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WEEKLY REPORT

***Recommendations
and
Reports***

Inside: Continuing Education Examination

**Diagnosis and Management of
Foodborne Illnesses**

A Primer for Physicians

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention (CDC)
Atlanta, GA 30333



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PREFACE

Foodborne illness is a serious public health problem. The Centers for Disease Control and Prevention (CDC) estimates that each year 76 million people get sick, more than 300,000 are hospitalized, and 5,000 Americans die as a result of foodborne illnesses, primarily the very young, elderly, and the immunocompromised. Recent changes in human demographics and food preferences, changes in food production and distribution systems, microbial adaptation, and lack of support for public health resources and infrastructure have led to the emergence of novel as well as traditional foodborne diseases. With increasing travel and trade opportunities, it is not surprising that the risk of contracting and spreading a foodborne illness now exists locally, regionally, and even globally.

Physicians have a critical role in the prevention and control of food-related disease outbreaks. This primer is intended to help physicians in this role by providing them with practical and concise information on the diagnosis, treatment, and reporting of foodborne illnesses. It was developed collaboratively by the American Medical Association, the Centers for Disease Control and Prevention, the Food and Drug Administration's Center for Food Safety and Applied Nutrition, and the US Department of Agriculture's Food Safety and Inspection Service as part of President Clinton's National Food Safety Initiative.

We encourage you to review this information and participate in the attached continuing medical education (CME) program. Even if you choose not to participate in the CME component, please take time to complete and return the "Program Evaluation Form." Your feedback is valuable for updating this primer and for planning future physician education programs.

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**Diagnosis and Management of Foodborne Illnesses:
A Primer for Physicians**

*American Medical Association
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Center for Food Safety and Applied Nutrition
Food and Drug Administration
Food Safety and Inspection Service
US Department of Agriculture*

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Centers for Disease Control and Prevention (CDC), the Food Safety and Inspection Services, US Department of Agriculture, and the Center for Food Safety and Applied Nutrition, Food and Drug Association. CDC is accredited by the ACCME to provide continuing medical education for physicians.

CDC designates this educational activity for a maximum of 3 hours in category 1 credit towards the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

DIAGNOSIS AND MANAGEMENT OF FOODBORNE ILLNESSES:

A PRIMER FOR PHYSICIANS

BACKGROUND

This primer is directed to primary care physicians, who are more likely to see the index case of a potential food-related disease outbreak. It is a teaching tool to update primary care physicians about foodborne illness and remind them of their important role in recognizing suspicious symptoms, disease clusters, and etiologic agents, and reporting cases of foodborne illness to public health authorities.

Specifically, this guide urges physicians to:

- Recognize the potential for a foodborne etiology in a patient's illness;
- Realize that many but not all cases of foodborne illness have gastrointestinal tract symptoms;
- Obtain stool cultures in appropriate settings, and recognize that testing for some specific pathogens, e.g. *E. coli* O157:H7, *Vibrio* spp., must be requested;
- Report suspect cases to appropriate public health officials;
- Talk with patients about ways to prevent food-related diseases; and
- Appreciate that any patient with foodborne illness may represent the sentinel case of a more widespread outbreak.

Foodborne illness is considered to be any illness that is related to food ingestion; gastrointestinal tract symptoms are the most common clinical manifestations of foodborne illnesses. This document provides detailed summary tables and charts, references, and resources for healthcare professionals. Patient scenarios and clinical vignettes are included for self-evaluation and to reinforce information presented in this primer. Also included is a CME component worth 3 credit hours.

This primer is not a clinical guideline or definitive resource for the diagnosis and treatment of foodborne illness. Safe food handling practices and technologies (e.g. irradiation, food processing and storage) also are not addressed. More detailed information on these topics is available in the references and resources listed in this document, as well as from medical specialists and medical specialty societies, state and local public health authorities, and federal government agencies.

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Or visit the following websites:

The American Medical Association

<http://www.ama-assn.org/foodborne>

The Centers for Disease Control and Prevention

<http://www.cdc.gov>

Center for Food Safety and Applied Nutrition, Food and Drug Administration

<http://www.fda.gov/cfsan>

Food Safety and Inspection Service, US Department of Agriculture

<http://www.usda.gov/fsis>

CLINICAL CONSIDERATIONS

Food-related disease threats are numerous and varied, involving biological and nonbiological agents. Foodborne illnesses can be caused by microorganisms and their toxins, marine organisms and their toxins, fungi and their related toxins, and chemical contaminants. During the last 20 years, some foods that have been linked to outbreaks include: milk (*Campylobacter*); shellfish (Norwalk-like viruses); unpasteurized apple cider (*Escherichia coli* O157:H7), eggs (*Salmonella*); fish (ciguatera poisoning); raspberries (*Cyclospora*); strawberries (hepatitis A virus); and ready-to-eat meats (*Listeria*).

While physicians have a critical role in surveillance for and prevention of potential disease outbreaks, only a fraction of the people who experience gastrointestinal tract symptoms from foodborne illness seek medical care. In those who do seek care and submit specimens, bacteria are more likely than other pathogens to be identified as causative agents. Bacterial agents most often identified in patients with foodborne illness in the United States are *Campylobacter*, *Salmonella*, and *Shigella* species, with substantial variation occurring by geographic area and season. Testing for viral etiologies of diarrheal disease is rarely done, but viruses are considered the most common cause of foodborne illness.

This section and the **Foodborne Illnesses Tables** summarize diagnostic features and laboratory testing for bacterial, viral, parasitic, and noninfectious causes of foodborne illness. For more specific guidance, consult an appropriate medical specialist or medical specialty society, as well as various resources listed in other sections of this document. Also refer to this section and the **Foodborne Illnesses Tables** when working through the **Patient Scenarios** and **Clinical Vignettes** of this primer.

RECOGNIZING FOODBORNE ILLNESSES

Patients with foodborne illnesses typically present with gastrointestinal tract symptoms (e.g. vomiting, diarrhea, and abdominal pain); however, nonspecific symptoms and neurologic symptoms may also occur. Every outbreak begins with an index case who may not be severely ill. A physician who encounters this person may be the only one with the opportunity to make an early and expeditious diagnosis. Thus, the physician must have a high index of suspicion and ask appropriate questions to recognize that an illness may have a foodborne etiology.

Important clues to determining the etiology of a foodborne disease are the:

- Incubation period;
- Duration of the resultant illness;

- Predominant clinical symptoms; and
- Population involved in the outbreak.

Additional clues may be derived by asking whether the patient has consumed raw or poorly cooked foods (e.g. raw or undercooked eggs, meats, shellfish, fish), unpasteurized milk or juices, home canned goods, fresh produce, or soft cheeses made from unpasteurized milk. Inquire whether any of the patient's family members or close friends has similar symptoms. Inquiries about living on or visiting a farm, pet contact, day care attendance, occupation, foreign travel, travel to coastal areas, camping excursions to mountains or other areas where untreated water is consumed, and attendance at group picnics or similar outings also may provide clues for determining the etiology of the illness.

If a foodborne illness is suspected, submit appropriate specimens for laboratory testing and contact the state or local health department for advice about epidemiologic investigation. For the physician, implication of a specific source in disease transmission is difficult from a single patient encounter. Attempts to identify the source of the outbreak are best left to public health authorities.

Because infectious diarrhea can be contagious and is easily spread, rapid and definitive identification of an etiologic agent may help control a disease outbreak. An individual physician who obtains testing can contribute the necessary piece of data that ultimately leads to identification of the source of an outbreak.

DIAGNOSING FOODBORNE ILLNESSES

Differential Diagnosis

As shown in Table 1 and the **Foodborne Illnesses Tables** a variety of infectious and noninfectious agents must be considered in patients suspected of having a foodborne illness. Establishing a diagnosis can be difficult, however, particularly in patients with persistent or chronic diarrhea, those with severe abdominal pain, and when there is an underlying disease process. The extent of diagnostic evaluation depends on the clinical picture, the differential diagnosis considered, and clinical judgment.

If any of the following signs and symptoms occur, alone or in combination, laboratory testing may provide important diagnostic clues (particular attention should be given to very young and elderly patients and to immunocompromised patients, all of whom are more vulnerable):

- Bloody diarrhea
- Weight loss
- Diarrhea leading to dehydration
- Fever
- Prolonged diarrhea (3 or more unformed stools per day, persisting several days)
- Neurologic involvement such as paresthesias, motor weakness, cranial nerve palsies
- Sudden onset of nausea, vomiting, diarrhea
- Severe abdominal pain

In addition to foodborne causes, a differential diagnosis of gastrointestinal tract disease should include underlying medical conditions such as irritable bowel syndrome;

inflammatory bowel diseases such as Crohn's disease or ulcerative colitis; malignancy; medication use (including antibiotic-related *Clostridium difficile* toxin colitis); gastrointestinal tract surgery or radiation; malabsorption syndromes; immune deficiencies; Brainerd diarrhea; and numerous other structural, functional, and metabolic etiologies. Consideration also should be given to exogenous factors such as the association of the illness with travel, occupation, emotional stress, sexual practices, exposure to other ill persons, recent hospitalization, child care center attendance, and nursing home residence.

The differential diagnosis of patients presenting with neurological symptoms due to a foodborne illness is also complex. Possible food-related causes to consider include recent ingestion of contaminated seafood, mushroom poisoning, and chemical poisoning. Because the ingestion of certain toxins (e.g. botulinum toxin, tetrodotoxin) and chemicals (e.g. organophosphates) can be life-threatening, a differential diagnosis must be made quickly with concern for aggressive therapy and life support measures (e.g. respiratory support, administration of antitoxin or atropine), and possible hospital admission.

Clinical Microbiology Testing

When submitting specimens for microbiologic testing, it is important to realize that clinical microbiology laboratories differ in protocols used for the detection of pathogens. To optimize recovery of an etiologic agent, physicians should understand routine specimen collection and testing procedures as well as circumstances and procedures for making special test requests. Some complex tests (e.g. toxin testing, serotyping, molecular techniques) may only be available from large commercial and public health laboratories. Contact your microbiology laboratory for more information.

Stool cultures are indicated if the patient is immunocompromised, febrile, has bloody diarrhea, has severe abdominal pain, or if the illness is clinically severe or persistent. Stool cultures are also indicated if many fecal leukocytes are present, which indicates diffuse colonic inflammation and is suggestive of invasive bacterial pathogens such as *Shigella*, *Salmonella*, and *Campylobacter* species, and invasive *E. coli*. In most laboratories, routine stool cultures are limited to screening for *Salmonella* and *Shigella* species, and *Campylobacter jejuni/coli*. Cultures for *Vibrio* and *Yersinia* species, *E. coli* O157:H7, and *Campylobacter* species other than *jejuni/coli* require additional media or incubation conditions and therefore require advance notification or communication with laboratory and infectious disease personnel.

Stool examination for parasites generally is indicated for patients with suggestive travel histories, who are immunocompromised, who suffer chronic or persistent diarrhea, or when the diarrheal illness is unresponsive to appropriate antimicrobial therapy. Stool examination for parasites is also indicated for gastrointestinal tract illnesses that appear to have a long incubation period. Requests for ova and parasite examination of a stool specimen will often enable identification of *Giardia lamblia* and *Entamoeba histolytica*, but a special request may be needed for detection of *Cryptosporidium parvum* and *Cyclospora cayetanensis*. Each laboratory may vary in its routine procedures for detecting parasites so it is important to contact your laboratory.

Blood cultures should be obtained when bacteremia or systemic infection are suspected.

Direct antigen detection tests and molecular biology techniques are available for rapid identification of certain bacterial, viral, and parasitic agents in clinical specimens. In some circumstances, microbiologic and chemical laboratory testing of vomitus or implicated food items also is warranted. For more information on laboratory procedures for

Table 1. Etiologic Agents to Consider for Various Manifestations of Foodborne Illnesses

Clinical Presentation	Potential Food-Related Agents to Consider
Gastroenteritis (vomiting as primary symptom; diarrhea also may be present)	Viral gastroenteritis, most commonly rotavirus in an infant or Norwalk-like virus in an older child or adult; or food poisoning due to preformed toxins (e.g. vomitoxin, <i>Staphylococcus aureus</i> toxin, <i>Bacillus cereus</i> toxin) and heavy metals.
Noninflammatory diarrhea (acute watery diarrhea without fever/dysentery; some cases may present with fever)*	Can be caused by virtually all enteric pathogens (bacterial, viral, parasitic) but is a classic symptom of: Enterotoxigenic <i>E. coli</i> <i>Vibrio cholerae</i> Enteric viruses (astroviruses, caliciviruses, enteric adenovirus, rotavirus) <i>Cryptosporidium parvum</i> <i>Cyclospora cayetanensis</i>
Inflammatory diarrhea (invasive gastroenteritis; grossly bloody stool and fever may be present)†	<i>Shigella</i> species <i>Campylobacter</i> species <i>Salmonella</i> species Enteroinvasive <i>E. coli</i> Enterohemorrhagic <i>E. coli</i> <i>Vibrio parahemolyticus</i> <i>Entamoeba histolytica</i> <i>Yersinia enterocolitica</i>
Persistent diarrhea (lasting ≥14 days)	Prolonged illness should prompt examination for parasites, particularly in travelers to mountainous or other areas where untreated water is consumed. Consider <i>Cyclospora cayetanensis</i> , <i>Cryptosporidium parvum</i> , <i>Entamoeba histolytica</i> , and <i>Giardia lamblia</i> .
Neurologic manifestations (e.g. paresthesias, respiratory depression, bronchospasm)	Botulism (<i>Clostridium botulinum</i> toxin) Organophosphate pesticides Thallium poisoning Scombroid fish poisoning (histamine, saurine) Ciguatera fish poisoning (ciguatoxin) Tetrodon fish poisoning (tetrodotoxin) Neurotoxic shellfish poisoning (brevitoxin) Paralytic shellfish poisoning (saxitoxin) Amnesic shellfish poisoning (domoic acid) Mushroom poisoning Guillain-Barré Syndrome (associated with infectious diarrhea due to <i>C. jejuni</i>)
Systemic illness	<i>Listeria monocytogenes</i> <i>Brucella</i> species <i>Trichinella spiralis</i> <i>Toxoplasma gondii</i> <i>Vibrio vulnificus</i> Hepatitis A virus

* Noninflammatory diarrhea is characterized by mucosal hypersecretion or decreased absorption without mucosal destruction and generally involves the small intestine. Some affected patients may be dehydrated because of severe watery diarrhea and may appear seriously ill. This is more common in the young and the elderly. Most patients experience minimal dehydration and appear mildly ill with scant physical findings. Illness typically occurs with abrupt onset and brief duration. Fever and systemic symptoms usually are absent (except for symptoms related directly to intestinal fluid loss).

† Inflammatory diarrhea is characterized by mucosal invasion with resulting inflammation and is caused by invasive or cytotoxic microbial pathogens. The diarrheal illness usually involves the large intestine and may be associated with fever, abdominal pain and tenderness, headache, nausea, vomiting, malaise, and myalgia. Stools may be bloody and may contain many fecal leukocytes.

the detection of foodborne pathogens, consult an appropriate medical specialist, clinical microbiologist, or state public health laboratory.

TREATING FOODBORNE ILLNESSES

Selection of appropriate treatment depends on identification of the responsible pathogen (if possible) and determining if specific therapy is available. Many episodes of acute gastroenteritis are self limiting and require fluid replacement and supportive care. Oral rehydration is indicated for patients who are mildly to moderately dehydrated; intravenous therapy may be required for more severe dehydration. Because many antidiarrheal agents have potentially serious adverse effects in infants and young children, their routine use is not recommended in this age group.

Choice of antimicrobial therapy should be based on:

- Clinical signs and symptoms;
- Organism detected in clinical specimens;
- Antimicrobial susceptibility tests; and
- Appropriateness of treating with an antibiotic (some enteric bacterial infections are best not treated).

Knowledge of the infectious agent and its antimicrobial susceptibility pattern allows the physician to initiate, change, or discontinue antimicrobial therapy. Such information also can support public health surveillance of infectious disease and antimicrobial resistance trends in the community. Antimicrobial resistance has increased for some enteric pathogens, which requires judicious use of this therapy.

SURVEILLANCE AND REPORTING OF FOODBORNE ILLNESSES

Reporting of foodborne illnesses in the United States began more than 50 years ago when state health officers, concerned about the high morbidity and mortality caused by typhoid fever and infantile diarrhea, recommended that cases of "enteric fever" be investigated and reported. The intent of investigating and reporting these cases was to obtain information about the role of food, milk, and water in outbreaks of gastrointestinal tract illness as the basis for public health actions. These early reporting efforts led to the enactment of important public health measures (e.g. the Pasteurized Milk Ordinance) that profoundly decreased the incidence of foodborne illnesses.

Often health care professionals may suspect foodborne illness either because of the organism involved or because of other available information, such as several ill patients who have eaten the same food. Health care professionals can serve as the eyes and ears for the health department by providing such information to the local or state public health authorities. Foodborne disease reporting is not only important for disease prevention and control, but more accurate assessments of the burden of foodborne illness in the community occur when physicians report foodborne illnesses to the local or state health department. In addition, reporting of cases of foodborne illness by practicing physicians to the local health department may help the health officer identify a foodborne disease outbreak in the community. This may lead to early identification and removal of contaminated products from the commercial market. If a restaurant or other food service establishment is identified as the source of the outbreak, health officers will work to correct inadequate food preparation practices, if necessary. If the home is the likely source of the contamination, health officers can institute public education about proper food handling

practices. Occasionally, reporting may lead to the identification of a previously unrecognized agent of foodborne illness. Reporting also may lead to identification and appropriate management of human carriers of known foodborne pathogens, especially those with high-risk occupations for disease transmission such as foodworkers.

Table 2 lists current reporting requirements for foodborne diseases and conditions in the United States. National reporting requirements are determined collaboratively by the Council of State and Territorial Epidemiologists and the Centers for Disease Control and Prevention (CDC).

Typically, the appropriate procedure for physicians to follow in reporting foodborne illnesses is to contact the local or state health department whenever they identify a specific notifiable disease. However, it is often unclear if a patient has a foodborne illness prior to diagnostic tests, so physicians should also report potential foodborne illnesses, such as when two or more patients present with a similar illness that may have resulted from the ingestion of a common food. Local health departments then report the illnesses to the state health department and determine if further investigation is warranted.

Each state health department reports foodborne illnesses to the CDC. The CDC compiles this data nationally and disseminates information to the public through annual summary reports. The CDC assists state and local public health authorities with epidemiologic investigations and the design of interventions to prevent and control food-related outbreaks. The CDC also coordinates a national network of public health laboratories, called PulseNet, which perform "molecular fingerprinting" of bacteria (by pulsed-field gel electrophoresis) to support epidemiologic investigations.

Thus, in addition to reporting cases of potential foodborne illnesses, it is important for physicians to report noticeable increases in unusual illnesses, symptom complexes, or disease patterns (even without definitive diagnosis) to public health authorities. Prompt reporting of unusual patterns of diarrheal/gastrointestinal tract illness, for example, can allow public health officials to initiate an epidemiologic investigation earlier than would be possible if the report awaited definitive etiologic diagnosis.

Finally, new information on food safety is constantly emerging. Recommendations and precautions for people at high risk are updated whenever new data about preventing foodborne illnesses become available. Physicians and other health care professionals need to be aware of and follow the most current information on food safety.

Table 2. Foodborne Diseases and Conditions Designated as Notifiable at the National Level, United States 2000

Notifiable BACTERIAL Foodborne Diseases and Conditions

Botulism
Brucellosis
Cholera
Escherichia coli O157:H7
Hemolytic uremic syndrome, post-diarrheal
Salmonellosis
Shigellosis
Typhoid fever

Notifiable VIRAL Foodborne Diseases and Conditions

Hepatitis A

Notifiable PARASITIC Foodborne Diseases and Conditions

Cryptosporidiosis
Cyclosporiasis
Trichinosis

In the United States, additional reporting requirements may be mandated by state and territorial laws and regulations. Details on specific state reporting requirements are available from the:

Council of State and Territorial Epidemiologists (telephone: 770 458-3811). Information is available electronically at <http://www.cste.org/reporting%20requirements.htm>.

Centers for Disease Control and Prevention *Morbidity and Mortality Weekly Report* [1999;48(21):447-448]. This information is available electronically at <http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/mm4821a4.htm>.

**Diagnosis and Management of Foodborne Illnesses:
A Primer for Physicians**

Foodborne Illnesses Table: Bacterial Agents

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Centers for Disease Control and Prevention

*Center for Food Safety and Applied Nutrition
Food and Drug Administration*

*Food Safety and Inspection Service
US Department of Agriculture*

January 2001

Foodborne Diseases and Conditions Designated as Notifiable at the National Level — United States 2000

In the United States, requirements for reporting diseases and conditions are mandated by state and territorial laws and/or regulations. However, physicians are highly encouraged to report foodborne illness that they may encounter in the event that an outbreak situation may be present. Reporting will facilitate the tracking of the outbreak and in fact, the case identified may even be the sentinel case!

Differences exist between states and territories as to which diseases and conditions are reportable. The Council of State and Territorial Epidemiologists (CSTE) and the Centers for Disease Control and Prevention (CDC) collaborate on which diseases and conditions are designated as nationally notifiable. Details on specific state requirements are located at <http://www.cste.org/reporting%20requirements.htm>. This information is also available by contacting CSTE at:

The Council of State and Territorial Epidemiologists (CSTE)
Suite 303; 2872 Woodcock Boulevard
Atlanta, Georgia 30341
Phone: 770 458-3811

Notifiable Bacterial Foodborne Diseases and Conditions

Botulism
Brucellosis
Cholera
Escherichia coli O157:H7
Hemolytic uremic syndrome, post-diarrheal
Salmonellosis
Shigellosis
Typhoid fever
Notifiable Viral Foodborne Diseases and Conditions
Hepatitis A
Notifiable Parasitic Foodborne Diseases and Conditions
Cryptosporidiosis
Cyclosporiasis
Trichinosis

References

Council of State and Territorial Epidemiologists. Available at:

<http://www.cste.org/reporting%20requirements.htm>.

Morbidity and Mortality Weekly Report. 1999; 48(21):447-448. Available at:

<http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/mm4821a4.htm>.

Toll-free Information Phone Numbers

USDA Meat and Poultry Hotline: 800 535-4555

FDA Safe Food Hotline: 888 SAFE-FOOD (723-3366)

CDC Voice Information System: 888 CDC-FAXX (232-3299)

Foodborne Illnesses (Bacterial)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Bacillus anthracis</i>	2 days to weeks	Nausea, vomiting, malaise, bloody diarrhea, acute abdominal pain.	Weeks	Insufficiently cooked contaminated meat.	Blood.	Penicillin is first choice for naturally acquired gastrointestinal anthrax. Ciprofloxacin is second option.
<i>Bacillus cereus</i> (diarrheal toxin)	10-16 hrs	Abdominal cramps, watery diarrhea, nausea.	24-48 hours	Meats, stews, gravies, vanilla sauce.	Testing not necessary, self-limiting (consider testing food and stool for toxin in outbreaks).	Supportive care, self-limiting.
<i>Bacillus cereus</i> (preformed enterotoxin)	1-6 hrs	Sudden onset of severe nausea and vomiting. Diarrhea may be present.	24 hrs	Improperly refrigerated cooked and fried rice, meats.	Normally a clinical diagnosis. Clinical laboratories do not routinely identify this organism. If indicated, send stool and food specimens to reference laboratory for culture and toxin identification.	Supportive care.
<i>Brucella abortus</i> , <i>B. melitensis</i> , and <i>B. suis</i>	7-21 days	Fever, chills, sweating, weakness, headache, muscle and joint pain, diarrhea, bloody stools during acute phase.	Weeks	Raw milk, goat cheese made from unpasteurized milk, contaminated meats.	Blood culture and positive serology.	<u>Acute:</u> Rifampin and doxycycline daily for ≥6 weeks. Infections with complications require combination therapy with rifampin, tetracycline and an aminoglycoside.
<i>Campylobacter jejuni</i>	2-5 days	Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody.	2-10 days	Raw and undercooked poultry, unpasteurized milk, contaminated water.	Routine stool culture; <i>Campylobacter</i> requires special media and incubation at 42°C to grow.	Supportive care. For severe cases, antibiotics such as erythromycin and quinolones may be indicated early in the diarrheal disease. Guillain-Barré syndrome can be a sequela.

(Continued) Foodborne Illnesses (Bacterial)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Clostridium botulinum</i> children and adults (preformed toxin)	12-72 hrs	Vomiting, diarrhea, blurred vision, diplopia, dysphagia, and descending muscle weakness.	Variable (from days to months). Can be complicated by respiratory failure and death.	Home-canned foods with a low acid content, improperly canned commercial foods, home-canned or fermented fish, herb-infused oils, baked potatoes in aluminum foil, cheese sauce, bottled garlic, foods held warm for extended periods of time (e.g. in a warm oven).	Stool, serum, and food can be tested for toxin. Stool and food can also be cultured for the organism. These tests can be performed at some State Health Department Laboratories and the CDC.	Supportive care. Botulinum antitoxin is helpful if given early in the course of the illness. Call 404 639-2206 or 404 639-3753 workdays, 404 639-2888 weekends and evenings.
<i>Clostridium botulinum</i> infants	3-30 days	In infants <12 months, lethargy, weakness, poor feeding, constipation, hypotonia, poor head control, poor gag and suck	Variable	Honey, home-canned vegetables and fruits.	Stool, serum, and food can be tested for toxin. Stool and food can also be cultured for the organism. These tests can be performed at some State Health Department laboratories and the CDC.	Supportive care. Botulism immune globulin can be obtained from the Infant Botulism Prevention Program, Health and Human Services, California (510 540-2646). Botulinum antitoxin is generally not recommended for infants.
<i>Clostridium perfringens</i> toxin	8-16 hrs	Watery diarrhea, nausea, abdominal cramps; fever is rare.	24-48 hrs	Meats, poultry, gravy, dried or precooked foods.	Stools can be tested for enterotoxin and cultured for organism. Because <i>Clostridium perfringens</i> can normally be found in stool, quantitative cultures must be done.	Supportive care. Antibiotics not indicated.

(Continued) Foodborne Illnesses (Bacterial)

Etiology	Incubation Period	Signs and Symptons	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Enterohemorrhagic <i>E. coli</i> (EHEC) including <i>E. coli</i> O157:H7 and other Shigatoxin-producing <i>E. coli</i> (STEC)	1-8 days	Severe diarrhea that is often bloody, abdominal pain and vomiting. Usually, little or no fever is present. More common in children <4 years.	5-10 days.	Undercooked beef, unpasteurized milk and juice, raw fruits and vegetables (e.g. sprouts), salami, salad dressing, and contaminated water.	Stool culture; <i>E. coli</i> O157:H7 requires special media to grow. If <i>E. coli</i> O157:H7 is suspected, specific testing must be requested. Shiga toxin testing may be done using commercial kits; positive isolates should be forwarded to public health laboratories for confirmation and serotyping.	Supportive care, monitor renal function, hemoglobin, and platelets closely. Studies indicate that antibiotics may be harmful. <i>E. coli</i> O157:H7 infection is also associated with hemolytic uremic syndrome, which can cause lifelong complications.
Enterotoxigenic <i>E. coli</i> (ETEC)	1-3 days	Watery diarrhea, abdominal cramps, some vomiting.	3->7 days	Water or food contaminated with human feces.	Stool culture. ETEC requires special laboratory techniques for identification. If suspected, must request specific testing.	Supportive care. Antibiotics are rarely needed except in severe cases. Recommended antibiotics include TMP-SMX and quinolones.
<i>Listeria monocytogenes</i>	9-48 hrs for gastrointestinal symptoms, 2-6 weeks for invasive disease At birth and infancy	Fever, muscle aches, and nausea or diarrhea. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. Elderly or immunocompromised patients may have bacteremia or meningitis. Infants infected from mother at risk for sepsis or meningitis.	Variable	Fresh soft cheeses, unpasteurized milk, inadequately pasteurized milk, ready-to-eat deli meats, hot dogs.	Blood or cerebrospinal fluid cultures. Asymptomatic fecal carriage occurs; therefore, stool culture usually not helpful. Antibody to listerolysin O may be helpful to identify outbreak retrospectively.	Supportive care and antibiotics; Intravenous ampicillin, penicillin, or TMP-SMX are recommended for invasive disease.

(Continued) Foodborne Illnesses (Bacterial)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Salmonella</i> spp.	1-3 days	Diarrhea, fever, abdominal cramps, vomiting. <i>S. typhi</i> and <i>S. paratyphi</i> produce typhoid with insidious onset characterized by fever, headache, constipation, malaise, chills, and myalgia; diarrhea is uncommon, and vomiting is usually not severe.	4-7 days	Contaminated eggs, poultry, unpasteurized milk or juice, cheese, contaminated raw fruits and vegetables (alfalfa sprouts, melons). <i>S. typhi</i> epidemics are often related to fecal contamination of water supplies or street-vended foods.	Routine stool cultures.	Supportive care. Other than for <i>S. typhi</i> , antibiotics are not indicated unless there is extra-intestinal spread, or the risk of extra-intestinal spread, of the infection. Consider ampicillin, gentamicin, TMP-SMX, or quinolones if indicated. A vaccine exists for <i>S. typhi</i> .
<i>Shigella</i> spp.	24-48 hrs	Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus.	4-7 days	Food or water contaminated with fecal material. Usually person-to-person spread, fecal-oral transmission. Ready-to-eat foods touched by infected food workers, raw vegetables, egg salads.	Routine stool cultures.	Supportive care. TMP/SMX recommended in the US if organism is susceptible; nalidixic acid or other quinolones may be indicated if organism is resistant, especially in developing countries.
<i>Staphylococcus aureus</i> (preformed enterotoxin)	1-6 hrs	Sudden onset of severe nausea and vomiting. Abdominal cramps. Diarrhea and fever may be present.	24-48 hrs	Unrefrigerated or improperly refrigerated meats, potato and egg salads, cream pastries.	Normally a clinical diagnosis. Stool, vomitus, and food can be tested for toxin and cultured if indicated.	Supportive care
<i>Vibrio cholerae</i> (toxin)	24-72 hrs	Profuse watery diarrhea and vomiting, which can lead to severe dehydration and death within hours.	3-7 days. Causes life-threatening dehydration.	Contaminated water, fish, shellfish, street-vended food.	Stool culture; <i>Vibrio cholerae</i> requires special media to grow. If <i>V. cholerae</i> is suspected, must request specific testing.	Supportive care with aggressive oral and intravenous rehydration. In cases of confirmed cholera, tetracycline or doxycycline is recommended for adults, and TMP-SMX for children (<8 years)

(Continued) Foodborne Illnesses (Bacterial)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Vibrio parahaemolyticus</i>	2-48 hrs	Watery diarrhea, abdominal cramps, nausea, vomiting.	2-5 days	Undercooked or raw seafood, such as fish, shellfish.	Stool cultures. <i>Vibrio parahaemolyticus</i> requires special media to grow. If <i>V. parahaemolyticus</i> is suspected, must request specific testing.	Supportive care. Antibiotics are recommended in severe cases: tetracycline, doxycycline, gentamicin, and cefotaxime.
<i>Vibrio vulnificus</i>	1-7 days	Vomiting, diarrhea, abdominal pain, bacteremia, and wound infections. More common in the immunocompromised, or in patients with chronic liver disease (presenting with bullous skin lesions).	2-8 days; can be fatal in patients with liver disease and the immunocompromised	Undercooked or raw shellfish, especially oysters; other contaminated seafood, and open wounds exposed to sea water.	Stool, wound, or blood cultures. <i>Vibrio vulnificus</i> requires special media to grow. If <i>V. vulnificus</i> is suspected, must request specific testing.	Supportive care and antibiotics; tetracycline, doxycycline, and ceftazidime are recommended.
<i>Yersinia enterocolytica</i> and <i>Y. pseudotuberculosis</i>	24-48 hrs	Appendicitis-like symptoms (diarrhea and vomiting, fever, and abdominal pain) occur primarily in older children and young adults. May have a scarlatiniform rash with <i>Y. pseudotuberculosis</i> .	1-3 weeks	Undercooked pork, unpasteurized milk, contaminated water. Infection has occurred in infants whose caregivers handled chitterlings, tofu.	Stool, vomitus or blood culture. <i>Yersinia</i> requires special media to grow. If suspected, must request specific testing. Serology is available in research and reference laboratories.	Supportive care, usually self-limiting. If septicemia or other invasive disease occurs, antibiotic therapy with gentamicin or cefotaxime (doxycycline and ciprofloxacin also effective).

Please call the state health department for more information on specific foodborne illnesses. These telephone numbers are available at: <http://www2.cdc.gov/mmwrinternational/relres.html>. See the reverse side for information hotlines and list of notifiable diseases.

**Diagnosis and Management of Foodborne Illnesses:
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Foodborne Illnesses Table: Viral Agents

American Medical Association

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US Department of Agriculture*

January 2001

Foodborne Diseases and Conditions Designated as Notifiable at the National Level — United States 2000

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Shigellosis
Typhoid fever
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Hepatitis A
Notifiable Parasitic Foodborne Diseases and Conditions
Cryptosporidiosis
Cyclosporiasis
Trichinosis

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Toll-free Information Phone Numbers

USDA Meat and Poultry Hotline: 800 535-4555

FDA Safe Food Hotline: 888 SAFE-FOOD (723-3366)

CDC Voice Information System: 888 CDC-FAXX (232-3299)

Foodborne Illnesses (Viral)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Hepatitis A	30 days average (15-50 days)	Diarrhea; dark urine; jaundice; and flu-like symptoms, (i.e., fever, headache, nausea, and abdominal pain).	Variable, 2 weeks-3 months	Shellfish harvested from contaminated waters, raw produce, uncooked foods and cooked foods that are not reheated after contact with infected food handler.	Increase in ALT, bilirubin. Positive IgM and anti-hepatitis A antibodies.	Supportive care. Prevention with immunization.
Norwalk-like viruses	24-48 hrs	Nausea, vomiting, watery, large-volume diarrhea; fever rare.	24-60 hrs	Poorly cooked shellfish; ready-to-eat foods touched by infected food workers; salads, sandwiches, ice, cookies, fruit.	Clinical diagnosis, negative bacterial cultures, >fourfold increase in antibody titers of Norwalk antibodies, acute and convalescent, special viral assays in reference lab. Stool is negative for WBCs.	Supportive care. Bismuth sulfate.
Rotavirus	1-3 days	Vomiting, watery diarrhea, low-grade fever. Temporary lactose intolerance may occur. Infants and children, elderly, and immunocompromised are especially vulnerable.	4-8 days	Fecally contaminated foods. Ready-to-eat foods touched by infected food workers (salads, fruits).	Identification of virus in stool via immunoassay.	Supportive care. Severe diarrhea may require fluid and electrolyte replacement.
Other viral agents (astroviruses, caliciviruses, adenoviruses, parvoviruses)	10-70 hrs	Nausea, vomiting, diarrhea, malaise, abdominal pain, headache, fever.	2-9 days	Fecally contaminated foods. Ready-to-eat foods touched by infected food workers. Some shellfish.	Identification of the virus in early acute stool samples. Serology.	Supportive care, usually mild, self-limiting.

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Foodborne Illnesses Table: Parasitic Agents

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Foodborne Illnesses (Parasitic)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Cryptosporidium parvum</i>	7 days average (2-28 days)	Cramping, abdominal pain, watery diarrhea; fever and vomiting may be present and may be relapsing.	Days to weeks	Contaminated water supply, vegetables, fruits, unpasteurized milk.	Must be specifically requested. May need to examine water or food.	Supportive care, self-limited. If severe consider paromomycin for 7 days.
<i>Cyclospora cayentanensis</i>	1-11 days	Fatigue, protracted diarrhea, often relapsing.	May be protracted (several weeks to several months)	Imported berries, contaminated water, lettuce	Request specific examination of the stool for <i>Cyclospora</i> . May need to examine water or food.	TMP/SMX for 7 days.
<i>Entamoeba histolytica</i>	2-3 days to 1-4 weeks	Bloody diarrhea, frequent bowel movements (looks like <i>Shigella</i>), lower abdominal pain.	Months	Fecal-oral; may contaminate water and food.	Examination of stool for cysts and parasites — at least 3 samples. Serology for long-term infections.	Metronidazole and iodoquinol.
<i>Giardia lamblia</i>	1-4 weeks	Acute or chronic diarrhea, flatulence, bloating.	Weeks	Drinking water, other food sources.	Examination of stool for ova and parasites — at least 3 samples.	Metronidazole.
<i>Toxoplasma gondii</i>	6-10 days	Generally asymptomatic, 20% may develop cervical lymphadenopathy and/or a flu-like illness. In immunocompromised patients: central nervous system (CNS) disease, myocarditis, or pneumonitis is often seen.	Months	Accidental ingestion of contaminated substances (e.g. putting hands in mouth after gardening or cleaning cat litter box); raw or partly cooked pork, lamb, or venison.	Isolation of parasites from blood or other body fluids; observation of parasites in patient specimens, such as broncho-alveolar lavage material or lymph node biopsy. Detection of organisms is rare, but serology can be a useful adjunct in diagnosing toxoplasmosis. Toxoplasma-specific IgM antibodies should be confirmed by a reference laboratory. However, IgM antibodies may persist for 6-18 months and thus may	Asymptomatic healthy, but infected, persons do not require treatment. Spiramycin or pyrimethamine plus sulfadiazine may be used for immunocompromised persons or pregnant women, in specific cases.

(Continued) Foodborne Illnesses (Parasitic)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
<i>Toxoplasma gondii</i> (congenital infection)	In infants at birth	Treatment of the mother may reduce severity and/or incidence of congenital infection. Most infected infants have few symptoms at birth. Later, they will generally develop signs of congenital toxoplasmosis (mental retardation, severely impaired eyesight, cerebral palsy, seizures) unless the infection is treated.		Passed from mother (who acquired acute infection during pregnancy) to child.	not necessarily indicate recent infection. For congenital infection: isolation of <i>T. gondii</i> from placenta, umbilical cord, or infant blood. PCR of white blood cells, CSF, or amniotic fluid (reference laboratory). IgM and IgA serology (reference laboratory).	
<i>Trichinella spiralis</i>	1-2 days to 2-8 weeks	Nausea, vomiting, diarrhea, abdominal discomfort followed by fever, myalgias, periorbital edema.	Months	Raw or undercooked contaminated meat, usually pork or wild game meat, e.g. bear or moose.	Positive serology or demonstration of larvae via muscle biopsy. Increase in eosinophils.	Supportive care + mebendazole.

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Foodborne Illnesses Table: Non-Infectious Agents

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Foodborne Illnesses (Non-Infectious)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Antimony	5 min-8 hrs. usually <1 hr	Vomiting, metallic taste.	Usually self-limited	Metallic container.	Identification of metal in beverage or food.	Supportive care.
Arsenic	Few hrs	Vomiting, colic, diarrhea.	Several days	Contaminated food.	Urine. May cause eosinophilia.	Gastric lavage, BAL (dimercaprol).
Cadmium	5 min-8 hrs. usually <1 hr	Nausea, vomiting, myalgia, increase in salivation, stomach pain.	Usually self-limited	Seafood, oysters, clams, lobster, grains, peanuts.	Identification of metal in food.	Supportive care.
Ciguatera fish poisoning (ciguatera toxin).	2-6 hrs	GI: abdominal pain, nausea, vomiting, diarrhea.	Days to weeks to months	A variety of large reef fish. Grouper, red snapper, amberjack, and barracuda (most common).	Radioassay for toxin in fish or a consistent history.	Supportive care, IV mannitol. Children more vulnerable.
	3 hrs	Neurologic: paresthesias, reversal of hot or cold, pain, weakness.				
	2-5 days	Cardiovascular: bradycardia, hypotension, increase in T wave abnormalities.				
Copper	5 min-8 hrs. usually <1 hr	Nausea, vomiting, blue or green vomitus.	Usually self-limited	Metallic container.	Identification of metal in beverage or food.	Supportive care.
Mercury	1 week or longer	Numbness, weakness of legs, spastic paralysis, impaired vision, blindness, coma. Pregnant women and the developing fetus are especially vulnerable.	May be protracted	Fish exposed to organic mercury, grains treated with mercury fungicides.	Analysis of blood, hair.	Supportive care.
Mushroom toxins, short-acting (museinol, muscarine, psilocybin, coprius artemetaris, ibotenic acid)	<2 hrs	Vomiting, diarrhea, confusion, visual disturbance, salivation, diaphoresis, hallucinations, disulfiram-like reaction, confusion, visual disturbance.	Self-limited	Wild mushrooms (cooking may not destroy these toxins).	Typical syndrome and mushroom identified or demonstration of the toxin.	Supportive care.

(Continued) Foodborne Illnesses (Non-Infectious)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Mushroom toxin, long-acting (amanita)	4-8 hrs diarrhea; 24-48 hrs liver failure	Diarrhea, abdominal cramps, leading to hepatic and renal failure.	Often fatal	Mushrooms.	Typical syndrome and mushroom identified and/or demonstration of the toxin.	Supportive care; life-threatening, may need life support.
Nitrite poisoning	1-2 hrs	Nausea, vomiting, cyanosis, headache, dizziness, weakness, loss of consciousness, chocolate-brown colored blood.	Usually self-limited	Cured meats, any contaminated foods, spinach exposed to excessive nitrication.	Analysis of the food, blood	Supportive care, methylene blue.
Pesticides (organophosphates or carbamates)	Few min to few hrs	Nausea, vomiting, abdominal cramps, diarrhea, headache, nervousness, blurred vision, twitching, convulsions.	Usually self-limited	Any contaminated food.	Analysis of the food, blood.	Atropine.
Puffer fish (tetrodotoxin)	<30 min	Paresthesias, vomiting, diarrhea, abdominal pain, ascending paralysis, respiratory failure.	Death usually in 4-6 hrs	Puffer fish.	Detection of tetrodotoxin in fish.	Life-threatening, may need respiratory support.
Scombroid (histamine)	1 min-3 hrs	Flushing, rash, burning sensation of skin, mouth and throat, dizziness, urticaria, paresthesias.	3-6 hrs	Fish: bluefin, tuna, skipjack, mackerel, marlin, and mahi mahi.	Demonstration of histamine in food or clinical diagnosis.	Supportive care, antihistamines.
Shellfish toxins (diarrheic, neurotoxic, amnesic)	Diarrheic shellfish poisoning (DSP) — 30 min to 2 hrs	Nausea, vomiting, diarrhea, and abdominal pain accompanied by chills, headache, and fever.	Hrs to 2-3 days	A variety of shellfish, primarily mussels, oysters, scallops, and shellfish from the Florida coast and the Gulf of Mexico.	Detection of the toxin in shellfish; high pressure liquid chromatography.	Supportive care, generally self-limiting. Elderly are especially sensitive to ASP.

(Continued) Foodborne Illnesses (Non-Infectious)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
	Neurotoxic shellfish poisoning (NSP) — few min to hrs	Tingling and numbness of lips, tongue, and throat, muscular aches, dizziness, reversal of the sensations of hot and cold, diarrhea, and vomiting.				
	Amnesic shellfish poisoning (ASP) — 24-48 hrs	Vomiting, diarrhea, abdominal pain and neurological problems such as confusion, memory loss, disorientation, seizure, coma.				
Shellfish toxins (paralytic shellfish poisoning)	30 min-3 hrs	Diarrhea, nausea, vomiting leading to paresthesias of mouth, lips, weakness, dysphasia, dysphonia, respiratory paralysis.	Days	Scallops, mussels, clams, cockles.	Detection of toxin in food or water where fish are located; high pressure liquid chromatography.	Life-threatening, may need respiratory support.
Sodium fluoride	Few min to 2 hrs	Salty or soapy taste, numbness of mouth, vomiting, diarrhea, dilated pupils, spasms, pallor, shock, collapse.	Usually self-limited	Dry foods (such as dry milk, flour, baking powder, cake mixes) contaminated with sodium fluoride-containing insecticides and rodenticides.	Testing of vomitus or gastric washings. Analysis of the food.	Supportive care.
Thallium	Few hrs	Nausea, vomiting, diarrhea, painful paresthesias, motor polyneuropathy, hair loss.	Several days	Contaminated food.	Urine, hair.	Supportive care.
Tin	5 min-8 hrs. usually <1 hr	Nausea, vomiting, diarrhea.	Usually self-limited	Metallic container.	Analysis of the food.	Supportive care.
Vomitoxin	Few min to 3 hrs	Nausea, headache, abdominal pain, vomiting.	Usually self-limited	Grains, such as wheat, corn, barley.	Analysis of the food.	Supportive care.
Zinc	Few hrs	Stomach cramps, nausea, vomiting, diarrhea, myalgias.	Usually self-limited	Metallic container.	Analysis of the food, blood and feces, saliva or urine.	Supportive care.

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BOTULISM POISONING: PATIENT SCENARIO

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January 2001

This learning scenario can be used to reinforce medical management information pertaining to foodborne illnesses, such as that provided from the other booklets of this primer. This case study provides questions that need to be considered when dealing with a potential case of foodborne illness. Answers are provided immediately following the questions to enhance the learning process.

Similar learning scenarios are also available for other foodborne pathogens.

BOTULISM POISONING: A PATIENT SCENARIO

On Sunday morning at 6am, you receive a call from the wife of a 35-year-old man who awoke complaining of dry mouth and blurred vision. His symptoms rapidly progressed over the next 2 hours to include diplopia, dysphagia, and weakness in his arms. You ask to talk with him directly, but he is having difficulty speaking. He was previously healthy.

You meet them in the local emergency department. On physical examination, he is afebrile with a heart rate of 80 beats per minute, a blood pressure of 120/80 mm Hg, and a respiratory rate of 12 breaths per minute. His pulse oximetry is 98% oxygen saturation. He has a hoarse voice, bilateral ptosis, a weak gag reflex, and bilateral proximal upper extremity weakness. He has no lower extremity weakness. Sensation is intact in all extremities. His mental status is normal.

What is the possible differential diagnosis for his chief complaint?

- Guillain-Barré Syndrome
- *Myasthenia gravis*
- *Tick paralysis*
- *Cerebral vascular accident*
- *Botulism intoxication*
- *Heavy metal (thallium, arsenic, lead) or organophosphate toxicity*

What additional information would assist in the diagnosis?

- *Has he had a recent flu-like illness?*
- *Has he had a recent gastrointestinal tract illness?*
- *Has he had similar symptoms before?*
- *Is there a family history of hypertension, stroke, or other neurological disorders?*
- *Has he found any ticks on himself or recently been in a tick-infested area?*
- *Had he had any occupational or recreational exposure to heavy metals or organophosphates?*
- *Has he eaten any home-canned foods? What foods has he consumed in the last 72 hours?*
- *Has anyone else in the home been ill?*

The patient denies having a flu-like illness within the last month. Neither he nor his family members have had similar symptoms. There is no family history of stroke or other neurological disorders, and he does not have hypertension or hypercholesterolemia. He has not discovered any ticks on himself or in his environment, and he has not been

camping, hiking, or in any tick-infested area within the last week. He has had no occupational or recreational exposures to heavy metals or organophosphates. He denies eating any home-canned foods. He cannot remember everything he ate during the last 72 hours, but recalls eating lunch at a coffee shop near his office. He and his wife hosted a barbecue one evening at which they served grilled chicken, vegetables, and home-made ice cream. The night before onset of his symptoms, they ate at their favorite Italian restaurant where they shared a calamari appetizer, had salad prepared by the waiter at the table, and shared an entree of Fettuccine Fra Diablo. They finished the meal with a cappuccino and tiramisu.

How does this information assist with the diagnosis?

Guillain-Barré Syndrome (GBS) is usually preceded by a diarrheal or flu-like illness within 5 days to 3 weeks before onset of symptoms. It characteristically presents with an ascending pattern of muscle weakness; however, the Miller-Fisher variant of GBS may present with a descending pattern of muscle weakness. Myasthenia gravis is characterized by muscle fatigue after exercise, and the symptoms fluctuate over time. Tick-borne paralysis should be ruled out by a thorough examination for a tick; it also usually presents with an ascending pattern of muscle paralysis. Heavy metal poisoning may cause gastrointestinal tract symptoms, alopecia, mental disturbances (irritability, concentration difficulties, and somnolence) and peripheral neuropathy. Organophosphate toxicity causes a cholinergic syndrome. Botulism is a probable diagnosis despite the absence of a history of consumption of home-canned foods; bilateral cranial nerve palsies and a descending pattern of weakness are classic symptoms of botulism. The incubation period for this illness is typically 18 to 36 hours; therefore, it is important to obtain as complete a dietary history as possible for this time period. It is important that the local or state health department be contacted immediately when botulism is suspected.

What diagnostic tests are needed?

Five diagnostic tests may help pinpoint the diagnosis:

- 1. Electromyogram (EMG) with rapid repetitive stimulation of the affected area at 20-50 Hertz*
- 2. Tensilon test*
- 3. Lumbar puncture — Cerebrospinal fluid (CSF) protein*
- 4. Computerized tomography (CT) scan of the head*
- 5. Magnetic resonance imaging (MRI)*

In cases of botulism intoxication, an EMG of the affected muscles done with rapid repetitive stimulation at 20-50 Hertz will usually demonstrate a potentiated response in muscle action potentials; whereas in GBS and myasthenia gravis rapid repetitive stimulation yields flat and decremental responses, respectively. Administration of Tensilon (edrophonium) will help confirm the diagnosis of myasthenia gravis by showing improved muscle strength after injection of this compound. CSF protein levels are normal in botulism but are almost always elevated in GBS except early in the course of the illness. A CT scan of the head with and without contrast may help rule out a significant cerebrovascular accident or encephalitis. An MRI may be helpful to distinguish soft tissue abnormalities or midbrain lesions. If the history suggests heavy metal or organophosphate toxicity, special tests including evaluation of hair or blood can be done.

You order the EMG, Tensilon test, CSF studies, and the CT scan of the head. The EMG shows a potentiated muscle action potential with rapid repetitive stimulation at 20 Hertz, consistent with botulism intoxication. The Tensilon test is negative (no improvement with Tensilon) and the CSF protein, glucose, and cell counts are normal. CT scan of the head shows no meningeal enhancement or evidence of intracranial hemorrhage.

What diagnostic test(s) will confirm the diagnosis of botulism?

To confirm the diagnosis of botulism, serum, stool, and any leftover suspect food should be tested for the presence of botulinum toxin. The test is a mouse bioassay. Mice are given injections of dilutions of sera, stool, and food extract followed by injections of monovalent antitoxins A, B, and E and polyvalent antitoxin ABCEF, and observed for signs of botulism and death. Stool and food also can be cultured for the bacterium Clostridium botulinum, which produces the toxins.

To order tests for botulinum toxin and C. botulinum culture, the state health department should be contacted. It can provide information about what specimens should be collected and how they should be stored, and will forward the specimens to the state public health laboratory or to the Centers for Disease Control and Prevention (CDC) if the state does not have the capacity to test for botulism.

What treatment is needed?

The most important treatment for botulism is supportive care. The patient's cardio-respiratory status should be monitored continuously in an intensive care unit. His respiratory function as measured by forced vital capacity should be monitored frequently, and he should be placed on assisted ventilation at the first sign of respiratory decompensation. Induced vomiting or gastric lavage are sometimes recommended to eliminate unabsorbed toxin from the stomach. These therapies are only done with a protected airway when the risk of aspiration is low. Cathartic agents or enemas are sometimes recommended to remove unabsorbed toxin from the gastrointestinal tract.

The only pharmacological treatment for botulism is antitoxin. The currently available licensed antitoxins are equine antibodies to toxin; one product has antibodies to toxin types A and B, the most common causes of botulism, and the other product has antibodies to toxin types A, B, and E. Use of the product containing antibodies to type E toxin is reserved for patients at high risk of type E botulism intoxication including those patients who were exposed to botulinum toxin in Alaska, or those who have a history of consumption of preserved fish, fish eggs, seal, walrus, whale, or beaver tail.

Antitoxin is most effective in preventing progression of the illness and shortening the duration of ventilatory failure if administered early (24-48 hours) after the onset of neurologic symptoms. If a diagnosis of botulism intoxication is strongly suspected, antitoxin should be administered promptly and should not be delayed until the diagnosis is confirmed. Hypersensitivity reactions have been reported in up to 9% of patients who receive antitoxin; therefore, skin testing is recommended prior to administration of antitoxin. Antimicrobials have not been of benefit in the treatment of foodborne botulism intoxication.

Botulinum antitoxin is obtained from quarantine stations with permission for release from the CDC and some state health departments; this should be arranged through the state health department. Epidemiologists within the Foodborne and Diarrheal Diseases

branch are available 24 hours a day through the CDC; you can contact the on-call epidemiologist at CDC by calling the security desk at 404 639-2888 or at 404 639-2206 during business hours (8:30am – 4:30pm EST).

Should this case be reported to the local health department?

All suspected cases of botulism intoxication should be reported **immediately** to the local health department. It will then notify the state health department, which will notify the CDC. In collaboration with state health departments, the CDC will assist with laboratory tests, arrange for treatment with botulinum antitoxin, and notify the Food and Drug Administration (FDA). The FDA is responsible for investigating commercial products possibly contaminated with botulinum toxin and assessing the need for a recall. In the present scenario, the patient denied consuming home-canned foods, suggesting the source of botulinum toxin was a commercial product. A contaminated, widely distributed commercial product could be a potential hazard to many people. State and local health officials with the assistance of the FDA will begin a more thorough investigation, searching for other cases and identifying suspect food exposures.

What was the most likely source of botulism intoxication in this patient? What commercial foods are potential sources of botulism intoxication?

Home-canned foods are responsible for over 90% of all cases of foodborne botulism. However, commercial products have also occasionally been implicated. A product with an anaerobic environment allows for the growth of *C. botulinum* spores and toxin production. The toxins are resistant to digestion by gastric enzymes. In the present scenario, the salad dressing was contaminated. The patient's wife had the house Dijon on her salad, but the patient had garlic-infused olive oil. The oil created an anaerobic environment, which allowed *C. botulinum* spores that were on the garlic to germinate and produce toxin. The oil was not acidified or refrigerated; these procedures could have prevented *C. botulinum* spore growth and toxin production.

How can botulism be prevented?

C. botulinum spores are highly heat-resistant; commercial and home-canning procedures should be done at the appropriate temperature and pressure to kill these spores. A pressure cooker must be used to can vegetables at home safely because it can reach temperatures above boiling (>212°F or >100°C). Information on safe home-canning procedures is available from local county extension home economists. Botulinum toxin is readily inactivated by heat; nevertheless, the FDA recommends that any food suspected to contain botulinum toxin be destroyed. Proper acidification and refrigeration of commercial products such as herb-infused oils will inhibit spore growth and toxin production.

Growth of *C. botulinum* in food may cause container lids to bulge and cause foods to have a bad odor. Commercial or home-canned food products with bulging lids or a bad odor should not be eaten. However, botulism has also been associated with foods that smell and taste normally; therefore, the smell and taste of food should not be used to determine if it is contaminated.

The patient's serum and stool contained type A botulinum toxin. An investigation by the state and local health department found four other cases of intoxication associated

with the garlic-infused oil at the restaurant. Two of the patients had been hospitalized with a diagnosis of stroke, one had been hospitalized with a diagnosis of myasthenia gravis, and one had been hospitalized with an unknown diagnosis. The patient in this scenario required assisted ventilation, but his respiratory muscle function improved after he received antitoxin. He fully recovered within 3 weeks of the onset of his symptoms.

**Diagnosis and Management of Foodborne Illnesses:
A Primer for Physicians**

***ESCHERICHIA COLI* O157:H7 INFECTION: PATIENT SCENARIO**

American Medical Association

Centers for Disease Control and Prevention

*Center for Food Safety and Applied Nutrition
Food and Drug Administration*

*Food Safety and Inspection Service
US Department of Agriculture*

January 2001

This learning scenario can be used to reinforce medical management information pertaining to foodborne illnesses, such as that provided from the other booklets of this primer. This case study provides questions that need to be considered when dealing with a potential case of foodborne illness. Answers are provided immediately following the questions to enhance the learning process.

Similar learning scenarios are also available for other foodborne pathogens.

***ESCHERICHIA COLI* O157:H7 INFECTION: A PATIENT SCENARIO**

Pierre is a 3-year-old who was brought to the outpatient clinic by his mother. He had a 2-day history of severe abdominal cramps and diarrhea (5 to 7 watery stools daily). He has had no fever or vomiting. His mother was especially alarmed this morning when she noticed blood in his diarrheal stools. He refuses to eat, but has been drinking a few ounces of liquids every 2 to 3 hours. She has been unable to assess his urine output because of his diarrhea. Pierre previously has been healthy, and has had no significant weight loss or other symptoms.

On physical examination, he is afebrile with normal blood pressure, respirations and capillary refill. His oral mucosa and skin are dry, but his skin turgor is normal. His abdomen has hyperactive bowel sounds, mild distension, and diffuse tenderness, but is soft with no rebound or guarding. He has loose stool in the rectal vault, which is grossly bloody.

What is the possible differential diagnosis for his chief complaint?

- *Inflammatory bowel disease*
- *Polyps*
- *Meckel's diverticulum*
- *Intussusception*
- *Coagulopathy*
- *Infectious enteritis*

What additional information would assist with the diagnosis?

- *Has he had similar symptoms before?*
- *Is there a family history of inflammatory bowel disease?*
- *Is there a family history of bleeding disorders?*
- *Do other household members or close acquaintances have diarrhea or bloody diarrhea?*
- *Does he attend child care? If "yes," have there been reports of diarrhea or bloody diarrhea in other children attending the child care facility?*

There is no family history of inflammatory bowel disease or bleeding disorders. Pierre's mother reports that he usually has 1 to 2 episodes of self-limited diarrhea each year, but has never had bloody diarrhea. No other household members have had diarrhea or bloody diarrhea; however, his grandmother and 15-year-old sister have had mild abdominal cramps. He does not attend child care; his mother has not heard that any of his playmates have been ill.

How does this information assist with the diagnosis?

Inflammatory bowel disease is an unlikely diagnosis because of his young age, the acute onset of diarrhea, and the absence of a history of recurrent diarrhea and other symptoms such as weight loss, fever, and arthritis. Even if inflammatory bowel disease is suspected, it would be appropriate to rule out an infectious etiology before proceeding with further work-up. Polyps and Meckel's diverticulum usually cause painless hematochezia. They can be complicated by intussusception, which is characterized by a tense abdomen and absent bowel sounds. If intussusception is suspected, evaluation with abdominal radiography and therapeutic enema may be performed. There is no family history of coagulopathic disorders and Pierre has not had a history of abnormal hemostasis. The symptoms of abdominal pain in other household members suggest an infectious etiology.

The most likely diagnosis is infectious enteritis. What additional historical information could assist with the identification of the etiologic agent?

- *What foods has he consumed within the last week? Specifically, has he consumed undercooked ground beef, unpasteurized juices, or alfalfa sprouts?*
- *Has he traveled to a foreign country within the last month?*
- *Does he have any pets, specifically reptiles such as an iguana or turtle?*
- *What is the family's source of drinking water?*
- *Have there been any outbreaks of diarrhea in the community, at church, or at his sibling's school?*
- *Has he recently visited a petting zoo?*

The most worrisome diagnosis in a child with bloody diarrhea is infection with Shiga toxin-producing *E. coli*, the most common being *E. coli* O157:H7. *E. coli* O157:H7 is associated with serious complications including the hemolytic uremic syndrome (HUS). *Campylobacter*, *Salmonella*, and *Shigella* infections also may cause bloody stools. The incubation periods for these four bacterial infections are 1 to 8 days, 2 to 5 days, 1 to 3 days, and 1 to 2 days, respectively. Therefore, any contaminated food that he consumed within the prior week could have contributed to his illness. Pierre's favorite and most frequently consumed foods are hot dogs and spaghetti. He usually has cereal for breakfast, although he occasionally eats an egg, which he prefers sunny-side-up. He has hot dogs or spaghetti with cheese or fruit for lunch, and has dinner with other family members. During the last week, his mother recalls that dinner has included baked chicken, meatloaf, hamburgers, and pizza from the local pizzeria. She reports the meatloaf was well cooked to 165°C; she checked the internal temperature with a meat thermometer before serving. The burger appeared to be well cooked; it was brown in the middle. The family doesn't eat alfalfa sprouts.

The family vacationed at a United States resort but has not traveled to a foreign country for 2 years. They have a menagerie of pets including a dog, a cat, two hamsters, a parrot, a Sicilian worm, and a new iguana. Pierre has not visited a petting zoo nor had contact with other animals. They live on a vegetable farm; they have no cows, pigs, or sheep. Their main source of water is from a well, but they use bottled water for drinking. They know of no other outbreaks of diarrhea or bloody diarrhea in the community, church,

or school. The local health department has not had other reports of bloody diarrhea or *E. coli* O157:H7 infection from the community.

Just as you are about to leave the room, the mother recalls that the nanny, who is a vegetarian and loves to introduce Pierre to various “veggie delights,” related a story last week about how she prepared for Pierre a veggie sandwich with cucumber, cream cheese, and alfalfa sprouts. The nanny said he ate only one bite of the sandwich and refused the rest, begging for spaghetti instead.

Are diagnostic tests needed?

Identification of the cause of Pierre’s diarrhea is important because it will influence antimicrobial therapy, follow-up, and prognosis, and may obviate the need for invasive diagnostic procedures such as laparotomy or colonoscopy. The child’s dietary, environmental, and travel history suggest he is at high risk for three of the infectious agents discussed above (i.e., Salmonella, Campylobacter, and E. coli O157:H7). For example, E. coli O157:H7 infection has been associated with undercooked ground beef. Although the hamburger he consumed appeared to be well-cooked (brown in the middle), recent studies have shown that a significant proportion of ground beef patties are brown in the middle before they have reached an internal temperature high enough to kill E. coli O157:H7 (160°F). Recently, E. coli O157:H7 outbreaks have also been associated with fresh produce such as unpasteurized apple juice, cabbage, and alfalfa sprouts. The infectious dose of E. coli O157:H7 is low; ground beef patties with less than 700 organisms per uncooked patty have been associated with illness.

Pierre also could have Campylobacter infection. Transmission of Campylobacter infection has been associated with the preparation or consumption of raw or undercooked chicken, and consumption of contaminated water and unpasteurized milk. Campylobacter can cross-contaminate fruits and vegetables when they contact surfaces that may have touched raw chicken such as knives and cutting boards. Campylobacter also has a low infectious dose.

Finally, Pierre is at risk for Salmonella infection. Children living in households with reptiles, such as iguanas, are at increased risk. Since 1985, Salmonella serotype Enteritidis has emerged as a pathogen in raw shell eggs. Chickens may become bacteremic with Salmonella Enteritidis, which seeds the eggs transovarially. Therefore, an egg that is clean and has a normal appearance may be contaminated. Many outbreaks of Salmonella infection have been associated with foods that contain raw or undercooked eggs. Salmonella infections also have been associated with undercooked meat and poultry and fresh fruits and vegetables.

Shigella is a less likely cause of his illness; it usually causes outbreaks in child care settings where person-to-person transmission is common. However, food products such as raw produce can be contaminated with Shigella and lead to illness.

What diagnostic tests are needed?

Routine stool cultures will detect common enteric bacterial enteropathogens such as Campylobacter and Salmonella. However, many clinical laboratories do not screen stools routinely for E. coli O157:H7; it is incumbent upon the clinician to request such testing when E. coli O157:H7 infection is suspected, especially for patients with bloody diarrhea. Bloody diarrhea is very common in patients with E. coli O157:H7 infection, although the absence of bloody diarrhea does not rule out the diagnosis. Culturing for E. coli O157:H7

is relatively simple and inexpensive; this bacteria does not ferment sorbitol and, therefore, appears as a colorless colony on sorbitol-MacConkey (SMAC) agar. Colorless colonies on SMAC agar are selected and assayed for O157 antigen using a commercial kit. All strains of E. coli that agglutinate with the O157 antibody are presumed to be E. coli O157:H7 and should be reported to the local public health authorities. Confirmation of the H flagellar antigen is usually done by a reference laboratory. Recently, rapid diagnostic kits that test for the presence of Shiga toxin have become available for use in clinical laboratories. Specimens that test positive should be forwarded to the public health laboratory for further evaluation.

The lab calls you with the results of the stool culture. Pierre's stool grew E. coli O157:H7.

What treatment is needed?

The treatment of E. coli O157:H7 infection is largely supportive. Dehydration should be treated with liberal oral or intravenous rehydration to reduce the stress of volume depletion on the kidneys. This is often best accomplished in the hospital with intravenous fluids and close monitoring.

The use of antimicrobial therapy is controversial. Data suggest that antimicrobial agents may be harmful. Antimicrobial agents may kill or disrupt intracolonic E. coli O157:H7 organisms, allowing them to release toxin that is absorbed systemically, and may increase the risk of hemolytic uremic syndrome (HUS). Antimicrobials also have not been shown to decrease illness severity.

Antidiarrheal medications, especially those that slow intestinal motility, should be avoided. They may delay clearance of the organism, increase the time for toxin absorption, and increase the risk and severity of HUS.

What are the complications of E. coli O157:H7 infection? What follow-up is needed?

Within one week after the onset of diarrhea, 10% of children <10 years of age with E. coli O157:H7 infection develop HUS, which is characterized by hemolytic anemia, thrombocytopenia, oliguria-anuria, and rarely seizures. Children with visible blood in their stools are at increased risk of developing HUS. If HUS has not developed within 2 to 3 days after the diarrhea has resolved, this complication is unlikely to occur. Pierre's parents should be instructed to watch for signs and symptoms of HUS, and he should be evaluated by a clinician if he develops these. Regardless of other symptoms, if his diarrhea continues longer than 4 to 5 days, a complete blood count, platelet count, and blood smear analysis should be considered.

Adults with E. coli O157:H7 infection may develop HUS or thrombotic thrombocytopenic purpura (TTP), a microangiopathic disorder that resembles HUS but is accompanied by neurologic abnormalities. The mortality rate with E. coli O157:H7-associated HUS is approximately 3% to 5% in children, but may be higher in elderly patients who develop TTP.

Should this case be reported to the local health department?

All cases of E. coli O157:H7 infection, post-diarrheal HUS, and post-diarrheal TTP should be reported to the local public health department. The ease with which

person-to-person transmission occurs, especially from children who are not toilet-trained, makes diagnosis and reporting very important. The health department can use this information to identify clusters of infection, discover common sources of exposure, and take measures to remove the source of the infection (i.e., remove the contaminated food) and prevent transmission of the organism to others.

In addition to reporting cases of E. coli O157:H7 infection, it also is helpful to send E. coli O157:H7 isolates to the local health department. Isolates can be subtyped by pulsed-field gel electrophoresis (PFGE) to determine if other reported cases of E. coli O157:H7 infection are related. Many state public health laboratories now have the capacity to do molecular subtyping. In 1995, the Centers for Disease Control and Prevention (CDC) initiated PulseNet, a national computer network of public health laboratories that employs standard methods to subtype E. coli O157:H7 strains. As of May 2000, there were 34 public health laboratories from various states participating in PulseNet, as well as laboratories from the US Department of Agriculture Food Safety and Inspection Service (USDA-FSIS), and the Food and Drug Administration (FDA). Laboratories within the network can transmit PFGE patterns electronically to a databank at the CDC where they are automatically compared to patterns of other isolates. If the patterns submitted by laboratories in different locations during a defined time period are found to match, the CDC computer will alert PulseNet participants of a possible multistate outbreak. The information can be used by the CDC, the USDA-FSIS, the FDA, and the state health departments to rapidly initiate outbreak investigations and preventive actions.

How can *E. coli* O157:H7 infection be prevented?

Consumers should avoid eating undercooked ground beef. The most reliable way to determine whether ground beef is cooked to a temperature high enough to destroy E. coli O157:H7 is to use a meat thermometer and cook to an internal temperature of 160°F. Use of meat thermometers when cooking ground beef is especially important for children, older persons, and the immunocompromised who are at highest risk of contracting foodborne diseases, of developing severe foodborne illness, and of dying from foodborne diseases. If a meat thermometer is not available, consumers should not eat ground beef that is pink in the middle. If served an undercooked (pink) hamburger at a restaurant, consumers should send it back and have it cooked longer.

Consumers should avoid unpasteurized juices and milk, and should wash all fresh produce thoroughly before consumption. Children under 5 years of age, immunocompromised persons, and the elderly should avoid eating alfalfa sprouts. Infected persons, especially children, should be encouraged to wash their hands carefully and frequently with soap and water to reduce the risk of spreading the infection.

Preventive measures to reduce the number of cattle that carry E. coli O157:H7 and to reduce contamination of meat during slaughter and grinding are also underway.

Pierre continued to have bloody diarrhea. On the fifth day of illness, a complete blood count showed a hemoglobin of 9g/dL and a platelet count of 79 x 10⁹/L. A peripheral blood smear revealed evidence of hemolysis. Despite hydration and appropriate supportive care, he developed renal insufficiency, which required dialysis. His renal function improved after 4 weeks of dialysis, and he eventually recovered with no other complications.

**Diagnosis and Management of Foodborne Illnesses
A Primer for Physicians**

**ENTEROTOXIGENIC *ESCHERICHIA COLI* O157:H7 INFECTION:
PATIENT SCENARIO**

American Medical Association

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*Center for Food Safety and Applied Nutrition
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January 2001

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Similar learning scenarios are also available for other foodborne pathogens.

ENTEROTOXIGENIC *ESCHERICHIA COLI* INFECTION: A PATIENT SCENARIO

Stephanie is a 35-year-old who presents to your office with a 4-day history of abdominal cramps, headache, and 8-10 episodes/day of watery diarrhea. She has had a few episodes of vomiting but denies fever or bloody diarrhea. She has no complaints of dysuria or back pain. She was previously healthy.

Physical examination reveals she is afebrile with a blood pressure of 120/80 mm Hg and normal capillary refill. She has a soft and diffusely tender abdomen with hyperactive bowel sounds but no rebound or guarding. She has no costovertebral angle (CVA) tenderness and stool examination is negative for occult blood.

What is the possible differential diagnosis for her chief complaint?

- *Infectious gastroenteritis*
- *Irritable bowel syndrome*
- *Carbohydrate malabsorption (lactose intolerance)*
- *Endocrinopathies — hyperthyroidism, adrenal insufficiency*
- *Carcinoid tumor*

What additional information would assist with the diagnosis?

- *Has she ever had similar symptoms before?*
- *Is there a family history of malabsorption syndromes or endocrinopathies?*
- *Does she have other signs or symptoms such as weight loss, bloating, history of milk intolerance, flushing, tachycardia, or weight loss?*
- *What is her occupation?*
- *Has she traveled to a foreign country within the last month?*
- *Do other household members or close acquaintances have gastrointestinal tract symptoms or diarrhea?*

Stephanie reports she rarely has diarrhea, usually less than one episode a year. She denies a family history of malabsorptive or endocrine disorders, and has had none of the other symptoms listed above. She is an art therapist for a local children's mental health clinic, and is not aware that any of her patients have had gastrointestinal tract symptoms or diarrhea. Other household members are well; however, several of her extended family members and friends who attended her younger sibling's high school graduation picnic last weekend also have diarrhea. In fact, her aunt (the hostess of the party) called the local health department because she was concerned that the illnesses might be associated with food that was served at the event from a local restaurant (Restaurant A). Stephanie is uncertain what her aunt learned from the health department.

How does this information assist with the diagnosis?

This information suggests that Stephanie's case of diarrhea may be part of a larger outbreak. The most appropriate next step in her management is to contact the local health department and ask if it is aware of an outbreak of foodborne disease, or if it has had reports of diarrheal illness from other patrons or partygoers who consumed food from Restaurant A. The health department also may provide information about the etiologic agent or suspected etiologic agent, and provide recommendations for treatment.

You call the health department and learn that there is an outbreak of foodborne illness associated with consumption of food from Restaurant A. Similar to Stephanie, most patients have had abdominal cramps and watery diarrhea, few have had fever, and no one has reported bloody diarrhea. The median incubation period is 42 hours and the diarrhea lasts 3 to 7 days. At this time, neither the vehicle of transmission nor the etiologic agent has been identified. The health department officials request that you obtain a stool culture and report the results back to them.

What are the possible etiologic agents of this outbreak of foodborne illness?

Based on its investigation, the health department suspects the vehicle for this outbreak was a food item consumed at Restaurant A, 42 hours before the illness. If this is so, the most likely etiologic agent is a bacterial pathogen as suggested by the moderate incubation period, the lack of vomiting, and the significant duration of illness. Foodborne illness caused by the most common enteric viral pathogens typically has a shorter incubation period, more vomiting, less diarrhea, and a shorter duration of symptoms. By contrast, parasitic infections usually have a longer incubation period (1 to 2 weeks) and a longer duration of illness (>2 to 3 weeks).

The bacterial enteric pathogens that should be considered as possible sources of the outbreak are Campylobacter and Salmonella, the two most common causes of bacterial foodborne diseases in the United States. Typically these infections are characterized by fever in addition to abdominal cramps and diarrhea, and bloody stools are possible but not common. E. coli O157:H7 infection should also be considered, although bloody stools frequently are reported with this infection. Vibrios and enterotoxigenic E. coli rarely are diagnosed causes of foodborne illness in the United States but should remain in the differential diagnosis given the profuse watery diarrhea that characterizes this outbreak.

A stool culture for bacterial enteropathogens including *Salmonella*, *Shigella*, *Campylobacter*, *Yersinia*, and *E. coli* O157:H7 is negative. You report this information to the health department and learn that the routine stool cultures from other patients in the outbreak are also negative. The state public health laboratory examined stools for common viral enteric pathogens; those preliminary studies are negative.

What other pathogen(s) should be considered? How are they identified?

The most likely etiologic agent of this outbreak is enterotoxigenic E. coli (ETEC). ETEC is a common cause of traveler's diarrhea and is an increasingly recognized cause of foodborne illness in the United States. This bacterium elaborates one or more enterotoxins that cause intestinal secretion and diarrhea. The incubation period, symptoms, and duration of diarrhea described for persons involved in this outbreak are characteristic of

ETEC infection. Furthermore, clinical laboratories and most state and territorial public health laboratories do not have the capacity to test for ETEC in stool; the identification process requires a complex procedure with expensive reagents. Therefore, if the characteristics of a diarrheal illness are suggestive of a bacterial etiology but routine stool cultures are negative for common bacterial and viral enteropathogens, ETEC should be strongly suspected as the etiologic agent. Local health departments can arrange to have stools tested for ETEC at the state public health laboratory or at the Centers for Disease Control and Prevention.

What should the patient know about ETEC infections? What is the next step in management?

ETEC is the most common cause of “traveler’s diarrhea” and is becoming a more frequently recognized cause of foodborne illness in the United States. The illness is self-limited; the diarrhea usually lasts fewer than 5 days.

Because the duration of illness is short, ETEC infections generally do not require antibiotic therapy. Treatment is mainly supportive including oral or intravenous fluids for rehydration. Occasionally antibiotics, such as ciprofloxacin for adults and trimethoprim/sulfamethoxazole for children, are given if the patient has an underlying illness or if the diarrhea is severe. ETEC infection may cause dehydration but there are generally no serious complications or long-term sequelae from this infection.

Patients should be reminded to wash their hands with warm running water and soap after using the bathroom and before and after eating to avoid transmitting the infection to others. They should tell friends who might have attended other parties at which food from Restaurant A was served to call the local health department to report cases of illness.

How can ETEC infections be prevented?

Human and animal wastes are the ultimate source of ETEC contamination. Travelers in developing countries should avoid foods that could be contaminated with bacteria. They should eat thoroughly cooked foods prepared in facilities that practice proper food handling techniques. They should avoid unpasteurized juices and milk, and drink bottled beverages, or water that has been boiled or adequately chlorinated. They should avoid raw foods (e.g. salads, peeled fruit or vegetables, raw seafood, undercooked meat or poultry) and foods from street vendors.

In the United States, proper food preparation and handling practices will reduce the risk of ETEC infections. This should include careful handwashing with warm water and soap after using the bathroom and before and after preparing or consuming food.

Stephanie’s watery diarrhea resolved after 5 days. She was mildly dehydrated and missed 3 days of work, but recovered completely with no long-term complications.

**Diagnosis and Management of Foodborne Illnesses:
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***LISTERIA MONOCYTOGENES* INFECTION: PATIENT SCENARIO**

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LISTERIA MONOCYTOGENES INFECTION: A PATIENT SCENARIO

Sandy, the pregnant mother of a 2-year-old boy presents to your office at 28 weeks' gestation complaining of fever, chills, headache, myalgias, and sore throat. She has previously been healthy and has had an uncomplicated pregnancy. She is somewhat concerned about the illness because she just returned from Kenya a few weeks earlier.

Physical examination reveals a temperature of 102°F, pulse of 100 beats per minute, respirations of 20 breaths per minute, and a blood pressure of 100/60 mm Hg. Her posterior pharynx is nonerythematous with no tonsillar enlargement or exudates. She has no remarkable cervical lymphadenopathy. Breath sounds are clear and equal bilaterally, and her abdomen is remarkable only for her gravid uterus. She has normal capillary refill and no petechiae or rashes.

What should be included in the differential diagnosis?

- *Viral illness*
 - Influenza*
 - Adenovirus*
 - Coxsackie virus*
 - Primary herpes*
 - Primary Human Immunodeficiency Virus (HIV)*
 - Infectious Mononucleosis (Epstein-Barr Virus [EBV])*
 - Cytomegalovirus (CMV)*
 - Parvovirus*
- *Tickborne diseases*
 - Ehrlichiosis*
 - Babesiosis*
 - Rocky Mountain Spotted Fever*
- *Bacterial diseases*
 - Mycoplasma*
 - Group A Streptococcus pharyngitis*
 - Gonococcal pharyngitis*
 - Bacteremia (Listeria monocytogenes, Group B Streptococcus, Salmonella typhi)*
- *Parasitic diseases*
 - Malaria*

What additional information would assist with the diagnosis?

- *What season of the year is it?*
- *Do other household members have similar symptoms?*
- *What is her occupation?*
- *Has she been around ill children or adolescents?*
- *Has she been camping, hiking, or exposed to ticks?*
- *When did she travel to Kenya; where did she visit?*
- *Did she take malaria prophylaxis, and what medication?*
- *Has she been sexually active with more than one partner during the last 6 months?*
- *Is she on any medications currently?*
- *Has she had any animal exposures?*

It is early autumn and no other household members are ill. She is a legal secretary; none of the clients with whom she has worked have been ill, and she has not been around ill children or adolescents. Her 2-year-old son attends day care; he has been well and there have been no reports of ill children from the center director. She traveled to Nairobi, Kenya, at 15 weeks' gestation, and was well throughout the trip. She took mefloquine for malaria prophylaxis once weekly, and did not forget any doses. She has not been camping or hiking, and is unaware of tick exposure. She recalls only one day of mild illness during her pregnancy, which occurred about 5 weeks earlier and was characterized by 2 or 3 episodes of vomiting and a few loose stools. She attributed the symptoms to a change in diet; she increased milk and fruit consumption in an attempt to be "healthy for the baby." She and her husband have been happily married for 5 years; she denies having any other sexual partners. She is currently taking no medications, and she has had no animal exposures except for her pet dog.

How does this information assist with the diagnosis?

Influenza is an unlikely diagnosis; it is early autumn and Sandy has not been exposed to other ill persons at home or work. Her sexual history indicates her risk for HIV, herpes, and gonorrhea infection is low. Her recreational history suggests tickborne disease is improbable. Malaria is a possible diagnosis but she has had no fever in the 12 weeks since she returned from Nairobi, a city over 5,000 feet above sea level where the risk of contracting malaria is low. Mycoplasma, adenovirus, coxsackie virus, group A Streptococcus, CMV, EBV, parvovirus, and other viral agents could account for her symptoms. She could also be bacteremic, but has no symptoms to indicate she is septic.

What diagnostic tests are needed?

Consider rapid antigen screen for group A Streptococcus

Consider rapid test for infectious mononucleosis

Consider urinalysis and thick and thin blood smear

The rapid tests for group A *Streptococcus* and infectious mononucleosis are negative. Urinalysis is negative for bacteria and thick and thin blood smear shows no evidence of malaria parasites. One hour after an appropriate dose of acetaminophen, her temperature is 101°F, and she continues to have flu-like symptoms. Her blood pressure,

capillary refill, and the rest of her physical examination are normal. She returns home with instructions to call you if she develops new symptoms, her symptoms worsen, or her symptoms do not abate in the next 24 hours.

Four weeks later, you receive another call from Sandy. She reports her water just broke. She has otherwise been well; the flu-like symptoms she had at her last visit resolved within 48 hours. You meet her in the labor and delivery suite, and confirm by physical examination that her membranes are prematurely ruptured. Despite tocolytic therapy, her labor progresses and she delivers an infant girl at 32 weeks' gestation. After delivery, Sandy has a normal post-partum course. The infant is admitted to the neonatal intensive care unit and requires supplemental oxygen for the first few hours of life, but soon after is weaned off oxygen and tolerates her first feeding without difficulty. At 22 hours of age, the infant's nurse notes she is tachypneic with intercostal retractions. The infant's blood pressure is in the low range of normal. The nurse is repeating the blood pressure measurement when the infant becomes bradycardic with delayed capillary refill. Despite full resuscitation efforts including intubation and inotropic support, the infant dies. The next morning you receive a report from the microbiology laboratory that blood cultures drawn just before the infant's death are growing gram-positive short rods/cocci.

What were the most likely causes of the infant's sepsis?

- *Group B Streptococcus*
- *Staphylococcus aureus*
- *Coagulase-negative Staphylococcus*
- *Enterococcus*
- *a-hemolytic Streptococcus*
- *Listeria monocytogenes*

Group B Streptococcus and *Escherichia coli* (a gram-negative rod) are responsible for up to 75% of cases of early-onset neonatal sepsis. *Listeria monocytogenes*, a less common cause of early-onset neonatal sepsis, also causes an illness that clinically parallels that of group B *Streptococcus*; infants are infected in utero and develop illness at birth or shortly thereafter.

The following morning, the microbiology laboratory calls to report it has identified the gram-positive short rods/cocci in the blood as *Listeria monocytogenes*.

What, if anything, could have been done to prevent this infant's death?

Listeriosis is an uncommon disease; approximately 1,200 cases of *Listeria monocytogenes* infection are reported each year in the United States. Up to one third of these infections occur in pregnant women, and can be complicated by maternal bacteremia, fetal loss, or infant bacteremia and meningitis. The symptoms associated with listeriosis during pregnancy are often nonspecific and may imitate those of influenza. These flu-like symptoms coincide with the bacteremic phase of infection. In pregnant women with a febrile illness, appropriate clinical management may include obtaining blood cultures to rule out listeriosis.

*Fetal infection most likely results from transplacental transmission of maternal bacteremia. Neonatal infection can be prevented if maternal *Listeria monocytogenes* is treated with the appropriate antibiotics during pregnancy.*

Listeria has been epidemiologically linked to such foods as fresh soft cheeses, ready-to-eat deli meats, hot dogs, and unpasteurized and inadequately pasteurized milk. Its ability to grow at temperatures as low as 3°C permits multiplication in refrigerated foods. Any one of these could have been the vector for this case.

*All pregnant women should receive dietary counseling to avoid foods that increase the risk of *Listeria monocytogenes* infection. They should be advised to avoid unpasteurized milk and cheeses made from unpasteurized milk (particularly fresh soft cheeses) during pregnancy. All pregnant women should cook (until steaming hot) leftover foods or ready-to-eat foods such as hot dogs, before eating, and wash their hands carefully to avoid cross-contamination if preparing these foods for others.*

Other groups at high risk for listeriosis are elderly and immunocompromised patients. They frequently present with sepsis or meningitis. People in these high-risk groups should also receive dietary counseling to avoid high-risk foods.

**Diagnosis and Management of Foodborne Illnesses:
A Primer for Physicians**

CLINICAL VIGNETTES: *WHAT'S YOUR CALL?*

American Medical Association

Centers for Disease Control and Prevention

*Center for Food Safety and Applied Nutrition
Food and Drug Administration*

*Food Safety and Inspection Service
US Department of Agriculture*

January 2001

PATIENT VIGNETTES — WHAT'S YOUR CALL?

The following clinical vignettes are provided for your self-evaluation. All are possible situations that may present at your practice. The Clinical Considerations booklet and the Foodborne Illnesses Tables that are also part of this primer will provide the information necessary for you to adequately address these clinical situations. Note that these vignettes include both infectious and noninfectious forms of foodborne illness.

For the following clinical vignettes, choose the best answer from the choices listed at the end of the vignettes:

A — likely diagnosis; choose the best possible answer listed on “answer selections” page under **A** selections.

B — most appropriate choice to confirm the diagnosis (there may be more than one correct answer — list all of them). Choose from the possible answers listed on “answer selections” page under the **B** section.

Finally, decide whether the situation warrants reporting to the local or state health department.

Clinical Vignettes

I. You receive a long-distance call from a patient who is an outdoorsman. He is with a group that collected and ate some wild mushrooms less than 2 hours ago. Several members of the group have since developed vomiting, diarrhea, and some mental confusion.

A — likely diagnosis: _____
B — most appropriate test to confirm etiology/follow-up action: _____
 Report to the health department? Yes No

II. A newborn child has symptoms of sepsis. Cerebrospinal fluid studies are consistent with meningitis. The mother had a flu-like syndrome prior to delivery.

A — likely diagnosis: _____
B — most appropriate test to confirm etiology/follow-up action: _____
 Report to the health department? Yes No

III. This patient has just returned today from Latin America following a 2-day business trip where he reports eating several meals of fish that he bought from street vendors around his hotel. He feels very ill with profuse, watery diarrhea and vomiting.

A — likely diagnosis: _____
B — most appropriate test to confirm etiology/follow-up action: _____
 Report to the health department? Yes No

IV. An 18-month child is brought to your office with fever, bloody diarrhea, and some vomiting. She has been drinking unpasteurized milk in the last 48 hours. No other family members are ill.

A — likely diagnosis: _____
B — most appropriate test to confirm etiology/follow-up action: _____
 Report to the health department? Yes No

V. A patient calls and states that he and several family members are ill with severe vomiting. They ate at a church picnic 4 hours earlier.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

VI. A patient calls and states that most family members have developed severe vomiting, about 1 hour after eating at a picnic. They ate barbecued beef, chips, potato salad, and homemade root beer. Some are complaining of a metallic taste.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

VII. A patient has had chronic intermittent diarrhea for about 3 weeks. There is no fever or vomiting and no blood in the stool. The patient travels to Latin America and Eastern Europe frequently, most recently 2 weeks ago.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

VIII. The parents of a 6-month old infant are concerned because she is listless and weak. The infant is feeding poorly, has poor head control, and is constipated. There is no fever or vomiting.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

IX. A businessman who travels frequently is ill with fatigue, jaundice, abdominal pain and diarrhea. About 1 month ago, he returned from an international trip during which he consumed raw oysters.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department Yes No

X. Several members of a single family are ill with abdominal cramps and watery diarrhea. They just returned from visiting friends on the East Coast of the United States where they consumed raw oysters 48 hours ago.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

XI. A minister at a local church calls to report that many members began developing watery diarrhea on the morning after the annual ham dinner fundraiser. Some people also reported nausea and abdominal cramps, but no one has fever or bloody stools.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

XII. You receive a long-distance call from a patient on a fishing vacation off the coast of Belize. Her family has been eating a variety of local fish and shellfish that they caught. She reports that several family members developed abdominal pain, severe diarrhea, and weakness the morning after they consumed the seafood for dinner. One family member began having difficulty speaking later on that same night.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

XIII. A family in a rural community is worried that their father may be having a stroke. He is complaining of double vision and is having trouble swallowing. They have a large garden and eat home-canned vegetables.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

XIV. A 2-year-old child who attends day care presents with abdominal cramps and severe bloody diarrhea, which has been present for 2 days. He has no fever.

A — likely diagnosis: _____

B — most appropriate test to confirm etiology/follow-up action: _____

Report to the health department? Yes No

ANSWER CHOICES

A: Choose from any of these possible etiologies:

1. Intoxication from preformed toxins of *Staphylococcus aureus* or *Bacillus cereus*
2. Intoxication from toxins produced *in vivo* by *Clostridium perfringens*
3. *Salmonella* or *Campylobacter* are possible.
4. E. coli O157:H7
5. Norwalk-like viruses, *Vibrio parahemolyticus*, and other *Vibrio* infections
6. *Vibrio cholerae* infection
7. Botulism must be ruled out
8. *Listeria monocytogenes sepsis*
9. *Cryptosporidium parvum*
10. *Cyclospora cayetanensis*
11. A form of metal poisoning
12. A form of mushroom poisoning
13. Likely fish/shellfish toxin
14. *Giardia lamblia*
15. *Trichinella spiralis*
16. Hepatitis A virus

B: Choose from any of these following tests/actions

1. Clinical diagnosis; laboratory tests may not always be indicated.
2. Generally detected on routine stool cultures.
3. Generally, a reference laboratory is needed to identify the toxin from food, stool, or vomitus.
4. Important to identify causative organism for public health reasons.

5. Send stool samples to health department (*Vibrio cholerae*, other *Vibrios*, *E. coli* O157:H7, special toxin tests, *Clostridium perfringens*, *Clostridium botulinum*).
6. Not detected by routine stool cultures (*E. coli* O157:H7, *Vibrio cholerae*, other *Vibrios*).
7. Should test for viral agents.
8. For cysts, ova, and parasite detection, at least 3 stool samples must be collected. Sometimes the organism may still be missed; thus sampling via endoscopy may be necessary.
9. Test for appropriate metal.
10. Special test needed to identify a fish toxin.
11. Consult a mycologist to identify the mushroom.
12. Blood culture is the best source for diagnosis.
13. Blood test helpful to identify the agent.
14. May need acute and convalescent serum or viral cultures.

Answers

Question number	Choice for A	Choice(s) for B	Report to health department?
I	12	11	Yes
II	8	12	Yes
III	6	5, 6	Yes
IV	3	2	Yes
V	1	1, 3	Yes
VI	11	9	Yes
VII	14	8	Yes
VIII	7	5	Yes
IX	16	7, 13, 14	Yes
X	5	5, 6, 7	Yes
XI	2	1, 5	Yes
XII	13	10	Yes
XIII	7	5	Yes
XIV	4	5, 6	Yes

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SUGGESTED FOOD SAFETY RESOURCES AND READING LIST

American Medical Association

Centers for Disease Control and Prevention

*Center for Food Safety and Applied Nutrition
Food and Drug Administration*

*Food Safety and Inspection Service
US Department of Agriculture*

January 2001

SUGGESTED RESOURCES

General Information

CDC Food Safety Information	http://www.cdc.gov/foodsafety
Continuing Medical Education (CDC)	http://www2.cdc.gov/mmwr/cme/conted.html
US Government Food Safety Information Gateway	http://www.foodsafety.gov/
Fight BAC!™ Education Campaign	http://www.fightbac.org
Foodborne Illness Education Information Center	http://www.nal.usda.gov/fnic/foodborne/
foodborn.htm	
Public Health Partners — Networks and Resources	http://www.cdc.gov/other.htm
Bad Bug Book (FDA)	http://www.cfsan.fda.gov/~mow/intro.html
Traveler's Health Information (CDC)	http://www.cdc.gov/travel/index.htm

Professional Organizations

American Academy of Family Physicians	http://www.aafp.org/
American Medical Association	http://www.ama-assn.org/
Infectious Diseases Society of America	http://www.idsociety.org/MAIN.HTM
American Academy of Pediatrics	http://www.aap.org

State and Local Organizations

Association of Food and Drug Officials	http://www.afdo.org
Association of Public Health Laboratories (APHL)	http://www.aphl.org/
Association of State and Territorial Health Officials (ASTHO)	http://www.astho.org/
Council of State and Territorial Epidemiologists (CSTE)	http://www.cste.org/
National Public Health Information Coalition (NPHIC)	http://www.nphic.org/
National Association of County and City Health Officials (NACCHO)	http://www.naccho.org/
State Health Departments search engine	http://search.cdc.gov/shd/search2.htm

Government

US Department of Agriculture (USDA)	
Food Safety and Inspection Service	http://www.fsis.usda.gov
Food and Drug Administration	http://www.fda.gov
Centers for Disease Control and Prevention	http://www.cdc.gov
State and local government agencies	http://www.foodsafety.gov/~fsg/fsggov.html
Role of Government Agencies in Food Safety	http://vm.cfsan.fda.gov/~lrd/foodteram.html

Reports and Journals

CDC, Morbidity and Mortality Weekly Report	http://www.cdc.gov/epo/mmwr/mmwr.html
CDC, Emerging Infectious Diseases Journal	http://www.cdc.gov/ncidod/eid/index.htm

Toll-free Information Phone Numbers

USDA Meat and Poultry Hotline: 800 535-4555
 FDA Safe Food Hotline: 888 SAFE FOOD (723-3366)
 CDC Voice Information System: 888 CDC-FAXX (232-3299)

SUGGESTED READING LIST

General Reading

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CAMPYLOBACTER

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AVOID FOODBORNE ILLNESS: FIGHT BAC!TM

The US food supply is among the safest in the world, but organisms that you can't see, smell, or taste — bacteria, viruses and tiny parasites — are everywhere in the environment. These microorganisms — called pathogens — can invade food and cause illness, sometimes severe and even life-threatening illness, especially in young children, older adults, and persons with weakened immune systems. In pregnant women, foodborne illness can endanger their unborn babies.

The most common symptoms of foodborne illness are diarrhea, abdominal cramps, vomiting, head- or muscle-aches, and fever. Symptoms usually appear 12 to 72 hours after eating contaminated food but may occur between 30 minutes and 4 weeks later. Most people recover within 4 to 7 days without needing antibiotic treatment.

If symptoms are severe or the ill person is very young, very old, pregnant, or already ill, call your doctor immediately.

Who Is At Risk

If you are among those at high risk, you need to be aware of and follow the most current information on food safety. Young children, pregnant women, older adults, and persons with weakened immune systems are at a higher risk for foodborne illness. Immune systems may be weakened by medical treatments, such as steroids or chemotherapy, or by conditions, such as AIDS, cancer, or diabetes. You are also at increased risk if you suffer from liver disease or alcoholism or if you have decreased stomach acidity (due to gastric surgery or the regular use of antacids).

If You Are At Risk

If you face a higher risk of foodborne illness, you are advised not to eat:

- Raw fish or shellfish, including oysters, clams, mussels, and scallops
- Raw or unpasteurized milk or cheeses
- Soft cheeses, such as feta, Brie, Camembert, blue-veined, and Mexican-style cheese (Hard cheeses, processed cheeses, cream cheese, cottage cheese, and yogurt need not be avoided)
- Raw or undercooked eggs or foods containing raw or lightly cooked eggs, including certain salad dressings, cookie and cake batters, sauces, and beverages such as unpasteurized egg nog (Foods made from commercially pasteurized eggs are safe to eat)
- Raw or undercooked meat or poultry
- Raw sprouts (Alfalfa, clover, and radish)
- Unpasteurized fruit or vegetable juices (These juices will carry a warning label)

It is also important to reheat some foods that are bought pre-cooked, because they can become contaminated with pathogens after they have been processed and packaged. **These foods include:** hot dogs, luncheon meats (cold cuts), fermented and dry sausage, and other deli-style meat and poultry products. New information on food safety is constantly emerging. Recommendations and precautions for people at high risk are updated as scientists learn more about preventing foodborne illness.

EVERYONE SHOULD FOLLOW THESE FOUR SIMPLE STEPS TO FOOD SAFETY

1. Clean: Wash hands and surfaces often.

Bacteria, viruses, and parasites can be spread throughout the kitchen and get onto cutting boards, utensils, and countertops. Here's how to Fight BAC![™]:

- Wash your hands with hot, soapy water before and after handling food and after using the bathroom, changing diapers, and handling pets.
- Wash your cutting boards, dishes, utensils, and countertops with hot, soapy water after preparing each food item and before you go on to the next food.
- Important: Rinse raw produce in water. Don't use soap or detergents. If necessary, use a small vegetable brush to remove surface dirt.

2. Separate: Don't cross-contaminate.

Cross-contamination is the word for how bacteria, viruses, and parasites can be spread from one food product to another. This is especially true when handling raw meat, poultry, seafood, and eggs, so keep these foods and their juices away from ready-to-eat foods. Here's how to Fight BAC![™]:

- Separate raw meat, poultry, and seafood from other foods in your grocery shopping cart and in your refrigerator.
- If possible, use a different cutting board for raw meat, poultry and seafood products.
- Always wash hands, cutting boards, dishes, and utensils with hot, soapy water after they come in contact with raw meat, poultry, seafood, and eggs.
- Use separate plates for cooked food and raw foods.

3. Cook: Cook to proper temperatures.

Food safety experts agree that foods are properly cooked when they are heated for a long enough time and at a high enough temperature to kill the harmful pathogens that cause foodborne illness. The best way to Fight BAC![™] is to:

- Use a clean thermometer that measures the internal temperature of cooked food to make sure meat, poultry, and casseroles are cooked to the temperatures in the chart at right.
- Cook eggs until the yolk and white are firm. If you use recipes in which eggs remain raw or only partially cooked, use pasteurized eggs.
- Fish should be opaque and flake easily with a fork.
- When cooking in a microwave oven, make sure there are no cold spots where pathogens can survive. For best results, cover food, stir, and rotate for even cooking. If there is no turntable, rotate the dish by hand once or twice during cooking.
- Bring sauces, soups, and gravy to a boil when reheating. Heat other leftovers thoroughly to at least 165°F.

4. Chill: Refrigerate promptly.

Refrigerate foods quickly because cold temperatures keep harmful pathogens from growing and multiplying. So, set your refrigerator no higher than 40°F and the freezer at 0°F. Check these temperatures occasionally with an appliance thermometer. Then, Fight BAC!™ by following these steps:

- Refrigerate or freeze perishables, prepared foods, and leftovers within two hours or sooner.
- Never defrost food at room temperature. Thaw food in the refrigerator, under cold running water, or in the microwave.
- Marinate foods in the refrigerator.
- Divide large amounts of leftovers into shallow containers for quick cooling in the refrigerator.
- Don't pack the refrigerator. Cool air must circulate to keep food safe.

Learn more about Fight BAC!™ at: www.fightbac.org

For more information:

US Department of Agriculture, Meat and Poultry
Hotline — 800 535-4555, TTY: 800 256-7076

US Food and Drug Administration, Food Information
Hotline — 888 SAFEFOOD
www.foodsafety.gov

Safe Cooking Temperatures	
Raw food	Internal temperature
Ground Products	
Hamburger	160°F
Beef, veal, lamb, pork	160°F
Beef, Veal, Lamb	
Roasts & steaks	
<i>medium-rare</i>	145°F
<i>medium</i>	160°F
<i>well-done</i>	170°F
Pork	
Chops, roasts, ribs	
<i>medium</i>	160°F
<i>well-done</i>	170°F
Ham, fresh	160°F
Sausage, fresh	160°F
Poultry	
Chicken, whole & pieces	180°F
Duck	180°F
Turkey (<i>unstuffed</i>)	180°F
Whole	180°F
Breast	170°F
Dark meat	180°F
Stuffing (<i>cooked separately</i>)	165°F
Eggs	
Fried, poached	<i>Yolk & white are firm</i>
Casseroles	160°F
Sauces, custards	160°F
Seafood	
Fin Fish	<i>Flesh opaque & flakes easily with fork</i>
Shrimp, Lobster & Crabs	<i>Shells red and flesh pearly & opaque</i>
Clams, Oysters & Mussels	<i>Shells are open</i>

PROGRAM EVALUATION FORM

Please circle your answers and add comments as desired. Please fax this form back to: L J Tan, PhD at 312 464-5841, or see back side for mailing instructions.

1. The primer increased my ability to recognize foodborne illnesses and increased the likelihood that I will consider such illnesses in my patients.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Comment:

2. The primer increased my knowledge and skills in the diagnosis and management of foodborne illnesses.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Comment:

3. This primer increased my knowledge of the role of public health authorities in the prevention and control of foodborne disease outbreaks.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Comment:

4. It is important to talk to my patients about food safety.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Comment:

5. As formatted, this primer is a useful physician education tool.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Comment:

6. The amount of information presented was appropriate for my needs.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Comment:

7. I will recommend this primer to my colleagues.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Comment:

8. I would like to receive regular updates of this primer.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Comment:

9. I would like to see a similar physician education program for other clinical issues.

1. *Strongly agree* 2. *Agree* 3. *Undecided* 4. *Disagree* 5. *Strongly disagree*

Suggested topics:

10. How long did it take you to work through this primer? _____

Provide any additional comments about this primer, your experiences with foodborne illnesses, and suggestions for future physician education efforts:

Please fax the completed survey to: L J Tan, PhD at 312 464-5841 or fold on the dotted lines with the mailing side out, tape, and mail this form back with first class postage. Thank you.

Diagnosis and Management of Foodborne Illnesses: A Primer for Physicians
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Center for Food Safety and Applied Nutrition, Food and Drug Administration
Food Safety and Inspection Service, US Department of Agriculture

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**Continuing Education Activity
Sponsored by CDC**

**Diagnosis and Management of Foodborne Illnesses:
A Primer for Physicians**

EXPIRATION — January 26, 2002

You must complete and return the response form electronically or by mail by **January 26, 2002**, to receive continuing education credit. If you answer all of the questions, you will receive an award letter for 3.0 hours Continuing Medical Education (CME) credit or 0.3 hour Continuing Education Units (CEUs). If you return the form electronically, you will receive educational credit immediately. If you mail the form, you will receive educational credit in approximately 30 days. No fees are charged for participating in this continuing education activity.

INSTRUCTIONS

By Internet

1. Read this *MMWR* (Vol. 50, RR-2), which contains the correct answers to the questions beginning on the next page.
2. Go to the *MMWR* Continuing Education Internet site at <<http://www.cdc.gov/mmwr/cme/conted.html>>.
3. Select which exam you want to take and select whether you want to register for CME or CEU credit.
4. Fill out and submit the registration form.
5. Select exam questions. To receive continuing education credit, you must answer all of the questions. Questions with more than one correct answer will instruct you to "Indicate all that apply."
6. Submit your answers no later than **January 26, 2002**.
7. Immediately print your Certificate of Completion for your records.

By Mail or Fax

1. Read this *MMWR* (Vol. 50, RR-2), which contains the correct answers to the questions beginning on the next page.
2. Complete all registration information on the response form, including your name, mailing address, phone number, and e-mail address, if available.
3. Indicate whether you are registering for CME or CEU credit.
4. Select your answers to the questions, and mark the corresponding letters on the response form. To receive continuing education credit, you must answer all of the questions. Questions with more than one correct answer will instruct you to "Indicate all that apply."
5. Sign and date the response form or a photocopy of the form and send no later than **January 26, 2002**, to
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Epidemiology Program Office, MS C-08
Centers for Disease Control and Prevention
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6. Your Certificate of Completion will be mailed to you within 30 days.

ACCREDITATION

Continuing Medical Education (CME). This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education through joint sponsorship of CDC; the Food Safety and Inspection Service, U.S. Department of Agriculture; and the Center for Food Safety and Applied Nutrition, Food and Drug Administration. CDC is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. CDC designates this educational activity for a maximum of 3.0 hours in category 1 credit toward the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

Continuing Education Unit (CEU). CDC has been approved as an authorized provider of continuing education and training programs by the International Association for Continuing Education and Training and awards .3 hour Continuing Education Units (CEUs).

GOALS and OBJECTIVES

This *MMWR* provides guidelines for the diagnosis, treatment, and reporting of foodborne illnesses. The goals of this *MMWR* are to provide physicians and health-care providers with the most current, scientific guidelines for the diagnosis, treatment, and reporting of foodborne illnesses; and with patient education materials that can be used to educate patients, including those who are at high risk for foodborne illness. Upon completion of this educational activity, the reader should be able to a) identify six etiologic agents to consider for manifestations of foodborne illness; b) identify four criteria for prescribing antibacterial therapy for foodborne illness; c) identify how to access the most current reporting requirements for foodborne illness; and d) identify three groups of people who are most at risk for foodborne illness.

To receive continuing education credit, please answer all of the following questions:

- 1. Which of the following provide important clues to the possible etiology of a food-associated illness?**
 - A. Incubation period.
 - B. Duration of illness.
 - C. Predominant clinical signs and symptoms (e.g., vomiting, diarrhea, and abdominal pain)
 - D. Travel history.
 - E. All of the above.
- 2. Which of the following are NOT consistent with inflammatory diarrhea?**
 - A. Presence of fecal leukocytes.
 - B. Grossly bloody stool.
 - C. Caused by infection with invasive or cytotoxigenic bacterial and protozoan species.
 - D. The small intestine is usually involved.
- 3. If a foodborne illness is suspected, which of the following should be considered?**
 - A. Submitting appropriate specimens for laboratory testing.
 - B. Contacting the state or local health department.
 - C. Initiating oral rehydration therapy.
 - D. All of the above.
- 4. What is the most likely food- or water-associated agent associated with persistent diarrhea (i.e., lasting >14 days)?**
 - A. *Giardia lamblia*.
 - B. *Shigella* species.
 - C. *Campylobacter jejuni*.
 - D. *Vibrio cholerae*.
- 5. Which of the following food-associated diseases and conditions is not designated as notifiable at the national level?**
 - A. Botulism.
 - B. Staphylococcal food poisoning.
 - C. Trichinosis.
 - D. Hepatitis A.
- 6. A routine stool culture will likely isolate which of the following food-related pathogens?**
 - A. *Listeria monocytogenes*.
 - B. *E. coli* O157:H7.
 - C. *Vibrio cholerae*.
 - D. Hepatitis A virus.
 - E. *Salmonella* species.

7. Which of the following foodborne pathogens can be prevented by vaccination?
- A. *Cyclospora cayetanensis*.
 - B. *Campylobacter jejuni*.
 - C. Hepatitis A virus.
 - D. *E. coli* O157:H7.
8. The examination of the stool for cysts and/or ova is the common diagnostic for which foodborne pathogen?
- A. Parasitic infections.
 - B. Viral infections.
 - C. Bacterial infections.
 - D. Noninfectious agents.
 - E. None of the above.
9. A rapid incubation period of 2–30 hours prior to gastrointestinal tract symptoms is indicative of which of the following?
- A. Hepatitis A virus infection.
 - B. Ciguatera fish poisoning.
 - C. *Giardia lamblia* infection.
 - D. *Brucella abortus* infection.
10. A patient tells you that he developed diarrheal illness following consumption of seafood from a street vendor in the Caribbean. Which of the following should you do?
- A. Request that your clinical microbiology laboratory specifically test for *Vibrio* species in the patient's stool sample.
 - B. Request that your clinical microbiology laboratory examine the patient's stool samples for cysts and ova of *Cyclospora*.
 - C. Request that your clinical microbiology laboratory specifically test for *E. coli* O157:H7 in the patient's stool sample.
 - D. Do not request that your clinical laboratory specifically test for a pathogen because *Campylobacter jejuni* is part of a routine stool culture.
11. If you are counseling a pregnant patient, what foods should she avoid to decrease her risk for listeriosis?
- A. Honey.
 - B. Fresh soft cheeses.
 - C. Sauerkraut.
 - D. Cooked mushrooms.
12. A patient presents with a history of abdominal cramps, bloody diarrhea, and dehydration. Which culture (not included in a routine screening test) must you request that the laboratory perform?
- A. *Shigella* species.
 - B. *E. coli* O157:H7.
 - C. *Salmonella* species.
 - D. *Campylobacter jejuni*.
13. Which scenario(s) might present a risk to patients, especially those who are immunocompromised?
- A. Pet reptiles in the home.
 - B. Eating sprouts on a sandwich.
 - C. Eating raw oysters.
 - D. Drinking nonpasteurized juices.
 - E. All of the above.

14. A patient presents to the emergency department with hoarseness, ptosis, and upper extremity paralysis. He has a history of home canning, and you suspect botulism. After you stabilize the patient and evaluate respiratory function, you...
- A. immediately induce vomiting.
 - B. contact the Food and Drug Administration.
 - C. contact the local or state health department.
 - D. all of the above.
15. Which of the following foodborne illnesses has the longest incubation period?
- A. Staphylococcal intoxication.
 - B. *Bacillus cereus* gastroenteritis.
 - C. Cholera.
 - D. Listeriosis.
 - E. *E. coli* diarrhea.
16. A patient who presents with chocolate-brown colored blood might have which of the following foodborne illnesses?
- A. Nitrite poisoning.
 - B. Organophosphate poisoning.
 - C. Botulism.
 - D. Mercury poisoning.
 - E. Tin poisoning.
17. Why might the use of antibiotics in children with *E. coli* O157:H7 infection be contraindicated?
- A. *E. coli* O157:H7 is multiply drug resistant to antibiotics and thus not treatable with antibiotics.
 - B. Antibiotic use only serves to increase the stress on the kidneys.
 - C. Data indicates that antibiotics might increase the risk for hemolytic uremic syndrome.
 - D. The use of antibiotics is not contraindicated, and data indicates a decrease in the severity of illness following its use.
18. When choosing to use antimicrobial therapy for a foodborne illness, which of the following should be considered during the decisionmaking process?
- A. The clinical signs and symptoms of the illness.
 - B. The organism that was isolated from clinical specimens.
 - C. The results of antimicrobial susceptibility tests.
 - D. The appropriateness of treating the illness with an antimicrobial.
 - E. All of the above.
19. Indicate your work setting.
- A. State/local health department.
 - B. Other public health setting.
 - C. Hospital clinic/private practice.
 - D. Managed care organization.
 - E. Academic institution.
 - F. Other.

20. Which best describes your professional activities?

- A. Patient care — emergency/urgent care department.
- B. Patient care — inpatient.
- C. Patient care — primary-care clinic or office.
- D. Laboratory/pharmacy.
- E. Public health.
- F. Other.

21. I plan to use these recommendations as the basis for... (Indicate all that apply.)

- A. health education materials.
- B. insurance reimbursement policies.
- C. local practice guidelines.
- D. public policy.
- E. other.

22. Each month, approximately how many patients with foodborne illness do you treat?

- A. None.
- B. 1–5.
- C. 6–20.
- D. 21–50.
- E. 51–100.
- F. >100.

23. How much time did you spend reading this report and completing the exam?

- A. 1–1.5 hours.
- B. More than 1.5 hours but fewer than 2 hours.
- C. 2–2.5 hours.
- D. More than 2.5 hours.

24. After reading this report, I am confident that I can identify six etiologic agents to consider for manifestations of foodborne illness.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

25. After reading this report, I am confident that I can identify four criteria for prescribing antibacterial therapy for foodborne illness.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

26. After reading this report, I am confident that I can identify how to access the most

current reporting requirements for foodborne illness.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

27. After reading this report, I am confident that I can identify three groups of people who are most at risk for foodborne illness.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

28. The objectives are relevant to the goal of this report.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

29. The tables, charts, and boxes are useful.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

30. Overall, the presentation of the report enhances my ability to understand the material.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

31. These recommendations will affect my practice.

- A. Strongly agree.
- B. Agree.
- C. Neither agree nor disagree.
- D. Disagree.
- E. Strongly disagree.

32. How did you learn about this continuing education activity?

- A. Internet.
- B. Advertisement (e.g., fact sheet, *MMWR* cover, newsletter, or journal).
- C. Coworker/supervisor.
- D. Conference presentation.
- E. *MMWR* subscription.
- F. Other.

Correct answers for questions 1-18.
1. E; 2. D; 3. D; 4. A; 5. B; 6. E; 7. C; 8. A;
9. B; 10. A; 11. B; 12. B; 13. E; 14. C; 15. D;
16. A; 17. C; 18. E

MMWR Response Form for Continuing Education Credit January 26, 2001/Vol. 50/No. RR-2

Diagnosis and Management of Foodborne Illnesses: A Primer for Physicians

To receive continuing education credit, you must

- 1. provide your contact information;*
- 2. indicate your choice of CME or CEU credit;*
- 3. answer all of the test questions;*
- 4. sign and date this form or a photocopy;*
- 5. submit your answer form by January 26, 2002.*

Failure to complete these items can result in a delay or rejection of your application for continuing education credit.

Detach or photocopy.

<i>Last Name</i>	<i>First Name</i>	<i>Check One</i>
<hr/>		<input type="checkbox"/> <i>CME Credit</i>
<i>Street Address or P.O. Box</i>		<input type="checkbox"/> <i>CEU Credit</i>
<hr/>		
<i>Apartment or Suite</i>		
<hr/>		
<i>City</i>	<i>State</i>	<i>ZIP Code</i>
<hr/>		
<i>Phone Number</i>	<i>Fax Number</i>	
<hr/>		
<i>E-Mail Address</i>		
<hr/>		

Fill in the appropriate blocks to indicate your answers. Remember, you must answer all of the questions to receive continuing education credit!

- | | |
|--|---|
| 1. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E | 17. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 2. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 18. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 3. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 19. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F |
| 4. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 20. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F |
| 5. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 21. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 6. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E | 22. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F |
| 7. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 23. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 8. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E | 24. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 9. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 25. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 10. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 26. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 11. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 27. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 12. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 28. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 13. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E | 29. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 14. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 30. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 15. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E | 31. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E |
| 16. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E | 32. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> E <input type="checkbox"/> F |

Signature

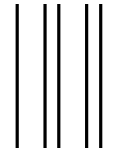
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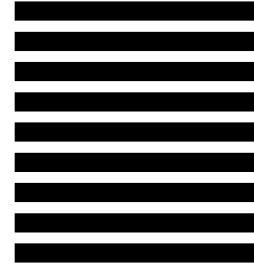
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