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Contributing Factors in a Successful Foodborne Outbreak Investigation: an Analysis of Data Collected by the Foodborne Diseases Active Surveillance Network (FoodNet), 2003-2010.

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Abstract

Background. Foodborne disease is estimated to cause 48 million illnesses annually in the US resulting in 3000 deaths [1]. Although most infections occur as sporadic cases, outbreak surveillance offers valuable insight about the foods and pathogens responsible for illnesses [2]. A total of 1632 foodborne disease outbreaks were reported during 2011-2012 [3] and recent data indicates an overall decrease in the number of outbreaks reported each year [4]. Understanding which factors contribute to the successful identification of a food vehicle in a foodborne outbreak investigation is crucial for improving outbreak response [5-10]. The purpose of this study was to describe outbreak characteristics and to determine which may be associated with the success of a foodborne outbreak investigation (i.e. one in which a food vehicle has been reported).

Methods. A foodborne disease outbreak was defined as the event in which two or more people acquired similar illnesses from consuming the same food or beverage.Outbreaks occurring in FoodNet sites during 2003 through 2010 were included in the analysis.

Results. Data were available for 1441(87%) of the 1655 foodborne disease outbreaks documented in FoodNet Outbreak Supplement Forms from 2003 through 2010. A food vehicle was identified in 692 of the 1441 (48%) outbreaks. Six outbreak characteristics remained statistically significant in both univariate and multivariate analyses: environmental and/or food culture collection, FDA or state agriculture involvement, outbreak size, case-control studies, and number of fecal specimens tested for norovirus.

Conclusions. Less than half of foodborne outbreaks examined here resulted in a food vehicle being identified. Having more robust resources available for outbreak detection and investigation may improve likelihood of a food vehicle being identified.

CONTRIBUTING FACTORS IN A SUCCESSFUL FOODBORNE OUTBREAK INVESTIGATION: AN ANALYSIS OF DATA COLLECTED BY THE FOODBORNE DISEASES ACTIVE SURVEILLANCE NETWORK (FOODNET), 2003-2010

By

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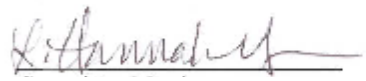

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"That's the wonderful thing about man; he never gets so discouraged or disgusted that he gives up doing it all over again, because he knows very well it is important and WORTH the doing."

~Ray Bradbury, Fahrenheit 451

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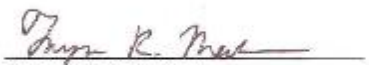

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Chapter I—Introduction

The Centers for Disease Control and Prevention defines foodborne illness as a disease acquired "by consuming contaminated foods or beverages" [11]. Contamination may occur at any stage in food production—pre-harvest, harvest, processing, transport, food preparation, or food handling—and may affect one individual or may lead to a large-scale outbreak [12, 13]. Foodborne illness, according to the United States Economic Research Services, costs the US nearly 7 billion dollars annually. This estimate accounts for lost productivity, medical treatments for sick persons, outbreak mitigation efforts, and lost trade [12].

Various public health regulations have emerged in order to encourage food safety and thereby lessen the burden of foodborne illness. While previous efforts focused primarily on enforcing hygienic conditions in the food service industry, current approaches involve monitoring pathogens at all stages of food production [12, 13]. The Food Safety Modernization Act (FSMA) in particular has been instrumental in reconstructing the US food safety system so that the focus is on prevention of foodborne outbreaks [14]. To improve compliance with food safety measures and response to food safety problems, this law grants the US Food and Drug Administration (FDA) several new authorities. These include: mandating preventive controls and safety standards at food establishments, creating regulations which protect against intentional contamination, ordering a mandatory recall if a voluntary one is unsuccessful, and establishing requirements for recordkeeping at facilities that handle high-risk foods [14]. Hazard Analysis Critical Control Points (HACCP) requires all food businesses to spot food

production stages at which potential hazards may occur and to propose methods for controlling these hazards [12]. The World Health Organization (WHO) and Food Agriculture Organization founded the Codex Alimentarius Commission, an international group responsible for developing food safety standards and guidelines. The WHO also provides health promotion materials to educate both food workers and consumers about the importance of practicing safe food handling and preparation behaviors [13].

Despite the existence of food safety laws and the continual effort to improve food safety, foodborne illness remains a prominent public health issue in the United States. Foodborne disease is estimated to cause 48 million illnesses annually in the US, resulting in 128,000 hospitalizations and 3000 deaths [1]. The 2012 data from FoodNet show that *Salmonella* and *Escherichia coli* infections collectively account for almost 90 percent of all foodborne outbreak-related cases [15]. Although most infections occur as sporadic cases, outbreak surveillance offers valuable insight about the foods and pathogens responsible for illnesses [2]. Preventing these illnesses poses a challenge due to limited resources and difficulty linking individual illnesses to a particular food vehicle. Understanding which factors contribute to the success of a foodborne outbreak investigation is crucial for attributing an illness to a food vehicle and for improving outbreak response [5-10].

This study focused on six different types of outbreak characteristics: agencies substantially involved in the investigation; items included in the investigation (i.e. case interviews, analytical epi investigation, environmental/food cultures, product traceback/recall); number of fecal specimens screened at a lab, public or private, via specified test methods; number of cases in the outbreak; type of etiologic agent identified

for a specific outbreak; and Interagency Food Safety Analytics Collaboration (IFSAC) category to which the food vehicle belongs. Data from FoodNet Outbreak Supplement Forms for the years 2003 through 2010 were included in the analysis. Odds ratios were calculated to estimate whether a specific outbreak characteristic—for example, food and/or environmental cultures attained in the investigation—increases the likelihood of a food vehicle being identified. The overall purpose of this study was to describe outbreak characteristics and to determine which may be associated with the success of a foodborne outbreak investigation (i.e. one in which a food vehicle has been identified and reported by the public health agency).

Chapter II—Literature review

Outbreak investigations involve a number of health agencies working to reduce the impact of foodborne illnesses. These agencies share a responsibility to ensure food safety by preventing, responding to, and controlling outbreaks. While some deem these efforts sufficient, others criticize their ability to lead an effective foodborne illness outbreak investigation.

The National Environmental Health Association (NEHA), in an assessment of food safety capacity at local and state health departments, identifies trends which may halt progress of an outbreak investigation [16]. Researchers found that lack of partnering between local and other agencies, decreased funding sources, inability to set long-term controls (i.e. product recall), inexperienced environmental health workers, inadequate training opportunities, and insufficient time for staff to investigate an outbreak may be responsible for reducing capacity of programs which address foodborne illness [16].

The Environmental Health Specialists Network (EHS-Net) oversaw a similar study using focus groups comprised of specialists from public health departments in eight states [10]. Discussion topics consisted of outbreak investigation procedures, methods for identifying factors associated with an outbreak, and challenges. Investigation practices varied widely by jurisdiction; in fact, nearly half of all participants noted minimal involvement except for routine restaurant inspections. Others recounted not only directing restaurant inspections but also interviewing customers and employees to find ill persons and suspected vehicle(s), requesting food or stool samples, and collaborating with epidemiologists and nurses. Instead of describing contributing factors, most

participants considered illness characteristics when determining a potential pathogen and managing a restaurant investigation. They cited the following as negatively affecting the investigation: uncooperative employees, difficulty contacting customers to complete a food history, poor epidemiologic assistance and management support, inadequate training in outbreak investigation, lack of cooperation among health agencies, insufficient staffing, physician noncompliance, and delayed outbreak notification. Shifting focus toward obtaining food and stool samples and identifying ill employees and unsafe food handling behaviors would likely increase pathogen detection and foodborne illness knowledge [10].

While both the NEHA and EHS-Net studies address issues faced by public health specialists, others examine consumer attitudes regarding foodborne illnesses. Arendt *et al* [17] convened focus groups to discover reasons for under-reporting. Feeling too ill, not knowing the cause or who to contact, and thinking that reporting would not benefit anyone kept consumers from reporting foodborne illnesses [17]. Healthcare professionals admitted that a lack of food safety knowledge prevented them from realizing the potential severity of foodborne illnesses and treating the patient appropriately. To better care for consumers, the authors recommended that healthcare professionals should receive training on detecting, preventing and managing foodborne illnesses [17].

Health and safety officials also shape consumer behaviors during an outbreak since they recommend which foods to avoid. Issuing warnings and food recalls requires determining which food may be responsible for an outbreak; however, incomplete and changing information makes it difficult for officials to provide advice to consumers. Arnade *et al* [9] learned that news about contamination of foods, rather than food safety,

piques consumer interest more often. This suggests that quickly identifying the suspected food vehicle(s) would facilitate better handling of food safety announcements and thus improve foodborne disease outbreak response.

Consumers, producers, supply chain managers, and governments all rely on news they receive during an outbreak to make decisions related to food production. A key component of recognizing when potential food-related hazards emerge is ability to link specific cases of illness to food vehicle(s) [18]. Attributing illnesses to food, however, proves difficult even for large outbreaks. Until recently, there existed no means by which foodborne illnesses could be categorized according to transmission mode [5]. Painter *et al* [19] devised a hierarchy of 17 commodities to help reporting agencies better describe foods causing outbreaks and to glean information regarding how different food commodities contribute to illness. Coupled with outbreak reports, this categorization scheme has been used to describe sources of illness at the point-of-consumption. In another study, Painter *et al* [7] reviewed data on foodborne disease outbreaks from 1998 to 2008 in order to estimate the number of foodborne illnesses, hospitalizations, and deaths for each of the 17 commodities. They attributed 22% of illnesses to leafy vegetables, 16% of hospitalizations to dairy products, and 19% of deaths to poultry. While these results may lend to prioritization of food safety interventions, one main limitation is that this analysis accounted for only those outbreaks with an implicated food vehicle and single etiologic agent. This represents only 37% of all foodborne disease outbreaks present in the database, suggesting that food attribution is an area of outbreak investigation that needs improvement.

Determining factors which lead to a successful foodborne outbreak investigation

may help with food attribution. Timeliness, according to Hedberg *et al* [20], plays a vital role in identifying those possibly exposed to the source of illness and in limiting case count for an outbreak. Jones *et al* [21] agrees that timely reporting—along with resource availability, health department priorities, specimens procured, health care sought by ill persons, and assistance from health care providers and lab workers—affects whether a food vehicle is established.

Tauxe *et al* [2] defines surveillance as "the systematic collection of reports of specific health events as they occur in a population". It delineates the burden of diseases and mobilizes epidemiologic investigations and prevention initiatives. Foodborne illness surveillance serves these primary purposes: ascertaining a food vehicle, etiology, and location of exposure; and summarizing the results of an outbreak investigation [22]. Implementing HACCP-based plans in the food industry, detecting unfamiliar pathogens, generating awareness of current problems, observing changes in the prevalence of outbreaks by etiology, and evaluating the effectiveness of control and prevention efforts represent additional benefits [2, 6, 22]. Although the United States began surveillance activities in the 1800s, it was not until 2010 that foodborne disease outbreaks emerged as "a nationally notifiable condition" [22].

The Centers for Disease Control and Prevention (CDC) maintains several complementary surveillance systems, including the National Outbreak Reporting System (NORS) and the Foodborne Diseases Active Surveillance Network (FoodNet), that compile data on foodborne illness and outbreaks in the United States. NORS captures data on enteric and waterborne disease outbreaks reported by public health departments. By integrating the Waterborne Disease and Outbreak Surveillance System and Foodborne

Disease Outbreak Surveillance System, NORS has enhanced outbreak reporting [23]. FoodNet monitors lab-confirmed infections caused by nine pathogens commonly transmitted through food: *Salmonella,* Shiga toxin-producing *Escherichia coli* (STEC) O157 and non-O157, *Campylobacter, Listeria, Vibrio, Cryptosporidium, Cyclospora, Shigella,* and *Yersinia* [24-26]. Though initially comprised of five states—California, Connecticut, Georgia, Minnesota, and Oregon—the surveillance area soon covered 10 states and 15 percent of the US population. FoodNet releases an annual *National Report Card on Food Safety*, which compares changes in incidence of diseases during the past year to a baseline period. These aid regulatory agencies, healthcare workers, and consumer and industry groups in tailoring food safety strategies to meet national health objectives. A report showing a rise in *Escherichia coli* O157 infections due to ground beef consumption, for example, prompted USDA's Food Safety and Inspection Service and the meat industry to launch a series of interventions which significantly reduced incidence of infection [24].

Foodborne disease outbreak surveillance systems like NORS and FoodNet provide valuable insight regarding the foods and pathogens responsible for illnesses [2]. CDC maintains NORS and FoodNet to collect data on foodborne disease outbreaks occurring in the United States and to ascertain the causes of these outbreaks. These systems serve as primary sources of information about illnesses, hospitalizations, deaths, food vehicle(s) and etiologic agents for foodborne disease outbreaks in the United States [15, 23].

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Chapter III—Manuscript

Contributing factors in a successful foodborne outbreak investigation: an analysis of data collected by the Foodborne Diseases Active Surveillance Network (FoodNet), 2003-2010

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Abstract

Background. Foodborne disease is estimated to cause 48 million illnesses annually in the US resulting in 3000 deaths [1]. Although most infections occur as sporadic cases, outbreak surveillance offers valuable insight about the foods and pathogens responsible for illnesses [2]. A total of 1632 foodborne disease outbreaks were reported during 2011-2012 [3] and recent data indicates an overall decrease in the number of outbreaks reported each year [4]. Understanding which factors contribute to the successful identification of a food vehicle in a foodborne outbreak investigation is crucial for improving outbreak response [5-10]. The purpose of this study was to describe outbreak characteristics and to determine which may be associated with the success of a foodborne outbreak investigation (i.e. one in which a food vehicle has been reported).

Methods. A foodborne disease outbreak was defined as the event in which two or more people acquired similar illnesses from consuming the same food or beverage.Outbreaks occurring in FoodNet sites during 2003 through 2010 were included in the analysis.

Results. Data were available for 1441(87%) of the 1655 foodborne disease outbreaks documented in FoodNet Outbreak Supplement Forms from 2003 through 2010. A food vehicle was identified in 692 of the 1441 (48%) outbreaks. Six outbreak characteristics remained statistically significant in both univariate and multivariate analyses: environmental and/or food culture collection, FDA or state agriculture involvement, outbreak size, case-control studies, and number of fecal specimens tested for norovirus.

Conclusions. Less than half of foodborne outbreaks examined here resulted in a food vehicle being identified. Having more robust resources available for outbreak detection and investigation may improve likelihood of a food vehicle being identified.

Foodborne disease is estimated to cause 48 million illnesses annually in the US resulting in 128,000 hospitalizations and 3000 deaths [1]. Although most infections occur as sporadic cases, outbreak surveillance offers valuable insight about the foods and pathogens responsible for illnesses [2]. An outbreak investigation may yield cause of illness, food vehicle(s), and exposure location; however, less than half of all foodborne disease outbreaks result in a food vehicle being identified [6].

Public health agencies in the United States voluntarily report foodborne disease outbreaks using the National Outbreak Reporting System (NORS). FoodNet enhances national surveillance of these outbreaks by monitoring 10 sites for lab-confirmed infections caused by nine pathogens commonly transmitted through food [11-13]. FoodNet data may provide information regarding how an outbreak investigation was conducted (i.e. agencies involved, studies conducted, specimens collected, outbreak size). Understanding which factors contribute to the success of a foodborne outbreak investigation is crucial for attributing an illness to a food vehicle and for improving outbreak response [3-8]. The purpose of this study was to describe outbreak characteristics and to determine which may be associated with the success of a foodborne outbreak investigation (i.e. one in which a food vehicle has been reported).

METHODS

Data on foodborne disease outbreaks occurring in FoodNet sites from 2003 through 2010 were included in the analysis. FoodNet monitors lab-confirmed infections caused by 9 pathogens commonly transmitted through food—*Salmonella,* Shiga toxin-producing *Escherichia coli* (STEC) O157 and non-O157, *Campylobacter, Listeria,*

Vibrio, Cryptosporidium, Cyclospora, Shigella, and *Yersinia* [11-13]. Though initially comprised of 5 states—California, Connecticut, Georgia, Minnesota, and Oregon—the surveillance area now covers 10 states and ≈15 percent of the US population. FoodNet also collects data on how outbreak investigations are conducted using FoodNet Outbreak Supplement Forms. These forms contain questions about who inititially reported the outbreak; which agencies led the investigation, how they responded to the outbreak, and what challenges they encountered; what items the investigation included (i.e. case-control study, cohort study, environmental and/or food cultures); when and where contamination of foods occurred; and media coverage of the outbreak.

A foodborne disease outbreak was defined as an event in which two or more people acquired similar illnesses from consuming the same food or beverage. For each outbreak, we linked data from the FoodNet Outbreak Supplement Forms with corresponding reports in the Foodborne Disease Outbreak Surveillance System (FDOSS). These reporting systems included data regarding the mode of transmission, size of outbreak, etiologic agent, and implicated food. Only outbreaks occurring in a single state that could be linked to reports in NORS were included in the analysis.

We considered only one outcome—whether a food vehicle was identified for the specific outbreak—and defined a successful outbreak investigation as one in which a food vehicle was reported. In selecting variables, we removed those with cell counts of less than 5 for "yes" responses and greater than 50 percent missing. We chose these exclusion criteria since most variables had a large number of missing values and we wanted to be able to analyze as many variables as possible. Missing values were recategorized as "no" when appropriate. For each outbreak, we described the year of the

outbreak, the reporting state, the agencies involved, items included (i.e. case interviews, analytical epi investigation, environmental/food cultures, product traceback/recall), number of fecal specimens tested via specified methods (bacterial culture, norovirus), number of cases, type of etiologic agent, and food category.

We performed univariate analysis for each of the independent variables to determine which exposures were significantly associated with a successful outbreak investigation (*FoodVehicleIdentified* = "yes"). Odds ratios were calculated to estimate whether a specific outbreak characteristic—for example, food and/or environmental cultures attained in the investigation—increases the likelihood of a food vehicle being reported. Chi-square values were used for the year of the outbreak, the reporting state, and the type of etiologic agent since these variables contained more than 2 categories, We then used forward stepwise selection to build a logistic model comprised of variables significantly affecting the outcome of an investigation. We conducted statistical analyses using SAS software version 9.3 (SAS Institute), and Excel and Access software, version 2013 (Microsoft). We submitted an Application for Designation of Not Human Subjects Research to Georgia State University's Institutional Review Board and earned permission to use data from FoodNet Outbreak Supplement Forms.

RESULTS

We included data for 1441 (87%) of the 1655 foodborne disease outbreaks documented in the FoodNet Outbreak Supplement Forms from 2003 through 2010. Excluded outbreaks represented those for which no record existed in FDOSS, data did not support a foodborne outbreak (i.e. other mode of transmission), or exposure occurred in

multiple states. A mean of 180 foodborne disease outbreaks were reported annually (range, 105-251) (Figure 1), and variability in the number and rate of outbreaks reported was observed among sites (Figures 3 and 4). Both year (χ^2 =14.7) (Table 2) and reporting state (χ^2 = 535.4) (Table 3) were significantly associated with a successful outbreak investigation, but neither of these factors significantly affected the outcome of a foodborne investigation when all other factors were considered.

A food vehicle was identified in 692 (48%) of the 1441 outbreaks (Table 1). During 2003 through 2010, the percentage of outbreaks with a food vehicle identified ranged from 37% in 2007 to 55% in 2004 (Figure 5). Approximately 23% of these outbreaks were attributed to multiple food categories and 25% were attributed to a single food category. Of the foodborne disease outbreaks in which the food vehicle could be classified into a single category, meat-poultry and produce were the most common (Figure 6).

An etiologic agent was identified in 1218 (85%) of the 1441 outbreaks (Table 1). Only a small percentage of outbreaks were attributed to multiple etiologies. Of the foodborne disease outbreaks in which the etiologic agent could be classified as a single etiology, viral and bacterial were the most common (Figure 7). Etiology was significantly associated with a successful outbreak investigation (χ^2 = 101.7) (Table 5), but this factor did not significantly affect the outcome of a foodborne investigation when all other factors were considered.

The agencies most often involved in an outbreak investigation were local and/or regional health departments (n=1227; 85%) or 1 or more state health departments (n=925; 64%) (Table 4). Outbreak investigations that involved FDA (OR, 13.6; 95% CI,

4.2-44.5), USDA (OR, 8.8; 95% CI, 2.0, 38.6), state agriculture (OR, 4.7; 95% CI, 2.7-8.3), CDC (OR, 3.1; 95% CI, 1.5-6.5), or 1 or more state health departments (OR, 1.4; 95% CI, 1.1-1.7) were found to be significantly associated with a successful outbreak investigation (Table 4). When all other factors were considered, FDA (χ^2 =22.6) and state agriculture (χ^2 =18.7) were the only agencies whose involvement significantly affected the outcome of a foodborne investigation (Table 6).

The items most commonly included in an outbreak investigation were case interviews (n=674; 47%) or EHS inspection and/or EHSNET evaluation (n=636; 44%) (Table 4). Outbreak investigations in which environmental and/or food cultures were collected (OR, 3.8; 95% CI, 2.4-5.9), state agriculture was contacted (OR, 4.2; 95% CI, 2.3-7.6), conference calls were held (OR, 5.4; 95% CI, 2.5-11.6), case-control studies were conducted (OR, 1.4; 95% CI, 1.04-1.8), or product traceback was done (OR, 1.8; 95% CI, 1.001-3.1) were found to be significantly associated with a successful outbreak investigation (Table 4). Collecting environmental and/or food cultures, conducting case interviews, and conducting case-control studies were the only items whose inclusion significantly affected the outcome of a foodborne outbreak investigation when all other factors were considered (Table 6).

Fecal specimens were tested for bacterial culture in 553 (38%) and for norovirus in 340 (24%) of the 1441 foodborne disease outbreaks (Table 4). Testing more than two fecal specimens via bacterial culture increased the odds of identifying a food vehicle by 30 percent (OR, 1.3; 95% CI, 1.4-1.6). When all other factors were considered, the number of fecal specimens tested for norovirus significantly affected the outcome of a foodborne outbreak investigation (Table 6).

In 688 (48%) of the 1441 foodborne disease outbreaks, more than 10 individuals became ill (Table 4). Outbreaks affecting more than 10 cases contributed to a 30% higher likelihood of identifying a food vehicle as compared with those with 10 or fewer cases (OR, 1.3; 95% CI, 1.0-1.6) (Table 4). When all other factors were considered, outbreak size significantly affected the outcome of a foodborne outbreak investigation (Table 6).

DISCUSSION

Our findings describe the outbreak characteristics associated with a food vehicle being identified and have a few important implications. Foodborne disease outbreak investigations were found to be most successful when environmental and/or food cultures were collected, FDA or state agriculture was involved, and case-control studies were conducted.

During 2003 through 2010, the number of foodborne disease outbreaks reported to FDOSS varied both by year and by reporting state. These variations may be attributed to differences in the resources available—laboratory testing, funding sources, skilled health workers, training opportunities— as well as regional variations in foodborne illnesses. Further research is needed to understand how these factors affect outbreak investigations at the individual state level.

We determined that several of the exposures were significantly associated with a successful outbreak investigation. Having 1 or more regulatory agencies (FDA, USDA, state agriculture) involved in an investigation substantially improved the likelihood of a food vehicle being identified. This is not surprising since state agriculture, FDA or USDA are sometimes not brought into an investigation until there is greater likelihood of

identifiying a specific food [14].The likelihood also increased when either CDC or 1 or more state health departments was involved in the outbreak investigation. These results were consistent with the studies conducted by the National Environmental Health Association (NEHA) [15] and the Environmental Health Specialists Network (EHS-Net) [10], both of which reported that lack of cooperation among health agencies and inavailability of resources may halt progress of an outbreak investigation. To better understand the roles of regional and local health departments, it would be helpful to consider whether the state has a home rule system (i.e. one in which a local or regional health department receives the initial report and relays this information to the state health department) or a centralized system (i.e. one in which a state health department handles the outbreak investigation).We found that investigations which included conference calls, contact with state agriculture, and environmental and/or food cultures were associated with a substantial increase in the odds of a food vehicle being identified. Case-control studies and product traceback were also found to increase these odds. These results are not surprising since doing a product traceback gives the investigators a good idea of which food is responsible for an outbreak [14]. Testing >2 fecal specimens for bacterial culture also proved to be a critical component of a successful outbreak investigation, but testing >3 fecal specimens for norovirus was not associated with an increased likelihood of a food vehicle being identified. These results are somewhat surprising since we would expect that testing more fecal specimens for norovirus would have increased the odds of a food vehicle being identified. There exist no standard methods for identifying a viral agent in foods, which may explain why so few of the outbreaks that tested more than 3 fecal specimens for norovirus resulted in a food vehicle being identified [8]. We were

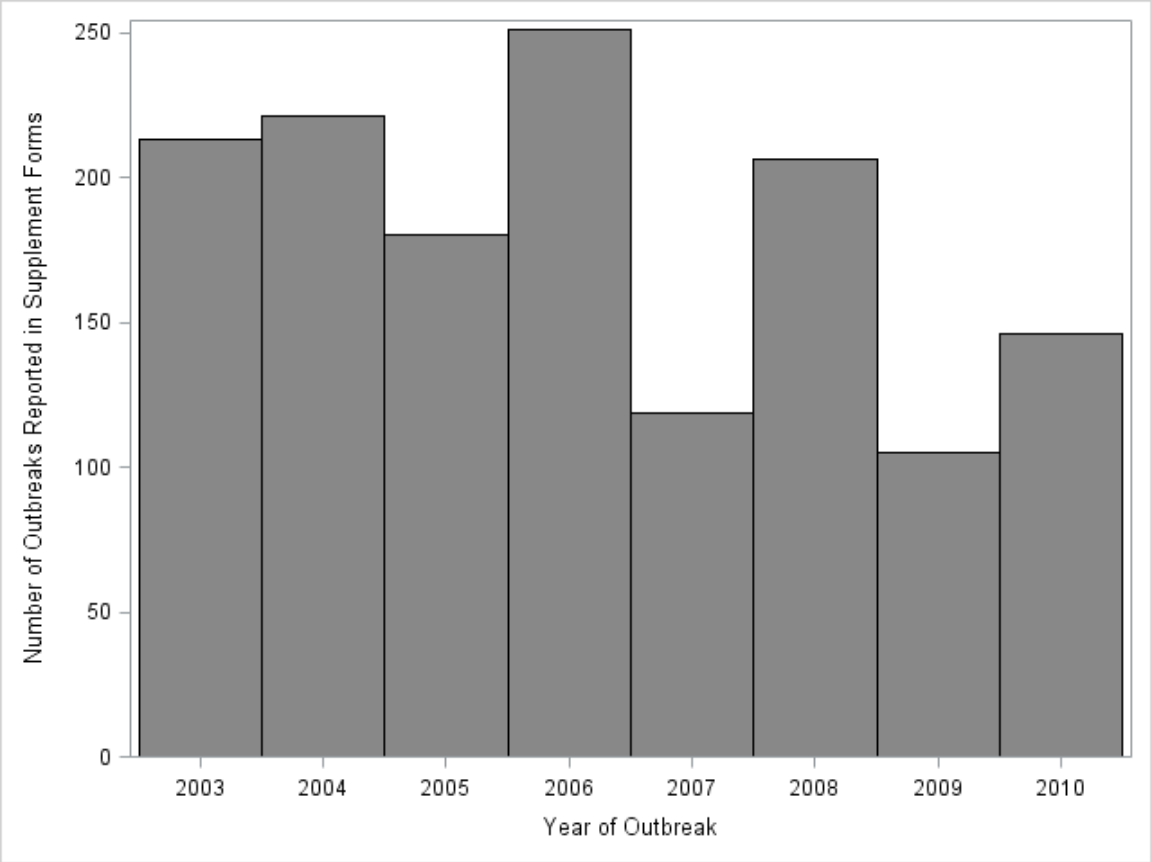
also surprised to learn that neither case interviews nor product recall was associated with an increased likelihood of a food vehicle being identified. Some research [10, 14] suggested that shifting focus toward obtaining food, environmental and stool samples would likely improve the likelihood that a pathogen and food vehicle are identified.

We found that outbreaks affecting more than 10 individuals contributed to a sizable increase in the odds of a food vehicle being identified as compared with those with 10 or fewer cases. Investigations for larger outbreaks also tend to have the resources necessary to conduct epidemiological studies and to collect laboratory specimens [16]. Although attributing illnesses to food may prove difficult even for large outbreaks [16], outbreak size is important because outbreaks with a high number of ill persons are more likely to be detected, reported and investigated [8].

While these results offer insight regarding the characteristics of a successful foodborne outbreak investigation, a major limitation was that the data obtained from the FoodNet Outbreak Supplement Forms may have been incomplete or inaccurate. During 2003-2010, the format of these forms changed and not all questions were asked each year. Most of the variables chosen had a large number of missing values, which we recategorized as “no” when appropriate, so this might have affected our results. Another limitation was that these reports are done voluntarily, so not all outbreaks may be captured. Since we evaluated outbreak characteristics at the 10 sites which participate in the FoodNet active surveillance, our results may not be generalizable to the US population. The number of reported foodborne disease oubreaks at FoodNet sites was similar in pattern of frequency when compared with national data (Figures 1 and 2), which implies that examining outbreaks in FoodNet may provide insight regarding how

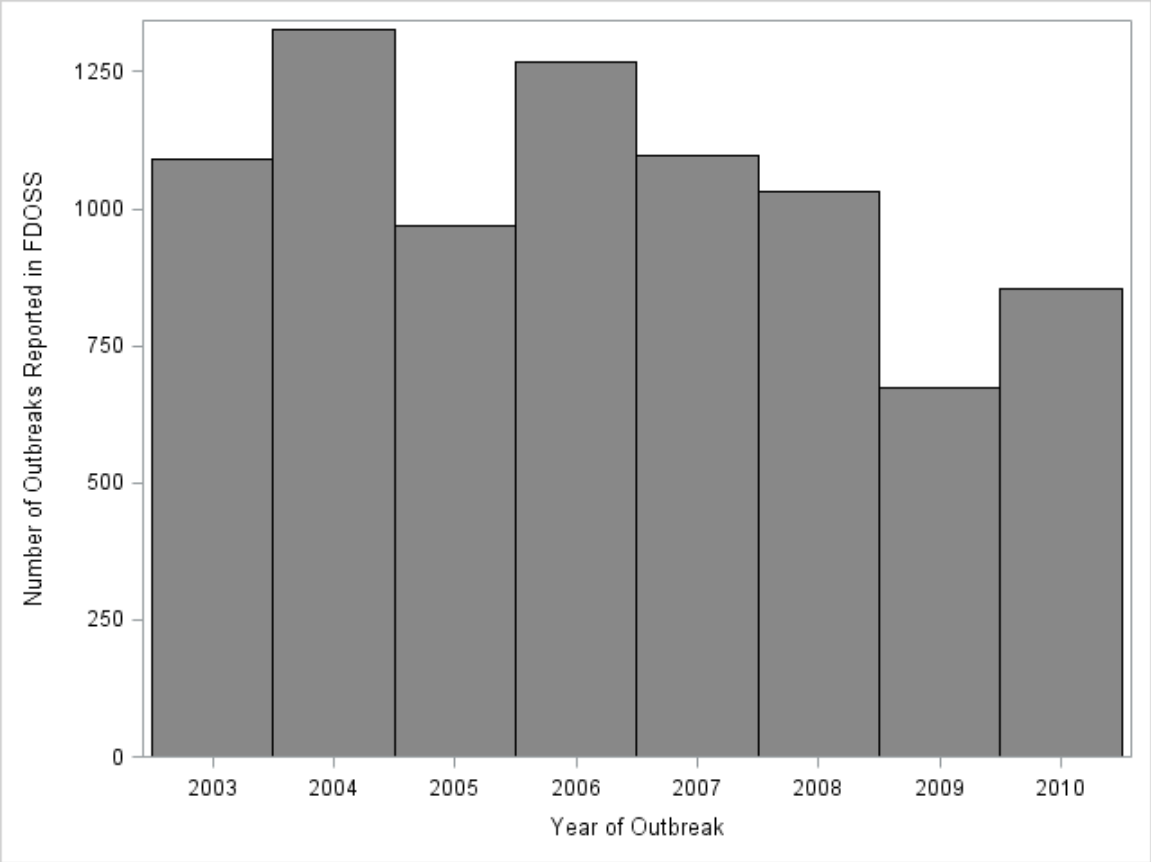
outbreak investigations can be improved. Less than half of foodborne disease outbreaks examined here resulted in a food vehicle being identified. The results of this study suggest that having more robust resources available for outbreak detection and investigation would improve likelihood of a food vehicle being identified.

Figure 1. Number* of foodborne disease outbreaks by year, FoodNet OB Supplement forms, 2003-2010.



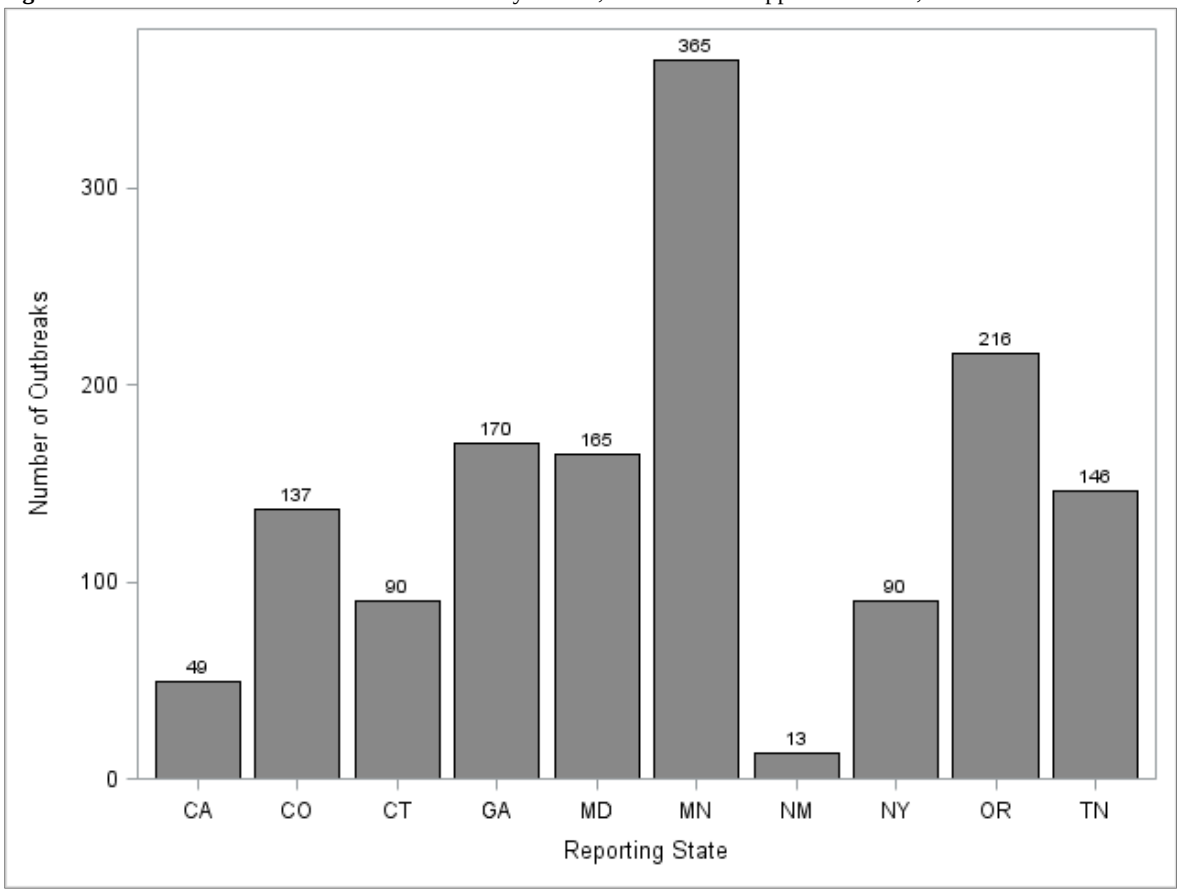
*N=1,441

Figure 2. Number* of foodborne disease outbreaks by year, FDOSS, 2003-2010.



*N=8,311

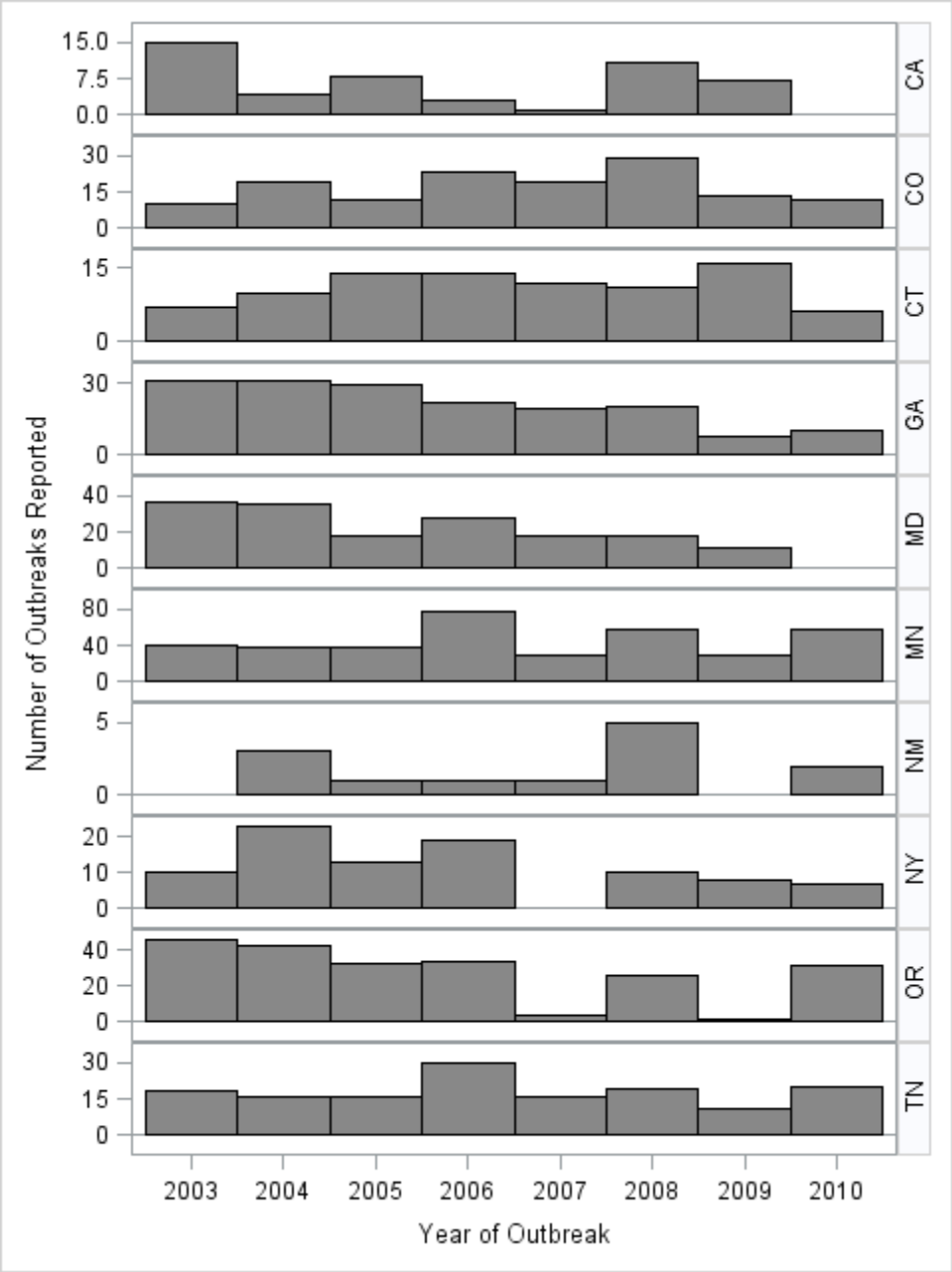
Figure 3. Number* of foodborne disease outbreaks by state**, FoodNet OB Supplement forms, 2003-2010.



*N=1,441

**New York, California, and Colorado only include selected counties in the states in FoodNet, which is why a large state like California has so few outbreaks included in this study.

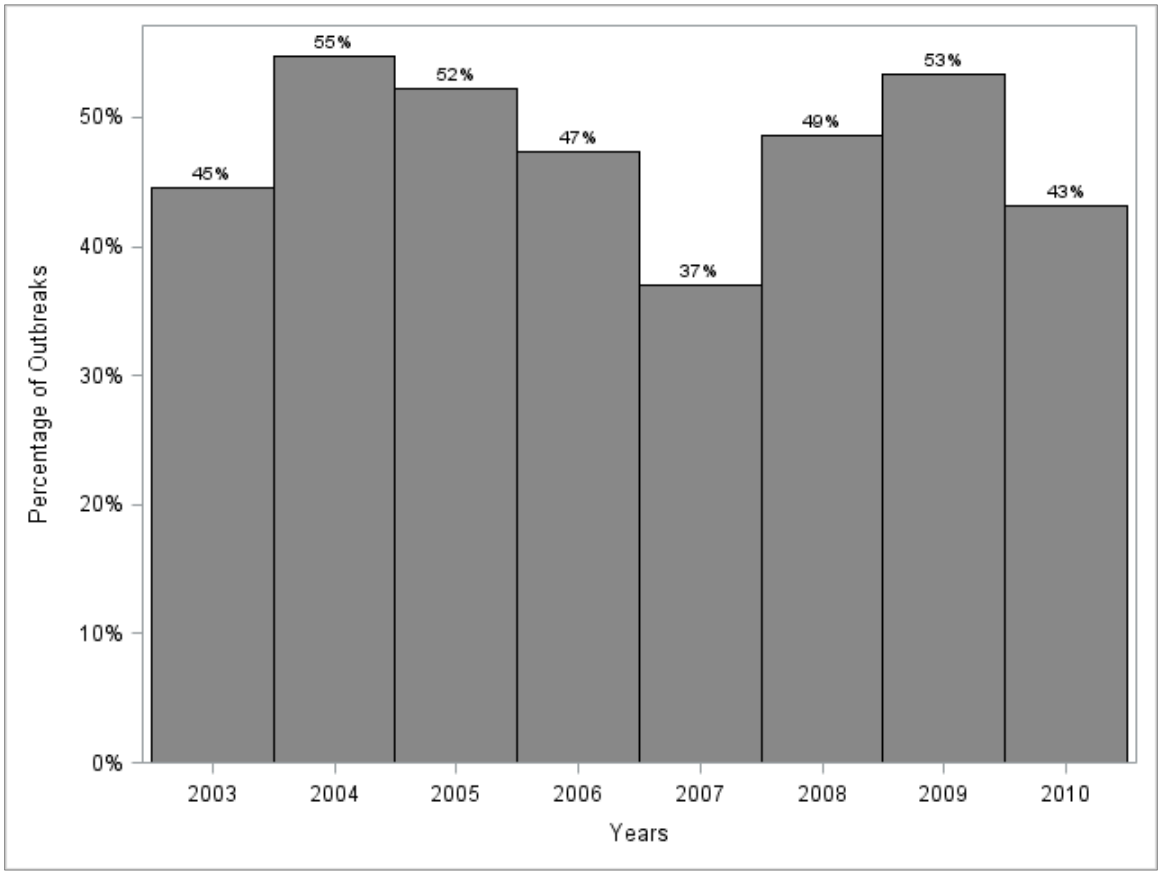
Figure 4. Number* of foodborne disease outbreaks by state** and year, FoodNet OB Supplement forms, 2003-2010.



*N=1,441

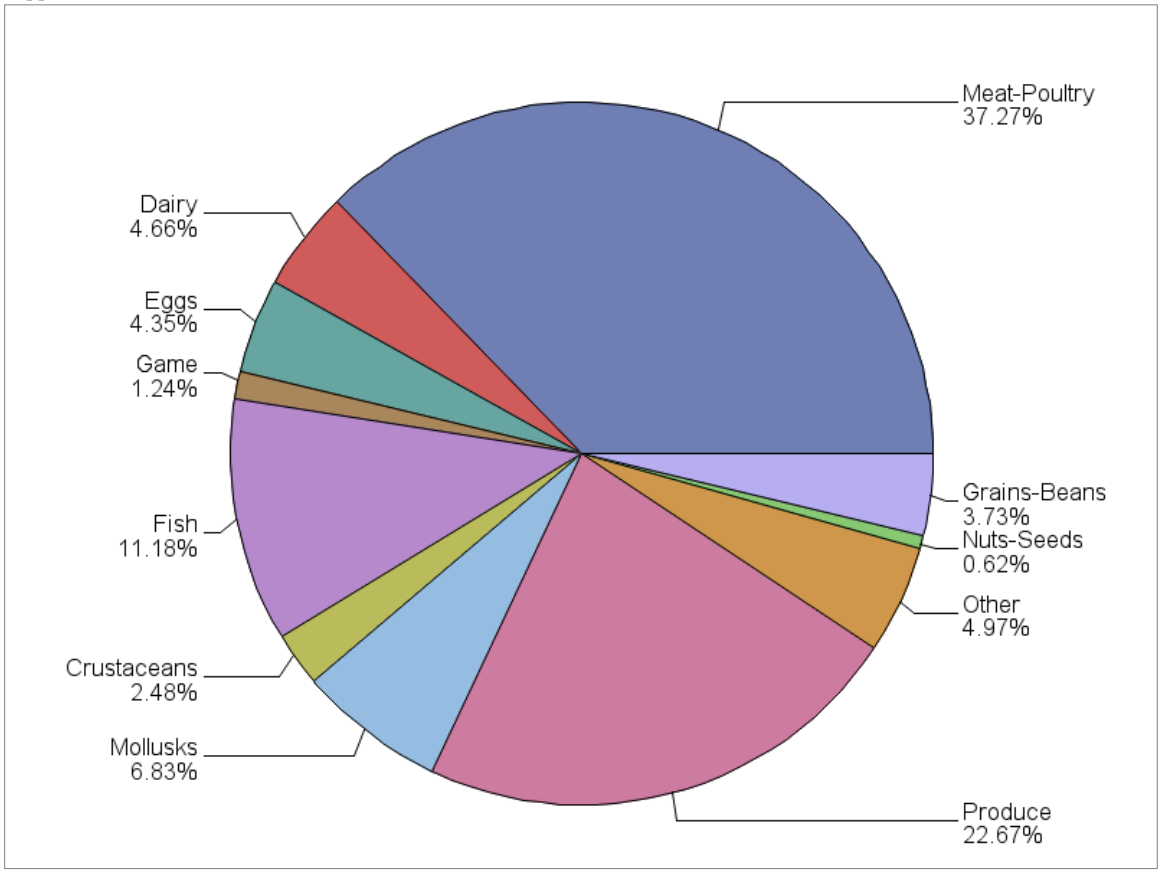
**New York, California, and Colorado only include selected counties in the states in FoodNet, which is why a large state like California has so few outbreaks included in this study. The reporting rate for New Mexico is consistently lower than the other states, which helps to explain why this state has so few outbreaks included in this study.

Figure 5. Percentage of foodborne disease outbreaks with food vehicle(s) identified* by year, FoodNet OB Supplement forms, 2003-2010



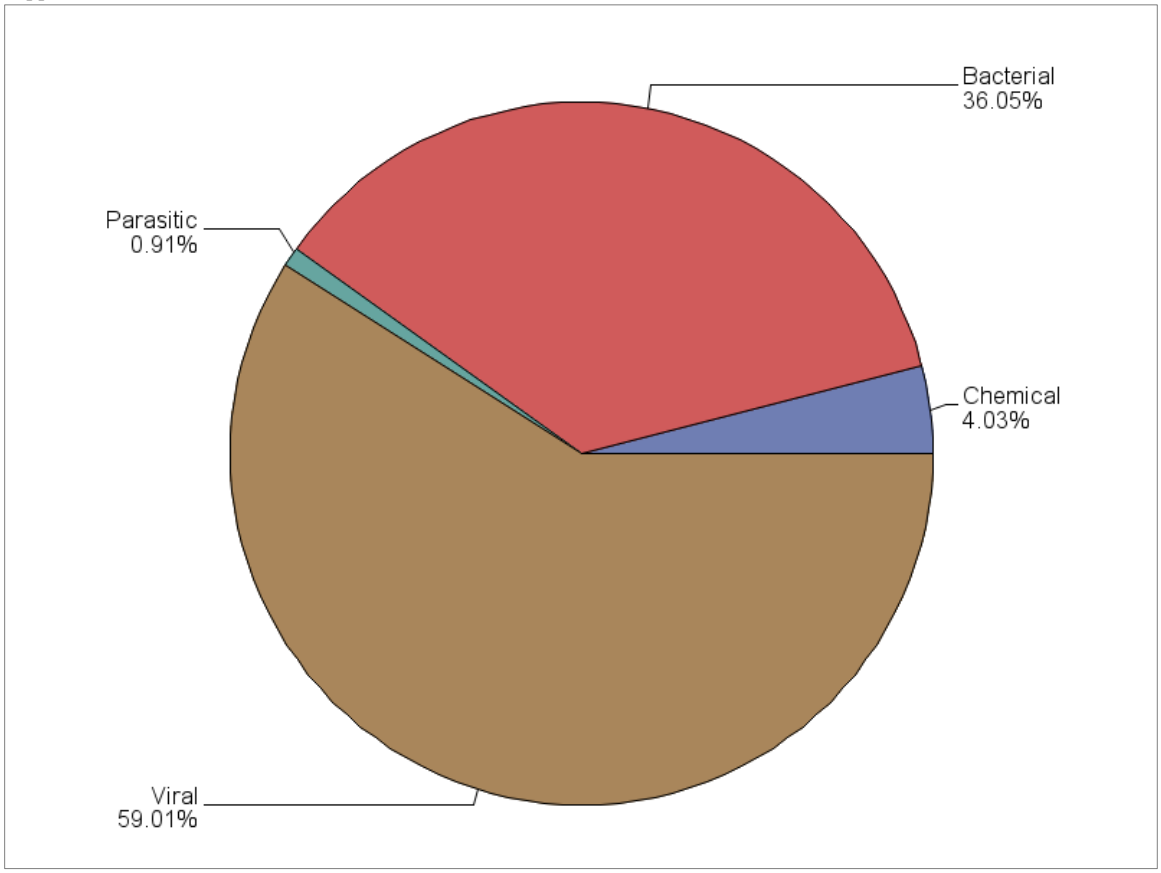
*n=692 (48.0%) of the total 1,441 foodborne disease outbreaks reported in the supplement forms

Figure 6. Percentage of foodborne disease outbreaks with a single food vehicle identified* by category, FoodNet OB Supplement forms, 2003-2010.



*N=322

Figure 7. Percentage of foodborne disease outbreaks with a single etiology identified* by etiology group, FoodNet OB Supplement forms, 2003-2010.



*N=1215

Table 1. Summary of descriptive statistics of foodborne disease outbreaks, FoodNet OB Supplement forms, 2003-2010.

	No. (%)
Total number of foodborne disease outbreaks	1441
Outbreaks in which a food vehicle was identified	692 (48.0)
Outbreaks in which an etiologic agent was identified	1218 (84.5)
Outbreaks in which case interviews were included	674 (46.8)
Outbreaks in which case-control studies were included	228 (15.8)
Outbreaks in which food/environmental samples were collected	113 (7.8)
Outbreaks in which product traceback and/or recall were included	66 (4.6)

Table 2. Univariate analysis of the year during which a foodborne disease outbreak occurred, FoodNet OB Supplement forms, 2003-2010.

Year of Outbreak	Food Vehicle Identified, No. (%)		Chi-Square	Significance (p-value)
	Yes	No		
2003	95 (6.7)	118 (8.2)	14.7	0.0396*
2004	121 (8.4)	100 (6.9)		
2005	94 (6.5)	86 (6.0)		
2006	119 (8.3)	132 (9.2)		
2007	44 (3.1)	75 (5.2)		
2008	100 (6.9)	106 (7.4)		
2009	56 (3.9)	49 (3.4)		
2010	63 (4.4)	83 (5.8)		

*This variable was significant at alpha=0.05.

Table 3. Univariate analysis of the state where a foodborne disease outbreak occurred, FoodNet OB Supplement forms, 2003-2010.

Reporting State	**Food Vehicle Identified, No. (%)**		**Chi-Square**	**Significance (p-value)**
	Yes	No		
California	22 (1.5)	27 (1.9)	535.4	<0.0001*
Colorado	63 (4.4)	74 (5.1)		
Connecticut	59 (4.1)	31 (2.2)		
Georgia	72 (5.0)	98 (6.8)		
Maryland	82 (5.7)	83 (5.8)		
Minnesota	195 (13.5)	170 (11.8)		
New Mexico	2 (0.1)	11 (0.8)		
New York	58 (4.0)	32 (2.2)		
Oregon	71 (4.9)	145 (10.1)		
Tennessee	68 (4.7)	78 (5.4)		

*This variable was significant at alpha=0.05.

Table 4. Univariate analysis of outbreak characteristics, FoodNet OB Supplement forms, 2003-2010.

Outbreak Characteristic			Food Vehicle Identified, No. (%)		Odds ratio (95% CI)	Significance (p-value)
			Yes	No		
Agencies substantially involved in investigation	Local &/or regional health depts.	Yes No	580 (40.3) 112 (7.8)	647 (44.9) 102 (7.1)	0.82 (0.61, 1.1)	0.1710
	1 or more state health depts.	Yes No	471 (32.7) 221 (15.3)	454 (31.5) 295 (20.5)	1.4 (1.1, 1.7)	0.0032**
	FoodNet group	Yes No	58 (4.0) 634 (44.0)	44 (3.1) 705 (48.9)	1.5 (0.98, 2.2)	0.0638
	CDC	Yes No	28 (1.9) 664 (46.1)	10 (0.7) 739 (51.3)	3.1 (1.5, 6.5)	0.0013**
	FDA	Yes No	36 (2.5) 656 (45.5)	3 (0.2) 746 (51.8)	13.6 (4.2, 44.5)	<0.0001**
	USDA	Yes No	16 (1.1) 676 (46.9)	2 (0.1) 747 (51.9)	8.8 (2.0, 38.6)	0.0005**
	State agriculture	Yes No	65 (4.5) 627 (43.5)	16 (1.1) 733 (50.9)	4.7 (2.7, 8.3)	<0.0001**
Items included in investigation	Active case finding	Yes No	122 (8.5) 570 (39.5)	114 (7.9) 635 (44.1)	1.2 (0.90, 1.6)	0.2168
	Case interviews	Yes No	307 (21.3) 385 (26.7)	367 (25.5) 382 (26.5)	0.83 (0.67, 1.02)	0.0781
	Chart or record review	Yes No	9 (0.6) 683 (47.4)	12 (0.8) 737 (51.2)	0.81 (0.34, 1.9)	0.6332
	Case-control study	Yes No	125 (8.7) 567 (39.4)	103 (7.2) 646 (44.8)	1.4 (1.04, 1.8)	0.0250**
	Cohort study	Yes No	122 (8.5) 570 (39.6)	123 (8.5) 626 (43.4)	1.1 (0.83, 1.4)	0.5419
	EHS inspection &/or EHSNET evaluation	Yes No	296 (20.5) 396 (27.5)	340 (23.6) 409 (28.4)	0.90 (0.73, 1.1)	0.3171
	Environmental &/or food cultures	Yes No	86 (6.0) 606 (42.0)	27 (1.9) 722 (50.1)	3.8 (2.4, 5.9)	<0.0001**
	Product traceback	Yes No	32 (2.2) 660 (45.8)	20 (1.4) 729 (50.6)	1.8 (1.001, 3.1)	0.0469**
	Product recall	Yes No	6 (0.4) 686 (47.6)	8 (0.6) 741 (51.4)	0.81 (0.28, 2.3)	0.6975
	Contact with state agriculture	Yes No	51 (3.5) 641 (44.5)	14 (1.0) 735 (51.0)	4.2 (2.3, 7.6)	<0.0001**
	Conference calls	Yes No	38 (2.6) 654 (45.4)	8 (0.6) 741 (51.4)	5.4 (2.5, 11.6)	<0.0001**
No. fecal specimens tested via specified methods*	Bacterial culture	>2 ≤ 2	287 (19.9) 405 (28.1)	266 (18.5) 483 (33.5)	1.3 (1.04, 1.6)	0.0201**
	Norovirus	>3 ≤ 3	143 (9.9) 549 (38.1)	197 (13.7) 552 (38.3)	0.73 (0.57, 0.93)	0.0118**
No. cases in outbreak*	Greater than 10 Less than or equal to 10		352 (24.4) 340 (23.6)	336 (23.3) 413 (28.7)	1.3 (1.03, 1.6)	0.0226**

*Since the distribution of these variables was very positively skewed and each of them had so many different values, the median values were used as cut-off points for these analyses.
**These variables were significant at alpha=0.05.

Table 5. Univariate analysis of types of etiologic agents identified for a specific foodborne disease outbreak, FoodNet OB Supplement forms, 2003-2010.

Type of etiologic agent	**Food Vehicle Identified, No. (%)**		**Chi-Square**	**Significance (p-value)**
	Yes	No		
Viral	278 (19.3)	439 (30.5)	101.7	<0.0001*
Unknown	88 (6.1)	135 (9.4)		
Parasitic	8 (0.6)	3 (0.2)		
Chemical	44 (3.1)	5 (0.4)		
Bacterial	271 (18.9)	167 (11.6)		

*This variable was significant at alpha=0.05.

Table 6. Summary of stepwise selection for multivariate analysis of outbreak characteristics, FoodNet OB Supplement forms, 2003-2010.*

Outbreak Characteristic		Odds ratio (95% CI)	DF	Score Chi-Square	Wald Chi-Square	Pr > ChiSq
Entered	**Removed**					
Environmental &/or Food Cultures		3.8 (2.4, 5.9)	1	38.7		<0.0001**
FDA		13.6 (4.2, 44.5)	1	22.6		<0.0001**
State Agriculture		4.7 (2.7, 8.3)	1	18.7		<0.0001**
Case Interviews		0.83 (0.67, 1.02)	1	12.8		0.0004**
Outbreak Size Group (>10, ≤ 10 cases)		1.3 (1.03, 1.6)	1	6.4		0.0116**
Case-Control Study		1.4 (1.04, 1.8)	1	4.3		0.0386**
No. Fecal Specimens Tested for Norovirus (>3, ≤ 3)		0.73 (0.57, 0.93)	1	4.2		0.0400**
No. Fecal Specimens Tested via Bacterial Culture (>2, ≤ 2)		1.3 (1.04, 1.6)	1	3.5		0.0630
	No. Fecal Specimens Tested via Bacterial Culture (>2, ≤ 2)	1.3 (1.04, 1.6)	1		3.5	0.0632

*Chi-square value for model: χ^2_{HF} (df=7) = 1.59; Prob > χ^2_{HF} = 0.9789.
**These variables were significant at alpha=0.05.

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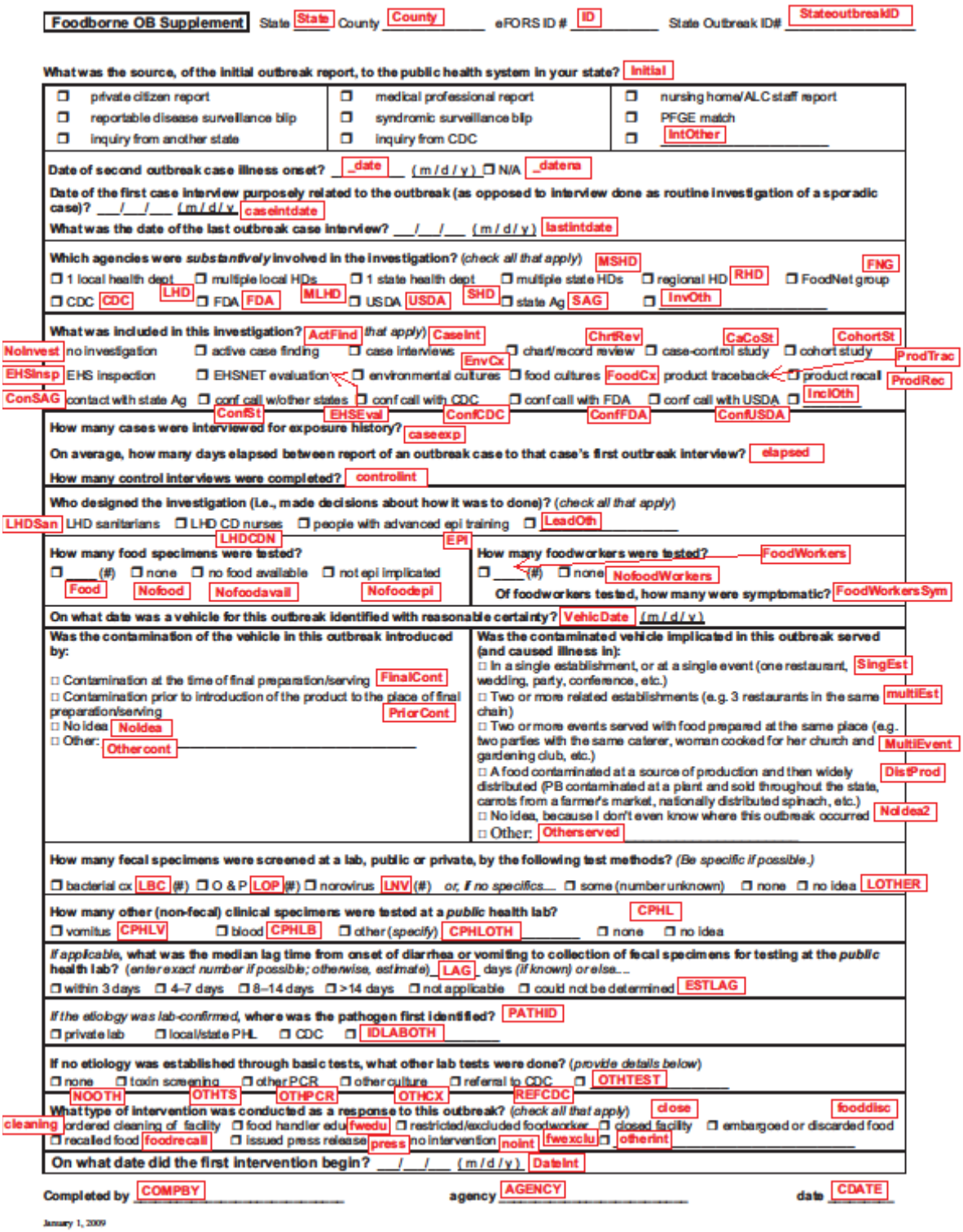
Appendix A: Annotated Foodborne OB Supplement Form



Foodborne OB Supplement State [State] County [County] eFORS ID # [ID] State Outbreak ID# [StateoutbreakID]

What was the source, of the initial outbreak report, to the public health system in your state? [Initial]

❒ private citizen report	❒ medical professional report	❒ nursing home/ALC staff report
❒ reportable disease surveillance blip	❒ syndromic surveillance blip	❒ PFGE match
❒ inquiry from another state	❒ inquiry from CDC	❒ [IntOther]

Date of second outbreak case illness onset? [_date] (m / d / y) ❒ N/A [_datena]

Date of the first case interview purposely related to the outbreak (as opposed to interview done as routine investigation of a sporadic case)? ___/___/___ (m / d / y) [caseintdate]

What was the date of the last outbreak case interview? ___/___/___ (m / d / y) [lastintdate]

Which agencies were *substantively* involved in the investigation? *(check all that apply)* [MSHD]

❒ 1 local health dept ❒ multiple local HDs ❒ 1 state health dept ❒ multiple state HDs ❒ regional HD [RHD] ❒ FoodNet group [FNG]

❒ CDC [CDC] [LHD] ❒ FDA [FDA] [MLHD] ❒ USDA [USDA] [SHD] ❒ state Ag [SAG] ❒ [InvOth]

What was included in this investigation? [ActFind] *that apply)* [CaseInt]

[NoInvest] no investigation ❒ active case finding ❒ case interviews [ChrtRev] ❒ chart/record review ❒ case-control study [CaCoSt] ❒ cohort study [CohortSt]

[EHSInsp] EHS inspection ❒ EHSNET evaluation [EnvCx] ❒ environmental cultures ❒ food cultures [FoodCx] product traceback [ProdTrac] ❒ product recall [ProdRec]

[ConSAG] contact with state Ag ❒ conf call w/other states [ConfSt] ❒ conf call with CDC [EHSEval] ❒ conf call with FDA [ConfCDC] ❒ conf call with USDA [ConfFDA] ❒ [InclOth] [ConfUSDA]

How many cases were interviewed for exposure history? [caseexp]

On average, how many days elapsed between report of an outbreak case to that case's first outbreak interview? [elapsed]

How many control interviews were completed? [controlInt]

Who designed the investigation (i.e., made decisions about how it was to be done)? *(check all that apply)*

[LHDSan] LHD sanitarians ❒ LHD CD nurses [LHDCDN] ❒ people with advanced epi training [EPI] ❒ [LeadOth]

How many food specimens were tested?

❒ ____(#) ❒ none ❒ no food available ❒ not epi implicated

[Food] [Nofood] [Nofoodavail] [Nofoodepi]

How many foodworkers were tested? [FoodWorkers]

❒ ____(#) ❒ none [NofoodWorkers]

Of foodworkers tested, how many were symptomatic? [FoodWorkersSym]

On what date was a vehicle for this outbreak identified with reasonable certainty? [VehicDate] (m / d / y)

Was the contamination of the vehicle in this outbreak introduced by:

□ Contamination at the time of final preparation/serving [FinalCont]

□ Contamination prior to introduction of the product to the place of final preparation/serving [PriorCont]

□ No idea [Noidea]

□ Other: [Othercont] _____

Was the contaminated vehicle implicated in this outbreak served (and caused illness in):

□ In a single establishment, or at a single event (one restaurant, wedding, party, conference, etc.) [SingEst]

□ Two or more related establishments (e.g. 3 restaurants in the same chain) [multiEst]

□ Two or more events served with food prepared at the same place (e.g. two parties with the same caterer, woman cooked for her church and gardening club, etc.) [MultiEvent]

□ A food contaminated at a source of production and then widely distributed (PB contaminated at a plant and sold throughout the state, carrots from a farmer's market, nationally distributed spinach, etc.) [DistProd]

□ No idea, because I don't even know where this outbreak occurred [Noidea2]

□ Other: [Otherserved] _____

How many fecal specimens were screened at a lab, public or private, by the following test methods? *(Be specific if possible.)*

❒ bacterial cx [LBC] (#) ❒ O & P [LOP] (#) ❒ norovirus [LNV] (#) *or, if no specifics…* ❒ some (number unknown) ❒ none ❒ no idea [LOTHER]

How many other (non-fecal) clinical specimens were tested at a *public* health lab? [CPHL]

❒ vomitus [CPHLV] ❒ blood [CPHLB] ❒ other *(specify)* [CPHLOTH] _____ ❒ none ❒ no idea

***If applicable*, what was the median lag time from onset of diarrhea or vomiting to collection of fecal specimens for testing at the *public* health lab?** *(enter exact number if possible; otherwise, estimate)* [LAG] days *(if known) or else…*

❒ within 3 days ❒ 4–7 days ❒ 8–14 days ❒ >14 days ❒ not applicable ❒ could not be determined [ESTLAG]

***If the etiology was lab-confirmed*, where was the pathogen first identified?** [PATHID]

❒ private lab ❒ local/state PHL ❒ CDC ❒ [IDLABOTH] _____

If no etiology was established through basic tests, what other lab tests were done? *(provide details below)*

❒ none ❒ toxin screening ❒ other PCR ❒ other culture ❒ referral to CDC ❒ [OTHTEST] _____

[NOOTH] [OTHTS] [OTHPCR] [OTHCX] [REFCDC]

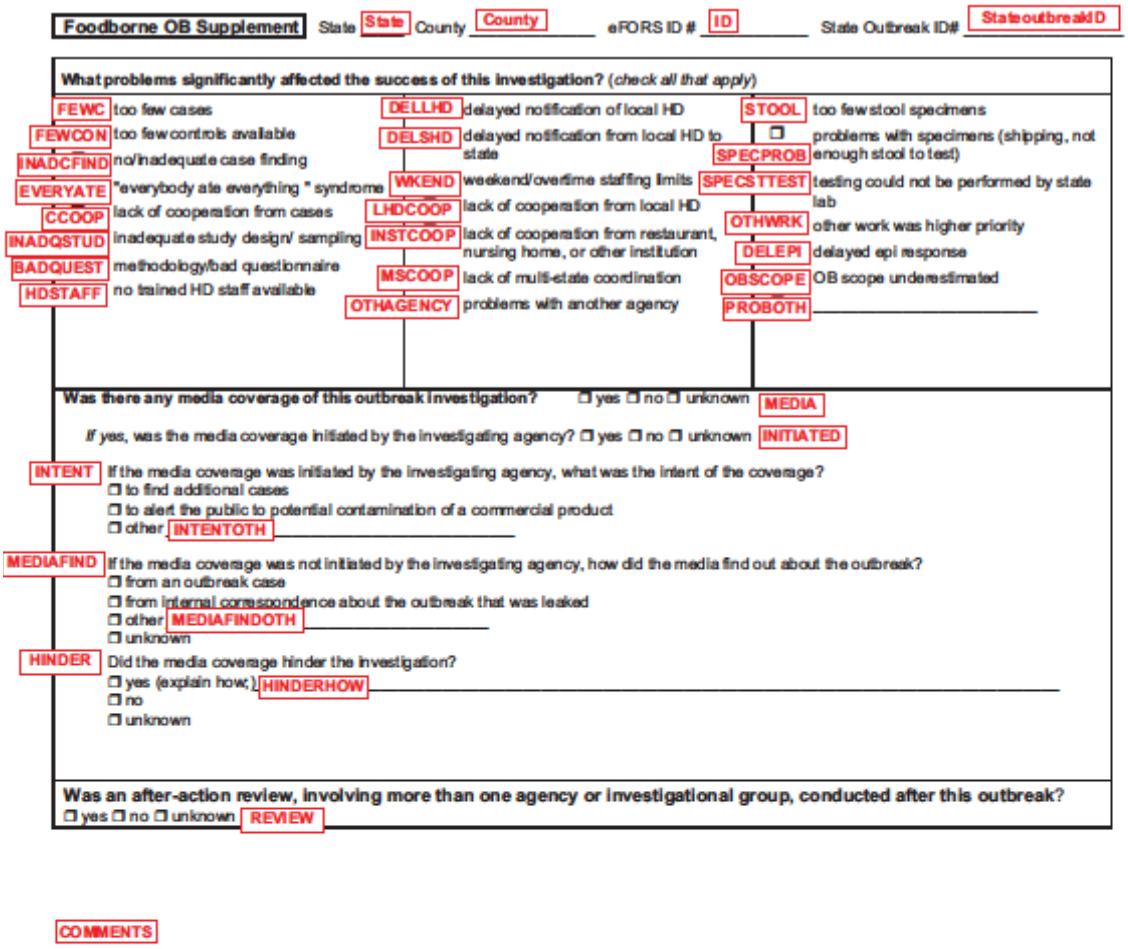
What type of intervention was conducted as a response to this outbreak? *(check all that apply)* [close] [fooddisc] [cleaning]

❒ ordered cleaning of facility ❒ food handler edu [fwedu] ❒ restricted/excluded foodworker ❒ closed facility ❒ embargoed or discarded food ❒ recalled food [foodrecall] ❒ issued press release [press] no intervention [noint] [fwexclu] ❒ [otherint] _____

On what date did the first intervention begin? ___/___/___ (m / d / y) [DateInt]

Completed by [COMPBY] _____ **agency** [AGENCY] _____ **date** [CDATE] _____

January 1, 2009


Foodborne OB Supplement
State State
County County
eFORS ID # ID
State Outbreak ID# StateoutbreakID
What problems significantly affected the success of this investigation? (check all that apply)
FEWC too few cases
FEWCON too few controls available
INADCFIND no/inadequate case finding
EVERYATE "everybody ate everything" syndrome
CCOOP lack of cooperation from cases
INADQSTUD inadequate study design/ sampling
BADQUEST methodology/bad questionnaire
HDSTAFF no trained HD staff available
DELLHD delayed notification of local HD
DELSHD delayed notification from local HD to state
WKEND weekend/overtime staffing limits
LHDCOOP lack of cooperation from local HD
INSTCOOP lack of cooperation from restaurant, nursing home, or other institution
MSCOOP lack of multi-state coordination
OTHAGENCY problems with another agency
STOOL too few stool specimens
SPECPROB problems with specimens (shipping, not enough stool to test)
SPECSTTEST testing could not be performed by state lab
OTHWRK other work was higher priority
DELEPI delayed epi response
OBSCOPE OB scope underestimated
PROBOTH
Was there any media coverage of this outbreak investigation? yes no unknown MEDIA
If yes, was the media coverage initiated by the investigating agency? yes no unknown INITIATED
INTENT If the media coverage was initiated by the investigating agency, what was the intent of the coverage?
to find additional cases
to alert the public to potential contamination of a commercial product
other INTENTOTH
MEDIAFIND If the media coverage was not initiated by the investigating agency, how did the media find out about the outbreak?
from an outbreak case
from internal correspondence about the outbreak that was leaked
other MEDIAFINDOTH
unknown
HINDER Did the media coverage hinder the investigation?
yes (explain how;) HINDERHOW
no
unknown
Was an after-action review, involving more than one agency or investigational group, conducted after this outbreak?
yes no unknown REVIEW
COMMENTS
Completed by COMPBY
agency AGENCY
date CDATE
January 1, 2009

Appendix B: eFORS Reporting Form

Form approved OMB No. 0920-0004

Electronic **F**oodborne **O**utbreak **R**eporting **S**ystem

Investigation of a Foodborne Outbreak

This form is used to report foodborne disease outbreak investigations to CDC. It is also used to report *Salmonella* Enteritidis and *E. coli* O157:H7 outbreak investigations involving any mode of transmission. 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 6 parts. Part 1 asks for the minimum or basic information needed and must be completed for the investigation to be counted in the CDC annual summary. Part 2 asks for additional information for any foodborne outbreak, while Parts 3 – 6 ask for information concerning specific vehicles or etiologies. Please complete as much of all parts as possible.

CDC Use Only
__-_____

State Use Only
_____

Part 1: Basic Information

1. Report Type

A.
□ Please check if this a final report

B.
□ Please check if data does not support a FOODBORNE outbreak

2. Number of Cases

Lab-confirmed cases_____(A)
Including _____ secondary cases

Probable cases_____(B)
Including _____ secondary cases

Estimated total ill_____
(If greater than sum A + B)

3. Dates
Please enter as many dates as possible

Date first case became ill __ __/__ __/__ __ __ __
Month Day Year

Date last case became ill __ __/__ __/__ __ __ __
Month Day Year

Date first known exposure __ __/__ __/__ __ __ __
Month Day Year

Date last known exposure __ __/__ __/__ __ __ __
Month Day Year

4. Location of Exposure

Reporting state _____

If multiple states involved:
□ Exposure occurred in multiple states
□ Exposure occurred in single state, but cases resided in multiple states
Other states: _____
_____
_____

Reporting county_____

If multiple counties involved:
□ Exposure occurred in multiple counties
□ Exposure occurred in one county, but cases resided in multiple counties
Other counties: _____
_____
_____

5. Approximate Percentage of Cases in Each Age Group

<1 year ____% 20-49 yrs ____%
1-4 yrs ____% ≥50 yrs ____%
5-19 yrs ____% Unknown ____%

6. Sex
(Estimated percent of the total cases)

Male_____%

Female_____%

7. Investigation Methods (Check all that apply)
□ Interviews of only cases
□ Case-control study
□ Food preparation review
□ Cohort study
□ Investigation at factory or production plant
□ Investigation at original source (farm, marine estuary, etc.)
□ Food product traceback
□ Environment / food sample cultures

8. Implicated Food(s): (Please provide known information)

Name of Food	Main Ingredient(s)	Contaminated Ingredient(s)	Reason(s) Suspected (See codes just below)	Method of Preparation (See attached codes)
e.g., Lasagna	e.g., Pasta, sauce, eggs, beef	e.g., Eggs	e.g., 4	e.g., M1
1)				
2)				
3)				

□ Food vehicle undetermined

Reason Suspected (List above 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

CDC 52.13 revised November, 2004

Public reporting burden of this collection of information is estimated to average 20 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to CDC/ATSDR Reports Clearance Officer; 1600 Clifton Road N.E. MS D-74, Atlanta, Georgia 30333; ATTN: PRA (0920-0004).

9. Etiology: (Name the bacteria, virus, parasite, or toxin. If available, include the serotype and other characteristics such as phage type, virulence factors, and metabolic profile. Confirmation criteria available at http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm or MMWR2000/Vol. 49/SS-1/App. B)

Etiology		Serotype	Other Characteristics (e.g., phage type)	Detected In (See codes just below)
1)	□ Confirmed			
2)	□ Confirmed			
3)	□ Confirmed			

□ Etiology undetermined

Detected In (List above all that apply)

1 – Patient Specimen(s) 3 -Environment specimen(s)

2 – Food Specimen(s) 4 - Food Worker specimen(s)

10. Isolate Subtype

State Lab ID	PFGE (PulseNet designation)	PFGE (PulseNet designation)	
1)			
2)			
3)			

11. Contributing Factors (Check all that apply. See attached codes and explanations)

□ **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*)

Part 2: Additional Information

12. Symptoms, Signs and Outcomes

Feature	Cases with outcome/ feature	Total cases for whom you have information available
Healthcare provider visit		
Hospitalization		
Death		
Vomiting		
Diarrhea		
Bloody stools		
Fever		
Abdominal cramps		
HUS or TTP		
Asymptomatic		
*		
*		
*		

13. Incubation Period
(Circle appropriate units)

Shortest_____(Hours, Days)
Longest_____(Hours, Days)
Median _____(Hours, Days)
□ Unknown

14. Duration of 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	Headache	Tachycardia
Arthralgia	Hypotension	Temperature reversal
Bradycardia	Itching	Thrombocytopenia
Bullous skin lesions	Jaundice	Urticaria
Coma	Lethargy	Wheezing
Cough	Myalgia	
Descending paralysis	Paresthesia	
Diplopia	Septicemia	
Flushing	Sore throat	

15. If Cohort Investigation Conducted:

Attack rate* = _____ (Exposed and ill) / _____ (Total number exposed for whom you have illness information) x 100 = _____%

* The attack rate is applied to persons in a cohort who were exposed to the implicated vehicle. The numerator is the number of persons who were exposed and became ill; the denominator is the total number of persons exposed to the implicated vehicle. If the vehicle is unknown, then the attack rate should not be calculated.

16. Location Where Food Was Prepared
(Check all that apply)

□Restaurant or deli
□ Day care center
□ School
□ Office setting
□ Workplace cafeteria
□ Banquet Facility
□ Picnic
□ Caterer
□ Grocery Store
□ Nursing home
□ Prison, jail
□ Private home
□ Workplace, not cafeteria
□ Wedding reception
□ Church, temple, etc
□ Camp
□ Contaminated food imported into U.S.
□ Hospital
□ Fair, festival, other temporary/ mobile services
□ Commercial product, served without further preparation
□ Unknown or undetermined
□ Other (Describe) _____

17. Location of Exposure or Where Food Was Eaten
(Check all that apply)

□ Restaurant or deli
□ Day care center
□ School
□ Office Setting
□ Workplace cafeteria
□ Banquet Facility
□ Picnic
□ Grocery Store
□ Fair, festival, temporary/ mobile service
□ Unknown or undetermined
□ Other (Describe) _____
□ Nursing Home
□ Prison, jail
□ Private home
□ Workplace, not cafeteria
□ Wedding Reception
□ Church, temple, etc.
□ Camp
□ Hospital

18. Trace back
□ Please check if trace back conducted

Source to which trace back led:

Source (e.g., Chicken farm, Tomato processing plant)	Location of Source State	Country	Comments

CDC 52.13 revised November, 2004

19. Recall
☐ Please check if any food product recalled

Recall Comments

20. Available Reports (Please attach)
☐ Unpublished agency report
☐ Epi-Aid report
☐ Publication (please reference if not attached)

21. Agency reporting this outbreak

Contact person:
Name _____
Title _____
Phone _____
Fax _____
E-mail _____

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

Part 3: School Questions

1. Did the outbreak involve a single or multiple schools?
☐ Single
☐ Multiple (*If yes*, number of schools ____)

2. School characteristics (for all involved students in all involved schools)
a. Total approximate enrollment
_____ (number of students)
☐ Unknown or Undetermined

b. Grade level(s) (Please check all grades affected)
☐ Preschool
☐ Grade School (grades K-12)
Please check all grades affected: ☐K ☐1st ☐2nd ☐3rd ☐4th ☐5th ☐6th ☐7th ☐8th ☐9th ☐10th ☐11th ☐12th
☐ College/University/Technical School
☐ Unknown or Undetermined

c. Primary funding of involved school(s)
☐ Public ☐ Private ☐ Unknown or Undetermined

3. Describe the preparation of the implicated item:
☐ Heat and serve (item mostly prepared or cooked off-site, reheated on-site)
☐ Served a-la-carte
☐ Serve only (preheated or served cold)
☐ Cooked on site using primary ingredients
☐ Provided by a food service management company
☐ Provided by a fast food vendor
☐ Provided by a pre-plate company
☐ Part of a club/ fundraising event
☐ Made in the classroom
☐ Brought by a student/teacher/parent
☐ Other _____
☐ Unknown or Undetermined

4. How many times has the state, county or local health department inspected this school cafeteria or kitchen in the 12 months before the outbreak?*
☐ Once
☐ Twice
☐ More than two times
☐ Not inspected
☐ Unknown or Undetermined

5. Does the school have a HACCP plan in place for the school feeding program?*
☐ Yes
☐ No
☐ Unknown or Undetermined

*If there are multiple schools involved, please answer according to the most affected school

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6. Was implicated food item provided to the school through the National School Lunch/Breakfast Program?

- ☐ Yes
- ☐ No
- ☐ Unknown or Undetermined

If Yes, **Was the implicated food item donated/purchased by :**

- ☐ USDA through the Commodity Distribution Program
- ☐ Purchased commercially by the state/school authority
- ☐ Other_____
- ☐ Unknown or Undetermined

Part 4: Ground Beef

1. What percentage of ill persons (for whom information is available) ate ground beef raw or undercooked? _____%

2. Was ground beef case ready? (Ground beef that comes from a manufacturer packaged for sale and not altered or repackaged by the retailer)

- ☐ Yes
- ☐ No
- ☐ Unknown or Undetermined

3. Was the beef ground or reground by the retailer?

- ☐ Yes
- ☐ No
- ☐ Unknown or Undetermined

If yes, was anything added to the beef during grinding (e.g., shop trim or any product to alter the fat content)_____

Part 5: Mode of Transmission

(Enterohemorrhagic *E. coli* or *Salmonella* Enteritidis only)

1. Mode of Transmission (for greater than 50% of cases)

Select one:

- ☐ Food
- ☐ Person to person
- ☐ Swimming or recreational water
- ☐ Drinking water
- ☐ Contact with animals or their environment
- ☐ Unknown or Undetermined

Part 6: Additional Egg Questions

1. Were Eggs: (Check all that apply)

- ☐ in-shell, un-pasteurized?
- ☐ in-shell, pasteurized?
- ☐ liquid or dry egg product?
- ☐ stored with inadequate refrigeration during or after sale?
- ☐ consumed raw?
- ☐ consumed undercooked?
- ☐ pooled?

2. If eggs traced back to farm, was *Salmonella* Enteritidis found on the farm?

- ☐ Yes
- ☐ No
- ☐ Unknown or Undetermined

Comment:_____

Contamination Factors:[1]

C1 - Toxic substance part of tissue (e.g., ciguatera)
C2 - Poisonous substance intentionally added (e.g., cyanide or phenolphthalein added to cause illness)
C3 - Poisonous or physical substance accidentally/incidentally added (e.g., sanitizer or cleaning compound)
C4 - Addition of excessive quantities of ingredients that are toxic under these situations (e.g., niacin poisoning in bread)
C5 - Toxic container or pipelines (e.g., galvanized containers with acid food, copper pipe with carbonated beverages)
C6 - Raw product/ingredient contaminated by pathogens from animal or environment (e.g., *Salmonella* Enteritidis in egg, Norwalk in shellfish, *E. coli* in sprouts)
C7 - Ingestion of contaminated raw products (e.g., raw shellfish, produce, eggs)
C8 - Obtaining foods from polluted sources (e.g., shellfish)
C9 - Cross-contamination from raw ingredient of animal origin (e.g., raw poultry on the cutting board)
C10 - Bare-handed contact by handler/worker/preparer (e.g., with ready-to-eat food)
C11 - Glove-handed contact by handler/worker/preparer (e.g., with ready-to-eat food)
C12 - Handling by an infected person or carrier of pathogen (e.g., *Staphylococcus*, *Salmonella*, 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/Amplification Factors:[1]

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:[1]

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

Method of Preparation:[2]

M1 - Foods eaten raw or lightly cooked (e.g., hard shell clams, sunny side up eggs)
M2 - Solid masses of potentially hazardous foods (e.g., casseroles, lasagna, stuffing)
M3 - Multiple foods (e.g., smorgasbord, buffet)
M4 - Cook/serve foods (e.g., steak, fish fillet)
M5 - Natural toxicant (e.g., poisonous mushrooms, paralytic shellfish poisoning)
M6 - Roasted meat/poultry (e.g., roast beef, roast turkey)
M7 - Salads prepared with one or more cooked ingredients (e.g., macaroni, potato, tuna)
M8 - Liquid or semi-solid mixtures of potentially hazardous foods (e.g., gravy, chili, sauce)
M9 - Chemical contamination (e.g., heavy metal, pesticide)
M10 - Baked goods (e.g., pies, éclairs)
M11 - Commercially processed foods (e.g., canned fruits and vegetables, ice cream)
M12 - Sandwiches (e.g., hot dog, hamburger, Monte Cristo)
M13 - Beverages (e.g., carbonated and non-carbonated, milk)
M14 - Salads with raw ingredients (e.g., green salad, fruit salad)
M15 - Other, does not fit into above categories (*please describe in Comments*)
M16 - Unknown, vehicle was not identified

[1] Frank L. Bryan, John J. Guzewich, and Ewen C. D. Todd. Surveillance of Foodborne Disease III. Summary and Presentation of Data on Vehicles and Contributory Factors; Their Value and Limitations. Journal of Food Protection, 60; 6:701-714, 1997.
[2] Weingold, S. E., Guzewich JJ, and Fudala JK. Use of foodborne disease data for HACCP risk assessment. Journal of Food Protection, 57; 9:820-830, 1994.

Appendix C: Annotated NORS Reporting Form

National Outbreak Reporting System

Foodborne Disease Transmission, Person-to-Person Disease Transmission, Animal Contact

This form is used to report enteric foodborne, person-to-person, and animal contact-related disease outbreak investigations. This form has 5 sections, General, Laboratory, Person-to-Person, Animal Contact, and Food, as indicated by tabs at the top of each page. ***Complete the General and Laboratory tabs for all modes of transmission and complete additional sections as indicated by the mode of transmission.*** *Please complete as much of all sections as possible.*

G1 CDC USE ONLY G2

CDC Report ID _____ State Report ID _____

Form Approved OMB No. 0920-0004

General Section

Primary Mode of Transmission *(check one)*

- ☐ Food *(complete General, Lab, and Food tabs)* G3
- ☐ Water *(complete CDC 52.12)*
- ☐ Animal contact *(complete General, Lab, and Animal Contact tabs)*
- ☐ Person-to-person *(complete General, Lab, and Person-to-Person tabs)*
- ☐ Environmental contamination other than food/water *(complete General and Lab tabs)*
- ☐ Indeterminate/Other/Unknown *(complete General and Lab tabs)*

Investigation Methods *(check all that apply)*

- ☐ Interviews only of ill persons
- ☐ Case-control study
- ☐ Cohort study
- ☐ Food preparation review
- ☐ Water system assessment: Drinking water
- ☐ Water system assessment: Nonpotable water
- ☐ Treated or untreated recreational water venue assessment
- ☐ Investigation at factory/production/treatment plant
- ☐ Investigation at original source (e.g., farm, water source, etc.)
- ☐ Food product or bottled water traceback
- ☐ Environment/food/water sample testing
- ☐ Other

G4

Comments G5

Dates (mm/dd/yyyy)

Date first case became ill *(required)* ____/____/____ G6 Date last case became ill ____/____/____ G7

Date of initial exposure ____/____/____ G8 Date of last exposure ____/____/____ G9

Date of report to CDC *(other than this form)* ____/____/____ G10

Date of notification to State/Territory or Local/Tribal Health Authorities ____/____/____ G11

Geographic Location

Reporting state: G12

☐Exposure occurred in multiple states G13

☐Exposure occurred in a single state, but cases resided in multiple states G14

Other states: G15

Reporting county: G16

☐Exposure occurred in multiple counties in reporting state G17

☐Exposure occurred in a single county, but cases resided in multiple counties in reporting state G18

Other counties: G19

City/Town/Place of exposure: G20

(Do not include proprietary or private facility names)

Primary Cases

Number of primary cases		Sex *(number or percent of the primary cases)*					
Lab-confirmed primary cases	G21 #	Male	G24	#	G27	%	
Probable primary cases	G22 #	Female	G25	#	G28	%	
Estimated total primary cases	G23 #	Unknown	G26	#	G29	%	

	# Cases	Total # of cases for whom info is available	Age *(number or percent of the primary cases)*					
Died	G30 #	G34 #	<1 year	G38 #	G46 %	20–49 years	G42 #	G50 %
Hospitalized	G31 #	G35 #	1–4 years	G39 #	G47 %	50–74 years	G43 #	G51 %
Visited Emergency Room	G32 #	G36 #	5–9 years	G40 #	G48 %	≥ 75 years	G44 #	G52 %
Visited health care provider (excluding ER visits)	G33 #	G37 #	10–19 years	G41 #	G49 %	Unknown	G45 #	G53 %

General

Incubation Period, Duration of Illness, Signs or Symptoms for Primary Cases Only

Incubation Period *(circle appropriate units)*			Duration of Illness *(among recovered cases-circle appropriate units)*		
Shortest	G54	Min, Hours, Days	Shortest	G62	Min, Hours, Days
Median	G56	Min, Hours, G57 Days	Median	G64	Min, G65 Days
Longest	G58	Min, Hours, G59 Days	Longest	G66	Min, G67 Days
Total # of cases for whom info is available	G60		Total # of cases for whom info is available	G68	
☐ Unknown incubation period G61			☐ Unknown duration of illness G69		

G55 G63

Signs or Symptoms *(*Refer to terms from appendix, if appropriate, to describe other common characteristics of cases.)*

Feature	# Cases with signs or symptoms	Total # of cases for whom info is available
Vomiting		
Diarrhea		
Bloody stools		
Fever		
Abdominal cramps		
HUS		
Asymptomatic		
*		
*		
*		

G70 G71 G72

Secondary Cases

Mode of secondary transmission *(check all that apply)*	Number of secondary cases		
☐ Food ☐ Water ☐ Animal contact ☐ Person-to-person ☐ Environmental contamination other than food/water ☐ Indeterminate/Other/Unknown	Lab-confirmed secondary cases	G74	#
	Probable secondary cases	G75	#
	Estimated total secondary cases	G76	#
	Estimated total cases (Primary + Secondary)	G77	#

G73

Environmental Health Specialists Network *(if applicable)*

EHS-Net Evaluation ID: 1.) G78 2.) G79 3.) G80 G81

Traceback *(for food and bottled water only, not public water)*

☐ Please check if traceback conducted G82

Source name *(if publicly available)*	Source type *(e.g., poultry farm, tomato processing plant, bottled water factory)*	Location of source: State	Location of source: Country	Traceback Comments
G83	G84	G85	G86	G87

Recall

☐ Please check if any food or bottled water product was recalled G88

Type of item recalled: G89

Comments: G90

Reporting Agency

Agency name: G91

Contact name: G92

Contact title: G93

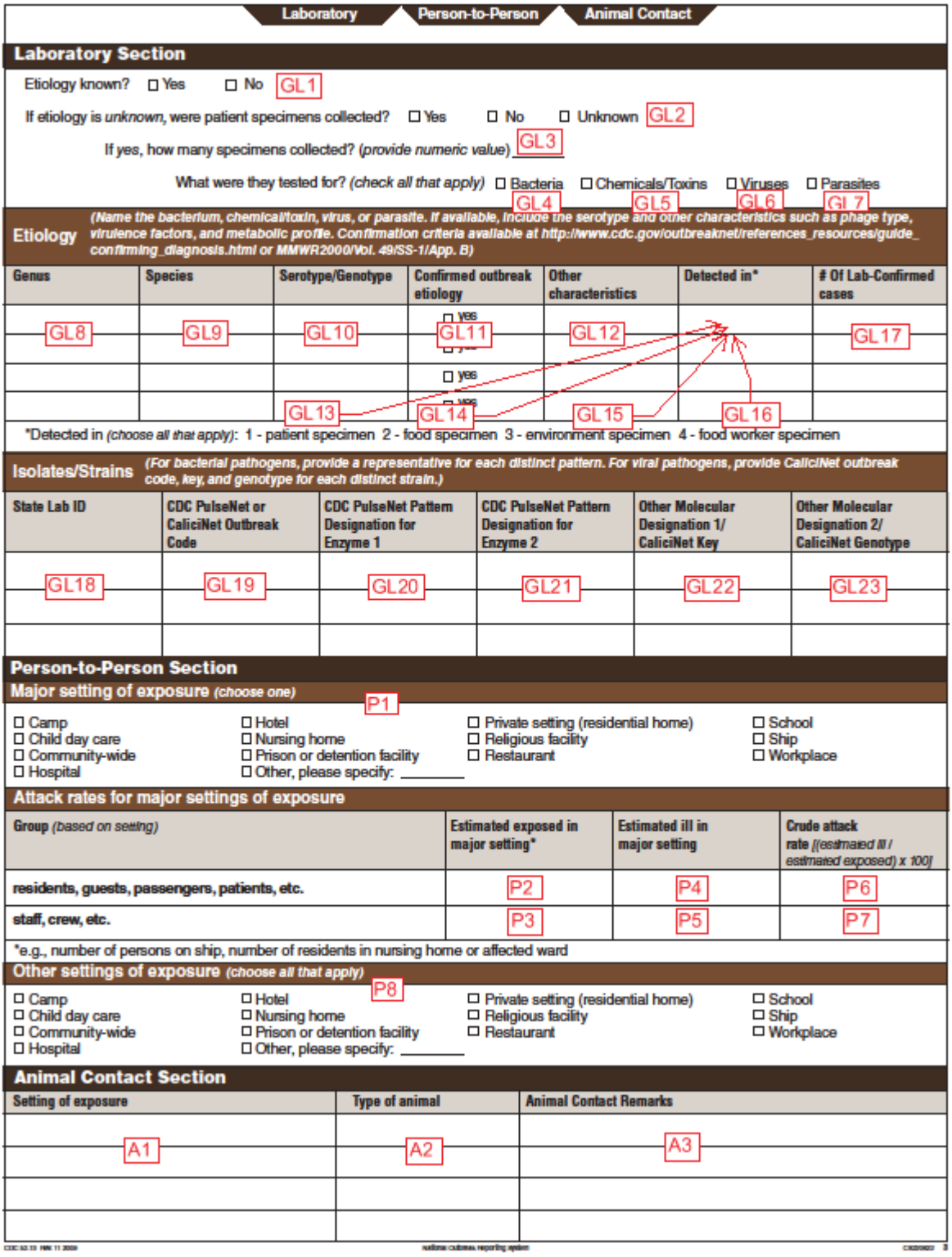
E-mail: G94

Phone no.: G95

Fax no.: G96

General Remarks *Briefly describe important aspects of the outbreak not covered above. Please indicate if any adverse outcomes occurred in special populations (e.g., pregnant women, immunocompromised persons.)*

G97



Laboratory | Person-to-Person | Animal Contact

Laboratory Section

Etiology known? ☐ Yes ☐ No GL1

If etiology is *unknown*, were patient specimens collected? ☐ Yes ☐ No ☐ Unknown GL2

If yes, how many specimens collected? (*provide numeric value*) GL3

What were they tested for? (*check all that apply*) ☐ Bacteria ☐ Chemicals/Toxins ☐ Viruses ☐ Parasites
GL4 GL5 GL6 GL7

Etiology *(Name the bacterium, chemical/toxin, virus, or parasite. If available, include the serotype and other characteristics such as phage type, virulence factors, and metabolic profile. Confirmation criteria available at http://www.cdc.gov/outbreaknet/references_resources/guide_confirming_diagnosis.html or MMWR2000/Vol. 49/SS-1/App. B)*

Genus	Species	Serotype/Genotype	Confirmed outbreak etiology	Other characteristics	Detected in*	# Of Lab-Confirmed cases
GL8	GL9	GL10	☐ yes GL11	GL12		GL17
			☐ yes			
		GL13	GL14	GL15	GL16	

*Detected in (*choose all that apply*): 1 - patient specimen 2 - food specimen 3 - environment specimen 4 - food worker specimen

Isolates/Strains *(For bacterial pathogens, provide a representative for each distinct pattern. For viral pathogens, provide CaliciNet outbreak code, key, and genotype for each distinct strain.)*

State Lab ID	CDC PulseNet or CaliciNet Outbreak Code	CDC PulseNet Pattern Designation for Enzyme 1	CDC PulseNet Pattern Designation for Enzyme 2	Other Molecular Designation 1/ CaliciNet Key	Other Molecular Designation 2/ CaliciNet Genotype
GL18	GL19	GL20	GL21	GL22	GL23

Person-to-Person Section

Major setting of exposure *(choose one)* P1

☐ Camp ☐ Hotel ☐ Private setting (residential home) ☐ School
☐ Child day care ☐ Nursing home ☐ Religious facility ☐ Ship
☐ Community-wide ☐ Prison or detention facility ☐ Restaurant ☐ Workplace
☐ Hospital ☐ Other, please specify: _____

Attack rates for major settings of exposure

Group *(based on setting)*	Estimated exposed in major setting*	Estimated ill in major setting	Crude attack rate *[(estimated ill / estimated exposed) x 100]*
residents, guests, passengers, patients, etc.	P2	P4	P6
staff, crew, etc.	P3	P5	P7

*e.g., number of persons on ship, number of residents in nursing home or affected ward

Other settings of exposure *(choose all that apply)* P8

☐ Camp ☐ Hotel ☐ Private setting (residential home) ☐ School
☐ Child day care ☐ Nursing home ☐ Religious facility ☐ Ship
☐ Community-wide ☐ Prison or detention facility ☐ Restaurant ☐ Workplace
☐ Hospital ☐ Other, please specify: _____

Animal Contact Section

Setting of exposure	Type of animal	Animal Contact Remarks
A1	A2	A3

Food

Food Section

☐ Food vehicle undetermined F1

Food	1	2	3
Name of food *(excluding any preparation)*	F2		
Ingredient(s) *(enter all that apply)*	F3		
Contaminated ingredients(s) *(enter all that apply)*	F4		
Total # of cases exposed to implicated food	F5		
Reason(s) suspected *(enter all that apply from list in appendix)*	F6		
Method of processing *(enter all that apply from list in appendix)*	F7		
Method of preparation *(select one from list in appendix)*	F8		
Level of preparation *(select one from list in appendix)*	F9		
Contaminated food imported to US? F10	☐ Yes, Country_____ F11 ☐ Yes, Unknown ☐ No	☐ Yes, Country_____ ☐ Yes, Unknown ☐ No	☐ Yes, Country_____ ☐ Yes, Unknown ☐ No
Was product *both* produced under domestic regulatory oversight *and* sold?	☐ Yes ☐ No F12 ☐ Unknown	☐ Yes ☐ No ☐ Unknown	☐ Yes ☐ No ☐ Unknown

Location where food was prepared *(check all that apply)* F13		**Location of exposure (where food was eaten)** *(check all that apply)* F14	
☐ **Restaurant – 'Fast-food'** *(drive up service or pay at counter)*	☐ **Nursing home, assisted living facility, home care**	☐ **Restaurant – 'Fast-food'** *(drive up service or pay at counter)*	☐ **Nursing home, assisted living facility, home care**
☐ **Restaurant – Sit-down dining**	☐ **Hospital**	☐ **Restaurant – Sit-down dining**	☐ **Hospital**
☐ **Restaurant – Other or unknown type**	☐ **Child day care center**	☐ **Restaurant – Other or unknown type**	☐ **Child day care center**
☐ **Private home**	☐ **School**	☐ **Private home**	☐ **School**
☐ **Banquet Facility** *(food prepared and served on-site)*	☐ **Prison, jail**	☐ **Banquet Facility** *(food prepared and served on-site)*	☐ **Prison, jail**
☐ **Caterer** *(food prepared off-site from where served)*	☐ **Church, temple, religious location**	☐ **Caterer** *(food prepared off-site from where served)*	☐ **Church, temple, religious location**
☐ **Fair, festival, other temporary or mobile services**	☐ **Camp**	☐ **Fair, festival, other temporary or mobile services**	☐ **Camp**
☐ **Grocery store**	☐ **Picnic**	☐ **Grocery store**	☐ **Picnic**
☐ **Workplace, not cafeteria**	☐ **Other** *(describe in Where Prepared Remarks)*	☐ **Workplace, not cafeteria**	☐ **Other** *(describe in Where Eaten Remarks)*
☐ **Workplace cafeteria**	☐ **Unknown**	☐ **Workplace cafeteria**	☐ **Unknown**

Where Prepared Remarks: F15

Where Eaten Remarks: F16

Food

Contributing Factors *(check all that contributed to this outbreak)* F18 F19

☐ Contributing factors unknown F17

Contamination Factor

☐ C1 ☐ C2 ☐ C3 ☐ C4 ☐ C5 ☐ C6 ☐ C7 ☐ C8 ☐ C9 ☐ C10 ☐ C11 ☐ C12 ☐ C13 ☐ C14 ☐ C15 ☐ C-N/A

Proliferation/Amplification Factor *(bacterial outbreaks only)*

☐ P1 ☐ P2 ☐ P3 ☐ P4 ☐ P5 ☐ P6 ☐ P7 ☐ P8 ☐ P9 ☐ P10 ☐ P11 ☐ P12 ☐ P-N/A

Survival Factor

☐ S1 ☐ S2 ☐ S3 ☐ S4 ☐ S5 ☐ S-N/A

The confirmed or suspected point of contamination *(check one)* F20 F21

☐ Before preparation ☐ Preparation

If *'Before Preparation'*: ☐ Pre-Harvest ☐ Processing ☐ Unknown

Reason suspected *(check all that ap* F22 F23 F24

☐ Environmental evidence F25	☐ Laboratory evidence F26
☐ Epidemiologic evidence F27	☐ Prior experience makes this a likely source F28

Was food-worker implicated as the source of contamination? ☐ Yes ☐ No F29

If yes, please check only one of the following:

☐ Laboratory *and* epidemiologic evidence
☐ Epidemiologic evidence
☐ Laboratory evidence F30
☐ Prior experience makes this a likely source

School Questions

(Complete this section only if "school" is checked in either sections "Location where food was prepared" or "Location of exposure (where food was eaten)").

1. Did the outbreak involve a single or multiple schools? F31

☐ Single
☐ Multiple (number of schools F32)

2. School characteristics *(for all involved students in all involved schools)*

a. Total approximate enrollment
F33 *(number of students)*
☐ Unknown or undetermined F34

b. Grade level(s) F35

☐ Preschool
☐ Grade school *(grades K-12)*
Please check all grades affected: ☐ K ☐ 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐ 6th ☐ 7th ☐ 8th ☐ 9th ☐ 10th ☐ 11th ☐ 12th
☐ College/university/technical school
☐ Unknown or Undetermined

c. Primary funding of involved schools F36

☐ Public
☐ Private
☐ Unknown

3. Describe the preparation of the implicated item: *(check all that apply)* F37

☐ Heat and serve *(item mostly prepared or cooked off-site, reheated on-site)*
☐ Served a-la-carte
☐ Serve only *(preheated or served cold)*
☐ Cooked on-site using primary ingredients
☐ Provided by a food service management company
☐ Provided by a fast-food vendor
☐ Provided by a pre-plate company
☐ Part of a club or fundraising event
☐ Made in the classroom
☐ Brought by a student/teacher/parent
☐ Other *(describe in General Remarks)*
☐ Unknown or Undetermined

4. How many times has the state, county or local health department inspected this school cafeteria or kitchen in the 12 months before the outbreak?* F38

☐ Once
☐ Twice
☐ More than two times
☐ Not inspected
☐ Unknown or Undetermined

*If multiple schools are involved, please answer according to the most affected school.

5. Does the school have a HACCP plan in place for the school feeding program?* F39

☐ Yes
☐ No
☐ Unknown or Undetermined

*If multiple schools are involved, please answer according to the most affected school.

Food

6. Was implicated food item provided to the school through the National School Lunch/Breakfast Program?

☐ Yes F40
☐ No
☐ Unknown or Undetermined

If yes, was the implicated food item donated/purchased by: F41

☐ USDA through the Commodity Distribution Program
☐ The state/school authority
☐ Other (*describe in General Remarks*)
☐ Unknown or Undetermined

Ground Beef

1. What percentage of ill persons (*for whom information is available*) ate ground beef raw or undercooked? _____ F42 %

2. Was ground beef case-ready? ☐ Yes ☐ No ☐ Unknown F43
(Case-ready ground beef is meat that comes from a manufacturer packaged for sale that is not altered or repackaged by the retailer.)

3. Was the beef ground or reground by the retailer?
☐ Yes ☐ No ☐ Unknown F44
If yes, was anything added to the beef during grinding (*such as shop trim or any product to alter the fat content*)?: _____ F45

Additional *Salmonella* Questions
(Complete this section for Salmonella outbreaks)

1. Phage type(s) of patient isolates:
_____ F46 *if RDNC* then include #* _____ F47
_____ *if RDNC* then include #* _____
_____ *if RDNC* then include #* _____
_____ *if RDNC* then include #* _____

* Reacts, Does Not Conform

Eggs

1. **Were eggs** *(check all that apply)*
☐ in shell, unpasteurized? F48
☐ in shell, pasteurized?
☐ packaged liquid or dry?
☐ stored with inadequate refrigeration during or after sale?
☐ consumed raw?
☐ consumed undercooked?
☐ pooled?

2. Was Salmonella enteritidis found on the farm? ☐ Yes ☐ No ☐ Unknown F49

Egg Comment *(e.g., eggs and patients isolates matched by phage type)*: _____ F50