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FOOD SAFETY

CDC Is Working to Address Limitations in Several of Its Foodborne Disease Surveillance Systems

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Abbreviations

CDC Centers for Disease Control and Prevention
GAO General Accounting Office
USDA United States Department of Agriculture

G A O
Accountability * Integrity * Reliability

United States General Accounting Office
Washington, DC 20548

September 7, 2001

The Honorable Tom Harkin
Chairman
Committee on Agriculture, Nutrition, and Forestry
United States Senate

Dear Mr. Chairman:

Foodborne disease in the United States annually causes an estimated 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths, according to the Centers for Disease Control and Prevention (CDC). The effects of these diseases range from mild gastroenteritis to life-threatening damage to the kidneys, heart, and nervous system. The U.S. Department of Agriculture (USDA) estimates that five major foodborne diseases alone cost the nation at least $6.9 billion each year in medical treatments, productivity losses, and premature deaths.

Surveillance is public health officials' most important tool for detecting and monitoring both existing and emerging foodborne diseases. Without adequate surveillance systems, local, state, and federal officials cannot gauge the impact of existing foodborne diseases and may not recognize new diseases until many people have been affected. These officials rely on surveillance data to focus their staff and financial resources on preventing and controlling the foodborne diseases that most threaten public health. Health officials also use surveillance data to monitor and evaluate the effectiveness of prevention and control programs.

In the United States, surveillance for foodborne disease is also used to identify outbreaks—two or more cases of a similar illness that result from ingestion of a common food—and their causes. Nearly all of CDC's surveillance systems are passive, which means they rely on physicians, laboratory and hospital staff, and others to take the initiative in reporting data to health departments. However, for FoodNet, one of CDC's principal foodborne disease surveillance systems, the reverse occurs. In this system—referred to as an active system—public health officials take the initiative to periodically contact laboratory officials to gather data instead of passively waiting to receive data from laboratories and others. Compared to a passive system, an active surveillance system produces more complete information but is more costly to use for data collection activities.

Responsibility for surveillance of foodborne diseases rests primarily with local and state health departments, although the federal government also has an important role. At the local level, health care providers identify cases of foodborne disease. Typically, these local officials report cases of certain diseases to state health departments. Both local and state health departments investigate outbreaks. State health departments voluntarily report those individual cases and outbreaks to CDC, which is part of the Department of Health and Human Services.

CDC, as the central control point for collection of such data at the national level, collects this data through two electronic information systems and other information sources, such as paper forms, in order to analyze and summarize foodborne disease information on a national basis. Surveillance information can be used to detect outbreaks and to confirm that the ensuing intervention is effective. For example, in 1996, public health officials used surveillance data to detect an outbreak associated with *Escherichia coli* (*E. coli*) O157:H7, which made 66 people ill and killed 1 after they drank unpasteurized apple juice. Surveillance triggered an outbreak investigation, and as a result, the juice responsible for the outbreak was recalled from all retail outlets.

However, the capabilities of any foodborne disease surveillance system are limited. Surveillance systems can detect only a fraction of disease cases because not all people who contract foodborne diseases actually seek treatment, are properly diagnosed, have their diagnoses confirmed through laboratory analysis, and then have their cases reported through the surveillance systems.

In this context, you asked us to (1) describe CDC's foodborne disease surveillance systems and (2) identify limitations of these systems, as well as any initiatives designed to address them. To accomplish these objectives, we examined CDC's surveillance systems and sent questionnaires to public health officials in all 50 states, the District of Columbia, and New York City to determine their level of participation in and opinions about the systems. Appendix I contains the questionnaire, which addressed those surveillance systems that focus on foodborne disease and cover more than one pathogen. It also addressed CDC's two primary databases that support these systems.

Results in Brief

CDC has 20 surveillance systems that include information on foodborne diseases. These systems are used to detect cases or outbreaks of foodborne disease, pinpoint their cause, recognize trends, and develop effective prevention and control measures. Of these, four principal

systems focus on foodborne diseases and cover more than one pathogen. The first such system, the Foodborne Disease Outbreak Surveillance System, collects information nationwide about the incidence and cause of foodborne outbreaks. This system relies on local health officials to take the initiative to report outbreaks to CDC through state public health officials. CDC and others use this system to maintain an awareness of ongoing problems, among other things. The second system, FoodNet, actively collects information in nine geographic areas on nine foodborne pathogens, hemolytic uremic syndrome (a serious complication of *E. coli* O157:H7 infection), Guillain-Barre syndrome (a serious complication of *Campylobacter* infection), and toxoplasmosis. Public health officials who participate in FoodNet receive funds from CDC to systematically contact laboratories in their geographical areas and solicit incidence data. As a result of this active solicitation, FoodNet provides more accurate estimates of the occurrence of foodborne diseases than is otherwise available. The third system, PulseNet, is used to identify whether separate cases of illness likely originate from a common source. Using this system, public health officials in 46 state and 2 local public health laboratories and in the food safety laboratories of both the USDA and the Food and Drug Administration submit to CDC genetic patterns of bacteria isolated from patients and/or contaminated food. The officials can then rapidly compare the new patterns to other patterns already in the PulseNet database. Matches may indicate an outbreak. The fourth system, the Surveillance Outbreak Detection Algorithm, uses statistical analysis to compare current data against a historical baseline in order to detect unusual increases in the incidence of two pathogens—*Salmonella* and *Shigella*. Such increases may indicate an outbreak. CDC's 16 other surveillance systems either collect data about a variety of diseases, only some of which are foodborne, or focus exclusively on a single foodborne disease. Collectively these systems provide information aimed at detecting and controlling the spread of foodborne disease.

While CDC's systems have contributed to food safety, the usefulness of several of these surveillance systems is impaired both by CDC's untimely release of surveillance data and by gaps in the data collected. Twenty-six survey respondents said that delays in publishing data from the Foodborne Disease Outbreak Surveillance System diminished the usefulness of this system. Many also said that more rapid release of data from FoodNet, PulseNet, and the Surveillance Outbreak Detection Algorithm would make these systems more useful. CDC officials attributed the delays in part to staffing shortages at CDC and to the sometimes untimely reporting of surveillance data by state and local health officials. To address these problems, CDC has hired additional staff and is training state and local

health officials about the reporting needs of both state health departments and CDC. Concerning gaps in data collection, survey respondents said that the problem is caused, in part, by shortages of trained epidemiologists at state and local health departments and by deficiencies in state laboratory capabilities. Another contributing factor is that each state decides which diseases it will track and which ones it will not. For example, while 32 survey respondents indicated that health providers in their states are required to notify state or local health departments about cases of cyclosporiasis—infection with *Cyclospora*, a parasite that causes diarrhea, stomach cramps, and nausea—19 said notification was not required. To help the states provide CDC with more complete information, CDC is providing funds to state and local health departments that are designed to address their staffing and technology limitations. Additionally, CDC officials told us they have entered into cooperative agreements with the Council of State and Territorial Epidemiologists and the Association of Public Health Laboratories to encourage more standardized reporting among states and to assess the states' capability and capacity to address public health issues, including foodborne disease. CDC's actions represent a good first step toward providing public health officials with more timely and complete surveillance data.

In commenting on a draft of this report, CDC officials generally agreed with the overall message of the report and provided technical comments, which we incorporated as appropriate.

Background

Surveillance of foodborne diseases allows public health officials to recognize trends, detect outbreaks, pinpoint the causes of these outbreaks, and develop effective prevention and control measures. Such surveillance presents a complex challenge. Many foods today are imported, prepared and/or eaten outside the home, and widely distributed after processing. As a result, an outbreak of foodborne disease can involve people in different localities, states, and even countries. The number and diversity of foodborne diseases further complicate surveillance. Although many of the more well-known foodborne pathogens are bacteria, such as *E. coli* O157:H7 and *Salmonella*, foodborne diseases are caused by a variety of other pathogens, including viruses, parasites, and toxins. Some of these diseases also can be transmitted by nonfood sources, such as through water or through person-to-person contact. Appendix II describes the major foodborne diseases currently under national surveillance.

The surveillance process usually begins when a person with a foodborne disease seeks medical care. To help determine the cause of the patient's illness, a physician may rely on a laboratory test, which could be

performed in the physician's own office, a hospital, an independent clinical laboratory, or a public health laboratory. If the test shows that the patient is ill with a disease (including a foodborne disease) that must be reported under state law, or if the physician diagnoses the disease without the use of a test, the cases are usually reported to the local health department. Health department staff collect these reports, check them for completeness, contact health-care professionals to obtain missing information or clarify unclear responses, and forward them to state health agencies. Staff resources devoted to disease reporting vary with the overall size and mission of the health department. Because nearly half of local health agencies have jurisdiction over a population of fewer than 25,000, many cannot support a large, specialized staff to work on disease reporting.

The states have principal responsibility for protecting the public's health and therefore take the lead in conducting surveillance. In state health departments, epidemiologists analyze the data reported and decide when and how to supplement passive reporting with active surveillance methods, conduct outbreak and other disease investigations, and design and evaluate disease prevention and control efforts. They also transmit state data to CDC, providing routine reporting on selected diseases.

Surveillance data are transmitted to CDC both electronically and using paper-based systems. Information about individual cases of disease is reported through two electronic systems. The National Electronic Telecommunications System for Surveillance collects data submitted by epidemiologists about patient demographics and residences, suspected or confirmed diagnoses, and the dates of disease onset. In contrast, the second system, the Public Health Laboratory Information System, collects more definitive data from public health laboratory officials on pathogens identified by laboratory tests.[1] Both systems also offer disease-specific reporting options that states may use to report additional data to CDC. For some surveillance systems, such as the Viral Hepatitis Surveillance Program, data are submitted to CDC both electronically and using paper forms. For other surveillance systems, such as the Foodborne Disease

[1]The Public Health Laboratory Information System is a national electronic laboratory reporting system that rapidly collects and transmits information about laboratory confirmed isolates from all 50 state public health laboratories. This system provides electronic laboratory data reporting for 20 pathogens or other conditions, including the National *Salmonella* and *Shigella* Surveillance Systems, and provides data transmission for FoodNet.

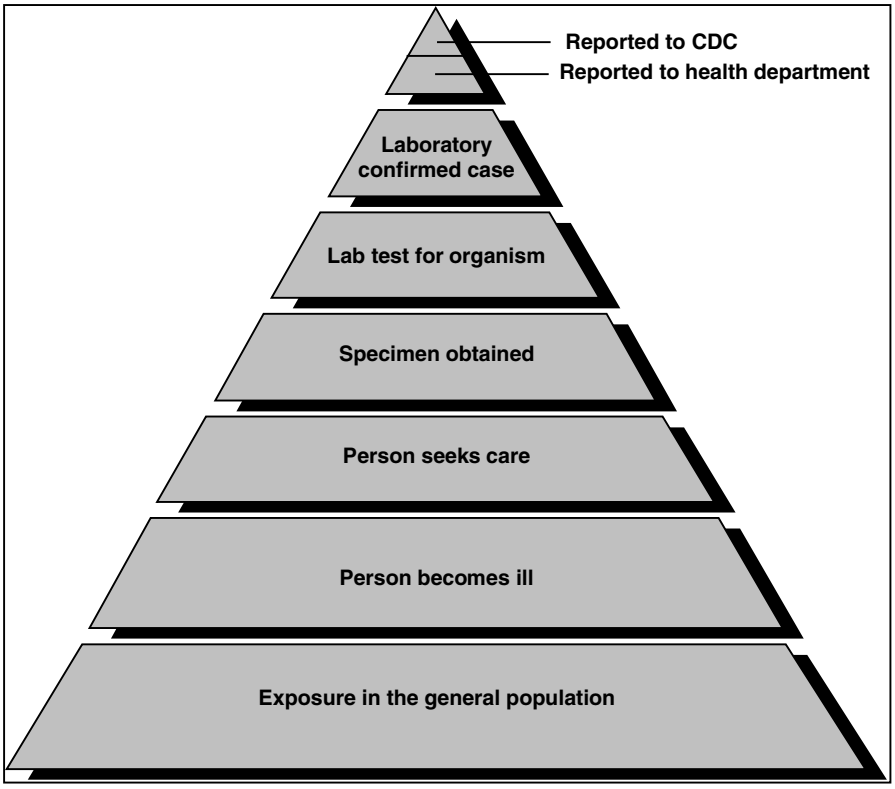
Outbreak Surveillance System, the data are submitted primarily through paper reporting. CDC officials told us they have an ongoing effort to integrate public heath information collected through these and other systems. They estimate this effort will take several years to complete.

Federal participation in the foodborne disease surveillance network focuses on CDC activities—particularly those of the National Center for Infectious Diseases. CDC analyzes the data furnished by states to (1) monitor national health trends, (2) formulate and implement prevention strategies, (3) evaluate state and federal disease prevention efforts, and (4) identify outbreaks that affect multiple jurisdictions, such as more than one state. CDC routinely provides public health officials, medical personnel, and others information on disease trends and analyses of outbreaks.

In fiscal year 2000, CDC's budget for foodborne disease surveillance through the Food Safety Initiative was $29 million. In order to maximize the effectiveness of its surveillance efforts, CDC works with the Council of State and Territorial Epidemiologists, a professional association of public health epidemiologists from each U.S. state and territory. They are responsible for monitoring trends in health and health problems and devising prevention programs that promote the entire community's health. The council is currently in its eighth year of a cooperative agreement with the CDC and has approximately 15 separate activities on which they work collaboratively with the CDC. CDC also works with the Association of Public Health Laboratories, which links local, state, national, and global health leaders in order to promote the highest quality laboratory practices worldwide.

However, regardless of the completeness and comprehensiveness of a surveillance system, it can generally detect only a fraction of disease cases—the tip of the iceberg, at best, as shown in figure 1.

Figure 1: Levels of Disease Reporting



Source: CDC.

Very few people who contract foodborne diseases actually seek treatment, are properly diagnosed, have their diagnoses confirmed through laboratory analysis, and then have their cases reported through the surveillance systems. For example, a recent CDC-sponsored study estimated that 340 million annual episodes of acute diarrheal illness occurred in the United States, but only 7 percent of people who were ill sought treatment. The study further estimated that physicians requested laboratory testing of a stool culture for only 22 percent of those patients who sought treatment, which produced about 6 million test results that could be reported.

Although federal participation in foodborne disease surveillance focuses on CDC activities, two other federal agencies have a key role in the wider arena of food safety and use surveillance information in their programs. USDA's Food Safety and Inspection Service is responsible for ensuring

that meat, poultry, and processed egg products moving in interstate and foreign commerce are safe. This agency primarily carries out its responsibilities through inspections at meat, poultry, and egg processing plants to ensure that these products are safe, wholesome, and accurately labeled. In addition, the Food and Drug Administration in the Department of Health and Human Services is responsible for ensuring that all other domestic and imported food products are safe. Unlike the USDA, the Food and Drug Administration, by and large, conducts post-market surveillance through domestic inspections and testing of products already in commerce to assure that foods are safe and comply with appropriate standards. This is especially true for imported foods where the surveillance program is primarily post-market testing, because the Federal Food, Drug and Cosmetic Act does not provide explicit inspection authority outside the United States. In addition to their other duties, these two agencies work to remove from the market foods that are implicated in foodborne disease outbreaks.

CDC Foodborne Disease Surveillance Systems Provide National Data Needed to Prevent and Control the Spread of Foodborne Disease

CDC conducts surveillance of foodborne diseases through 20 systems. Four of these—the Foodborne Disease Outbreak Surveillance System, FoodNet, PulseNet, and the Surveillance Outbreak Detection Algorithm—focus on foodborne diseases and cover multiple pathogens. The other 16 either collect data about a variety of diseases, only some of which are foodborne, or focus exclusively on a single foodborne disease. Collectively, these systems provide information to detect and control the spread of foodborne disease.

The Foodborne Disease Outbreak Surveillance System collects nationwide information about the occurrence and causes of foodborne outbreaks. This system relies on local health officials to correctly identify, investigate, and report outbreaks to CDC through state public health officials. CDC uses the system to, among other things, compile and periodically report national outbreak data. In 1997, the latest year for which published data are available, states and U. S. territories reported 806 outbreaks to CDC through this system. Furthermore, information from this system can serve as a basis for regulatory and other changes to improve food safety. For example, data from the Foodborne Disease Outbreak Surveillance System has played an important role in documenting the importance of shell eggs as a source of human infection with *Salmonella* Enteritidis. In response to this data and other reports pointing out the dangers posed by improperly handled eggs, government agencies and the egg industry have taken steps to reduce *Salmonella* contamination of eggs. These steps include refrigerating eggs during transport from the producer to the consumer, identifying and removing infected laying flocks, diverting eggs from

infected flocks to pasteurization facilities, and increasing on-farm quality assurance and sanitation measures. CDC has advised state health departments, hospitals, and nursing homes of specific measures to reduce *Salmonella* Enteritidis infection, and the USDA tests the breeder flocks that produce egg-laying chickens to ensure that they are free of *Salmonella* Enteritidis. The Food and Drug Administration has amended its regulations, which now require that all shell eggs in retail establishments be held at a temperature of 45 degrees Fahrenheit or lower and that all egg cartons carry safe-handling instructions to inform consumers about proper storage and cooking of eggs.

FoodNet is a surveillance system operating in nine sites selected by CDC on the basis of their capability to conduct active surveillance and because of their geographic location. FoodNet produces a more stable and accurate national estimate than is otherwise available of the frequency and sources of nine foodborne pathogens, hemolytic uremic syndrome (a serious complication of *E. coli* O157:H7 infection), Guillain-Barre syndrome (a serious complication of *Campylobacter* infection), and toxoplasmosis. These improved estimates result from the use of active surveillance and additional studies that are not characteristic of CDC's other foodborne surveillance systems. Public health departments who participate in FoodNet receive funds from CDC to systematically contact laboratories in their geographical areas and solicit incidence data.[2] In 1999, state officials participating in FoodNet contacted each of the more than 300 clinical labs within the FoodNet areas on a regular basis.[3] FoodNet studies include various "case control" studies, which are used to determine factors, such as food preparation or handling practices, that affect the risk of infection by pathogens covered by the system. The studies also examine the association between infections and specific foods. In addition, public health officials that participate in FoodNet conduct surveys to identify physician and lab practices that may limit the identification of foodborne diseases.

PulseNet is a nationwide network of public health laboratories that perform DNA "fingerprinting" on four types of foodborne bacteria in order to identify and investigate potential outbreaks. The four bacteria

[2]Funding for FoodNet comes not only from CDC but also from the Food and Drug Administration and the USDA.

[3]Throughout this report, we use 1999 as the reference year because it is the most recent year for which surveillance data are consistently available.

fingerprinted by PulseNet—*Salmonella*, *E. coli* O157:H7, *Listeria*, and *Shigella*—were selected because of their public health importance and the availability of specific "fingerprinting" methods for the pathogens. These four bacteria are either common or have severe symptoms, or both. Public health officials in 46 state and 2 local public health laboratories as well as the food safety laboratories of the USDA and the Food and Drug Administration submit "fingerprint" patterns of bacteria isolated from patients and/or contaminated food to the PulseNet database. The PulseNet network permits rapid comparison of the patterns in the database. Matches may indicate an outbreak. Similar patterns in samples taken from different patients suggest that the bacteria come from a common source, for example, a widely distributed contaminated food product. In addition, strains isolated from food products can be compared with those isolated from ill persons to provide evidence that a specific food caused the disease. By identifying these connections, PulseNet provides critical data for identifying and controlling the source of an outbreak, thus reducing the burden of foodborne disease for the pathogens within the scope of this network. Thirty survey respondents told us that, in the last 3 years, PulseNet had identified a cluster of cases in their state that turned out to be a previously unknown outbreak. In addition, 42 respondents reported that PulseNet helped their state detect and investigate outbreaks of *E. coli* O157:H7, *Salmonella*, *Listeria*, and/or *Shigella*. Twenty-five of these said that PulseNet greatly helped in this area. In 2000, over 17,000 patterns were submitted to the PulseNet database, and 105 potential outbreaks were identified and investigated.

Another system that CDC uses to detect potential foodborne outbreaks is the Surveillance Outbreak Detection Algorithm. In contrast to PulseNet, which uses advanced technology to compare bacterial DNA, the Surveillance Outbreak Detection Algorithm uses statistical analysis to compare currently reported incidence of two common pathogens, *Salmonella* and *Shigella*, to a historical baseline in order to detect unusual increases in a specific serotype, such as *Salmonella* Enteritidis. Such increases may indicate an outbreak. CDC selected *Salmonella* and *Shigella* because there are many different serotypes of these organisms, and tracking and comparing the frequency of each serotype was a task well suited for computer analysis. In addition, baseline data for these two pathogens were already available through the National *Salmonella* Surveillance System and the National *Shigella* Surveillance System, described below and in appendix III. Beginning in 2002, CDC plans to expand the system to include *E. coli* O157:H7. Twenty-five of the states that we surveyed told us that in their state, at least once in the last 3 years

the Surveillance Outbreak Detection Algorithm had identified a cluster of cases in their state that turned out to be a previously unknown outbreak.

In addition to these 4 systems, CDC also has the following 16 systems that either collect information about a number of diseases, only some of which are foodborne, or focus solely on one disease:

- The Botulism Surveillance System is a national system designed to collect information about all types of botulism, including foodborne. Because every case of foodborne botulism is considered a public health emergency, CDC maintains intensive surveillance for botulism in the United States.
- The CaliciNet is a network of public health laboratories that perform genetic "fingerprinting" for foodborne viruses, allowing rapid identification and comparison of strains.
- The Creutzfeldt-Jakob Disease Surveillance Program monitors the occurrence of this disease through periodic review of national cause-of-death data. Surveillance for this disease was enhanced in 1996 to monitor for the possible occurrence of new variant Creutzfeldt-Jakob Disease after this new form of the disease was reported to have possibly resulted from consumption of cattle products contaminated with bovine spongiform encephalopathy (also known as "mad cow" disease).
- The Epidemic Information Exchange (Epi-X) is a secure Web-based communications network that allows local, state, and federal public health officials to share and discuss outbreak data on a real-time basis. This system can immediately notify health officials of urgent public health events so that they can take appropriate actions.
- The *Escherichia coli* O157:H7 Outbreak Surveillance System is a national system established to collect detailed information about risk factors and vehicles of transmission for *E. coli* infection and is used to inform the public about new vehicles of transmission.
- The National Antimicrobial Resistance Monitoring System is used to monitor the antimicrobial resistance of certain bacteria that are under surveillance through other systems. The system currently operates in 17 sites throughout the United States.
- The National Giardiasis Surveillance System includes data from participating states about reported cases of giardiasis—a condition caused by a parasite found in contaminated water or food such as fruits and vegetables. This system began in 1992, when the Council of State and Territorial Epidemiologists assigned giardiasis a code that enabled states to begin voluntarily reporting surveillance data on this disease to CDC electronically.
- The National Notifiable Diseases Surveillance System is a national system that collects information about 58 diseases, most of which are not

considered foodborne, about which regular, frequent, and timely information is considered necessary for their prevention and control. Data from the system are used to analyze disease trends and determine relative disease burdens on a national basis.

- The National *Salmonella* Surveillance System is a national system that collects information on the isolates of *Salmonella* that are serotyped in state public health laboratories, as well as the isolates from food and animals. This system tracks the frequency of more than 500 specific serotypes to determine trends, detect outbreaks, and focus interventions. The system can detect outbreaks either locally or spread out over several jurisdictions.
- The National *Shigella* Surveillance System is a national system that collects information on the isolates of *Shigella* that are serotyped in state public health laboratories. This system tracks the frequency of more than 40 specific serotypes to determine trends, detect outbreaks, and focus interventions. The system can detect outbreaks either locally or spread out over several jurisdictions.
- The *Salmonella* Enteritidis Outbreak Surveillance System is a national system designed to track these outbreaks and to collect information on implicated food items and the results of traceback investigations conducted by local agencies and the Food and Drug Administration.
- The Sentinel Counties Study of Viral Hepatitis is carried out in six U.S. counties to elicit more detailed information on individual hepatitis cases and collect samples for further analyses.
- The Trichinellosis Surveillance System is a national surveillance system used to monitor long-term trends for this disease.
- The Typhoid Fever Surveillance System is a national surveillance system for monitoring long-term trends in the epidemiology of typhoid fever in the United States. The system provides information about risk factors that is used in making vaccine recommendations.
- The *Vibrio* Surveillance System is composed of two parts: a national system used for reporting cases of *Vibrio cholerae* (cholera), and another system, which is more geographically limited, that is used for reporting all *Vibrio* infections. All cases reported to this system are confirmed through laboratory tests by the relevant state or CDC. Surveillance data for this system are used to identify environmental risk factors, retail food outlets where high-risk exposures occur, and target groups that may benefit from consumer education.
- The Viral Hepatitis Surveillance Program is a national system designed to collect information about acute cases of viral hepatitis: hepatitis A; hepatitis B; and non-A, non-B hepatitis (including hepatitis C). States report basic demographic information for each case, as well as other factors, such as risk-factor information. These data are essential for

monitoring trends in the characteristics of the various types of viral hepatitis.

Collectively, these surveillance systems provide crucial national data needed to detect and control the spread of foodborne disease. More detailed information about these systems is contained in appendix III, in alphabetical order by system.

Delayed Reporting and Incomplete Data Limit CDC's Surveillance Systems, but CDC Is Working to Address These Problems

Public health officials that we contacted said that both untimely release of surveillance data by CDC and the gaps in some of CDC's data limit the surveillance systems' usefulness. Some of these problems have resulted from staff shortages at CDC, while others have been caused by shortages of trained epidemiologists and laboratory personnel at state and local health departments. Another contributing factor is that each state decides which diseases it will track and which ones it will not. Therefore, the diseases that are reported to CDC vary from one state to another. In response to these problems, CDC has taken action to address its staff deficiencies and to assist state and local health officials to improve their data collection and reporting abilities. CDC's actions represent a good first step toward providing public health officials with more timely and complete surveillance data.

Delayed Reporting

Delayed dissemination of information from CDC's foodborne disease surveillance systems has impaired the usefulness of the data. For example, for the Foodborne Disease Outbreak Surveillance System, CDC did not publish outbreak data for the years 1993–1997 until March 2000. CDC officials told us that the late publication of the March 2000 outbreak report was due in part to staff shortages. As of June 2001, data from 1997 was the most recent available from this system. Officials from both the Food and Drug Administration and USDA's Food Safety and Inspection Service told us that this delay limited the data's usefulness. In addition, of the 52 respondents to our survey, 26 said that the 3-year lag between the end of the reporting period and the publication of CDC's March 2000 report diminished the usefulness of the report to their state. Of the 43 survey respondents that used this report, nearly all said that the outbreak data was used as a source of information about foodborne disease trends or to determine associations between pathogens and food.

Many survey respondents also told us that more rapid reporting or release of data from FoodNet, PulseNet, and the Surveillance Outbreak Detection Algorithm would improve the systems' usefulness. For FoodNet, CDC publishes surveillance results annually. However, as of June 2001, CDC had not published any detailed results from its case control studies about

the proportion of foodborne disease caused by specific foods or food preparation and handling practices, even though FoodNet has been operational since 1995. CDC officials told us that they had submitted the results of these surveys and studies to professional journals, but the results were never published. For PulseNet, nearly half of the survey respondents said that more rapid analysis of data and more rapid reporting of identified clusters would make the system more useful. In addition, 33 of the respondents said that direct access to the PulseNet database would make the system more useful. For the Surveillance Outbreak Detection Algorithm, 25 of the respondents said that more rapid analysis of state, regional, and national data by CDC would make that system more useful. In addition, 20 respondents said more rapid reporting of clusters by CDC would make the system more useful.

CDC officials told us that the late publication of the March 2000 outbreak report was due in part to staff shortages. CDC took action to address this problem when the agency hired four new staff between June 2000 and September 2000 to take on the responsibilities of collecting, verifying, coding, processing, and summarizing the outbreak data in addition to other duties. In the future, CDC plans to release outbreak data annually beginning with 1998 data, instead of aggregating these data over several years. CDC is currently compiling 2001 outbreak data and intends to publish it by the end of 2002. In addition, CDC is developing a system, called the Electronic Foodborne Outbreak Reporting System, which will allow states to electronically transmit reports of foodborne disease outbreaks. Thirty-six survey respondents indicated that this system would increase the timeliness of their initial outbreak reports to CDC. Finally, in November 2000 CDC introduced an electronic bulletin board, known as Epi-X, which allows local, state, and federal public health officials to share outbreak data on a real-time basis. This system can automatically notify health officials of urgent public health events so that they can take appropriate actions.

CDC also has plans to provide more rapid reporting or release of data from FoodNet and PulseNet. For FoodNet, CDC officials said they plan to publish by the end of 2001 a number of case control study results that were previously unavailable. For PulseNet, CDC told us it has developed new software that, effective June 30, 2001, gives all participating certified laboratories direct access to the PulseNet database. This allows state officials to query the PulseNet database directly instead of waiting for CDC to send them notice of a new pattern.

However, CDC's ability to disseminate surveillance data in a timely fashion also depends in part on the timeliness of state and local officials' submittal of the data. For example, for the Foodborne Disease Outbreak Surveillance System, 24 of the survey respondents said they did not report any outbreak data for 2000 until the end of the year or even later. Thus, data could be over a year old before it gets reported to CDC. Similarly, CDC officials also told us that for the Surveillance Outbreak Detection Algorithm, some states report information only quarterly, which is too late to allow CDC to provide early detection of an ongoing outbreak. Because responsibility for surveillance of foodborne diseases rests primarily with the states, states' reporting of data to CDC is voluntary. To assist in overcoming this problem, CDC is developing a new program known as the National Electronic Disease Surveillance System. This system is intended to facilitate the ready exchange of data between local and state health departments, among states, and among states and CDC. While this may not overcome delayed reporting by the states, it should make information more readily available. In addition, through their Epidemic Intelligence Service program, CDC is training medical doctors, researchers, and scientists, who serve in 2-year assignments, about the needs of both state health departments and CDC. Agency officials said that they hope graduates from the program will understand the value of sharing information in a timely manner and help speed the flow of information into CDC.

Incomplete Data

The completeness of CDC's data is dependent in large part on the submissions from state and local health officials, which often do not report all cases or all information requested about individual cases. For example, 17 survey respondents told us that not all of the outbreaks in their states were reported to the Foodborne Disease Outbreak Surveillance System. Moreover, for those outbreaks that were reported, 25 survey respondents said the responsible pathogen was identified in only half or fewer of their reports submitted to CDC. Further, as regards the contaminated food item that caused the outbreaks, 28 survey respondents said they identified and reported the responsible food item in half or fewer of their reports. According to FDA and FSIS officials, identifying the responsible pathogen and the contaminated food item is critical for understanding and controlling foodborne disease, and for tracing the cause of the contaminant to its original source.

Survey respondents cited several reasons for the gaps in outbreak information sent to CDC. Table 1 summarizes some of the major reasons.

Table 1: Conditions That Could Hinder Detection and Investigation of Foodborne Disease Outbreaks

Conditions	True in our state	Not true in our state	Total respondents
There are not enough trained epidemiologists at the local level to investigate outbreaks.	44	6	50
Workload and priorities at local level discourage investigation of outbreaks.	36	15	51
There is local resistance to linking a business name with foodborne disease.	32	19	51
There are not enough trained epidemiologists at the state level to investigate outbreaks.	32	19	51
State labs do not have capability to analyze specimens for a full range of pathogens (e.g., viruses).	31	20	51
Foodborne disease has much lower priority for resources compared to other public health issues.	26	24	50
Local health departments do not always inform the state about outbreaks.	26	23	49

Source: GAO survey.

As the table shows, the majority of the respondents said shortages of personnel and capacity in state and local health departments, among other things, hinder their ability to detect and investigate foodborne disease outbreaks. A complete listing of conditions that could hinder state and local public health officials is included in our questionnaire results, contained in appendix I.

Another cause of incomplete data submissions to the Foodborne Disease Outbreak Surveillance System, as well as to other systems, is the lack of standard disease reporting requirements among states. Each state has a separate list of "reportable" diseases that must be reported to the state health department. The lists vary greatly from state to state because of differences in the extent to which the diseases occur. For example, while 32 survey respondents indicated that health providers in their state are required to notify state or local health departments about cases of cyclosporiasis, 19 said notification was not required. (See app. I for more information on state reporting requirements for a number of foodborne pathogens.) Although states can forward data to CDC about diseases that are not reportable, overall data about such diseases are often incomplete because of deficiencies in reporting by physicians and labs.

To improve local and state health officials' ability to respond to a broad range of public health issues relating to infectious diseases, which include foodborne outbreaks, CDC provides funding to state and local health departments through its Emerging Infections Programs and its

Epidemiology and Laboratory Capacity program. Funding for these two programs has increased from $900,000 in 1994 to approximately $50 million in 2001. These programs are designed to address staffing or technology shortages, or both, and will help the states provide CDC with more complete information. For example, states have received grants to significantly increase the capacity of their laboratories. According to CDC officials, now nearly every state has properly trained staff able to use PulseNet technology.

To encourage more standardized reporting among the states, CDC consults annually with the Council of State and Territorial Epidemiologists to determine which infectious diseases, including foodborne diseases, are important enough to merit routine reporting to CDC. Officials from CDC told us they have also entered into cooperative agreements with the council and with the Association of Public Health Laboratories to assess the states' capability and capacity to address public health issues, including foodborne diseases.

Agency Comments

In commenting on a draft of this report, CDC officials generally agreed with the overall message of the report and provided technical comments to ensure completeness and accuracy. We incorporated these comments into our report as appropriate. CDC comments are presented in appendix IV.

Scope and Methodology

To describe CDC's foodborne disease surveillance systems, we obtained information from CDC on the systems used most often in conducting foodborne disease surveillance activities. We examined each of these systems to identify their use and how they operate. We also discussed the systems' use and operation with officials from the Food and Drug Administration, USDA's Food Safety and Inspection Service, the Council of State and Territorial Epidemiologists, the Association of Public Health Laboratories, the National Pork Producers Council, the American Meat Institute, the National Broilers Council, and the Center for Science in the Public Interest. As a result of our initial work, we then directed the remainder of our review effort to four surveillance systems that focus on foodborne disease and that cover more than one pathogen. These four systems were the Foodborne Disease Outbreak Surveillance System, FoodNet, PulseNet, and the Surveillance Outbreak Detection Algorithm. We reviewed extensive literature about each of these four systems and examined the systems' input and reporting documentation.

To identify limitations of these surveillance systems, we sent mail-back questionnaires to officials in the 50 state health departments, as well as in the District of Columbia, and New York City.[4] We pretested this survey in three states to ensure that our questions were clear, unbiased, and precise, and that responding to the survey did not place an undue burden on the health departments. We received completed questionnaires from 100 percent of those surveyed. We discussed limitations identified in the survey with CDC and other federal and state public health officials and with other groups that use foodborne disease surveillance systems. To identify initiatives designed to address these limitations, we met with CDC officials responsible for the surveillance systems and discussed actions they have taken or plan to take to address the limitations.

We conducted our review from August 2000 through July 2001 in accordance with generally accepted government auditing standards.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution of it until 30 days from the date of this letter. We will then send copies to the congressional committees with jurisdiction over food safety issues; the Secretary of Health and Human Services; the Director, Office of Management and Budget; and other interested parties. We will also provide copies to others on request.

[4]We added New York City because CDC officials told us that sometimes the city's public health department reports data directly to CDC.

If you or your staff have any questions about this report, please call me on (202) 512-3841. Key contributors to this report are listed in appendix V.

Sincerely yours,

Lawrence J. Dyckman
Director, Natural Resources
and Environment

Appendix I: Questionnaire Results

United States General Accounting Office

GAO

Survey of State Health Departments Concerning Foodborne Disease Surveillance and Investigation

Introduction

The U.S. General Accounting Office (GAO) is an agency that collects and summarizes information for the U.S. Congress. The Congress asked us to report on federal and state activities related to foodborne disease surveillance. As part of our review, we are surveying all state departments of health to determine their participation in federal surveillance programs and other surveillance activities.

Your participation in our survey is critical in order for us to provide the Congress with a complete nationwide summary of activities. If you are not the person in your state who has day-to-day responsibility for the surveillance and investigation of foodborne disease, please forward the survey to that person and let us know of your action. We plan to summarize the survey responses in a report to the Congress.

We would appreciate your response within 10 days of receiving the survey. This will enable us to give a more timely report to the Congress. Please use the enclosed business-reply envelope. If the envelope is missing or has been misplaced, our return address is:

U.S. General Accounting Office
Attn: Paul Pansini
2635 Century Parkway, Suite 700
Atlanta, GA 30345

If you have any questions, please contact Paul Pansini toll-free at 1-877-446-3320 (email: pansinip@gao.gov). Thank you for your cooperation.

State Surveillance and Investigation Activities

1. Which, if any, of the following surveillance and investigative activities does your state health department perform regarding foodborne diseases? *(Check all that apply.)*

1(4-16)

52 Investigate complaints, suspected cases, and/or outbreaks

51 Perform lab analysis and/or diagnosis from specimens provided by hospitals, doctors, and other health service providers

49 Collect descriptive information about cases and/or outbreaks from local health departments (e.g., county, city, township, parish, etc.) and/or other health service providers

51 Submit reports of outbreaks to the Center for Disease Control and Prevention (CDC)

50 Maintain statewide records of cases and outbreaks

50 Provide primary coordination with the federal government for outbreak investigations

47 Provide training and/or technical assistance to health service providers and other professionals

41 Provide environmental preventive care (e.g., facility and/or product inspections, training of food-handlers, etc.)

24 Engage in research activities

6 Other *(Please specify.)*

0 Do not perform any surveillance or investigative activities related to foodborne diseases. →**Stop here. Please return your questionnaire.**

1

2. Compared to other reportable acute infectious diseases in your state (e.g., sexually transmitted diseases, HIV/AIDS, tuberculosis), how does foodborne disease rank on each of the following? *(Check one for each.)* (17-21)

	Foodborne disease surveillance and investigation ranks					
	Highest (top 3) (1)	High (2)	In the middle (3)	Low (4)	Lowest (bottom 3) (5)	No basis to judge (6)
1. Estimated incidence of disease in the state (number of cases)	5	20	16	8	1	1
2. Dollars available for surveillance and investigation	4	1	15	19	11	1
3. Staff hours spent on surveillance and investigation	6	11	23	10	0	1
4. Public concern	8	23	13	5	0	1
5. Other *(Please specify.)*	1	2	0	1	1	0

3. How satisfied or dissatisfied are you with the level of effort devoted to foodborne disease surveillance and investigation of cases and outbreaks at the federal, state, and local levels, compared to other acute infectious diseases? *(Check one for each.)* (22-27)

	Very satisfied (1)	Generally satisfied (2)	About as satisfied as not (3)	Generally dissatisfied (4)	Very dissatisfied (5)
Surveillance					
1. Federal	7	30	10	4	0
2. Your state	3	20	14	12	2
3. Local areas within your state	0	12	21	13	3
Investigation					
4. Federal	5	33	10	1	0
5. Your state	3	23	18	5	1
6. Local areas within your state	0	13	19	13	3

2

4. Please answer three questions about each of the following bacterial causes of foodborne disease:.

A. Does your state law or regulation require that doctors, hospitals, labs and/or other health service providers notify a state or local health department when a case is suspected or confirmed? *(Check one.)*

B. Does your state health department investigate single cases when they are reported? *(Check one.)*

C. Does your state health department investigate clusters of cases when they are reported? *(Check one.)* (28-78)

	A. Notification		B. Single Cases			C. Clusters of Cases		
Bacteria	Required (1)	Not required (2)	Almost always investigate (3)	Sometimes investigate (4)	Rarely investigate (5)	Almost always investigate (6)	Sometimes investigate (7)	Rarely investigate (8)
1. *Bacillus cereus*	6	45	8	9	33	44	5	1
2. *Clostridium botulinum*	51	0	48	2	1	50	1	0
3. *Campylobacter*	49	2	21	14	16	48	3	0
4. *Clostridium perfringens*	9	41	8	12	30	45	4	1
5. *E. coli*O157:H7	50	1	42	8	1	50	1	0
6. Other Shiga toxin-producing *E. coli*	32	18	27	14	9	47	2	0
7. *Listeria monocytogenes*	45	6	31	18	2	48	3	0
8. *Salmonella*Enteritidis	50	1	27	14	10	50	1	0
9. *Salmonella*Typhimurium	49	1	26	16	9	50	1	0
10. *Salmonella*Typhi	49	1	47	3	1	49	1	0
11. *Salmonella*, non-typhoidal	50	0	26	15	10	49	2	0
12. *Shigella*	50	0	29	13	8	48	3	0
13. *Staphylococcus aureus*	10	37	8	10	29	44	4	2
14. *Vibrio cholerae*	48	2	44	6	1	49	2	0
15. *Vibrio vulnificus*	26	24	32	9	7	45	3	1
16. *Vibrio parahaemolyticus*	27	22	28	12	8	45	3	1
17. *Yersinia enterocolitica*	35	15	21	18	10	47	3	0

3

5. Please answer three questions about each of the following parasites, viruses, or toxins that can cause foodborne disease.

A. Does your state law or regulation require that doctors, hospitals, labs and/or other health service providers notify a state or local health department when a case is suspected or confirmed? *(Check one.)*

B. Does your state health department investigate single cases when they are reported? *(Check one.)*

C. Does your state health department investigate clusters of cases when they are reported? *(Check one.)* 2(4-36)

	A. Notification		B. Single Cases			C. Clusters of Cases		
	Required (1)	Not required (2)	Almost always investigate (3)	Sometimes investigate (4)	Rarely investigate (5)	Almost always investigate (6)	Sometimes investigate (7)	Rarely investigate (8)
Parasites								
1. *Trichinella spiralis*	45	7	38	5	6	46	1	2
2. *Cryptosporidium parvum*	50	2	27	14	10	46	2	0
3. *Cyclospora cayetanensis*	32	19	29	11	8	44	2	0
4. *Giardia lamblia*	43	9	18	17	16	40	8	0
5. *Toxoplasma gondii*	13	39	8	12	25	33	6	5
Viruses								
6. Hepatitis A	52	0	38	11	1	47	1	0
7. Norwalk-like	6	45	4	13	32	41	7	1
8. Rotavirus	2	49	10	39	0	27	13	6
Toxins								
9. Ciguatera	11	40	32	8	8	40	5	2
10. Scombroid fish poisoning	10	41	32	9	7	41	4	2
11. Paralytic shellfish poisoning	12	39	32	8	8	40	5	2

4

Foodborne Disease Outbreak Surveillance System

The Foodborne Disease Outbreak Surveillance System is a collaborative effort between the states and CDC. The system collects and periodically reports national data on the occurrence and causes of foodborne disease outbreaks. The system is maintained by CDC. States are not required to report outbreaks to CDC; rather, their reporting is voluntary.

A foodborne disease **outbreak** is the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food.

6. Are suspected foodborne disease outbreaks reportable in your state? That is, are doctors, hospitals, labs and/or other health service providers required by state law or regulation to report suspected outbreaks of these diseases to a state or local health department? *(Check one.)* (37)

52 Yes
0 No
0 Not sure

7. In calendar year 2000, how often, if at all, did your department submit reports of foodborne outbreaks to CDC on Form 52.13 (the "fork and spoon" form)? *(Check one.)* (38)

4 As soon as an outbreak investigation was initiated →Skip to Question 7.
16 As soon as an outbreak investigation was completed →Skip to Question 7.
2 Monthly →Skip to Question 7.
1 Quarterly →Skip to Question 7.
9 At the end of the year →Skip to Question 7.
15 Have not reported, but will report by _____, 2001. →Enter month and skip to Question 7.
2 Other *(Please specify.)* →Skip to Question 7.

1 Not planning to submit reports to CDC → Please continue.

8. Which of the following reasons, if any, explain why your state does not plan to report outbreaks in calendar year 2000 to CDC? *(Check all that apply.)* (39-49)

0 Our department does not collect information about foodborne disease outbreaks.
1 Our department does not have sufficient staff to take responsibility for reporting.
0 The reporting forms and methods are too confusing.
1 Our department does not obtain any benefits from reporting these data to CDC.
0 State privacy laws and regulations, established to protect medical records, prohibit sharing data with CDC
1 The information requested by CDC to report outbreaks is too burdensome
1 CDC reliance on paper-based reporting forms discourages us from reporting
1 Foodborne outbreak data from the national surveillance system is not useful to or used by our department
1 We are reluctant to report unless we have determined the cause (e.g., pathogen or food vehicle) of the outbreak.
1 Other (Please specify.)

9. Overall, for calendar year 2000, about what percentage of known foodborne disease outbreaks in your state did you report or do you plan to report to CDC on Form 52.13? *(Check one.)* (50)

33 All
8 Almost all
3 Most
3 About half
2 Some
0 Very few
1 None →Skip to Question 11.

5

10. In general, for calendar year 2000, about what proportion of individual Form 52.13s you submitted or plan to submit to CDC identified the pathogen and food vehicle that caused the outbreak? *(Check one.)*

(51-52)

Pathogen

4 All
8 Almost all
10 Most
11 About half
11 Some
3 Very few
0 None
2 Don't know

Food Vehicle

2 All
4 Almost all
12 Most
6 About half
20 Some
2 Very few
0 None
2 Don't know

11. Overall, to what extent, if at all, does having incomplete data (unreported outbreaks, forms missing pathogen or food vehicle data, etc.) in the Foodborne Disease Outbreak Surveillance System affect your use of the data? *(Check one.)*

(53)

9 Little or no extent
9 Some extent
16 Moderate extent
9 Great extent
2 Very great extent
5 No opinion

6

12. Listed below are conditions that, if they existed in your state, could hinder the detection and investigation of foodborne disease outbreaks. Please indicate whether or not the condition is true in your state. Then, if true, rate how much, if at all, each condition hinders the detection and investigation of foodborne disease outbreaks in your state. *(Check if true or not true; then if true, check one rating for each condition.)* (54-77)

			Condition hinders				
	True in our state (1)	Not true in our state (2)	Little or not at all (3)	Somewhat (4)	Moderately (5)	Greatly (6)	Very greatly (7)
1. There are not enough trained epidemiologists at the local level to investigate outbreaks.	44	6	2	6	16	14	6
2. There are not enough trained epidemiologists at the state level to investigate outbreaks.	32	19	0	10	13	4	5
3. Private citizens are reluctant to provide stool specimens.	45	5	0	8	17	18	2
4. State does not have the resources (e.g., staff time, courier services) to obtain stool specimens.	33	19	0	12	8	11	1
5. State labs do not have capability (e.g., staff, equipment, etc.) to analyze stool specimens for a full range of pathogens (e.g., viruses).	31	20	2	8	10	5	5
6. State labs do not have capability to analyze food samples.	13	39	1	2	5	3	2
7. Foodborne disease has much lower priority for resources compared to other public health issues.	26	24	2	3	9	7	3
8. State government agencies/groups with overlapping roles for foodborne disease do not always share information (e.g., epidemiology and environmental health, etc.).	18	34	0	10	6	1	1
9. Local health departments do not always inform the state about outbreaks.	26	23	1	12	9	4	0
10. Workload and priorities at local level discourage investigation of outbreaks.	36	15	0	9	10	13	4
11. There is local resistance to linking a business name with foodborne disease.	32	19	6	15	8	1	1
12. Other *(Please specify.)*	6	0	0	0	0	4	2

7

13. CDC is developing a standard record format that can be used to electronically transmit reports of foodborne disease outbreaks, called EFORS (Electronic Foodborne Outbreak Reporting System). EFORS requests standard information such as the specific disease, location of the incident, and other information. To what extent would the use of EFORS increase or decrease each of the following? *(Check one for each.)* 3(4-13)

	Greatly increase (1)	Somewhat increase (2)	No effect (3)	Somewhat decrease (4)	Greatly decrease (5)	Don't know (6)
1. Your cooperation in providing outbreak information to CDC	3	17	28	1	0	2
2. Your department's ability to provide all the information requested by CDC	1	8	38	2	0	2
3. Your department's ability to report all confirmed foodborne disease outbreaks in your state	4	13	31	1	0	2
4. Timeliness of your initial outbreak reports to CDC	8	28	12	1	0	1
5. Timeliness of your report updates to CDC	8	28	12	1	0	1
6. Accuracy of your outbreak reports	2	10	37	0	0	1
7. Convenience of reporting	17	26	6	0	1	1
8. Confidence that reported data is received by CDC	11	18	17	1	0	3
9. Potential for users to query CDC's database	26	18	3	0	0	4
10. Your department's ability to complete in-state reporting requirements	2	15	31	0	0	2
11. Other *(Please specify.)*	1	1	0	1	0	1

8

CDC's March 2000 Report on Foodborne Disease Outbreaks

The following questions are about CDC's most recent report on data collected through the Foodborne-Disease Outbreak Surveillance System. This report, "Surveillance for Foodborne Disease Outbreaks-United States, 1993-1997," was published on March 17, 2000. Our questions concern the original report, not the revised data.

14. According to CDC's March 2000 report, your state reported _____ foodborne disease outbreaks for calendar year 1997. Is this the actual number of outbreaks in your state in 1997? *(Check one.)* (14)

    11 Yes →Skip to Question 16.

    35 No →How many foodborne disease outbreaks did your state have in 1997? _____

    4 Not sure →Skip to Question 16. (15-20)

15. Which of the following reasons, if any, could explain why the number of outbreaks in your state in 1997 differs from that reported in CDC's March 2000 report? *(Check all that apply.)* (21-28)

    9 We did not report outbreaks in 1997 to CDC.

    13 Reporting to CDC was not a high priority for our state in 1997.

    2 CDC's numbers reflect our initial reports, which we later updated.

    2 We completed additional outbreak investigations after we reported to CDC and we did not submit additional reports.

    2 We did not submit reports directly to the Foodborne and Diarrheal Branch as requested on the form. We submitted forms to FoodNet.

    6 We submitted all outbreak reports to CDC and do not know why their numbers disagree with ours.

    9 Other *(Please specify.)*

    5 Don't know

16. How familiar, if at all, are you with CDC's March 2000 Report? *(Check one.)* (29)

    14 Hardly or not at all familiar →Skip to Question 22.

    10 Somewhat familiar →Please continue.

    14 Moderately familiar →Please continue.

    13 Very familiar →Please continue.

17. For which, if any, of the following purposes do you use CDC's March 2000 report? *(Check all that apply.)* (30-35)

    27 As a source of information about foodborne disease trends

    14 To determine associations between pathogens and food

    0 To allocate resources within the department

    2 To request funds for foodborne disease surveillance and investigation

    0 Other *(Please specify.)*

    9 Have not used CDC's March 2000 report

18. How useful to your department, if at all, are the national summary data provided in CDC's March 2000 report? *(Check all that apply.)* (36-41)

    4 Extremely useful

    8 Very useful

    10 Moderately useful

    11 Somewhat useful

    4 Not at all useful

    0 No opinion or not sure

9

19. In your opinion, how much more useful, if at all, would CDC's outbreak report be if it included detailed summaries by state? *(Check all that apply.)* (42-49)

Summaries for your state

15 About as useful as it is now
14 Somewhat more useful
7 Much more useful
1 No opinion or not sure

Summaries for other states

11 About as useful as it is now
15 Somewhat more useful
7 Much more useful
4 No opinion or not sure

20. To what extent, if at all, did the 3-year lag between the end of the reporting period and the publication of CDC's March 2000 report diminish the usefulness of the report to your state? *(Check one.)* (50)

12 Little or no extent
14 Some extent
6 Moderate extent
4 Great extent
1 Very great extent

21. Overall, how would you describe the timing of CDC's March 2000 report for your purposes? *(Check one.)* (51)

0 Much too early
0 Somewhat early
3 Just about right
16 Somewhat too late
5 Much too late
12 No opinion or not sure

22. How frequently would you prefer to receive national summary data from CDC? *(Check one.)* (52)

13 Real time (i.e., as soon as an outbreak is suspected)
5 Real time (i.e., as soon as an outbreak is confirmed)
3 Aggregated monthly
6 Aggregated quarterly
4 Aggregated every 6 months
18 Aggregated annually
2 No preference

23. If CDC had not yet published the outbreak data from 1993-1997, would your department have access to any other sources of national summary data about foodborne disease outbreaks? *(Check all that apply.)* (53-55)

10 Yes, we have access to another data source. *(Please specify source.)*

35 No, we have no access to another data source.
7 Not sure

10

Disease Specific Surveillance Systems

CDC has designated for national tracking or surveillance 16 pathogens that cause foodborne disease. CDC collects data on these pathogens from state and/or local health agencies, primarily through two reporting systems: the National Electronic Telecommunications System for Surveillance (NETSS) and the Public Health Laboratory Information System (PHLIS). CDC analyzes the submitted data to identify outbreaks and other trends.

24. For which, if any, of the following purposes has your department used NETSS data? *(Check all that apply.)* (56-60)

43 As a source of information about foodborne disease trends

7 To allocate resources within the department

18 To request funds for foodborne disease surveillance and investigation

6 Other *(Please specify.)*

7 Have not used NETSS data

25. Which, if any, of the following changes would improve the usefulness of NETSS? *(Check all that apply.)* (61-67)

13 Increase the frequency of CDC's published reports on the data collected from NETSS

31 Provide access to the information from NETSS on CDC's web site

23 Conversion of summary numbers of cases to summary rates of disease incidence

40 Integrate PHLIS and NETSS systems

11 Require data input to PHLIS or NETSS, but not both

5 Other *(Please specify.)*

4 No changes needed

26. Does your state routinely submit foodborne disease cases that are confirmed by the state public health lab to PHLIS, NETSS, or both? *(Check one.)* (68)

2 Only to PHLIS

3 Only to NETSS

22 Generally to both PHLIS and NETSS

25 Always to both PHLIS and NETSS

0 Neither

27. Do any of your state labs have the capability to report cases to PHLIS? *(Check one.)* (69)

47 Yes →Please continue.

5 No →Skip to Question 29.

28. Overall, how helpful, if at all, have NETSS and PHLIS been to you in conducting your state's foodborne disease surveillance efforts? *(Check one.)* (70-71)

NETSS

8 Of little or no help

15 Somewhat helpful

10 Moderately helpful

11 Very helpful

7 Extremely helpful

PHLIS

13 Of little or no help

15 Somewhat helpful

10 Moderately helpful

6 Very helpful

3 Extremely helpful

3 Our labs cannot use PHLIS

11

***Salmonella* Outbreak Detection Algorithm (SODA)**

To assist states in identifying *Salmonella* outbreaks using lab-based surveillance data, CDC developed the *Salmonella* Outbreak Detection Algorithm (SODA). SODA is a statistical algorithm designed to rapidly detect an unusual increase or cluster(s) of *Salmonella* infections. CDC runs this algorithm based on weekly data from PHLIS. Using the previous five years of data, the algorithm compares the current week's results to identify any unusual numbers or clusters of *Salmonella* infections.

29. In the last three years, about how many times has SODA identified a cluster of cases in your state that turned out to be a previously unknown outbreak of *Salmonella*? *(Check one.)* (72)

23 None
17 1-3
7 4-6
0 7-10
1 More than 10
4 Have not used SODA

30. How much has SODA improved the speed with which your state is able to detect and investigate increased numbers or cluster(s) of *Salmonella* infections? *(Check one.)* (73)

27 Hardly or not at all improved
14 Somewhat improved
3 Moderately improved
1 Greatly improved
0 Very greatly improved
2 No opinion

31. Overall, how satisfied or dissatisfied are you with SODA? *(Check one.)* (74)

2 Very satisfied
13 Generally satisfied
25 About as satisfied as not
2 Generally dissatisfied
4 Very dissatisfied

32. Which, if any, of the following changes would make SODA more useful to your state? *(Check all that apply.)* 4(4-11)

21 More rapid reporting of *Salmonella* isolate data from clinical labs to the state health department
20 More rapid analysis of submitted isolates by the state health department labs
25 More rapid analysis of state, regional, and national data by CDC
20 More rapid reporting by CDC of identified clusters to our state
19 Identifying *Salmonella* clusters by subtype
13 Increased predictive accuracy of the algorithm
8 Other *(Please specify.)*

7 No changes needed

33. In your opinion, for which, if any, of the following diseases would an algorithm like SODA be beneficial for detecting and investigating foodborne disease outbreaks in your state? *(Check all that apply.)* (12-15)

16 *Shigella*
16 Other *(Please specify.)*

14 None
10 No opinion

12

PulseNet

PulseNet is a national network of public health labs that perform DNA "fingerprinting" on *E. coli* O157:H7, *Listeria*, *Shigella*, and *Salmonella* isolates. Participants in PulseNet exchange lab results though an electronic database at CDC.

34. What was your state health department lab's certification status for participating in PulseNet during any part of calendar year 2000? *(Check all that apply.)* (16-21)

33 Certified to test for *E. coli* O157:H7
27 Certified to test for *Salmonella* Typhimurium
14 Certified to test for *Listeria monocytogenes*
14 Certified to test for *Shigella*
5 Other *(Please specify.)*

14 No certification

35. How often, if at all, has your state used PulseNet for each of the following pathogens? *(Check one for each.)* (22-25)

	Not at all (1)	Very few times (2)	Moderately often (3)	Very often (4)
1. *E. coli*O157:H7	6	9	16	19
2. *Listeria*	20	11	6	9
3. *Shigella*	20	11	8	8
4. *Salmonella*	9	7	19	15

36. How much, if at all, have resources limited your state's use of PulseNet? *(Check one.)* (26)

13 Not at all
11 Somewhat
9 Moderately
11 Greatly
7 Very greatly

37. How much has PulseNet helped your state detect and investigate outbreaks of *E. coli* O157:H7, *Salmonella*, *Listeria*, and/or *Shigella*? *(Check one.)* (27)

15 Very greatly helped
10 Greatly helped
9 Moderately helped
8 Somewhat helped
4 Not helped at all
6 Have not used PulseNet

38. In the last three years, about how many times has PulseNet identified a cluster of cases in your state that turned out to be a previously unknown outbreak of *E. coli* O157:H7, *Salmonella*, *Listeria*, or *Shigella*? *(Check one.)* (28)

16 None
14 1-3
12 4-6
1 7-10
3 More than 10
5 Have not used PulseNet

39. How satisfied or dissatisfied are you with the timeliness of CDC's analyses of PulseNet data? *(Check one.)* (29)

5 Greatly satisfied
16 Somewhat satisfied
7 As satisfied as not
8 Somewhat dissatisfied
5 Greatly dissatisfied
10 No basis to judge

13

40. Which, if any, of the following changes would make PulseNet more useful to your state? *(Check all that apply.)* (30-36)

25 More rapid analysis of data
24 More rapid reporting of identified clusters
16 Identifying *Salmonella* clusters by subtype
33 Direct access to PulseNet computer database
12 Including additional foodborne pathogens *(Please list.)*
10 Other *(Please specify.)*
7 No changes needed

FoodNet (Foodborne Diseases Active Surveillance Network)

FoodNet comprises nine states or sites that conduct active surveillance for foodborne diseases and related investigations. These sites contact clinical labs in their area to collect information about FoodNet pathogens. They also conduct studies, such as surveys about health provider practices and risky behaviors in the general population associated with foodborne diseases.

41. How familiar, if at all, are you with FoodNet activities, results and findings? *(Check one.)* (37)

11 Extremely familiar
8 Greatly familiar
16 Moderately familiar
9 Somewhat familiar
8 Not at all familiar →Skip to Question 52.

42. In general, how much, if at all, have the summarized results of FoodNet activities improved your ability to address foodborne diseases (e.g., public health education, surveillance, investigation, etc.)? *(Check one.)* (38)

10 To little or no extent
11 To some extent
13 To a moderate extent
5 To a great extent
3 To a very great extent
1 No opinion

43. How much, if at all, do you expect to increase or decrease your use of information provided by FoodNet over the next two years? *(Check one.)* (39)

5 Greatly increase
22 Somewhat increase
12 No change
0 Somewhat decrease
0 Greatly decrease
5 Not sure

44. Overall, how satisfied or dissatisfied are you with FoodNet? *(Check one.)* (40)

6 Very satisfied
20 Generally satisfied
16 About as satisfied as not
1 Generally dissatisfied
0 Very dissatisfied

14

45. Which of the following changes would make FoodNet results more useful to you in addressing foodborne disease? *(Check all that apply.)*

(41-46)

- 16 More rapid release of study results
- 12 Better user access to the results of specific studies and surveys
- 16 Easier access to FoodNet data for staff who do not participate in FoodNet
- 3 Modifications to the list of pathogens studied *(Please explain.)*
- 4 Other *(Please specify.)*
- 11 No changes needed

46. Does your state or any area in your state participate in FoodNet? *(Check one.)*

(47)

- 9 Yes →Please continue.
- 34 No →Skip to Question 52.
- 1 Don't know

47. About what proportion of the labs in your designated (catchment) area cooperate with FoodNet data requests? *(Check one.)*

(48)

- 7 All →Skip to Question 49.
- 2 Almost all
- 0 Most
- 0 About half
- 0 Some
- 0 Very few
- 0 None

48. About what proportion of the tests performed in your designated (catchment) area are from labs that do not cooperate with FoodNet data requests? *(Check one.)*

(49)

- 0 All
- 0 Almost all
- 0 Most
- 0 About half
- 0 Some
- 1 Very few
- 0 None

49. How often do you typically contact the majority of labs in your designated (catchment) area to obtain information about confirmed cases of FoodNet pathogens? *(Check one.)*

(50)

- 0 Daily
- 0 Weekly
- 2 Every two weeks
- 6 Monthly
- 1 Quarterly
- 0 Other *(Please specify.)*

50. How often do you send CDC information about cases of FoodNet pathogens in your state? *(Check one.)*

(51)

- 0 Daily
- 5 Weekly
- 1 Every two weeks
- 3 Monthly
- 0 Quarterly
- 0 Other *(Please specify.)*

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51. Which of the following changes would improve the information you gather for FoodNet studies from other health departments and labs in your state? *(Check all that apply.)*

(52-57)

- 7 Reimbursing clinical labs for some or all of their expenses
- 3 Courier service to other labs throughout the state
- 1 The participation in FoodNet studies and activities of all labs and other health departments in the state
- 6 Improved methods for health service providers to report data to the state health department
- 1 Other *(Please specify.)*
- 0 No changes needed

Conclusion

52. How much, if at all, would each of the following types of information or services that CDC is not currently providing improve your efforts to detect and investigate foodborne diseases in your state? *(Check one for each.)*

(58-64)

	Hardly or not at all improve (1)	Somewhat improve (2)	Moderately improve (3)	Greatly improve (4)	Very greatly improve (5)
1. Ability to query CDC databases, like NETSS	8	15	14	9	4
2. Secure, searchable electronic registry to investigate interstate outbreaks as soon as information is available	1	8	16	21	6
3. Comparative summary reports with detailed information for each state	9	17	17	6	2
4. Ability to obtain more localized, regional outbreak data	3	8	20	14	5
5. Reports with outbreak rates in addition to numbers of cases	12	19	10	8	1
6. Better access to computers by local health departments	11	13	7	8	8
7. Other *(Please specify.)*	0	0	0	3	3

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53. Please provide the following information in case we need to contact the primary person who completed this survey.

Name _____

Title _____

Agency/Department _____

Phone _____

Email address _____

54. Comments. Please provide any additional comments you may have on topics covered by this questionnaire. (65)

Thank you for your cooperation.

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Appendix II: Major Foodborne Pathogens Under Surveillance by the Centers for Disease Control and Prevention

Pathogen	Incubation period	Common symptoms	Transmission	Associated foods
Bacterial				
Campylobacter	2 to 5 days	Fever, abdominal cramps, diarrhea (often bloody)	Consumption of contaminated food or water; contact with infected animals	Raw or undercooked poultry meat, unpasteurized milk
Clostridium botulinum (Botulism)	18 to 36 hours; can be 6 hours to 10 days	Double vision, drooping eyelids, slurred speech, difficulty swallowing and other signs of muscle paralysis	Ingestion of contaminated food product; infected wounds	Home-canned foods with low acid content, such as green beans, beets and corn; chopped garlic in oil; chili peppers
Escherichia coli O157:H7	1 to 10 days; usually 3 to 4 days	Bloody diarrhea, abdominal cramps, little or no fever	Consumption of contaminated food, swimming in contaminated water, person to person contact	Ground beef, salami, lettuce, unpasteurized milk, juice
Listeria monocytogenes	2 to 8 weeks	Fever, muscle aches; sometimes nausea and/or diarrhea	Consumption of contaminated food	Hot dogs and packaged meats; soft cheeses
Salmonella non-typhoidal	Usually 12 to 72 hours; can be up to 7 days	Abdominal cramps, fever, diarrhea; sometimes nausea and vomiting	Consumption of contaminated food or water; contact with infected animals	Beef, poultry, milk, eggs, and produce
Salmonella typhi (Typhoid Fever)	1 to 3 weeks	Sustained high fever, weakness, stomach pains, headache, or loss of appetite	Contaminated drinking water or food	Risk is very low in the United States
Shigella	12 to 72 hours	Watery or bloody diarrhea, abdominal pain, fever, malaise	Most commonly from person to person, but can be transmitted by food and water	Fresh produce, salads, foods with hand preparation
Vibrio non-cholera, including V*ibrio vulnificus*	4 hours to 4 days; average of 15 hours	Diarrhea, abdominal pain, nausea, vomiting; sometimes fever	Ingestion of contaminated seafood or exposure of an open wound to seawater	Contaminated seafood, such as raw oysters
Vibrio cholerae (Cholera)	6 hours to 5 days	Profuse watery diarrhea, vomiting, circulatory collapse, shock	Contaminated drinking water or food	Undercooked shellfish; virtually no cases in the United States
Yersinia enterocolitica	4 to 7 days	Fever, abdominal pain, diarrhea (often bloody)	Contaminated food or drinking water; contact with infected animals	Raw or undercooked pork, unpasteurized milk
Parasitic				
Cryptosporidium	2 to 10 days	Diarrhea (usually watery), stomach cramps, upset stomach, slight fever	Contaminated water or food; contact with infected items, such as toys and bathroom fixtures	Any food contaminated by an ill food handler

Pathogen	Incubation period	Common symptoms	Transmission	Associated foods
Cyclospora	1 to 14 days	Diarrhea (usually watery), loss of appetite, substantial loss of weight, stomach cramps, nausea, vomiting, fatigue	Contaminated food or drinking water	Various types of fresh produce, including imported raspberries
Giardia	1 to 2 weeks	Diarrhea (usually watery) and stomach cramps	Contaminated water, food, or surfaces	Fruits and vegetables
Toxoplasma	5 to 23 days	Flu-like illness; congenital infection causes neurological and ocular disease	Consumption of raw or undercooked meat; ingestion of the organism after contact with cat feces or soil contaminated with cat feces	Undercooked meat, especially pork, lamb, and wild game meat; contaminated fruits and vegetables
Trichinella	1 to 2 days for initial symptoms; others begin 2 to 8 weeks after infection	Nausea, diarrhea, vomiting, fatigue, fever, abdominal discomfort	Consumption of raw or undercooked meat	Undercooked pork or wild game; infection is relatively rare in the United States
Viral				
Hepatitis A	15 to 50 days, with an average of 28 days	Fever, fatigue, loss of appetite, nausea, abdominal cramps, dark urine, jaundice	Person-to-person or by contaminated food or water (fecal-oral)	Contaminated foods eaten uncooked or foods contaminated after cooking
“Norwalk-like” virus	12 to 48 hours	Vomiting, non-bloody diarrhea, nausea, abdominal pain, fever	Contaminated food or water; person to person; contact with a contaminated item (fecal-oral)	Shellfish, salads, sandwiches, ready-to-eat foods with bare-hand contact
Other				
New variant Creutzfeldt-Jakob disease	Multiple years	Prominent behavior changes, neurological abnormalities, dementia	Consumption of contaminated meat	Beef and beef products that include brain or nerve tissue; no documented cases in the United States

Source: GAO’s presentation of disease data.

Appendix III: CDC's Surveillance Systems for Foodborne Disease

Botulism Surveillance System

The Botulism Surveillance System was established in 1973 to collect detailed information about all types of botulism—foodborne, wound, infant, and child or adult. Because every case of foodborne botulism is considered a public health emergency, CDC maintains intensive surveillance for botulism in the United States. All states except California and Alaska must contact CDC when a case of botulism is suspected, because CDC is the main source of the antitoxin used to treat botulism. As a result, most cases of botulism are reported to CDC immediately. CDC officials follow up on these cases to collect demographic information about the affected individuals, as well as additional information about which foods were involved and their handling and preparation. This information is especially important because the hazardous food may still be available.

Geographic Scope: National.

Pathogen: *Clostridium botulinum.*

Cases Reported: In 1999, a total of 174 cases were reported to this system, of which 26 were foodborne.

Data Sources: Data are initially collected using three main sources: CDC clinical consultation reports, National Electronic Telecommunications Surveillance System reports, and pharmacy antitoxin release reports. Data collected from these sources are compiled and considered to be unconfirmed *Clostridium botulinum* cases. Following the compilation of this data, states are asked to verify the list of cases reported, and the list is then compared to laboratory data. From this two-step process, laboratory-confirmed and epidemiologically linked cases are ascertained.

CaliciNet

CaliciNet, an initiative currently under development, is a network of public health laboratories that uses DNA sequence analysis for "fingerprinting" of foodborne viruses. The network permits rapid comparison of the genetic patterns of foodborne caliciviruses through an electronic sequence database at CDC. Laboratories participating in CaliciNet detect "Norwalk-like" viruses in samples from patients involved in outbreaks of gastroenteritis. Depending on the capabilities in the laboratory, amplification products from positive samples are sequenced locally, sent to a contract laboratory for sequencing, or sent to CDC for confirmatory testing and sequencing. Comparison of newly identified sequences with those in the database may help public health laboratories to identify cases with a common source.

Geographic Scope: Thirteen state health departments (California, Florida, Idaho, Iowa, Maryland, Michigan, Minnesota, Missouri, New York, Oregon, Virginia, Washington, and Wisconsin) and the Los Angeles County health department are currently submitting samples for confirmatory testing and genetic analysis. Ten other state health departments (Colorado, Connecticut, Illinois, Nevada, New Hampshire, New Mexico, Ohio, Rhode Island, South Carolina, and Tennessee) are currently undergoing proficiency testing.

Pathogens: "Norwalk-like" viruses and "Sapporo-like" viruses.

Cases Reported: In 1999, 94 specimens from 9 states were submitted for confirmatory testing and genetic analysis at CDC.

Data Sources: State public health laboratories submit samples to CDC for confirmatory testing and genetic analysis, or sequences are transmitted electronically.

Creutzfeldt-Jakob Disease Surveillance Program

CDC monitors the occurrence of Creutzfeldt-Jakob disease through periodic review of national multiple-cause-of-death data. Surveillance for this disease was enhanced in 1996 to monitor for the possible occurrence of new variant Creutzfeldt-Jakob disease after this new form of the disease was reported to have possibly resulted from consumption of cattle products contaminated with bovine spongiform encephalopathy (also known as "mad cow" disease).

One enhancement focused on striking differences in the age distribution of new variant Creutzfeldt-Jakob disease cases, for which the median age at death is 28 years, from that of sporadic cases of Creutzfeldt-Jakob disease in the United States, for which the median age at death is 68 years. This enhancement included an ongoing review of the clinical and pathologic records of U.S. victims of Creutzfeldt-Jakob disease under 55 years of age.

In addition, in collaboration with the American Association of Neuropathologists, CDC established a National Prion Disease Pathology Surveillance Center to facilitate neuropathologic evaluation of patients suspected of having Creutzfeldt-Jakob disease or other diseases caused by prions.

Geographic Scope: National.

Pathogens: The agents of Creutzfeldt-Jakob disease and the new variant form of Creutzfeldt-Jakob are believed to be prions.

Cases Reported: Between January 1979 and June 2001, over 5,000 U.S. cases of Creutzfeldt-Jakob disease were reported; no evidence of the occurrence of new variant Creutzfeldt-Jakob disease in the United States was detected.

Data Sources: National multiple-cause-of-death data are compiled by the National Center for Health Statistics. Physicians, pathologists, other health care workers, and state and local health departments report suspected cases of prion diseases.

Epidemic Information Exchange (Epi-X)

The Epidemic Information Exchange, known as Epi-X, is a secure, Web-based communications network for public health officials that simplifies and expedites the exchange of routine and emergency public health information among state and local health departments, CDC, and the U.S. military. CDC recognized that the public health profession had a need for rapid communication, research, and response to widespread food and food-product contamination. After consulting with more than 300 health officials, CDC developed this new system, which enables federal, state, and local epidemiologists, laboratory staff, and other health professionals to quickly notify colleagues of disease outbreaks as they are identified and investigated. The system allows users to compare information on current and past outbreaks through an easily searchable database, discuss a response to the outbreak with colleagues through e-mail, Internet, and telecommunications capabilities, and request epidemiological assistance from CDC on-line. Epi-X is endorsed by the Council of State and Territorial Epidemiologists.

Geographic Scope: National.

Pathogens: Any pathogen, including bacteria, chemicals, parasites, and viruses (also products or devices).

Cases Reported: From November 2000 through August 2001, 153 outbreaks were reported, including 37 foodborne outbreaks. Two health alerts related to foodborne outbreaks of food contamination were issued; over 85 percent of Epi-X users were notified within 30 minutes.

Data Sources: CDC and state and local public health officials submit encrypted reports to CDC. At CDC, reports are decrypted, reviewed for accuracy and quality, and posted within 48 hours after they are received.

Escherichia Coli O157:H7 Outbreak Surveillance System

The *Escherichia coli* (*E. coli*) O157:H7 Outbreak Surveillance System began in 1982, after the first recognized outbreak of this pathogen, and was established to collect detailed information about risk factors and vehicles of transmission for *E. coli* infection. State health departments are encouraged to report any outbreak of *E. coli* O157:H7 infection in their state to CDC. Data are collected on outbreaks caused by all sources including food, recreational water, drinking water, animal contact, and person-to-person transmission. *E. coli* O157:H7 infections can be quite serious and may result in death. Therefore, public health officials at CDC follow up with state health departments on reported outbreaks of *E. coli* infection to determine their cause and prevent additional spread. Data from this surveillance system are used to inform the public about new vehicles of transmission.

Geographic Scope: National.

Pathogen: *E. coli* O157:H7.

Cases Reported: In 1999, 38 confirmed outbreaks (causing 1,897 illnesses) were reported to CDC.

Data Sources: Outbreaks of *E. coli* O157:H7 infection are reported to CDC through several sources including PulseNet; the Foodborne Outbreak Listserve, through which state and local health departments can share information about confirmed and potential outbreaks; Epi-X; U.S. Department of Agriculture and Food and Drug Administration contacts; and state health department contacts.

Foodborne Disease Outbreak Surveillance System

CDC created the Foodborne Disease Outbreak Surveillance System in 1973 to collect data about cases of foodborne disease that are contracted by two or more patients as a result of ingesting a common food. In the event of such an outbreak, state and local public health department officials provide data to the system about the pathogen that caused the outbreak, the contaminated food that was involved, and contributing factors associated with foodborne disease outbreaks. The data help focus public health actions intended to reduce illnesses and deaths caused by foodborne disease outbreaks. Trend analysis of the data shows whether outbreaks occur seasonally and whether certain foods are more likely to contain pathogens. It also helps public health officials identify critical control points in the path from farm to table that can be monitored to reduce food contamination. However, the data from this system do not always identify the pathogen responsible for a given outbreak; such identification may be hampered by delayed or incomplete laboratory investigation, inadequate laboratory capacity, or inability to recognize a particular pathogen as a cause of foodborne disease.

Geographic Scope: All 50 states, the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands.

Pathogens: Any pathogen, including bacteria, chemicals, parasites, and viruses.

Cases Reported: In 1997, 806 outbreaks were reported to CDC through this system.

Data Sources: State and local public health officials submit this data to CDC using a paper form. CDC has also been piloting electronic reporting of outbreaks using a system called the Electronic Foodborne Outbreak Reporting System.

FoodNet

The Foodborne Diseases Active Surveillance Network, also known as FoodNet, is a collaborative project of the CDC, the USDA, the Food and Drug Administration, and nine sites that gathers information about nine foodborne pathogens, two syndromes, and toxoplasmosis. A significant distinction between FoodNet and other foodborne surveillance systems is that FoodNet participants actively and routinely contact the clinical laboratories in their areas to collect information about the number of cases of each disease covered by this system. For other systems, state and local reporting practices to CDC may not be consistent from state to state.

In addition to the active surveillance efforts, FoodNet participants conduct studies and surveys of the physicians, laboratories, and populations within the nine sites. Case control studies are used to determine risk factors, such as food preparation or handling practices, for acquiring infections from the pathogens covered by the system, as well as the association between these infections and specific foods. These studies have been conducted for *E. coli* O157:H7, *Salmonella*, *Campylobacter*, and others. CDC also collects information through population surveys, in which individuals who live in a FoodNet catchment area and were not part of a case control study are surveyed about their consumption of certain foods and how often they see a physician. To determine which tests are typically performed at laboratories in FoodNet areas, CDC administers laboratory surveys. Finally, state officials in the FoodNet areas have administered two physician surveys. The first survey asked physicians to describe actions they take when seeing a patient with a possible foodborne illness, while the second asked how they educate patients about foodborne diseases. FoodNet data can also test the efficacy of interventions designed to reduce the incidence of foodborne pathogens.

Geographic Scope: Nine sites consisting of parts or all of the states of California, Colorado, Connecticut, Georgia, Maryland, Minnesota, New York, Oregon, and Tennessee.

Pathogens: Nine pathogens—*Campylobacter*, *Cryptosporidium*, *Cyclospora*, *E. coli* O157:H7, *Listeria monocytogenes*, *Salmonella*, *Shigella*, *Vibrio*, *Yersinia enterocolitica*—and hemolytic uremic syndrome (a serious complication of *E. coli* O157:H7 infection), Guillain-Barre syndrome (a serious complication of *Campylobacter* infection), and toxoplasmosis.

Cases Reported: The number of cases varies by pathogen.

Data Sources: State public health officials submit lab-confirmed case data to CDC using the Public Health Laboratory Information System.

National Antimicrobial Resistance Monitoring System—Enteric Bacteria

The National Antimicrobial Resistance Monitoring System for Enteric Bacteria began in 1996 as a collaborative effort among CDC, the Food and Drug Administration, and USDA. Its purpose is to monitor the resistance of human enteric (intestinal) bacteria. Participating health departments forward some portion of their isolates for six types of bacteria to CDC for susceptibility testing. Susceptibility testing involves determining the sensitivity of the bacteria toward 17 antimicrobial agents that inhibit their growth. *Campylobacter* isolates are submitted only by the FoodNet sites and are tested against 8 antimicrobial agents instead of 17. Because these data have been collected continually since 1996, trend analyses are possible. This can provide useful information about patterns of emerging resistance, which in turn can guide mitigation efforts.

Geographic Scope: Seventeen state and local public health laboratories in California, Colorado, Connecticut, Florida, Georgia, Kansas, Los Angeles County, Maryland, Minnesota, Massachusetts, New Jersey, New York City, New York, Oregon, Tennessee, Washington, and West Virginia participate in this system.

Pathogens: *Campylobacter*, *Enterococcus*, *E. coli* O157:H7, *Salmonella* non-typhoidal, *Salmonella* typhi, and *Shigella*.

Cases Reported: The number of cases varies by pathogen.

Data Sources: Participating health departments submit isolates of human bacteria to CDC for testing.

National Giardiasis Surveillance System

The National Giardiasis Surveillance System began in 1992 when the Council of State and Territorial Epidemiologists assigned giardiasis a code that enabled states to voluntarily report giardiasis cases to CDC electronically. For each case, basic information is collected, such as the age, sex, and race of the patient, as well as the place and time of infection. This surveillance system provides data used to educate public health practitioners and health-care providers about the scope and magnitude of giardiasis in the United States. The data can also be used to establish research priorities and to plan future prevention efforts. In June 2001, the Council of State and Territorial Epidemiologists voted to add giardiasis to the list of Nationally Notifiable Diseases.

Geographic Scope: Forty-three states, the District of Columbia, New York City, Guam, and Puerto Rico.

Pathogen: *Giardia intestinalis* (also known as *Giardia lamblia*).

Cases Reported: In 1999, over 23,000 cases of giardiasis were reported to CDC through this system.

Data Sources: State officials report this data to CDC using the National Electronic Telecommunication System for Surveillance.

National Notifiable Diseases Surveillance System

The National Notifiable Diseases Surveillance System collects information about 58 diseases designated as nationally notifiable—that is, diseases about which regular, frequent, and timely information regarding individual cases is considered necessary for their prevention and control. The first annual report on notifiable diseases was published in 1912 for 10 diseases. CDC assumed responsibility for the collection and publication of this data in 1961. The list of nationally notifiable diseases is revised periodically to include emerging pathogens and to delete those whose incidence has declined significantly. CDC also publishes provisional figures for some of these diseases weekly.

Policies for reporting notifiable disease cases can vary by disease or reporting jurisdiction, depending on case status classification (i.e., confirmed, probable, or suspect). Reporting of diseases is mandated by legislation or regulation only at the state and local level. Thus, the list of diseases considered notifiable varies slightly by state. Public health officials report basic information for each case, such as age, sex, and race of the patient, as well as the place and time of infection. The data reported in the annual summaries for this system are useful for analyzing disease trends and determining relative disease burdens.

Geographic Scope: National.

Pathogens/Diseases: Botulism, cholera, cryptosporidiosis, cyclosporiasis, *E. coli*, hepatitis A, listeriosis, salmonellosis, shigellosis, trichinosis, and typhoid fever (also 47 other pathogens or diseases, which are not considered to be foodborne).

Number of Cases Reported: The number of cases varies by disease.

Data Sources: Health departments in the 50 states, 5 territories, New York City, and the District of Columbia report case information for this system to CDC using the National Electronic Telecommunications System for Surveillance.

National *Salmonella* Surveillance System

The National *Salmonella* Surveillance System began in 1962 when the Council of State and Territorial Epidemiologists and the Association of Public Health Laboratories agreed that state public health laboratories would routinely test samples of *Salmonella* to determine their serotype and report the results to CDC. For many years these reports were submitted as paper forms, but for the last 10 years, reporting has been electronic. In addition to the specific serotype, the reports include the age, sex, and county of residence of the person from whom the sample was isolated, the clinical source (such as stool, blood, or abscess), and the date the sample was received in the state laboratory. CDC maintains the national reference laboratory for *Salmonella* and provides the laboratory reagents and training needed to determine the serotypes. These data are used to identify long-term trends and specific populations at risk for infection, detect and investigate outbreaks, and monitor the effectiveness of prevention efforts.

Geographic Scope: All 50 states, New York City, and Guam.

Pathogens: *Salmonella enterica.*

Cases Reported: In 1999, approximately 32,750 cases were reported to CDC through this system.

Data Sources: State health officials report these data to CDC using the Public Health Laboratory Information System.

National *Shigella* Surveillance System

The National *Shigella* Surveillance System began in 1963 when the Council of State and Territorial Epidemiologists and the Association of Public Health Laboratories agreed that state public health laboratories would routinely test samples of *Shigella* to determine their serotype and report the results to CDC. For many years these reports were submitted as paper forms, but for the last 10 years, reporting has been electronic. In addition to the specific serotype, the reports include the age, sex, and county of residence of the person from whom the sample was isolated, the clinical source (such as stool, blood, or abscess), and the date the sample was received in the state laboratory. CDC maintains the national reference laboratory for *Shigella* and provides the laboratory reagents and training needed to determine the serotypes. These data are used to identify long-term trends and specific populations at risk for infection, detect and investigate outbreaks, and monitor the effectiveness of prevention efforts.

Geographic Scope: All 50 states, New York City, and Guam.

Pathogen: *Shigella* species.

Cases Reported: In 1999, approximately 12,000 cases were reported to CDC through this system.

Data Sources: State health officials report these data to CDC using the Public Health Laboratory Information System.

PulseNet

PulseNet is a national network of public health laboratories that, since 1996, has been using standardized methods to perform genetic "fingerprinting" of four types of foodborne bacteria. The network permits rapid comparison of the bacteria's genetic patterns through an electronic database at CDC. Laboratories participating in PulseNet use a method called pulsed-field gel electrophoresis to identify the genetic patterns in bacterial pathogens isolated from patients and from suspected food items. Once the patterns are generated, they are entered into an electronic database of patterns at the state or local health department and transmitted to CDC where they are filed in the PulseNet database. If patterns submitted by laboratories during a defined time period are found to match, CDC will alert the laboratory officials of the match so that a timely investigation can be performed.

PulseNet can help public health authorities recognize when cases of foodborne illness occurring at the same time in geographically separate locales are caused by the same strain of bacteria and may be due to a common exposure, such as a food item. An epidemiologic investigation of those cases can then determine what they have in common. If a bacterial pathogen is isolated from a suspected food, the pathogen's genetic pattern can be quickly compared with the patterns of pathogens isolated from patients. Matching patterns can indicate possible nationwide outbreaks and lead to public health actions such as epidemiologic investigations, product recalls, and long-term prevention measures.

Geographic Scope: 46 state and 2 local public health laboratories—New York City and Los Angeles County—and the food safety laboratories of the Food and Drug Administration and USDA.

Pathogens: *E. coli* O157:H7, *Salmonella*, *Listeria*, and *Shigella*.

Cases Reported: In 2000, over 17,000 patterns were submitted to the CDC PulseNet database, and 105 potential outbreaks were investigated by state and local officials.

Data Sources: State public health laboratories submit patterns to CDC electronically.

Salmonella Enteritidis Outbreak Surveillance System

The *Salmonella* Enteritidis Outbreak Surveillance System began in 1985. This passive system collects reports of outbreaks as they occur throughout the calendar year. States are encouraged to report any outbreak of *Salmonella* Enteritidis infection in their state to CDC. The surveillance system tracks morbidity and mortality associated with outbreaks and collects information on implicated food items and on the results of traceback investigations conducted by local agencies and the Food and Drug Administration. Surveillance data have been used to identify risk factors for *Salmonella* Enteritidis infection, contaminated food items, and groups that may benefit from education.

Geographic Scope: National.

Pathogen: *Salmonella* Enteritidis.

Outbreaks Reported: In 1999, 44 confirmed outbreaks of *Salmonella* Enteritidis were reported, affecting U.S. residents in 17 states.

Data Sources: Outbreaks of *Salmonella* Enteritidis infection are reported by each state throughout the calendar year. Detailed information is maintained about the details of the outbreak. States are requested to verify all data, checking accuracy and completeness at the end of each year.

Sentinel Counties Study of Viral Hepatitis

The Sentinel Counties Study of Viral Hepatitis began in 1979 to collect more detailed information on risk factors for cases of acute viral hepatitis and to detect newly emerging viruses. Under contracts with CDC, county health departments collect data for each reported case and a serum sample for each reported case and report the information to CDC. In recent years, data from this system have been used to better characterize hepatitis A epidemiology and to develop molecular subtyping techniques.

Geographic Scope: Six counties–Pinellas, Florida; Jefferson, Alabama; Denver, Colorado; Pierce, Washington; Multnomah, Oregon; and San Francisco, California.

Pathogens: Hepatitis A; hepatitis B; and non-A, non-B hepatitis (including hepatitis C).

Cases Reported: In 1999, 240 cases of hepatitis A, 134 cases of hepatitis B, and 32 cases of non-A, non-B hepatitis (including hepatitis C) were reported to CDC through this system.

Data Sources: Participating county health departments submit paper forms and serologic specimens to CDC for each case.

Surveillance Outbreak Detection Algorithm

The Surveillance Outbreak Detection Algorithm was designed to detect unusual clusters of cases of a foodborne disease that indicate a potential outbreak. The algorithm was first used in 1996 for *Salmonella* cases. The algorithm compares, by serotype, the number of cases reported through the Public Health Laboratory Information System during a given week with a 5-year historical baseline for that serotype and week to detect unusual increases from the baseline. The weekly comparisons are done on a national, regional, and state basis. If they detect any unusual clusters, CDC notifies the affected state(s) by fax.

The Surveillance Outbreak Detection Algorithm is useful for identifying multistate outbreaks, especially where individual cases may be quite diffuse. The software also has an interface with which any user can easily generate basic statistical information. The interface also produces graphs and maps to facilitate identification of trends or anomalies. State health departments have access to a limited version of the algorithm via the Public Health Laboratory Information System.

Geographic Scope: National.

Pathogens: *Salmonella* and *Shigella*.

Cases Reported: Using the algorithm, CDC officials identified 133 potential *Salmonella* outbreaks in 1999 and 273 in 2000.

Data Sources: The algorithm is run on a database of lab-confirmed cases submitted to CDC through the Public Health Laboratory Information System.

Trichinellosis Surveillance System

The Trichinellosis (Trichinosis) Surveillance System was created in 1947, when the U.S. Public Health Service began collecting statistics on cases of infection at the national level. In 1965, trichinellosis was included among the notifiable diseases that physicians report weekly to state health departments and to CDC through the National Morbidity Reporting System. A standardized surveillance form was developed to collect detailed information for each case.

Geographic Scope: National.

Pathogen: *Trichinella* spp.

Cases Reported: In 1999, 12 cases were reported to CDC through this system.

Data Sources: Trichinellosis is reported to CDC through the National Notifiable Diseases Surveillance System.

Typhoid Fever Surveillance System

The Typhoid Fever Surveillance System was established in 1962 to collect detailed information about all cases of *Salmonella* typhi. State health department officials are asked to complete a typhoid fever surveillance report form when a laboratory confirms a case of typhoid fever. The form collects demographic information about each case, as well as information about patients' international travel and vaccination history, and the antibiotic susceptibility of isolates. This information is especially important for developing travel advisories, vaccination recommendations, and treatment guidelines.

Geographic Scope: National.

Pathogen: *Salmonella* typhi.

Cases Reported: In 1999, 115 cases were reported to this system.

Data Sources: Local or state health department officials complete the typhoid fever surveillance report forms and submit them to CDC's Foodborne and Diarrheal Diseases Branch. In addition, cases of laboratory-confirmed *Salmonella* typhi infection are reported to CDC through the Public Health Laboratory Information System as part of the National *Salmonella* Surveillance System, accompanied by limited information on patient age and sex, and on the clinical source of the isolate.

Vibrio Surveillance System

The *Vibrio* Surveillance System began in 1988 and is composed of two parts. One is a national passive system for reporting cases of toxigenic *Vibrio cholerae* infection (cholera), and the other is a more active system that covers all types of *Vibrio* infections in a more limited geographic area. For the active system, investigators use a standardized form to collect clinical data, information about patients' underlying illnesses, and epidemiologic data about patients' seafood consumption and exposure to seawater for the week preceding illness. Surveillance data have been used to identify environmental risk factors, retail food outlets where high-risk exposures occur, and groups that may benefit from consumer education.

Geographic Scope: National for the cholera portion of the system; the non-cholera portion of the system initially included only the Gulf Coast states of Alabama, Florida, Louisiana, and Texas but is open to all states and has expanded to include, among others, the FoodNet sites and states along both the East and West coasts.

Pathogen: Toxigenic *Vibrio cholerae*; *Vibrio* spp.

Cases Reported: In 2000, four cases of V*ibrio cholerae* and 295 laboratory-confirmed cases of other types of *Vibrio* infections were reported to CDC through this system.

Data Sources: State health departments report cases of *Vibrio cholerae* to CDC, and isolates are confirmed at the CDC reference laboratory; for other types of *Vibrio* infection, state health departments collect and report data throughout the year using CDC's *Vibrio* Surveillance Report form.[1]

[1]To enhance the accuracy and completeness of reporting, CDC requests that participating states verify the information reported twice a year.

Viral Hepatitis Surveillance Program

The Viral Hepatitis Surveillance Program was created in 1961 to collect demographic, clinical, serologic, and risk-factor information on cases of acute viral hepatitis. The data collected through the program are essential for monitoring trends in the epidemiologic characteristics of the various types of viral hepatitis. These data are also valuable for monitoring the effectiveness of prevention programs.

Pathogens: Hepatitis A; hepatitis B; non-A, non-B hepatitis (including hepatitis C).

Geographic Scope: National.

Number of Cases Reported: In 1999, 17,047 cases of hepatitis A, 7,694 cases of hepatitis B, and 3,111 cases of non-A, non-B hepatitis were reported through National Electronic Telecommunication Surveillance System. Information about risk factors was reported through the Viral Hepatitis Surveillance Program for approximately 33 percent of these cases.

Source of Data: States report this information to CDC through the extended-record capability of the National Electronic Telecommunication Surveillance System or by submitting a paper form with this information.

Appendix IV: Comments From the Centers for Disease Control

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
and Prevention (CDC)
Atlanta GA 30333

AUG 23 2001

Lawrence J. Dyckman
Director, Natural Resources and Environment
U.S. General Accounting Office
441 G Street N. W.
Washington, D.C. 20548

Dear Mr. Dyckman:

The Centers for Disease Control and Prevention (CDC) appreciates the opportunity to comment on the draft report, *Food Safety: CDC Is Working to Address Limitations in Several of Their Foodborne Disease Surveillance Systems*. In general, we concur with the findings outlined in this report. It recognizes the importance of surveillance for detecting and monitoring existing and emerging foodborne diseases and that effective and efficient surveillance systems are dependent on capacity and coordination at the federal as well as at state and local levels. It also recognizes the importance of a strong infrastructure of public health and information systems, laboratories, and trained professional staff using state-of-the-are technologies.

We agree that more timely and complete reporting and release of surveillance data would improve the usefulness of this information. We appreciate that the report acknowledges CDC's efforts to address these limitations. We also appreciate GAO's recognition that, because CDC is largely dependent on the public health infrastructure in place at the state and local levels, addressing some of the limitations is beyond CDC direct control. As noted in the report, CDC's National Center for Infectious Diseases is making a significant effort to enhance core capacity within the states.

In addition to working to improve surveillance of the well-recognized bacterial pathogens, as summarized in the report, CDC is building effective systems to monitor new and emerging foodborne pathogens. A significant example is the development of detection methods for Norwalk-like viruses, for which diagnostic tests have not been readily available, and the development of CaliciNet, a laboratory surveillance system for Norwalk-like viruses. New methods and systems such as these provide public health officials new tools for identifying and managing foodborne illness, as well as new mechanisms for timely reporting of surveillance data.

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Enclosed are technical comments in response to the draft report. If you have questions concerning these comments, please contact Carolyn Russell, Director, Management Analysis and Services Office, (404) 498-1500.

Sincerely,

James D. Seligman
Associate Director for Program Services

Enclosure

cc:

NCID, Sarah Wiley

Appendix V: GAO Contacts and Staff Acknowledgments

GAO Contacts

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Robert C. Summers, (404) 679-1839

Staff Acknowledgments

In addition to those named above, Carolyn Boyce, Cathy Helm, Natalie Herzog, Cynthia Norris, Paul Pansini, and Stuart Ryba made key contributions to this report.

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