

Key Findings and Public Health Messages

- The California Department of Public Health (CDPH) received reports of 1,375 foodborne disease outbreaks (FBDOs) involving 24,280 cases with symptom onsets from 2001 through 2008. Of these 1,375 outbreaks, 26 involved exposures and cases in more than 1 California county and an additional 13 involved exposures and cases in more than 1 state.
- From 2001 through 2007, the annual numbers of reported outbreaks remained relatively level (average 180 outbreaks per year, range: 151 to 210 outbreaks) but decreased by 25.2 percent from 2007 (155) to 2008 (116).
- The etiologic agent responsible for causing the outbreak was confirmed in 392 (28.5 percent), suspected in 832 (60.5 percent), and undetermined in 151 (11.0 percent) outbreaks.
- From 2001 through 2008, CDPH received reports of 392 confirmed outbreaks involving 10,999 cases (45.3 percent of all reported cases). Etiologic agents included bacteria (53.6 percent), viruses (37.2 percent), chemical agents (7.4 percent), and parasites (1.8 percent).
- Among confirmed FBDOs, norovirus caused the most outbreaks (141) and involved the most cases (4,372).
- Reducing the occurrence of FBDOs requires coordination between public health and agricultural and food industries. These efforts, along with additional research and consumer education, may offer the best opportunities for controlling and preventing FBDOs.

Background

Foodborne diseases incur significant morbidity and mortality in the United States (US), causing an estimated 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths each year¹. Foodborne disease outbreaks (FBDO) contribute to this burden and are important sentinel public health events. Etiologic agents that cause FBDOs include bacteria (including bacterial toxins), viruses, chemicals (toxins and metals), and parasites. The clinical syndromes associated with outbreaks vary by etiologic agent but can range from mild to life threatening illnesses. There are 2 national objectives to reduce outbreaks of infections caused by key foodborne bacteria. These *Healthy People 2010* target objectives are to reduce the numbers of annual *Escherichia coli* O157:H7 and *Salmonella* serotype Enteritidis outbreaks in the US to, respectively, 11 and 22.

We describe here the epidemiology of FBDOs in California from 2001 through 2008. Data for 2008 are provisional and may differ from results in future publications. For a complete discussion of the definitions, methods and limitations associated with this report, please refer to Technical Notes².

California reporting requirements and surveillance case definition

California Code of Regulations, Title 17, requires health care providers to report suspected FBDOs to their local health department immediately by telephone. A FBDO is defined by California regulation as an incident in which two or more persons experience similar illness after ingestion of a common food, and epidemiologic analysis implicates the food as the source of the illness. Additionally, one case of botulism or chemical poisoning constitutes an outbreak if laboratory studies identify the causative agent in food. Two or more suspected cases of foodborne disease from separate households suspected to have the same source of illness (in the absence of epidemiologic analysis) are considered suspected FBDOs.

California regulations also require local health officers to report FBDOs to CDPH. CDPH officially counted FBDOs that satisfied Centers for Disease Control and Prevention (CDC) surveillance case definitions³ with some modifications. While outbreak definitions are agent-specific, a confirmed etiology generally required laboratory evidence of a specific etiologic agent in two or more cases³. CDPH also

classified an etiology as *suspected* if, in the absence of laboratory-confirmation, clinical and epidemiologic characteristics and the incubation period suggested an etiologic category. The etiology was unknown or undetermined when the criteria for an outbreak were met (≥ 2 cases with similar illness after ingesting a common food) but the clinical features of the illness did not suggest a specific etiologic category. CDPH counted aggregate estimates of total persons ill reported on the standardized CDC Electronic Foodborne Outbreak Reporting System form. Some cases included in this report may not have met CDC surveillance case definitions for individual case reporting².

We considered an outbreak to be multicounty if exposures and cases involved more than 1 California county and multistate if exposure and cases involved more than 1 state.

Epidemiology of FBDOs in California

CDPH received reports of 1,375 FBDOs involving 24,280 cases with symptom onsets from 2001 through 2008. The annual numbers of reported outbreaks were: 178 in 2001, 210 in 2002, 188 in 2003, 177 in 2004, 151 in 2005, 200 in 2006, 155 in 2007, and 116 in 2008 [Figure 1]. The number of reported outbreaks decreased by 25.2 percent from 2007 (155) to 2008 (116) although this may, in part, reflect incomplete reporting for 2008. A total of 26 (1.9 percent) outbreaks involving 2,474 (10.2 percent) cases were multicounty and an additional 13 (0.9 percent) involving 220 (0.9 percent) cases were multistate.

FBDOs by etiologic agent and confirmation status

Of reported etiologic agents, 605 (44.0 percent) were bacterial, 535 (38.9 percent) were viral, 76 (5.5 percent) were chemical, 8 (0.6 percent) were parasitic, and 151 (11.0 percent) were unknown or undetermined. The etiologic agent was confirmed in 392 (28.5 percent), suspected in 832 (60.5 percent), and undetermined in 151 (11.0 percent) outbreaks [Figure 2]. Etiologic agents were confirmed in 210 (34.7 percent) reported bacterial outbreaks, 146 (27.3 percent) reported viral outbreaks, 29 (38.2 percent) reported chemical outbreaks, and 7 (87.5 percent) of reported parasitic outbreaks. The etiologic agent was confirmed in 224 (40.6 percent) of 552 outbreaks involving more than 10 cases and 167 (20.3 percent) of 821 outbreaks involving 10 or fewer cases.

Figure 1. Reported outbreaks by year and confirmation status

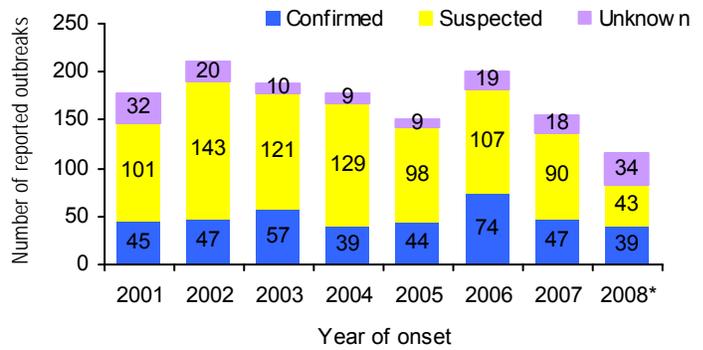


Figure 2. Reported outbreaks by etiology and level of confirmation 2001 - 2008*, excluding 151 outbreaks of unknown etiology

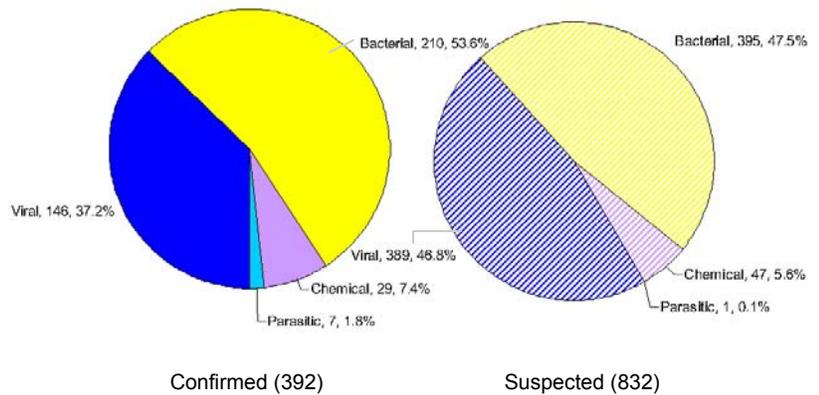
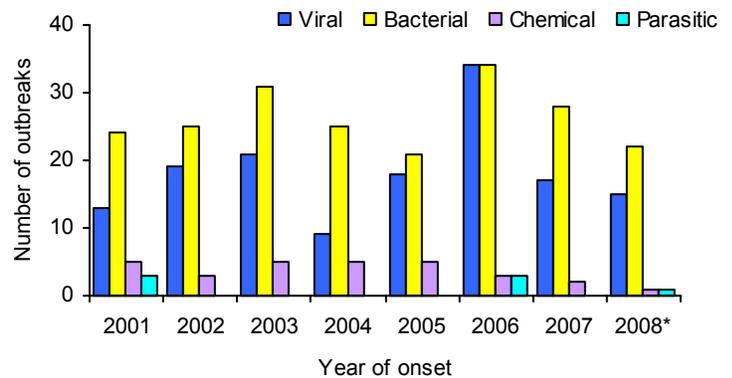


Figure 3. Confirmed outbreaks by etiologic agent and year



*2008 data are provisional

Table 1. Confirmed foodborne disease outbreaks and cases reported to CDPH by etiologic agent, 2001-2008*

| | Outbreaks | | Outbreak cases | | |
|---|------------|--------------|----------------|--------------|---------------------|
| | Number | Percent | Total | Percent | Median per outbreak |
| All agents | 392 | 100.0 | 10,999 | 100.0 | 12 |
| Bacterial pathogens | 210 | 53.6 | 6,155 | 56.0 | 10.0 |
| Botulism, foodborne | 4 | 1.0 | 11 | 0.1 | 2.0 |
| <i>Brucella</i> | 2 | 0.5 | 7 | 0.1 | 3.5 |
| <i>Campylobacter</i> spp. | 16 | 4.1 | 1,809 | 16.4 | 5.0 |
| <i>Clostridium perfringens</i> | 7 | 1.8 | 151 | 1.4 | 9.0 |
| <i>Shiga toxin-producing Escherichia coli</i> | 22 | 5.6 | 437 | 4.0 | 8.0 |
| <i>Listeria monocytogenes</i> | 1 | 0.3 | 28 | 0.3 | - |
| Multiple agents | 1 | 0.3 | 7 | 0.1 | - |
| <i>Salmonella</i> | 125 | 31.9 | 3,106 | 28.2 | 12.0 |
| <i>Shigella</i> | 19 | 4.8 | 417 | 3.8 | 9.0 |
| <i>Staphylococcus aureus</i> | 6 | 1.5 | 112 | 1.0 | 16.0 |
| <i>Vibrio</i> spp (non-cholerae) | 6 | 1.5 | 56 | 0.5 | 6.5 |
| <i>Yersina Enterocolitica</i> | 1 | 0.3 | 14 | 0.1 | - |
| Chemical agents | 29 | 7.4 | 186 | 1.7 | 4.0 |
| Ciguatoxin | 1 | 0.3 | 4 | < 0.1 | - |
| Gemyloxin | 1 | 0.3 | 10 | 0.1 | - |
| Mushroom toxin | 3 | 0.8 | 13 | 0.1 | 6.0 |
| Scombrotxin | 24 | 6.1 | 159 | 1.4 | 3.0 |
| Parasitic pathogens | 7 | 1.8 | 173 | 1.6 | 18.0 |
| <i>Cyclospora cayetanensis</i> | 1 | 0.3 | 59 | 0.5 | - |
| <i>Giardia intestinalis</i> | 2 | 0.5 | 80 | 0.7 | 40.0 |
| <i>Paragonimus</i> | 1 | 0.3 | 18 | 0.2 | - |
| <i>Trichinella spiralis</i> | 3 | 0.8 | 16 | 0.1 | 7.0 |
| Viral pathogens | 146 | 37.2 | 4,485 | 40.8 | 22.0 |
| Hepatitis A | 4 | 1.0 | 51 | 0.5 | 12.0 |
| Multiple agents | 1 | 0.3 | 62 | 0.6 | - |
| Norovirus | 141 | 36.0 | 4,372 | 39.7 | 22.0 |

*2008 data are provisional

Numbers in bold are grand and subtotals

FBDOs with confirmed etiologies

Confirmed FBDOs (392) involved 10,999 cases (45.3 percent of all reported cases) [Table 1]. Etiologic agents included bacteria (53.6 percent), viruses (37.2 percent), chemical agents (7.4 percent), and parasites (1.8 percent) although these proportions varied by year of outbreak onset [Figure 3]. Among confirmed outbreaks, 24 (6.1 percent) were multicounty outbreaks of salmonellosis (12), *Escherichia coli* O157:H7 infection (6), campylobacteriosis (2), trichinellosis (2), scombroid (1), and norovirus infection (1). An additional 13 (3.9 percent) were multistate outbreaks of

salmonellosis (9), and *Escherichia coli* O157:H7 infections (4).

The class of etiologic agents that accounted for the largest number of confirmed outbreaks and cases was bacterial agents [Figure 2, Table 1]. However, among specific etiologic agents, norovirus caused the most outbreaks (36.0 percent) and involved the most cases (39.7 percent). Among confirmed bacterial agents, *Salmonella* species caused the most outbreaks (125). During the surveillance period, the average annual numbers of *Escherichia coli* O157:H7 and *Salmonella* serotype Enteritidis

outbreaks were, respectively, 2.8 and 3.2.

A total of 155 (39.5 percent) confirmed outbreaks had an implicated food vehicle that was confirmed by either epidemiologic or laboratory evidence. The most commonly confirmed foods were vegetables and fruits (35, 22.6 percent), complex mixed food items such as burritos, sandwiches, or coleslaw (31, 20.0 percent), and meats (30, 19.4 percent) including beef, chicken, pork and bear. The proportion of FBDOs involving complex mixed food items was higher among FBDOs caused by viral agents (32.7 percent) than among FBDOs caused by bacterial agents (15.8 percent).

Notable outbreaks

In 2006, a multicounty outbreak of campylobacteriosis involving 1,644 cases (52 culture-confirmed) was linked to consumption of pasteurized milk. Cases were reported from 11 prison facilities. Pasteurized milk was traced to a dairy at a prison facility. *Campylobacter* spp. was not recovered from milk samples but laboratory testing of retention samples from the outbreak period had notably high levels of bacterial contamination. The outbreak was likely associated with contamination of pasteurized milk rather than inadequate pasteurization.

Also in 2006, a multistate outbreak of *E. coli* O157:H7 involving 205 cases, 103 hospitalizations, 30 cases of hemolytic uremic syndrome, and 3 deaths was linked to consumption of fresh, bagged, baby spinach⁵. Cases were reported from 26 states and Canada including 2 cases from California. Contaminated spinach was traced to 1 processing plant and 4 growing fields in California. Isolates of the outbreak strain were recovered from cattle feces, feral swine feces, surface waters, and soil sediment samples in or near the fields.

Comment

During the surveillance period, CDPH received an average of 170 FBDO reports each year although this is likely a fraction of the outbreaks that actually occurred. The identification, investigation, and reporting of FBDOs outbreaks represent a complex chain of events and under-reporting of outbreaks is well established^{3,4}. The likelihood that an outbreak will be recognized and reported depends, among other things, on its size, severity, and scope.

During the surveillance period, fewer than 1 in every 3 California FBDOs had a laboratory-confirmed etiologic agent. Confirming the specific etiology of FBDOs provides critical information for developing focused control measures. Limited collection and/or testing of specimens during an outbreak can delay or impede the investigation⁴.

Among confirmed outbreaks reported to CDPH, norovirus caused the most outbreaks and the most illnesses. FBDOs of norovirus infections and of salmonellosis tended to be large (based on the median number of cases per outbreak) and frequent. FBDOs of giardiasis tended to be large but infrequent. The multicounty outbreak of campylobacteriosis associated with pasteurized milk was notably large.

Outbreak investigations provide an important opportunity to understand the epidemiology of foodborne illnesses, identify needed illness prevention measures, and assess and build preparedness capacity for infectious disease emergencies. Reducing the occurrence of FBDOs requires coordination between public health and agricultural and food industries. These efforts, along with additional research and consumer education, may offer the best opportunities for controlling and preventing FBDOs.

References and additional resources

¹Mead PS, Slutsker L, Dietz V et al. Food-related illness and death in the United States. *Emerg Infect Dis* 1999;5:607-25.

<http://www.cdc.gov/ncidod/eid/Vol5no5/pdf/mead.pdf>

²Epidemiologic Summaries of Selected General Communicable Diseases in California, 2001-2008
Technical notes

<http://www.cdph.ca.gov/data/statistics/Documents/technicalnotes-episummary-aug2409.pdf>

³Centers for Disease Control and Prevention. Surveillance for foodborne-disease outbreaks - United States, 1998-2002. *MMWR* 2006;55:SS-10.

⁴Jones TF, Imhoff B, Samuel M et al. Limitations to successful investigation and reporting of foodborne outbreaks: an analysis of foodborne disease outbreaks in FoodNet catchment areas, 1998-1999. *2004*;38(Suppl 3):S297-302.

⁵Jay MT, Cooley M, Carychao D et al. *Escherichia coli* O157:H7 in feral swine near spinach fields and cattle, central California coast. *2007*;13:1908-11.

Last update: 10/22/2009

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