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Food Safety

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Goal

Reduce foodborne illnesses.

Overview

Foodborne illnesses impose a burden on public health and contribute significantly to the cost of health care.

From 1988 through 1992, foodborne disease outbreaks caused an annual average of more than 15,000 cases of illness in the United States.¹ The actual illness rate may be higher because a count is taken only when the microorganism that caused the illness is identified by a laboratory and reported by a physician.

When unreported cases are taken into account, an estimated 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths each year may be associated with microorganisms in food.² Hospitalizations due to foodborne illnesses are estimated to cost over \$3 billion each year.³ The cost of lost productivity is estimated at between \$20 billion and \$40 billion each year.³ In addition to acute illness, some microorganisms can cause delayed or chronic illness. Foodborne chemical contaminants may cause chronic rather than acute problems, and specific estimates of their impact on health and the economy are not available.

Since 1996, selected State and local health departments, the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), and the Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture (USDA) have been cooperating in FoodNet to produce better national estimates of foodborne disease. The focus is on organisms that cause the highest number of foodborne illnesses and on new or emerging foodborne pathogens. Active surveillance, based on laboratory data, is being conducted at FoodNet sites.

The success of improvements in food production, processing, preparation, and storage practices can be measured through the reduction in outbreaks of disease caused by foodborne pathogens. An outbreak occurs when two or more cases of a similar illness result from eating the same food.¹ Smaller outbreaks—those with fewer cases—may be a direct result of improved food preparation practices and better epidemiologic followup once cases are identified.

Issues and Trends

Underlying forces may make foodborne illnesses more of a problem in the years to come. These include emerging pathogens; improper food preparation, storage, and distribution practices; insufficient training of retail employees; an increasingly global food supply; and an increase in the number of people at risk because of aging and compromised capacity to fight foodborne diseases.⁴

Emerging pathogens. Microorganisms continue to adapt and evolve, sometimes increasing in their ability to make an individual sick. Microorganisms previously not recognized as human pathogens or pathogens unexpectedly found in particular foods have caused outbreaks of illness. Examples are *Listeria monocytogenes*, *Escherichia coli* O157:H7, and *Cyclospora cayetanensis*. Known pathogens also may become resistant to drugs. For example, some strains of *Salmonella* species now are resistant to multiple important antimicrobial drugs.

The general trend toward increased resistance by microorganisms to multiple antimicrobial agents heightens public health concerns about treatment options and health care costs associated with foodborne illness. Of particular concern is the potential for transmission of antimicrobial-resistant pathogens to humans through the food supply. For these reasons, increased testing is planned to identify and monitor changes in patterns and trends of antimicrobial resistance in both human and animal populations.

Food preparation and storage practices. Most meals (71 percent) and snacks (78 percent) are prepared at home.⁵ For these meals, the food-preparing consumer needs to protect against foodborne illness. Surveys show that consumers should improve the way they prepare, thaw, and store food.^{6,7}

Training of retail employees. The retail food industry has a large employee population with high rates of turnover. Language and literacy barriers and nonuniform systems for training and certifying workers pose additional challenges. Improper holding temperatures, inadequate cooking, poor personal hygiene, contaminated equipment, and foods from unsafe sources have been associated with foodborne disease outbreaks in retail food establishments. Retail food employees' use of safe food preparation and storage practices, along with use of recommended practices spelled out in the U.S. Public Health Service's *Food Code*, should reduce outbreaks.

Global food supply. An increasing amount of the food eaten in most countries originates in other countries. Diverse methods of and standards for growing and processing agricultural products and different frequencies and types of gastrointestinal infections in food workers in different regions increase the possibility of food contamination and the range of pathogens expected.

Protecting the safety of the Nation's food supply involves safeguarding against both biological and chemical contaminants in food. Chemical contaminants in food can include pesticides, toxic elements, naturally occurring toxins (for example, mycotoxins and phytotoxins), antibiotic residues in animal products, endocrine disruptor compounds, and other trace substances in food. Many questions remain unanswered about the chronic effects of exposure to these types of substances. (See Focus Area 8. Environmental Health.)

The U.S. Environmental Protection Agency (EPA) has set safety standards (tolerances) to limit the amount of pesticide residues that legally may remain in or on

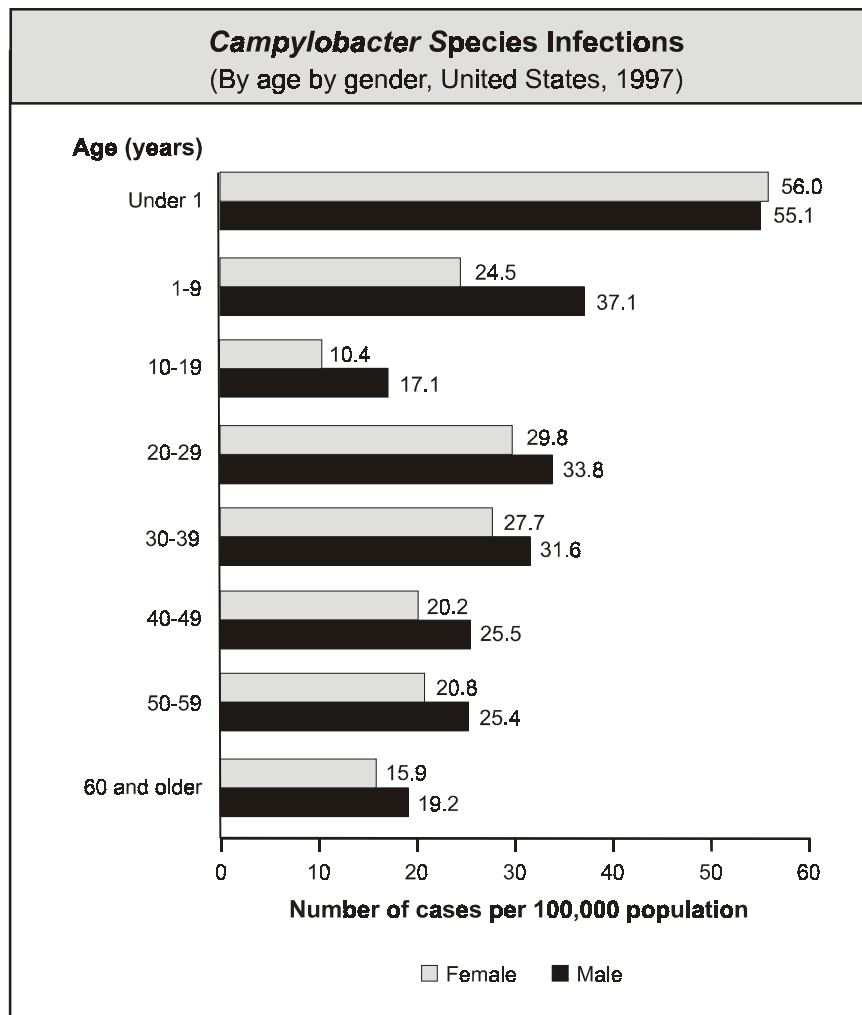
food or animal feed sold in the United States. Consumers and others have been concerned about the potential risk to children from pesticides. The Food Quality Protection Act of 1996 requires EPA to reassess all existing standards for pesticides by the year 2006. Under this act, EPA considers the risk from dietary exposures from all food uses of pesticides and drinking water; nonoccupational exposure, such as the use of the pesticides for lawn care; and any special sensitivities for children. FDA monitors domestic and imported foods to ensure compliance with these pesticide safety standards.⁸ Under the Pesticide Data Program, USDA's Agricultural Marketing Service measures how much of certain pesticides remains in or on food.⁹

Naturally occurring toxins present a different issue. Mycotoxins cannot be avoided entirely or eliminated from human foods or animal feeds because the molds that create them occur naturally in grains and other food commodities. Risk reduction strategies, such as adherence to specific good manufacturing practices (GMPs), have been developed for aflatoxins. For other mycotoxins, FDA is using a science-based risk assessment procedure to help identify appropriate risk reduction measures.

Because representative national data systems may not be available in the first half of the decade for tracking progress on mycotoxins in foods, this subject is not covered in this focus area's objectives. Research on risk reduction and efforts to collect representative national data on mycotoxins in foods will be addressed in the coming decade.

Allergen risk. Although most foodborne illness results from a microbial or chemical contaminant in food, a food itself also can cause severe adverse reactions. In the United States food allergy is an important problem: 2 to 4 percent of children under age 6 years^{10, 11} and 1 to 2 percent of adults are allergic to specific foods.¹² The foods most likely to cause allergic reactions are milk and milk products, eggs and egg products, peanuts and peanut products, tree nuts and tree nut products, soybeans and soybean products, fish and fish products, shellfish and shellfish products, cereals containing gluten, and seeds. Allergic reactions to natural rubber latex from food handlers' gloves have been reported.^{13, 14}

Based on a 3-year study of anaphylaxis cases treated at an emergency department, an estimated 2,500 individuals per year in the United States experience food-induced anaphylaxis.^{15, 16} Food allergy is the most frequent cause of anaphylaxis occurring outside of the hospital and the most common cause for emergency department visits for anaphylaxis.¹⁷ Because potentially allergenic foods are present as ingredients in a variety of food products, and because even trace amounts of these allergenic foods can induce anaphylaxis, research, education, and clear food ingredient labeling information are critical for managing food allergies.



Source: CDC, NCID. Foodborne Disease Active Surveillance Network (FoodNet), unpublished data, 1997.

The Food, Drug, and Cosmetic Act requires manufacturers to list all ingredients of a packaged food, with two exemptions. Spices, flavorings, and colorings may be declared collectively without each one being named.¹⁸ Incidental additives, such as processing aids present in a food at insignificant levels and not having a technical or functional effect in the finished food, do not have to be listed individually.¹⁹ However, the presence of a substance that may cause an adverse reaction is considered significant and so it must be listed on the food label. FDA has advised manufacturers that, because adhering to GMPs is essential for effective reduction of adverse reactions, precautionary labeling, such as “may contain (insert name of allergenic ingredient),” should not be used in lieu of adherence to GMPs.²⁰

Disparities

More than 30 million people in the United States are likely to be particularly susceptible to foodborne disease.²¹ Very young, elderly, and immunocompromised persons experience the most serious foodborne illnesses. They may become ill

from smaller doses of organisms and may be more likely than other persons to die of foodborne disease. For example, children under age 1 year have the highest rate of *Campylobacter* species infections (see figure). Other high-risk populations include residents in nursing homes or chronic care facilities; hospitalized, cancer, and organ transplant patients; and individuals with AIDS, with cirrhosis, on antimicrobial treatment, or with reduced stomach acid such as due to antacid medications. In cases of listeriosis and toxoplasmosis, pregnant women and their fetuses or newborns are at higher risk than other groups.

Representative data on specific U.S. populations, such as racial and ethnic groups or socioeconomic groups, are not available from FoodNet. Efforts are under way to improve reporting of this information. A report from the United Kingdom indicates a relationship between socioeconomic status and foodborne illness that may apply to the United States. It found that hospital admissions for gastrointestinal infections increased with increasing socioeconomic deprivation.²²

Opportunities

The opportunities to reduce the burden of foodborne illness involve risk reduction and control interventions targeted at various steps from production to consumption. These strategies include Hazard Analysis and Critical Control Points programs (required starting in 1997 for seafood and in 1998 for meat and poultry processing); improved adherence to GMPs; education of food processors, preparers, and servers at all levels in the food industry and in the home; and improved investigation of outbreaks and sporadic cases of foodborne illness.

The Partnership for Food Safety Education was formed in 1997 as a part of the National Food Safety Initiative. The Partnership—composed of industry, State, and consumer organizations and government liaisons from FDA, FSIS, Cooperative State Research, Education, and Extension Service (CSREES), CDC, and EPA—cooperatively developed the FightBAC!TM Campaign with messages to reach all consumers. The messages are based on four key food safety practices:

- Clean: Wash hands and surfaces often.
- Separate: Don't cross-contaminate.
- Cook: Cook to proper temperatures.
- Chill: Refrigerate promptly.

Increased surveillance, planned as a result of the 1997 initiative and the improvements to the FoodNet program, will inform the public health community, veterinary and producer groups, and regulatory agencies of the extent of the problem of human pathogens that come from the intestines of animals. These organisms might resist drug therapy when human illness occurs. Public health experts anticipate an initial increase in the number of resistant pathogens detected due to improved surveillance. Over time, as control and educational programs are enacted, decreases should follow. Wider and more representative testing will give a better

picture of the nature and extent to which antimicrobial-resistant foodborne pathogens are transmitted from animals to humans.

Interim Progress Toward Year 2000 Objectives

Of the four Healthy People 2000 food safety objectives targeted to reducing foodborne illness, only one has been met—reducing the incidence of disease caused by four key pathogens (*Salmonella* species, *Campylobacter* species, *Escherichia coli* O157:H7, and *Listeria monocytogenes*). Two objectives show solid progress—decreasing the number of outbreaks of *Salmonella* serotype Enteritidis from 77 to 44 outbreaks per year and State agency adoption (16 States) and review (23 States plus Puerto Rico and the District of Columbia) of the *Food Code* for retail-level food establishments (1999 *Food Code* data). The consumer food safety practices objective shows improvement. In fact, the target for washing cutting boards with soap has been surpassed (79 percent) if all safe practices, such as washing with bleach or using a different cutting board following use with raw meat or poultry, are considered.

Note: Data are from the Centers for Disease Control and Prevention, National Center for Health Statistics, *Healthy People 2000 Review, 1998–99*, and from the *Healthy People 2000 Progress Review, Food and Drug Safety*, September 1, 1999.

Healthy People 2010—Summary of Objectives

Food Safety

Goal: Reduce foodborne illnesses.

Number	Objective Short Title
10-1	Foodborne infections
10-2	Outbreaks of foodborne infections
10-3	Antimicrobial resistance of <i>Salmonella</i> species
10-4	Food allergy deaths
10-5	Consumer food safety practices
10-6	Safe food preparation practices in retail establishments
10-7	Organophosphate pesticide exposure

Healthy People 2010 Objectives

10-1. Reduce infections caused by key foodborne pathogens.

Target and baseline:

Objective	Reduction in Infections Caused by Microorganisms	1997 Baseline	2010 Target
<i>Cases per 100,000</i>			
10-1a.	<i>Campylobacter</i> species	24.6	12.3
10-1b.	<i>Escherichia coli</i> O157:H7	2.1	1.0
10-1c.	<i>Listeria monocytogenes</i>	0.5	0.25
10-1d.	<i>Salmonella</i> species	13.7	6.8
10-1e.	<i>Cyclospora cayetanensis</i>	Developmental	
10-1f.	Postdiarrheal hemolytic uremic syndrome	Developmental	
10-1g.	Congenital <i>Toxoplasma gondii</i>	Developmental	

Target setting method: 50 percent improvement.

Data sources: Foodborne Disease Active Surveillance Network (FoodNet), CDC, NCID; FDA, CFSAN; FSIS, OPHS; and State agencies.

Potential data source: Toxoplasmosis data—National Notifiable Diseases Surveillance System (NNDSS), CDC, NCID.

NOTE: THE TABLE BELOW MAY CONTINUE TO THE FOLLOWING PAGE.

Total Population, 1997	10-1a. <i>Campylobacter</i> Species	10-1b. <i>Escherichia coli</i> O157:H7	10-1c. <i>Listeria mono-</i> <i>cyto-</i> <i>genes</i>	10-1d. <i>Salmo-</i> <i>nella</i> Species
	Cases per 100,000			
TOTAL	24.6	2.1	0.5	13.7
Race and ethnicity				
American Indian or Alaska Native	DSU	DSU	DSU	DSU
Native Hawaiian and other Pacific Islander	DSU	DSU	DSU	DSU
Black or African American	DSU	DSU	DSU	DSU
White	DSU	DSU	DSU	DSU

Total Population, 1997	10-1a. <i>Campylobacter</i> Species	10-1b. <i>Escherichia coli</i> O157:H7	10-1c. <i>Listeria monocytogenes</i>	10-1d. <i>Salmonella</i> Species
	Cases per 100,000			
Hispanic or Latino	DSU	DSU	DSU	DSU
Not Hispanic or Latino	DSU	DSU	DSU	DSU
Black or African American	DSU	DSU	DSU	DSU
White	DSU	DSU	DSU	DSU
Gender				
Female	21.7	2.2	0.4	13.3
Male	27.5	2.0	0.5	14.0
Family income level				
Poor	DNC	DNC	DNC	DNC
Near poor	DNC	DNC	DNC	DNC
Middle/high income	DNC	DNC	DNC	DNC
Select populations				
Age groups				
Under 1 year	55.5	4.6	2.3	111.4
1 to 19 years	21.9	4.9	0.1	17.5
20 to 59 years	27.2	0.9	0.3	10.7
60 years and older	17.1	1.6	1.7	9.1

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.

NOTE: THE TABLE ABOVE MAY HAVE CONTINUED FROM THE PREVIOUS PAGE.

Campylobacteriosis and salmonellosis are the most frequently reported foodborne illnesses in the United States.² The emerging pathogens *E. coli* O157:H7 and *L. monocytogenes* cause infections that are less often reported but commonly more severe. *L. monocytogenes* is rare; however, septicemia and meningitis may result from infection with this organism, and up to 20 percent of patients may die.² Persons with altered or deficient immune response, such as infants and young children, older adults, pregnant women and their fetuses, and immunosuppressed persons, are at highest risk. Listeriosis in pregnant women may lead to miscarriage, stillbirth, or septicemia and meningitis in newborns.

Cyclospora cayetanensis, a parasite, was made a nationally notifiable disease (States report all cases to CDC) and added to FoodNet in 1998. Information about this emerging pathogen, such as the proportion of infections that are foodborne, is needed. Examination for *C. cayetanensis* is not universal in clinical laboratories; thus, data for this organism may be less reliable than for the other organisms.

The parasite *Toxoplasma gondii* causes toxoplasmosis and may cause miscarriage, stillbirth, or fetal abnormality. Although results of *Toxoplasma gondii* testing are not generally reported by clinicians, results from national surveys that include blood testing suggest that toxoplasmosis may be one of the most common infections associated with food. Blood tests reveal toxoplasmosis infections at a rate of 7.2 percent for children aged 6 to 10 years.²³ Preliminary data from a European study showed that a majority of toxoplasmosis cases were foodborne.²⁴ Another study found that food consumption and preparation practices accounted for five of the top six practices by pregnant women that were significantly associated with congenital toxoplasmosis.²⁵ The food practices were eating raw or undercooked minced meat products, eating raw or undercooked mutton, eating raw or undercooked pork or lamb, eating unwashed raw vegetables, and washing kitchen knives infrequently after preparation of raw meat and prior to handling another food item.²⁵ Changing the cat litter, although often thought to be the major cause of toxoplasmosis, ranked fifth in importance of the six practices. As with other parasitic diseases, diagnostic laboratory testing for toxoplasmosis often is not available or is done infrequently. Efforts are under way in the United States to make congenital toxoplasmosis a nationally notifiable disease, with serological data collection beginning in 2000.

10-2. Reduce outbreaks of infections caused by key foodborne bacteria.

Target and baseline:

Objective	Reduction in Infections Caused by Foodborne Bacteria	1997 Baseline	2010 Target
<i>Number of Outbreaks per Year</i>			
10-2a.	<i>Escherichia coli</i> O157:H7	22	11
10-2b.	<i>Salmonella</i> serotype Enteritidis	44	22

Target setting method: 50 percent improvement.

Data source: Foodborne Disease Outbreak Surveillance System, CDC, NCID.

Outbreaks of *E. coli* O157:H7 have been associated with undercooked or raw ground beef, unpasteurized apple juice, and some types of fresh (raw) produce. The most frequent known cause of outbreaks of *Salmonella* Enteritidis is the consumption of food that contains undercooked or raw eggs.

10-3. Prevent an increase in the proportion of isolates of *Salmonella* species from humans and from animals at slaughter that are resistant to antimicrobial drugs.

Target and baseline:

Objective	Prevention of Increase in Proportion of <i>Salmonella</i> Species Resistant to Antimicrobial Drugs	1997 Baseline	2010 Target
		<i>Percent of Isolates</i>	
	<i>Salmonella</i> from humans that are resistant to:		
10-3a.	Fluoroquinolones	0	0
10-3b.	Third-generation cephalosporins	0	0
10-3c.	Gentamicin	3	3
10-3d.	Ampicillin	18	18
	<i>Salmonella</i> from cattle at slaughter that are resistant to:		
10-3e.	Fluoroquinolones	Developmental	
10-3f.	Third-generation cephalosporins	Developmental	
10-3g.	Gentamicin	Developmental	
10-3h.	Ampicillin	Developmental	
	<i>Salmonella</i> from broilers at slaughter that are resistant to:		
10-3i.	Fluoroquinolones	Developmental	
10-3j.	Third-generation cephalosporins	Developmental	
10-3k.	Gentamicin	Developmental	
10-3l.	Ampicillin	Developmental	
	<i>Salmonella</i> from swine at slaughter that are resistant to:		
10-3m.	Fluoroquinolones	Developmental	
10-3n.	Third-generation cephalosporins	Developmental	
10-3o.	Gentamicin	Developmental	
10-3p.	Ampicillin	Developmental	

Target setting method: No increase.

Data sources: National Antimicrobial Resistance Monitoring System: Enteric Bacteria–*Salmonella* (NARMS: Enteric Bacteria), CDC, NCID; FDA, CVM; USDA, FSIS, APHIS, and ARS; Foodborne Disease Active Surveillance Network (FoodNet), CDC, FDA, USDA, FSIS.

10-4. (Developmental) Reduce deaths from anaphylaxis caused by food allergies.

Potential data source: National Vital Statistics System (NVSS), CDC, NCHS.

10-5. Increase the proportion of consumers who follow key food safety practices.

Target: 79 percent.

Baseline: 72 percent of consumers followed key food safety practices in 1998, based on total population of adults who engaged in the practice.

Target setting method: Better than the best.

Data source: Food Safety Survey (FSS), FDA and FSIS, USDA.

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Adult Population, 1998	Followed Key Food Safety Practices
	Percent
TOTAL	72
Race and ethnicity	
American Indian or Alaska Native	DSU
Asian or Pacific Islander	DSU
Asian	DNC
Native Hawaiian and other Pacific Islander	DNC
Black or African American	70
White	73
Hispanic or Latino	
Hispanic or Latino	DSU
Not Hispanic or Latino	72
Black or African American	DSU
White	DSU
Gender	
Female	75
Male	69
Family income level (annual)	
Less than \$10,000	DSU
\$10,000 to \$19,999	72
\$20,000 and above	72

Adult Population, 1998	Followed Key Food Safety Practices
	Percent
Education level (aged 18 years and older)	
Less than high school	DSU
High school graduate	74
At least some college	72
Disability status	
Persons with disabilities	DNC
Persons without disabilities	DNC
Select populations	
Children under age 5 years in household	
No	72
Yes	73
Age groups	
18 to 59 years	72
60 years and older	75

DNA = Data have not been analyzed. DNC = Data are not collected. DSU = Data are statistically unreliable.
 Note: Adjusted to 1993 census proportions on gender, race, and education.

NOTE: THE TABLE ABOVE MAY HAVE CONTINUED FROM THE PREVIOUS PAGE.

Key food safety practices are based on the four FightBAC!™ Campaign messages: clean—wash hands and surfaces often; separate—don’t cross-contaminate; cook—cook to proper temperatures; and chill—refrigerate promptly.

10-6. (Developmental) Improve food employee behaviors and food preparation practices that directly relate to foodborne illnesses in retail food establishments.

Potential data source: Retail Food Database of Foodborne Illness Risk Factors, FDA, CFSAN.

Five food safety risk factors related to employee behaviors and preparation practices have been identified by CDC as contributing to foodborne illness: improper holding temperatures, inadequate cooking, contaminated equipment, food from an unsafe source, and poor personal hygiene. “For each year from 1988 through 1992, the most commonly reported food preparation practice that contributed to foodborne disease concerned improper holding temperature; the second concerned poor personal hygiene of food handlers. Food obtained from an unsafe source was the least commonly reported factor for all 5 years. In most outbreaks caused by bacterial pathogens, the food was stored at improper holding temperatures.”¹

To help control the risk factors, the *Food Code* provides key public health interventions: use of time-temperature control, prevention of hand contact with foods as a vehicle of contamination, employee health, demonstration of knowledge by the manager, and a consumer advisory to inform consumers of their risk when eating raw or undercooked animal foods. Proper application and implementation of these interventions are crucial to combat foodborne disease.

10-7. (Developmental) Reduce human exposure to organophosphate pesticides from food.

Potential data source: Total Diet Study, FDA, CFSAN.

The Food Quality Protection Act of 1996 mandated that EPA reassess existing standards for pesticides used on food crops. Organophosphates, a group of approximately 40 closely related pesticides, have been designated as first priority in the standards reassessment. These pesticides are used on fruits and vegetables important in the diet of children.

Related Objectives From Other Focus Areas

8. Environmental Health

- 8-5. Safe drinking water
- 8-6. Waterborne disease outbreaks
- 8-8. Surface water health risks
- 8-10. Fish contamination
- 8-24. Exposure to pesticides
- 8-25. Exposure to heavy metals and other toxic chemicals
- 8-29. Global burden of disease
- 8-30. Water quality in the U.S.-Mexico border region

14. Immunization and Infectious Diseases

- 14-21. Antimicrobial use in intensive care units

20. Occupational Safety and Health

- 20-8. Occupational skin diseases or disorders

23. Public Health Infrastructure

- 23-2. Public access to information and surveillance data

Terminology

(A listing of abbreviations and acronyms used in this publication appears in Appendix H.)

Anaphylaxis: A severe allergic reaction commonly caused by certain foods. It occurs within minutes of exposure and may include hives, itching, skin swelling, blood vessel collapse, shock, and often life-threatening respiratory distress.²⁶

Cephalosporins, third generation: Potent antimicrobial drugs capable of fighting a wide variety of bacterial infections. *Salmonella* species infections in certain high-risk and severely ill patients, particularly children, often are treated with such drugs.

Emerging pathogen: An illness-causing microorganism previously unknown to be a human pathogen, a foodborne pathogen not expected to occur in particular foods, or a pathogen that has caused a dramatic increase in new cases of illness.

Food Code: A book of recommendations of the U.S. Public Health Service that FDA first published in 1993 and revises every 2 years. It consists of model requirements for safeguarding public health and ensuring food is unadulterated and honestly presented to the consumer. FDA offers the *Food Code* for adoption by local, State, Tribal, and Federal government jurisdictions for administration by the units that have compliance responsibilities for food service, retail food stores, or food vending operations.

Foodborne disease or foodborne illness: Infection or intoxication caused by microbial or chemical contaminants in foods. Some foodborne illnesses, such as salmonellosis and staphylococcal food poisoning, can be caused by a single helping or less of a food that contains sufficient microorganisms or toxin to cause illness. Other foodborne illnesses result from eating compounds, such as naturally occurring aflatoxin, in foods over long periods of time.

Foodborne disease outbreak: When two or more cases of a similar illness result from eating the same food.¹

Food industry: Food producers (farmers, fishers, ranchers), food processors, food storers, food warehouseers and transporters, and retail food operators.

FoodNet: The Foodborne Diseases Active Surveillance Network, a collaborative project conducted by CDC, participating States, FSIS, and FDA that began in 1996. FoodNet produces national estimates of the burden and sources of specific diseases in the United States through active surveillance and other studies. California, Connecticut, Georgia, Maryland, Minnesota, New York, Oregon, and Tennessee, representing a total population of 28 million people (approximately 10 percent of the U.S. population), are the eight FoodNet sites.²⁷

Good manufacturing practices (GMPs): Criteria, including regulations, that ensure that food is fit for consumption and is manufactured under sanitary conditions. These criteria address factors that affect production of safe food, including disease control, cleanliness (personal hygiene and dress codes), education, and training.

Hazard Analysis and Critical Control Points (HACCP): A science-based and systematic approach to prevent potential food safety problems by anticipating how and where biological, chemical, or physical hazards are most likely to occur and by installing appropriate measures to prevent them from occurring. The seven principles of HACCP are hazard analysis, determination of critical control points, specification of critical limits, monitoring, corrective actions, verification, and documentation (recordkeeping).

Hemolytic uremic syndrome (HUS), postdiarrheal: A serious, sometimes fatal complication often associated with illness caused by *Escherichia coli* O157:H7 and other shiga toxin-producing *E. coli*.²⁸ HUS occurs mainly in children under the age of 10 years. Renal failure, hemolytic anemia, and a severe decrease in the number of blood platelets characterize HUS.

Mycotoxins: Naturally occurring toxins formed by fungi (molds) in food and in animal feed (for example, aflatoxins, fumonisins, deoxynivalenol, and patulin).

Outbreak: See foodborne disease outbreak above.

Pathogen: A microorganism that causes illness.

Retail food industry: As covered by the *Food Code*, a level within the food industry that includes but is not limited to the following establishments: vending operations, grocery stores, other retail food outlets, and food service in restaurants and institutions.

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