CHAPTER

7

Special Considerations for Multijurisdictional Outbreaks

CHAPTER SUMMARY POINTS

- A multijurisdictional outbreak of foodborne illness requires the resources of more than one local, state, territorial, tribal, or federal public health or food regulatory agency to detect, investigate, or control.
- Recognition of outbreaks with multistate exposures will continue to increase with implementation of whole-genome sequencing in foodborne illness surveillance.
- Special efforts may be needed to
    - Help agencies recognize when a multijurisdictional outbreak is occurring and then identify and engage key partners in the investigation.
    - Improve communication and coordination among agencies at all levels of government that are investigating multijurisdictional outbreaks.
    - Increase the speed and effectiveness of investigating and controlling multijurisdictional outbreaks.

URLs in this chapter are valid as of August 28, 2019.

7.0 Introduction

Multijurisdictional investigations range from different agencies and departments at a local level collaborating on a simple investigation to a large multistate outbreak with the potential identification of imported foods. As the number of agencies and levels of organizations across jurisdictions increases, the need for special efforts to maintain effective communication and coordination increases as well. (See Chapter 5 for general approaches to investigating clusters and outbreaks of foodborne illnesses.)

7.1 Categories and Frequency of Multijurisdictional Outbreaks

A multijurisdictional outbreak of foodborne illness requires the resources of more than one local, state, territorial, tribal, or federal public health or food regulatory agency to detect, investigate, or control the pathogen in question (Box 7.1). For some, such as multistate outbreaks identified through PulseNet surveillance, the multijurisdictional nature of the outbreak may be readily apparent. For others, it may emerge during the investigation. Special efforts may be needed to help agencies recognize a multijurisdictional outbreak and then to identify and engage key partners in the investigation.

The passage of the Food Safety Modernization Act (*1*) in 2011 gave new authorities to the Food and Drug Administration (FDA) and provided a mandate to enhance surveillance and response capacity at local, state, territorial, tribal, and federal levels. Combined with the development and implementation of whole-genome sequencing (WGS), these investments in foodborne disease surveillance have increased the number of outbreaks recognized as multijurisdictional (Table 7.1). For example, during 2006–2010, 1.7% of all foodborne illness outbreaks reported to the Centers for Disease Control and Prevention (CDC) National Outbreak Reporting System [NORS] involved multistate exposures and many more affected residents of multiple states or counties (*2*). During 2011–2016 the percentage of outbreaks with multistate exposures doubled to 3.4% (*3*). Overall, during 2009-2018, 27.1% of *Escherichia coli* O157:H7 outbreaks and 14.1% of *Salmonella* outbreaks involved multistate exposures, discovered largely through PulseNet (*3*). Thus, for these most important foodborne pathogens, the need for multijurisdictional coordination should be anticipated during the earliest stages of an investigation.

Box 7.1. Categories of Multijurisdictional Outbreaks

- Outbreaks affecting multiple local health jurisdictions (e.g., city, county, town) within the same state.
- Outbreaks involving multiple states.
- Outbreaks involving multiple countries.
- Outbreaks affecting multiple distinct agencies (e.g., public health, food regulatory, emergency management).
- Outbreaks, regardless of jurisdiction, caused by highly pathogenic or unusual agents (e.g., *Clostridium botulinum*) that require specialized laboratory testing, investigation procedures, or treatment.
- Outbreaks in which the suspected or implicated vehicle is a commercially distributed, processed, or ready-to-eat food contaminated before the point of service.
- Outbreaks involving large numbers of cases that may require additional resources to investigate.
- Outbreaks in which intentional contamination is suspected.

7.1 Categories and Frequency of Multijurisdictional Outbreaks

Table 7.1. Number of foodborne outbreaks with multistate exposure, multistate residency, multicounty exposure, and multicounty residency, by etiology, United States, 2009–2018 (*3*)

ETIOLOGY AND AGENT	NO. TOTAL OUTBREAKS	MULTISTATE EXPOSURE	MULTISTATE RESIDENCY, SINGLE STATE EXPOSURE	MULTICOUNTY EXPOSURE	MULTICOUNTY RESIDENCY, SINGLE COUNTY EXPOSURE
Confirmed Etiology	4,239	317	228	239	1,075
Escherichia coli O157:H7	192	52	5	32	42
Salmonella	1,291	182	76	121	347
Clostridium perfringens	165	0	3	0	49
Staphylococcus aureus	47	0	2	1	14
Hepatitis A virus	27	2	2	4	7
Norovirus	1,532	3	89	22	437
Other	985	78	51	59	179
Suspected Etiology	1,962	5	101	18	385
Unknown Etiology	2,184	2	101	36	357
Multiple Etiologies	146	1	6	3	36
TOTAL	8,531	325	436	296	1,853

Specifically related to multijurisdictional outbreaks, recent investments have been made to

- Improve coordination and data-sharing between public health partners and the public.
- Increase state and local participation in national surveillance networks.
- Expand and integrate national surveillance systems.
- Enhance laboratory and epidemiologic methods for agent identification and outbreak detection and investigation.

Coordinating offices for foodborne illness investigations in the three primary federal agencies include

- CDC: Outbreak Response and Prevention Branch (Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic Infectious Diseases).
- FDA: Coordinated Outbreak Response and Evaluation Network (CORE).
- U.S. Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS): Applied Epidemiology Staff.

7.2 Multijurisdictional Outbreak Detection

7.2.1 Multijurisdictional outbreaks may be detected at local, state, territorial, tribal, or federal levels. Outbreaks detected at the local level through investigations of consumer complaints, individual cases, or case clusters of reportable foodborne illnesses (Chapter 4) may identify common-source outbreaks or multiple subclusters of illnesses that implicate or suggest likely contamination of food before the point of service.

Detection of multijurisdictional outbreaks at a state level may result from an increase of sporadic infections with common subtype characteristics identified, investigation of subclusters of illnesses that identify a possible association with multiple food service establishments, or the linking of multiple, discrete common-source outbreaks by common agent, food, or water.

Similarly, national increases of infections with common subtype characteristics identified; identification of subclusters of illnesses associated with multiple restaurants or food service establishments in multiple states; and linkage of multiple, discrete common-source outbreaks in multiple states would lead to a multijurisdictional outbreak investigation.

Detection of a pathogen, such as *Listeria monocytogenes*, Shiga toxin–producing *E. coli*, or *Salmonella*, from a food item that resulted from testing by a federal or state food regulatory agency would lead to a search for human illnesses caused by the same organism with common subtype characteristics. Multijurisdictional investigation of infections with common subtype characteristics would be conducted to determine whether they were part of an outbreak.

7.2.2 When findings indicate that multiple jurisdictions might be involved in an investigation, additional communication and coordination are needed (Table 7.2). With initiation of an investigation of a potential multijurisdictional outbreak, a local agency should ensure notification of the state health department and other local agencies, as appropriate, and provide subsequent updates in accordance with state procedures to ensure coordination between epidemiology, environmental health, and the public health laboratory.

Detection of multijurisdictional outbreaks at a state level requires notification of affected county and city health departments. CDC and state and federal food regulatory agencies need to be notified of subclusters or linked common-source outbreaks. For example, FDA has established its CORE Network to respond to outbreaks. USDA-FSIS has developed a template for including their agency in foodborne illness outbreak response procedures (*4*). Notify USDA-FSIS of outbreaks potentially associated with USDA-FSIS-regulated products by sending an email to FoodborneDiseaseReports@usda.gov and to the appropriate regional contact in the USDA-FSIS Office of Enforcement, Investigation, and Audit (https://www.fsis.usda.gov/wps/portal/informational/districtoffices#oiea).

Detection of multijurisdictional outbreaks at a national level requires notification of appropriate state and federal food regulatory agencies and state health departments of an increase in apparently sporadic infections, subclusters, or linked common-source outbreaks. In these events, states typically notify local agencies of the outbreak and the need for their assistance in conducting the investigation. Of particular importance are requests to interview case-patients as soon as possible using a detailed exposure questionnaire to obtain detailed food and environmental exposure histories, including product brand and retail source.

7.2.3 Assemble and brief the outbreak and investigation control team. Open communication between investigation team members to plan, conduct, and evaluate

7.2 Multijurisdictional Outbreak Detection

Table 7.2. Multijurisdictional Outbreak Identification Methods and Required Notification steps, by Agency Level

OUTBREAK IDENTIFICATION METHOD	REQUIRED NOTIFICATION STEPS
LOCAL LEVEL	
• Common-source outbreak identified with cases among persons who reside in other local jurisdictions. • Common-source outbreak identified with exposures in another jurisdiction. • Common-source outbreak identified in one jurisdiction, investigation implicates food item contaminated before the point of service. • Subcluster of illnesses associated with restaurants or food service establishments.	• Notify affected jurisdictions to request assistance to contact and interview case-patients in other jurisdictions. • Notify the affected jurisdiction immediately. • Notify appropriate state and federal food regulatory agencies about probable contaminated food vehicle, or subcluster. • Notify affected county and city health departments, state health department, and Centers for Disease Control and Prevention (CDC).
STATE LEVEL	
• Statewide increase identified in infections with common subtype characteristics. • Subclusters of illnesses associated with multiple restaurants or food service establishments. • Common-source outbreaks in multiple local jurisdictions linked by common agent, food, or water.	• Notify affected county and city health departments and CDC. • Notify appropriate state and federal food regulatory agencies of subclusters or linked common-source outbreaks.
FEDERAL LEVEL	
• National increase identified in infections with common subtype characteristics. • Subclusters of illnesses associated with multiple restaurants or food service establishments in multiple states. • Common-source outbreaks in multiple states linked by common agent, food, or water. • Food item tested positive by federal or state food regulatory agency linked to apparently sporadic infections with common subtype characteristics.	• Notify appropriate state and federal food regulatory agencies, and state health departments of increase in infections, subclusters, or linked common-source outbreaks. • Notify CDC, affected state health departments, and other state and federal food regulatory agencies.

outbreak investigation activities is critical to the success of the investigation (Chapter 5). For multijurisdictional investigations, the outbreak investigation and control team should include members from all agencies participating in the investigation (Chapter 3, Tables 3.1 and 3.2). Agency preparedness plans should be in place to facilitate rapid identification and notification of these key partners. In addition, many health departments have an incident command system (ICS) that guide outbreak response (Box 7.2). Historically, investigations of multijurisdictional foodborne illness outbreaks have not required formal activation of ICS. However, federal regulatory agencies use ICS for their response to outbreak incidents.

7.2 Multijurisdictional Outbreak Detection

Box 7.2. Use of Incident Command Systems

An incident command system (ICS) is the nationally recognized way that diverse individuals, agencies, and the private sector plan to work together to command, coordinate, and communicate during emergencies. Agencies responding to a public health emergency or foodborne outbreak can use ICS principles to help manage responses. ICS principles provide the flexibility needed to manage a wide range of foodborne illness outbreak responses, including single agency and multiagency outbreak investigation and control teams.

ICS provides for internal communications among primary event responders, public information officers, and security/safety officers and for external liaison with various organizations. Key features for foodborne outbreak investigation and control teams include the following:

- Standardized but flexible organizational structure.
- Clearly defined and standardized roles and responsibilities.
- Formal and systematic planning approach.
- Coordinated response team, stakeholder, and public communications.
- Formal mechanisms for managing transitions from routine to nonroutine responses by expanding and contracting response team structure and resources as needed.

These features provide a predictable framework that can bring order to potentially chaotic situations when standard agency operating procedures and routine chain of command are inadequate to address the needs of an incident.

Because outbreak investigation staff may be physically located in different agencies in several different cities or states, briefings may need to be conducted by teleconference or webinar. All members of the of the investigation team—epidemiologists, environmental health specialists, laboratorians, and food regulators—need to be familiar with and follow relevant state and federal laws, terms of any memorandum of understanding between agencies, and data-handling practices.

7.3 Identifying and Investigating Subclusters

Subclusters are groups of cases within a larger defined cluster for which exposure to the same individual points of service, such as a restaurant, cafeteria, grocery store, or institution, is identified. Subcluster investigations provide an invaluable opportunity to solve an outbreak because the outbreak vehicle was most likely served by the common establishment (Chapter 5). Although subclusters have traditionally been identified within clusters of cases defined by a common serotype, pulsed-field gel electrophoresis pattern, or closely related genomic sequence, successful subcluster investigations also have been conducted during *Cyclospora* outbreaks, where no subtyping of the outbreak strain characteristics was possible.

In multijurisdictional investigations, make special efforts to identify potential subclusters across the geographic distribution of outbreak cases and to prioritize the coordination of subcluster investigations and tracing of common food exposures associated with the subclusters. If not previously established, a coordinating office (or individual) for subcluster investigations should be empowered to prioritize collection, organization, and dissemination of subcluster data.

7.4 Coordinating Multijurisdictional Investigations

Coordinating a multijurisdictional investigation might require establishment of a coordinating office to collect, organize, and disseminate data from the investigation. Depending on the scope and nature of the multijurisdictional event, the coordinating office might be located at a local or state public health or food regulatory agency or at CDC, FDA, or FSIS.

Several principles guide decision about where to locate the coordinating office for a given multijurisdictional investigation. The primary goal is to avoid interagency conflict about coordination that might distract from prompt conduct of the investigation and to present unified, consistent messages to the public.

- Outbreaks are most efficiently investigated as close to the source as possible. In general, investigations should be coordinated at the level at which the outbreak originally was detected and investigated. This is likely to be where most relevant investigation materials will reside, which can facilitate organization and analysis of data. An outbreak involving several local health agencies might best be coordinated by a lead local agency. Similarly, investigation of a multistate outbreak with most cases in one or a few adjacent states might best be coordinated by a lead state agency. Investigations of outbreaks of more widely dispersed cases identified through pathogen-specific surveillance might best be coordinated by CDC.
- The coordinating office must have sufficient resources, expertise, and legal authority to collect, organize, and disseminate data from the investigation. Local agencies might not have sufficient resources to effectively coordinate a multijurisdictional investigation, or state rules might assign jurisdiction over multicounty investigations to the state health department. In these situations, the coordinating office should be located at the state level. In multistate investigations, the coordinating office should be located at CDC if no individual state is prepared to do so. In multistate investigations led by an individual state, CDC should support the investigation in coordination with the lead agency.
- Investigations of the food contamination phase should be coordinated within food regulatory agencies. In addition to food regulatory agencies' greater expertise and experience with these investigations, rules governing the collection of product manufacturing and distribution information might dictate that authorized food regulatory agencies not share that information with outbreak investigators in other agencies.

7.4.1 Outbreak investigations progress through phases of activity, and leadership of the investigation should reflect the focus of the investigation at the time. Investigations initiated at a local level are handled in accordance with routine policies and procedures under local agency leadership unless otherwise specified by state procedures. The level of state involvement depends on local or state protocols.

During investigations that require active participation from multiple local agencies and state agencies, a state agency needs to coordinate among the epidemiology, environmental health, and laboratory components of the investigation at the state level and ensure that state epidemiology, environmental health, and laboratory programs communicate and coordinate activities with counterparts at the local and federal levels. Typically, epidemiologic efforts to characterize the outbreak by person, place, and time dominate the early stages of an investigation. Efforts to identify the mode of transmission and food vehicle begin to incorporate environmental health specialists and food regulators. Determining contributing factors and environmental antecedents, conducting regulatory tracebacks, and

7.4 Coordinating Multijurisdictional Investigations

implementing control measures move the investigation into the food regulatory realm. Transition of leadership within the outbreak control team should be planned in advance by consensus and communicated to the entire team.

During investigations of national significance, federal agencies need to coordinate the epidemiology, environmental health, and laboratory components of the investigation at the federal level and ensure that federal epidemiology, environmental health, and laboratory programs are communicating and coordinating activities with their counterparts at the state and local levels.

7.4.2 Communication and coordination plans should reflect the focus of the investigation at the time. Investigations initiated at a local level require information sharing and coordination among multiple local agencies under local agency leadership unless otherwise specified by state procedures. The state receives information and provides consultation.

When the resources of one or more local jurisdictions cannot adequately respond to events by following routine procedures, the state should provide response coordination, consultation, and information sharing. On the basis of established procedures, emergency management systems, possibly including ICS, might be activated at the local—or possibly state—level. Federal agencies are notified and involved depending on product type and distribution.

Multistate outbreaks and outbreaks associated with regionally or nationally distributed food products involve a transition from state to national significance. These outbreaks might require regional or national resources. Although they require active participation from multiple local agencies and state response coordination, consultation, and information sharing, they also might require federal agency leadership, depending on the capabilities and willingness of the states involved.

Sharing of information between public health and food regulatory agencies is critical to the effectiveness of multijurisdictional investigations. Ensuring the facilitation of rapid and open information sharing can greatly enhance the efficiency and effectiveness of multijurisdictional investigations. Because these activities build on each other, establishing information-sharing protocols during the earliest stages of the investigation is critical. State, local, and federal public health officials should ensure that their agencies have the legal authorities needed to share information and that their professional staff understand those authorities (Chapter 2). Unless state and local public health officials have been commissioned to receive confidential information from FDA, they might need to work directly with the establishment implicated in the outbreak to obtain those data (Chapters 2 and 3). FDA's Office of Partnerships has a commissioning and credentialing program that enables the sharing of commercial confidential information to Commissioned Officials and/or signatories of Confidentiality Agreements (Chapter 2.3.4).

Identifying the source of a multijurisdictional outbreak is a collaborative process among local, state, and federal agencies and industry. Individual food companies and trade associations should be engaged early on to help with the investigation. Industry collaborators might be able to provide important information about food product identities, formulations, and distribution patterns that can improve hypothesis generation and assist in informational tracebacks to aid hypothesis testing. Early engagement of industry also can facilitate control measures by enabling affected industries to implement orderly product withdrawal or recall procedures.

7.4 Coordinating Multijurisdictional Investigations

Release of public information about the outbreak should be coordinated with the lead investigating agency when feasible. Although the public and news media are not aware of most outbreak investigations, the results of investigations are public information. In addition, responding to media attention is important to address public concerns about the outbreak. Although individual agencies participating in the investigation might be obligated to provide the perspective of their own leadership when responding to media inquiries, a coordinated communications plan can help provide a consistent, unified message about the progress of the investigation, the source of the outbreak, or any prevention activities that the public can do to protect itself. Coordinating communications with the media is particularly important when media attention is needed for public action to avoid exposure to a specific contamination source, such as a recalled food product.

7.4.3 Use standardized data-collection forms and centralize compilation of data from case-patient interviews. The National Hypothesis Generating Questionnaire (NHGQ) can be used to collect information on a broad range of food and nonfood exposures (http://cifor.us/downloads/clearinghouse/NHGQ_v2_OMB0920_0997.pdf) during the early stages of an outbreak investigation (Chapter 5). As hypotheses develop and are refined, an outbreak-specific questionnaire can be developed to systematically collect data from the various states or local jurisdictions contributing to the investigation. Collecting detailed information on both the food item and its source as early in the process as possible is key to identifying the source of an outbreak. Thus, ensuring that all agencies participating in the investigation use the same outbreak-specific questionnaire is important. In addition, if sufficient staff are not available to rapidly conduct interviews, agencies should request external assistance to conduct interviews.

Compiling data from case-patient interviews in a central location where they can be reviewed in aggregate will facilitate recognition of suspected food items, particularly when an unusual or new food item may be involved.

7.4.4 Coordinate informational tracebacks to identify suspected vehicles and guide sampling activities. Tracing the source of food items or ingredients through distribution to source of production can be critical to identifying epidemiologic links among cases or ruling them out (Chapter 5).

Multijurisdictional investigations increase the importance of product tracing because they can triangulate among multiple distribution pathways that may link geographically dispersed cases. Thus, coordinating traceback investigation across the outbreak should be prioritized. The coordinating office (or individual) for traceback investigations should be empowered to prioritize collection, organization, and dissemination of traceback data to determine whether it converges on a common source or supplier. Because this information can be critical to identifying epidemiologic links, results should be shared, as they develop, with epidemiologists, which will enable epidemiologists to have meaningful input in exposure selection and interpretation to help guide future directions for the investigation (*5*).

Identification of a common source or supplier can facilitate sampling activities to confirm contamination of the product and the potential source of the contamination.

7.5 Multijurisdictional Outbreak Investigation After-Action Reports and Reporting to NORS

The lead agency(ies) coordinating the investigation should hold a conference call 1–3 months after the initial investigation ends to review lessons learned and to update participants about findings, conclusions, and actions taken (Chapter 6). After the conference call, they should prepare an after-action report to summarize the effectiveness of communication and coordination among jurisdictions, identify specific gaps or problems that arose during the investigation, and communicate lessons learned regarding root cause and contributing factors.

All participating agencies should have the opportunity to review and comment on the report before it is more widely distributed. The lead agency(ies) should review after-action reports periodically to determine whether common problems regarding investigation, response, or root cause are recurring over time; this review can help with an agency's quality improvement and prevention efforts.

Individual states should report all multijurisdictional investigations to NORS. The lead investigating agency, whether a state or local health department or CDC, should collate information from all involved jurisdictions and submit one outbreak report to NORS (https://www.cdc.gov/nors/downloads/appendix-b.pdf).

References

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5 Smith K, Miller B, Vierk K, Williams I, Hedberg C. Product tracing in epidemiologic investigations of outbreaks due to commercially distributed food items—utility, application, and considerations. http://mnfoodsafetycoe.umn.edu/wp-content/uploads/2015/10/Product-Tracing-in-Epidemiologic-Investigations.pdf

CHAPTER

6

Control Measures and Prevention

CHAPTER SUMMARY POINTS

- Effective control measures include a combination of immediate controls to stop the current outbreak and longer term controls to prevent future outbreaks.
- Effective and timely information sharing among investigation and response partner agencies, impacted food industries, and the public is essential to control foodborne illness outbreaks.
- Appropriate control measures vary depending on whether the implicated food was contaminated
  - At a single local food-service or retail food establishment, or
  - Before being commercially distributed.
- Three strategies used to stop foodborne illness outbreaks are
  - Controlling contaminated foods at their source.
  - Controlling contaminated food products that have left the source (e.g., recalls).
  - Preventing secondary spread of infection.
- To identify appropriate control measures, information from different sources, such as epidemiology, laboratory, and environmental health should be integrated into the outbreak response.
- General control measures are often followed up with more specific controls as investigators learn more about the source(s), contributing factor(s) and root cause(s) (i.e., antecedents, underlying reasons) of the outbreak.
- Investigation and control teams should use the after-action review processes to:
  - Assess the strengths and limitations of past responses.
  - Identify action steps to improve future responses.
  - Track corrective actions using the organization's continuous process improvement programs.
  - Prevent outbreak recurrence by applying lessons learned regarding root cause and contributing factors.
- Foodborne illness investigation reports are used to accurately document actions and conclusions to improve future investigation practices and make changes to prevent future outbreaks.

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6.0 Introduction

6.0.1 The purposes of outbreak investigations are to stop the current outbreak, determine how contamination occurred, and implement measures to prevent future outbreaks by addressing the root cause(s) in the implicated, and potentially other, facilities. Whereas the investigation is critical for understanding the cause, effective and timely control measures are critical for stopping the outbreak and preventing reoccurrence of illness. Identifying the root cause(s) of foodborne illness improves the effectiveness of prevention efforts.

The rapid and accurate response to foodborne illness is critical.

Investigators from all three primary disciplines (epidemiology, environmental health, and laboratory) must quickly assess information and identify suspected foods or facilities to prevent additional illnesses.

There are generally two types of foodborne disease outbreaks, and each requires different control measures.

- **Local outbreaks** may be associated with food-preparation errors or contamination of food by food workers at the site of preparation or distribution, e.g., foods prepared at home, food-service, and retail food establishments. Local outbreaks typically are controlled through local actions.
- Outbreaks associated with contaminated **commercially distributed foods** may originate from a commercial food manufacturer or agricultural commodity distributed to multiple sites. The resulting foodborne illness may be linked to a variety of food establishments or to foods prepared in the home. These outbreaks are usually multijurisdictional and require coordinated intervention by local, state, territorial, tribal, and federal agencies and the industry.

6.0.2 Effective communication between team members and with other response partners is essential during all phases of the investigation to ensure opportunities to quickly implement or improve control measures are not missed. The exchange of specific actionable information is paramount to success. Communication within the response team and with other stakeholders during an outbreak response is of primary importance. For all foodborne illness outbreaks, early sharing of information between epidemiologists, laboratory staff, and environmental health specialists is critical to determine what control measures to implement to prevent foodborne illness. Timely food-supply investigations, such as product tracing and environmental assessments, can better define the food vehicle(s) that need to be controlled and identify the contributing factors and environmental root causes that led to foodborne illness (Chapter 5).

6.1 Information-Based Decision Making

6.1.1 Investigation and control teams should be prepared to act at any point in the investigation when credible information identifies opportunities to control or mitigate disease transmission. Controls can be implemented concurrently with product tracing (i.e., traceback, traceforward) investigations, environmental assessments, or other investigative processes. Waiting for laboratory results, medical diagnosis confirmation, or implication of a specific food may not be necessary before implementation of initial control measures to prevent additional exposures.

6.1 Information-Based Decision Making

Control measures typically progress from general to specific as investigations gather more information and should be implemented immediately whenever their need becomes apparent. General precautionary control measures that have high potential for public health benefit and low impact on business operations are usually not controversial and can be implemented relatively quickly in the field by the regulatory authority. Examples include holding a suspected nonperishable food from sale or screening for and excluding an ill employee. Decisions to implement more costly controls, such as recalling a food from distribution or closing a facility, should be based on clear and convincing evidence that food from the facility caused illness or that an imminent hazard to health exists. These decisions should involve input from the entire response team, including risk communication specialists and legal advisors (Chapter 2). Depending on the complexity of the outbreak, input from federal agencies, trade associations, or other industry and academic experts may be necessary.

6.1.2 Investigation and control teams should use a systematic process to evaluate information and regularly reassess control measure decisions. Sometimes the type of control measures needed to stop an outbreak is readily apparent early in the investigation (e.g., significant food temperature or risk factor violations). More commonly, however, key information is initially unavailable about the source, contributing factors, and root causes of foodborne illness outbreaks.

Typical steps in the evaluation include the following:

- Send a team to the likely source as soon as possible.
- Inform and involve the owner or manager of the implicated establishment.
- Assess potential risks on the basis of information provided by each discipline.
- Assess availability of resources needed to implement controls (e.g., legal authorities, equipment, and staff).
- Identify priority control measures, and clarify expectations among team members about the timeliness and completeness of control efforts.
- Implement control measures.
- Reassess and adjust control measures as additional information is gathered.

The quality of information is related to multiple factors (Chapter 5). Evaluate epidemiologic, laboratory, environmental health, and other evidence together to determine the degree to which the integrated data are consistent with each other, biologically plausible, and sufficiently strong to support implementation of control measures.

6.1.3 Investigation and control teams must balance the likelihood that control measures will prevent further illness against other consequences (Box 6.1). Inaction or delayed action in the face of ongoing exposure can result in additional illnesses. Conversely, aggressive control interventions, such as recalling food or closing a food establishment, can have legal or economic consequences for food workers, employers, communities, and entire food industries. Investigation and control team members should not delay initiating steps to protect public health if available information indicates the need to act.

6.1 Information-Based Decision Making

Box 6.1. Questions to Address when Considering Control Options

- Is the contaminant causing the disease highly pathogenic, virulent, or toxic? Are susceptible populations exposed?
- Is the causative microorganism highly infectious and likely to be a source of secondary infections in the community?
- How effective, and how costly, is the proposed control measure likely to be?
- Who would play a role in implementing the control (government agency, food industry, or others)? What information will they need to act?
- Is a narrow, focused action possible—such as recalling a specific group of products or notifying only the persons most likely to have been exposed—rather than a more general recommendation to avoid consuming a general category of food or notifying the public?
- Will the actions affect only one business or an entire industry? How much economic or operational burden will be placed on the public who will need to respond on the basis of the proposed action?
- As they ponder these questions, investigation and control team members must recognize that a rapid response is critical if the threat of serious illness and death is ongoing.

Studies not associated with current investigation.

6.2 Communications With the Public

Agencies should anticipate, prepare for, and allocate resources to respond to and manage public concerns related to any public health messaging about the investigation. All members of the outbreak investigation and control team (epidemiology, environmental health, and laboratory) and health department leadership should provide input into the decision to make a public notification (Box 6.2)

6.2.1 Messages to the public about foodborne disease outbreaks should follow best practices for risk communication and provide objective, fact-based information about the outbreak.

- Ideally, before an outbreak occurs, prepare templates for public messages and have them reviewed by appropriate staff, including legal counsel. Use the templates consistently during the investigation. For examples of communication templates, see the CIFOR Clearinghouse (https://cifor.us/clearinghouse/cifor-toolkit-focus-area-3-communications).
- Follow agency communication protocols. Prepare communication following the agency's risk communication protocols. Seek assistance from the agency public information officer or the public information officer at another agency if the agency with jurisdictional responsibility does not have this resource.
- Provide information about the disease, including symptoms, mode of transmission, prevention, and actions to take if illness occurs.
- Include information about what is known, what is not known, and what officials are doing to learn more.
- Do not speculate about the outbreak. Sharing preliminary or unconfirmed information with the public may result in undue worry if there is no definite action to be taken (i.e., avoidance of a certain food). Such announcements often result in inquiries from concerned citizens and the media, and the resulting expanded workload can rapidly

6.2 Communications With the Public

Box 6.2. Questions to Address when Considering Whether Public Notification is Necessary

- What is the potential severity of disease and risk for additional illnesses (e.g., secondary infections in the community?
- Is medical treatment necessary for persons who might have been exposed to the etiologic agent? If so, urgent public notification is critical.
- Is public reporting of suspected illness necessary to determine the scope of the outbreak? If so, public notification might be appropriate.
- Does risk for exposure still exist? People take food home from restaurants, so public notification still might be appropriate.
- Are large numbers of unknown persons likely to be ill with highly infectious agents, such as norovirus or *Shigella*? If so, an advisory that ill persons should stay out of work or restrict activities may help prevent secondary transmission at other food establishments, day care, and healthcare facilities.
- Is the source of the outbreak past its shelf life so no further risk exists to the public? If so, public notification may not be needed.

divert resources from the investigation and control team and increase pressure to quickly name the source of the outbreak.

- Ensure that officials prepare talking points to respond to media inquiries and social media questions, if needed. The Colorado Integrated Food Safety Center of Excellence developed the Communications Toolkit: Media Relations to help agencies work constructively with the media during foodborne illness outbreaks (*1*).
- Work closely with public information officers to ensure that consistent messaging is used to answer inquiries. This collaboration can reduce the potential for confusion or panic among consumers and industry.
- Maintain effective, accurate, and consistent communication with other agencies (i.e., local, state, territorial, tribal, and federal) involved in, or impacted by, the investigation.

6.2.2 Notify the public when actionable information is available that the public can act on to prevent additional illness (Box 6.3). Attempt to reach all members of the population at risk, including non–English-speaking and low-literacy populations.

- Means of notification depend on the public health risk and the target population and might include press releases, radio, television, fax, telephone, text messaging, email, Web posting, social media, or letters.
- Provide clear and actionable information about how to handle a suspected product (discard, special preparation instructions, or return to place of purchase) or whether the local jurisdiction is interested in obtaining the product from households that still have it.
- Consider notifying area clinicians and healthcare facilities if an increase is expected in the number of people seeking healthcare after public notification.

6.2.3 If public notification is expected to generate considerable public concern and/or media inquiries, consider setting up an emergency hotline for the public and media. Train people answering the phones to give consistent responses. Give them talking points or frequently asked questions and answers. Consider staffing the hotline after hours to answer phones after the early evening news or to respond to questions posed on social media.

6.2 Communications With the Public

Box 6.3. Notifying the Public About Actionable Information

Early public announcements should reinforce basic food safety messages and inform the public about how to contact appropriate authorities to report suspected foodborne illnesses.

Educational materials on food safety targeted at the public are available from the Partnership for Food Safety Education (http://www.fightbac.org) and the Centers for Disease Control and Prevention's Food Safety website (https://www.cdc.gov/foodsafety). The following specific food safety messages are important to communicate to the public.

- Personal protection from disease outbreak:
  - Thoroughly wash hands with soap and warm water after using the bathroom and before preparing or eating food. Also wash hands after changing diapers, assisting a child at the toilet, and handling animals or animal waste. Hand washing is the single most important measure to protect the public's health.
  - At home or at a social gathering (e.g., potluck dinner), avoid eating food that has not been handled properly (e.g., hot food that has not been kept hot, cold food that has not been kept cold).
- Proper food preparation:
  - Thoroughly cook food; keep hot food hot and cold food cold; thoroughly clean all food-preparation surfaces and utensils with soap and water; avoid contaminating food that will not be cooked, such as salads, with food that must be cooked, such as raw meat or chicken products; and wash hands frequently with soap and water.
  - If you are ill with diarrhea or vomiting, do not prepare food for others until at least 72 hours after you are free of diarrhea or vomiting.
  - Wash hands before and during food preparation.
- Actions if someone in the household or childcare, or institutional setting has diarrhea or vomiting:
  - If a norovirus-like illness is involved, emphasize the importance of thorough cleaning and sanitation of high-risk transmission surfaces, such as toilet seats and flush handles, washbasin taps, and washroom door handles.
- Appropriate community guidance, references, and educational materials are available at https://www.cdc.gov/norovirus/preventing-infection.html.

6.3 Communications With Response Partners and Stakeholders

Early communication with healthcare providers, the food industry involved, and others impacted by the outbreak can increase case detection, reduce the risk for secondary transmission, and help identify the source of contamination. If the pathogen causing enteric illnesses is known, use of general communicable disease control measures may limit further spread, even before the mode of transmission is clear or a food or facility has been implicated. Control measures at this point typically focus on preventing secondary spread by known cases and communicating with healthcare providers and the public about precautionary measures they can take to prevent illness transmission of the identified pathogen.

6.3 Communications With Response Partners and Stakeholders

6.3.1. Effective communication with other agencies involved in the investigation or potentially impacted by the response helps staff from multiple agencies take timely actions to prevent further illnesses. During multistate outbreaks, others involved might include agencies and organizations at the local, state, territorial, tribal, and federal public health and regulatory levels (Chapter 7). A consistent public message alleviates confusion and reduces the potential for panic among consumers.

6.3.2 Communications with healthcare providers should include reminders and instructions to be shared with ill persons about personal hygiene, ways to avoid spreading infection, and infection control precautions for hospitalized patients and residents of long-term–care facilities. Instruct healthcare providers to report suspected illness to local health departments for follow-up and interviews, especially when ill persons work in settings where the risk for disease transmission is most likely, such as in food establishments and childcare and healthcare facilities. Advise healthcare providers about whether to collect clinical samples for analysis, if indicated.

6.3.3 Early communication with impacted food establishments, commodity groups, or food industries likely impacted by the public notification can assist them to

- Prepare for media enquiries.
- Consider how they can cooperate with the investigation to identify the cause(s).
- Implement control measures to prevent further cases.

Food-industry representatives often have detailed knowledge about typical food-handling, storage, and distribution practices that can guide investigation and control efforts. Early sharing of clear, credible, and objective information often motivates firms to voluntarily bolster efforts to comply with standard food safety and communicable disease control measures, such as

- Excluding or restricting ill persons from food handling.
- Eliminating bare-hand contact with ready-to-eat foods.
- Proper handwashing.
- Thorough cooking.
- Effective cleaning and sanitizing procedures.

It is often helpful to provide a written summary identifying key information, including the type of agent (viral, bacterial, chemical, toxic), the exposure time period (particularly if exposure is potentially ongoing), and whether a single point source or multiple different exposures most likely caused the illnesses.

The Communications Toolkit: Industry Relations developed by the Colorado Integrated Food Safety Center of Excellence is an example of resources available to help agencies communicate effectively with the food industry during foodborne illness outbreaks (*1*).

6.4 Control Measures

Although most reported foodborne illness outbreaks are investigated and controlled at the local level, site-specific food-safety controls may be needed at multiple points along the distribution network and in the impacted communities (Figure 6.1).

6.4 Control Measures

Figure 6.1. Controlling the Source and Communicating with the Public

At the source:

Stop further production of contaminated food at the implicated food establishment.

Control any contaminated food remaining at the establishment.

In distribution:

Remove contaminated food from commercial distribution.

In the community:

Notify the public not to consume contaminated products that may be in their homes.

Appropriate control measures vary depending on whether the implicated food is associated with a food-service/retail food establishment or is a manufactured food that has been commercially distributed. The outbreak response team must determine as soon as possible whether one facility or multiple facilities are involved.

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6.4.1 Implement initial control measures at an implicated facility on the basis of investigation findings and review of what is known about other outbreaks caused by the agent and the food establishment's food-safety history. Credible epidemiologic, laboratory, and environmental health evidence can support early implementation of nonspecific control measures at an implicated facility, even though a specific food has not yet been identified.

- Adjust control measures on the basis of knowledge of the agent and whether a food item is suspected. An outbreak caused by *Clostridium perfringens* has very different contributing factors and control measures than one caused by norovirus. Controls for a *C. perfringens* outbreak focus on time and temperature for food safety, including rapid cooling, proper hot holding, and reheating. Controls for a norovirus outbreak focus on identifying and excluding ill employees. Also ensure proper hand-washing, no bare-hand contact of ready-to-eat foods, disposal or embargo of ready-to-eat foods when bare-hand contact occurs and thorough cooking is not possible, enhanced cleaning and sanitizing procedures, and (possibly) changes in the source of suspected high-risk foods used in the facility. Focusing on pathways commonly linked to the agent are most likely to identify and address the root causes of the outbreak.
- Review the establishment's history for recurring foodborne illness risk factors, previous outbreaks, illness complaints, recall, positive food samples, and correction of serious food-safety hazards. This information can indicate management's capability and willingness to consistently maintain food-safety controls. Understanding the facility's existing level of active managerial or process control can guide how the investigation and control team works with management to implement changes needed to address contributing factors and the environmental root causes that led to the outbreak.

6.4.2 Coordinate onsite investigation, environmental assessment, and control measures at the implicated facility. Most foodborne illness outbreaks are local events investigated and controlled by staff from local public health agencies. For large-scale or multijurisdictional outbreaks, staff from multiple disciplines or agencies may be involved. Staff should identify investigation and control objectives and clarify agency roles and responsibilities before arriving at the implicated food establishment. Initial clarification of both types of objectives helps ensure that appropriate staff visit the facility.

- A team approach is often needed to effectively conduct the onsite investigation and implement control measures. When conducting any environmental assessment, at least two environmental health specialists should be deployed in the field to ensure both investigative and control measure objectives are achieved. Environmental assessment teams visiting facilities for the first time must often simultaneously seek to complete multiple objectives. A few examples include communicating with firm management to enlist its cooperation, ensuring the safety of foods being served/sold, placing seizures/embargoes/holds on implicated or suspected foods or leftovers, interviewing food workers, assessing foods served and processes during the period of interest, and collecting documents and samples as needed.
- Rapid initial assessments to identify conditions requiring immediate control measures should be coordinated with ongoing investigation activities. Effective control measures address both the contributing factors that resulted in foodborne illness (what went wrong) and the root cause(s) of the outbreak (why it went wrong at this location).

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6.4.3 Gather samples while they are still available. Early collection of samples while they are still available can greatly aid in determining the root causes of foodborne illness (Chapter 5). Discarding suspected food can help stop the outbreak, but isolating the etiologic agent from the food provides the most convincing evidence a food was the source of the outbreak. Use both epidemiologic data and guidance from the laboratory to inform decisions about what samples to collect and how to handle them.

6.4.4 Control measures for localized events associated with a single food-service or retail food establishment will usually be established by local public health agencies or state and local food-regulatory agencies. Although all of the following control measures are recommended, some may be more appropriate than others in specific outbreaks, and full implementation might not be possible in some jurisdictions. Implementing the most appropriate control measures as completely and promptly as possible improves the effectiveness of those measures. Before using any control measure, the environmental health/regulatory specialist must understand applicable laws and procedures for implementing them (Chapter 2).

- **Inform and engage facility management in implementing controls.** Environmental health specialists should work with the food establishment's person-in- charge (PIC) to implement active managerial controls and create a risk-control plan or consent agreement. Active involvement of the PIC uses his or her expertise and often increases commitment to implement controls to stop the current outbreak and prevent additional outbreaks. The CIFOR Industry Guidelines outlines, clarifies, and explains the recommended role of owners, operators, and managers of food establishments in a foodborne illness outbreak investigation (*2*).
- **Remove food from sale or prevent consumption**. If evidence from the epidemiologic, laboratory, and environmental assessment/root cause analysis supports the action, implicated or potentially unsafe foods should be embargoed, seized, placed under regulatory hold, or otherwise removed from service or sale. Fully document the information that led to the decision and the process used to make the decision. Issuing a written hold or embargo order establishes clear expectation and regulatory requirements and prevents the establishment owner from serving or destroying the food before the investigation is complete.
- **Clean and sanitize.** If evidence from the outbreak investigation identifies the potential for onsite contamination during the outbreak, the environmental health specialist must ensure involved equipment and areas of the facility are thoroughly cleaned and sanitized. This process includes disassembling all equipment and retraining staff on proper cleaning and maintenance procedures for the equipment. The cleaning and sanitizing process is particularly important if *Salmonella*, *Listeria monocytogenes*, or norovirus contamination of food is suspected. Industry guidance documents are identified under references.
- **Train food managers and workers.** Assess to what degree the presence of food-safety risks is due to inadequate food worker knowledge, inadequate supervision, or lack of active managerial control. Ensure the firm's food-safety management system is adequate to ensure that managers and food workers receive consistent food-safety training appropriate for their job duties. Ensure remedial training is provided, as needed so that food managers and workers have a functional understanding of the disease (e.g., symptoms, modes of transmission) and the food-safety practices (e.g., use of procedures for rapid cooling and thorough cooking

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and reheating of foods) needed to stop the outbreak and prevent recurrence.

- **Modify a food process.** Assess food-production or food-preparation processes at the establishment using both investigation findings and the best available scientific information. Examples of critical steps and controls include process times, temperatures, parameters (pH, water activity level), and label instructions. Implement changes needed to consistently prevent contamination of food or the survival and proliferation of disease-causing microorganisms.
- **Modify the menu.** Eliminate implicated foods from the menu until adequate control measures are in place to ensure food safety. For example, if shell eggs are implicated, remove all foods that contain shell eggs, and substitute pasteurized egg product until the investigation is complete and proper controls are in place.
- **Remove infected food workers.** Ensure that ill or infected food workers are excluded from the workplace or restricted in accordance with the Food Code (*3*) or other regulatory requirements unless evidence gathered by the investigation team indicates that a longer exclusion period is needed (e.g., evidence exists of ongoing norovirus transmission within the food establishment). Because many food workers are employed by more than one food establishment, ensure ill workers are excluded or restricted from all food establishments where they work.
  - Food establishment management should conduct daily monitoring of worker health to prevent further contamination of food by ill or infected workers. For example,
    - A person ill with vomiting or diarrhea should be excluded from the facility.
    - Pathogen-specific guidance and other information about restricting and excluding food workers is available in the latest version of the Food and Drug Administration (FDA) Food Code (*3*).
  - In *Salmonella* and *Shigella* outbreaks, fecal samples should be analyzed for the pathogen because of the likelihood of asymptomatic but infectious food workers. Restricting activities of food workers who do not comply with the request might be necessary.
  - Excluding ill food workers is not as simple as it might seem. Food workers may be reluctant to inform managers of illness because of fear of lost wages, reprisal, or leaving their co-workers short-handed. Conversely, managers underappreciating the risk to public health and their firm's economic viability may be reluctant to relieve food workers of their duties or may themselves work while ill.
  - Facilities with a strong food-safety culture ensure that both managers and food workers are well informed about alternatives to coming to work while sick, including alternate jobs that ill food workers can perform and allowing ill employees to trade for shifts when their exclusion has been lifted.
- **Use risk-control plans.** Written risk-control plans or other agreements are used to identify and focus control measures that establishments need for safe operation. Important aspects of these plans include
  - Process changes, such as recipe adjustments or development of a Hazard Analysis and Critical Control Point plan.
  - Worker training.
  - Adequate oversight measures to ensure workers follow proper procedures.

  Plans may require
  - Increased focus on regulatory requirements (e.g., additional measures to ensure appropriate handwashing by all employees).

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- Additional measures above and beyond regulatory minimum requirements (e.g., extra temperature checks and logging of temperature).

- **Close food establishments.** Facilities that cannot safely remain in operation must be closed in accordance with applicable local and/or state regulations. A facility linked to an ongoing foodborne illness outbreak, in which significant noncompliance with regulatory food-safety standards is documented, is an imminent or substantial health hazard.
- **Communicate findings.** Effective communication of the evidence gathered by the investigation and control team can be a powerful motivator for establishment management to close or significantly modify operations. Voluntary actions are often the most efficient and timely way to reduce risks to the public. If the owner cannot or will not take immediate corrective action to eliminate ongoing food-safety hazards, mandatory closing of the premises may be necessary.
- **Notify the public.** As control measures are implemented at the source, public notification can be an effective way to prevent additional illnesses and further disease transmission, but it must be used judiciously. If the outbreak involves only one facility, carefully consider whether public notification is truly necessary. See 6.2 for details.
- **Monitor control measures.** The strategy for monitoring short- and long-term correction of the factors within the food establishment that caused the outbreak should be identified in writing. Food establishments should integrate monitoring steps into their food-safety management systems (e.g., Active Managerial Control), and regulatory officials should provide the facility with timely follow up inspections so the effectiveness of control measures can be assessed, modified, or removed when appropriate. Public health officials should maintain enhanced surveillance of potentially exposed populations to ensure controls are effective, secondary spread of infections is not occurring, and systems are in place to prevent reoccurrence.

6.5 Outbreaks Involving Commercially Distributed Foods

6.5.1. Control measures associated with commercially distributed foods typically require coordination of multiple agencies across jurisdictional levels, especially when an implicated food item is subject to recall (Chapter 7). Careful coordination of control measures at the food-manufacturing facility, in distribution channels, and in consumer homes often is needed to stop outbreaks linked to commercially distributed foods. Food manufacturers can range from small facilities with limited local distribution to large, complex facilities capable of producing huge quantities of diverse products daily. Although contaminated products may still be stored onsite at the manufacturing facility, the probability is much higher that they have moved through various points of often complex distribution networks that can span the globe and include a wide range of locations, including; warehouses, distributors, retail establishments, consumer homes, and food banks. Timely product tracing investigations often identify the point in the production and distribution process where the implicated food became contaminated and where contaminated products may have been distributed after that (Chapter 5). The type of food products involved and the extent of their distribution often determine which regulatory agency leads the implementation and coordination of control measures.