinal phase; 2–4 weeks for systemic phase</td>
<td>Fever, myalgia, periorbital edema, and high eosinophil count</td>
<td>Two or more ill persons and positive serologic test or demonstration of larvae in muscle biopsy</td>
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<tr>
<td><strong>Viral</strong></td>
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<tr>
<td>1. <em>Hepatitis A</em></td>
<td>15–50 days; median: 28 days</td>
<td>Jaundice, dark urine, fatigue, anorexia, and nausea</td>
<td>Detection of immunoglobulin M antibody to hepatitis A virus (IgM anti-HAV) in serum from two or more persons who consumed epidemiologically implicated food</td>
</tr>
<tr>
<td>2. <em>Norovirus</em> (NoV)</td>
<td>12–48 hours (median: 33 hours)</td>
<td>Diarrhea, vomiting, nausea, abdominal cramps, and low-grade fever</td>
<td>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)</td>
</tr>
<tr>
<td>3. <em>Astrovirus</em></td>
<td>12–48 hours</td>
<td>Diarrhea, vomiting, nausea, abdominal cramps, and low-grade fever</td>
<td>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</td>
</tr>
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