# GLOBAL HANDBOOK ON FOOD AND WATER SAFETY

## ABOUT THE AUTHORS

**SONIA YUSON-DE LEON** is a professor in the Department of Food Science and Nutrition at the University of the Philippines (UP) in Quezon City. She holds a Bachelor of Science in Food Technology (cum laude) from the UP, a Ph.D. in Food Technology from the University of Massachusetts, and a Masters of Business Management from the Asian Institute of Management. Over the last four decades, she has researched and written technical articles and more than fifteen books on food science and technology, including *Food Safety and Sanitation for Philippine Consumers*. She has worked on installing, maintaining, and evaluating food safety systems in various firms throughout the Philippines. She has participated in Codex food hygiene meetings and is presently working with the Department of Agriculture as technical consultant on Food Hygiene–related issues in Codex.

**SUSAN MEACHAM, Ph.D., R.D.,** chair of the Department of Nutrition Sciences at the University of Nevada Las Vegas (UNLV), and director of the American Dietetic Association accredited Didactic Program in Dietetics at UNLV, obtained a Ph.D. in Human Nutrition and Foods from Virginia Polytechnic Institute and State University and currently teaches complementary and integrative medical nutrition therapy and metabolism courses. Dr. Meacham also works with the Nevada Nutrition Education and Research Program in the School of Medicine at UNLV, the School of Dentistry at UNLV. As a member of the UNLV Cancer Research Institute, she compares dietary intake methodologies, determines the essentiality of trace minerals and reviews the effectiveness of complementary and integrative therapies for chronic disease prevention. Dr. Meacham is on the editorial board of *Today's Dietitian* and consults at Canyon Ranch Spa Club at the Venetian Hotel in Las Vegas. Meacham, past president of numerous local dietetic associations, is a founding member the Nevada Chapter of the Society of Public Health Educators (SOPHE).

**VIRGINIA S. CLAUDIO, Ph.D, MNS, R.D.,** earned a B.S.H.E. degree (Foods and Nutrition) from the University of the Philippines; her dietetic diploma at the Indiana University Medical Center, and a Masters degree in Nutritional Science from Cornell University, New York. She finished her Ph.D. at Kansas State University as a General Foods Fellow. Mrs. Claudio has twenty years of teaching experience. As an associate professor at Chicago State University, Texas A&I, California State University, and the Charles R. Drew University School of Allied Health at Los Angeles, she conducted research in addition to her teaching duties. Additionally, she worked as a dietitian for twenty-two years in United States' hospitals, nursing homes, medical clinics, and university food services. As Foodservice Director, her administrative duties included enforcing the policies for food sanitation and safety and coordinating quality assurance activities. As an R.D. consultant for group home facilities, she monitored proper food handling of support personnel. Currently, she is a private practitioner in Las Vegas, Nevada, in medical nutrition services and continues to write textbooks. This volume is her twelfth book.

# GLOBAL HANDBOOK ON FOOD AND WATER SAFETY

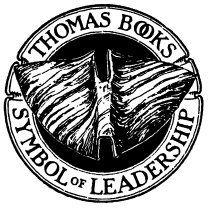
## For the Education of Food Industry Management, Food Handlers, and Consumers

*By*

SONIA Y. de LEON, PH.D., M.B.M.

SUSAN L. MEACHAM, PH.D., R.D.

VIRGINIA S. CLAUDIO, PH.D., R.D.

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*Dedicated to our families for their moral support in writing this book.*

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# PREFACE

The world is now referred to as the "global village," and the globalization of food trade has made food from distant lands very accessible to consumers in a very short period of time. With the increased volume and value of international trade, some new problems have surfaced, such as emerging food pathogens that the present regulatory systems have difficulties in detecting and controlling. The World Health Organization (WHO) has proclaimed, "Access to food, water, and sanitation is a fundamental human right and is vital for the dignity and health of all people." Providing this global village safe food and water is indeed one of the main challenges of the millennium.

Most illnesses and death from food and waterborne diseases are preventable. Pathogenic microbial growths, and physical and chemical hazards, are controllable. We have written this book to help in preventing food and waterborne diseases.

This book is for consumers and food handlers throughout the food chain, from the farm and sea to the consumer's table. It gives guidelines for management, for trainers of food handlers, and for consumers. If we can save one life, and prevent one foodborne or waterborne illness, the effort expended in writing this book will have been well worth it!

–THE AUTHORS

# INTRODUCTION

This book is a practical reference on food and water safety for food managers, trainers/educators, food handlers, and consumers worldwide. There are four parts, each with unique features and learning goals.

The first two chapters of the text emphasize the importance of food and water safety on health and life maintenance. The remaining chapters are the whys and means in ensuring food and water safety. Each chapter has an introductory paragraph that states the objective(s) and scope of the chapter text. Definitions of useful terms, tables, and figures/illustrations serve to make the key points better understood and easier to remember. At the end of each chapter is a bibliography for that chapter. This list of references gives the reader a chance to delve into areas of interest and read further for more information. Review questions at the end of the chapters enhance the learning experience.

A unique feature of this book is a section presenting foodborne disease outbreaks. An introductory page explains the selection of fifty cases presented in this text as representative samples of literally hundreds of foodborne disease outbreaks that can be found in the literature. These sample cases are also important learning tools for problem-solving and evaluating foodborne illnesses.

The appendices supplement the text, giving additional information in a brief, concise manner, such as tables, charts, and sample forms. The list of selected web sites on food and water safety concludes the appendix material.

This book is unique because:

- It explains **water safety** in more detail, whether it is used for drinking and cooking or in recreational water facilities.
- It contains numerous examples of **foodborne disease outbreaks** (FBDOs) worldwide with a variety of etiologic agents that cause the illnesses from contaminated food or water.
- It offers guidelines to supply safe food and water for emergencies that include preparedness in case of **bioterrorism, power outage, floods, hurricanes, and other disasters.**

- Each chapter has **practical guidelines about food and water safety** when handling foods throughout the food chain.
- Chapter 14 deals with **challenges for the future** to ensure a safe water and food supply.
- The last chapter (Chapter 15) presents fifty foodborne disease outbreaks from different parts of the world caused by a variety of etiologic agents.

In light of global trade and increasing cultural diversity in food consumption, this book is a valuable addition to one's library. We encourage readers to share with the authors their suggestions to enhance the next revision of this volume.

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# GLOBAL HANDBOOK ON FOOD AND WATER SAFETY

# Chapter 1

# IMPORTANCE OF FOOD AND WATER SAFETY


1.0 Introduction
2.0 Food and Water Safety: Effects on Health
  2.1 Epidemiology
  2.2 Effects of Foodborne Illnesses on Health
3.0 Food and Water Safety: Socioeconomic Considerations
  3.1 Costs That May Be Incurred by the Sick Individual or Caregiver/Family
  3.2 Business and Industry Costs
  3.3 Cost to the Nation and Government
4.0 Reporting Foodborne Illnesses
  4.1 Guide to Consumers
  4.2 Guide to Physicians
  4.3 Procedures for Food Service Institutions
5.0 Benefits of Safe Water and Food Supply
6.0 Concluding Remarks
Review Questions
References


## 1.0 INTRODUCTION

Food and water safety is an essential public health issue for all countries. Every person must eat and drink to sustain life, but life will be shortened or the quality of a person's health will suffer, if food or water contaminated with a foodborne pathogen or its toxin has been consumed. No one in either developed or developing countries is spared from contracting foodborne diseases.

The following statements from international health organizations highlight the importance of food and water safety:

"Access to food, water, and sanitation is a fundamental need and a human right. It is vital for the dignity and health of all people."[1]

"Access to safe food, water, and sanitation is the foundation of development."[2]

"Access to nutritionally adequate and SAFE food is a right of each individual."[3]

The last statement was initiated during a joint international conference of the Food and Agriculture Organization and World Health Organization (FAO/WHO) in 1992. In May 2000, the World Health Assembly, which is the governing body of WHO, adopted a resolution that directs future priority issues on food safety and increases involve-

ment with the Codex Alimentarius Commission.

## 2.0 FOOD AND WATER SAFETY: EFFECTS ON HEALTH

Disease caused by contaminated food and water is one of the most widespread and growing health problems, both in developed and developing countries. The global incidence of foodborne disease is difficult to estimate because many are not reported; however, available statistics are useful in showing general trends.

### 2.1 Epidemiology

In developed countries, the percentage of people suffering from foodborne disease increases by 30 percent each year. In the United States alone, about 76 million cases are estimated to occur annually. In developing countries, diarrheal disease is a major cause of malnutrition among infants and children under five, of which 70 percent is attributed to contaminated food and water.[4]

Globally, there are 50 million deaths per year of which 80 percent are in developing countries. Half of the mortality in developing countries is due to infectious diseases and parasites.[5]

The United States of America (USA) has one of the safest food and water supplies in the world. Nonetheless, in the United States, *on a daily basis,* the estimated number of deaths (25) and illnesses (16,000) are alarming.[6]

The number of persons potentially affected per incidence of a foodborne disease could range from one individual, an entire family, a community, or as many as hundreds and thousands of people. Table 1.1 lists some examples of food poisoning outbreaks, showing the number of deaths in each incidence.

The Centers for Disease Control and Prevention (CDC), of the US, documents cases of foodborne illnesses that are reported worldwide. Their weekly reports are available at the web site http://www.cdc.gov/mmwr. The problem of waterborne diseases is related to the fact that more than 1 billion people or one-sixth of the world's population do not have access to safe drinking water, and nearly 2.4 billion, or 40 percent of the world's population, lack proper hygienic sanitation systems. Almost all of these problems are seen in the developing countries.[12]

Chapter 2 deals with water safety and cites more statistics and control systems for water supplies globally.

### 2.2 Effects of Foodborne Illnesses on Health

The full impact of foodborne diseases on health cannot be fully appreciated if based solely on the number of people affected. The severity and duration of the illness are important to know, as well as the onset or incubation period when the signs and symptoms start to appear. These factors vary according to the kind of infection or intoxication, the virulence of the etiologic agent, the dose or number of microorganisms, the age and health status of the victim, and pre-existing medical conditions that reduce a person's immune system or resistance to disease. The young, elderly, pregnant women, persons undergoing chemotherapy, and individuals suffering from malnutrition, HIV/AIDS, cancer, anemia, and tuberculosis are at higher risks to contract foodborne illnesses sooner than the average, healthy adult.

To illustrate the wide variety of signs and symptoms manifested in each of the common foodborne diseases, the succeeding tabulated

Table 1.1
EXAMPLES OF FOOD POISONING OUTBREAKS

| *Location* | *Year* | *Disease* | *Cases* | *Deaths* | *Reference* |
|---|---|---|---|---|---|
| Cairo | 1991 | Botulism | 91 | 18 | Rakha, 1992[7] |
| China | 1988 | Hepatitis A | 292,000 | 32 | Christian, 1990[8] |
| India | 1974 | Aflatoxic hepatitis | n.a. | 100 | Krishnamachari et al., 1982[9] |
| Latin America (10 Countries) n/a* | 1991 | Cholera | 300,000 | 3,170 | Dawson & Costaarrica, 1992[10] |
| USA 1998[11] (Wisconsin) | 1993 | Cryptosporidiosis | 400,000 | 104 | Scott & Sockett, |

*Not Available

data (Tables 1.2 to 1.6) have been compiled from the latest CDC publication prepared as a primer for physicians for the diagnosis and management of foodborne illnesses.[13]

Note from the tables that the classical signs and symptoms of most foodborne diseases generally include vomiting, diarrhea, abdominal pain, gastroenteritis, fever, fatigue, and general weakness. If the episode lasts only a day or two, and the illness is mild, the person affected does not seek medical help, but often mistake the symptoms for an intestinal flu. Many cases are therefore unreported, and of those reported, usually the investigation and final diagnosis cannot be completed.

Some foodborne illnesses of longer duration could affect other organs of the body, such as the liver, kidneys, heart, central nervous system, the lungs and respiratory system, and the skin.[14]

More details on the effects of foodborne diseases on health are given in Chapter 5, which discusses the microbiological hazards of food safety. Information on the incubation period, duration of the illness, foods associated or implicated with its occurrence, how transmitted, and preventive measures, are also included in Chapter 5. The signs and symptoms of foodborne illnesses caused by bacteria, parasites, viruses, chemicals and biological toxins are generally summarized here.

## 3.0 FOOD AND WATER SAFETY: SOCIOECONOMIC CONSIDERATIONS

The grief, anguish, pain, and misery suffered by the victim, family members, and caregivers of those suffering from foodborne illnesses cannot be measured in monetary value. The worst scenario is when the final result of the episode or illness is death. Some of the economic losses could be measurable and are documented, but are often underestimated because the indirect costs associated with the foodborne illness are not always observable or determined immediately.

The following outline summarizes the various costly factors related to foodborne illness:[15]

Table 1.2
SIGNS AND SYMPTOMS OF FOODBORNE ILLNESSES CAUSED BY BACTERIA

| *Etiology Agent* | *Signs and Symptoms* |
|---|---|
| *Bacillus cereus* (diarrheal toxin) | Abdominal cramps, watery diarrhea, nausea |
| *Bacillus cereus* (emetic toxin) | Sudden onset of severe nausea and vomiting |
| *Campylobacter jejuni* | Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody |
| *Clostridium botulinum* (children and adults) | Vomiting, diarrhea, blurred vision, diplopia, dysphagia, and descending muscle weakness |
| *Clostridium botulinum* (infants) | Infants under 12 months: lethargy, weakness, poor feeding, constipation, hypotonia, poor head control, poor gag and suck |
| *Clostridium perfringens* | Watery diarrhea, nausea, abdominal cramps |
| *Enterotoxigenic* | Watery diarrhea, abdominal cramps |
| *E. coli* (ETEC) | Some vomiting |
| *Listeria monocytogenes* | Fever, muscle aches, and nausea or diarrhea. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. The elderly or immunocompromised patients may have bacteremia or meningitis. |
| *Salmonella* spp. | Diarrhea, fever, abdominal cramps, vomiting. *S. Typhi* and *S. Paratyphi* produce typhoid with insidious onset characterized by fever, headache, constipation, malaise, chills, and myalgia; diarrhea is uncommon. Vomiting is usually not severe. |
| *Shigella* spp. | Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus. |
| *Staphylococcus aureus* | Sudden onset, severe nausea and vomiting; abdominal cramps; diarrhea and fever may be present |
| *Vibrio cholerae* | Profuse watery diarrhea and vomiting, which can lead to severe dehydration and death within hours |
| *Vibrio parahaemolyticus* | Watery diarrhea, abdominal cramps, nausea, vomiting |
| *Yersinia enterocolitica* | Appendicitis-like symptoms (diarrhea and vomiting, fever, and abdominal pain) |

## 3.1 Costs That May Be Incurred by the Sick Individual or Caregiver/Family

- Loss of family income
- Loss of opportunities for advancement
- Increased insurance
- Medical expenses to include physical rehabilitation and long-term care
- Cost for pediatric and geriatric care
- Cost of special dietary needs
- Loss of productivity, leisure, and travel opportunities
- Funeral expenses as applicable