

# Environmental Health Specialists' Self-Reported Foodborne Illness Outbreak Investigation Practices

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## Abstract

To collect qualitative data on the investigation practices of environmental health specialists with respect to foodborne illness outbreaks, the authors convened six focus groups of randomly selected specialists working in public health agencies in eight states. Participants discussed their investigation activities, methods used to identify contributing factors, success in identifying contributing factors, and the difficulties they faced when conducting investigations. Findings revealed substantial variability in the type of activities in which participants engaged during investigations, and the amount and nature of the collaboration between epidemiologists and environmental health specialists during investigations. Many participants indicated that during investigations they often did not identify contributing factors associated with an outbreak. Participants also identified several difficulties associated with outbreak investigations, including difficulties associated with restaurant employees, restaurant customers, and environmental health organizations.

## Introduction

For the years 1993 to 1997, an annual average of 550 foodborne illness outbreaks was reported in the United States (Olsen, MacKinnon, Goulding, Bean, & Slutsker, 2000). More than 40 percent of these outbreaks were attributed to food service establishments. Environmental health specialists along with epidemiologists and laboratorians in federal, state, and local public health agencies are typically involved in investigations of foodborne illness outbreaks. These investigations are important food safety ac-

tivities because they can identify the pathogens that caused an outbreak and the circumstances that led to the introduction or proliferation of those pathogens (i.e., contributing factors such as improper holding temperatures and worker bare-hand contact with food). Knowledge of the pathogens and contributing factors associated with outbreaks can increase understanding of the causes of, and prevention strategies for, outbreaks. (Jones et al., 2004).

The quality and effectiveness of foodborne illness outbreak investigations have,

however, been criticized (Bryan, 2002; Food and Drug Administration, 2001; Jones et al., 2004). Some have contended that investigations often yield inadequate information concerning the etiology and contributing factors of foodborne illness outbreaks. Contributing factors were identified in only 57 percent of outbreaks reported to the Centers for Disease Control and Prevention (CDC) (Olsen, MacKinnon, Goulding, Bean, & Slutsker, 2000). This inadequacy may result, at least in part, from specialists' ineffective outbreak investigation practices and from barriers encountered during investigations (Bryan, 2002; Ehiri & Morris, 1994; Jones et al., 2004).

The Environmental Health Specialists Network (EHS-Net) wished to gain a better understanding of specialists' foodborne illness outbreak investigation practices and consequently spearheaded the study reported here. EHS-Net is a collaborative project focused on food and water safety research and includes epidemiologists and environmental health specialists from CDC, the Food and Drug Administration (FDA), the U.S. Department of Agriculture (USDA), the U.S. Environmental Protection Agency (U.S. EPA), and nine state public health agencies. Currently, EHS-Net includes California, Connecticut, Georgia, Iowa, Minnesota, New York, Oregon, Rhode Island, and Tennessee; before 2005, Colorado was an EHS-Net state and Iowa and Rhode Island were not.

**TABLE 1****Characteristics of Participants (n = 42)**

Characteristic	Percentage of Participants
<b>Gender</b>	
Male	50
Female	50
<b>Age</b>	
18–24	2
25–44	52
45–54	38
55 or older	7
<b>Race</b>	
White	86
Black	10
Other	5
Hispanic or Spanish origin	7
<b>Education</b>	
Some postsecondary education (e.g., associate's degree)	2
4-year college degree	74
Postgraduate degree	24
<b>Employer</b>	
City/township	17
County/district	57
State	19
Other	7
<b>Certifications*</b>	
NEHA Registered Sanitarian or Environmental Health Specialist	31
NEHA Certified Food Safety Professional	7
Registered in state	57
FDA standardization	36
<b>Years working in environmental health</b>	
1–5	32
6–10	19
11–15	15
16–20	17
>20	17
<b>Years working in food programs</b>	
1–5	34
6–10	22
11–15	19
16–20	10
>20	15
<b>Position</b>	
Sanitarian/specialist	83
Manager or senior sanitarian/specialist	17

\* These figures total more than 100 percent because participants could answer yes to all questions.

**Method**

In 2004, EHS-Net convened six focus groups of specialists who worked in state or local public health departments in EHS-Net states. The groups met through telephone conference calls, a cost-effective method of collecting data from participants who are geographically dispersed. This method has been found to generate as much information as the use of face-to-face focus groups (Silverman, 2003).

To enroll participants, study recruiters telephoned specialists randomly selected from public lists to request their participation in the study. Eligible participants had spent at least 30 percent of their time conducting restaurant inspections and had worked in their current positions for at least six months. To minimize the possibility that participants might know one another, only two participants from any state and only one participant from any agency were scheduled in a group together. Each group session lasted approximately two hours, and participants received a \$60 incentive for their participation.

During the focus group meetings, participants discussed various topics associated with their restaurant food safety activities. This paper covers only the discussions of participants' investigation practices for foodborne illness outbreaks, the methods they used to identify contributing factors, their success in identifying contributing factors, and the difficulties they faced when conducting investigations. The meetings were audio taped, the transcripts of the audiotapes were reviewed, and common themes among responses were identified. Participants also completed a short survey on their personal characteristics (e.g., education and certification).

The study protocol was reviewed and approved by CDC's Institutional Review Board.

**Results****Participant Characteristics**

Each focus group had five to eight participants, for a total of 42 participants. Of the participants, 50 percent were male, 52 percent were between 25 and 44 years of age, 86 percent were white, and 98 percent had a four-year college or a postgraduate degree (Table 1). Over half worked for a county or district and a third were National Environmental Health Association (NEHA) registered sanitarians or environmental health specialists. Sixty-eight percent had worked in

the environmental health profession for more than five years, and 66 percent had worked in food programs for more than five years. Seventeen percent identified themselves as managers or senior sanitarians/environmental health specialists.

### Foodborne Illness Outbreak Investigation Practices

About half the participants had been involved in foodborne illness outbreak investigations. Those who had not participated in an outbreak investigation said either that their jurisdiction had not had any outbreaks since their employment there; that outbreak investigation was not a priority in their jurisdiction, so they did not conduct outbreak identification or investigation activities; or that environmental health personnel in their jurisdiction conducted only routine restaurant inspections in outbreak investigations because epidemiology personnel were responsible for all other investigation activities.

Participants who had engaged in outbreak investigations described several investigation activities, including conducting restaurant inspections and investigations, identifying customers in outbreak restaurants, developing and administering food history questionnaires, collaborating with epidemiologists, conducting epidemiologic analyses, taking stool or food samples, and collaborating with public health nurses. Most indicated that during an investigation they conducted inspections in the restaurant associated with the outbreak. Several participants said that they conducted “routine inspections” during outbreak investigations. Many, however, said outbreak inspections differed from routine inspections. Some said outbreak inspections focused on the suspected vehicle and the food handling practices associated with that vehicle; some said outbreak inspections focused on the food handling practices most strongly associated with foodborne illness in general (often referred to as risk factors), and some said outbreak inspections focused on talking to employees to identify those who might be ill. Similarly, many outbreak inspections focused less on noncritical violations (regulation violations not considered to be strongly related to foodborne illness), such as whether the floors were clean. Some participants used hazard analysis critical control point (HACCP) system terms, such as environmental investigations, food flows, and food preparation reviews, and a few participants referred specifically to the HACCP concept.

## TABLE 2

### Outbreak Investigation Difficulties Identified by Participants

Difficulty Category	Specific Difficulty
Restaurant employees	Lack of cooperation
Restaurant customers	Contact constraints
	Lack of cooperation
	Lack of knowledge
Organization	Lack of epidemiologic assistance or a team approach
	Lack of training and experience in outbreak investigation
	Lack of support from environmental health management
	Lack of cooperation between agencies
	Lack of staff
Other	Lack of physician cooperation
	Notification delay

Some participants indicated that during an outbreak investigation they tried to identify as many customers of the outbreak restaurant as possible by culling pertinent information from restaurant credit card receipts and interviewing known customers of the restaurant. Most said they played some role in developing questionnaires to be administered to restaurant customers and sometimes workers. These questionnaires were designed to help identify ill people, symptom characteristics, and foods linked to the outbreak (i.e., the vehicle).

Many participants said they collaborated with epidemiology personnel during outbreak investigations, although the nature of this collaboration varied across jurisdictions. Some participants said they worked closely and collaboratively with epidemiologists throughout the investigation (e.g., “Our communication is very good, and we have a very strong team approach”). In some jurisdictions, epidemiologists and specialists had very defined investigation roles. For example, in one jurisdiction, epidemiologists interviewed restaurant customers, while specialists conducted the restaurant investigation. In other cases, although specialists conducted most investigation activities, they involved epidemiology personnel if the epidemiologists’ expertise was needed (e.g., to determine pathogen incubation periods). Participants’ comments also indicated variation in which group led investigations—in some jurisdictions, epidemiology personnel led, and in others, specialists led. Some said

either that they did not have access to epidemiology personnel or that little or no collaboration occurred between epidemiologists and specialists (e.g., “When an outbreak occurs, ... they just send us out to do the inspection and don’t keep us informed....”).

Several participants said they conducted epidemiologic data analyses, such as identifying foods that ill people had consumed in common. Some said they tried to get ill people to provide stool samples for pathogen identification, and a few took food samples for the same reason. Some participants indicated that during an outbreak investigation they worked with public health nurses, who were primarily involved in conducting interviews with ill people.

### Identifying Contributing Factors

When asked to describe their methods for identifying contributing factors associated with outbreaks, participants tended to focus on identifying pathogens rather than contributing factors. Often participants specifically discussed contributing factor identification only after probing by the moderator. Participants’ comments suggested that contributing factor identification was often dependent upon identification of vehicle, pathogen, or both. Participants primarily discussed three sources of information used to determine the pathogen, vehicle, and contributing factors—illness characteristics, epidemiologic analyses, and restaurant investigations. Most said illness characteristics were often their first clue in an investigation. These

characteristics provided information about the possible pathogen involved, which led to a focus on foods associated with that pathogen (e.g., “Let’s say ... the incubation duration was classic for *Bacillus cereus*; we would investigate the rice [with a focus on] cooling”). Some said epidemiologic analyses into foods ill people had consumed in common were helpful in focusing the investigation on suspected foods and the pathogens and practices associated with those foods. Some participants indicated that the restaurant investigation sometimes provided clues to the pathogen and contributing factors. For example, an interview with a worker might reveal information about unsafe cooking practices. Most often, however, information on illness characteristics, vehicles, and pathogens was used to focus the restaurant investigation (e.g., “If we’re looking at a Norwalk, we’re going to be emphasizing ... handwashing; if it’s *Salmonella* we’ll probably be looking at their storage, preparation, and service of eggs or chicken”).

### Effectiveness of Investigations

When asked how effective their outbreak investigations were in identifying contributing factors to outbreaks, participants again tended to focus on identifying pathogens rather than contributing factors. Participants said that in many cases they were able to make an educated guess about the pathogen involved in the outbreak, based on the vehicle and the incubation period; however, laboratory confirmation of the pathogen was seldom obtained from stool or food samples (e.g., “We might know from the incubation period, but if we don’t have lab confirmation, we can’t say for sure.”). A few participants, however, said they were more successful—one participant said that pathogens found in food and stool samples were matched in 95 percent of outbreaks in their jurisdiction. Several participants also indicated that identification of the vehicle, and therefore the pathogen, was easier with large outbreaks and outbreaks in situations where there were limited menu choices, such as catered events.

When prompted to discuss contributing factors rather than pathogens, participants said identifying contributing factors was difficult and they were not often able to do so. According to participants, employee turnover, uncooperative restaurant employees, and the time lapse between preparation of the vehicle and the investigation made it difficult to identify the preparation practices associated with the suspected vehicle and to determine whether ill workers had been involved in food preparation.

### Investigation Difficulties

Participants identified 11 factors that negatively affected outbreak investigations. We grouped these factors into four categories: restaurant employees, restaurant customers, organizational, and other (see Table 2). Participants reported that restaurant employees did not always cooperate with outbreak investigations. Examples included employees refusing to answer questions truthfully or at all and managers coaching employees on “correct” answers to food preparation questions. According to participants, employees sometimes do not cooperate because they are afraid of negative consequences for themselves or their employers, they doubt their food made anyone sick, or they are focused on attempting to identify the individuals who complained about their restaurant. Participants indicated, however, that in general, restaurant employees were very cooperative in outbreak situations.

Participants identified four difficulties associated with restaurant customers—contacting customers, lack of cooperation, obtaining food histories, and lack of knowledge. According to participants, contacting customers was difficult because such attempts were typically made during the day, when many people were not home. Examples of customer lack of cooperation cited by participants included reluctance to discuss illness symptoms and to provide stool samples. In addition, participants said people cannot easily remember what they ate several days before their illness, so obtaining accurate food histories is difficult. Several participants indicated that the public’s lack of knowledge about foodborne illness delayed outbreak investigations because investigators had to educate complainants about foodborne illness before they could collect the information they needed. For example, complainants frequently attribute their illness to the last meal eaten and thus are resistant to discussing other meals.

Participants identified five organizational difficulties associated with outbreak investigations. A few participants said that during investigations, epidemiology and environmental health personnel did not work together or that epidemiology personnel did not provide assistance to environmental health. Some said they did not have adequate training or experience in outbreak investigation. In one jurisdiction, outbreak investigations were not conducted because

management did not understand the importance of investigations and therefore did not support them. One participant said that state agencies did not notify local agencies of outbreaks in a timely manner, and another said that they needed larger staff to adequately conduct investigations.

Participants also discussed two additional difficulties—lack of cooperation from physicians and delay in learning of outbreaks. Some participants indicated that physicians sometimes created difficulties during investigations because, when asked to support the investigation by testing patients with appropriate illness symptoms, they did not always comply. Several participants said that there was often a delay (anywhere from several days to several weeks) between the start of an outbreak and their notification of the outbreak, and that this delay made it difficult to obtain accurate food histories and stool samples from ill people, accurate information concerning the preparation of the suspected vehicle, and samples of the suspected vehicle. According to participants, notification delays occurred because ill people wait to notify health departments of their illness and because departments or agencies aware of outbreaks do not always notify environmental health programs or specialists in a timely fashion.

### Discussion

Our findings reveal substantial variability in the investigation of the activities of environmental health specialists with respect to foodborne illness outbreaks. Of particular interest is the finding that while some specialists reported conducting routine inspections during outbreak investigations, others reported activities such as collecting stool and food samples, identifying ill workers, and identifying unsafe food handling practices associated with suspected vehicles and foodborne illness. Routine inspections are not likely to identify the pathogens that cause outbreaks or the factors that contribute to outbreaks, because inspections are typically used only to determine regulatory compliance with food safety codes or laws. On the other hand, activities with a different focus, such as stool and food sample collection and identification of ill workers and unsafe food handling practices, are more likely to lead to the identification of outbreak pathogens and contributing factors, thereby furthering our understanding of the causes of outbreaks.

Participants identified several investigation difficulties associated with restaurant employ-

ees, restaurant customers, and physicians. To address the difficulties posed by uncooperative employees, investigators should try to conduct their restaurant investigation as early as possible in the process, because anecdotal evidence suggests that employees and managers are more likely to be cooperative at this point. Difficulties associated with restaurant customers, such as their lack of knowledge about foodborne illness and reluctance to cooperate with investigations, may be alleviated by foodborne illness education programs (Fein, Lin, & Levy, 1995; Green et al., 2005). Similarly, difficulties associated with physicians may also be alleviated by education of physicians about foodborne illness diagnosis and investigation. The development of CDC's physician primer on foodborne illness diagnosis is an important step in this educational process (CDC, 2004).

Several findings suggest that collaboration and communication between epidemiology and environmental health programs is an important issue for outbreak investigation. Participants reported a lack of epidemiologic assistance and variability in the amount and nature of the collaboration between epidemiology personnel and environmental health personnel during investigations. In addition, participants identified the delay between the time when an outbreak occurs and when environmental health personnel learn of the outbreak as an investigation difficulty. This delay is likely to be due at least partially to a lack of communication and collaboration among agencies and programs. Both epidemiology and environmental health bring valuable knowledge and skills to the outbreak investigation process. Improvement in collaboration between these two programs requires developing and defining the role that environmental health can and should play in outbreak investigations. A clear understanding of the role of environmental health and its importance in outbreak investigations is needed to provide an adequate basis for managers to ensure collaboration between the two programs.

Participants also identified lack of training and lack of management support in outbreak investigation as difficulties. Once the role of environmental health is defined, as suggested above, environmental health programs will require resources, training, and management support to fulfill their outbreak investigation roles.

Many participants said they did not often identify contributing factors during investigations. Three factors may influence this lack of identification. First, identifying contributing factors did not seem to be a priority—many participants said they focused on identifying pathogens rather than contributing factors. Second, although some participants saw pathogen identification as a prerequisite to identification of contributing factors, they also said that pathogen identification did not happen very often. Third, participants indicated that barriers such as uncooperative restaurant employees and delay in outbreak notification impede the identification of contributing factors. Contributing factor identification is critical to improving food safety because it leads to the development of effective interventions. Earlier suggestions—improving collaboration between environmental health and epidemiology, defining the role of environmental health in investigations, and providing training and management support—should increase the ability of environmental health to identify contributing factors during investigations.

CDC is participating in several ongoing efforts to improve investigation and reporting of foodborne illness outbreaks. First, CDC's EHS-Net is working to improve identification and reporting of contributing factors among the EHS-Net states. From this work, training resources and model data collection instruments will be developed and shared with other environmental health programs. Second, CDC has funded the Enteric Disease Investigation Timeline Study (EDITS), a project focused on collecting and analyzing data on foodborne illness complaint and outbreak investigation timelines, and developing recommendations for improvement (Hedberg, 2005). Third, CDC has implemented

the Electronic Foodborne Outbreak Reporting System (EFORS), a Web-based system that allows state health departments to report data from foodborne illness outbreaks electronically (CDC, 2000; CDC, 2005). This system includes information on contributing factors, and CDC is currently working with state health departments to increase the reporting of contributing factors in this system. Fourth, CDC and NEHA have developed Epi-Ready Team Training, a nationwide initiative that provides training on foodborne illness outbreak investigations to state and local environmental health programs (NEHA, 2006).

Qualitative focus group studies are useful for identifying issues of concern for specific populations, as our study has done. Data from such studies should not, however, be interpreted in a quantitative sense or generalized to a larger population. Thus, although we can be fairly certain of the existence of outbreak investigation practices and difficulties identified by the participants in our study, we are unable to determine the extent of these practices and difficulties in the specialist population. Future research will be needed to make this determination. Our discussion of this study's findings should be reviewed with these facts in mind. 🚗

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