

Foodborne Disease Surveillance and Outbreak Detection

The term “foodborne disease surveillance” generally refers to the routine monitoring in a population for enteric disease for which a food vehicle may be involved. The actual vehicle usually is not known during the surveillance process, and transmission ultimately could be due to food, water, person-to-person spread, or other vehicles.

One of the primary functions of foodborne disease surveillance and outbreak investigation is to detect problems in food and water production and delivery systems that might otherwise have gone unnoticed. Rapid detection and investigation of outbreaks is a critical first step to abating these active hazards and preventing their further reoccurrence (discussed further in Chapter 5). Broader goals of surveillance include defining the magnitude and burden of disease in the community, providing a platform for applied research, and facilitating understanding of the epidemiology of foodborne diseases.

4.0. Introduction

Unlike food-monitoring programs, which seek to identify problems in food production and correct them before illnesses occur, foodborne disease surveillance cannot prevent initial cases of disease. Nevertheless, surveillance is the most sensitive tool available for identifying failures anywhere in our food supply systems. Food monitoring must concentrate on monitoring the effectiveness of risk reduction procedures at critical control points in the production of food. However, the range of potential vehicles detectable through foodborne disease surveillance includes all food or other substances contaminated at any link in the chain from production to ingestion. Foodborne disease surveillance complements regulatory and commercial monitoring programs by providing primary feedback on the effectiveness of prevention programs.

Over the years, foodborne disease surveillance, coupled with outbreak investigation, has remained among the most productive public health activities, resulting in the

recall of hundreds of millions of pounds of contaminated products and prompting numerous large and small changes in food-production and food-delivery systems. Many improvements in food safety during the last 100 years directly or indirectly resulted from outbreak investigations. However, current surveillance practices vary widely, are unevenly resourced, and generally exploit only a fraction of the system's potential.

When a potential foodborne disease outbreak is first detected or reported, investigators will not know whether the disease is foodborne, waterborne, or attributable to other causes. Investigators must keep an open mind in the early stages of the investigation to ensure that potential causes are not prematurely ruled out. While the focus of these Guidelines is foodborne disease, many of the surveillance and detection methods described in this chapter and the investigation methods described in Chapter 5 apply to a variety of enteric and other illnesses, regardless of source of contamination.

4.1. Overview

Disease surveillance is used to identify clusters of potential foodborne illness. Investigation methods (Chapter 5) then are used to identify common exposures of ill persons in the cluster that distinguish them from healthy persons. Although, in practice, detecting individual foodborne disease outbreaks involves multiple approaches, three general methods are used in outbreak detection (Table 4.1):

- **Pathogen-specific surveillance:**
Health-care providers and laboratorians report individual cases of disease when selected pathogens, such as *Salmonella enterica* or *Escherichia coli* O157:H7, are identified in specimens from patients. This surveillance method also includes specific clinical syndromes with or without laboratory confirmation, such as hemolytic uremic syndrome (HUS) and botulism. Exposure information is gathered by interviews with
- cases. Data and pathogens collected as part of food, animal, or environmental monitoring programs enhance this surveillance method. The national PulseNet system is an example of pathogen-specific surveillance.
- **Notification/complaint systems:**
Health-care providers or the public identify and report suspected disease clusters or independent complaints. Exposure information is acquired by interviews of cases.
- **Syndromic surveillance:**
This surveillance method generally involves systematic (usually automated) gathering of data on nonspecific health indicators that may reflect increased disease occurrence, such as use of Immodium®, visits to emergency departments for diarrheal complaints, or calls to poison control hotlines. Exposure information is not routinely collected.

4.1. Overview

Table 4.1. Comparison of foodborne disease surveillance systems

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FUNCTIONAL CHARACTERISTIC OF SYSTEM	SURVEILLANCE METHOD				
	PATHOGEN-SPECIFIC	NOTIFICATION/COMPLAINT			SYNDROMIC
		GROUP NOTIFICATION	INDIVIDUAL COMPLAINT		
Inherent speed of outbreak detection	Relatively slow	Fast	Fast	Fast	Potentially fast*
Sensitivity to widespread, low-level contamination events (<i>best practices used</i>)	High	Intermediate	Intermediate	Intermediate	Low [†]
Types of outbreaks (etiology) that system can potentially detect	Limited to clinically suspected or laboratory-confirmed diseases under surveillance	Any [‡]		Any, although effectiveness limited to agents with short incubation periods [‡]	Limited to syndromes (or indicators) under surveillance
Initial outbreak signal (at <i>public health level</i>)	Cluster of cases in space or time with common agent	Report of group illnesses recognized by health-care provider, laboratory, or the public		Multiple independent reports with common exposures in space or time or unique clinical presentation recognized by the agency receiving the reports	Trend in health indicator different from expected, space/time clusters of diagnosed cases
No. cases needed to create initial signal	Low to moderate	Low		Low to moderate	High [§]
Signal-to-noise ratio	High ^{**} (after interview of cases and collection of appropriate food history) Even higher when combined with subtyping	High ^{**} (after interview of cases and collection of appropriate food history)		Low to moderate (after interview of cases and collection of appropriate food history)	Low [¶]

* An advantage in speed is limited mainly to nonspecific health indicators (preclinical and clinical prediagnostic data). Data must be analyzed, and a follow-up investigation is required, including comparison with standard surveillance, before public health action can be taken.

† Sensitivity is higher for rare, specific syndromes, such as botulism-like syndrome.

‡ Although outbreaks can be detected without an identified etiology, linking multiple outbreaks to a common source may require agent information.

§ The number of cases needed to create a meaningful signal is related to the specificity of the indicator. Indicators that offer an advantage in speed also tend to have low specificity.

¶ Exposure histories are not typically obtained.

** A high signal-to-noise ratio means that even a small number of cases stand out against a quiet background. A low ratio means a cluster of cases or events is difficult to perceive because it is lost in the many other similar cases or events happening simultaneously—similar to a weak radio signal lost in static noise. The signal-to-noise ratio is lowest for nonspecific health indicators, such as Immodium® use or visits to the emergency department with diarrhea complaints. The ratio increases with increasing specificity of agent or syndrome information. For highly specific, rare syndromes, such as “botulism-like” syndrome, the signal-to-noise ratio would approach that of pathogen-specific surveillance.

4.1. Overview

This chapter reviews major features, strengths, and limitations of each surveillance method and provides recommendations for increasing the effectiveness of each. Because many agents transmitted by food also can be transmitted

by water and from person to person, animal to person, or other mechanisms, outbreaks are not considered “foodborne” until determined by investigation to be so.

4.2. Pathogen-Specific Surveillance

4.2.1. Purpose

To systematically collect, analyze, and disseminate information about laboratory-confirmed illnesses or well-defined syndromes as part of prevention and control activities.

4.2.2. Background

Surveillance for typhoid fever began in 1912 and was extended to all *Salmonella* in 1942. National serotype-based surveillance of *Salmonella* began in 1963, making it one of the oldest pathogen-specific surveillance programs and the oldest public health laboratory subtype-based surveillance system. The usefulness of pathogen-specific surveillance is related to the specificity with which agents are classified (i.e., use of subtyping and method), permitting individual cases of disease to be grouped with other cases most likely to share a common food source or other exposure. This type of surveillance greatly expanded during the 1990s with the development of PulseNet and molecular subtyping of selected foodborne diseases, including *Salmonella*, *Escherichia coli* O157:H7, *Shigella*, *Listeria*, and *Campylobacter*.

4.2.3. Case Reporting and Laboratory Submission Process

Most diseases included under pathogen-specific surveillance are reportable (i.e., notifiable) diseases. State or local health agencies establish criteria for voluntary or mandatory reporting of infectious diseases, including those that might be foodborne (Box 4.1). These criteria describe the diseases to report, to whom, how, and in what time frame.

For this type of surveillance, diseases are defined by specific laboratory findings, such as isolation of *Salmonella enterica*, or by well-defined syndromes, such as HUS. Diseases are reported primarily by laboratories, medical staff (e.g., physicians, infection-control practitioners, medical records clerks), or both. Diseases can be reported by telephone, mail, or fax; through a secure website; or automatically through reports generated from an electronic medical record or laboratory information

Box 4.1. Selected nationally notifiable diseases that can be foodborne

- Anthrax (gastrointestinal)
- Botulism (foodborne)
- Cholera
- Cryptosporidiosis
- Cyclosporiasis
- Giardiasis
- Hemolytic uremic syndrome, postdiarrheal
- Hepatitis A infection, acute
- Listeriosis
- Salmonellosis
- Shiga toxin-producing *Escherichia coli* (STEC) infection
- Shigellosis
- Trichinellosis (Trichinosis)
- Typhoid fever
- *Vibrio* infection

From CDC. Nationally Notifiable Infectious Diseases. United States 2008. Revised. Available at: <http://www.cdc.gov/ncphi/diss/nndss/phs/infdis.htm>.

4.2. Pathogen-Specific Surveillance

system. In addition, isolates or other clinical materials are forwarded from laboratories serving primary health-care facilities to public health laboratories for confirmation and further characterization, as required by state laws or regulations or as requested by the local jurisdiction. CDC works with states to compile national surveillance data. Requirements for individual states are available at <http://www.cste.org/nndss/reportingrequirements.htm>.

4.2.4. Epidemiology Process

Information received by the public health agency through multiple avenues, including basic clinical and demographic data from individual cases of specific laboratory-confirmed illness or well-defined syndromes, is reconciled and associated with case isolates or other clinical materials received in the public health laboratory. Reconciled case reports are forwarded to higher jurisdictional levels (local health agency to state agency, state agency to federal agency) by a variety of mechanisms. In general, records are redacted (stripped of individual identifiers) when they are sent outside the reporting states.

Cases may be interviewed one or more times about potential exposures and additional clinical and demographic information. The scope of these interviews may vary by jurisdiction. Interviews typically cover basic descriptive information and exposures of local importance, such as attendance at a child-care facility, occupation as a food worker, and medical follow-up information. Whereas many local agencies collect information about a limited set of high-risk exposures, detailed exposure interviews usually are reserved for investigating clusters or recognized outbreaks (Chapter 5). However, routine collection of detailed exposure information can provide a basis for the evaluation of clusters as they are detected (“real time”) and may be justified for enteric pathogens of sufficient public health importance, such as *E. coli* O157:H7 and

Listeria monocytogenes. (See Chapter 5 for further discussion.)

Agent, time, and place are examined individually and in combination to identify potentially significant clusters or trends. This is the critical first step in hypothesis generation. Clusters of unusual exposures, abnormal exposure frequencies, or unusual demographic distributions (e.g., predominance of cases in a particular age group) may be identified. Clusters of cases are examined as a group and, if a common exposure seems likely, investigated further (Chapter 5).

Hypotheses to explain the cluster can be developed in several ways. If trawling questionnaires are routinely administered after a case is reported, hypotheses can be generated through examination of previously obtained exposure data for commonality or trends and may be followed by an iterative follow-up interview (see below). In jurisdictions where trawling questionnaires are not used routinely, extensive hypothesis-generating interviews may be used only for cases suspected to be part of a common-source cluster. Unless these interviews identify an obvious exposure leading to direct public health intervention, hypotheses are tested during the ensuing investigation (see Chapter 5).

Questionnaire data are not the sole source of information available to investigators. They also should take advantage of product distribution data obtained from the food distributors or noteworthy “coincidences,” such as the occurrence of a majority of cases among children, which might point to a product targeted at children. The most successful investigators develop and consider information from as wide a variety of sources as possible.

4.2.5. Laboratory Process

For some foodborne pathogens, clinical

4.2. Pathogen-Specific Surveillance

diagnostic laboratories forward case isolates or other clinical materials to public health laboratories as part of mandated or voluntary reporting rules. Problems such as mislabeling, broken-in-transit, or quantity-not-sufficient are resolved. Receipt of specimens is recorded, and specimen information is entered into the Laboratory Information Management System before or concurrently with testing. Patient information submitted with the sample may be provided to the epidemiology department for comparison with cases already reported and to allow reconciliation of case reports and laboratory samples and identification of previously unreported cases.

The agent identification is confirmed, and tests (such as serotyping, molecular subtyping, or antimicrobial susceptibility assays) are conducted to further characterize the agent. Reports are issued either singly or in consolidation to the epidemiology department. Reports also may be issued to submitters as permitted by local policies, and specimen data (including detailed subtyping results) are uploaded to national systems such as the Public Health Laboratory Information System (PHLIS) and PulseNet. Clusters of cases identified by the public health laboratory are reported to the epidemiology department. For suspected multijurisdictional outbreaks, national notification or inquiries can be conducted through PulseNet.

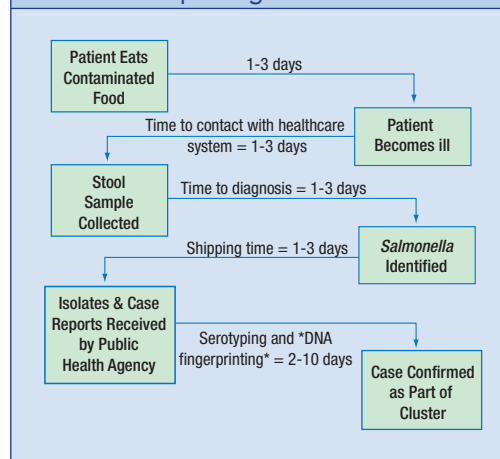
For an individual case of botulism, and occasionally for an individual case of other infections, testing food or other environmental specimens is useful (e.g., pet reptiles for *Salmonella* or frozen ground beef for an *E. coli* O157:H7 infection) but is otherwise not advised. This testing may be conducted at a state or local public health laboratory or at a state food testing regulatory laboratory. Without strong epidemiologic data or environmental information, microbiologic screening of food to investigate clusters generally is unproductive and always is

resource-intensive. However, this approach occasionally is warranted when only a few foods are suspected, reasonable samples are available, and other investigation approaches do not appear to be working.

4.2.6. Timeline for Case Reporting and Cluster Recognition

Pathogen-specific surveillance requires a series of events to occur between the time a patient is infected and the time public health officials determine the patient is part of a disease cluster. This delay is one of the limiting factors of this type of surveillance. Minimizing delay by streamlining the individual processes improves the likelihood of overall success. A sample timeline for *Salmonella* case reporting is presented in Figure 4.1.

Figure 4.1. Sample *Salmonella* case reporting timeline



1. Incubation time:

The time from ingestion of a contaminated food to beginning of symptoms. For *Salmonella*, this typically is 1–3 days, sometimes longer.

2. Time to contact with health-care provider or doctor:

The time from the first symptom to medical care (when a diarrhea sample is collected for laboratory testing). This time may be an additional 1–5 days, sometimes longer.

4.2. Pathogen-Specific Surveillance

3. Time to diagnosis:

The time from provision of a sample to lab identification of the agent in the sample as *Salmonella*. This may be 1–3 days from the time the lab receives the sample.

4. Sample shipping time:

The time required to ship the *Salmonella* bacteria from the lab to the state public health authorities who will perform serotyping and DNA fingerprinting. This usually takes 0–7 days, depending on transportation arrangements within a state and distance between the clinical lab and the public health department. Diagnostic labs are not required by law in many jurisdictions to forward *Salmonella* isolates to public health labs, and not all diagnostic labs forward any isolates unless specifically requested to do so.

5. Time to serotyping and DNA fingerprinting:

The time required for the state public health authorities to serotype and to perform DNA fingerprinting on the *Salmonella* and compare it with the outbreak pattern. Serotyping typically takes 3 working days but can take longer. DNA fingerprinting can be accomplished in 2 working days (24 hours). However, many public health labs have limited staff and space and experience multiple emergencies simultaneously. In practice, serotyping and PFGE subtyping may take several days to several weeks; faster turnarounds are obviously highly desirable.

The time from onset of illness to confirmation of the case as part of an outbreak is typically 2–3 weeks. Case counts in the midst of an outbreak investigation are therefore always preliminary and must be interpreted within this context.

4.2.7. Strengths of Pathogen-Specific Surveillance for Outbreak Detection

- Permits detection of widespread disease clusters initially linked only by a common agent. Most national and international

foodborne disease outbreaks are detected in this manner.

- When combined with specific exposure information, is arguably the most sensitive single method for detecting unforeseen problems in food and water supply systems caused by the agents under surveillance. The specificity of agent or syndrome information combined with specific exposure information obtained by interviews allows the positive association of small numbers of cases with exposures.

4.2.8. Limitations of Pathogen-Specific Surveillance

- Works only for diseases detected by routine testing and reported to a public health agency.
- Is relatively slow because it requires that (a) patients seek medical attention; (b) tests are ordered; (c) samples are collected, transported, and tested; and (d) isolates are forwarded to public health laboratories for further characterization.

4.2.9. Key Determinants of Successful Pathogen-Specific Surveillance

The following interrelated factors are critical to understanding the use of surveillance data to identify potential outbreaks and form the basis for best practices of cluster investigations (Chapter 5).

4.2.9.1. Sensitivity of case detection

Surveillance represents a sampling of the true population of affected persons because most cases of foodborne disease are not diagnosed and reported. **The completeness of the reporting and isolate submission processes affects the representativeness of the reported cases and the potential number and size of outbreaks detected.**

If the percentage of cases reported or isolates submitted is low (i.e., sensitivity is low), small outbreaks, or outbreaks spread over space and

4.2. Pathogen-Specific Surveillance

time are likely to be missed. Furthermore, if sensitivity is low, reported cases might differ significantly from cases not reported. Therefore, care must be taken in using characteristics of reported cases to develop hypotheses about the outbreak (see Chapter 5).

4.2.9.2. *Prevalence of the agent and specificity of agent classification*

The more common the agent, the more difficult it is to identify outbreaks and the more likely sporadic (unrelated) cases are to be misclassified with outbreak cases.

This obscures trends and dilutes outbreak measures of association (type 2 probability error or the possibility of missing an exposure–disease association when one truly exists). Consequently, a larger number of outbreak cases are needed to significantly associate illness with exposure.

Examination of subsets of cases using case definitions based on specific agent classifications (e.g., inclusion of subtyping results) or restricting cases using certain time, place, or person characteristics can minimize this impact. For example, *Salmonella enterica* serotype Typhimurium, a common serotype, provides the opportunity for misclassification (i.e., grouping together cases resulting from different exposures). However, *Salmonella* Typhimurium cases that are part of a common-source outbreak are more likely than cases not associated with the outbreak to share a PFGE subtype. Therefore, using the PFGE subtype in the case definition will decrease misclassification (i.e., exclude cases not related to the outbreak) and increase the chance of finding a statistically significant association between illness and exposure. This is the basic principle behind PulseNet.

Increasing the specificity of strain classification is useful only to a point. Because truly associated cases with different subtypes (or no subtyping at all) also can be eliminated from the study, increasing strain classification

specificity may become problematic when the number of cases is small. For this reason, use of several different levels of agent specificity during the investigation might be helpful.

4.2.9.3. *Sensitivity and specificity of interviews of cases*

One reason an ill person seeks medical attention is his or her suspicion that he or she might have been part of a foodborne disease outbreak. Routine case interviews should always identify group exposures, such as a banquet, after which other persons may have been ill. For these cases, the event itself largely (but not entirely) defines the exposures of interest. However, exposures that otherwise need to be considered in pathogen-specific surveillance usually are open-ended; they include all exposures in a time frame appropriate to the disease.

As noted above, many local agencies collect information about a limited set of high-risk exposures, and routine collection of detailed exposure information can provide a basis for “real-time” evaluation of clusters that may be justified for enteric pathogens of sufficient public health importance. Lack of a list of specific exposures, such as a menu, makes prompting cases during the interview more difficult. Furthermore, cases identified through pathogen-specific surveillance usually are interviewed later after the exposure than are those reported as part of specific events. **Thus, greater attention must be paid to interview timing and content.**

4.2.9.3.1. *Timing*

To decrease the time between exposure to the disease-causing agent and interview of the case, reporting of cases by health-care providers and laboratories should be as easy as possible. Patients should be interviewed as soon as possible because recall will be better closer to the time of the exposure and cases will be more motivated to share information with investigators closer to the time of their illness.

4.2. Pathogen-Specific Surveillance

4.2.9.3.2. Content

In pathogen-specific surveillance, the interview form itself must include a broader range of potential exposures than interview forms for event-driven investigations. Interview forms that use of a combination of question types will increase the likelihood of detecting the desired exposure information and should be used, as appropriate to the outbreak and surrounding circumstances. Interview forms can include questions that:

- Collect information about specific exposures, such as a broad range of specific food items and nonfood exposures previously (or plausibly) associated with the pathogen through close-ended questions;
- Prompt cases to further describe exposures, such as brand information and place of purchase or consumption; and
- Enable cases to identify unanticipated exposures through open-ended questions (“At which restaurants did you eat?”).

Questionnaire design involves balancing a number of competing demands; the end result is always a compromise. Questionnaires with lots of open-ended questions require more highly trained and skilled personnel than interviews using more pre-defined lists of exposures. Longer questionnaires can cover more potential exposures, but may task the patience of both subject and interviewer; cases may quit the interview before it is completed. Open-ended questions generally are more difficult and time-consuming to abstract and keypunch.

No one questionnaire will work for all investigations or surveillance systems. Investigators should consider the specifics of the outbreak and setting, the importance of collecting the information, and the likely trade-offs before deciding on the content of the interview form.

Regardless of interview content, use of a standardized interview form, with which the interviewer is familiar, will decrease time spent on staff training and decrease errors in data collection. In addition, use of standardized “core” questions (i.e., questions that use the same wording for collecting information about certain exposures) and data elements will enhance data sharing and allow comparisons among jurisdictions in multijurisdictional outbreaks.

4.2.9.4. Overall speed of the surveillance and investigation processes

As described in section 4.2.6 above, time delays are inherent in pathogen-specific surveillance. **The usefulness of pathogen-specific surveillance in preventing ongoing transmission of disease from contaminated food, especially perishable commodities, is directly related to the speed of the process.**

Once an outbreak investigation is under way, “routine” surveillance practices and work schedules must be changed to match the urgency of the investigation (Chapter 5).

4.2.10. Routine Surveillance—Model Practices

This section lists model practices for routine surveillance programs. Practices used in any particular situation depend on a host of factors, including circumstances specific to the outbreak (e.g., the pathogen and number and distribution of cases), staff expertise, structure of the investigating agency, and agency resources. For example, aggressive case identification and investigation of *E. coli* O157:H7 cases can identify outbreaks and lead to abatement steps that may minimize serious illness and death, whereas investigation of more numerous *Campylobacter* cases is unlikely to lead to public health interventions. Although a systematic evaluation under different circumstances had not been performed on these practices, experiences from successful

4.2. Pathogen-Specific Surveillance

investigations support their value. Investigators are encouraged to use a combination of practices as appropriate to the specific outbreak.

4.2.10.1. Reporting and isolate submission

Encourage health-care providers to test patient specimens as part of the routine diagnostic process for possible foodborne diseases. Increase reporting and isolate submission by clinical laboratories and health-care providers through (a) education about the value of testing and reporting mechanisms; (b) regulatory action (such as modifying reporting rules to mandate isolate submission); (c) laboratory audits; and (d) provision of easier methods for compliance, such as automated or Web-based reporting, isolate-transport systems, more consistent reporting across reporting areas, and limitation of the amount of information initially requested. Educate physicians, laboratorians, and medical records clerks by workshops or conferences, newsletters, electronic health alerts, and regular feedback from public health agencies.

The medical rationale and specific recommendations for testing can be found in *Practical Guidelines for the Management of Infectious Diarrhea*¹ and “Diagnosis and management of foodborne illnesses: a primer for physicians and other health-care professionals.”² The latter document provides a series of tables giving useful information about major food pathogens, including signs and symptoms, incubation periods, and appropriate laboratory tests and describes sample patient scenarios to help with the diagnostic process.

4.2.10.2. Isolate characterization

Confer with the laboratory to determine subtyping methods available for the pathogen under study. Undertake subtyping as the specimens are submitted—don’t wait for a specific number of specimens to accumulate before testing them. Tests such as PFGE and serotyping ideally are performed concurrently

to reduce turnaround time. Recommended turnaround times are described in the Association of Public Health Laboratories/ CIFOR “yardstick” project. Post results to national databases as quickly as possible.

4.2.10.3. Case interviews

Quality exposure information usually is difficult to obtain and often is the major limiting factor of pathogen-specific surveillance. **Interview all patients with laboratory-diagnosed cases of potentially foodborne disease as soon as case reports or laboratory isolates are received, when patient recall and motivation to cooperate with investigators is the greatest.**

Obtain an exposure history consistent with the incubation period of the pathogen identified (see http://www.cdc.gov/foodborneoutbreaks/guide_fd.htm for a table of incubation for the most common foodborne agents).

As appropriate to circumstances, construct the interview to include a mix of question types that will collect the desired exposure information including

- Specific close-ended questions about exposures as a priori hypotheses to be tested (including specific food items that have been linked to previous outbreaks or that could plausibly be associated with the specific pathogen);
- Broad open-ended questions to capture exposures that might not have been considered; and
- Questions that elicit additional details, such as brand and place of purchase or consumption, for some of the highest likelihood exposures.

Where possible, use standardized “core” questions and data elements used by other investigators to enhance data sharing and comparisons across jurisdictions. Experience can make one a better and more efficient

4.2. Pathogen-Specific Surveillance

interviewer. If investigations are infrequent, achieving and maintaining proficiency can be difficult; centralizing the interview process reduces these problems and makes questionnaires easier to modify on the fly.

The CIFOR Clearinghouse (<http://www.cifor.us/clearinghouse/index.cfm>) provides examples of questionnaires used by various health departments to collect exposure information for different pathogens. Questions with a yes/no check-box format are efficient for collecting information about variables for which the expected frequency of exposure is low. For example, because less than 20% of the population is expected to eat raw spinach, asking only whether a case ate raw spinach should be sufficient to identify raw spinach as a potential vehicle. However, because more than 75% of the population is expected to eat chicken, additional brand or source information is needed. Thus, using a hybrid approach for collecting basic exposure information about low-frequency exposures and more specific information about high-frequency exposures may be the most effective approach. The use of open-ended questions complicates electronic data entry and analysis. For jurisdictions that rely on electronic data entry at the local public health level for rapid communication with the state, answers to open-ended questions may need to be captured as text fields that can be reviewed as needed.

Routine collection of detailed exposure information allows for the evaluation of clusters in “real time.” However, most public health agencies do not have sufficient resources to conduct such interviews for every case. Given the reality of these resource limitations, a two-step interviewing process may represent the best alternative approach. **When first reported, all cases should be interviewed with a standardized questionnaire to collect exposure information about limited high-risk exposures specific to the pathogen. When the novelty of the subtype pattern,**

geographic distribution of cases, or ongoing accumulation of new cases indicate the cluster represents a potential outbreak associated with a commercially distributed food product, all cases in the cluster should be interviewed using a detailed exposure questionnaire as part of a “dynamic cluster investigation” (see Chapter 5).

4.2.10.4. Data analysis

Use daily, automated laboratory reporting and analysis systems, where possible, to compare disease agent frequencies at multiple levels of specificity (e.g., species, serotype or other subtype, more stringent subtype) and in subgroups of the population (defined by selected demographic characteristics) to historical frequencies and national trends.

Determine a “cluster” on the basis of the novelty of a subtype pattern; determine increased occurrence of a relatively common subtype on the basis of geographic spread, temporal distribution, or demographic pattern of cases. The number of cases needed to form a cluster cannot be absolutely defined; this is a area of active public health research.

4.2.10.5. Communication

Establish and use routine procedures for communicating among epidemiology, laboratory, and environmental health branches within an agency and between local and state agencies. Rapidly post subtyping results to PulseNet, and note the detection of clusters to PulseNet and Foodborne Outbreak listserves to improve communication and cooperation within and among local, state, and federal public health agencies. **Poor coordination within and among agencies limits the effectiveness of pathogen-specific surveillance.**

4.2.11. Multijurisdictional Considerations for Pathogen-Specific Surveillance

Because pathogen-specific surveillance does

4.2. Pathogen-Specific Surveillance

not depend on geographic clustering, it is more sensitive to detection of widespread, low-level contamination events than surveillance through notification/complaint systems. Outbreaks detected by pathogen-specific surveillance are more likely to span multiple jurisdictions. See Chapter 7 for Multijurisdictional Investigation Guidelines.

4.2.12. Indicators/Measures for Pathogen-Specific Surveillance

The success of pathogen-specific surveillance at detecting and resolving common-source outbreaks depends on multiple interrelated processes. Indicators for assessing and improving surveillance programs can be found in Chapter 8.

4.3. Notification/Complaint Systems

4.3.1. Purpose

Notification or complaint systems are intended to receive, triage, and respond to reports from the community about possible foodborne disease events to conduct prevention and control activities. Programs range from ad hoc response to unsolicited phone reports to systematic solicitation and interview of and response to community reports.

4.3.2. Background

Receiving and responding to reports of disease in the community has been a basic function of public health agencies since their inception. Whereas reports of diseases caused by specific pathogens generally follow specific disease reporting rules, complaints of illnesses by consumers associated with specific events or establishments generally have been referred to the agency responsible for licensing the establishment. These consumer complaints lead to the identification of most localized foodborne disease outbreaks and are the only method for detecting outbreaks caused by agents, such as norovirus, for which there is no pathogen-specific surveillance.

4.3.3. Group Illness/Complaint Reporting

Group illness/complaint reporting involves passive collection of reports of possible foodborne illness from individuals or groups. Reporting is of two basic types, each with its

own dynamics and requirements:

- Reports from any individual or group who observes a pattern of illness affecting a group of people, usually following a common exposure. Examples include reports of illness among multiple persons eating at the same restaurant or attending the same wedding and reports from health-care providers of unusual patterns of illness, such as multiple patients with bloody diarrhea in a short time span.
- Multiple independent complaints about illness in single individuals.

Group illness and independent complaints may be used together and linked with data obtained through pathogen-specific surveillance. In contrast to pathogen-specific surveillance, reporting does not require identification of a specific agent or syndrome or contact with the health-care system.

4.3.4. Epidemiology Process

Notification of group illnesses or independent complaints can occur at the local, regional, state, or national level. Some jurisdictions mandate reporting of “unusual clusters of disease.” Reports from health-care providers of unusual clusters are triaged; occurrence of the same disease is confirmed; data are analyzed; investigations are initiated; and control measures are implemented as appropriate. For reports of group illness associated with an

4.3. Notification/Complaint Systems

event or venue, investigation generally involves obtaining lists of attendees, confirming ill persons have the same disease, obtaining menus, interviewing cases, performing a cohort or case-control study, and collecting food and patient specimens (see Chapter 5). Outbreaks detected in this manner may be linked to other outbreaks or to other cases in the community by a variety of processes, such as PulseNet or eFORS, and communication conducted through Epi-X or OutbreakNet.

Two or more individuals with a common exposure identified through interview of independent complaints are used to identify clusters of illness in much the same manner as common agents are used in pathogen-specific surveillance. Exposure information captured in the initial complaint generally is limited and biased toward exposures shortly before onset of symptoms. Therefore, routine interviews are needed for this process to be robust. In the absence of common, suspicious exposures shared by two or more cases, complaints of individual illness with nonspecific symptoms, such as diarrhea or vomiting generally are not worth pursuing.

4.3.5. Public Health Laboratory Process

Laboratory activities are not essential for primary detection of outbreaks by this process but are essential for determining etiology, linking separate events during the investigation, and monitoring the efficacy of control measures (see chapters 5 and 6). Due to public health laboratory testing, links may be seen across jurisdictional boundaries, and broader, even national outbreaks may then be detected. For instance, an outbreak associated with a particular restaurant may come to the attention of authorities solely on the basis of a report by a customer who observed illnesses among multiple fellow patrons. Laboratory testing and identification of *Salmonella* Typhimurium as the causative agent can result in refinement of the case definition used in

this investigation, in additional testing and restrictions for workers found to be carriers, or in connection of this outbreak with other outbreaks from a contaminated commodity.

4.3.6. Strengths of Notification/Complaint Systems for Outbreak Detection

- Because detection does not depend on identification of an agent, this system is able to detect outbreaks from any cause, known or unknown. Thus, the notification/complaint system is one of the best methods for detecting non-reportable pathogens and new or emerging agents.
- For event-related notifications only: recall of food items eaten and other exposures by cases is usually good for reported events because specific exposures associated with the event (such as menus) can normally be determined and specifically included in the interview.
- Notification and complaint surveillance systems are inherently faster than pathogen-specific surveillance because the chain of events related to laboratory testing and reporting is not required.

4.3.7. Limitations of Notification/Complaint Systems

- Notification of illness in groups generally is less sensitive to widespread low-level contamination events than is pathogen-specific surveillance because recognition by an individual of a person-place-time connection among cases is required.
- The value of complaints about single possible cases of foodborne disease in detecting outbreaks is limited by the exposure information used to link cases, and by the lack of specific agent or disease information to exclude unrelated cases. The illness reported by individuals might or might not be foodborne, and illness presentation might or might not be typical.

4.3. Notification/Complaint Systems

For any true outbreak, the inability to identify an agent makes misclassification of cases more likely. Misclassification of cases makes identification of an association between an outbreak and an exposure more difficult.

- Without a detailed food history (either in the initial report or follow up interview), surveillance of independent complaints is sensitive only for short incubation (generally chemical or toxin-mediated) illness or illness with unique symptoms because most persons associate illness with the last meal before onset of symptoms, and are thus unlikely to identify the correct exposure. This is not a limitation if routine interviews are conducted.

4.3.8. Key Determinants of Successful Notification/Complaint Systems

The following factors drive interpretation of notification/complaint surveillance data, affect the success of investigations, and form the basis for best practices.

4.3.8.1. Sensitivity of case or event detection

The dynamics of outbreak detection differ somewhat for notification involving groups of illnesses and collection of independent complaints. **Detection of outbreaks by notification of group illness is limited only by the severity of the illness, public awareness of where to report the illness, ease and availability of the reporting process, and investigation resources (to determine whether the clusters are in fact outbreaks). In contrast, detection of clusters of illnesses from independent complaints relies on analysis by the public health agency of an entire group of complaints collected over time.** As with pathogen-specific surveillance, the size and number of outbreaks detectable using independent complaints as primary surveillance data are driven by the number of individual cases reported, uniqueness of the illness or reported exposure,

sensitivity and specificity of the interview process, and methods used to evaluate exposure data.

4.3.8.2. Background prevalence of disease—group complaints

When a group illness is reported, some of the cases may be ill for a reason other than a common group exposure. The likelihood of this occurring depends on the background prevalence of the disease or complaint. For example, unrelated cases of diarrhea may inadvertently be grouped with true outbreak-related cases because at any one time a substantial proportion of the population “normally” has diarrhea. **Inclusion of misclassified cases (i.e., cases not associated with the outbreak) hinders the detection of associations between exposures and disease, thus decreasing the likelihood of discovery of a common source.** When reported clusters are small, the possibility must be considered that the reported cluster results from coincidence rather than causal association (type I probability error—i.e., detection of an association between an exposure and a disease where one does not exist). With unusual syndromes, such as neurologic symptoms associated with botulism or ciguatera fish poisoning, the likelihood of misclassification and type I probability error is low. The system specificity may be increased by identifying a specific agent or disease marker or by increasing the specificity of the symptom information (e.g., bloody diarrhea or specific mean duration of illness) or by obtaining exposure information.

4.3.8.3. Sensitivity and specificity of case interviews—group complaints

Interviews of cases for group complaints capture two types of information:

- Specific exposures associated with the reported event and
- Individual food histories to rule out alternate hypotheses and exclude misclassified cases.

4.3. Notification/Complaint Systems

Because exposures associated with group events are relatively few and can be described specifically, recall tends to be good and timing is less an issue than with pathogen-specific surveillance or independent complaints. In studies of food recall accuracy, the positive predictive value of individual food items ranged from 73% to 97%.^{3,4} The negative predictive value ranged from 79% to 98%. Highly distinctive foods tended to be more accurately reported. Nonetheless, the more specific exposure-related questions are, the better recall will be. For example, cases asked whether they “ate German potato salad” at a particular event are more likely to remember than if they were asked whether they ate “salad” or asked to list the foods they ate. Interviews of food-preparation staff additionally provide valuable information because they can list ingredients that cases are not likely to recall or even know about and that a standardized questionnaire would not include. A good example is the 1998 international outbreak of shigellosis associated with parsley added as a garnish to restaurant-served meals.

The second type of information gathered in the investigation of group complaints, individual food histories, has the same challenges as information collected for outbreaks detected through pathogen-specific surveillance (i.e., includes a broad range of potential exposures among cases and is associated with difficulties in recall). The problems may be even greater because no causative agent has been identified that would allow investigators to focus on exposures previously associated with that pathogen. Hence, interviews must be done promptly for this aspect of the case interview to be effective.

4.3.9. Notification/Complaint Systems—Model Practices

This section lists model practices for notification and complaint systems. The

practices used in any particular situation depend on a host of factors, including the circumstances specific to the outbreak (e.g., the pathogen and number and distribution of cases), staff expertise, structure of the investigating agency, and agency resources. For example, reports of bloody diarrhea may warrant aggressive case identification and investigation to minimize serious illness and death. A cluster of potential norovirus infections may be investigated less aggressively or not investigated at all. Although these practices have not been systematically evaluated under different circumstances, experiences from successful investigations support their value. Investigators are encouraged to use a combination of these practices as is appropriate to the specific outbreak.

4.3.9.1. Interviews related to individual complaints

Detection of outbreaks based on multiple individual complaints requires a system for recording complaints and comparing food histories reported by the individuals.

A detailed 5-day exposure history is essential for individual complaints because common exposures are the sole mechanism to link cases. Although outbreaks caused by agents with short incubation periods may be able to be identified on the basis of information provided during initial complaints only, the signal-to-noise ratio would be low, and investigations would tend to be nonproductive. Therefore, a detailed interview, using a standardized form that includes both food and nonfood exposures, is preferred.

When beginning an investigation based on multiple individual complaints, the best approach is to collect a 5-day exposure history. Given the ubiquity of norovirus infections, the investigator should pay particular attention to exposures in the 24–48 hours before onset whenever norovirus is suspected. As more information about the likely etiologic agent

4.3. Notification/Complaint Systems

is collected, this approach can be modified. The complaint and subsequent interviews can lead to a hypothesis about the pathogen that leads to a different time frame for the exposure history (e.g., vomiting leads to a different hypothesis and exposure history time frame than does bloody diarrhea).

Health departments may choose to collect specimens from independent complaints or encourage patients to seek health care.

4.3.9.2 Follow-up of commercial establishments named in individual complaints of potential foodborne illness

Health department staff might be required by local or state statute to investigate any commercial food establishment named by a person reporting a potential foodborne illness. However, because complainants often focus on foods prepared or eaten at commercial food establishments or the last meal eaten rather than other meals, investigation of the named establishment might not contribute to identifying the source of the reported illness or be the best use of limited health department resources.

In jurisdictions where visits are not required to every restaurant named in illness complaints, health department staff must decide whether investigation of a commercial food establishment is likely to be beneficial. To make this decision, investigators should consider details of the complainant's illness and the foods eaten at the establishment. In the following situations, investigation of a named commercial food establishment might be warranted:

- The confirmed diagnosis and/or clinical symptoms are consistent with the foods eaten and the timing of illness onset (e.g., a person in whom salmonellosis is diagnosed reports eating poorly cooked eggs 2 days before becoming ill).

- The complainant observed specific food preparation or serving procedures likely to lead to a food-safety problem at the establishment.
- Two or more persons with a similar illness or diagnosis implicate a food, meal, or establishment and have no other shared food history or evident source of exposure.

As noted below in Section 4.3.9.6, regular review of individual complaints is critical in recognizing that multiple persons have a similar illness or diagnosis and share a common exposure.

Clues that a follow-up investigation of a food establishment is unlikely to be productive include:

- Confirmed diagnosis and/or clinical symptoms that are not consistent with the foods eaten at the establishment and/or the onset of illness (e.g., bloody diarrhea associated with a well-cooked hamburger eaten the night before illness onset).
- Signs and symptoms (or confirmed diagnoses) among affected individuals that suggest they might not have the same illness.
- Ill persons who are not able to provide adequate information for investigation including date and time of onset of illness, symptoms, or complete food histories.
- Repeated complaints by the same individual(s) for which prior investigations revealed no significant findings.

4.3.9.3. Interviews related to reported illnesses in groups

“Complaints” of illness among groups often are tantamount to outbreak reports. A report of illness among 8–12 people who ate together merits a different response than an isolated report of diarrhea.

Focus interviews on the event shared by members of the group. However, be aware they may have more than one event in

4.3. Notification/Complaint Systems

common, and explore that possibility. For example, an outbreak associated with a wedding reception might actually result from the rehearsal dinner, which involves many of the same people. Interviews should ask about other potential exposures either for the interviewee or for others he or she might have contacted, such as child-care attendance, employment as a food worker, or ill family members.

4.3.9.4. *Clinical specimens and food samples related to group illness*

Obtain clinical specimens from members of the ill group. If the presumed exposure involves food, collect and store—but do not test—food from the implicated event. Store the food appropriately, but generally test the food only after epidemiologic implication. Food samples that are frozen when collected should remain frozen until examined. Samples should be analyzed within 48 hours after receipt. If sample analysis is not possible within 48 hours, then perishable foods should be frozen (−40 to −80°C). Storage under refrigeration can be longer than 48 hours, if necessary, but the length of the storage period is food dependent. Because certain bacteria (e.g., *Campylobacter jejuni*) die when frozen, affecting laboratory results, immediate examination of samples without freezing is encouraged. Food samples can be collected as part of the process of removing suspected food from service.

Note: Food testing has inherent limitations because most testing is agent-specific, and demonstration of an agent in food, especially viruses, is not always possible or necessary before implementation of public health action. **Detection of microbes or toxins in food is most important for outbreaks involving preformed toxins such as enterotoxins of *Staphylococcus aureus* or *Bacillus cereus*, where detection of toxin or toxin-producing organisms in clinical specimens frequently is problematic.** In addition, organisms such as *S. aureus* and *Clostridium perfringens*, which are

commonly found in the human intestinal tract, can confound interpretation of culture results.

Specific contaminants or foods might require special collection and testing techniques and demonstration of an agent in food is not always possible. Furthermore, results of testing are often difficult to interpret. Because contaminants in food change with time, samples collected during an investigation might not be representative of those ingested when the outbreak occurred. Subsequent handling or processing of food might result in the death of microorganisms, multiplication of microorganisms originally present in low levels, or introduction of new contaminants. If contamination of the food is not uniform, the sample collected might miss the contaminated portion. Finally, because food usually is not sterile, microorganisms can be isolated from samples but not be responsible for the illness under investigation. As a result, food testing should not be undertaken as a matter of routine, but based on meaningful associations.

If food testing is determined to be necessary—for example if a food has been epidemiologically implicated—official reference testing methods must be used at a minimum for regulated products (e.g., pasteurized eggs or commercially distributed beef).

4.3.9.5. *Establishment of etiology through laboratory testing*

Even though the etiology is not essential for primary linkage of cases, as it is for pathogen-specific surveillance, **information about agents is important for understanding the outbreak and for implementation of rational intervention and facilitates establishing links to other outbreaks or sporadic cases by PulseNet and eFORS.** Further information about investigation methods and establishing etiology is available in Chapter 5.

4.3.9.6. *Regular review of interview data*

Review interview data regularly to look for

4.3. Notification/Complaint Systems

trends or commonalities. **Compile interview data in a single database, and examine daily for exposure clustering.** Comparison with exposure data obtained through pathogen-specific surveillance interviews might reveal a potential connection among cases and increase the sensitivity of both surveillance systems for detecting outbreaks.

4.3.9.7. Improvement of interagency cooperation and communication

Improve cooperation among agencies that receive illness complaints (e.g., agriculture agencies, facility licensing agencies, poison control centers). Regularly communicate with these agencies, and ensure they have current contact information for your staff. Because complaints might be made to multiple agencies, having a robust method of sharing information is important.

4.3.9.8. Other potentially useful tools

Check complaint information against national databases, such as the USDA/FSIS Consumer Complaint Monitoring System (CCMS).

4.3.9.9. Simplification of reporting process

To increase surveillance sensitivity, make the reporting process as simple as possible for the public. For example, provide one 24/7 toll-free telephone number or one website. Such systems allow callers to leave information that public health staff can follow up.

4.3.9.10. Increased public awareness of reporting process

Promote reporting by routine press releases that educate the public about food safety, and advertise the contact phone number or website for reports of illness. Use a telephone number that easily can be remembered or found in the telephone directory. Train food managers and workers about the importance of reporting unusual patterns of illness among workers or customers and food code requirements for disease reporting.

4.3.9.11. Centralized reporting or report review process

Set up the reporting process so all reports go through one person or one individual routinely reviews reports. Centralization of the reporting or review process increases the likelihood that patterns among individual complaints and seemingly unrelated outbreaks will be detected.

4.3.9.12. Maintenance of contact with other organizations that might receive complaints

Consumers may submit complaints to multiple organizations, such as poison control centers or grocery stores. **Identify the organizations in your community that are likely to receive complaints, and maintain routine contact with them.** Ideally, set up a database that public health agencies can access and review.

4.3.10. Multijurisdictional Considerations for Notification/Complaint Systems

Outbreaks discovered through notification/complaints might span multiple jurisdictions, as evidenced by the 1998 parsley-associated shigellosis outbreak and the 2006 multistate lettuce-associated *E. coli* O157:H7 outbreak in taco restaurants. See Chapter 7 for Multijurisdictional Investigation Guidelines.

4.3.11. Indicators/Measures

The success of notification/complaint-based surveillance systems at detecting and resolving common-source outbreaks depends on multiple interrelated processes. Indicators for assessing and improving surveillance programs can be found in Chapter 8.

4.4. Syndromic Surveillance

4.4.1. Overview

The utility of syndromic surveillance has not been established. In theory, the electronic collection of nonspecific health indicators could permit rapid detection of significant trends, including outbreaks. In practice, the right mix of sensitivity and specificity has proven difficult to find, and the utility of such systems may be marginal.

4.4.2. Background

Syndromic surveillance is a relatively new concept, developed in the 1990s and expanded after the 2001 postal anthrax attacks in an attempt to improve readiness for bioterrorism. One of the first systems implemented was in New York City in 2001.

4.4.3. Reporting

Syndromic surveillance typically relies on automated extraction of health information:

- Preclinical (i.e., not dependent on access to health care, consequently less specific and potentially less useful)—school and work absenteeism, nurse help-lines, sales of over-the-counter drugs, complaints to water companies, calls to poison control centers.
- Clinical prediagnostic (i.e., requires contact with the health-care system but does not rely on a full workup or laboratory confirmation and, therefore, takes less time)—emergency department chief complaint, ambulance dispatch, lab test orders.
- Postdiagnostic data—hospital discharge codes (ICD-9, ICD-10).

4.4.4. Epidemiology Process

Epidemiology or emergency preparedness groups evaluate alerts triggered by the syndromic surveillance system. The effectiveness of syndromic surveillance in detecting outbreaks has not been

demonstrated. Presumably, cases would be interviewed and exposures determined if an alert were determined likely to represent a true outbreak.

4.4.5. Laboratory Process

Laboratories do not play a direct role in syndromic surveillance. Laboratories would be involved during epidemiologic investigations triggered by a syndromic surveillance signal.

4.4.6. Strengths of Syndromic Surveillance

- In theory, syndromic surveillance has the potential to identify clusters of disease before definitive diagnosis and reporting, thus generating a faster signal than can be expected with pathogen-specific surveillance.
- As with notification/complaint systems, outbreaks from any cause, known or unknown, potentially can be detected. Included are clusters of cases identified with discharge diagnoses that include specific agents not part of standard surveillance.
- Syndromic surveillance may be able to detect large, undiagnosed events, such as an increase in gastrointestinal illness among persons of all ages consistent with norovirus, an increase in diarrheal illness among young children consistent with rotavirus, and the arrival of epidemic influenza.
- Most syndromic surveillance systems have been built with automated electronic data transfer. This infrastructure should be useful for other types of surveillance and public health activities.

4.4.7. Limitations of Syndromic Surveillance

- Lack of specificity for most syndromic surveillance indicators in the area of foodborne disease makes for an unfavorable signal-to-noise ratio, meaning that only the largest events would be detected, and many false-positive signals would be expected.

4.4. Syndromic Surveillance

Responding to false-positive signals drains an agency's resources substantially.

- Evaluating a signal usually means cross-checking it with routine surveillance reports, meaning it cannot replace routine surveillance.
- More specific signals, such as discharge diagnoses, are less timely and do not appear to offer advantage over standard surveillance methods.
- The usefulness of syndromic surveillance has not been demonstrated for foodborne disease. After examination of 2.5 million patient records in its first year of operation, the New York City surveillance system identified 18 diarrhea or vomiting alerts during 3 outbreak periods. Five institutional outbreaks were identified during one of these periods, but whether the data were sufficiently specific to allow for public health intervention is not clear.^{5,6,7}
- The cost of developing syndromic surveillance systems is substantial, and if development occurs at the expense of maintaining or upgrading routine surveillance, degraded, rather than enhanced, surveillance results.

4.4.8. Key Determinants of Successful Syndromic Surveillance Systems

The following factors drive the interpretation of syndromic surveillance data, affect the success of investigations, and form the basis for best practices.

4.4.8.1. *Specificity and speed*

Although the potential speed of syndromic surveillance is its chief strength, speed is inversely proportional to the specificity of the indicator disease information. Preclinical information, such as sales of over-the-counter drugs is generally available sooner and is less specific than clinical, prediagnostic signals (such as laboratory test orders). Prediagnostic signals, in turn, are available sooner and are

less specific than postdiagnostic signals (such as hospital discharge data).

Lack of specificity at any level results in both type 1 probability error (the suggestion of an association between a signal and a significant health event when, in fact, none exists) and type 2 probability error (the lack of signal suggests a disease event is not occurring, when, in fact, it is). **Less specificity means that more cases are needed to overcome background noise and that false-positive alerts are likely.**

The most specific signals—hospital discharge data—include both nonspecific diagnoses (e.g., diarrhea of infectious origin, ICD-9 009.3) and diagnoses based on identification-specific agents (e.g., *Salmonella* gastroenteritis, ICD-9 003.0). Discharge signals for reportable disease such as salmonellosis should not offer any time advantage over standard methods because

- The diagnoses requires agent identification and would have the same limitations as pathogen-specific surveillance,
- Standard investigation probably would be required for public health action, and
- Identification of illness may precede discharge.

Signals from rare, specific syndromes without laboratory confirmation, such as botulism-like syndrome, should be as effective as pathogen-specific surveillance. This is the basis for the national botulism surveillance program at CDC, which provides emergency clinical, epidemiologic, and microbiologic consultation and antitoxin treatment for people with suspected botulism because of the extremely serious nature of that illness and the possibility that one case might herald other cases from the same exposure⁸ (http://www.cdc.gov/nczved/dfbmd/disease_listing/files/botulism.pdf).

4.4. Syndromic Surveillance

4.4.8.2. *Personal information privacy issues*

In a survey on implementation of syndromic surveillance systems, more than half (54.2%) of respondents reported some or substantial problems caused by real or perceived patient confidentiality concerns and the Health Insurance Portability and Accountability Act (HIPAA). Respondents noted that many health-care providers and medical staff did not understand HIPAA and so tended to give minimal patient information. Questions also were raised about whether syndromic surveillance falls under the same regulations as reports of diagnosis-related disease. For example, whether health departments have the legal authority to collect these data is not always clear. Most respondents were using current disease reporting regulations to cover syndromic surveillance. Many respondents believed more specific syndromic indicators are needed to incorporate them into regulations. **Most agencies that had implemented a syndromic surveillance system used deidentified data, which slows investigations of positive signals from the surveillance system.**⁹

4.4.9. Practices for Improving Syndromic Surveillance

Because the usefulness of syndromic surveillance for detecting foodborne disease events has not been demonstrated, the need for additional investment is not clear, especially if these systems compete for resources with under-resourced standard surveillance systems. If an agency implements or seeks to improve a syndromic surveillance system, it needs to consider the following practices:

- Better electronic and process integration with standard surveillance systems may improve usefulness.
- Syndromic surveillance data are most useful when corroborated with data from multiple sources (e.g., increased sales of over-the-counter diarrheal medicines associated with rise in emergency department chief complaints of diarrhea). As historical data accumulate, fine-tuning detection algorithms to reduce false-positive signals might be possible.

4.5. References

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