

PREVENTING EMERGING INFECTIOUS DISEASES

*Addressing
the Problem of
Foodborne and
Waterborne Diseases*



*A Strategy for the
21st Century*

CDC
CENTERS FOR DISEASE CONTROL
AND PREVENTION



Never in history has food been more plentiful, varied, or available than it is now. Yet foodborne illness continues to challenge public health. Major reasons range from failures on the farm to failures in the kitchen. How we produce, transport, preserve, store, prepare, and consume food influences its healthfulness and its safety.



Although drinking water quality has continued to improve in recent years, many public health challenges remain—the discovery of new organisms resistant to traditional water treatment processes; the use of old and breaking water-distribution pipes that allow infectious agents to enter the water after treatment; land development for housing around watersheds and concentrated animal production that increases the risk of fecal contamination and sewage overflow into water reservoirs and rivers; and the occurrence of old diseases in communities that have polluted sources of water and the lack of financial resources to properly treat their drinking water.

Infectious diseases are a continuing menace to all segments of society, regardless of age, gender, lifestyle, ethnic background, and socioeconomic status. They cause suffering and death and impose an enormous financial burden on society. Because we do not know what new diseases will arise, we must always be prepared for the unexpected. The Centers for Disease Control and Prevention (CDC) has recently released a plan, *Preventing Emerging Infectious Diseases: A Strategy for the 21st Century*, which describes steps that we can take to move toward the realization of CDC's vision of a world in which all people join in a common effort to address today's emerging infectious diseases and prevent those of tomorrow.

The national emerging infectious disease plan targets specific categories of emerging infectious disease problems and particular groups of people who are at special risk. The nine target areas are antimicrobial resistance; foodborne and waterborne diseases; diseases transmitted through blood transfusions or blood products; chronic diseases caused by infectious agents; vaccine development and use; diseases of people with impaired host defenses; diseases of newborns and pregnant women; and diseases of travelers, immigrants, and refugees. This booklet focuses on foodborne and waterborne diseases.

Public health activities for the nine target areas are organized under four broad, intersecting goals: surveillance and response, applied research, infrastructure and training, and prevention and control.

The goal of surveillance and response is to detect, investigate, and monitor emerging pathogens, the diseases they cause, and the factors influencing their emergence, and to respond to problems as they are identified. For applied research, the goal is to integrate laboratory science and epidemiology to better understand and optimize public health practices for the prevention and control of emerging infectious diseases. The goal of infrastructure and training is to strengthen the underlying foundation of public health surveillance, research, and programs by supporting the planning, delivery, and evaluation of public health activities and practices. Finally, the goal of prevention and control is to ensure prompt implementation of prevention and control strategies and enhance communication of public health information about emerging infections.

The Centers for Disease Control and Prevention Responds

The CDC's National Center for Infectious Diseases (NCID) has developed specific public health activities that address the nine target areas. Many of the activities build on existing efforts or are in the planning stages. Others represent new efforts. These activities are described in individual booklets for each target area.

FOODBORNE AND WATERBORNE DISEASES

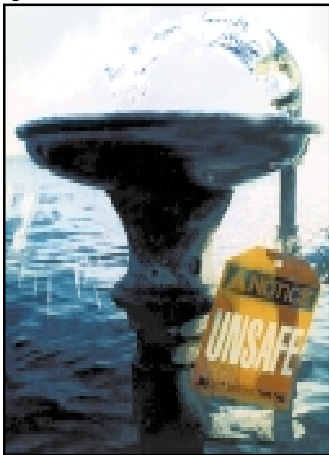
Foodborne and waterborne infections are major public health problems. Each year, millions of people in the United States are infected with foodborne diseases, and several thousand die. Hospitalization costs for these illnesses are estimated at over \$3 billion a year, and costs from lost productivity are much higher. Waterborne diseases also contribute significantly to the U.S. disease burden. Many different pathogens can be foodborne or waterborne, and more are likely to be discovered. Preventing these diseases depends on understanding how food or water becomes contaminated and involves working with many partners to reduce or prevent contamination.

Foodborne pathogens are numerous and have many ways to enter the food chain, which makes disease prevention very complex. Some emerging foodborne pathogens are found in food animals, including cattle, poultry, fish, and shellfish. Although these animals may appear healthy, the meat, eggs, milk, or other products derived from them can be contaminated with *Escherichia coli* O157:H7, *Salmonella*, or other pathogens. Fresh produce is an important component of a healthy diet, but fruits and vegetables can also be sources of infection if they are contaminated in the field or after harvest. Moreover, some pathogens are spread from infected people who contaminate the food while preparing it. Safe food production and preparation practices applied throughout the food industry can reduce the risk of contamination. For some food products, further safety may be ensured by pasteurization, irradiation, or similar processes.



CDC ACTIVITIES

New challenges due to foodborne pathogens are likely to emerge in the future. Wide commercial distribution of food products means that outbreaks can affect many people simultaneously over a large geographic area. Pathogens common in the developing world now cause illness in the United States because more of our food crosses international borders. In addition, the frequent use of antibiotics in food animals may select for antibi-



otic-resistant bacteria that can be transmitted to humans.

The problems posed by waterborne pathogens are also changing. In the past, most cases of waterborne diseases were due to bacterial contamination, which can be prevented by standard water disinfection treatments such as chlorination. In much of the developing world, however, this level of protection remains unachievable. In the United States and Europe, pathogens that are resistant to routine disinfection are now more commonly recognized as causes of waterborne diseases. These include Norwalk-like viruses and the parasite *Cryptosporidium*, which caused the largest single waterborne disease outbreak in the United States in 1993, affecting more than 400,000 people. Of the waterborne outbreaks reported to CDC during 1993 and 1994, more than half of those for which an infectious cause could be identified were due to contamination by chlorine-resistant microbes.

FOODBORNE AND WATERBORNE DISEASES

In partnership with other governmental agencies and international groups, the CDC is working toward effective global surveillance and control of foodborne and waterborne pathogens. The CDC is a major participant in the National Food Safety Initiative (NFSI), which was created in 1997 to address food safety problems in the United States. Through the NFSI, the CDC is improving surveillance and response to foodborne diseases, while the FDA, the USDA, and other agencies are expanding food safety inspection, research, training, and prevention activities. Similarly, the CDC is collaborating with the EPA and the drinking water industry to better estimate the risk of waterborne disease, develop better methods for detecting new pathogens in drinking water, and identify human and animal sources of water contamination.

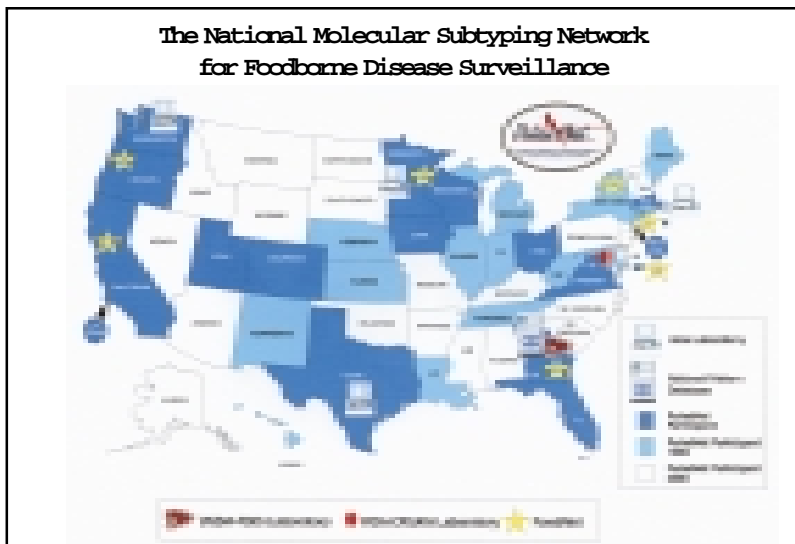


Figure 1. PulseNet is an electronic communications system for public health and food safety professionals throughout the United States (PulseNet got its name from the laboratory technique [pulsed-field gel electrophoresis] that helped scientists recognize widely dispersed foodborne disease outbreaks that would otherwise have gone unnoticed or been mistaken for sporadic cases).

NCID Activities for Addressing Foodborne and Waterborne Diseases

In collaboration with many private and public partners, NCID plans to conduct numerous public health activities to address foodborne and waterborne diseases.

Goal I: Surveillance and Response

- ◆ Assess the burden of sporadic and outbreak-related non-gastrointestinal foodborne and waterborne diseases in the United States.
- ◆ Transfer standardized molecular methods for subtyping foodborne pathogens to state health department laboratories and link the laboratories into a national electronic network.
- ◆ Monitor the incidence of, and complications caused by, gastrointestinal foodborne and waterborne illnesses that are not identified by laboratory examination of diarrheal stools.
- ◆ Enhance rapid detection and coordinated response to multistate and multinational foodborne outbreaks.
 - ◆ Monitor the levels of antibiotic resistance in foodborne pathogens.

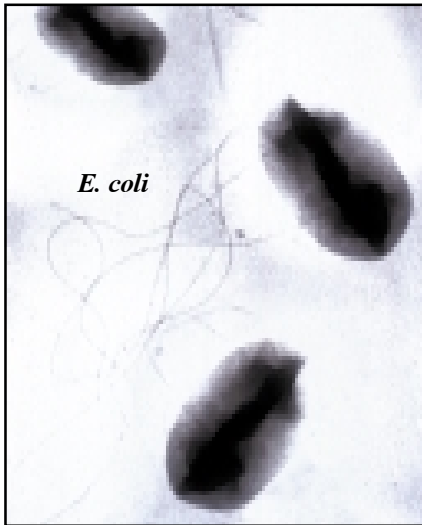


Cyclospora



Goal II: Applied Research

- ◆ Develop assays for detecting and subtyping foodborne and waterborne pathogens for which adequate testing methods do not currently exist.
- ◆ Evaluate food production and distribution practices, as well as behavioral risk factors associated with foodborne and waterborne diseases, both in the United States and internationally.



- ◆ Identify the causative agents for foodborne and waterborne outbreaks of unknown etiology, as well as pathogens responsible for sporadic cases of foodborne and waterborne illness.
 - ◆ Evaluate the public health significance of chlorine-resistant organisms in municipal drinking water distribution systems.
- ◆ Evaluate new strategies for reducing contamination of food and water, including irradiation of solid foods and ultraviolet disinfection of water.



CDC ACTIVITIES



Cryptosporidium (red)

Goal III: Infrastructure and Training

- ◆ Provide state and local public health facilities with computer equipment, software, and training for conducting laboratory-based electronic surveillance of foodborne and waterborne pathogens.
- ◆ Train state and local health departments to use new surveillance methods for detecting emerging foodborne and waterborne microorganisms, including the techniques of molecular epidemiology, so that broadly distributed outbreaks can be detected more rapidly.
- ◆ Provide epidemiologists at state and local health departments with the resources and training to respond to outbreaks of foodborne and waterborne diseases.

Goal IV: Prevention and Control

- ◆ Conduct and evaluate educational campaigns to change food-handling behaviors.
- ◆ Promote disease prevention strategies in food animal production and processing to reduce pathogen contamination and antibiotic resistance.
- ◆ Evaluate the impact of changes in meat inspection, egg refrigeration, irradiation, and other food industry practices on food safety.
- ◆ Evaluate the impact of improved water filtration methods and new water disinfectants such as ozone and ultraviolet light irradiation.



- ◆ Ensure that people at particular risk for foodborne and waterborne diseases have access to information that can help them make informed choices on how to reduce their risks.



CDC ACTIVITIES

- ◆ Work with public and private partners to implement sustainable foodborne and waterborne disease intervention programs in developing countries throughout the world.



- ◆ Develop and evaluate strategies for reducing outbreaks from exposure to contaminated recreational water.



FOODBORNE AND WATERBORNE PATHOGENS

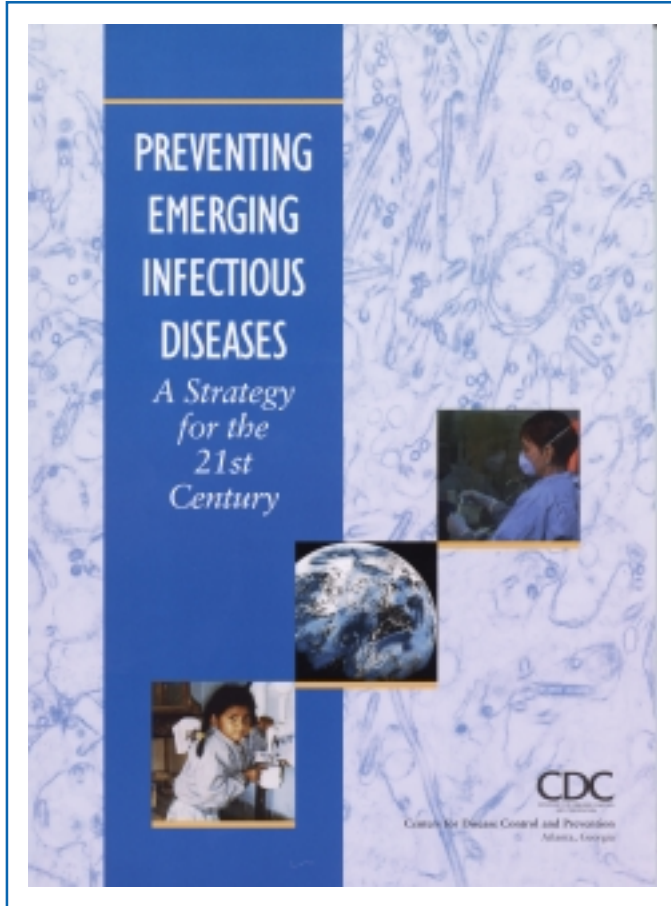
- ◆ *Campylobacter* is the most common contaminant of chicken.
- ◆ *Cryptosporidium* is a parasite that infects many wild and domestic animals and humans. It is highly resistant to disinfectants used to purify drinking water and can get through many types of water filters.
- ◆ *Cyclospora* is a parasite that has been traced to raspberries, basil in pesto sauces, and drinking water.
- ◆ *E. coli* O157: H7 is a bacterium found primarily in meats, in produce contaminated by manure in growing fields (e.g., sprouts), and in water. Although easily killed by water disinfectants, it has caused outbreaks in people in swimming pools not adequately chlorinated and in communities served by well water that was not disinfected.
- ◆ *Giardia* is one of the most common parasites implicated in waterborne outbreaks in the United States. It is moderately resistant to water disinfectants.
- ◆ *Listeria* is a contaminant of cold foods like soft cheeses and deli meats.
- ◆ *Salmonella* Enteritidis is found in eggs.
- ◆ *Shigella* are bacteria that cause serious illness when water supplies are not adequately disinfected.
- ◆ Unpasteurized milk is a source of *Salmonella* Typhimurium DT-104, an aggressive strain of *Salmonella* that is resistant to many antibiotics.



MORE INFORMATION

Where To Find Additional Information

- ◆ Web site for the complete plan, *Preventing Emerging Infectious Diseases: A Strategy for the 21st Century*:
www.cdc.gov/ncidod/emergplan
- ◆ Voice Fax for CDC (receive information on various diseases by voice message or printed fact sheets):
1-888-CDC-FAXX (1-888-232-3299)
- ◆ Web sites for Foodborne and Waterborne Diseases:
www.cdc.gov/ncidod/dbmd/foodborn.htm
www.cdc.gov/ncidod/dpd/new.htm
www.cdc.gov/ncidod/dpd/p_diseas.htm
- ◆ Web site for Molecular Subtyping Network for Foodborne Pathogens (PulseNet):
www.cdc.gov/ncidod/dbmd/pulsenet/pulsenet.htm
- ◆ Web site for Foodborne Disease Active Surveillance Network (FoodNet):
www.cdc.gov/ncidod/dbmd/foodnet
- ◆ Address for obtaining additional copies of this booklet:
Office of Health Communication
National Center for Infectious Diseases
Centers for Disease Control and Prevention
Mailstop C-14
1600 Clifton Road, NE
Atlanta, GA 30333



Copies of this 75-page plan are available from
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