Contents

Preface
David Acheson, Jennifer McEntire, and Cheleste M. Thorpe  xiii

Perspectives in Foodborne Illness
Gerald T. Keusch  501
This article provides a historical framework on food safety for more contemporary details to rest on, focusing primarily on the past 100 years or so (with a touch of ancient history) as particular issues that affect how the safety of the food we eat have been appreciated, have evolved or at times have been successfully dealt with, or have newly emerged or reemerged, in large part because of the impact of technology, trade, and travel.

Emerging Trends in Foodborne Diseases
Christopher R. Braden and Robert V. Tauxe  517
New foodborne pathogens continue to emerge, and the globalization of the food supply means that the safety of our food depends on policies and practices in many countries. Public health surveillance of foodborne bacterial pathogens depends on culture, isolation, and subtyping. New diagnostic strategies that bypass culture threaten public health surveillance in the short-term but offer the potential for more refined and rapid outbreak detection in the future. Infectious disease clinicians play a critical role in diagnosis and reporting because they may be the first to suspect a new problem and often link clinical and public health communities.

How to Diagnose a Foodborne Illness
Michael S. Donnenberg and Shivakumar Narayanan  535
Timely diagnosis of foodborne infection can be critical not only for the patient, but also for the larger community because of the potential to interrupt further spread. This article presents the diagnostic approach to patients with foodborne illness, discussing epidemiologic clues of various foodborne pathogens and their distinguishing clinical features of diagnostic importance. Also discussed are situations whereby stool cultures should be ordered; other helpful stool tests; nonculture methods of identifying organisms and their applicability in clinical settings; the role of pulsed-field gel electrophoresis in typing organisms; and large-scale sharing of data to aid in identification of large outbreaks.

Treating Foodborne Illness
Theodore Steiner  555
In healthy adults and children in developed countries, most foodborne and waterborne infections are short-lived and resolve without specific treatment. In developing areas, these infections may produce acute mortality and chronic morbidity caused by developmental impairment.
Immune-compromised hosts are at increased risk of life-threatening complications. This article reviews recommendations for the treatment of the most common and important foodborne illnesses, focusing on those caused by infections or toxins of microbial origin. The cornerstone of life-saving treatment remains oral rehydration therapy, although the use of other supportive measures as well as antibiotics for certain infections is also recommended.

**Treatment of Shiga Toxin–Producing Escherichia coli Infections**

T. Keefe Davis, Ryan McKee, David Schnadower, and Phillip I. Tarr

The management of Shiga toxin-producing *Escherichia coli* (STEC) infections is reviewed. Certain management practices optimize the likelihood of good outcomes, such as avoidance of antibiotics during the pre-hemolytic uremic syndrome phase, admission to hospital, and vigorous intravenous volume expansion using isotonic fluids. The successful management of STEC infections is based on recognition that a patient might have an STEC infection, and appropriate use of the microbiology laboratory. The timeliness of STEC identification cannot be overemphasized, because it avoids therapies prompted by inappropriate additional testing and directs the clinician to focus on effective management strategies. The opportunities during STEC infections to avert the worst outcomes are brief, and this article emphasizes practical matters relevant to making a diagnosis, anticipating the trajectory of illness, and optimizing care.

**Long-Term Consequences of Foodborne Infections**

Michael B. Batz, Evan Henke, and Barbara Kowalcyk

Foodborne infections with *Campylobacter*, *E. coli* O157:H7, *Listeria monocytogenes*, *Salmonella*, *Shigella*, *Toxoplasma gondii*, and other pathogens can result in long-term sequelae to numerous organ systems. These include irritable bowel syndrome, inflammatory bowel disease, reactive arthritis, hemolytic uremic syndrome, chronic kidney disease, Guillain-Barré Syndrome, neurological disorders from acquired and congenital listeriosis and toxoplasmosis, and cognitive and developmental deficits due to diarrheal malnutrition or severe acute illness. A full understanding of the long-term sequelae of foodborne infection is important both for individual patient management by clinicians, as well as to inform food safety and public health decision making.

**Iatrogenic High-Risk Populations and Foodborne Disease**

David Acheson

Certain subsets of the population are at a greater risk of acquiring foodborne infections and have a greater propensity to develop serious complications. Susceptibility to foodborne infection is dependent on numerous factors that largely relate to the status of an individual’s defense systems in regard to both preventing and mitigating foodborne illness. Key examples include the increased susceptibility of pregnant women to listeriosis and increased severity of enteric bacterial infections in patients with AIDS. Clinicians must communicate with higher-risk patients about the risks of foodborne illness, and provide patients with information regarding safe food-handling practices.
Shiga Toxin–Producing *Escherichia coli* O104:H4: An Emerging Pathogen with Enhanced Virulence

Dakshina M. Jandhyala, Vijay Vanguri, Erik J. Boll, YuShuan Lai, Beth A. McCormick, and John M. Leong

Pathogenic *Escherichia coli* are genetically diverse and encompass a broad variety of pathotypes, such as enteroaggregative *E. coli* (EAEC) or enterohemorrhagic *E. coli* (EHEC), which cause distinct clinical syndromes. The historically large 2011 German outbreak of hemolytic uremic syndrome (HUS), caused by a Shiga-toxin producing *E. coli* (STEC) of the serotype O104:H4, illustrated the emerging importance of non-O157 STEC. STEC O104:H4, with features characteristic of both enteroaggregative *E. coli* and enterohemorrhagic *E. coli*, represents a unique and highly virulent pathotype. The German outbreak both allowed for the evaluation of several potential therapeutic approaches to STEC-induced HUS and emphasizes the importance of early and specific detection of both O157 and non-O157 STEC.

Epidemiology, Prevention, and Control of the Number One Foodborne Illness: Human Norovirus

Erin DiCaprio, Yuanmei Ma, John Hughes, and Jianrong Li

Human norovirus (NoV) is the number one cause of foodborne illness. Despite tremendous research efforts, human NoV is still poorly understood and understudied. There is no effective measure to eliminate this virus from food and the environment. Future research efforts should focus on developing: (1) an efficient cell culture system and a robust animal model, (2) rapid and sensitive detection methods, (3) novel sanitizers and control interventions, and (4) vaccines and antiviral drugs. Furthermore, there is an urgent need to build multidisciplinary and multi-institutional teams to combat this important biodefense agent.

Transmission of *Clostridium difficile* in Foods

Dallas G. Hoover and Alexander Rodriguez-Palacios

*Clostridium difficile* is a human intestinal pathogen most frequently involved in diarrheal illnesses following the administration of antibiotics. There is growing concern that some *C difficile* infections (CDI) may be acquired from ingestion of *C difficile* spores in contaminated foods. The number of CDI cases is increasing with a heightening in the severity of disease symptoms and an increasing number of community-associated infections not connected to health care–associated risk. This article provides an overview of information related to assessing the risk of foodborne transmission of CDI, highlighting studies on *C difficile* relevant to food safety in health care settings.

Foodborne Disease: The Global Movement of Food and People

Jennifer McEntire

Foodborne illness afflicts people throughout the world. The food safety systems in some countries afford better consumer protection than others. This situation, combined with differing climates and ecologies, results in the association of different types of foodborne illness with different
regions of the world. In a global economy, both people and food travel the world. With this travel comes the potential for patients to acquire unexpected diseases. Clinicians need to consider foreign travel as well as the consumption of food from other parts of the world when determining the cause of foodborne disease.