

Appendices

APPENDIX 1 Glossary	247
APPENDIX 2 Onset, Duration, and Symptoms of Foodborne Illness and Associated Organism or Toxin (from the US Food and Drug Administration <i>Foodborne Pathogenic Microorganisms and Natural Toxins Handbook</i>).....	251
APPENDIX 3 List of Key Websites and Resources Cited	255

Appendix 1

GLOSSARY

Note: The definitions given are valid as they are used in this publication, but different definitions may be used in other contexts.

Active surveillance:

Contacting possible sources of disease reports to solicit and collect reports or specimens, rather than waiting until they are submitted to the mandated government agency. Possible sources of disease reports or specimens include laboratories, hospitals, and physicians.

Adulterated:

A legal term meaning a food product fails to meet federal or state standards. Adulteration usually refers to noncompliance with health or safety standards as determined in the United States by the Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA).

Analytic study:

In epidemiology, a study designed to examine associations, commonly putative or hypothesized causal relationships; usually concerned with identifying or measuring the effects of risk factors or with the health effects of specific exposures.

Bare-handed contact:

Contact between bare skin and food items during preparation or serving (covered under section 3-301.11 of the FDA Food Code).

Case:

In epidemiology, a countable instance in the population or study group of a particular disease, health disorder, or condition under investigation

Case-control study:

A type of observational analytic study. Enrollment into the study is based on presence (“case”) or absence (“control”) of disease. Characteristics such as previous exposure, are then compared between cases and controls.

Case definition:

Standardized criteria for deciding whether a person has a particular disease or health-related condition by specifying clinical criteria and limitations on time, place, and person.

Chain-of-custody:

Standards and procedures for which evidentiary documentation and strict record keeping are indicated or required. The chain-of-custody establishes proof that the items of evidence collected during an investigation are the same as those being presented in a court of law. The chain-of-custody requires direct interviews and collection of supporting documentation (e.g., invoices, bills of lading, import documents) during the investigation. The chain-of-custody also establishes who had contact with the evidence; the date and time the evidence was handled; the circumstances under which the evidence was handled; and what changes, if any, were made in the evidence.

Cluster:

An unusual aggregation of cases grouped in time or space. The term is commonly used in pathogen-specific surveillance, when multiple infections caused by similar microbial strains are identified by a public health laboratory. The purpose of identifying clusters is to trigger further investigations to determine whether they might represent an outbreak. The number of cases needed to form a cluster cannot be absolutely defined; cluster definition can vary by type of agent, novelty of the subtype, season, and resources available for further investigation.

Cohort:

A well-defined group of people who have had a common experience or exposure and who are then followed up for the incidence of new diseases or events, as in a cohort or prospective study. A group of people born during a particular period or year is called a birth cohort.

Appendix 1

Cohort study:

A type of observational analytic study. Enrollment into the study is based on exposure characteristics or membership in a group. Disease, death, or other health-related outcomes are then ascertained and compared.

Contributing factors:

The food-safety practices and behaviors that most likely contributed to a foodborne illness outbreak.

Control:

In a case-control study, comparison group of persons without disease.

Denaturing:

Applying substance, such as household bleach or carboic acid, to all portions of food products to prevent their use for food purposes.

eFORS:

Electronic Foodborne Outbreak Reporting System. A secure Web-based reporting system that enables state health departments to report foodborne disease outbreaks electronically to the Centers for Disease Control and Prevention (CDC). eFORS is being subsumed into the National Outbreak Reporting System (NORS), which will include outbreaks from all transmission routes, including water, person to person, and animal contact.

Embargo:

An order issued by a permit-issuing official or his/her designated representative at a state or local agency that prevents food from being used, sold, donated, discarded, repackaged, or otherwise disposed of until the order is lifted by the permit-issuing official, his/her designated representative, or court of competent jurisdiction.

Environmental health specialist (also called sanitarian):

A person who conducts research or performs investigations to identify, diminish, and/or eliminate sources of pollutants and hazards

that affect the environment or the health of the population. He or she might collect, synthesize, study, report, and take action on the basis of data derived from measurements or observations of air, food, soil, water, and other sources.

Epidemiologist:

An investigator who studies the occurrence of disease or other health-related conditions or events in defined populations. The control of disease in populations also is often considered to be a task for the epidemiologist. Epidemiologists conduct surveillance and carry out investigations using hypothesis testing and analytic research to identify the causes of disease, including the physical, biologic, social, cultural, and behavioral factors that influence health.

Epi-X:

CDC's Web-based communications solution for public health professionals. Through Epi-X, CDC officials, state and local health departments, poison control centers, and other public health professionals can access and share preliminary health surveillance information—quickly and securely. Users also can be notified about breaking health events as they occur.

Food Code:

A reference guide published by FDA. The guide instructs retail outlets, such as restaurants and grocery stores, and institutions, such as nursing homes, how to prevent foodborne illness. It consists of a model code adopted by nearly 3000 state, local, and tribal jurisdictions as the legal basis for their food-inspection programs for safeguarding public health. It ensures that food is safe and unadulterated (free from impurities) and honestly presented to the consumer. It also provides references and public health reasons and explanations for code provisions, guidelines, and sample forms. FDA first published the Food Code in 1993 and revises it every 4 years.

Appendix 1

Food establishment: An operation that a) stores, prepares, packages, serves, and/or vends food directly to the consumer or otherwise provides food for human consumption, such as a restaurant; satellite or catered food location; catering operation if the operation provides food directly to a consumer or to a conveyance used to transport people; market; vending location; or institution or food bank; and b) relinquishes possession of food directly, or indirectly through a delivery service, such as home delivery of grocery orders or restaurant takeout orders, or delivery service that is provided by common carriers.

Food-safety regulatory agency: Government agencies at the local, state, or federal level that are granted regulatory oversight of some aspect of the food industry. The goal of food-regulatory agencies is to ensure the public food supply is safe from disease caused by infection from human handling or by contamination from chemical or other hazardous substances.

Foodborne disease: Any disease caused by ingestion of contaminated food. Although some agents are more likely than others to be transmitted by food, identification of foodborne, waterborne, person-to-person, or animal-to-person transmission requires investigation. Furthermore, multiple modes of transmission can be involved in any one outbreak.

Foodborne disease surveillance: Surveillance of diseases or conditions that *might* be foodborne. Thus, all diseases of enteric origin can be tracked by this mechanism, including norovirus infection (which involves substantial person-to-person transmission), listeriosis (which can have a diarrheal stage but generally is detected by blood culture), or botulism (which presents as neurologic disease).

FoodNet Atlas of Exposures: The results of periodic population-based surveys undertaken at selected sites in the United States. The survey collects information about exposures that might be associated with foodborne illnesses and can be used to estimate the background rates of different food exposures in the community.

HACCP (Hazard Analysis and Critical Control Point): A science-based and systematic approach to prevent potential food-safety problems by anticipating how biologic, chemical, or physical hazards are most likely and by installing appropriate measures to prevent them.

Imminent hazard: An important threat or danger to health that exists when evidence is sufficient to show that a product, practice, circumstance, or event creates a situation that requires immediate correction or cessation of operation to prevent injury based on a) the number of possible injuries and b) the nature, severity, and duration of the anticipated injury.

Impound: To take possession of or to seize and hold in the custody of the law.

Jurisdiction: A government entity with the legal authority to interpret and apply the law. Also refers to the limits or territory within which that authority can be exercised.

Multijurisdictional: Requiring the resources of more than one local, state, territorial, tribal, or federal public health or food-regulatory agency to detect, investigate, or control. A multijurisdictional investigation can involve a foodborne disease outbreak or the distribution or recall of a contaminated food product.

Appendix 1

Outbreak:

Two or more cases of a similar illness shown by an investigation to result from a common exposure, such as ingestion of a common food. An outbreak is a cluster with a clear association between cases, with or without a recognized common source or known disease agent. Single cases of certain rare and serious conditions, such as gastrointestinal anthrax, botulism, or cholera, elicit an outbreak-like response.

Outbreak Response Protocol:

A comprehensive document outlining the roles, responsibilities, and required actions of all individuals and organizations involved in the investigation of a foodborne disease outbreak. Outbreak response protocols can be developed for a specific organization or can encompass multiple organizations and jurisdictions.

OutbreakNet:

A national collaboration of epidemiologists and other public health officials who investigate outbreaks of foodborne, waterborne, and other enteric illnesses in the United States. The purpose of OutbreakNet is to ensure rapid, coordinated detection and response to multistate outbreaks of enteric diseases and promote comprehensive outbreak surveillance.

Public health agency:

A government agency established at the local, state, or federal level that is responsible for developing and managing public health programs, including surveillance for infectious disease and noninfectious conditions, interventions to prevent and limit the spread of disease, and promotion of healthy behaviors and environments.

PulseNet:

An international surveillance network comprising national, state, and local public health and food-regulatory agency laboratories that conduct standardized molecular subtyping of foodborne disease pathogens (i.e., DNA

fingerprinting) and maintain centrally accessible databases of patterns. PulseNet also functions as a communication hub for laboratories involved in food and foodborne disease monitoring.

Recall:

A voluntary action of removing a product from retail or distribution. The action is conducted by a manufacturer or distributor to protect the public from products that might cause health problems or possible death.

Reportable conditions (notifiable diseases):

The list of diseases based on state laws or regulations that should be reported by health-care providers (e.g., physicians and their medical staff, laboratories, and hospitals) to local or state health agencies. The list of notifiable diseases and legal obligation for reporting differ from state to state. States can report notifiable diseases to CDC, which maintains a list of nationally notifiable diseases, but compliance is voluntary. CDC reports selected diseases to the World Health Organization in compliance with the International Health Regulations.

Sporadic case:

A case not linked epidemiologically to other cases of the same illness. Single sporadic cases of extremely rare and serious conditions, such as gastrointestinal anthrax, botulism, or cholera, merit a detailed investigation as soon as possible, as though they were outbreaks, to prevent any further cases.

Surveillance:

The systematic collection, analysis, interpretation, and dissemination of data for public health action.

Traceback:

The process by which the origin or source of a cluster of contaminated food is identified.

Appendix 1

Traceforward:

The tracking of a recalled product from the origin or source through the distribution system.

Trawling, trolling, shotgun, or hypothesis-generating questionnaire:

A variety of interview forms designed to capture a wide range of exposures. These forms can be designed with embedded questions focused on disease-specific hypotheses (e.g., exposures previously associated with the pathogen or plausibly associated with the pathogen), as well as other food items and exposures that have not been associated with the pathogen, which can consolidate the hypothesis-generation and testing processes into a single step. For instance, the trawling questionnaire for an

outbreak of *Escherichia coli* O157:H7 infection might contain standardized questions about known transmission mechanisms for this agent, such as hamburger consumption, child-care attendance, recreational pool use, animal exposures, and other exposures identified in previous outbreaks, which function as a priori hypotheses.

USDA-FSIS Consumer Complaint Monitoring System (CCMS):

An electronic database for capturing consumer complaints. Since 2001, USDA-FSIS has used this database to record, triage, and track complaints about FSIS-regulated meat, poultry, and egg products. CCMS helps to identify and trace adulterated product in commerce and enables the agency to respond and mitigate possible food-safety hazards.

Appendix 2

Onset, Duration, and Symptoms of Foodborne Illness and Associated Organism or Toxin*

APPROXIMATE ONSET TIME TO SYMPTOMS	PREDOMINANT SYMPTOMS	ASSOCIATED ORGANISM OR TOXIN
Upper gastrointestinal tract symptoms (nausea, vomiting) occur first or predominate		
<1 hrs	Nausea, vomiting, unusual taste, burning of mouth	Metallic salts
1–2 hrs	Nausea, vomiting, cyanosis, headache, dizziness, dyspnea, trembling, weakness, loss of consciousness	Nitrites
1–6 hrs (mean 2–4 hrs)	Nausea, vomiting, retching, diarrhea, abdominal pain, prostration	<i>Staphylococcus aureus</i> and its enterotoxins
8–16 hrs (2–4 hrs emesis possible)	Vomiting, abdominal cramps, diarrhea, nausea	<i>Bacillus cereus</i>
6–24 hrs	Nausea, vomiting, diarrhea, thirst, dilation of pupils, collapse, coma	Amanita species mushrooms
Sore throat and respiratory symptoms occur		
12–72 hrs	Sore throat, fever, nausea, vomiting, rhinorrhea, sometimes a rash	<i>Streptococcus pyogenes</i>
2–5 days	Inflamed throat and nose, spreading grayish exudate, fever, chills, sore throat, malaise, difficulty swallowing, edema of cervical lymph node	<i>Corynebacterium diphtheriae</i>
Lower gastrointestinal tract symptoms (abdominal cramps, diarrhea) occur first or predominate		
2–36 hrs (mean 6–12 hrs)	Abdominal cramps, diarrhea, putrefactive diarrhea associated with <i>Clostridium perfringens</i> , sometimes nausea and vomiting	<i>Clostridium perfringens</i> , <i>Bacillus cereus</i> , <i>Streptococcus faecalis</i> , <i>Staphylococcus faecium</i>
12–74 hrs (mean 18–36 hrs)	Abdominal cramps, diarrhea, vomiting, fever, chills, malaise, nausea, headache possible. Sometimes bloody or mucoid diarrhea, cutaneous lesions associated with <i>Vibrio vulnificus</i> . <i>Yersinia enterocolitica</i> infection mimics flu and acute appendicitis	<i>Salmonella</i> species (including <i>S. arizonae</i>), <i>Shigella</i> , enteropathogenic <i>Escherichia coli</i> , other <i>Enterobacteriaceae</i> , <i>Vibrio parahaemolyticus</i> , <i>Yersinia enterocolitica</i> , <i>Aeromonas hydrophila</i> , <i>Plesiomonas shigelloides</i> , <i>Campylobacter jejuni</i> , <i>Vibrio cholerae</i> (O1 and non-O1) <i>Vibrio vulnificus</i> , <i>Vibrio fluvialis</i>
3–5 days	Diarrhea, fever, vomiting abdominal pain, respiratory symptoms	Enteric viruses

Appendix 2

Onset, Duration, and Symptoms of Foodborne Illness and Associated Organism or Toxin* (Continued)

APPROXIMATE ONSET TIME TO SYMPTOMS	PREDOMINANT SYMPTOMS	ASSOCIATED ORGANISM OR TOXIN
1–6 wks	Mucoid diarrhea (fatty stools) abdominal pain, weight loss	<i>Giardia lamblia</i>
1 to several weeks	Abdominal pain, diarrhea, constipation, headache, drowsiness, ulcers, variable—often asymptomatic	<i>Entamoeba histolytica</i>
3–6 mos	Nervousness, insomnia, hunger pains, anorexia, weight loss, abdominal pain, sometimes gastroenteritis	<i>Taenia saginata</i> , <i>T. solium</i>
Neurologic symptoms (visual disturbances, vertigo, tingling, paralysis) occur		
<1 hr	*** See Gastrointestinal and/or neurologic symptoms (shellfish toxins) below	Shellfish toxin
	Gastroenteritis, nervousness, blurred vision, chest pain, cyanosis, twitching, convulsions	Organic phosphate
	Excessive salivation, perspiration, gastroenteritis, irregular pulse, pupils constricted, asthmatic breathing	Muscaria-type mushrooms
	Tingling and numbness, dizziness, pallor, gastrohemorrhage, and desquamation of skin, fixed eyes, loss of reflexes, twitching, paralysis	Tetradon (tetrodotoxin) toxins
1–6 hrs	Tingling and numbness, gastroenteritis, dizziness, dry mouth, muscular aches, dilated pupils, blurred vision, paralysis	Ciguatera toxin
	Nausea, vomiting, tingling, dizziness, weakness, anorexia, weight loss, confusion	Chlorinated hydrocarbons
2 hrs–6 days, usually 12–36 hrs	Vertigo; double or blurred vision; loss of reflex to light; difficulty swallowing, speaking, and breathing; dry mouth; weakness; respiratory paralysis	<i>Clostridium botulinum</i> and its neurotoxins
>72 hrs	Numbness, weakness of legs, spastic paralysis, impairment of vision, blindness, coma	Organic mercury
	Gastroenteritis, leg pain, ungainly high-stepping gait, foot and wrist drop	Triorthocresyl phosphate

Appendix 2

Onset, Duration, and Symptoms of Foodborne Illness and Associated Organism or Toxin* (Continued)

APPROXIMATE ONSET TIME TO SYMPTOMS	PREDOMINANT SYMPTOMS	ASSOCIATED ORGANISM OR TOXIN
Allergic symptoms (facial flushing, itching) occur		
<1 hr	Headache, dizziness, nausea, vomiting, peppery taste, burning of throat, facial swelling and flushing, stomach pain, itching of skin.	Histamine (scombroid)
	Numbness around mouth, tingling sensation, flushing, dizziness, headache, nausea	Monosodium glutamate
	Flushing, sensation of warmth, itching, abdominal pain, puffing of face and knees	Nicotinic acid
Generalized infection symptoms (fever, chills, malaise, prostration, aches, swollen lymph nodes) occur		
4–28 days (mean 9 days)	Gastroenteritis, fever, edema about eyes, perspiration, muscle pain, chills, prostration, labored breathing	<i>Trichinella spiralis</i>
7–28 days (mean 14 days)	Malaise, headache, fever, cough, nausea, vomiting, constipation, abdominal pain, chills, rose spots, bloody stools	<i>Salmonella typhi</i>
10–13 days	Fever, headache, myalgia, rash.	<i>Toxoplasma gondii</i>
10–50 days, mean 25–30 days	Fever, malaise, lassitude, anorexia, nausea, abdominal pain, jaundice	Etiologic agent not yet isolated—probably viral
Varying periods, depending on specific illness	Fever, chills, headache or joint ache, prostration, malaise, swollen lymph nodes, other specific symptoms of disease in question	<i>Bacillus anthracis</i> , <i>Brucella melitensis</i> , <i>B. abortus</i> , <i>B. suis</i> , <i>Coxiella burnetii</i> , <i>Francisella tularensis</i> , <i>Listeria monocytogenes</i> , <i>Mycobacterium tuberculosis</i> , <i>Mycobacterium</i> species, <i>Pasteurella multocida</i> , <i>Streptobacillus moniliformis</i> , <i>Campylobacter jejuni</i> , <i>Leptospira</i> species.
Gastrointestinal and/or neurologic symptoms (shellfish toxins)		
0.5–2 hrs	Tingling, burning, numbness, drowsiness, incoherent speech, respiratory paralysis	Paralytic shellfish poisoning (saxitoxins)

Appendix 2

Onset, Duration, and Symptoms of Foodborne Illness and Associated Organism or Toxin* (Continued)

APPROXIMATE ONSET TIME TO SYMPTOMS	PREDOMINANT SYMPTOMS	ASSOCIATED ORGANISM OR TOXIN
2–5 mins to 3–4 hrs	Reversal of hot and cold sensation, tingling; numbness of lips, tongue and throat; muscle aches, dizziness, diarrhea, vomiting	Neurotoxic shellfish poisoning (brevetoxins)
30 mins to 2–3 hrs	Nausea, vomiting, diarrhea, abdominal pain, chills, fever	Diarrheic shellfish poisoning (dinophys toxin, okadaic acid, pectenotoxin, yessotoxin)
24 hrs (gastrointestinal) to 48 hrs (neurologic)	Vomiting, diarrhea, abdominal pain, confusion, memory loss, disorientation, seizure, coma	Amnesic shellfish poisoning (domoic acid)

*From FDA. Bad bug book: foodborne pathogenic microorganisms and natural toxins handbook. Available at www.fda.gov/Food/FoodborneIllnessContaminants/CausesOfIllnessBadBugBook/ (accessed October 11, 2013).

Appendix 3

List of Key Websites and Resources Cited

Applied Epidemiology Competencies:

www.cste.org/group/CSTECDCAEAC

CDC's Diseases and Conditions A–Z index:

www.cdc.gov/diseasesConditions

CIFOR Clearinghouse:

www.cifor.us/clearinghouse/keywordsearch.cfm

Control of Communicable Diseases Manual (latest edition),
American Public Health Association Press

Environmental Assessment Forms and Consumer Complaint Forms:

www.cdc.gov/nceh/ehs/EHSNet/

FDA Food Code:

www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/default.htm

FoodNet Atlas of Exposures:

www.cdc.gov/foodnet/studies/population-surveys.html

Forensic Epidemiology, v. 3.0: training curriculum, www.cdc.gov/phlp/publications/forensicepidemiology/index.html

Model Memorandum of Understanding for Joint Public Health-Law Enforcement Investigations: www.cdc.gov/phlp/publications/type/mmou.html

National Botulism Surveillance Program:

www.cdc.gov/nationalsurveillance/botulism_surveillance.html

Procedures to Investigate Foodborne Illness (latest edition),
International Association for Food Protection

Standardized Outbreak Questionnaires:

www.cdc.gov/foodsafety/outbreaks/surveillance-reporting/investigation-toolkit.html

State-Specific Notifiable Condition Reporting Requirements:

www.cste2.org/izenda/entrypage.aspx

