Foodborne Illness Investigation and Control Reference Manual

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
Division of Epidemiology and Immunization
Food Protection Program
Division of Diagnostic Laboratories

Foodborne Illness Investigation and Control Reference Manual

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Foodborne Illness Investigation and Control Reference Manual

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Preface

Purpose Of The Manual

The Massachusetts Department of Public Health (MDPH) is placing increased emphasis on foodborne illness investigation, control and prevention. This emphasis is based on the following:

- the MDPH's Working Group on Foodborne Illness Control (WGFIC),
- local board of health members and health department staff in Massachusetts who have come together at focus groups and meetings coordinated by the Division of Epidemiology and Immunization and the Food Protection Program, and
- the CDC's 1994 publication, *Addressing Emerging Infectious Disease Threats: A Prevention Strategy for the United States.*

These sources point out the need for up-to-date information and increased technical assistance to the local health departments for prevention and control of infectious diseases, including foodborne illness.

This reference manual is part of the MDPH's focus on providing more trainings and technical assistance for local boards of health and health department staff. The purpose of the manual is to guide local boards of health and health department staff through foodborne illness investigation and control. It is designed as a comprehensive reference covering both epidemiologic and environmental aspects of a foodborne illness investigation, and emphasizes the practical and necessary features of investigation and control. Contained within the manual are basic information, guidelines, recommendations and regulatory requirements. While this manual is targeted to board of health members and health department staff, other health professionals can also use the information to facilitate understanding of how local boards of health and health department staff operate, and how they themselves play a role in foodborne illness investigation and control.

The MDPH's Working Group on Foodborne Illness Control

The development of this manual has been made possible by the CDC, National Center for Infectious Diseases and the Massachusetts Department of Public Health's Working Group on Foodborne Illness Control (WGFIC). This working group is comprised of members of three divisions involved in the investigation of foodborne illness, each in a separate bureau in the Department of Public Health. They are:

- The Food Protection Program (Center for Environmental Health),
- the Division of Epidemiology and Immunization (Bureau of Communicable Disease Control), and
- the Division of Diagnostic Laboratories (Bureau of Laboratory and Environmental Sciences).

The Working Group's main functions are:

- to respond to consumer complaints regarding foodborne illness,

- to assist and/or train local boards of health in investigations of foodborne illness or outbreaks,
- to identify causes of outbreaks (through environmental inspections, lab analysis and epidemiologic analysis),
- to track cases and complaints linked to the consumption of food, and
- to make recommendations and take necessary steps for the prevention and control of foodborne illness.

Team Approach

Investigation of an outbreak of foodborne illness is a team effort in which each member plays an essential role. The collaborative nature of the Working Group has contributed to improved communication between the Divisions and a better understanding of what is going on throughout the state. Collaboration and closer working relationships for those board of health members and health department staff who address foodborne illness will be emphasized throughout the manual. Increased understanding of others' responsibilities and even cross-training can result in improved local foodborne illness investigation and control programs. It is also important to note that the WGFIC is available to offer guidance and assistance as needed.

Organization Of The Manual

Chapters 1-3 intend to give the reader appropriate background information on foodborne illness.

Chapter 1 presents an overview of the history and trends of foodborne illness, both for the nation and Massachusetts.

Chapter 2 discusses how foodborne disease is classified and contains descriptions of causative agents and associated illnesses. The focus of the manual is on illness caused by three common microbial food hazards: viruses, bacteria and parasites. Other less common etiological agents such as molds and chemicals are referred to but not specifically addressed.

Chapter 3 provides an overview of the pathogenesis of foodborne illness.

Chapters 4-8 cover the sequential events of investigations.

Chapter 4 explains the concepts of disease surveillance, describes the methods by which foodborne illness data are collected and used, and addresses various data collection issues, including confidentiality.

Chapter 5 addresses how staff should proceed when addressing foodborne illness complaints.

Chapter 6 presents steps in an epidemiologic investigation.

Chapter 7 presents steps in an environmental investigation.

Chapter 8 covers documenting complaints, writing outbreak reports, recommended strategies for control and using data for prevention.

NOTE: While Chapters 4-8 are organized in a particular order, an investigation does not necessarily have to be carried out in this order. Several steps may be put into action simultaneously; thus please note the references to other chapters and sections as you read along.

References are listed at the end of each chapter and serve to direct readers to noteworthy publications, both basic and specialized, that further explore the subject of each chapter. The appendices contain additional supplemental information and are referred to within the chapters. The list of acronyms and the glossary may be a useful adjunct to the text.

PLEASE NOTE THE FOLLOWING:

1) This manual is designed to give an overview of foodborne illness investigation and control. As experience has proved, outbreaks can vary greatly from setting to setting, and it is impossible to address all the questions and situations that may come up. Again, The Working Group on Foodborne Illness Control is available to offer guidance and assistance as needed. (Telephone numbers are listed on page xiii.

2) This reference manual is focused on retail food and food service establishment settings. This includes restaurants, supermarkets, institutional food service operations, catered affairs, temporary food establishments and kitchens in bed and breakfast establishments. Other settings, such as private homes, will be addressed as needed.

3) The terms “foodborne illness” and “foodborne disease” are used interchangeably throughout this manual.

4) The terms “food handler” and “food worker” are used interchangeably throughout this manual.

5) “You” and “your” refers to the people/audience for which this manual is intended, namely, board of health members and health department staff.

6) All information in this manual must be considered in light of newer information available after publication. The three-ring binder format of this manual allows for additional and updated material as available.

List of Acronyms

Aw	Water Activity
AIDS	Acquired Immune Deficiency Syndrome
AR	Attack Rate
ASTHO	Association of State and Territorial Health Officials
BOH or **LBOH**	Local Board of Health
CD	Communicable Disease
CDC	U.S. Centers for Disease Control and Prevention
CMR	Code of Massachusetts Regulations
CCP	Critical Control Point
CSTE	Council of State and Territorial Epidemiologists
DDL	Division of Diagnostic Laboratories
EHEC	Enterohemorraghic *Escherichia coli*
FDA	U.S. Food and Drug Administration
FPP	Food Protection Program
GI	Gastrointestinal
HACCP	Hazard Analysis Critical Control Point
HAV	Hepatitis A Virus
HRA	HACCP Risk Assessment
HUS	Hemolytic Uremic Syndrome
IG	Immune Globulin
I&Q	Isolation and Quarantine
MDPH	Massachusetts Department of Public Health
MGL	Massachusetts General Law
MMWR	Morbidity and Mortality Weekly Report
O&P	Ova and Parasites
PIC	Person-in-Charge
PHF	Potentially Hazardous Food
PSP	Paralytic shellfish poisoning
SE	*Salmonella enteritidis*
SLI	State Laboratory Institute
USDA	U.S. Department of Agriculture
VNA	Visiting Nurse Association
WGFIC	Massachusetts Working Group on Foodborne Illness Control

Important Reference Materials - How To Obtain Them

There are numerous references to two Massachusetts regulations throughout this reference manual. Information on how to obtain a copy of each is listed below.

- **Regulation 105 CMR 300: Reportable Diseases and Isolation and Quarantine Requirements (July 1994):** A free copy can be obtained by calling the MDPH, Division of Epidemiology and Immunization at (617) 983-6800.

- **Regulation 105 CMR 590: Minimum Sanitation Standards For Food Service Establishments - Article X (April 1994):** A copy can be bought from the State House Book Store or ordered by mail. The address is: State House Book Store, State House, Room 116, Boston, MA 02133. For more information call the State House Book Store at (617) 727-2834.

The **Reference Manual for Food Protection Programs,** published and sold by the Massachusetts Health Officers Association (MHOA), contains detailed food protection information specific to Massachusetts and can be used as a supplement.

For information on ordering, contact the MHOA:

MHOA
PO Box 849
Sherborn, MA 01770
(508) 653-8203

Important Telephone Numbers

Massachusetts Department of Public Health - Working Group on Foodborne Illness Control

Division of Epidemiology and Immunization
(617) 983-6800

Contact for technical assistance with the epidemiologic investigation such as obtaining medical histories, coordinating stool specimen submissions and developing questionnaires. On-site investigation assistance is often available for larger outbreaks. The Division maintains a 7day/week, 24 hour epidemiologist on-call for emergencies (e.g., outbreak assistance). The emergency telephone number for nights and weekends is **(617) 522-3700**.

Food Protection Program
(617) 983-6712

Contact for policy and technical assistance with the environmental investigation such as conducting a HACCP risk assessment, initiating enforcement actions and collecting food samples. On-site investigation assistance is often available for larger outbreaks.

Division of Diagnostic Laboratories
(617) 983-6600

Contact for technical assistance with the collection protocol for food and clinical specimens and interpretation of laboratory results.

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Summary - Sequential Steps in the Investigation of Foodborne Illness Complaints and Outbreaks

Steps	reference
1) Be prepared. Designate responsible individual(s) trained in foodborne disease prevention and control to evaluate and investigate foodborne illness complaints and outbreaks.	Chapter 5
2) Maintain a foodborne illness surveillance system. This is necessary to determine any changes in the frequency or distribution of cases and permits early identification of outbreaks or potential outbreaks of foodborne illness.	Chapter 4
3) Record complaints on a *Foodborne Illness Complaint Worksheet*. Log all reports in a logbook or electronic data system. Send worksheets to the MA Food Protection Program. (Immediately refer complaints of food prepared or manufactured in another jurisdiction to the appropriate LBOH.)	Chapter 4
4) Decide whether to investigate. Is the complaint valid?	Chapter 5
5) Report all clusters or outbreaks to the Massachusetts Food Protection Program (617-983-6712) or the Division of Epidemiology and Immunization (617-983-6800).	Chapter 5
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6) Take steps to verify diagnosis.	
• Collect leftover food samples when appropriate from the food establishment and/or complainant in a timely manner.	Appendix B
• Obtain clinical samples when appropriate in a timely manner.	Chapter 6
• Obtain case histories.	Chapter 6
• Immediately investigate reports of suspect sick food workers and exclude if necessary. Request all symptomatic food workers to submit stool specimens. Stool samples should be submitted within 48 hours of your request. In an outbreak situation, request ALL food workers to submit stool specimens, especially when an implicated food is not apparent. Food workers who do not submit stool specimens must be restricted from work until they comply.	Chapter 6 and Appendix A
7) Conduct an environmental investigation within 24 hours. Conduct a Hazard Analysis Critical Control Point (HACCP) risk assessment of the implicated foods as part of your investigation.	Chapter 7
8) Develop a case definition and identify cases. Make epidemiological associations (TIME, PLACE, PERSON). Formulate hypotheses.	Chapter 6
9) If necessary, initiate immediate correction or enforcement actions (embargo, disposal, emergency closure, suspension of operations). Coordinate food recalls and tracebacks with industry and other local, state and federal regulatory agencies. If necessary, issue a press release or public notice.	Chapter 7
10) Expand investigation. Find and interview additional cases and persons at risk. Collect data, make calculations, analyze data. Test hypotheses. Take control action.	Chapter 6
11) Complete and submit *case report forms* (on reportable diseases) to MDPH.	Chapter 4
12) Document all LBOH actions. Submit all reports of your investigation including a copy of the last routine food inspection report for the implicated establishment to the Food Protection Program.	Chapter 8

Chapter 1

HISTORY AND TRENDS

1) Background on Foodborne Illness

2) Foodborne Illness: A National Overview

3) Foodborne Illness: A Massachusetts Overview

HISTORY AND TRENDS

Introduction

Foodborne illness in the United States is a major cause of personal distress, social disruption, preventable death and avoidable economic burden. Foodborne diseases cause an estimated 24 to 81 million sporadic and outbreak-associated cases of human illness and 10,000 deaths annually in the United States. The economic impact of illness is staggering since the unpleasant symptoms of even a "mild" case of foodborne illness may require absence from school or work. Some investigators estimate that diarrheal foodborne illnesses cost from $7 to $17 billion a year in the United States. Entire industries have been crippled (i.e., economic loss) as a result of foodborne outbreaks.

1) Background on Foodborne Illness

The microbiologic hazards associated with food and food preparation are receiving increasing public attention. They are causing increasing concern not only among consumers, but also among those involved in all facets of food production and distribution. Historically, most foods were produced and consumed locally, but modern production and distribution of foods have become highly complex and involve global distribution of many kinds of fresh and processed food products. One has to merely browse the isles of the local grocery store to witness the tremendous influx of food products from throughout the world. While the benefits of the availability of such a variety of foods are many, the potential for the transmission of foodborne pathogens to large populations spread over large geographic areas also increases with modern food production and distribution.

In addition to the dangers inherent in the modern food distribution system, newly emerging or re-emerging infectious diseases influence and complicate the occurrence of foodborne illness. Transmission of a new pathogen may be poorly understood and laboratory methods for diagnosis may be difficult or unavailable. Implementation of prevention and control measures may be delayed. The 1996 and 1997 outbreaks of cyclosporiasis in the United States are examples of foodborne outbreaks caused by an emerging pathogen, *Cyclospora cayetanensis*. Approximately 1,465 individuals in 20 states were infected in 1996, and 1997 looks to be a comparable year with multiple

nationwide outbreaks reported. Since the outbreak, more has been learned about the parasite and laboratory methods of detection have become more routine.

Factors Associated With the Increase in Emerging and Reemerging Infectious Diseases

Population growth	Crowding
Changes in agriculture and food practices	Microbial evolution
Changes in ecology and climate	Modern travel
Animal migration	Animal relocation
Inadequacy of public infrastructure	Population shifts

Most foodborne illness occurs through **fecal-oral transmission**. A disease-causing organism is shed in human or animal feces and is deposited on a food item which is then eaten. A contaminated food item may result in infection if:

1. raw food contaminated with a pathogen is not cooked long enough to kill the pathogen or is consumed raw (e.g., chicken, eggs or sushi), or
2. cooking utensils are used on a raw food contaminated with a pathogen, then the same utensils are used on another uncooked food (e.g., knife used to cut chicken is also used to cut lettuce for salad).

In addition, a non-contaminated product may become contaminated when handled by an infected food handler who failed to wash his/her hands after using the bathroom and before handling food. Any of these routes of contamination may occur in either a home setting or in a commercial operation such as a restaurant and may result in one or two cases of illness or a large number of ill individuals.

Recent outbreaks of *E. coli* O157:H7 and salmonella clearly demonstrate the potential for the amplification of a pathogen. For example, from November 15, 1992 through February 28, 1993 more than 500 laboratory- confirmed infections with *E. coli* O157:H7 and four associated deaths occurred in the western United States associated with eating hamburgers from one fast food restaurant chain. In addition, it is estimated that over 200,000 people became ill in 1994 after eating a nationally distributed ice cream that was made from an ice cream premix product contaminated with *Salmonella enteritidis (SE).*

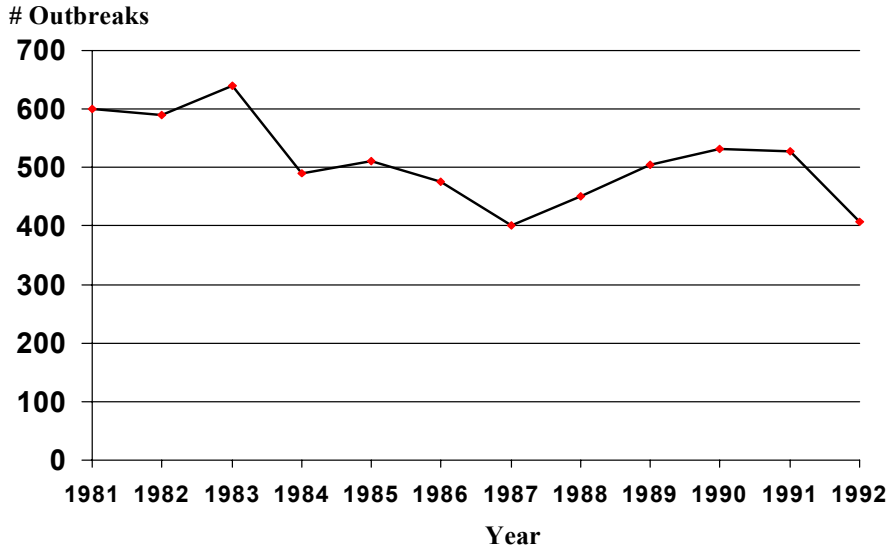
2) Foodborne Illness: A National Overview

Despite the increasing chances for transmission of pathogenic microorganisms, national data on reported outbreaks do not accurately represent the actual occurrence of disease. In fact, national data actually suggest an overall downward trend in the occurrence of foodborne outbreaks (see Figure 1.1). This is most likely attributable to reporting artifact rather than an actual decrease in decrease. With limited resources dedicated to

investigating incidents of foodborne illness, even recognizing an outbreak is becoming more difficult. Resources are limited on both the local and national level, while widespread outbreaks involving many states and even many countries are occurring with increasing frequency. Alfalfa sprouts grown from seeds contaminated with salmonella caused an international outbreak in 1995. This outbreak was only recognized because it involved a very unusual serotype of salmonella. Even then it required a large expenditure of time, energy and resources at local, national and international levels to investigate the outbreak and identify and control the source of infection. Smaller outbreaks and outbreaks caused by more common organisms may remain unidentified.

Figure 1.1

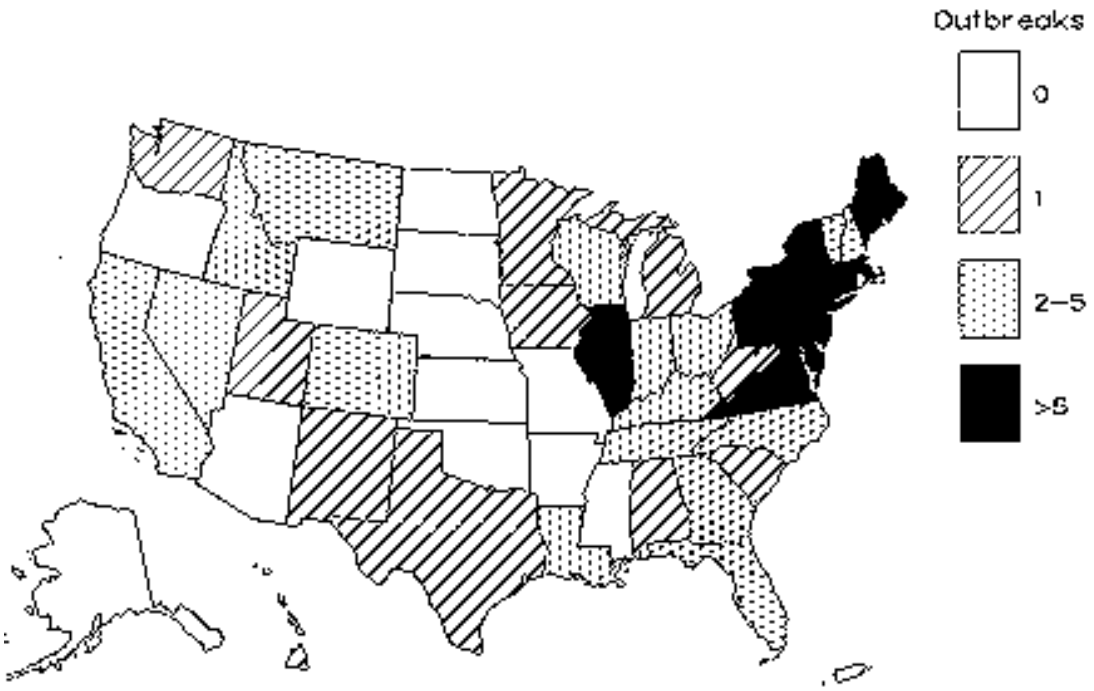
Reported Foodborne Illness Disease Outbreaks, United States,1981-1992



Source: CDC, MMWR 1996; SS-6

The need for resources for foodborne illness investigation at all levels cannot be overstated. A dramatic illustration was the recognition of the increased incidence of *Salmonella enteritidis* (*SE*) in the Northeast in the mid to late 1980s (see Figure 1.2). A 1988 report by the Centers for Disease Control and Prevention (CDC) reported that the national incidence of *SE* infections had increased significantly during the previous decade. Further investigation revealed a dramatic increase in *SE* in the Northeast. This increase was found to be associated with consumption of whole shell eggs or foods containing shell eggs. Further analysis revealed that the increase in *SE* cases in the Northeast had actually begun around 1984 (see Figure 1.3).

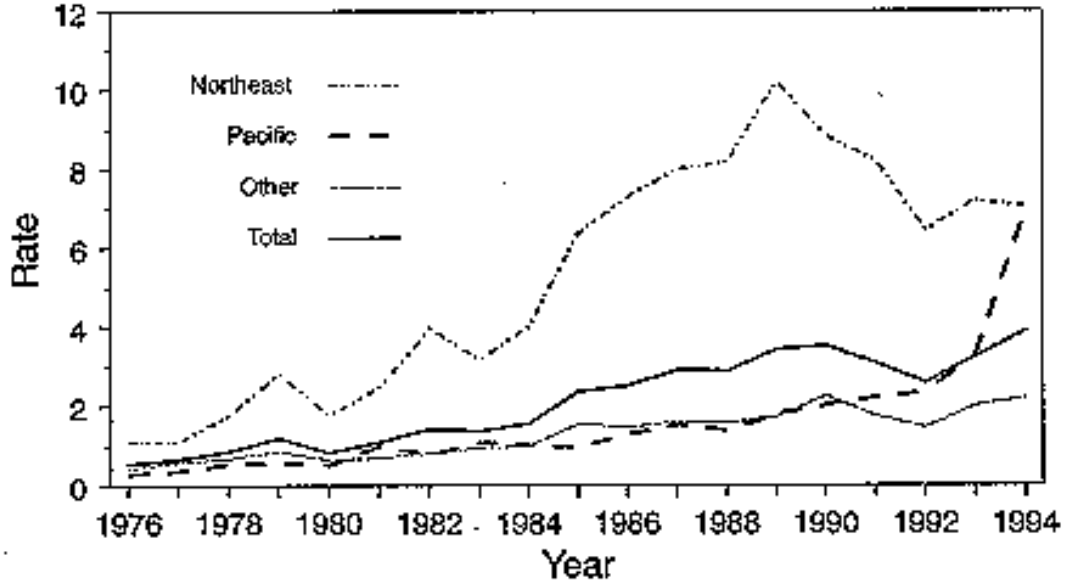
FIGURE 1.2
Reported Outbreaks of S. enteritidis
United States 1985–1991



Data from Mishu et al, J Inf Dis, 1994.

Figure 1.3

Rate* of Isolation of *Salmonella* serotype Enteritidis by Region and Year - United States, 1976-1994



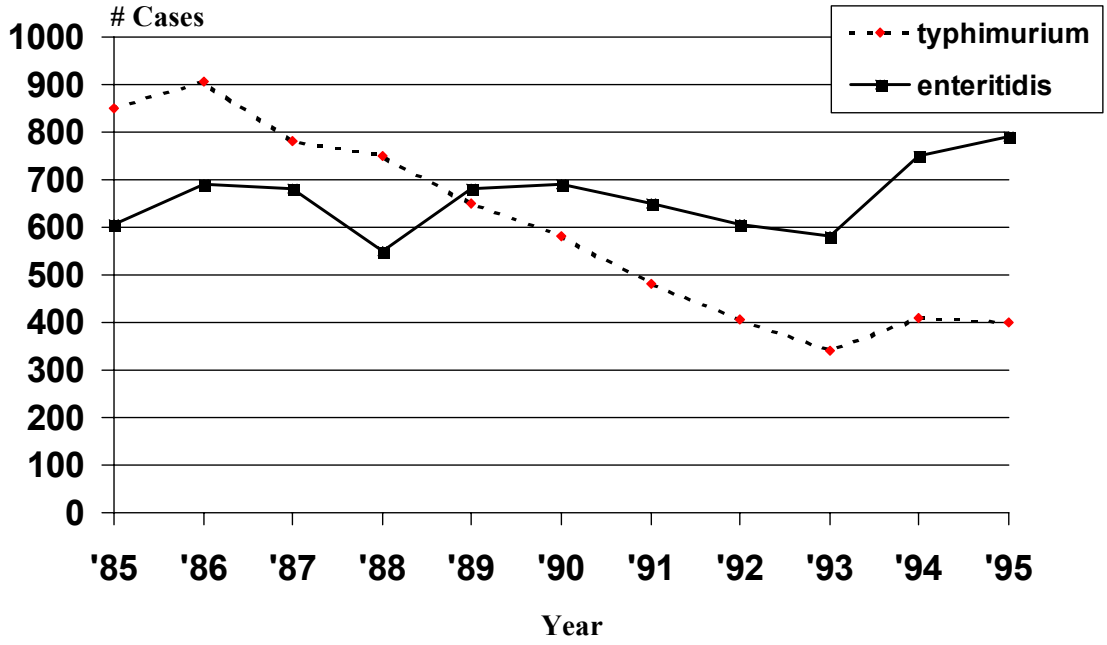
*Per 100,000 population.

Source: CDC, MMWR, August 30, 1996, Vol. 45, No. 34.

In Massachusetts the increase in occurrence of *SE* infection became strikingly clear when in 1989 *SE* infections surpassed *S. typhimurium* infections. Until 1989, *S. typhimurium* was the leading serotype of salmonellosis in Massachusetts (see Figure 1.4). From 1989-1992 *SE* accounted for the most foodborne outbreaks, cases, and deaths, with the majority of cases associated with eating raw or undercooked eggs. The recognition of eggs as an important source of disease had dramatic local, regional and national ramifications. Producers, distributors, cooks and consumers of chicken and egg products were affected. Stricter controls, from refrigeration during distribution to adequate cooking, have prevented much illness. The changing epidemiology of *Salmonella* infections would not have been recognized without national and local capacity for investigation.

Figure 1.4

Common Salmonella Serotypes,
Massachusetts Reported Cases, 1985-1995



Source: MDPH, Working Group on Foodborne Illness Control, 1995

In addition, resources for laboratory investigations are necessary. Laboratory testing for many foodborne pathogens is difficult and in some cases non-existent. Testing methods for certain parasites and viruses are difficult and often unavailable. Also, testing for staphylococcal, *Bacillus cereus* or *Clostridium perfringens* toxins is not commonly performed. Consequently, laboratory confirmation of the causative organism is not available for over half of the foodborne disease outbreaks reported to the CDC.

In addition to the common causes of foodborne illness, nationwide outbreaks of "new" pathogens are also being identified. As mentioned previously, the 1996 and 1997 nationwide outbreaks of infection due to the parasite *Cyclospora cayetanensis* were recognized. For both years, the primary vehicle of infection was raspberries imported from outside this country.

Despite increasing competition for resources at all levels, the number of foodborne disease outbreaks reported to the CDC per year did not change substantially from 1988 to 1991. In 1992 however, the CDC revised part of its definition of a foodborne outbreak

resulting in a decline in the number of reported outbreaks. Prior to 1992, one person intoxicated by *Clostridium botulinum* toxin was considered an outbreak. In 1992, two or more cases of intoxication by *C. botulinum* toxin have been required to constitute an outbreak. (Note that one case of botulism in Massachusetts would elicit an in-depth investigation.)

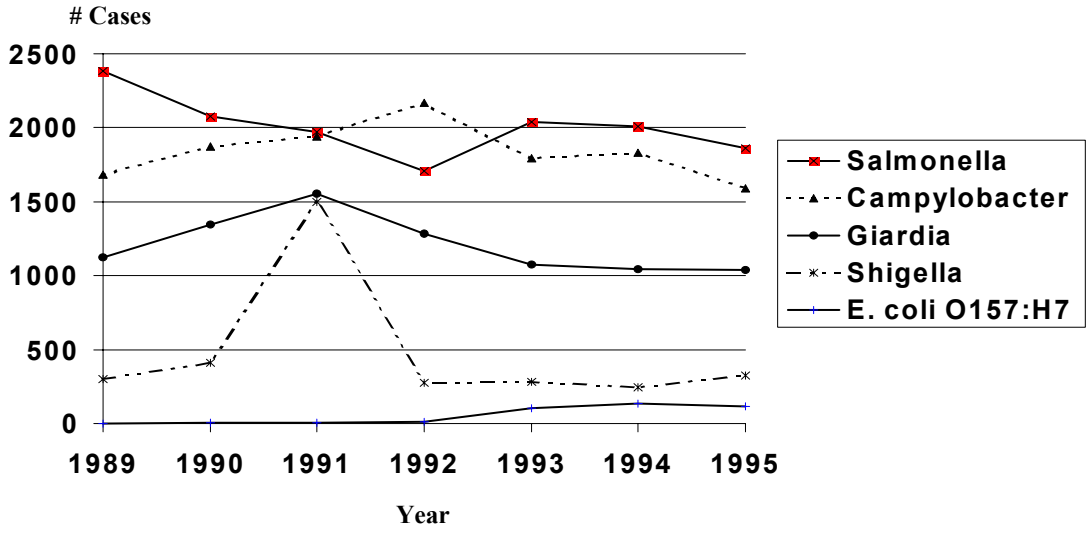
Continued surveillance of disease at a national level is imperative and will be achieved only through continued surveillance at state and local levels. The following section will summarize the occurrence of foodborne illness in Massachusetts.

3) Foodborne Illness: A Massachusetts Overview

During the last seven years the number of cases of enteric illness reported to the MDPH by local BOH, laboratories and others has remained fairly constant (see Figure 1.5). The large increase in Shigella cases in 1991 was due to an outbreak of shigellosis in the Springfield area in which over 1,000 cases resulted from person-to-person transmission primarily among children. Salmonella, the most commonly reported enteric pathogen, continues to be a large problem with over 1800 cases reported in 1995 (see Figure 1.5). The incidence of *SE* has been increasing since the mid 1980s when it was discovered that eggs distributed in the Northeast were contaminated with *SE*.

Figure 1.5

Cases of Reported Enteric Illness, Massachusetts, 1989-1995



Source: MDPH, Working Group on Foodborne Illness Control, 1995

Both *E. coli* O157:H7 and hemolytic uremic syndrome (HUS) were added to the Massachusetts list of reportable diseases in August 1994. (A copy of the Massachusetts *Diseases Reportable by Healthcare Providers* follows Chapter 4.) Cases of *E. coli* O157:H7 and HUS had been reported sporadically (by local BOH, laboratories and others) to the MDPH Surveillance Unit since 1988.

An outbreak of *E. coli* O157:H7 occurred in 1991 and was associated with the consumption of locally produced apple cider made with unwashed and unbrushed apples. This outbreak was recognized when four children from southeastern Massachusetts were admitted to a Boston children's hospital with HUS between October 23 and November 20, 1991. (HUS is a severe and sometimes fatal result of *E. coli* O157:H7 infection.) The subsequent investigation identified 23 additional individuals with *E. coli* O157:H7 infection and the cause of the outbreak. Another *E. coli* O157:H7 outbreak occurred in 1995 and was associated with the consumption of foods containing ground beef from a Mexican food stand at a county fair. (For more information on HUS, see Chapter 2, Section 3-C.)

Collecting information and tracking reportable foodborne diseases or conditions is a difficult undertaking. Most of these illnesses resolve within 24-48 hours with the person never seeking medical attention. And even when a health care provider is consulted, laboratory testing is not always performed. The lack of testing is becoming more prevalent with the growth of managed care. The task becomes even more difficult when an illness or syndrome is caused by a pathogen that is "emerging," i.e., not widely known or newly recognized as causing illness. Frequently these new diseases are not on the list of reportable diseases and conditions, and the MDPH is therefore unlikely to be notified. This occurred during the 1996 nationwide outbreak of *Cyclospora* infection that was thought to be caused by the consumption of contaminated fresh berries. When the first cases of the outbreak were identified the MDPH requested that labs report infection of *Cyclospora*. Within two months of the first report, the MDPH had learned of over 80 sporadic cases and a similar number associated with group events in Massachusetts.

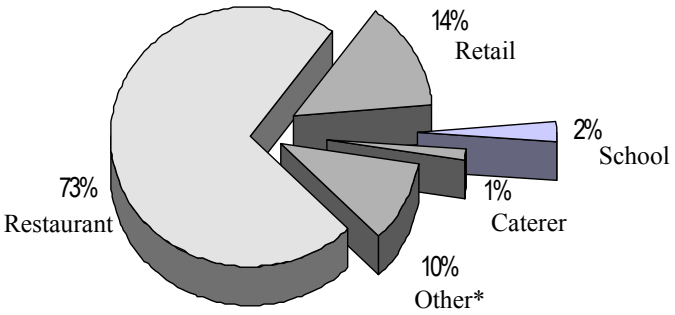
One of the main purposes of the MDPH Working Group on Foodborne Illness Control (WGFIC) is to track cases and complaints of foodborne illness. The earlier problems are recognized, the quicker control measures may be implemented and additional cases of illness prevented. For this reason, it is important to track consumer complaints and review the data periodically for clusters of illness or changes in trends of illness. Changes in the occurrence of disease compared to previous time periods may necessitate further investigation.

NOTE: See Chapter 4, Sections 3 and 6 for more information on tracking consumer complaints at the local level and using the information collected. See Chapter 5 for further information on pursuing foodborne illness investigations.

Information collected on consumer complaints can also be used to identify areas in need of improvement. In 1996, approximately 73% of foodborne illness *complaints* by the WGFIC in Massachusetts involved restaurants, while 1% were associated with caterers (see Figure 1.6). When foodborne illness *cases* are analyzed by establishment type, however, 38% of cases involved catered food (see Figure 1.7). This information illustrates that while outbreaks at catered events are less common, larger numbers of people are affected. Caterers may prepare large amounts of food for large groups, under conditions that are not always ideal. This information is useful for designing foodborne illness control programs or modifying existing ones. Thoughtful analysis of surveillance data allows the identification of areas of concern and is useful in planning.

Figure 1.6

Foodborne Illness *Complaints* by Establishment Type, Massachusetts: 1996

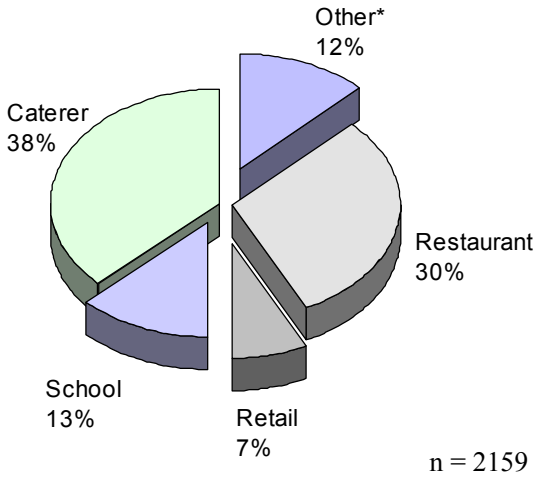


n = 411

Source: MDPH, Working Group on Foodborne Illness Control, 1996
* "Other" category includes nursing homes, private homes and mobile food vendors

Figure 1.7

Foodborne Illness *Cases* by Establishment Type, Massachusetts: 1996



Source: MDPH, Working Group on Foodborne Illness Control, 1996
* "Other" category includes: nursing homes, private homes and mobile food vendors

Foodborne illness surveillance, with accurate and complete documentation, is necessary at local, state, national and international levels. Food is often imported and exported. Raspberries are imported from Guatemala and people all over the world use maple syrup from Vermont. We must always be aware of what is happening now and what has happened in the past in order to develop effective strategies for preventing foodborne and waterborne illness.

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CHAPTER 1

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Chapter 2

DISEASE CHARACTERIZATION

1) **Characteristics of Viruses, Bacteria and Parasites**
2) **Classification of Foodborne Illness**
3) **Clinical Features of Foodborne Illness**
4) **The Carrier State**

DISEASE CHARACTERIZATION

Introduction
The majority of foodborne diseases are caused by microbial pathogens such as **viruses**, **bacteria** and **parasites**. Although foodborne diseases are also caused by physical and/or chemical contamination, this chapter will focus primarily on the microbial agents. A list of foodborne diseases, including chemical contaminants, is provided in Table 2.5 at the end of this chapter.

One way of categorizing foodborne illness is:
foodborne infection (the organism in ingested food invades and multiplies in the intestinal lining OR the organism in ingested food invades, multiplies and produces a toxin while in the intestinal tract), and **foodborne intoxication** (organism produces a toxin in food that is subsequently ingested).
These two categories are discussed further in this chapter.

1) Characteristics of Viruses, Bacteria and Parasites

A. Viruses

Viruses are minute organisms, smaller than bacteria and parasites. **Viruses can only reproduce within living cells in the body of the host and cannot multiply in foods. However, some viruses remain infectious in the environment and thus are transported through food**.

Viruses that are associated with foodborne diseases are characterized by growth in the intestinal cells and subsequent excretion in the feces. More than 100 types of enteric viruses exist, although only a few have been proved to cause foodborne disease (e.g., rotavirus, hepatitis A, "small round-structured viruses," such as the Norwalk and Norwalk-like agents). Although other viruses such as adenovirus can cause gastrointestinal illness, the mode of transmission is believed to be primarily person-to-person. **Foodborne viruses cause infection and not intoxication.**

Documentation of viral foodborne disease is scant. This is because of diverse symptoms (often mild illness), difficulty of detection of viruses in food, and difficulty of routine, conclusive diagnosis through stool specimens. Food usually becomes contaminated when it is handled by a person infected with a virus who has poor personal hygiene or when the food comes in contact with virus-laden sewage. It does not take a large quantity of virus

for infection. For example, a person with rotavirus diarrhea may excrete approximately a trillion infectious particles per milliliter of stool, but as few as 10 particles can cause illness. Additionally, excretion of viruses in feces may occur even if a person has no symptoms of GI illness.

Viruses are increasingly being recognized as significant causes of foodborne illness in the United States. Outbreaks of hepatitis A transmitted through food are recorded every year. During the 5-year period 1988-1992, hepatitis A virus ranked between fourth and seventh among the identified causes of foodborne outbreaks in the United States. In 1996, more than 250 people became sick in a single Massachusetts outbreak caused by a "small round-structured virus."

B. Bacteria

Bacteria are one-celled living microorganisms that have a cell wall. Bacterial cells vary in shape and range in size from about 1 micrometer (μm), which equals one millionth of a meter, to 5 or 10 micrometers in length. In contrast to viruses, bacteria can be seen with a conventional microscope. **Bacterial cells increase when each cell divides into two, which grow to full size and divide into two again (two-fold division). Unlike viruses or parasites, bacteria ARE able to multiply in or on food. Under optimum conditions, large numbers can easily be achieved.** (See Chapter 7, Section 2-B for additional information on growth of bacteria.)

Some pathogenic bacteria, including *Bacillus cereus, Clostridium botulinum, and Clostridium perfringens*, form spores that can survive adverse environmental conditions. The spores germinate to form viable cells that increase to large numbers. Spore-forming pathogens are significant because when the spores occur in foods, they are more difficult to kill. For example, although *Bacillus cereus* bacteria survive up to 122^{o} F, much higher temperatures are required to kill the spores of *B. cereus*. (See Chapter 7, Section 2-B for additional information on spores.)

Pathogenic bacteria can cause foodborne infections OR intoxications. *Salmonella* is the leading documented cause of foodborne infections in this country. The bacteria that produce foodborne intoxications most often in the United States include *Bacillus cereus*, *Clostridium botulinum* and *Staphylococcus aureus.*

C. Parasites

Parasites are single or multi-celled organisms that live either within or upon but always at the expense of a host. They are larger than viruses and bacteria, with dimensions usually greater than 10 micrometers (μm). One-celled parasites are commonly termed "parasitic protozoa," although for the purposes of simplicity, "parasites" will be used throughout this manual to refer to both one-celled and other types**. With regard to foodborne illness, parasites only cause infection, not intoxication. And similar to viruses, parasites do not multiply in foods, but can survive in the environment and thus be transported through food**.

Often, parasites go through structural changes during their life cycles. The structural form transmissible through food often is a cyst that is inert and resistant to the environment outside the host, similar to a bacterial spore but less resistant to heat. Once the cyst, by means of food, enters the body of a new host, it can multiply.

One-celled parasites occurring in foodborne outbreaks in the United States include *Entamoeba histolytica*, *Toxoplasma gondii* and *Giardia lamblia*. *Cryptosporidium parvum* is becoming more common and is also a problem in immunocompromised people, e.g., patients with acquired immune deficiency syndrome (AIDS). *Cyclospora cayetanensis* is a newly recognized parasite that was first reported in the medical literature in 1979. Cases have been identified and reported with increased frequency since the mid-1980s. During the summers of 1996 and 1997, nationwide outbreaks of cyclosporiasis occurred from the consumption of imported, contaminated berries.

The multi-celled parasites found in food may occur as eggs, larvae, or other forms. They can be ingested into the body where they may hatch, leading to the development of new parasites. *Trichinella spiralis* is reported to cause a few cases of foodborne illness (trichinosis) in the United States each year. Formerly, this was an important pathogen associated with undercooked pork. Tapeworm species occurring in the United States include the beef tapeworm (*Taenia saginata*), the pork tapeworm (*Taenia solium*), and the fish tapeworm (*Diphyllobothrium species*). Infection from these is rare.

2) Classification of Foodborne Illness

FOODBORNE INFECTION. A foodborne infection is caused by ingestion of food contaminated by either viruses, bacteria or parasites, and occurs in one of two ways:
1) Viruses, bacteria or parasites in ingested food invade and multiply in the intestinal mucosa and/or other tissues.
2) Bacteria in ingested food invade and multiply in the intestinal tract and then release a toxin or toxins that damage surrounding tissues or interfere with normal organ or tissue function. This type of infection is sometimes referred to as a **toxin-mediated infection**. *Viruses and parasites are not able to cause a toxin-mediated infection.*

FOODBORNE INTOXICATION
A foodborne intoxication is caused by ingestion of food already contaminated by a toxin. Sources of toxin are:
1) certain bacteria,
2) poisonous chemicals (e.g., heavy metals like copper), or
3) toxins found naturally or formed in animals, plants or fungi (e.g., certain fish and shellfish, certain wild mushrooms).

Viruses and parasites are unable to cause intoxications.

3) Clinical Features of Foodborne Illness

A. Transmission of Pathogens

Most foodborne illness occurs through **fecal-oral transmission**. A disease-causing organism is shed in human or animal feces and is deposited on a food item which is then eaten. A contaminated food item may result in infection if:

1. raw food contaminated with a pathogen is not cooked long enough to kill the pathogen or is consumed raw (e.g., chicken, eggs or sushi), or
2. cooking utensils are used on a raw food contaminated with a pathogen, then the same utensils are used on another uncooked food (e.g., knife used to cut chicken is also used to cut lettuce for salad).

In addition, a non-contaminated product may become contaminated when handled by an infected food handler who failed to wash his/her hands after using the bathroom and before handling food. Any of these routes of contamination may occur in either a home setting or in a commercial operation such as a restaurant and may result in one or two cases of illness or a large number of ill individuals.

NOTE: More information on food microbiology can be found in Chapter 7, Section 2.

B. Recognizing Foodborne Illness

The site of illness is usually limited to the gastrointestinal tract, but certain pathogens can move beyond the GI tract to infect other areas of the body. The majority of cases can be described as short-term (24-48 hours) gastroenteritis of abrupt and sometimes violent onset, with median incubation periods ranging from 2 to 36 hours. Signs and symptoms of foodborne illness can range from mild gastrointestinal discomfort to severe reactions that can result in death. **Although signs and symptoms vary, the most common are vomiting, abdominal cramps and diarrhea.** The severity of symptoms depends on many factors discussed throughout Chapter 3. **Because many pathogens are excreted into the feces, infected persons not only experience illness themselves but may be sources of infection to others.**

Investigators often face the problem of having to **implement control measures** before an etiologic agent has been identified. It may be difficult to differentiate between the illnesses and pathogens involved without clinical or lab confirmation. Laboratory analysis is required to make a firm diagnosis, but attention to the symptoms (the time of onset and the presence or absence of some symptoms) may indicate the likely cause and permit a more efficient investigation.

NOTE: See Chapters 5-7 for more information on investigations.

Most cases of foodborne disease are single cases, and not associated with a recognized outbreak. Most occur secondary to exposures in the home or at a party, barbecue or picnic as opposed to restaurant exposure. **Single cases are difficult to associate with a**

particular food or establishment unless there is a distinctive clinical syndrome OR the same agent responsible for the illness is also identified in the food. An example of a distinctive clinical syndrome is fish-borne ciguatera poisoning that produces GI symptoms as well as pronounced and persistent neurosensory symptoms such as a sensation of loose teeth, the inability to identify hot by taste or touch, and numbness and pain in the extremities.

Outbreaks of foodborne disease are usually recognized by the occurrence of illness among people who eat one or more foods in common AND the illness occurs within a short period of time from each other. While laboratory analysis is pending, it is important to focus on the incubation period. The incubation period in relation with the clinical symptoms is useful in determining an etiologic agent.

C. Foodborne Infections

Foodborne infections are a consequence of the growth of a microorganism in the human body, and this growth can take varying amounts of time. **Thus, the incubation period is generally rather long, usually measured in days compared to hours with that for most foodborne intoxications**. (For example, the incubation period for salmonellosis is usually 12-48 hours, but can be four days.) **Symptoms of infection usually include diarrhea, nausea, vomiting and abdominal cramps. Fever is often associated with infection.**

The organisms causing infection often possess colonization or adherence factors, allowing them to attach and to multiply in specific parts of the intestine. For example, *Giardia lamblia* trophozoites attach to the upper small bowel. When the numbers become large, they can cover the absorptive surface and interfere with nutrient uptake. *Vibrio cholerae*, the agent of cholera, colonizes the intestine and produces a toxin (choleragen) causing an outpouring of fluid from the exposed cells. Death of the patient from dehydration is possible. *Shigella* species erode the intestinal lining, causing shigellosis, or "bacillary dysentery."

Other organisms can move beyond the GI tract to infect other tissues. Hepatitis A virus appears to infect intestinal cells and then spread to liver cells leading to the predominant manifestation of the disease, inflammation of the liver. *Salmonella typhi* may enter the bloodstream and spread throughout the body, causing typhoid fever. However, most serotypes of *Salmonella* penetrate the intestinal lining without progressing beyond the deeper layers into other tissues. Toxins produced by *E. coli* O157:H7 and other toxigenic *E. coli* can adhere to cells in the intestines, kidneys, and central nervous system, prevent protein synthesis, and cause cell death. Depending on the site of action, the result can be hemorrhagic colitis, hemolytic uremic syndrome, or thrombotic thrombocytopenic purpura. (See Chapter 3, Section 2 for additional information on infections beyond the GI tract.)

TABLE 2.1 Classification of *Escherichia coli* Associated with Diarrhea

Types of *E. coli*	Epidemiology	Type of Diarrhea
Enteropathogenic	Acute and chronic endemic and epidemic diarrhea in infants	Watery
Enterotoxigenic	Infantile diarrhea in developing countries and traveler's diarrhea	Watery
Enteroinvasive	Diarrhea with fever in all ages	Bloody or nonbloody
Enterohemorrhagic (e.g., E. coli O157:H7)	Hemorrhagic colitis and hemolytic uremic syndrome (see Box 2.2) in all ages and thrombotic thrombocytopenic purpura in adults	Bloody or nonbloody

Source: Data adapted from American Academy of Pediatrics, 1994 Red Book.

BOX 2.2 What is Hemolytic Uremic Syndrome (HUS)?

- Life threatening illness affecting the kidneys and clotting mechanisms of blood.
- In North America occurs commonly after an *E. coli* O157:H7 infection.
- First described in 1955, but first linked to *E. coli* O157:H7 in 1983.
- Predominantly affects infants and children.
- Most common cause of acute renal failure in children.

Chronic medical conditions (sequelae) may be associated with infections from foodborne pathogens. The incidence of sequelae after foodborne illness is unknown but probably less than 5%. Susceptibilities differ and may be linked to several host risk-factors that are discussed further in Chapter 3.

D. Foodborne Intoxications

Foodborne intoxications most often result from bacteria that release toxins into food during growth in the food. The preformed toxin is ingested, thus, live bacteria do not need to be consumed to cause illness. Microbial toxins such as botulinum toxin and many of the marine algal toxins are some of the most potent toxins known. Indications that a food contains a preformed toxin (changes in appearance, odor or taste) are rare.

Illness from an intoxication manifests more rapidly because the body is affected quickly by the toxin or wants to expel it. Time for growth and invasion of the intestinal lining, as in an infection, is not required. The incubation period for an intoxication is often measured in minutes or hours. For example, the incubation period for *Staphylococcus aureus* toxin-related illness is one to six hours, with a mean of four hours. In cases of paralytic shellfish poisoning (PSP) (caused by the eating of shellfish containing a potent algal toxin) symptoms may be experienced within 15 minutes of ingestion.

The most common or sometimes only symptom of an intoxication is vomiting. Other symptoms can range from nausea and diarrhea to interference with sensory and motor functions (e.g., taste, touch, muscle movements). These include: double vision, weakness, respiratory failure, numbness, tingling of the face and disorientation. **Fever is rarely present with intoxication**. Absence of fever is important when trying to determine cause of illness.

TABLE 2.3 Clinical Features of the Main Types of Foodborne Illness

Usual Incubation	Typical Symptoms	Possible Cause
Short		
1-5 hours	Vomiting, nausea, sometimes diarrhea and cramps	*Bacillus cereus*
2-6 hours	Vomiting, nausea, diarrhea	*Staphylococcal aureus*
Intermediate		
8-18 hours	Diarrhea, abdominal pain	*Clostridium perfringens*
8-16 hours	Diarrhea, abdominal pain	*Bacillus cereus*
Long		
12-24 hours	Nausea, vomiting, diarrhea lasting 1-2 days	Small round structured viruses (Norwalk like)
12-24 hours	Diarrhea, abdominal pain	*Vibrio parahaemolyticus*
12-36 hours	Weakness, double vision, difficulty swallowing, dry mouth	*Clostridium botulinum*
12-48 hours	Diarrhea, fever, abdominal pain lasting several days	Salmonella species
1-2 days	Diarrhea, often bloody	*E. coli* (toxigenic species)
1-3 days	Abdominal pain, bloody and mucoid diarrhea, fever	Shigella species
2-5 days	Diarrhea (sometimes bloody), abdominal pain, fever	Campylobacter species
7-10 days	Very watery diarrhea, nausea, vomiting, gas, malaise, weight loss	Cyclospora
1-2 weeks	Diarrhea, bloating	*Cryptosporidium parvum*
1-3 weeks	Fever or constipation	*Salmonella typhi*
15-50 days	Jaundice, malaise, fever, diarrhea	Hepatitis A
1-10 weeks	Mild "flu," malaise, meningitis	*Listeria monocytogenes*

Source: Data adapted from Department of Health, *Mgt. of Outbreaks of Foodborne Illness*, London, 1994.

For a typical intoxication to occur, bacteria must be able to multiply and produce toxins in food. In some cases, toxigenic bacteria can contaminate foods and not produce toxin. Therefore, the presence of bacteria does not always mean that the food is hazardous to eat. On the other hand, bacteria may have grown in a food and produced the toxin, yet the bacteria are no longer viable or recoverable. Nevertheless, the toxin remains and causes illness.

The ability to detect the toxin in food, therefore, is more important than the ability to detect bacterial cells. It is more expensive and technologically difficult to detect toxins than bacteria. Currently, animal bioassays are being replaced by new molecular methods. A type of bioassay using mice is still required for detection of botulinum toxin. (See Chapter 6, Section 4-F for information on botulism testing.) **When testing for toxin in food is unavailable, identification of a large number of bacteria can be circumstantial evidence of toxin presence.** There are currently no laboratory tests to detect toxin within an individual.

TABLE 2.4 Summary of Foodborne Infection and Foodborne Intoxication

	Foodborne Infection	Foodborne Intoxication
Incubation Period	Generally rather long, usually measured in days	Generally rather short, often measured in minutes or hours
Typical Symptoms	Diarrhea, nausea, vomiting, abdominal cramps. Fever is often present.	Vomiting is more common. Can range from nausea to vomiting to interference with taste, touch and muscle movements (e.g., double vision, weakness, numbness, tingling of face, disorentiation, flushing)
Pathogens	Infection: *Salmonella* species, Hepatitis A, *Shigella* species, *Giardia lamblia* *Campylobacter* species, *Yersinia* species, *Listeria monocytogenes*, *Vibrio parahaemolyticus*, *Vibrio vulnificus*, rotavirus, Norwalk virus, *Toxoplasma gondii, Cyclospora cayetanensis, Cryptosporidium parvum* Toxin-mediated infection: *C. botulinum* (infant), *B. cereus* (long incubation), *E. coli* species, *V. cholerae*, *C. perfringens*	*C. botulinum* (adult), *S. aureus* *B. cereus* (short incubation), certain metals, certain wild mushrooms, certain fish and *shellfish*

E. Examples of Seafood Intoxications

In North America, several kinds of seafood-associated toxins can cause illness.

- **Paralytic shellfish poisoning (PSP)** is transmitted to humans through mussels, clams, and scallops that have ingested and concentrated toxic marine protozoa. The toxin is found mainly in coastal waters and is often associated with a red discoloration of seawater due to algal bloom known as "red tide."

- **Diarrhetic shellfish poisoning** is also caused by ingestion of seafood containing toxic marine protozoa. Illnesses have occurred in eastern Canada, Japan and Western Europe.

- **Amnesic shellfish poisoning** can result from eating shellfish that are contaminated with algae that produces domoic acid. It was responsible for over 100 cases and 3 deaths in eastern Canada in a 1987 outbreak.

- **Ciguatera poisoning** is a result of ingestion of ciguatoxin and related toxins, produced in tropical fish, but also implicated in farm-raised salmon. Areas of higher risk are the Pacific and northern Caribbean. However, imported fish have occasionally caused outbreaks in the United States.

- **Scombroid poisoning**, arising from bacterial spoilage of fish and subsequent production of histamine and related compounds, occurs more frequently than other seafood toxin poisonings. Tuna, mackerel, mahi-mahi and marlin are often implicated.

None of these toxins mentioned above are not destroyed by heat or cold storage, and control depends on the preprocessing stages.

NOTE: See Table 2.5 at the end of this chapter for a more complete listing of typical symptoms of common agents.

NOTE: The quantity (also called "dose") of viruses, bacteria and parasites necessary to cause illness depends on a number of factors that are discussed further throughout Chapter 3. Table 3.3 also provides the infective/toxic dose of various agents.

4) The Carrier State

Foodborne disease carriers are individuals who harbor a specific infectious agent but do not exhibit symptoms of illness or disease. **Because the agent is excreted in the feces, a carrier is a potential source of infection for others**.

Characteristics of carriers are listed below.

- Carriers may be people in the incubation phase (the period before symptoms appear) of an infection. In the period before illness, an infected person may excrete the infective agent (e.g., the hepatitis A virus is excreted for as long as two weeks before symptoms appear).
- Certain individuals who are exposed to a contaminated food or become infected never show signs of illness, but as healthy carriers can spread pathogens unknowingly to others. They may show no symptoms either because they have a subclinical infection or because they are only mildly infected. This is particularly dangerous in a food-handling setting.
- Carriers may be people in the convalescent (recovery) stages of an illness. Certain microorganisms can be excreted into feces during the convalescent period, often 24-72 hours after symptoms cease. This is true for viruses, *Salmonella* species, and *Shigella* species. Approximately 1% of patients continue to excrete nontyphoidal Salmonella for more than 1 year.
- The carrier state can be of short or long duration (temporary or chronic carrier). The carrier state usually ceases spontaneously after several weeks or a few months, but some individuals may become chronic carriers (e.g., for periods exceeding a year, for agents such as *Salmonella typhi*).

Carrier states are important to remember when investigating and controlling foodborne illness. It is not only individuals with symptoms who are capable of transmission to others, but also those who are in the incubation or convalescent phases of illness and those who are asymptomatic. For example, when determining the close contacts who need prophylatic immune globulin (IG) in a hepatitis A outbreak, it is necessary to identify the onset date of symptoms in the patient and then identify those individuals who may have had close contact with the patient for as long as two weeks prior to that date.

NOTE: See Appendix A, Section 5, for detailed information on hepatitis A control measures.

Conclusion

The next chapter (Chapter 3) discusses the pathogenesis of foodborne illness. It expands further on issues addressed in this chapter. These issues focus on the development of disease among people who eat the same contaminated food. Why do some people get sick when others do not? Why is the severity of symptoms different among those who get ill? Why do some people develop chronic medical conditions when others do not? What quantity of bacteria, virus or parasite (infective or toxic dose) does it take to cause illness?

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TABLE 2.5

a) Common Foodborne Diseases Caused by Bacteria

Disease (causative agent)	Latency Period (duration)	Principal Symptoms	Typical Foods	Mode of Contamination	Prevention of Disease
(*Bacillus cereus)* food poisoning, diarrheal	8-16 hr (12-24 hr)	Diarrhea, cramps, occasional vomiting	Meat products, soups, sauces, vegetables	From soil or dust	Thorough heating and rapid cooling of foods
(*Bacillus cereus*) food poisoning, emetic	1-5 hr (6-24 hr)	Nausea, vomiting, sometimes diarrhea and cramps	Cooked rice and pasta	From soil or dust	Thorough heating and rapid cooling of foods
Botulism; food poisoning (heat labile toxin of *Clostridium botulinum*)	12-36 hr (months)	Fatigue, weakness, double vision, slurred speech, respiratory failure, sometimes death	Types A & B: vegetables, fruits, meat, fish, and poultry products, condiments; Type E: fish and fish products	Types A & B: from soil or dust; Type E: water and sediments	Thorough heating and rapid cooling of foods
Botulism; food poisoning infant infection	Unknown	Constipation, weakness, respiratory failure, sometimes death	Honey, soil	Ingested spores from soil, dust or honey colonize intestine	Do not feed honey to infants - will not prevent all
Campylobacteriosis *(Campylobacter jejuni)*	3 - 5 days (2 - 10 days)	Diarrhea, abdominal pain, fever, nausea, vomiting	Infected food-source animals	Chicken, raw milk	Cook chicken thoroughly; avoid cross-contamination; irradiate chickens; pasteurize milk
Cholera *(Vibrio cholerae)*	2 - 3 days hours to days	Profuse, watery stools; sometimes vomiting, dehydration; often fatal if untreated	Raw or undercooked seafood	Human feces in marine environment	Cook seafood thoroughly; general sanitation
(*Clostridium perfringens)* food poisoning	8 - 22 hr (12 - 24 hr)	Diarrhea, cramps, rarely nausea and vomiting	Cooked meat and poultry	Soil, raw foods	Thorough heating and rapid cooling of foods
(*Escherichia coli*) foodborne infections enterohemorrhagic	12-60 hr (2-9 days)	Watery, bloody diarrhea	Raw or undercooked beef, raw milk	Infected cattle	Cook beef thoroughly; pasteurize milk
(*Escherichia coli*) enteroinvasive	at least 18 hr (uncertain)	Cramps, diarrhea, fever, dysentery	Raw foods	Human fecal contamination, direct or via water	Cook foods thoroughly; general sanitation
(*Escherichia coli*) foodborne infection: enterotoxigenic	10-72 hr (3-5 days)	Profuse watery diarrhea; sometimes cramps, vomiting	Raw foods	Human fecal contamination, direct or via water	Cook foods thoroughly; general sanitation
Listeriosis (*Listeria monocytogenes*)	3-70 days	Meningoencephalitis; still-births; septicemia or meningitis in newborns	Raw milk, cheese and vegetables	Soil or infected animals, directly or via manure	Pasteurization of milk; cooking
Salmonellosis (*Salmonella* species)	5-72 hr (1-4 days)	Diarrhea, abdominal pain, chills, fever, vomiting, dehydration	Raw and undercooked eggs; raw milk, meat and poultry	Infected food-source animals; human feces	Cook eggs, meat, and poultry thoroughly; pasteurize milk; irradiate chickens
Shigellosis (*Shigella* species)	12-96 hr (4-7 days)	Diarrhea, fever, nausea; sometimes vomiting, and cramps	Raw foods	Human fecal contamination, direct or via water	General sanitation; cook foods thoroughly
Staphylococcal food poisoning (heat-stable enterotoxin of *Staphyloccocus aureus*)	1-6 hours (6-24 hours)	Nausea, vomiting, diarrhea, cramps	Ham, meat and poultry products, cream-filled pastries, whipped butter, cheese	Handlers with colds, sore throats or infected cuts, food slicers	Thorough heating and rapid cooling of foods
Streptococcal foodborne infection (*Streptococcus pyogenes*)	1-3 days (varies)	Various, including sore throat, erysipelas, scarlet fever	Raw milk, deviled eggs	Handlers with sore throats, other "strep" infections	General sanitation, pasteurize milk
***Vibrio parahaemolyticus* foodborne infection**	12-24 hr (4-7 days)	Diarrhea, cramps; sometimes nausea, vomiting, fever headache	Fish and seafoods	Marine coastal environment	Cook fish and seafoods thoroughly
***Vibrio vulnificus* foodborne infection**	In persons with high serum iron: 1 day	Chills, fever, prostration, often death	Raw oysters and clams	Marine coastal environment	Cook shellfish thoroughly
Yersiniosis (*Yersinia enterocolitica*)	3-7 days (2-3 weeks)	Diarrhea, pains mimicking appearance of appendicitis, fever, vomiting, etc.	Raw or undercooked pork and beef; tofu packed in spring water	Infected animals especially swine; contaminated water	Cook meats thoroughly, chlorinate water

b) Common Foodborne Diseases Caused by Viruses

Disease (Causative agent)	Onset (Duration)	Principal Symptoms	Typical Foods	Mode of Contamination	Prevention of Disease
Hepatitis A (Hepatitis A virus)	15-50 days (weeks to months)	Fever, weakness, nausea, discomfort, often jaundice	Raw or undercooked shellfish; sandwiches, salads, etc.	Human fecal contamination, via water or direct	Cook shellfish thoroughly; general sanitation
Viral gastroenteritis (Norwalk-like viruses)	1-2 days (1-2 days)	Nausea, vomiting, diarrhea, pains, headache, mild fever	Raw or undercooked shellfish, sandwiches, salads, etc.	Human fecal contamination, via water or direct	Cook shellfish thoroughly; general sanitation
Viral gastroenteritis (rotaviruses)	1-3 days (4-6 days)	Diarrhea, especially in infants and children	Raw or mishandled food	Probably human fecal contamination	General sanitation

c) Common Foodborne Diseases Caused by Fungi Other Than Mushrooms

Disease (Causative agent)	Latency Period (Duration)	Principal Symptoms	Typical Foods	Mode of Contamination	Prevention of Disease
Aflatoxicosis ("aflatoxins" of *Aspergillus flavus* and related molds)	Varies with dose	Vomiting, abdominal pain, liver damage; liver cancer (mostly Africa and Asia)	Grains, peanuts, milk	Molds grow on grains and peanuts in field or storage; cows fed moldy grain	Prevent mold growth; don't eat or feed moldy grain or peanuts; treat grain to destroy toxins
Alimentary toxic aleukia ("trichothecene" toxin of *Fusarium* molds)	1-3 days (weeks to months)	Diarrhea, nausea, vomiting; destruction of skin and bone marrow; sometimes death	Grains	Mild growth on grain, especially if left in the field through winter	Harvest grain in the fall; don't use moldy grain
Ergotism (toxins of *Claviceps purpurea*)	Varies with dose	Gangrene (limbs die and drop off); or convulsions and dementia; abortion (now not seen in the U.S.)	Rye; or wheat, barley, and oats	Fungus grows on grain in the field; grain kernel is replaced by a "sclerotium"	Remove sclerotia from harvested grain

d) Common Foodborne Diseases Caused by Protozoa and Parasites

Disease (Causative agent)	Onset (duration)	Principal Symptoms	Typical Foods	Mode of Contamination	Prevention of Disease
(PROTOZOA) Amebic dysentery (*Entamoeba histolytica*)	2-4 weeks (varies)	Dysentery, fever, chills; sometimes liver abscess	Raw or mishandled foods	Cysts in human feces	General sanitation; thorough cooking
Cryptosporidiosis (*Cryptosporidium parvum*)	1-12 days (1-30 days)	Diarrhea; sometimes fever, nausea, and vomiting	Mishandled foods	Oocysts in human feces	General sanitation; thorough cooking
Giardiasis (*Giardia lamblia*)	5-25 days (varies)	Diarrhea with greasy stools, cramps, bloat	Mishandled foods	Cysts in human and animal feces, directly or via water	General sanitation; thorough cooking
Toxoplasmosis (*Toxoplasma gondii*)	10-23 days (varies)	Resembles mononucleosis; fetal abnormality or death	Raw or undercooked meats; raw milk; mishandles foods	Cysts in pork or mutton, rarely beef; oocysts in cat feces	Cook meat thoroughly; pasteurize milk; general sanitation
(ROUNDWORMS, Nematodes) Anisakiasis (*Anisakis simplex, Pseudoterranova decipiens*)	Hours to weeks (varies)	Abdominal cramps, nausea, vomiting	Raw or undercooked marine fish, squid or octopus	Larvae occur naturally in edible parts of seafoods	Cook fish thoroughly or freeze at -4°F for 30 days
Ascariasis (*Ascaris lumbricoides*)	10 days-8 weeks (1-2 years)	Sometimes pneumonitis, bowel obstructions	Raw fruits or vegetables that grow in or near soil	Eggs in soil, from human feces	Sanitary disposal of feces; cooking food
Trichinosis (*Trichinella spiralis*)	8-15 days (weeks, months)	Muscle pain, swollen eyelids, fever; sometimes death	Raw or undercooked pork or meat or carnivorous animals (e.g., bears)	Larvae encysted in animal's muscles	Thorough cooking of meat; freezing pork at 5°F for 30 days; irradiation
(TAPEWORMS, Cestodes) Beef tapeworm (*Taenia saginata*)	10-14 weeks (20-30 years)	Worm segments in stool; sometimes digestive disturbances	Raw or undercooked beef	"Cysticerci" in beef muscle	Cook beef thoroughly or freeze below 23°F
Fish tapeworm (*Diphyllobothrium latum*)	3-6 weeks (years)	Limited; sometimes vitamin B-12 deficiency	Raw or undercooked fresh-water fish	"Plerocercoids" in fish muscle	Heat fish 5 minutes at 133°F or freeze 24 hours at 0°F
Pork tapeworm (*Taenia solium*)	8 weeks-10 years (20-30 years)	Worm segments in stool; sometimes "cysticercosis" of muscles, organs, heart, or brain	Raw or undercooked pork; any food mishandled by a *T. solium* carrier	"Cysticerci" in pork muscle; any food-human feces with *T. solium* eggs	Cook pork thoroughly or freeze below 23°F; general sanitation

e) Common Foodborne Diseases Caused by Chemicals and Metals

Disease (causative agent)	Latency Period (duration)	Principal Symptoms	Typical Foods	Mode of Contamination	Prevention of Disease
(TOXINS IN FINFISH) Ciguatera poisoning (ciguatoxin, etc.)	3-4 hr (rapid onset) 12-18 hr (days-months)	Diarrhea, nausea, vomiting, abdominal pain Numbness and tingling of face; taste and vision aberrations, sometimes convulsions, respiratory arrest and death (1-24 hrs)	"Reef and island" fish: grouper, surgeon fish, barracuda, pompano, snapper, etc.	(Sporadic); food chain, from algae	Eat only small fish
Fugu or pufferfish poisoning (tetrodotoxin, etc.)	10-45 min to ≥3 hrs	Nausea, vomiting, tingling lips and tongue, ataxia, dizziness, respiratory distress/arrest, sometimes death	Pufferfish, "fugu" (many species)	Toxin collects in gonads, viscera	Avoid pufferfish (or their gonads)
Scombroid or histamine poisoning (histamine, etc.)	minutes to few hours (few hours)	Nausea, vomiting, diarrhea, cramps, flushing, headache, burning in mouth	"Scombroid" fish (tuna, mackerel etc.); mahi-mahi, others	Bacterial action	Refrigerate fish immediately when caught
(TOXINS IN SHELLFISH) Amnesic shellfish poisoning (domoic acid)		Vomiting, abdominal cramps, diarrhea, disorientation, memory loss; sometimes death	Mussels, clams	From algae	Heed surveillance warnings
Paralytic shellfish poisoning (saxitoxin, etc.)	<1 hr (<24 hr)	Vomiting, diarrhea, paresthesias of face, senory and motor disorders; respiratory paralysis, death	Mussels, clams, scallops, oysters	From "red tide" algae	Heed surveillance warnings
(MUSHROOMS TOXINS) Mushroom poisoning (varies greatly among species)	<2 hrs to ≥3 days	Nausea, vomiting, diarrhea, profuse sweating, intense thirst, hallucinations, coma, death	Poisonous mushrooms	Intrinsic	Don't eat wild mushrooms
(PLANT TOXINS) Cyanide poisoning (cyanogenetic glycosides from plants)	(Large doses) 1-15 min	Unconsciousness, convulsions, death	Bitter almonds, cassava, some lima bean varieties, apricot kernels	Intrinsic, natural	Proper processing; avoid some so-called foods
(METALS) Cadmium	Depends on dose	Nausea, vomiting, diarrhea, headache, muscular aches, salivation, abdominal pain, shock, liver damage, renal failure	Acid foods, food grilled on shelves from refrigerator	Acid or heat mobilizes cadmium plating	Select food contact surfaces carefully
Copper poisoning	Depends on dose (24-48 hours)	Nausea, vomiting, diarrhea	Acid foods, foods contacting copper	Acid mobilizes copper	Select food contact surfaces carefully
Lead poisoning	Depends on dose	Metallic taste, abdominal pain, vomiting, diarrhea, black stools, oliguria, collapse, coma (also chronic effects)	Glazes, glasses, illicit whiskey	Lead dissolves in beverages and foods	Test glazes and glasses; avoid illicit whiskey
Mercury poisoning	Depends of dose	Metallic taste, thirst, abdominal pain, vomiting, bloody diarrhea, kidney failure	Treated seeds (fungicide); fish	Intentional; food chain	Eat only seeds intended for food
Zinc poisoning	Depends on dose (24-48 hr)	Nausea, vomiting, diarrhea	Acid foods in galvanized containers	Acid mobilizes zinc plating	Select food contact surfaces carefully

Source: Institute of Food Technologists, *Food Technology*, 1995. Used with permission.

Chapter 3

PATHOGENESIS

1) The Digestive Tract
2) The Body's Defense System
3) High-Risk Populations
4) Infective or Toxic Dose

PATHOGENESIS

Introduction
Ingested pathogens, transmitted from contaminated foods, enter the body by way of the gastrointestinal (GI) tract. The body has defenses to fight these pathogens, but an overwhelming dose of pathogens or a weakened resistance can lead to illness. Certain populations, for example, the very young, the elderly, and some immunocompromised persons, are at higher risk for foodborne disease and for serious complications of foodborne disease. The severity of illness may be different among people eating the same contaminated food. The variability in illness severity is due to several factors including: the virulence of the pathogen, the health status of the host, and the concentration of the pathogen. The minimum dose of pathogens necessary to cause illness varies from organism to organism and host to host.

1) The Digestive Tract

Food digestion begins in the mouth, where the food is mixed with enzyme-containing saliva, and then continues in the stomach, where other acid and enzymes in the gastric juice are added. The large molecules of proteins, fats, and carbohydrates cannot be used until they move to the small intestine where they are digested into smaller molecules by enzymes. Normal intestinal bacteria are present in large quantities and aid in digestion.

The surface layer of the small intestine consists of a lining called the epithelium that mediates exchanges between the partially-digested food and the deeper tissue layers containing blood, lymph vessels, glands and nerves. The smaller molecules are absorbed across this lining into the blood and the lymph. Hence, the molecules gain entry into the body and are used for energy and other bodily requirements. The large intestine has comparatively little digestive function. It mainly absorbs water and electrolytes from the digested food. It then expels the resulting waste products as feces, which contain undigested material (fiber), but is mostly normal bacteria by weight.

The digestive tract is under frequent attack, and serves as the main line of defense against the actions of potential foodborne pathogenic microorganisms. Illness results when the number of microorganisms or the concentration of their toxins overwhelms the body's threshold point. Most foodborne exposures are mild, the body successfully fights off the microorganisms, and the person never experiences any symptoms of illness. Or, a person

may experience mild abdominal symptoms, or perhaps more severe symptoms, without realizing that the cause was foodborne.

The threshold point for illness differs from person to person and is affected by various factors described in the following sections. For pathogens that cause infections, the threshold point is termed the **infective dose**; for pathogens that cause intoxications, it is termed the **toxic dose**. The frequency and severity of illness usually increases as the dose consumed exceeds this threshold. This is termed an illness or attack rate dose-response relationship. (See Table 3.3 at the end of this chapter for the infective and toxic dose of various microorganisms.)

2) The Body's Defense System

The human body possesses a wide variety of defense mechanisms for counteracting foodborne pathogens. The components of the GI defense system include:

- stomach acid pH,
- GI tract immune system,
- intestinal flora, and
- bile acids and digestive enzymes.

A. Stomach pH

The gastric fluid present in the stomach is quite acidic, with a pH of about 2. Many bacteria that enter the stomach are killed in such an environment. The pH indicates the degree of acidity or alkalinity of a substance. A neutral substance, such as water, has a pH of 7. Acids have a pH less than 7 and bases have a pH ranging from 7 to 14.

The acidity of the stomach can reduce or eliminate pathogenic microorganisms or toxins before they can reach the small intestine, where most absorption occurs. Anything decreasing stomach acidity (resulting in increased pH) can potentially protect many pathogens and toxins and increase their chance of reaching the small intestine rendering the person more susceptible to illness. Such factors include:

- the buffering capacity of food (e.g., the components of milk decrease acidity),
- the consumption of antacids (these are buffering agents and decrease acidity),
- the use of certain drugs, acid blockers (e.g., cimetidine and ranitidine for treatment of ulcers inhibit the secretions of stomach acids),
- partial or total gastrectomies (these are associated with decreased acidity).

Salmonella is a good example of a bacterium that benefits from the buffering capacity of foods. Relatively large numbers of *Salmonella* bacteria are normally required to cause illness in healthy adults. However, infection can occur with lower doses from foods that protect *Salmonellae* from the acidity of the stomach (e.g., milk). The same applies to

Campylobacter species if the organism is consumed with milk or other foods that neutralize stomach acidity.

Clostridium botulinum has an effective way to cause illness while being protected against the acidity of the stomach. When growing in contaminated foods, it makes a toxin consisting of two parts (toxic and nontoxic). The toxic part induces the illness but is easily altered by stomach acidity. The nontoxic portion serves to protect the toxic part during passage through the stomach. After passage to the small intestine, the toxin is released by intestinal enzymes, thus causing illness.

B. The GI Tract Immune System

The GI tract has its own immune system. It is related to, but distinct from, the overall immune system. The GI tract immune system helps to keep the body healthy by reducing absorption of some large molecules or reducing colonization or invasion of the epithelium by pathogens. It does all of this without affecting normal bacterial flora.

Large particles, such as toxins, are immobilized within the epithelium. Certain enzymes can then attack the immobilized form. Another way in which the intestines minimize entry of particles into the body is by breaking down particles that attach to the bowel wall. The intestinal wall also contains lymphocytes and antibody producing cells that fight infection. Generally only organisms that can attach to the intestinal lining cause problems. Otherwise organisms are swept out by the motility of the GI tract.

Although the intestinal immune system is well designed to handle many invading molecules and pathogens, certain ones are difficult to control. Some pathogenic microorganisms can change their outside surfaces so that they are not recognized or are considered harmless. They are therefore not attacked or eliminated by the host and can then cause illness.

Persons who have been exposed to certain pathogens or toxins may develop partial or total immunity to later exposures to the same pathogen/toxin. The immunity results from a specific immune reaction and greatly increases the infective or toxic dose required to cause subsequent illness. For example, hepatitis A antibodies appear early in the course of infection, remain detectable for the person's lifetime and indicate lifelong immunity. Subsequent exposure to hepatitis A will not result in illness.

C. The Intestinal Flora

More than 400 species of bacteria (also called normal flora) live in the adult human GI tract. These flora can provide resistance to colonization by some pathogenic microorganisms. Animal studies indicate that colonization resistance exerted by the normal flora increases throughout adulthood. In the healthy individual, host tissues and the normal GI flora operate in harmony.

Most foodborne pathogens are not normal inhabitants of the intestines. Exceptions include certain strains of *Clostridium perfringens* and *Escherichia coli*, which are normal inhabitants of the intestinal tract, but are not virulent strains causing disease in the healthy individual.

To cause illness, foodborne pathogens must be able to compete successfully against the normal flora. They must be able to either colonize the epithelial surface or hide from the GI immune system. Some pathogens produce attachment factors which enable them to colonize the intestinal walls. Others produce enzymes, toxins, or other compounds altering permeability or damaging epithelial cells allowing pathogens to invade. A few examples to help illustrate this are described below.

Shigella are localized in the intestinal cells where they remain attached to, or multiply within these cells. They cause a severe local inflammatory response which results in a bloody, mucopurulent diarrhea. Unlike S*higella*, *Vibrio cholerae* do not penetrate the epithelial layer, but remain adhered to it. The pathogen produces severe diarrhea, resulting from the secretion of a toxin that affects the underlying cells.

Manifestations of some foodborne diseases are not restricted to the GI tract. For example, *Salmonella typhi* (*S. typhi*) can move through the intestinal wall penetrating the epithelial cells. Following inflammation in the small intestine, the organisms may invade the regional lymph nodes. From the lymphatic system, they may enter the blood and infect various organs and tissues, including the liver, kidneys, spleen, bone marrow, gall bladder and even the heart. Symptoms of *S. typhi* infection include headache, loss of appetite, abdominal pain, weakness and a continued fever. Hepatitis A is an example of a virus that moves beyond the GI tract into the liver. Other microorganisms that play an etiologic role in illness beyond the GI tract include: *E. coli* O157:H7 (hemolytic uremic syndrome), *Campylobacter jejuni* (Guillain-Barré syndrome) and *Listeria monocytogenes* (fetal morbidity and meningitis).

D. Bile Acids and Digestive Enzymes

Bile acids are produced in the liver and assist in the digestion and absorption of fat. They inhibit the growth of many pathogenic microorganisms. They are thought to be partly responsible for preventing *Clostridium botulinum* from producing toxin in the intestinal tract of adults. However, other enteric microorganisms such as *Escherichia*, *Salmonella*, and *Shigella* are not affected by bile acids.

Digestive enzymes are active throughout the GI tract. As mentioned in the preceding sections of this chapter, many may inhibit or inactivate a variety of microorganisms. For example, lysozyme in saliva kill and digest microbes. In some cases, however, as with botulinum toxin, GI enzymes actually play a role in activating a toxin.

E. Treatment

While antibiotic therapy is sometimes useful in treating foodborne illness, it can sometimes be ineffective or actually make the condition worse. Antibiotics can prevent the growth of normal flora. In the absence of normal flora, pathogenic bacteria may become established. Normally, such organisms do not flourish in the intestines because they cannot compete with the normal flora. But with the normal flora eliminated from antibiotic use, they can take over.

Furthermore, oral antibiotics can facilitate intestinal colonization of certain foodborne pathogens and prolong carriage. For example, antibiotic therapy is usually not indicated for those patients with uncomplicated gastroenteritis caused by non-typhi *Salmonella* species. Antibiotic therapy can prolong the excretion of *Salmonella* organisms into feces. Treatment is indicated however for those patients with invasive disease or an increased risk of invasive disease, such as infants younger than 3 months of age and immunocompromised individuals.

There does not appear to be a role of antibiotic treatment for patients with *E. coli* O157:H7. Some studies have demonstrated that antibiotics (such as trimethoprim sulfamethoxazole) have no effect on the progression of symptoms, fecal pathogen excretion or progression to HUS. Other analyses have demonstrated that trimethoprim sulfamethoxazole can increase the chances of progression to HUS. The data are insufficient to provide an answer at this time, and further studies need to be done.

Overall, antibiotic therapy should be used with care, especially if the pathogen is resistant and the normal flora is sensitive to the antibiotic.

3) High-Risk Populations

Certain populations of people are predisposed to prolonged, more frequent, and often more severe illness. As the population of the U.S. ages, an increasing percentage of the population is becoming more susceptible to foodborne pathogens (see Table 3.1). Elderly individuals undergo a decrease in immune function and are more susceptible to microbial infections and to the complications of diarrheal disease (e.g., dehydration). Those older than 65 years account for approximately 10% of the U.S. population, and this number is growing by about 1 million per year.

Individuals immunocompromised as a result of transplant operations, chemotherapy, or AIDS are also potentially at higher risk for certain foodborne illnesses. Immunocompromised individuals may also be infected by lower infective or toxic doses of pathogenic microorganisms than healthy individuals.

Listeria and *Salmonella* are much more pathogenic in immunocompromised individuals. The risk of infection with *Listeria* is estimated to be 100 to 300 times higher in patients with AIDS. For these individuals, the illness carries a mortality rate of 23 percent. The

risk of infection with *Salmonella* is 20 times higher for these same individuals, with septicemia six times more likely to develop as a complication of infection. The number of U.S. transplant patients requiring continued immunosuppressive therapy is increasing each year; with the number of heart, kidney, liver, and pancreas transplants increasing by as much as 50% annually. Immunosuppressive therapy can reduce the ability of the body's immune system to fight off infection from pathogens.

TABLE 3.1 Populations Sensitive to Foodborne Disease in the United States

Population Category	Individuals	Year
Pregnant women	6,484,000	1992
Children under 5 years	19,286,000	1996
Elderly (over 65)	33,200,000	1994
Cancer patients	1,208,000	1994
Organ transplant procedures	17,331	1994
AIDS patients	66,816	1996

Source: U.S. Department of Commerce, 1996; U.S. Department of Health and Human Services, 1996.

Other factors may also increase an individual's risk for foodborne illness. Pregnancy puts a woman's fetus at risk for infections with *Listeria monocytogenes* or *Toxoplasma gondii*. Each of these organisms may cause abortion, stillbirth or fetal abnormality. Patients with sickle cell disease are at high risk of invasive *Salmonella* infection. Additionally, hospitalized persons are at increased risk for microbial infection. Nearly one-third of all hospitalized patients are treated with antibiotics. As mentioned in Section 2 of this chapter, antibiotic treatment alters the normal flora leaving one more vulnerable to foodborne illness.

In total, more than 30 million individuals in the United States are likely to be at high risk for foodborne illness. These and other factors discussed in this chapter are presented in Table 3.2 at the end of the chapter.

4) Infective or Toxic Dose

The minimum infective or toxic dose of microorganisms needed to cause illness for an individual is difficult to determine because of all the variables described. Not everyone exposed to a contaminated food will become clinically ill. Doses necessary to cause illness can range from one to hundreds to millions of microorganisms.

Predictions have been made to determine the number of pathogens needed to cause illness. These predictions were developed from human feeding studies and are based on probability models. One study by Rose and Sobsey (1993) estimates that individuals consuming 60 grams of raw shellfish from approved waters in the United States may have on average a 1 in 100 chance of becoming infected with an enteric virus. When the

rotavirus probability model is used, which represents a more infectious virus, the risk increases to 5 in 10. These predictions can help explain why outbreaks continue to occur.

These studies should be interpreted with caution because of the limitations of sampling and laboratory methodology. The feeding trials are usually done with healthy young men who may report mild or no illness, whereas in an actual outbreak, lower levels of pathogens may cause illness due to the variations of people involved. Also, the food may have a significant effect on infectivity, for example, certain foods may be especially efficient vehicles for transmission of infectious or toxic agents in that they enhance the probability of infection or illness (e.g., milk).

Additionally, pathogens that cause illness differ greatly among types, genera, species and strains. Not all microorganisms sharing the same genus and species name (e.g., *Escherichia* is the genus and *coli* is the species) are identical, and they may differ greatly in their infectiousness. In fact, some may not be capable of causing human illness, while others are quite hazardous. Additionally, smaller numbers of pathogens can more easily cause illness in a person who is at higher risk than in one who is not.

The probability of infection and subsequent illness is a function of:

- **the vulnerability of the host (e.g., age, immune resistance),**
- **the number of units of the infectious agent ingested with food (e.g., viral particles, bacterial cells, parasitic cysts), and**
- **the virulence or pathogenicity of the agent.**

Table 3.3 at the end of the chapter presents what is currently known of the infectivity/toxigenicity of the more common agents. This information has been drawn from human feeding studies as well as from foodborne illness outbreaks.

Conclusion

Chapters 4-8 of this reference manual cover the sequential events in the investigation of foodborne illness. While chapters 1-3 consist of background or textual information, the following chapters contain more of the “how to” or “hands on” material. Each chapter provides information on a specific part of an investigation. Keep in mind that these events do not necessarily happen in the order that the material is printed. Many events happen simultaneously; note the various references to other chapters and sections as you go along.

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TABLE 3.2 Factors Increasing the Risk or Severity of Foodborne Illness

FACTORS	REASONS
Microbial Factors:	
Type and strain of pathogen ingested	Some pathogens and strains more virulent than others
Quantity of pathogens ingested	Higher numbers ingested may increase severity of illness and/or shorten onset time
Host Factors:	
Age less than 5 years	Lack of developed immune systems, smaller infective dose-by-weight required
Age greater than 50 or 60 years (depending on pathogen)	Immune system failing, weakened by chronic ailments, occurring as early as 50 to 60 years of age
Pregnancy	Altered immunity during pregnancy
Hospitalized persons	Immune systems weakened by other diseases or at risk of exposure to antibiotic-resistant strains
Concomitant infections	Overloaded or damaged immune systems
Consumption of antibiotics	Alteration of normal intestinal microflora
Excessive iron in blood	Iron in blood serving as nutrient for some organisms
Reduced liver/kidney function (alcoholism)	Reduced digestion capabilities, altered blood-iron concentrations
Possession of certain human antigenic determinants duplicated or easily mimicked by microorganisms	Predisposition to chronic illness (sequelae)
Surgical removal of portions of stomach or intestines	Reduction in normal defense systems against infection
Immunocompromised individuals including those on chemotherapy or radiation therapy; recipients of organ transplants taking immunocompromising drugs; persons with leukemia, AIDS, or other illnesses	Immune system inadequate to prevent infection
Stress	Body metabolism changes allowing easier establishment of pathogens, or lower dose of toxin required for illness
Poor hygiene	Increased likelihood of ingestion of pathogens
Diet related factors:	
Nutritional deficiencies either through poor absorption of food (mostly ill or elderly persons) or unavailability of adequate food supply (starving persons)	Inadequate strength to build up resistance and/or consumption of poor-quality food ingredients, which may contain pathogens
Consumption of antacids	Increased pH of stomach
Consumption of large volume of liquids including water	Dilution of acids in the stomach and rapid transit through the stomach
Ingestion of fatty foods (such as chocolate, cheese, hamburger) containing pathogens	Protection of pathogens by the fat against stomach acids
Other factors:	
Geographic location	Likelihood of exposure to endemic virulent strains, limited food and water supply, varied distribution of organisms in water and soil

Source: CAST, Foodborne Pathogens Risks and Consequences, 1994. Used with permission.

TABLE 3.3 Infectivity or Toxigenicity of Various Microorganisms

AGENT	INFECTIVITY/TOXIGENICITY
Bacillus cereus	Symptoms arise after ingestion of food containing large numbers of toxigenic bacteria (> 10^5/g), or preformed toxin.
Campylobacter jejuni	As few as 100 organisms can cause illness if consumed with milk or other foods that may neutralize gastric acidity.
Clostridium botulinum	The toxin is potentially lethal at very low doses.
Clostridium perfringens	Usually >10^6 microorganisms are required to cause illness.
Cryptosporidium species	High infectivity, approximately 100-150 organisms can cause illness.
E. coli O157:H7	Relatively high toxigenicity as <1000 bacteria can cause illness.
Giardia lamblia	As few as 25-100 cysts can cause illness.
Hepatitis A	High infectivity, as approximately 10-100 particles of virus can cause illness.
Listeria monocytogenes	Not highly pathogenic for healthy adults outside high-risk groups.
Salmonella species (excluding *S. typhi* and *S. paratyphi*)	Normally, relatively large numbers of bacteria (10^5) required to cause illness in healthy adults, but vulnerable groups can be infected by lower numbers. Infection can occur from relatively low doses, particularly in foods that protect salmonellae from the acidity of the stomach.
Salmonella typhi *Salmonella paratyphi*	Variable infectivity. 10^5-10^9 bacteria may be required to cause illness, depending on the strain and host susceptibility. As few as 10 to 100 *S. typhi* have caused illness.
Shigella species	Small numbers of bacteria (10-100) have caused illness in volunteers.
Staphylococcus aureus enterotoxin	Illness can occur in the absence of live cells; toxin may have been produced, and the organisms may die out. Sufficient toxin to cause illness may be produced if bacterial numbers reach 10^5 to 10^6.
Vibrio cholerae serotype 01 and non 01 strains	10^6 organisms cause illness. If given with alkali to neutralize stomach acidity as few as 100-1000 can cause disease.
Vibrio parahaemolyticus	Relatively low infectivity - at least 10^5 to 10^7 organisms of virulent strain may be required to cause illness.
Viruses	Relatively high infectivity. For example, the infective dose of rotavirus in a child can be as few as 10 particles.
Yersinia enterocolitica	Relatively low infectivity. Larger numbers are required to cause illness.

Data taken from: Mandell, G. et al, 1995, and Department of Health Working Group, England, 1994.

Chapter 4

FOODBORNE ILLNESS SURVEILLANCE

1) Purpose of Surveillance
2) Historical Development of Surveillance
3) Information You Need to Collect
4) How to Collect Information
5) Reporting Issues: Timeliness, Priorities and Confidentiality
6) Using the Information Collected
7) Limitations of Data

FOODBORNE ILLNESS SURVEILLANCE

Introduction

Surveillance of foodborne illness serves as the framework from which public health officials can act to control and prevent diseases which can be acquired through food. Surveillance is necessary to determine any significant changes in frequency or distribution of cases. These observations are a continuous process to determine the extent of disease, risk of transmission, and to develop an approach for the prevention and control of illness.

The purpose of this chapter is to outline the information necessary to collect when conducting foodborne illness surveillance, to explain the methods by which this information is collected, and to give several examples about how this information can be used. In addition, a historical perspective on disease surveillance is offered, along with discussions about the limitations of data, timely disease reporting, and confidentiality issues surrounding such reporting.

1) Purpose of Surveillance

Simply stated, surveillance is the regular collection, summarization and analysis of data.

The key to recognizing foodborne illness lies in routine surveillance. How, after all, do you know what is **unusual** if you do not keep track of what happens every day? This point illustrates the importance of prompt reporting. Thus, the purpose of foodborne illness surveillance is to interrupt the transmission of disease to susceptible persons by:

- seeking notification of illness through timely reporting,
- identifying outbreaks, investigating outbreaks, and
- interpreting investigative data and disseminating findings.

2) Historical Development of Surveillance

Current concepts of surveillance evolved from earlier public health activities. In the late Middle Ages, governments in Western Europe began to assume responsibility for health protection in towns and cities. A simple system of monitoring illness led to regulations against polluting streets and public water, and proper food handling. An example of the earliest public health action related to surveillance is during the period of bubonic plague when public health authorities boarded ships in the port near the Republic of Venice to prevent persons with plague-like illness from disembarking.

National disease-monitoring activities did not begin in the United States until 1850 when mortality statistics based on death registration and the national census were first published by the Federal Government. A prominent name in the development of public health surveillance at this time was Lemuel Shattuck. Shattuck's *Report of the Massachusetts Sanitary Commission* (1850) was a landmark publication that related death, infant and maternal mortality, and communicable diseases to living conditions.

Massachusetts was the first state to begin systematic reporting of disease in 1874 when the Massachusetts State Board of Health instituted a voluntary plan for weekly reporting of prevalent diseases by physicians, using a standard postcard-reporting format. By 1901, all states required notification from physicians to local authorities of selected communicable diseases such as smallpox, tuberculosis, and cholera. It was not however, until 1925 that all states were participating in the national reporting of infectious disease.

The Council of State and Territorial Epidemiologists (CSTE) was authorized in 1951 by its parent body, the Association of State and Territorial Health Officials (ASTHO), to recommend what diseases should be reported by states to the U.S. Centers for Disease Control and Prevention (CDC). The CSTE meets annually and recommends appropriate changes in morbidity reporting and surveillance, including what diseases should be reported to CDC. This information is published in the *Morbidity and Mortality Weekly Report* (*MMWR*) and its supplements.

In Massachusetts, reporting of communicable diseases is required under **Massachusetts General Law, Chapter 111, Sections 3, 6, 7, 109, 110 and 112**. These laws are implemented by regulation under **Chapter 105, Code of Massachusetts Regulations (CMR), Section 300 *et seq*: Reportable Diseases and Isolation and Quarantine Requirements.** The purpose of these regulations is "to list those diseases declared dangerous by the MA Department of Public Health, and to establish reporting, isolation and quarantine requirements. This is intended for use by local boards of health, hospitals, physicians, educational and recreational program health officials, food industry officials, and the public." (See *Diseases Reportable By Healthcare Providers* at the end of this chapter.)

In Massachusetts, local boards of health or their designee (often local Visiting Nurse Associations) are authorized to accept, investigate and submit reportable disease case information to the MA Department of Public Health, Bureau of Communicable Disease Control. Certain conditions such as AIDS, tuberculosis (in most cities and towns) and sexually transmitted diseases are directly reportable by health care providers and laboratories to the Bureau of Communicable Disease Control (see Figure 4.3 - Massachusetts Reportable Disease Surveillance System). Summary information on nationally-notifiable diseases is submitted to the CDC on a weekly basis (without personal identifiers). This information is used to track national and regional disease trends.

3) Information You Need To Collect

Two main categories of information should be collected as part of a foodborne illness surveillance system: **Descriptive Information** and **Investigational Findings**.

A. Descriptive Information.

First, information is needed regarding the time(s), place(s), and person(s) connected with a particular complaint. Collecting this descriptive information will enable one to decide whether a complaint is valid (see Chapter 5, Section 3). For example, when notified of a potential foodborne illness, one should gather the following information:

WHO, WHEN, WHAT, WHERE

- **WHO** became ill and what are the characteristics of this person(s) (age, sex, occupation)?
- **WHEN** did the person(s) become ill?
- **WHAT** foods, beverages, or meals are suspect? (See "Guidelines For Determining Suspect Foods" below)
- **WHERE** did the ill person(s) eat or purchase these foods and **when** did they consume them?

These data and other information should be collected using the standardized *Foodborne Illness Complaint Worksheet*. A detailed explanation of the worksheet is provided in Section 4 of this chapter.

NOTE: A copy of the *Foodborne Illness Complaint Worksheet* can be obtained by calling the MDPH Division of Epidemiology at 617-983-6800 or the Food Protection Program at 617- 983-6712.

BOX 4.1 - Guidelines For Determining Suspect Foods

I. Only **one person** is reported ill.

a) If cause (organism) is NOT KNOWN**:** determine foods/beverages/meals consumed for **at least 72 hours prior to the onset of illness.**

b) If cause (organism) is **known:** determine foods/beverages/meals which were consumed during the appropriate incubation period prior to the onset of illness (for appropriate incubation periods, please refer to Chapter 2, Table 2.3 or Table 2.5).

II. **Two or more persons** are reported ill.

a) If cause (organism) is NOT KNOWN**:** determine foods/beverages/meals COMMON to all persons for **at least 72 hours prior to the onset of illness.**

b) If cause (organism) is **known:** determine foods/beverages/meals COMMON to all persons which were consumed during the appropriate incubation period prior to the onset of illness (for appropriate incubation periods, please refer to Chapter 2, Table 2.3 or Table 2.5).

B. Investigational Findings

Based on the information from above, a foodborne illness investigation may be initiated. A second category of information will be collected as an investigation proceeds. These investigational findings are a crucial component of a foodborne illness surveillance system because such findings enable public health officials to more clearly understand the causes of foodborne illness. Findings may include the answers to some or all of the following questions:

- **What** specific food item(s) or ingredient(s) was linked to the illness?

- **What** type of contaminant (bacterium, virus, parasite, toxin or chemical) caused the illness?

- **What** were the factors leading to the contamination, survival, or growth of a particular contaminant in an implicated food item? (Was the item improperly cooked or stored? Did a sick food handler prepare food?)

4) How To Collect Information

The most direct method for collecting information regarding a potential foodborne illness is to complete a *Foodborne Illness Complaint Worksheet* when a complaint is received (see Figure 4.2 - Recording a Complaint About a Possible Foodborne Illness). This is the quickest way in which to identify and respond to a suspect foodborne illness.

NOTE: **The Working Group on Foodborne Illness Control (WGFIC) at the Massachusetts Department of Public Health strongly encourages local boards of health to use the *Foodborne Illness Complaint Worksheet*. It will help assure that the pertinent information is gathered during the initial interview.**

Another method for collecting information regarding potential foodborne illnesses is through the routine follow-up of reportable diseases. Several of the reportable illnesses that can be acquired through foods, such as laboratory-confirmed *Salmonella*, *Campylobacter*, and *E. coli* infections must be reported to the local boards of health. Local health departments collect information about the cases and forward the information on *case report forms* to the Massachusetts Department of Public Health (MDPH) (see Figure 4.3 - Massachusetts Reportable Disease Surveillance System).

Both methods of collecting foodborne illness surveillance information are discussed below.

A. The *Foodborne Illness Complaint Worksheet*

As outlined in the current (1994) **Reportable Diseases and Isolation and Quarantine Requirements (105 CMR 300.120)**, any illness, regardless of whether or not it is a reportable illness, that is believed to be caused by the consumption of food must be reported to local boards of health by health care providers and those in supervisory positions at a school, day care, hospital, institution, clinic, medical practice, laboratory, labor or other camp. However, complaints of possible foodborne illness are also reported by consumers, neighboring health officials, and restaurant owners.

No matter who reports a potential foodborne illness, the *Foodborne Illness Complaint Worksheet* should be used to record all information and should be filed as a permanent record of the complaint. Remember, if investigating a report of possible foodborne illness in which a reportable illness has been confirmed (e.g., salmonellosis), an official *case report form* must be completed **in addition to** the *Foodborne Illness Complaint Worksheet*.

When completing the *Foodborne Illness Complaint Worksheet,* please keep the following factors in mind:

Figure 4.2 Recording a Complaint About a Possible Foodborne Illness

- Consumers
- Health care providers
- Others

Register complaint with

or

If notified first, MDPH forwards information to the appropriate local board of health

Local board of health

Massachusetts Department of Public Health

Completes *Foodborne Illness Complaint Worksheet*

Using the *Worksheet* will assure that the pertinent information is gathered during the initial interview, and provides a written record for your files and for database entry.

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1) Always try to **collect as much information as possible** from the complainant the first time contact is made. It might be difficult to contact this individual again. If the complainant cannot provide critical pieces of information, then try to find out who may be able to and contact that person. By collecting enough information in the initial stages, you will be able to determine the validity of the complaint more easily (see Chapter 5, Section 3), and possibly avoid conducting an unnecessary investigation.

2) **A laboratory diagnosis is not required for a foodborne illness complaint to be legitimate**. The complainant may have been infected through food, but may have not received medical care. Also, remember that many foodborne illnesses (for example, those caused by viruses), are not reportable and are difficult to diagnose in the laboratory.

3) Remember that many illnesses that can be acquired through foods may also be acquired through other means, such as water, person-to-person contact, and animal-to-person contact. In addition, a complainant may be "sure" about the source of the illness and report only one suspect food or food establishment. Do not be deterred from obtaining an appropriate food consumption history. (See Box 4.1 - Guidelines For Determining Suspect Foods in Section 3 of this chapter.)

4) Be sure to **accurately record dates and times** of the onset of illness, dates and times of food consumption, and symptom information. Most people who have experienced a recent illness should be able to provide you with these answers. If they can not, try to find out why.

5) The completed worksheets should be filed at the LBOH for easy retrieval. This will facilitate the identification of specific complaints or possibly related complaints during certain time periods.

NOTE: Any foodborne illness complaint that is initially received at the state level will be forwarded to the appropriate local board of health via phone or fax.

NOTE: Although it is not mandatory, the MDPH Working Group on Foodborne Illness Control is requesting the LBOH to send a copy of completed *Foodborne Illness Complaint Worksheets* to the MDPH. (Remember to also keep a copy on file at the LBOH.)

When complaints are received at the state level, the WGFIC enters the *Foodborne Illness Complaint Worksheet* information into a computer database. Use of this database greatly facilitates finding, reviewing, and analyzing records. If the board of health currently has or soon will have access to a computer and would be interested in using this system, please refer to section 6-C of this chapter for additional information.

Where to send the *Foodborne Illness Complaint Worksheet*

Promptly send completed worksheets in envelopes marked "**Confidential**" to:

Food Protection Program
Massachusetts Department of Public Health
State Laboratory Institute
305 South Street
Jamaica Plain, MA 02130

B. Massachusetts Reportable Disease Surveillance System

Reporting is the activity whereby a surveillance system receives a timely and regular flow of information on cases of illness. As mentioned earlier, certain reportable diseases in Massachusetts can be acquired through food. Most of these are gastrointestinal illnesses, for example salmonellosis, and **once confirmed must be reported by local boards of health to the MDPH** using the *Bacterial/Parasitic Gastroenteritis Case Report Form*. Several c*ase report forms* are available for other reportable diseases which can be foodborne, such as listeriosis, trichinosis, and toxoplasmosis. Again, a listing of all reportable diseases and reporting requirements can be found in **105 CMR 300: Reportable Diseases and Isolation and Quarantine Requirements**.

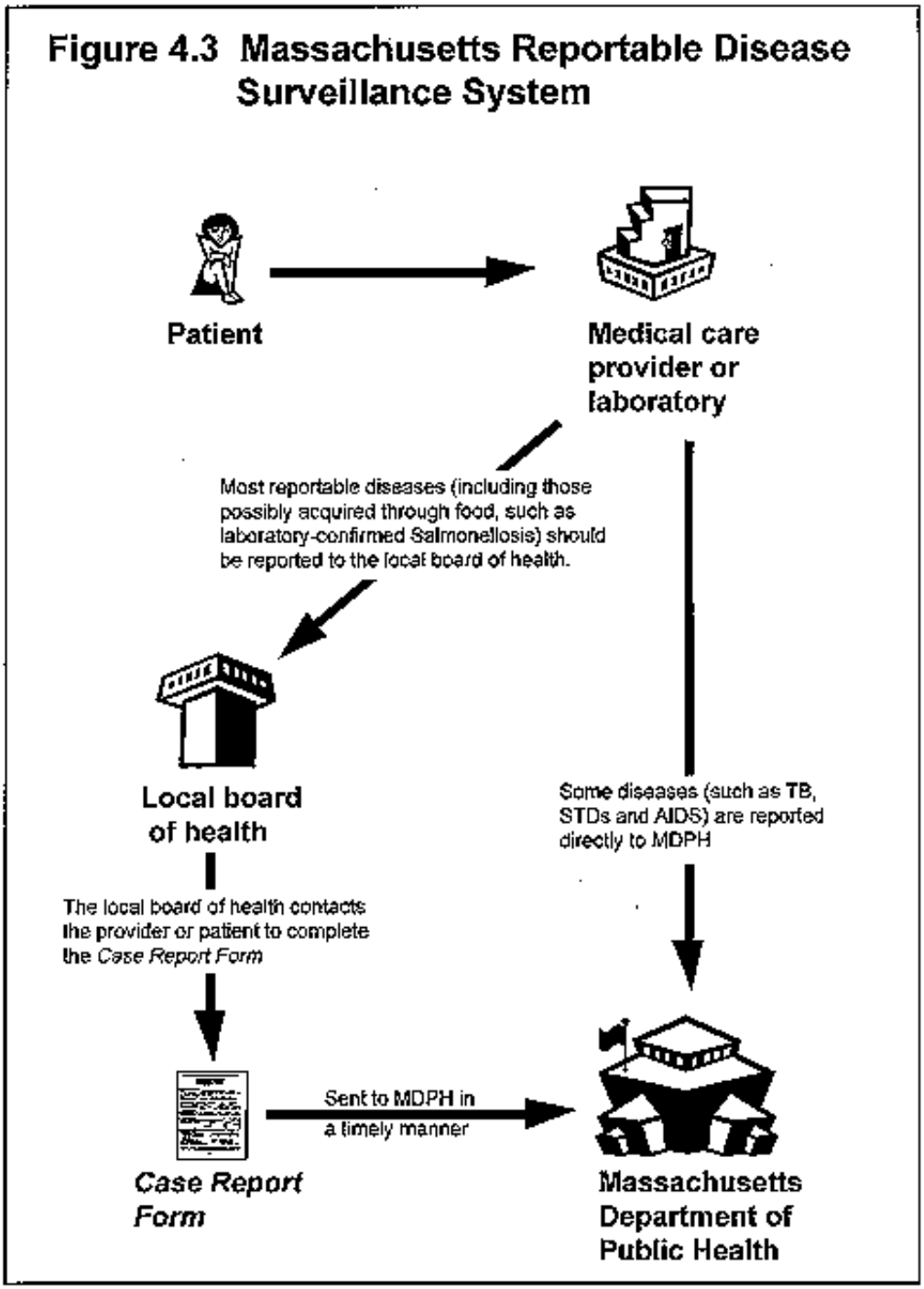
NOTE: A completed *Foodborne Illness Complaint Worksheet* is **not a substitution** for an official c*ase report form*.

NOTE: A copy of the *Bacterial/Parasitic Gastroenteritis Case Report Form* (and the *Foodborne Illness Complaint Worksheet*) can be obtained by calling the MDPH Division of Epidemiology and Immunization, Surveillance Program at (617) 983-6801. This form is most commonly used for enteric illness. Other *case report forms* can be obtained by calling this same number.

When a notification of a reportable disease is received from a health care provider, laboratory, or other source besides the MDPH Enteric Laboratory, the case should be reported as soon as possible to the MDPH (see Section 5-A of this chapter). Many of the enteric cases are confirmed at the MDPH Enteric Laboratory and thus the state will first notify the LBOH of a case.

In either situation, the local board of health official or contracted Visiting Nurse Association (VNA) agent, will then begin the task of collecting information requested on the *Bacterial/Parasitic Gastroenteritis Case Report Form* or other appropriate c*ase report form*. Since initial case reports (from providers, labs, etc.) usually contain minimal information on the case, the completion of a c*ase report form* is often critical for determining a possible or probable means through which a case may have become infected (e.g., a summer cook-out or consumption of home-made ice cream). In order to begin completion of the c*ase report form*, it may be necessary to contact the laboratory or provider for the required information to contact the case (address, telephone numbers, etc.).

Figure 4.3 Massachusetts Reportable Disease Surveillance System



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Please consider the following points when completing a *Bacterial/Parasitic Gastroenteritis Case Report Form*:

1) Be sure to **accurately record dates and times of the onset of illness and symptom information.**

2) Please **refer to the correct incubation period range** for the etiologic agent reported (for example, the incubation period range for *Salmonella* is 12-36 hours).

3) Once you know the incubation period range, then **ask the case about exposure history during one incubation period range before the illness started** (for example, if the patient had *Salmonella*, ask about exposures during the time period 12-36 hours before the illness started).

4) Exposure history:

a) Questions about travel history and outdoor activities are asked in order to identify where the patient became infected.

b) Questions about animal contact are asked because **certain animals can carry and transmit enteric diseases to humans.** (For example, reptiles can shed *Salmonella* in their feces which can then be transmitted to humans through poor hygiene or food contamination.)

c) Information about water usage is collected because **many agents that cause gastrointestinal illness can be transmitted through water.**

5) Other questions were designed to examine the case's risk for having either acquired illness from household or day care contacts and the potential for transmitting the illness to these contacts.

6) Please keep in mind that food handling not only can refer to restaurant employees, but also **to medical care providers, dental office employees, food processing factory workers, and others** (see the food handler definition in Appendix A, Section 2).

7) Attach the lab report to the c*ase report form*. (Keeping a copy of all forms as complete files on a local level are strongly encouraged.)

8) **Promptly send completed c*ase report forms* in envelopes marked "Confidential" to:**

Surveillance, Room 511
MA Department of Public Health
State Laboratory Institute
305 South Street
Jamaica Plain, MA 02130

NOTE: See Section 5-A for more information on timeliness with reporting.

NOTE: Individuals collecting case information and completing *case report forms* must ensure that they use the most recent forms available from the MDPH Bureau of Communicable Disease Control. If questions arise about the most recent forms or in completing the forms, investigators should contact the Bureau of Communicable Disease Control, Surveillance Program at (617) 983-6801.

NOTE: If during the completion of a *Bacterial/Parasitic Gastroenteritis Case Report Form* or other *case report form*, it appears possible or likely that food was the source of infection, a *Foodborne Illness Complaint Worksheet* (Section 4-A of this chapter) should be started and the appropriate investigations should be initiated (Chapters 5-7) as with any other foodborne illness complaint.

5) Reporting Issues: Timeliness, Priorities, and Confidentiality

A. Timeliness

Report as soon as possible. As presented in Section 4-B of this chapter, all cases of reportable disease must be reported using a c*ase report form*. Because the process of obtaining information for a *case report form* can take time, you should initially phone in a report, or send a brief written notification via mail or fax to the Surveillance Program within 24 hours. (See telephone numbers in Box 4.4 below.) Later, one can follow-up with an official *case report form.* As long as the LBOH is notifying the MDPH of cases within 24 hours via mail or fax, most *case report forms* can be sent in on a monthly basis. See the attached *Diseases Reportable By Healthcare Providers* at the end of the chapter for further clarification.

The MDPH Bureau of Communicable Disease Control has an epidemiologist on duty daily to answer your questions. An epidemiologist is also available via beeper during non-work hours for **emergency situations** (e.g., if you receive several complaints and are concerned about a potential foodborne illness outbreak). All calls are returned promptly.

The importance of timely reporting can not be overemphasized. If data are reported or collected sporadically, it will be difficult, if not impossible, to actually mount a reasonable and timely public health response. For example, if a local health authority saves up all its reports of salmonella and only submits them once every three years, the data could be interpreted incorrectly. One might think that there had been no salmonella for several years, and that there was suddenly an outbreak situation. Likewise, potential outbreaks among neighboring towns might be missed because no data were received from the local health authority in this particular town until it was too late.

BOX 4.4 MDPH Telephone Numbers and Address To Report

- During normal business hours call the Surveillance Program at (617) 983-6801.
- Or fax to the Surveillance Program at (617) 983-6813 (24 hours a day - 7 days a week). **NOTE**: Call the Surveillance Program at (617) 983-6801 to confirm receipt of the fax.
- Mailing Address To Report. (Remember to have envelopes stamped "Confidential.")
  Surveillance, Room 511, MDPH
  State Laboratory Institute
  305 South Street
  Jamaica Plain, MA 02130
- **For situations considered to be an emergency, where control measures may be indicated to deter continued transmission, do not wait for complete information. Report initial information of suspect cases immediately to the MPDH, Division of Epidemiology. During normal business hours, call (617) 983-6800. For emergencies at nights or weekends, call (617) 522-3700.**

B. Priorities

The most important investigations to do immediately are those that are a severe threat to an individual's health or where a timely control response is critical. There are times when cases of foodborne illness may be of a lower priority than other cases. Top priorities would include:

- Clusters of illness potentially connected with a specific individual or facility.
- Foodborne illness in a food handler or a household contact of a food handler.
- Indications of adulterated food presenting an imminent danger.
- One or more botulism cases.
- Hepatitis A in a food handler.

If you are unsure about which investigations to do first, or need technical assistance, feel free to contact the MDPH on-call Epidemiologist at (617) 983-6800. Again, submit initial information to the state health department via phone or fax and then follow-up with a complete *case report form* later.

C. Confidentiality

Confidentiality is a legal requirement. The information that public health practitioners collect is often of an extremely personal nature. Success and cooperation lies in protecting the privacy rights of the individuals.

It is important to realize that it is not just the investigator who needs to be concerned about confidentiality. Clerical staff, administrative staff, interns and elected officials who

may be aware of personal information on a case should all be familiar with and mindful of the basic tenets of maintaining an individual's confidentiality. Only individuals who have a **"need to know"** should have access to sensitive records. At your agency, evaluate who these individuals are and be certain that the concept and practice of confidentiality is well understood.

If you are unsure about whether it is appropriate to release information: ***do not release it*!** Check with a supervisor, the municipal attorney or legal advisor, or contact the Bureau of Communicable Disease Control at (617) 983-6800 for advice. Make sure information is released only to people who are authorized to receive it. Do not be pressured into a hasty decision. One should not confirm that an individual is even in your records unless one is certain it is appropriate to release that information. If unsure about who the requesting individual is, request better confirmation of identity before releasing information (i.e., a signed consent form with documented identification such as a driver's license; for guardians: documentation of guardianship).

NOTE: To obtain a copy of the *MDPH Bureau of Communicable Disease Control Confidentiality Policy*, call the Bureau of Communicable Disease Control Administrative Office at (617) 983-6550.

It is, of course, important to realize that information must often be shared between municipalities, with providers, and with the state health department during the course of public health investigations and control activities. However, even in these instances the **"need to know"** rule described above applies. Information on individual cases is available only from the MDPH Bureau of Communicable Disease Control if one is the responsible representative of a local health authority involved in an investigation of the case, or if the person who is the case, their guardian or designee requests it (with written informed consent).

Always consider what type of information is **"personally-identifying"** and what is not. When releasing information on a small number of cases (e.g., during an investigation), demographic information such as age, race, sex, or zip code could be used to identify individuals.

Local and state public health authorities have investigated cases of infectious disease and collected sensitive information for more than 100 years. These efforts would not be so successful if all personnel did not uphold the public's trust by maintaining strict confidentiality.

BOX 4.5 Important Points Regarding Confidentiality

- **Sharing of confidential information should be kept to a minimum.**
- **Confidential information should be shared only with those with a "need to know." If unsure about one's identify, request better confirmation (e.g., a copy of driver's license).**
- **Confidential information that is being reported to the LBOH or MDPH should be sent in a way which guards confidentiality (telephone probably best option, email and fax are secondary options for security reasons).**
- **Information from case report forms and other forms with personal identifiers *CAN NOT* be released without a signed consent form from the individual involved.**

6) Using the Information Collected

In order to use surveillance information to its full potential, it must be collected accurately and consistently. As described in Section 3, there are two principal methods by which information about possible foodborne illness is collected: 1) completing the *Foodborne Illness Complaint Worksheet*, and 2) completing *case reports forms* for reportable diseases. Sections 6-A and 6-B (below) explain some of the ways that foodborne illness surveillance information obtained from each method can be used. Section 6-C provides information on computerized entry of the *Foodborne Illness Complaint Worksheet*.

A. Using the *Foodborne Illness Complaint Worksheet*

Perhaps the most important reason for using the *Foodborne Illness Complaint Worksheet* is that it will allow local and state public health officials to "speak the same language" regarding foodborne illness. Such standardized data that are shared between agencies will be more easily interpreted, thus providing the opportunity for more rapid responses.

When a complaint is received, descriptive information is requested first from the complainant(s). Later, any investigational findings can be added to the worksheet. **By consistent and accurate recording of these data the public health official is maintaining a foodborne illness surveillance system!** Data can be reviewed or analyzed for different purposes, including answering the following questions:

1) How many complaints about possible foodborne illness were received during defined time periods? How many persons were ill during those periods?

2) Do the number and/or nature of the complaints appear to be changing over time?

3) Have certain food establishments or food items been associated with an increase in complaints?

4) Can you identify links among complaints (using the descriptive information discussed in Section 3 of this chapter), possibly indicating a more widespread cluster of foodborne illness?

5) Of the complaints received during a defined time period, how many were investigated?

6) How many complaints were deemed valid but could not be investigated because of the lack of personnel or training?

7) Do certain investigational findings (for instance, certain contributing factors) appear to be related to particular types of establishments or foods?

By routinely examining your data, the answer to these and other questions regarding foodborne illness in your community will emerge. Such answers will help guide you in making policy and directing resources towards commonly identified problem areas.

B. Using the Massachusetts Reportable Disease Surveillance System

As part of the case follow-up for diseases caused by potential foodborne pathogens (such as salmonellosis), an appropriate individual will be completing a *case report form* which will then be sent to the MDPH. The case's answers to exposure history questions may reveal that food was a possible or probable source of the infection. If so, a *Foodborne Illness Complaint Worksheet*, should be completed in addition to the case report form, and appropriate follow-up should occur as with any other foodborne illness complaint (e.g., the local food establishment inspector should be notified, if appropriate).

In the Division of Epidemiology and Immunization at the MDPH, *case report forms* (completed by local boards of health) are entered into a large computer database. Diseases are routinely analyzed for trends. Occasionally, more cases of a certain disease are reported than would be expected. In this situation, attempts are made to determine similarities among the cases in question, and to identify an outbreak. **It is clear that reportable disease follow-up performed at the local level is critical for identifying widespread clusters of foodborne or other illness.**

C. Computerized Entry of the *Foodborne Illness Complaint Worksheet*

As mentioned at the end of Section 4-A in this chapter, the WGFIC is using a computer database to log complaints of suspect foodborne illness. In this system, certain information obtained on the *Foodborne Illness Complaint Worksheet* is entered into the database. Local boards of health which routinely use computers and which employ one or

more individuals with some database management experience may consider adopting this system. It is simple to use, allows greater accessibility to data, facilitates review of data and/or answering of questions regarding foodborne illness in the community (see sample questions, Section 6-A), and may be used to manage other data. When compared to the time-consuming method of searching through records in a file cabinet, the advantages of such a program can be appreciated.

NOTE: Upon request, the WGFIC will provide local board of health officials with software which can be used in conjunction with the *Foodborne Illness Complaint Worksheet*. For more information, call the Division of Epidemiology and Immunization at (617) 983-6800.

A long-term goal of the WGFIC is that community-based data will be transferred electronically to a statewide foodborne illness surveillance database. It is hoped that at the state and local levels, computerized management of foodborne illness complaints will result in more timely and improved identification of clusters, more meaningful analyses of trends in occurrence and cause of foodborne illness, and information-based policies resulting in the enhanced prevention of foodborne illness.

7) Limitations of Data

Several problems inherent in data obtained through surveillance must be recognized if the data are to be interpreted correctly.

A. Under-Reporting and Incomplete Data

Because most surveillance systems are based on diseases reported by health care providers, under-reporting is inevitable. It is estimated that 5% to 80% of cases that actually occur will be reported. For example, foodborne illness is often underreported by individuals with disease because a health care provider is not consulted; or a diagnosis of "gastrointestinal illness" is made and treated without any diagnostic tests that might confirm a particular infecting organism. The lack of testing is becoming more prevalent with the growth of managed care. Yet, even with incomplete information, it is often possible to detect key trends and/or sources of infection. For diseases that occur less frequently, the need for completeness becomes more important. Each individual case must be treated as a "key" event.

B. Lack of Representativeness of Reported Cases

Health conditions are not reported randomly. For example, illnesses in a health facility are reported more frequently than those diagnosed by private providers. A health problem that results in hospitalization is more likely to be reported than health problems dealt with

on an outpatient basis. A provider is more likely to report a case of hepatitis A if the patient is severely ill than if the patient has few or no symptoms. A case of meningitis is more likely to be reported than is a case of chickenpox. Thus, reporting biases can distort interpretation of reported disease data.

C. Changing Case Definitions

Different practitioners frequently use different case definitions for health problems. The more complex the disease syndrome, the greater the difficulty in reaching consensus on a case definition. Moreover, with newly emerging diseases, as understanding progresses, case definitions are frequently adjusted to allow greater accuracy of diagnosis. Also, as new diagnostic tests are developed, case definitions sometimes change to incorporate these tests. Persons who interpret surveillance data must be aware of any changes in case definitions and must adjust interpretations correctly. Attachment 4.6 at the end of this chapter contains the CDC's most recent listing of case definitions or laboratory criteria for the enteric diseases. These case definitions establish uniform criteria for disease reporting and should not be used as the sole criteria for public health action. Use of additional clinical, epidemiologic, and laboratory date may enable a physician to diagnose a disease even though the formal surveillance case definition may not be met.

Conclusion

The real art of conducting surveillance lies in collecting accurate and timely data, and in carefully and correctly interpreting the data. The interpretation should focus on elements that might lead to control of the condition. Investigators can use surveillance as a basis for appropriate public health action. Epidemics can be recognized, preventive strategies applied, and the effects of such actions can be assessed.

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ATTACHMENT 4.6

Case Definitions for Infectious Conditions Under Public Health Surveillance

Laboratory criteria for diagnosis:

Amebiasis

Intestinal amebiasis.

- Demonstration of cysts or trophozoites of *E. histolytica* in stool or
- Demonstration of trophozoites in tissue biopsy or ulcer scrapings by culture or histopathology

Extraintestinal amebiasis.

- Demonstration of *E. histolytica* trophozoites in extraintestinal tissue

Botulism, Foodborne

- Detection of botulinum toxin in serum, stool, or patient's food or
- Isolation of *Clostridium botulinum* from stool

Cryptosporidiosis

- Demonstration of Cryptosporidium oocysts in stool, or
- Demonstration of Cryptosporidium in intestinal fluid or small-bowel biopsy specimens, or
- Demonstration of Cryptosporidium antigen in stool by specific immunodiagnostic test (e.g., enzyme-linked immunosorbent assay)

Campylobacter Infection

- Isolation of *Campylobacter* from any clinical specimen

Escherichia coli O157:H7

- Isolation of *E. coli* O157:H7 from a clinical specimen or
- Isolation of Shiga toxin-producing *E. coli* O157:NM* from a clinical specimen

* Strains of *E. coli* O157:H7 that have lost the flagellar "H" antigen become nonmotile and are designated "NM."

Giardiasis

- Demonstration of *G. lamblia* cysts in stool, or
- Demonstration of *G. lamblia* trophozoites in stool, duodenal fluid, or small-bowel biopsy, or
- Demonstration of *G. lamblia* antigen in stool by a specific immunodiagnostic test (e.g., enzyme-linked immunosorbent assay)

Hepatitis A

- Hepatitis A immunoglobulin M (IgM) antibody to hepatitis a virus (anti-HAV) positive

Listeriosis

- Isolation of *L. monocytogenes* from a normally sterile site (e.g., blood or cerebrospinal fluid or, less commonly, joint, pleural, or pericardial fluid)

Salmonellosis

- Isolation of *Salmonella* species from a clinical specimen

Shigellosis

- Isolation of *Shigella* species from a clinical specimen

Trichinosis

- Demonstration of *Trichinella spiralis* larvae in tissue obtained by muscle biopsy, or
- Positive serologic test for *Trichinella*

Typhoid Fever

- Isolation of *S. typhi* from blood, stool or other clinical specimen

Source: CDC. Case Definitions for Infectious Conditions Under Public Health Surveillance. *MMWR*. May 2, 1997; Vol. 46, No. RR-10.

Chapter 5

FOODBORNE ILLNESS COMPLAINT/OUTBREAK ACTIONS

FOODBORNE ILLNESS COMPLAINT/OUTBREAK ACTIONS

Introduction
Local boards of health (LBOH) are the primary agencies responsible for investigating foodborne illness complaints implicating foods prepared or sold in food establishments within their jurisdiction. Also among their responsibilities are the investigation of confirmed **or suspected** reports of sick food workers. Foodborne illness complaints should be promptly investigated, preferably within 24-48 hours of being received, to evaluate the need for collecting food samples, to identify and correct poor food handling procedures and to request clinical specimens from food handlers. Certain situations may require an immediate investigation. This chapter addresses how to evaluate and respond to reports of foodborne illnesses and infected food workers and also gives a list of sequential steps to ensure a thorough, efficient investigation.

1) Preparation

Importance of Investigation.
The public relies on health and food regulatory officials, as well as the food industry, for protection from foodborne illness. **The single most important reason to investigate a foodborne illness complaint is to identify contaminated food and remove it from the marketplace to prevent the occurrence of further illness.** Prompt investigations and actions by the LBOH can lead to disease prevention in the community.

Established LBOH Foodborne Illness Policy.
Receiving and investigating foodborne illness complaints is a critical program component in determining the nature of the illness and whether an implicated food might be a causal factor. Local boards of health are responsible for administering their food protection program in accordance with *105 CMR 590.000 - Minimum Sanitation Standards for Food Establishments, Article X*. Failure or inability to investigate valid foodborne illness reports endangers the public health. In such situations, the Massachusetts Department of Public Health is authorized to intervene and take necessary measures to ensure that the

public's health is protected. Every LBOH should have an established policy on how foodborne illness complaints are handled and by whom.

Trained Personnel.
Depending on the nature of the incident, foodborne illness complaints will warrant various degrees of response by the LBOH. A public health professional trained in the investigation of foodborne disease, such as a sanitarian, health agent or public health nurse, should be responsible for *evaluating the validity* of the complaint based on their knowledge of the etiology of foodborne disease, food microbiology and contributing environmental factors relating to food preparation. If the complaint is deemed valid, a follow-up investigation should be initiated in a coordinated fashion. In an outbreak situation, it is important to designate a LBOH contact person to interact with other investigating agencies, the media and the general public.

Supplies.
To conduct a foodborne illness investigation, be prepared with the appropriate supplies. Keep a supply of the following:

- Appropriate paperwork such as *Foodborne Illness Complaint Worksheets* and c*ase report forms.* A copy of these can be obtained by calling the MDPH Division of Epidemiology and Immunization at (617) 983-6800. Other forms can be found in Appendix E.
- Stool specimen collection kits. These are available from the MDPH Enteric Laboratory. See Chapter 6, Section 4-E for more information on obtaining stool kits.
- Food sample containers and inspection equipment such as thermometers, forms and test papers. Information on inspection equipment and supplies can be found in Appendix B.

Communication.
Coordination and communication with other members of the foodborne illness complaint response team (e.g., sanitarian, food inspector, public health nurse, the MDPH) is imperative. Additionally, be sure to keep others not directly involved in an outbreak informed (e.g., other board of health members or health department staff).

2) Receiving and Monitoring Foodborne Illness Complaints

Use the standardized *Foodborne Illness Complaint Worksheet* to record complaint information. This form is explained in Chapter 4, Section 4-A and Section 6-A, and a copy can be obtained by calling the MDPH Division of Epidemiology and Immunization at (617) 983-6800. When possible, speak directly with ill complainants to obtain complete and accurate information. Listen carefully to the complainant. Often you will obtain additional information and details during the re-telling of the complaint.

Obtain a *72-hour or longer* food history to ensure that the suspected food item is the most appropriate to be investigated, based on the diagnosis or symptoms, implicated food vehicle, and onset time. (See Box 4.1, *Guidelines For Determining Suspect Foods* in Chapter 4, Section 3.) A longer food history is necessary when organisms such as hepatitis A, campylobacter and parasites which have incubation periods longer than 72 hours are suspected (see Table 2.3 and Table 2.5 in Chapter 2 for incubation periods). Often, complainants will associate the illness with the last food or meal consumed in a commercial establishment. Although foods prepared in commercial food establishments are implicated in reported outbreaks, foods prepared at home are most often responsible for single cases of foodborne illness and should not be ignored.

Record all single case complaints since the single case may be the first of an outbreak. Record all anonymous complaints that appear to be valid. Complainants often request anonymity for fear of retribution. Some boards of health have different policies on whether or not they will accept anonymous complaints. The MDPH encourages LBOH to accept anonymous complaints since, as stated earlier, the single case may be the first of an outbreak. Immediately record foodborne illness complaints in one logbook or electronic database to help identify a potential outbreak.

NOTE: The importance of documenting single complaints cannot be overstated. An outbreak may not always manifest as an obvious group of ill people. Sporadic cases of diseases may occur when a contaminated food is widely distributed (e.g., chicken with *Salmonella*). This situation can lead to a low attack rate distributed over a large geographic area, so that no one may realize that an outbreak is occurring.

NOTE: If during the completion of a *Bacterial/Parasitic Gastroenteritis Case Report Form* or other *case report form*, it appears possible or likely that food was the source of infection, a *Foodborne Illness Complaint Worksheet* (Section 4-A of Chapter 4) should be started and the appropriate investigations should be initiated as with any other foodborne illness complaint.

3) Criteria to Determine If a Complaint is Valid

Single case complaints should be investigated if there is a possibility that the confirmed diagnosis and/or clinical symptoms are consistent with the foods eaten and the onset time of illness. For example, one person reports having bloody diarrhea three days after eating ground beef which may indicate potential *E. coli* infection. Other factors such as the possibility of sick food handlers and poor food handling/physical facility violations observed by the complainant should also be considered when determining if an investigation is warranted. Failure to respond to a valid single case complaint may result

in additional persons becoming ill if corrective actions are not initiated. If the complaint appears valid, it is the responsibility of the board of health to investigate and make a presumptive determination if the implicated food is the causal factor.

If two or more persons implicate a food, meal or establishment that does not seem to be a likely source but there is **no other shared food history or evident source of exposure**, the LBOH should conduct an environmental investigation. (See Section 4 of this chapter and all of Chapter 7 for more information on environmental investigations.)

In some situations, a follow-up investigation may not be warranted or minimal follow-up may be sufficient if:

1) it is obvious that the symptoms or diagnosis are clearly unrelated to the food which the complainant believes to be causal, and
2) no other information is available (e.g., incomplete food history).

For example:

- An individual with salmonellosis believes the illness was contracted from eggs consumed one-half hour prior to the onset of their symptoms. (The average incubation period for salmonella infection is 12-36 hours.)

- Three family members believe they became ill with cramps and diarrhea from commercially canned cranberry sauce eaten with their home baked stuffed turkey and rice. (Baked stuffed turkey and even rice are potentially hazardous foods which are more likely to be contaminated during home preparation.)

- A complaintant with *Campylobacter* (incubation period is 2-5 days) gives only last meal and is unable to provide complete food history.

Before acting on a suspect foodborne illness complaint, always obtain a complete 72-hour or longer food history to determine if other food may have been the causal factor. Note that there are pathogens which have incubation periods longer than 72 hours. In such circumstances, longer food histories will be necessary. Use the *Guidelines For Determining Suspect Foods* (Chapter 4, Box 4.1) when determining the time length of the food history.

Consumers often focus on foods prepared or eaten at commercial food establishments rather than home-prepared meals. It may be necessary to explain to the complainant the possibility of other exposures, such as home-prepared foods, daycare centers and pet reptiles. It is appropriate, as well as good public health practice, to evaluate and review procedures used in preparing suspect home-cooked food.

If it is determined that an environmental investigation is not warranted, notify (preferably in person) the food establishment that has been implicated in a suspected foodborne

illness complaint. Establish through an interview with the manager, if food handlers have been ill and if the establishment has received any other similar complaints.

Often complainants will call their LBOH implicating food prepared outside of the LBOH jurisdiction. Immediately refer complaints involving food prepared in another jurisdiction to the appropriate local board of health or, if outside Massachusetts, to the MDPH Food Protection Program. The Food Protection Program will investigate foods manufactured in Massachusetts and will forward complaints implicating foods manufactured out of state to the appropriate state or federal regulatory agency.

Another situation in which a follow-up investigation may not be necessary is when repeated complaints are made by the same individual(s) and prior investigation revealed no significant findings. Invalid complaints may be generated by disgruntled employees, competitors, unfriendly neighbors and dissatisfied customers. Whatever the situation, always briefly summarize for the file your reasons why an investigation was not conducted.

NOTE: If uncertain of whether or not to proceed with an investigation, contact the Massachusetts Food Protection Program (617-983- 6712) or the Division of Epidemiology and Immunization (617-983-6800).

4) Expanding the Investigation

If the complaint appears valid, an environmental and/or epidemiological investigation should be initiated within 24-48 hours. The LBOH should have coverage for weekends and holidays in emergency situations.

The Environmental Investigation. This is not a routine inspection but a foodborne illness investigation. The sanitarian or investigator gathers and assimilates facts to find the cause and contributing factors to illness.

Sanitarians play a key role in proving that a food is responsible for illness by making observations and measurements that relate to contamination, survival and growth of the etiologic agent. The environmental investigation should focus on the preparation and service of the implicated food to determine the risk of contamination and temperature abuse. Foods found to be at risk for contamination because of an infected food handler, poor food handling practices or procedures, or an unapproved source (i.e., clams illegally harvested from contaminated beds) should be embargoed. When contamination is blatant, foods should be discarded. An emergency closure or suspension order may be issued by the LBOH when an imminent health hazard exists, such as several infected food handlers or the lack of adequate refrigeration.

FOODBORNE ILLNESS COMPLAINT/OUTBREAK ACTIONS

NOTE: See Chapter 7 for detailed information on environmental inspections and enforcement procedures.

The Epidemiologic Investigation. Epidemiologic investigations are usually conducted in outbreak situations. The purpose of the investigation is to identify a problem, collect data, formulate and test hypotheses. It involves the collection and analysis of more facts or data to determine the cause of illness and to implement control measures to prevent additional illness. A questionnaire is often solicited to assist the investigator in developing better hypotheses about the etiologic agent's identity, source and transmission. The investigators interview ill and well persons, and calculate and compare incidence rates of both groups. They make time, place, and person associations and calculate the probability that a food was the responsible vehicle.

The investigator incorporates results from epidemiological associations and the environmental and laboratory investigations, and uses these data in forming and testing hypotheses. Careful development of epidemiologic inferences coupled with persuasive clinical and laboratory evidence will almost always provide convincing evidence of the source and mode of spread of a disease. In situations where food and stool testing are negative, the cause of an outbreak is implicated by epidemiological association.

NOTE: See Chapter 6 for detailed information on the steps in an epidemiologic investigation.

Foodborne Illness in Private Homes. Suspect foods prepared in private homes are sometimes the causative factor in reported illnesses. While it is not within the board of health's authority to conduct an on-site inspection of private homes, the LBOH should try to conduct a HACCP risk assessment based on an interview with the food preparer to identify possible sources of contamination. Often, friends and family are hesitant to participate in an interview or epidemiology questionnaire studies. Encourage participation in an investigation and offer assistance with food and stool specimen testing. Offer advice or educational materials on safe food handling practices and advocate the prevention of further illnesses by ensuring that sick individuals seek medical attention. Additionally, they should be informed of work restrictions associated with certain diseases transmissible through food.

If it appears that a commercially processed food prepared in the home may have been contaminated when the consumer purchased it, obtain product information (e.g., manufacturer name and address, package size and type, code or lot number, expiration dates) and immediately notify the Massachusetts Food Protection Program. Try to obtain the suspect food itself, if there are leftovers (see Section 7 of this chapter for more information on collecting leftover food samples).

A press release may need to be issued. Press releases often are issued in hepatitis A incidents and outbreaks if it is determined that exposed patrons and food handlers should receive immune globulin. A press release might also be issued in a large outbreak or serious food-related illness situation to inform the public of recommendations to avoid potential illness. A sample hepatitis A press release can be found in Appendix E.

Results of an investigation, however small or large, should always be documented. Reports may vary in length from one paragraph in a single case incident to several pages for a large outbreak. Examples of summary reports are provided in Chapter 8, Section 4.

NOTE: With certain foodborne illnesses, such as botulism or a chemical poisoning, even one case requires an in-depth epidemiological and environmental investigation.

5) Notifying the Massachusetts Department of Public Health

Immediately report suspected foodborne illness outbreaks and one case of botulism or chemical poisoning to the:

- MDPH Food Protection Program, 617-983-6712 or
- MDPH Division of Epidemiology and Immunization, 617-983-6800.

The notification should be **within 24 hours** in accordance with *105 CMR 300.110: Case Reports by Local Board of Health and 105 CMR 300:122: Illness Believed To Be Part Of An Outbreak Or Cluster*.

NOTE: A suspected foodborne disease outbreak is usually defined as: two or more persons experiencing a similar illness, usually gastrointestinal, after ingestion of a common food OR different foods in a common place. An outbreak may also be defined as a situation when the observed number of cases unaccountably exceeds the expected number.

Notifying Others. Maintain a list of people on your board of health and in the local community to contact in an outbreak, including hospitals and emergency rooms. Notifying area health care providers may aid in the identification of related cases.

6) Restricting an Infected Food Worker

Infected food handlers represent a significant contributing factor in foodborne illness outbreaks. Fecal-oral transmission by food handlers is possible since certain pathogens can be shed during and after illness. For example, food workers have been found to be shedding enteric viruses and bacteria weeks after symptoms have ended. Food handlers with infected skin lesions may also be reservoirs of pathogens, such as *Staphylococcus aureus*, which can be transmitted to food when there is direct contact. Refer to Appendix A - Infected Food Handler Policy for detailed information on restrictions.

7) Collecting Leftover Food Samples

Leftover food specimens may hold the clue to the cause of a foodborne illness outbreak. Leftover food samples should be collected in outbreaks and in a timely manner to prevent important evidence from being discarded. However, leftover foods which have been discarded in the garbage or have been out of refrigeration normally should not be collected since the integrity of the food has not been maintained.

Procedures for collecting food samples are outlined in Appendix B. Always notify the Division of Diagnostic Laboratories at the State Laboratory Institute (SLI) at 617-983-6600 prior to collecting and delivering samples in order to review methodology and determine what tests will be conducted on the food.

The general policy of the SLI is only to test food samples implicated in suspected outbreaks. The LBOH may suggest that the holders of food implicated in single case incidents locate a private laboratory which will test the food or to store the food in their freezer for a period of time in case additional reports are received. An exception to this single-case policy is when botulism is suspected. In **all botulism-suspect cases**, it is appropriate to test the suspected food items. Additionally, a single, confirmed case with leftover food consumed with the incubation period, may be considered for testing.

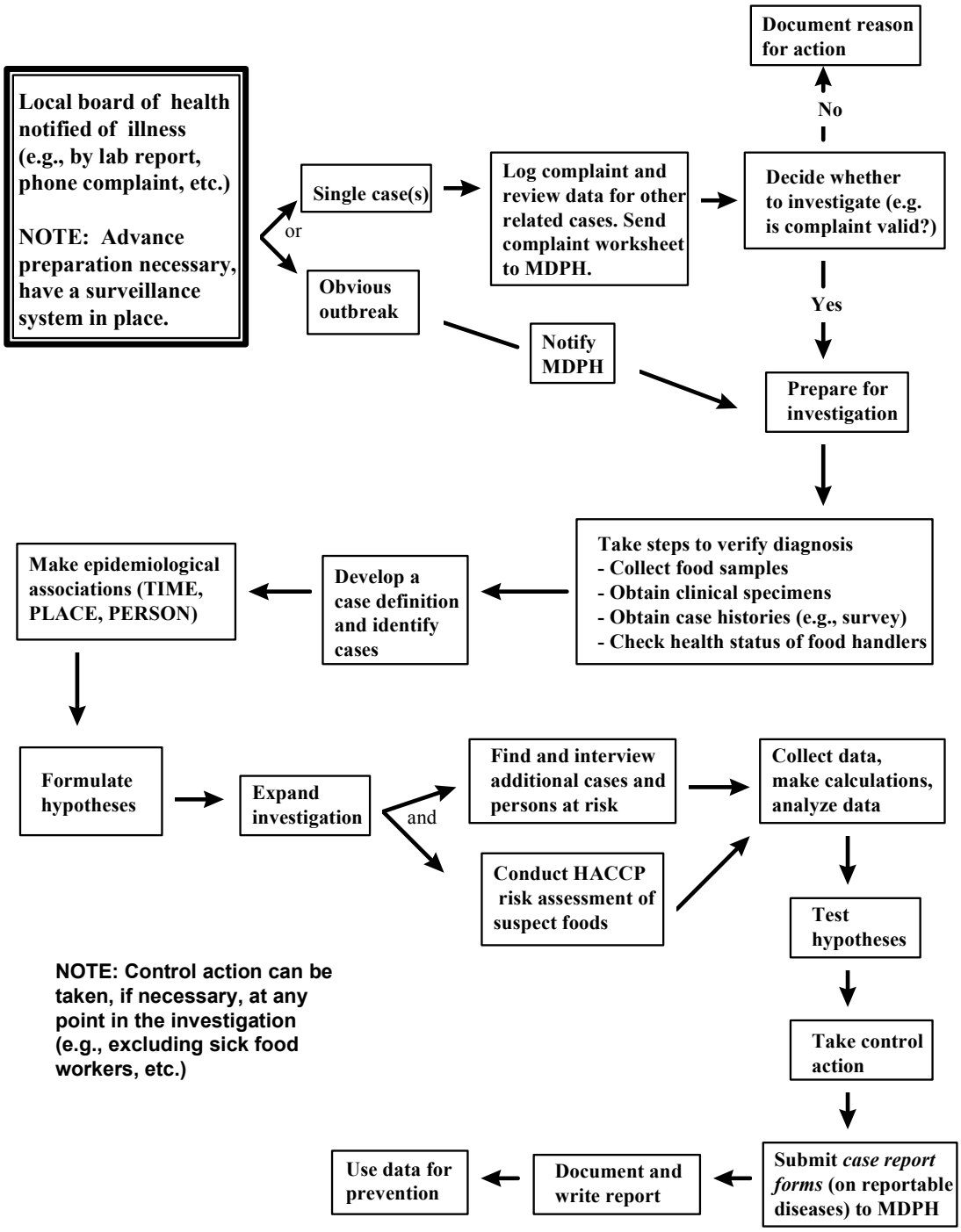
Further information on collecting leftover food samples can be found in Chapter 7, Section 1 and in Appendix B.

NOTE: The following two pages contain summary information on the sequential steps in the investigation of foodborne illness complaints and outbreaks. Both pages contain the same information. For some, it is preferable to follow a list of steps, for others it is preferable to follow a flow chart.

Summary - Sequential Steps in the Investigation of Foodborne Illness Complaints and Outbreaks

Steps	Reference
1) Be prepared. Designate responsible individual(s) trained in foodborne disease prevention and control to evaluate and investigate foodborne illness complaints and outbreaks.	Chapter 5
2) Maintain a foodborne illness surveillance system. This is necessary to determine any changes in the frequency or distribution of cases and permits early identification of outbreaks or potential outbreaks of foodborne illness.	Chapter 4
3) Record complaints on a *Foodborne Illness Complaint Worksheet*. Log all reports in a log book or electronic data system. Send worksheets to the Massachusetts Food Protection Program. (Immediately refer complaints of food prepared or manufactured in another jurisdiction to the appropriate LBOH.)	Chapter 4
4) Decide whether to investigate. Is the complaint valid?	Chapter 5
5) Report all clusters or outbreaks to the Massachusetts Food Protection Program (617-983-6712) or the Division of Epidemiology and Immunization (617-983-6800).	Chapter 5
6) Take steps to verify diagnosis.	
• Collect leftover food samples when appropriate from the food establishment and/or complainant in a timely manner.	Appendix B
• Obtain clinical samples when appropriate in a timely manner.	Chapter 6
• Obtain case histories.	Chapter 6
• Immediately investigate reports of suspect sick food workers and exclude if necessary. Request all symptomatic food workers to submit stool specimens. Stool samples should be submitted within 48 hours of your request. In an outbreak situation, request ALL food workers to submit stool specimens, especially when an implicated food is not apparent. Food workers who do not submit stool specimens must be restricted from work until they comply.	Chapter 6 and Appendix A
7) Conduct an environmental investigation within 24 hours. Conduct a Hazard Analysis Critical Control Point (HACCP) risk assessment of the implicated foods as part of your investigation.	Chapter 7
8) Develop a case definition and identify cases. Make epidemiological associations (TIME, PLACE, PERSON). Formulate hypotheses.	Chapter 6
9) If necessary, initiate immediate correction or enforcement actions (embargo, disposal, emergency closure, suspension of operations). Coordinate food recalls and tracebacks with industry and other local, state and federal regulatory agencies. If necessary, issue a press release or public notice.	Chapter 7
10) Expand investigation. Find and interview additional cases and persons at risk. Collect data, make calculations, analyze data. Test hypotheses. Take control action.	Chapter 6
11) Complete and submit *case report forms* (on reportable diseases) to MDPH.	Chapter 4
12) Document all LBOH actions. Submit all reports of your investigation including a copy of the last routine food inspection report for the implicated establishment to the Massachusetts Food Protection Program.	Chapter 8

Summary - Sequential Events in the Investigation of Foodborne Illness Complaints and Outbreaks



Source: Data adapted from Bryan et al, 1987

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Chapter 6

CONDUCTING AN EPIDEMIOLOGIC INVESTIGATION

1) **What is Epidemiology?**

2) **Conducting an Epidemiologic Investigation**

3) **Steps in an Epidemiologic Investigation**

4) **Submission of Clinical Specimens to the State Laboratory Institute**

CONDUCTING AN EPIDEMIOLOGIC INVESTIGATION

Introduction

Epidemiologic investigation is an important part of the complete foodborne illness investigation that also includes environmental (see Chapter 7) and laboratory investigations (see Section 4 of this chapter and Appendix B). Each part of the investigation compliments the other and team work and open communication is of utmost importance.

The purpose of the epidemiologic investigation is to identify a problem, collect data, formulate and test hypotheses. It involves the collection and analysis of more facts or data to determine the cause of illness and to implement control measures to prevent additional illness.

This chapter addresses epidemiology, the steps involved in an epidemiologic investigation, and laboratory submission of clinical specimens.

1) What is Epidemiology?

A textbook definition of epidemiology is the study of the **distribution** and **determinants** of disease **frequency** in human populations. It is the collection and analysis of data to determine whether an association may exist between one or more exposures and the occurrence of disease. In practice, epidemiologists often employ statistics and probability to look at who gets sick or injured and why. In a sense, epidemiology is as old as medicine itself. Hippocrates suggested, in the fifth century B.C., that the development of human disease might be related to the external as well as the personal environment of an individual.

John Snow, a British physician is frequently considered the “father” of epidemiology. His investigations of cholera in London in the 1840s-1850s drew together all three components of the definition of epidemiology (frequency, distribution and determinants of disease). When a cholera outbreak occurred in London, Snow determined that cases occurred most frequently in specific neighborhoods of the city that used water supplied by one company. Snow canvassed the involved neighborhood to determine the source of water for each household that had a case of cholera. Snow charted the frequency and distribution of cases and was able to discover possible causes and determinants of infections. At one point, cases were mapped to the supply of one particular water pump;

Snow had the handle of the implicated water pump removed. The approach used by Snow is still used today and is outlined in Section 3, "Steps In An Epidemiologic Investigation" below.

2) Conducting an Epidemiologic Investigation

Epidemiologic investigations are usually conducted in outbreak situations. The main reasons for conducting an epidemiologic investigation are:

- to determine the cause of an outbreak, and
- to implement control measures to prevent additional illness.

A questionnaire is often solicited to assist the investigator in developing better hypotheses about the etiologic agent's identity, source and transmission. The investigators interview ill and well persons, and calculate and compare rates of illness in both groups. They make time, place, and person associations and calculate the probability that a food was the responsible vehicle.

The investigator incorporates results from epidemiological associations and the environmental and laboratory investigations, and uses these data in forming and testing hypotheses. Careful development of epidemiologic inferences coupled with persuasive clinical and laboratory evidence will almost always provide convincing evidence of the source and mode of spread of a disease. In situations where food and stool testing are negative, the cause of an outbreak is often implicated by epidemiological association.

In addition to the above, epidemiologic investigations also serve as a teaching tool. By carrying out the following steps you will gain an understanding of the systematic, logical approach an epidemiologist or "disease detective" follows in an investigation.

It is often unclear when to conduct a full epidemiologic investigation. There is usually no question when you are notified about a large number of people getting ill at approximately the same time after eating at the same establishment or attending the same event. However, uncertainty arises when sporadic complaints are reported. You will need to consider whether the reports indicate that the affected cases are all suffering from the same illness and whether there is any evidence of an association between them. This underscores the need to follow-up (i.e., determine the validity of and initiate further action if necessary) on every complaint you receive. You may find that single complaints are actually related to an outbreak.

- Refer to Chapter 4, Sections 3 and 4 for more information on what information to collect and how to collect it.

- Refer to Chapter 5, Sections 2 and 3 for more information on handling single complaints.

When you are notified of an incident in which illness has resolved and no new cases have been identified, your decision to conduct an epidemiologic investigation should be based on an assessment of what you will gain from it. As stated above, an investigation always serves as a learning tool. But, if you do not have the resources (time, personnel, etc.), it may not be warranted to conduct a full investigation. Rather, you should ensure that appropriate control measures have been implemented to prevent future outbreaks.

This is especially true of home-based foodborne outbreaks. In many instances, the illness is confined to a finite number of people in a discrete time period. In addition, you are notified after the fact when there is little material left for testing and people have recovered. You should review food preparation techniques with the responsible parties and use the opportunity to educate them on proper food handling and preparation methods.

NOTE: Investigation of an outbreak of foodborne illness is a team effort where each member has an essential role to perform. In some instances the team may include a number of individuals at the local level (public health nurse, sanitarian, laboratory, health agent) as well as the Working Group on Foodborne Illness Control (WGFIC) at the state level. At times, there may be only one person involved at the local level. **Whatever your circumstances, it is important to remember that the WGFIC is available for guidance and assistance throughout each step of your investigation.** Phone numbers for the Working Group are listed below.

MDPH Working Group on Foodborne Illness Control

Food Protection Program (617) 983-6712	For policy and technical assistance with the environmental investigation such as conducting a HACCP risk assessment, initiating enforcement actions and collecting food samples. On-site investigation assistance is often available for larger outbreaks.
Division of Epidemiology and Immunization (617) 983-6800	For technical assistance with the epidemiologic investigation such as obtaining medical histories, coordinating stool specimen submissions and developing questionnaires. On-site investigation assistance is often available for larger outbreaks.
Division of Diagnostic Laboratories (617) 983-6616	For technical assistance with the collection protocol for food and clinical specimens.

3) Steps in an Epidemiologic Investigation

The following steps need to be taken in all epidemiologic investigations.

1. Confirm the existence of an epidemic or an outbreak.
2. Confirm the diagnosis.
3. Determine the number of cases.
4. Orient the data in terms of time, person and place.
5. Develop a hypothesis.
6. Compare the hypothesis with the established facts.
7. Execute control and preventive measures.
8. Write a written report.

NOTE: It is important to note that while the above list of steps is in a particular order, they do not necessarily have to be carried out in that order. In fact, several steps may be put into action simultaneously. However, confirming the diagnosis and the establishment of the existence of an outbreak always deserve early attention.

NOTE: Depending on staffing, resources and time, you may not be able to cover all the steps or cover them thoroughly. As stated previously, the WGFIC is available for guidance and assistance. (Telephone numbers for the WGFIC are listed on the previous page.)

Step 1. Confirm the existence of an epidemic or an outbreak. What is an epidemic or an outbreak? In Chapter 5, Section 5, an outbreak of foodborne illness is defined as two or more persons experiencing a similar illness after ingestion of a common food OR different food in a common place. An outbreak may also be defined as a situation when the observed number of cases unaccountably exceeds the expected number. However, with certain foodborne illnesses such as botulism or chemical poisoning, a single case would elicit an in-depth epidemiological and environmental investigation.

To determine if there is an outbreak, you can compare the current number of cases (incidence) with past levels of the same disease over a similar time period. If the number is unusually large or unexpected for the given place and time, you may have an outbreak. For example, in June of 1996, there was an outbreak of salmonellosis in a town west of Boston. When five cases of gastrointestinal illness were identified among patrons of a fast food restaurant, the local board of health (LBOH) immediately notified the Food Protection Program. The LBOH clearly identified this as an unusual occurrence that led to the initiation of the investigation.

An outbreak may not always manifest itself in an obvious manner as above. Outbreaks dispersed over a broad geographic area, with few cases in any one jurisdiction, are much

more difficult to detect locally. This underscores the importance of establishing and maintaining a surveillance system discussed in Chapter 4. By maintaining a surveillance system and reporting to the MDPH in a timely manner, an outbreak dispersed over a broad geographic area may then be recognized at the state level.

When trying to confirm an outbreak, it is important to rule out other causes for increases in numbers of cases. For example, you might notice that several cases of *E. coli* O157:H7 have been reported to you over the past month. When you compare the numbers with cases recorded for the same month last year, you notice an increase. Then you remember that *E. coli* O157:H7 was recently made a reportable disease and this could be "surveillance artifact." That would be an artificial increase, and not necessarily a cause for alarm. Media attention to other outbreaks of the same disease tend to heighten public awareness and can lead to an increased number of cases being reported.

Step 2. Confirm the diagnosis. This is done by obtaining appropriate specimens for laboratory study and obtaining clinical histories.

Laboratory study is done by standard methods, (e.g., blood tests, stool culture). Be wary of verbal reports of cases of hepatitis A. Insist on obtaining laboratory evidence of positive IgM anti-HAV (IgM hepatitis A antibody). Other evidence to support the diagnosis (e.g., a lab-confirmed case in a contact) can sometimes be used in lieu of laboratory results. (Information on submitting clinical specimens is discussed in Section 4 of this chapter.) In some instances, there will be outbreaks of unknown etiology, and there will be no laboratory results to confirm the diagnosis. Cases or outbreaks of diseases of unknown etiology are just as valid as those with known etiologies.

NOTE: Laboratory identification of a pathogen can validate the hypothesis and perhaps allow easier implementation of control and preventive measures. **Therefore, time is of the essence when requesting and collecting clinical and food specimens.**

- Refer to Section 4 of this chapter for information on submission of clinical specimens.
- Refer to Chapter 7, Section 1 and Appendix B for more information on submission of food specimens.

Whether the etiology is known or not, the investigator must still characterize the illness by interviewing ill persons, family members or physicians. This can be done through phone calls, informal interviews, or a more formal survey that will be discussed further in Step 3 - "Determine the number of cases." **Remember, this information is confidential and should be shared with only those individuals involved in the investigation.** (See Chapter 4, Section 5 for more information on confidentiality.)

To initially assist in the organization of data, a good starting point can be the creation of a "line listing" table. Case names and numbers are listed down the left hand column, and the heading row at the top of the table should contain pertinent information such as the

case's age, sex, onset time, and symptoms. This type of organization permits a simple means for comparison of many characteristics, at one time, for possible patterns, similarities, or associations. Further on in the investigation you may want to conduct a survey or questionnaire (discussed in Step 3 below).

Example of a Line Listing Table

#	Name	Age	Sex	Onset Date	Onset Time	Symptoms
1	Mary	32	F	5/4/97	1:00 PM	Diarrhea, abd. cramps
2	Bob	25	M	5/4/97	1:30 PM	Diarrhea
3	Carol	26	F	5/4/97	10:15 AM	Diarrhea, nausea
4	Mark	18	M	5/3/97	11:30 PM	Diarrhea, abd. cramps

Step 3. Determine the number of cases (ill people). This helps to get an idea of the magnitude of the problem. Determination of case numbers is based on creating a **case definition**. A case definition is a set of criteria for deciding whether an individual should be classified as a case. The case definition places boundaries on who is considered a case, so the investigation does not include those with illnesses unrelated to the outbreak.

The common elements of a case definition include information on symptoms, laboratory results, time, place and person.

a) Symptoms: People with the same illness do not always have the same symptoms, but they will experience similar ones. It is important to remember that the symptoms of some foodborne illnesses can mimic other foodborne diseases. The following list of symptoms can be used as a "general rule of thumb" for determining the incubation period and possible etiologic agent:

- chemical poisoning symptoms, (e.g., vomiting) usually start within 1 hour of ingestion;
- nausea and vomiting usually start within 6 hours of ingestion;
- cramps and diarrhea usually start between 6-20 hours after ingestion;
- and diarrhea, chills, fever usually start between 12-72 hours after ingestion.

An example of a case definition that is commonly used for foodborne illness outbreaks without a known cause is: an individual who attended a specific event and then experienced diarrhea or a combination of two to three other gastrointestinal symptoms within a specified time after the event.

b) Laboratory results: If you are fortunate enough to have a laboratory confirmed diagnosis, this will make the task of defining a case much easier. You may want to consider notifying the laboratories in your jurisdiction that an outbreak exists and ask them to notify you of additional cases of the illness under investigation. **Note: during an outbreak of foodborne illness, efforts should be made to send all specimens and/or isolates to the State Laboratory Institute (SLI) for further identification,**

confirmation and to assure coordination of the investigation. (See Sections 4-B and 4-C of this chapter for more information on what testing is done at the SLI.)

c) Time: If there appears to be a common meal involved, then the time between consumption of that meal and the onset of symptoms provides an indication of the incubation period. The incubation period and symptoms are helpful in determining which illnesses should be considered as possible causes of the outbreak and thus may facilitate decision-making regarding what types of laboratory tests should be run. As with symptoms, incubation periods can vary among individuals; therefore, be sure to offer a range of time when considering an incubation period. For example, if you are investigating a salmonella outbreak, you may want to include, as cases, those persons who experienced symptoms consistent with the case definition anywhere from 6 - 72 hours after the meal in question.

d) Place: When there is a common meal involved, you already know the place. But sometimes the only information available may be that cases are occurring in several different locations over the same time period. It is only after more information becomes available that the case definition will become more specific as to the location of the outbreak.

e) Person: The outbreak may or may not take place within a particular group of people. Therefore, characteristics such as age, sex, occupation, ethnic group, social affiliations or function attendance greatly assist in qualifying the case definition.

Your initial case definition should be general so that potential cases are not left out. Once you have more information about the outbreak, you can refine the case definition to "weed out" extraneous cases. Once you have the case definition in place, decide how to find additional cases, (i.e., routine methods versus more intensive methods). Do you feel comfortable relying on telephone reporting from physicians? Or do you feel the need to actively search for cases from area physicians or area laboratories, use local media or enlist the help of the local hospital?

The Questionnaire/Survey

A common method of finding cases, organizing and analyzing data is to conduct a questionnaire or survey among the population you believe to be at risk, (e.g., attendees of a wedding). A questionnaire that targets specific questions about foods eaten and symptoms experienced is a valuable epidemiologic tool. A questionnaire is solicited to those ill and well, associated with the incident, and assists in developing better hypotheses about the etiologic agent's identity, source, including the means and time of transmission.

Key questions to consider when developing a questionnaire

- What are the demographic characteristics of the individual? (name, age, sex, occupation, home and work addresses, phone numbers)
- Was the individual exposed to the suspected source and when?

- What are the symptoms, date of onset, their order of occurrence and duration?
- What medical treatment has been sought and received?
- Is there a diagnosis or laboratory results?
- Who else has been exposed to a case during his or her infectious period? (secondary contacts)
- What foods were consumed in the last 72 hours or other appropriate time frame, before the time of onset? It is also important to interview and obtain food histories from those who ate the same suspect food and did not get sick.

These questions are intended as a guide. They will require modification to fit the particular circumstances surrounding the investigation. Questionnaires can be designed for personal or telephone interviews by the investigator (nurse, sanitarian, health agent, etc.). A self-administered form can also be conducted through the mail, but the response rate can be lower, and responses can take a long time.

NOTE: An example of a foodborne illness questionnaire/survey can be found at the end of this chapter (Attachment 6.5).

For those who have computer capabilities, there is a computer software program called EPI INFO which can be used to develop questionnaires and analyze data. (The software is free. You can obtain a copy by contacting the Division of Epidemiology and Immunization at (617) 983-6800 or via the Internet at: www.cdc.gov). For more information about when you should send out a questionnaire or about EPI INFO, contact the Division of Epidemiology and Immunization at (617) 983-6800.

Another useful tool for collecting this information or to initially spot an outbreak is the *Bacterial/Parasitic Gastroenteritis Case Report Form*. (Further information on *case report forms* can be found in Chapter 4, Section 4-B.) As discussed in Chapter 4, timeliness of reporting is important to ensure that control measures to prevent additional cases are implemented as soon as possible.

Step 4. Orient the data in terms of TIME, PLACE, and PERSON. The purpose of data orientation or epidemiological characterizations is to arrange all incoming data so it means something. The investigator is searching for common associations based on TIME, PLACE, and PERSON to strengthen or amend current hypotheses. A common method of data orientation is plotting, on a graph, the cases by time of symptom onset to get an **epidemic curve**.

NOTE: An **epidemic curve** is a graph that depicts the association of the time of illness onset of all cases that are associated with the outbreak. It helps to determine whether the outbreak originated from a common source or person to person. Time is plotted on the horizontal axis and the number of cases plotted on the vertical axis.

From the line listing and/or survey described above (Steps 2 and 3), you will have collected information on the characteristics of the ill persons (age, sex, occupation, exposures to specific foods or other items). Very often, simply by knowing these descriptive aspects, the diagnosis and then plotting an **epidemic curve**, the source, mode of transmission and who is at risk can be determined. Once the population at risk has been determined, appropriate control measures can be targeted.

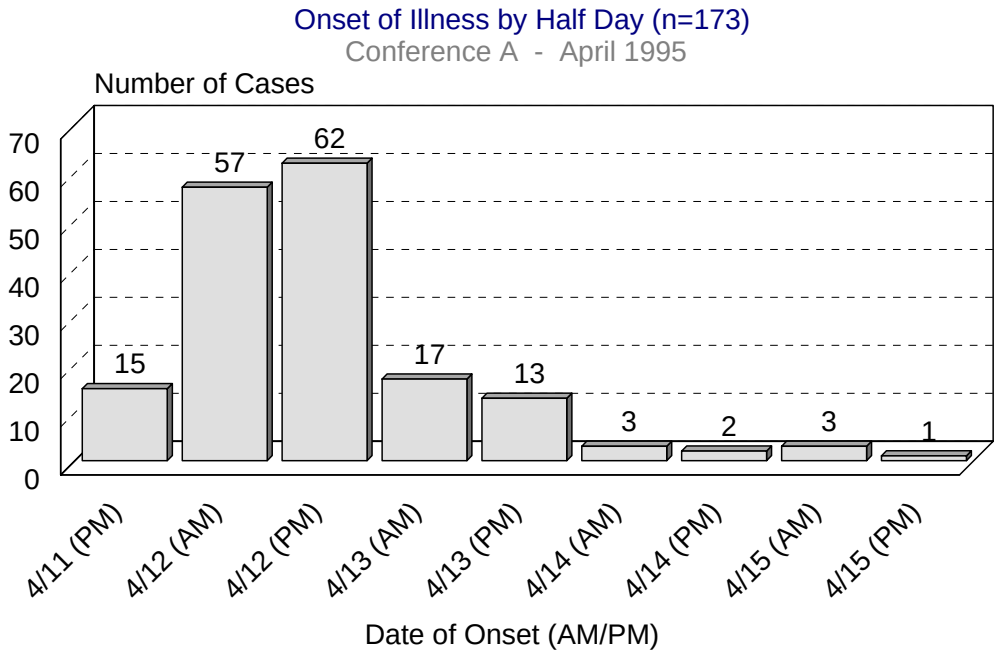
The shape of the epidemic curve may suggest what kind of outbreak is occurring. A *common-source* or *point-source outbreak* looks different than a *propagated-source* or *person-to-person outbreak* and a *continual source outbreak*. Definitions of these kinds of outbreaks, and an example of each epidemic curve are found below. Epidemic curves are also useful when communicating to lay persons (consumers, restaurant operators, etc.) the nature and magnitude of the outbreak spread.

NOTE: The following pages contain definitions and examples of the different kinds of outbreaks:

- Common-Source or Point-Source Outbreak
- Propagated-Source Outbreak or Person-to-Person Outbreak
- Continual-Source Outbreak

Common-Source or Point-Source Outbreak. An outbreak of disease or illness in which susceptible individuals are exposed simultaneously to one source of infection. For example: guests at a wedding reception. The epidemic curve for this type of outbreak is characterized by a sharp rise to a peak followed by a decline usually less abrupt than the rise. See Example 6.1 below.

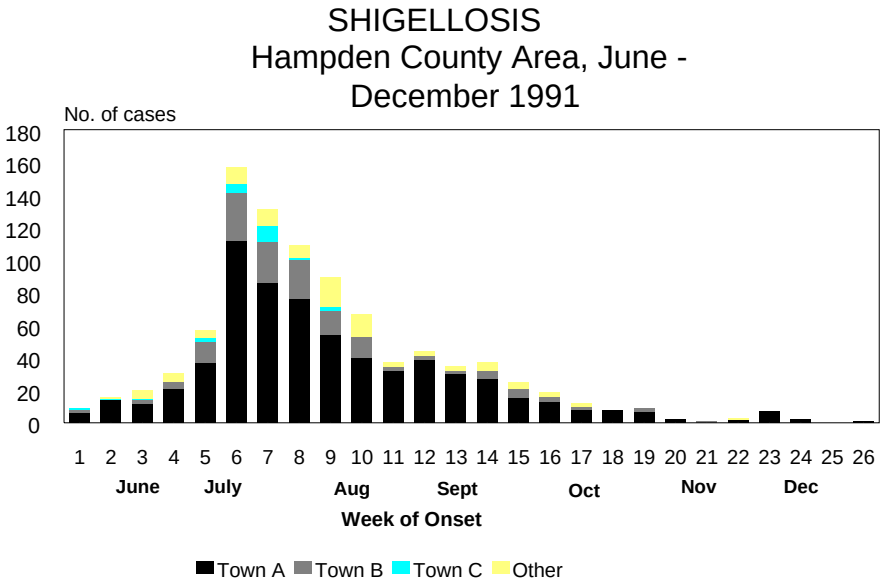
Example 6.1
Common-Source Outbreak Epidemic Curve



Source: MDPH, Working Group on Foodborne Illness, 1995

Propagated-Source Outbreak or Person-to-Person Outbreak. An outbreak of disease or illness that is spread from one person to another rather than from a single source. For example: a community-wide outbreak of shigellosis. The epidemic curve for this type of outbreak is characterized by a relatively slow, progressive rise. The curve will continue for the duration of several incubation periods of the disease. For example: a shigellosis outbreak in western MA lasted about six months. See Example 6.2 below.

Example 6.2
Propagated-Source Outbreak Epidemic Curve



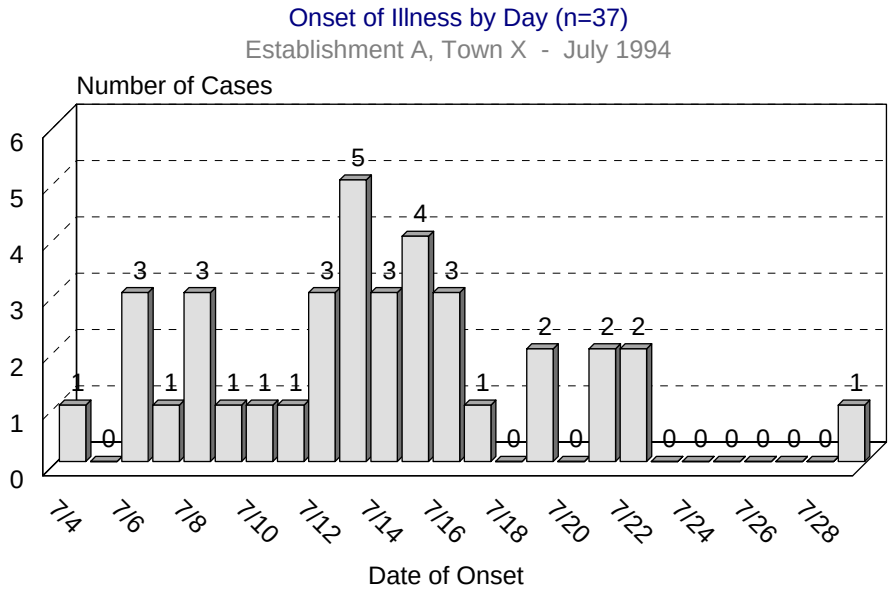
July

N = 927 with known date of onset
(Cases reported as of 12/27/91)

Source:
MDPH, Working Group on Foodborne Illness Control, 1991

Continual-Source Outbreak. An extended outbreak of disease or illness caused by a source that continues to be contaminated. For example: an outbreak where food is continuously contaminated by an infected food handler. The epidemic curve for this type of outbreak is characterized by continual peaks over time (e.g., weeks, months). The peaks may not be as dramatic as a common-source epidemic curve, and the outbreak may not be as obvious. See Example 6.3 below.

Example 6.3
Continual-Source Epidemic Curve



Source: MDPH, Working Group on Foodborne Illness, 1994

NOTE: Remember, if at any time throughout the entire investigation, an ongoing, potentially hazardous source of illness is discovered, recommendations should be decided and acted upon. Regulatory actions may also need to be taken.

Step 5. Develop a hypothesis that explains the specific exposure(s) that may have caused the disease (and test this by appropriate statistical methods). Using the information gathered from the previous steps, consider the possible source(s) from which the disease may have been contracted. One example of a simple hypothesis is: the cases became ill after sharing a common meal.

As stated in Step 4, very often, simply by knowing the descriptive aspects, the diagnosis and then plotting an **epidemic curve**, the source, mode of transmission and who is at risk can be determined. Once the population at risk has been determined, appropriate control measures can be targeted. This descriptive aspect of the epidemiological investigation is what is most often carried out at the local level.

To test or prove your hypothesis, you would want to apply more analytical techniques, such as statistical testing. This is often carried out by an epidemiolgist at the state level (or in collaboration with the state), and for the purposes of this manual, will be referred to below and not discussed in detail.

Often in a foodborne illness outbreak, food-specific attack rates (AR) are calculated. Attack rates are used to determine if one or more food items were responsible for causing the illness. The food that caused the problem shows a higher attack rate in persons who ate the food than in those who did not. The AR is usually expressed in percent. It represents the proportion of ill persons observed due to a specific exposure or event.

You may have heard of other terms: “odds ratio, relative risk, and p-value." These are some of the statistical tests that can be used to test a hypothesis. Many of these tests are automatically calculated by computer programs like EPI INFO, although they can be done by hand.

NOTE: Refer to Example 8.3 - Outbreak Report in Chapter 8 for an example of an investigation where more advanced analytical techniques were employed. (Note the various tables and graphs at the end of this report.)

NOTE: If you have computer capabilities and/or are interested in learning more about analytical epidemiology and statistical testing, contact the Division of Epidemiology and Immunization. Additionally, please refer to the references at the end of this chapter.

Step 6. Compare the hypothesis with the established facts and draw conclusions. For example, based on evidence gathered, you have a hypothesis that the salad was the vehicle of transmission in a salmonella outbreak. You then need to ask yourself how the salad became contaminated with salmonella and could this be verified with the results of the environmental investigation. In other words, are your epidemiologic results plausible and consistent with other investigational findings? For instance, salad is not usually a food that harbors salmonella. However, it can become contaminated when ill or infected food handlers prepare the salad without adequate handwashing or use of gloves. Compare your hypothesis to the results of the environmental investigation. Did the inspector note how the salad was made and served? Was it possible for this scenario to have happened? Some of the questions that need to be addressed to make sure that your hypothesis is not only statistically sound, but makes sense in the real world are:

- Could your hypothesized events actually have happened?
- Is your hypothesis consistent with the environmental aspects of the investigation? (See Chapter 7 for more information on environmental investigations.)
- Is it likely the vehicle of transmission identified became contaminated with the organism that has been isolated?

NOTE: Not all outbreaks have a resolution. In fact, it is rare when everything comes together and a cause can be definitively determined. Do not be discouraged. Careful development of epidemiologic inferences coupled with persuasive clinical and environmental evidence will almost always provide convincing evidence of the source and mode of spread of a disease. In most cases, there will be enough evidence to present a plausible hypothesis.

Step 7. Execute control and preventive measures. Before initiating any control measures, think about the effectiveness, timeliness, costs, available resources, personnel requirements and possible ramifications of proposed actions. Are the recommendations realistic for the establishment involved? For example, will they be able to install the new dishwasher or the 3-bay sink that was recommended? If not, what are the alternatives? **NOTE**: **Be advised that some control measures should be implemented very early in an outbreak investigation.** For example, removal of ill food handlers or the embargo, recall or destruction of contaminated food items should be implemented immediately, if necessary.

In addition, all corrective actions must be verified by the LBOH to ensure that steps to reduce or eliminate the hazards have actually occurred. See Chapter 7, Section 3-Steps 4 and 5 for additional information on control and preventive measures.

Step 8. Write a report. After analysis of epidemiologic and environmental data, conclusions should be summarized in a report. This is one of the most important steps in

the outbreak investigation. Not only does the report detail your agency's efforts, but identifies a potential source(s) of the outbreak and suggests control measures to prevent future illness.

- See Chapter 8 for detailed information on writing a report. Sample reports are also included in Chapter 8.

4) Submission of Clinical Specimens to the State Laboratory Institute

Clinical specimens (blood, feces, etc.) were mentioned in the previous section under Step 2, "Confirming The Diagnosis." Laboratory identification of a pathogen can validate the hypothesis and perhaps allow easier implementation of control and preventive measures. Increased certainty results if statistical association is combined with isolation of a pathogen from the ill person and the implicated food. This evidence is almost certain to be irrefutable. **Therefore, time is of the essence when requesting and collecting clinical and food specimens.**

- Refer to Appendix B for more information on submitting food specimens.

A. Role of the State Laboratory

The Division of Diagnostic Laboratories (DDL) is part of the State Laboratory Institute (SLI) of the MDPH located at 305 South Street in Jamaica Plain, Massachusetts. The DDL is the state reference laboratory, where hospitals and other laboratories send specimens or isolates for confirmation and serotyping. In addition to reference laboratory activities, the DDL examines implicated food and clinical specimens (in outbreak and non-outbreak situations) to identify the organism or extraneous materials responsible for human illness. Specimens are submitted by local boards of health, other public agencies and health care providers.

The two units within the DDL that conduct foodborne illness-related testing are:

- the Enteric Lab (stool testing) and
- the Food Microbiology Lab (often referred to as the Food Lab).

The Environmental Chemistry Lab may be involved in situations that involve suspected chemical poisonings or for the testing of naturally occurring toxins. In outbreak situations, LBOHs can coordinate food and clinical specimen submissions with the DDL to ensure that all specimens (e.g., food handlers, patrons, implicated foods) are handled in a coordinated fashion.

B. What is accepted for testing?

Feces and Food
The two specimens considered most appropriate for foodborne illness-related testing are **feces** and **food.** Food specimen submission is addressed in Appendix B.

Other Specimens
Urine is not a usual specimen for culture although the Enteric Lab does receive isolates (usually from hospital labs) from urine specimens of *Salmonella*, *Shigella* and *E. coli* O157:H7 for identification or serotyping. If the board of health should receive notification from the Enteric Lab of a positive pathogen from a urine specimen, follow-up should include a stool specimen. If the case is a food handler, the employee still must submit at least one negative stool specimen for clearance to return to work (with the exception of *S. typhi* which is three negative stool specimens). See *105 CMR 300: Reportable Diseases and Isolation and Quarantine Requirements*.

Blood is an acceptable specimen when typhoid or botulism is suspected (see Section 4-F on more information on botulism testing), or the clinician requests blood testing for another reason. Blood tests for hepatitis A are usually performed through the individual's private medical provider, and are not performed at the State Laboratory Institute.

C. What tests are performed on fecal specimens?

Routine cultures:

- *Campylobacter* species
- *Salmonella* species
- *Shigella* species
- *Vibrio* species
- *Yersinia* species
- *E. coli* O157:H7, also known as Enterohemorrhagic colitis or EHEC

Other cultures and tests performed upon special request (if symptoms of illness are consistent) include those for:

- *Clostridium perfringens*
- *Bacillus cereus*
- *Staphylococcus aureus*
- *Clostridium botulinum* (see Section 4-F)

NOTE: The DDL does not examine specimens for ova and parasites (e.g., *Giardia lamblia*, *Cryptosporidium parvum*, *Cyclospora cayetanensis*). If there is a need for ova and parasite testing (e.g., food handlers, individuals without health insurance), arrangements can be made through the SLI for specimens to be sent to a contract laboratory.

The DDL does not perform viral isolation on stool specimens. In special circumstances, the Centers for Disease Control and Prevention (CDC) in Atlanta may be able to offer laboratory assistance and conduct viral testing on fresh stool specimens. **If there is a situation that warrants this service, contact the Division of Epidemiology and Immunization (617-983-6800) or the DDL (617-983-6600) for assistance.**

D. Turnaround Times on Specimens (specimens submitted directly to SLI)

The following table details the minimum time to complete enteric testing from receipt of sample to test result. (This does not include weekend days.)

Table 6.4 - Stool Testing Turnaround Times

Species	Positive (minimum hrs)	Negative (minimum hrs)
Campylobacter	48	72
Salmonella	48	72
Yersinia	96	48
Shigella	48	24
Vibrio	96	48
E. coli O157:H7	48	24
C. perfringens	72	48
Bacillus cereus	72	24
S. aureus	72	48

E. Procedure for Stool Sample Collection and Submission

1) The Enteric Laboratory currently provides the following fecal specimen collection kits:

- Transport for *Salmonella sp., Shigella sp., Yersinia sp.* The kit contains a clear plastic bottle with a *white* label and a green top.
- Transport for *Campylobacter sp.* only. The kit contains a clear plastic bottle with an *orange* label and a green top.
- The combined outfit which contains both types of transport bottles.

NOTE: 1) The preferred method for submitting specimens for *E. coli O157:H7* is a fresh stool in a sterile container placed on wet ice submitted to the laboratory as quickly as possible. If this is not feasible, contact the Enteric Laboratory at (617) 983-6609 for further instruction.
2) Instructions for the submission of specimens suspected of containing *Vibrio species*. can be obtained by calling the Enteric Laboratory at (617) 983-6609.

NOTE: All enteric culture kits now provided by the SLI have clearly labeled "expiration dates" on them. Older kits had a date stamped on the outer container. This date is not an expiration date but indicates the date the kits were made. Kits generally last for about 10 years. It is not necessary to discard older kits. The kit can be used as long as the transport medium (liquid solution inside) has not turned yellow. If the solution has turned yellow, *DO NOT USE*. Return the unused kit and obtain a new one.

2) When to collect clinical specimens

- Diagnosis of most foodborne diseases can be made more easily when etiologic agents are isolated from clinical specimens of ill persons. **Encourage ill persons to submit stool specimens while they are still experiencing symptoms or as soon as is practical thereafter. Pathogens or toxins may remain in the intestinal tract for only a short time after illness onset.**
- Collect stool specimens prior to antibiotic treatment. **NOTE: A repeat sample may need to be submitted if the patient was on antibiotics when the initial culture was taken. This often happens if the patient is a food handler and needs clearance to return to work.**

3) How much to collect

- A sample, the size of a dime, should be placed on the paddle in the transport medium. The medium stabilizes the specimens and prevents overgrowth of normal flora. If the stool is liquid, transfer no more than 4 ml of specimen to the container. **DO NOT OVERFILL.**
- Take care not to contaminate feces with urine.
- A container such as a bedpan or plastic wrap can be placed over the toilet for easier fecal collection.

4) Rectal swabs

Swabs are not usually recommended for testing because the sample size is too small (exception, see Section 4-F, "Botulism Testing"). If a rectal swab is the only available sample, care should be taken to insert the swab past the anal sphincter muscle to obtain a representative fecal specimen. Transfer the swab to the appropriate transport container, rotate the swab in the medium, press the swab vigorously against the side of the container, break or cut off the handle and include swab with container.

5) Label each specimen bottle with:

- patient name
- physician name and address (or local board of health name and address)
- date of specimen collection

6) Complete the *Enteric Culture Requisition* form that is found inside the container. It must include the following:

- patient name, address, date of birth, sex

- provider information (board of health, private physician, etc.) Name and address are needed to report results.
- occupation, (e.g., food handler, daycare provider, etc.)
- history of recent travel outside the U.S.
- history of shellfish consumption
- whether the patient is a "contact" to a known case or whether this is a "release" or clearance specimen
- note whether a particular food establishment is involved or if part of a known outbreak

7) Packaging

- **To prevent leakage, tighten cover of transport bottle completely.**
- Place transport bottle into inner metal container.
- Place *Enteric Culture Requisition* form between the inner metal and outer cardboard mailing container.

8) Delivery

- Mail the specimen using first class postage or
- Hand deliver to:
  - DDL

  Enteric Laboratory - Fourth Floor
  State Laboratory Institute
  305 South Street
  Jamaica Plain, MA 02130

NOTE:

- If there are any questions, contact the Enteric Laboratory at (617) 983-6609.
- To obtain stool kits, contact the DDL secretary (617) 983-6603.
- Appendix E includes a form entitled *Instructions For Submitting Enteric Specimens*. This two-page form contains abbreviated instructions on the information in this section.

F. Botulism Testing

Request for testing for possible botulism cases should come directly to the Division of Epidemiology and Immunization. Since botulism testing is very involved, i.e., not a simple blood test (see below), physicians need to contact the Division of Epidemiology and Immunization directly to discuss the situation. The epidemiologist collects a clinical history and a food history and discusses with the physician the patient's symptoms and other test results. After the information is collected, the epidemiologist and the physician determine whether or not botulism testing is appropriate. If a decision to test is made, the other members of the WGFIC (DDL and FPP) and the LBOH will be contacted to coordinate specimen collection and laboratory preparation.

If the case is highly suspect, antitoxin arrangements must be made. Stool samples need to be collected **before** antitoxin is administered. Approval for release of antitoxin must be obtained from the CDC. Antitoxin is only administered to adult patients. This antitoxin, of equine origin, may cause serum sickness in approximately 20% of treated persons. Antitoxin is not used for infants because of the lack of evidence of its benefit.

Specimen Collection
The primary and best specimen for foodborne botulism testing is stool. A quantity of at least 25 grams (1 oz.) can be collected into any sterile container (there is no special kit). With infants less than one year of age, it is acceptable to submit rectal swabs. Multiple swabs are usually collected to obtain as much stool as possible.

The stool must be kept fresh (no preservatives) on wet ice and sent to the SLI as quickly as possible. If the sample cannot be delivered on the same day as collection, it can be kept refrigerated. Ideally, the lab should receive the specimen early in the day.

The secondary specimen is serum (not whole blood). A minimum of 10 cc (5 cc for infants less than one year of age) needs to be collected and delivered to the SLI on wet ice. Again, it can be refrigerated if it cannot be delivered on the same day as collected. **NOTE:** The likelihood of demonstrating toxin in serum is much less than in stool.

Stool testing
The stool is tested by two methods. The first is a mouse bioassay or the mouse neutralization test. Extracts from the stool specimen that may contain botulinum toxin are injected into live mice. The mice are paired, with one being the control and the other receiving the extract with antitoxin. The mice are then observed for neurologic symptoms and death. Testing may take a few days or several weeks for a definitive answer. A second method is by culture to isolate the organism, *Clostridium botulinum*. This process can take from 4-6 days. Culture of toxin-producing clostridium is confirmed by the mouse neutralization test.

Serum testing
Serum is tested by the mouse neutralization method (described above).

Food testing
Coordination for pickup and testing of food samples is arranged between the Division of Epidemiology and Immunization, FPP, LBOH, the family or the restaurant involved. Food is tested by the methods described above.

G. Reporting Results

Written reports on all positive results are sent to:

- the CDC in Atlanta,
- the board of health where the patient lives (always),

- other submitters as noted on the *Enteric Culture Requisition* form (e.g., the patient's physician or a hospital lab),
- the board of health handling an outbreak,
- the Bureau of Communicable Disease Control, and
- the DDL files.

Written reports on all negative results are sent to:

- the board of health where patient lives (if the patient is a release or contact, if BOH is listed as submitter on *Enteric Culture Requisition* form or if BOH requests result),
- other submitters as noted on the *Enteric Culture Requisition* form (e.g., the patient's physician or a hospital lab),
- the board of health handling an outbreak, and
- the DDL files.

References

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Hennekens, C. and Buring, J. E. *Epidemiology in Medicine*. Toronto: Little, Brown and Company, 1987.

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ATTACHMENT 6.5 Sample Questionnaire/Survey

Board of Health Letterhead here.

July 25, 1996

The Massachusetts Department of Public Health in conjunction with the XXXXX Board of Health is investigating an outbreak of gastrointestinal illness which occurred among the attendees of a business conference held at Establishment A on July 19, 1996. Please complete these questions **ONLY IF YOU ATTENDED** the meeting. Your completion of the following questions, **EVEN IF YOU DID NOT HAVE ANY SYMPTOMS**, will greatly assist us in our efforts to identify the source of this illness. **All information which you provide will be kept strictly confidential and used solely for the purposes of this investigation.** Please return the completed questionnaire to the XXXXX Board of Health at the address or fax below. Thank you for your assistance.

RETURN TO:

Board of Health
(123) 456-7890
Fax: (123) 456-7781

PLEASE DO NOT LEAVE ANY QUESTIONS BLANK

DATE COMPLETED: ____/____/____

1. LAST NAME _____ FIRST NAME _____
ADDRESS _____ TOWN _____

STATE _____ ZIP CODE _____ SEX: □M □F AGE _____

PHONE: (_____) - _____ - _____

CHAPTER 6

2. Please mark any of the following **symptoms** that you have had **SINCE ATTENDING** the meeting on July 19, 1996?

□ NONE ***(IF NONE, PLEASE MARK 'NONE' AND GO TO QUESTION # 10)**

□ Nausea □ Vomiting □ Abdominal Cramps □ Chills
□ Muscle Aches □ Headaches □ Loss of Appetite □ Fever □ Fatigue □ Dizziness Highest Temp: _____
□ Diarrhea: # Episodes of diarrhea per day: _____
Type of diarrhea:
□ Soft stool
□ Watery Diarrhea
□ Bloody Diarrhea
Other Symptoms:_____

3. **What day** did your symptoms begin? □ Friday, 7/19/96
□ Saturday, 7/20/96
□ Sunday, 7/21/96
□ Monday, 7/22/96
□ Other _____

4. **What time** did your symptoms begin? TIME: _____**:**_____ □ AM □ PM

5. **How long** did your symptoms last? □ HOURS: # _____ (Choose either hours or days)
□ DAYS: # _____

6. Did you seek **medical care** for your symptoms? □ YES □ NO
If YES, name of doctor? _____ Phone # / Town? _____/_____

7. Were you **hospitalized** for your symptoms? □ YES □ NO
If YES, name of hospital? _____

8. Did you provide a **stool sample** for testing? □ YES □ NO
Results of the test? _____

9. Did any family/household members **who did not attend the meeting** experience similar symptoms following your illness? □ YES □ NO

If YES, # ILL _____ DATE(S): _____

10. Have **you** recently had any diarrhea, vomiting, or other symptoms **before the meeting?**

□ YES □ NO If YES, DATE(S): _____

11. Did you eat any food(s) or drink any beverage(s) at the meeting held on July 19, 1996 at Establishment A? □ YES □ NO

If YES, what time did you eat? TIME: _____:_____ □ AM □ PM

12. Please mark 'YES' **OR** 'NO' to indicate whether you consumed the following items:

Turkey □ YES □ NO
Ham □ YES □ NO
Salami □ YES □ NO
Cheese □ YES □ NO
Bread Rolls □ YES □ NO
Sandwich Condiments:
Lettuce □ YES □ NO Pickle □ YES □ NO
Onion □ YES □ NO Mayonnaise □ YES □ NO
Tomato □ YES □ NO Mustard □ YES □ NO
Other _____
Potato Salad □ YES □ NO
Tuna Salad □ YES □ NO
Coleslaw □ YES □ NO
Tossed Green Salad □ YES □ NO
Type of Dressing: □ French □ Italian □ No Dressing
Broccoli soup □ YES □ NO
Chocolate Cake □ YES □ NO
Carrot Cake □ YES □ NO
Danish □ YES □ NO
Sliced Fruit □ YES □ NO
Type of fruit: □ Pineapple □ Canteloupe □ Honeydew Melon
Water □ YES □ NO Ice □ YES □ NO
Coffee □ YES □ NO Tea □ YES □ NO
Cream □ YES □ NO Milk □ YES □ NO
Soda □ YES □ NO Juice □ YES □ NO
Other Beverages or Food:_____

THANK YOU FOR RESPONDING TO THESE QUESTIONS

Chapter 7

CONDUCTING AN ENVIRONMENTAL INVESTIGATION

1) **What Does the Environmental Investigation Entail?**

2) **Background to a Hazard Analysis Critical Control Point (HACCP) Risk Assessment**

3) **Application of HACCP Principles in a Foodborne Illness Investigation**

CONDUCTING AN ENVIRONMENTAL INVESTIGATION

Introduction

The local board of health (LBOH) is the public health agency responsible for conducting an environmental investigation in response to a suspect foodborne illness complaint. **The objective of the environmental investigation is to:**

- identify the reason for, or source of contamination, and
- initiate corrective actions, if necessary, to eliminate contaminated foods or poor food handling practices which may result in contaminated foods.

Further illnesses may be avoided if potentially contaminated foods are promptly identified and removed from sale or service to the public, and poor food-handling practices are corrected.

Other reasons for initiating an environmental investigation include government responsibility, consumer expectation, and vindication of innocent establishments. Investigative findings are important information: they are a public record and may be subpoenaed for legal proceedings, as are inspection reports.

1) What Does the Environmental Investigation Entail?

The primary objective of the environmental investigation is to determine what specific factors may have contributed to the illness or outbreak and, if discovered, assure that they are corrected. Unlike routine inspections, a quality environmental investigation of a foodborne disease outbreak may take several hours because it involves the evaluation of all suspected processes but starts with a review of the previous routine inspection reports of the implicated food establishment. One must be acquainted with the inspection equipment and forms necessary to conduct a complete investigation. **An environmental investigation should be initiated within 24-48 hours of the receipt of a complaint** and involves the following:

A. Collecting Food Samples

To avoid important evidence from being inadvertently discarded during your investigation, always identify and collect leftovers of the suspect food(s) immediately.

See Box 4.1 - *Guidelines For Determining Suspect Foods* in Chapter 4-Section 3-A. Food collection should be completed prior to initiating the HACCP risk assessment of the suspect food. Review how to aseptically collect food samples and transport them for analysis. Bring the proper food sample containers and investigation forms with you.

NOTE: Guidelines for how to collect food samples are provided in Appendix B. For information on where to obtain food containers, contact the Food Protection Program at 617-983-6712.

B. Facilitating Enteric Collections

As with food samples, stool samples must be collected as soon as possible in order to confirm a clinical diagnosis. Bring an adequate supply of enteric kits and instructions for collection. Determine who is responsible for distributing enteric stool kits to food handlers. Determine who is responsible for instructing food workers on how stool specimens should be collected.

NOTE: Further information on obtaining enteric stool kits and instructions on collection can be found in Chapter 6, Section 4. Detailed information on the MDPH Infected Food Worker Policy can be found in Appendix A.

C. Inspecting the Food Establishment

The food inspector or sanitarian should be trained in the provisions outlined in *105 CMR 590.000: Minimum Sanitation Standards for Food Establishments.* Bring the most current version of *105 CMR 590.000.* Bring the necessary equipment to conduct an inspection. An inspector's equipment checklist is provided in Appendix E. A list of food sampling equipment and food submission forms are provided in Appendix B.

D. Conducting A HAACP Risk Assessment on Implicated Foods

Hazard Analysis Critical Control Point (HACCP) is a science-based method of evaluating food handling procedures to identify or prevent hazards which contribute to foodborne disease. Have a food inspector or sanitarian trained in conducting a HACCP Risk Assessment.

NOTE: More information on a HACCP risk assessment can be found in Sections 2 and 3 of this chapter. For technical assistance, contact the MDPH Food Protection Program at 617-983-6712.

E. Initiating Corrective or Enforcement Actions

Have a food inspector or sanitarian trained in enforcement (e.g., embargo, voluntary disposal, emergency closure, food worker restrictions) procedures outlined in *105 CMR 590.000***.**

Persons conducting the environmental investigation should be knowledgeable in the

following areas:

- food microbiology,
- etiology of foodborne disease,
- high-risk factors in foodborne illness outbreaks,
- the application of HACCP principles,
- food preparation review and food establishment investigation procedures,
- regulatory provisions, and
- enforcement procedures outlined in *105 CMR 590.000*.

Good communication skills are also required to conduct a thorough investigation. When identifying yourself to the person-in-charge (PIC), explain the purpose of the "foodborne illness" investigation and be prepared for a variety of reactions. Food establishment operators are often tense, nervous, defensive, angry, and, sometimes, in complete denial at the prospect of being responsible for a customer's illness. Stay calm, respectful and professional. Encourage cooperation by explaining the LBOH responsibility, as well as the food establishment's responsibility to ensure that practices and procedures are adequate to prevent foodborne diseases. If necessary, remind the PIC that failure to cooperate in the investigation may result in the suspension or revocation of the food permit. In any situation, maintain an unbiased attitude and assure the PIC that other plausible causes will be addressed.

The designated LBOH spokesperson responsible for talking to the media and affected groups in high-profile investigations (e.g., larger outbreaks) should also be knowledgeable in risk management issues and have a medical or public health background.

NOTE: If you are uncertain on how to proceed, contact the MDPH Working Group on Foodborne Illness Control (see telephone numbers below).

MDPH Working Group on Foodborne Illness Control

Food Protection Program (617) 983-6712	For policy and technical assistance with the environmental investigation such as conducting a HACCP risk assessment, initiating enforcement actions and collecting food samples. On-site investigation assistance is often available for larger outbreaks.
Division of Epidemiology and Immunization (617) 983-6800	For technical assistance with the epidemiologic investigation such as obtaining medical histories, coordinating stool specimen submissions and developing questionnaires. On-site investigation assistance is often available for larger outbreaks.
Division of Diagnostic Laboratories (617) 983-6616	For technical assistance with the collection protocol for food and clinical specimens.

2) Background to a Hazard Analysis Critical Control Point (HACCP) Risk Assessment

A. What is HACCP?

HACCP provides a systematic, science-based approach to food safety. A HACCP-based investigation focuses on the suspect food or meal implicated, rather than on a cursory inspection of the physical and sanitary facilities of the food establishment. The production of the implicated food item is evaluated for hazards which can contribute to the occurrence of foodborne disease. This is done at each step of handling from receipt to sale or service to the consumer.

The ideal steps in conducting a HACCP risk assessment of the implicated food include actual observation of the suspect food being prepared, taking temperatures and identifying potentially faulty food handling practices. Since this may not be feasible if the food establishment is not producing the implicated food or meal at the time of the investigation, it will be necessary to interview the PIC of food production on how the food was handled from receipt to sale or service. General food handling practices should be evaluated by observing food workers and by measuring various potentially hazardous food temperatures.

To effectively conduct a HACCP risk assessment, a sanitarian or food inspector must have a general understanding of applied food microbiology, high-risk factors in food preparation and the application of HACCP principles.

B. Applied Food Microbiology

An understanding of how pathogens (disease-causing microorganisms) can contaminate food, survive and/or multiply (and in some cases produce toxins) is essential to evaluate risk. Pathogens may be present in raw foods as well as in infected food workers. Pathogens in food, present either naturally or by contamination, can survive if the food requires no further cooking or is undercooked. It is important to note that while bacteria may survive and multiply in potentially hazardous food, viruses and parasites may survive but cannot multiply without a living host (see Chapter 2, Section 1). Pathogens in infected food workers may be shed in feces, infected lesions and respiratory secretions and thus can be transmitted to food. A list of primary sources of common foodborne pathogens is provided at the end of the chapter (see Attachment 7.1). Use this list when trying to determine the source of contamination.

Potentially hazardous foods (PHFs) are those high-risk foods in which bacteria can survive, multiply and with certain bacteria, produce toxin. Foods with a pH of 4.6 or above and a water activity of 0.85 Aw or greater are regarded as PHFs. PHFs are also defined as any food or ingredient, natural or synthetic, in a form capable of supporting the rapid and progressive growth of infectious or toxigenic microorganisms or the slower growth of *Clostridium botulinum*. The pH and Aw for several categories of food are provided at the end of the chapter (see Attachment 7.2).

Examples of PHFs include:

- Beef
- Poultry
- Pork
- Finfish
- Shellfish
- Dairy Products
- Eggs
- Vegetables (cooked vegetables, raw bean sprouts, cabbage)
- Starchy Foods (tofu, rice, potatoes, grains)

The optimum growth temperature range for the majority of pathogens is between 60° and 120° F. Some pathogens such as *Listeria* and *Yersinia* grow best under refrigeration temperature ranges. Under optimum growth temperatures, bacteria, in their vegetative state, can double in number every 15-20 minutes. At temperatures below freezing, foodborne pathogens may survive but cannot grow. Most pathogens are destroyed at temperatures above 140° F.

While PHFs may provide the optimum environment for the growth of pathogens, other non-PHFs may be the causal factor in a foodborne illness outbreak by simply acting as the food vehicle in which bacteria, parasites or viruses can survive until ingested. The food listed below, not normally defined as PHFs, have been implicated in foodborne outbreaks.

Non-PHFs Implicated in Foodborne Illness Outbreaks:

Food	Outbreak
Orange juice	*Salmonella*
Apple cider	*E. coli* O157:H7
Lettuce	*E. coli* O157:H7
Raspberries	*Cyclospora*
Cantaloupe	*Salmonella*
Water/ice	Viruses
Mushrooms	*Staphylococcus aureus*
Garlic in oil	Botulism

Many pathogens which are naturally found in soil-grown vegetables, grains and spices have a dormant **spore** state which can be heat shocked into a vegetative state after cooking. With the exception of infant botulism, bacterial spores do not cause foodborne disease. However, if a pathogen's spore (e.g., *Bacillus cereus* in rice) is heat shocked into its vegetative state after cooking, the *Bacillus cereus* bacteria can then multiply rapidly if left at optimum growth temperatures (60° - 120° F).

Some pathogens such as *Bacillus cereus* and *Staphylococcus aureus* are **toxin-producing pathogens**. If a food is contaminated and stored at optimum growth temperatures, these organisms can produce heat-stable toxins (i.e., toxins which are not destroyed by heating), which can remain toxic even after reheating (see Chapter 2, Section 1-B).

C. High-Risk Factors in Food Preparation

Significant factors in foodborne illness outbreaks have been documented in several foodborne disease investigation surveillance studies. Significant factors associated with the occurrence of foodborne disease are listed below and can be divided into three hazard categories: contamination, survival, growth.

Contamination:

- *infected person*
- *contaminated ingredients*
- *hand contact/implicated food*
- *unclean equipment*
- *toxic container*
- *cross-contamination*
- *added poisonous chemicals*
- *unapproved source*
- *natural toxicant*
- *consumption of raw or lightly cooked food of animal origin*

Survival:

- *inadequate cooking*
- *inadequate reheating*

Growth:

- *inadequate refrigeration*
- *preparation several hours before serving*
- *inadequate hot-holding*
- *improper cooling*
- *anaerobic packaging*

Such factors will vary in significance depending on the significant ingredient and how it is prepared. Definitions of these contributing factors and questions you may need to address are outlined below in Section 3-Step 3. Further information on contributing factors associated with the implicated pathogen, significant ingredient and method of preparation can found in Appendix C - HACCP Foodborne Disease Data.

3) Application of HACCP Principles in a Foodborne Illness Investigation

Table 7.3 below lists the steps in a HACCP risk assessment. A *HACCP Risk Assessment Form* can be used to facilitate risk assessment of the suspect food and, if used, must be attached to the inspection report. The LBOH can use the *HACCP Risk Assessment Form* to identify the procedures used by the establishment in preparing the suspect food as well as to identify corrective actions initiated as a result of the investigation. **Correction of faulty food handling practices is essential to ensure prevention of further illness.**

NOTE: A sample of a blank and completed *HACCP Risk Assessment Form* are provided in Appendix E.

A HACCP risk assessment must be conducted for each suspect food item prepared. If baked chicken and gravy is the suspect food, one should evaluate separately how each was prepared. In outbreaks, when multiple foods have been identified, a *HACCP Risk Assessment Form* can be used to evaluate procedures for a particular category of food such as soups, salads, or sandwiches.

TABLE 7.3 STEPS IN A HACCP RISK ASSESSMENT

1. **Identify ingredients, weight/volume, and steps involved in the preparation of suspect food(s).**
2. **Identify food-handling procedures at each step in the preparation of suspect food(s).**
3. **Based on observation or interview, identify potential hazards and critical control points (CCP).**
4. **Identify violations and initiate corrective actions.**
5. **Verify corrective actions undertaken by the food establishment.**

STEP 1. Identify ingredients, weight/volume, and steps involved in the preparation of suspect food(s).

Ingredients in the suspect food.
Obtain recipes for all suspect food items. List all ingredients for each suspect food item. Ingredients must be from an approved source, especially high-risk ingredients such as raw shellfish or canned low-acid foods. It is usually not necessary to obtain exact measurements of each ingredient unless there is a question on the pH of the food. Note new changes in recipes or ingredient substitutions. **NOTE:** Recipes are proprietary information and must be treated with strict confidentiality.

The suspect food is contaminated at the source (farm/ocean) or at the manufacturing level.
Contaminated produce, eggs, seafood and commercially-processed foods have been implicated in many foodborne illness outbreaks. When such products, contaminated at the source, are implicated, it is crucial to obtain as much information as possible from the food establishment or consumer to identify the exact source and/or manufacturer/distributor. Product lot numbers, expiration dates and sales records are necessary when conducting a trace back to identify an implicated source. When investigating such products, be sure to obtain the following product information.

Manufactured Product Identification

- Brand Name
- Product Name
- Code/Lot Number
- Expiration/Sell by/Use by Date
- Size/Weight
- Package Type
- Date of Purchase
- Manufacturer Name and Address
- Distributor Name and Address
- Retail Food Establishment Where Purchased

Shellfish identification tags should always be obtained for clams, oysters, quahogs and other molluscan shellfish associated with a foodborne illness. For information on conducting food tracebacks, see traceback article (Attachment 7.4) at the end of this chapter.

Volume of the suspect food prepared by the food establishment.
List the weight/volume of the suspect food prepared. Large volumes may indicate problems with cooling or food handling procedures, especially if the food was prepared a day or more before service. If the volume was greater than what is normally prepared, different procedures may have been used.

Suspect food preparation schedule.
Dates and the length of time are important information needed to determine potential time/temperature abuse. It is important to document **date and time prepared**, when applicable, to determine if there was ample time for temperature abuse which may have resulted in the growth of pathogens or the production of toxin.

Identify steps in preparing the suspect food.
Each step (e.g., store, thaw, cook, cool, serve) in the preparation of a food item is regarded as a **"control point."** (More information on control points can be found in next step, Step 3. List each step or control point on the *HACCP Risk Assessment Form*. Listing the steps as a flow chart permits the visualization of each preparation step.

STEP 2. Identify food handling procedures at each step in the preparation of suspect food(s).

Clearly document **how the food was handled** at each step. The method used to identify food handling procedures at each step is to observe the actual process. Since this may not be feasible in some situations, it is essential to interview the manager-in-charge of food production and then walk-through the preparation steps in the kitchen afterwards. Identify how suspect foods were thawed, cooked, cooled, reheated, served and transported. Identify how food workers determined final cooking temperatures. Indicated what equipment was used in the preparation of the suspect food. Specify if food workers use disposable gloves or utensils to handle cooked and read-to-eat foods. Indicate handwashing practices observed.

Clearly document **who prepared the food**. It is recommended that the initials of the **employee responsible for handling food** be documented. An infected food worker with poor hygiene may be the source of contamination. The initials (versus "line cook" or "waitress") are helpful when comparing the positive or symptomatic food workers to their job functions to determine if there is a relationship. Inquire if the food worker had been recently ill. Ask if the worker is a new employee or new to the particular operation because a new or different food worker unaware of the proper procedure may have been responsible for preparing the suspect food. Review the food establishment's sick or infected food worker policies. See Appendix A for the MDPH Infected Food Handler Policy.

Focus on the significant factors in foodborne illness outbreaks. When conducting a HACCP Risk Assessment, focus on poor food handling practices which can contribute to foodborne disease. Definitions for each significant factor are listed in Step 3 in addition to questions that may need to be addressed during your assessment.

STEP 3. Based on observation or interview, identify potential hazards and critical control points (CCP).

The level of risk for a suspect food depends on the probability of occurrence of a hazard or the sequential occurrences of several hazards identified in the preparation procedure.

As mentioned earlier in this chapter, the three main microbiological hazards are:
a) Contamination (C)
b) Survival (S)
c) Growth/Toxin Production (G/T)

a) Contamination.

Determine if there are risks at each step in the food preparation for microbial CONTAMINATION (C) from either the food worker, food, or improperly cleaned and sanitized equipment /utensils. (Food could be raw animal foods already contaminated or foods

which were contaminated at the point of harvesting and intended to be consumed raw such as lettuce, raspberries and unpasteurized apple cider.)

Epidemiological data indicates that microbiological hazards pose the highest risks to the greatest number of persons. Physical and chemical hazards usually affect individuals rather than groups. Microbiological contamination such as bacteria, viruses and parasites are present in infected food workers and raw foods of animal origin. Indirect or cross-contamination from raw foods of animal origin to ready-to-eat foods that will receive no further heating can also result in microbiological contamination.

Contributing Factors Associated With Contamination:

***Contaminated Ingredients*:** The suspect food or a component of the food contained the pathogenic agent when it arrived at the point of preparation.

- Determine if the suspect food harbors contaminants normally found in soil, fertilizers or raw animal foods (e.g., raw meat, poultry, seafood, root vegetables etc.).
- Check to determine if the water/ice supply was possibly contaminated.
- Check to determine if back-flow prevention devices were present on plumbing cross-connections.
- Check to determine if the suspect food was from an approved source.
- Check to determine if the source may have contributed to the suspect foods contamination (e.g., shellfish from a contaminated growing bed).

***Unapproved Source*:** The suspect food was obtained from a source that does not comply with appropriate regulatory standards (e.g., shellfish harvested from closed growing beds).

- Determine if all foods (including water/ice) were obtained from an approved source.
- Check identification tags on shellfish and if they are retained for 90 days.

***Infected Person*:** A food worker involved in the preparation of the suspect food was infected or was suspected as being infected at the time the food was prepared. This individual was identified as the probable source of the agent in the outbreak.

- Identify the persons responsible for preparing the suspect foods.
- Determine if any of the food workers were ill before or during the time that the suspect food was being prepared.
- Check if any of the food workers were observed with infected cuts or wounds on their fingers or hands.

***Consumption of Raw or Lightly Cooked Food of Animal Origin*:** The suspect food was eaten raw or after a heat treatment that would not have reduced the level of agent contamination to below an infectious dose.

- Determine if the suspect food of animal origin was served raw or undercooked?
- If required by law, check if consumer advisories were properly posted?

***Cross-Contamination*:** The pathogen was transferred to the suspect food during preparation by contact with contaminated worker hands, equipment, utensils, drippage, or spillage. If

worker hands were the mode of contamination, the worker was not necessarily infected with or a carrier of the organism.

- Determine if raw foods were stored separately from cooked and ready-to-eat foods.
- Check if food workers were properly washing their hands and using a physical safety barrier such as disposable gloves, deli papers and utensils in-between handling raw and cooked or ready-to-eat foods.
- Check equipment, utensils and food contact surfaces for proper cleaning and sanitizing between use

***Unclean Equipment*:** The suspect food was prepared with or stored in equipment that was contaminated with the agent.

- Check if the equipment and utensils used to prepare the suspect food were properly cleaned and sanitized in accordance with *105 CMR 590.000*.

***Hand Contact with Implicated Food*:** A food worker who was identified as the source of the agent prepared the vehicle with his/her bare hands.

- Check if infected workers used their bare hands to handle or to prepare cooked and ready-to-eat foods.
- Determine if food workers are trained to use physical safety barriers such as disposable gloves, deli papers and utensils in-between handling raw and cooked or ready-to-eat foods.

***Added Poisonous Chemicals*:** The chemical agent was deliberately or inadvertently added to the suspect food. In former cases, this addition typically occurred at the time of preparation or packaging of the vehicle.

- Determine if any toxic substances were improperly stored or used around the suspect food.
- Check if there were any recent situation involving a disgruntled employee possibly seeking revenge.
- Investigate where any toxic substance in the immediate vicinity of the suspect food may have been mislabeled.

***Natural Toxicant*:** A chemical agent of biologic origin that occurs naturally in the suspect food or bioaccumulates in the suspect food prior to or soon after harvest.

- Investigate whether a suspect food is known to harbor natural toxicants (e.g., histamine in scombroid fish, aflatoxins in grain, toxins in poisonous mushrooms, dinoflagellate toxins in shellfish).

Toxic Container: A chemical agent originated in the material from which the food container was made. The agent migrated from the container into the suspect food.

- Determine if the suspect food was in direct contact with lead, copper, aluminum, tin, cadmium or other heavy metals.
- Is the suspect food acidic (pH < 7)? The more acidic the product, the greater potential for metals to leach into foods. Check to see that food is stored in the proper containers.

b) Survival.

Determine if pathogens SURVIVED (S) the cooking process. The survival of pathogens is determined by the "thermalization" or cooking procedure used. Pathogens are easily destroyed by adequate cooking or reheating. The consumption of undercooked or raw foods of animal origin is a significant factor in foodborne disease outbreaks. Massachusetts is currently in the process of adopting time/temperature cooking and reheating requirements outlined in the 1997 Food Code. Time/temperature cooking requirements are listed below:

Time/Temperature Cooking Requirements

Temp.	Holding Time	Food Product
145° F	15 seconds	Fish/meat/game animals/raw shell eggs that are broken and prepared for immediate service.
145° F 150° F 155° F	3 minutes, or 1 minute, or 15 seconds	Pork/ratites*/injected meats/comminuted* fish, meat and game animals/raw shell eggs that are broken and held prior to cooking or are held prior to service after cooking.
165° F	15 seconds	Poultry/wild game animals as allowed by law/stuffed fish, meat, pasta poultry, ratites or stuffing containing fish, meat, poultry or ratites.
130° F 132° F 134° F 136° F 138° F 140° F 142° F 144° F 145° F	121 minutes 77 minutes 47 minutes 32 minutes 19 minutes 12 minutes 8 minutes 5 minutes 3 minutes	Whole beef roasts. (Refer to *105 CMR 590.000* for appropriate oven temperature based on roast weight. Holding time may include post-oven heat rise.)

* Ratites = ostrich and emus.
* Comminuted. Reduced in size by methods including chopping, flaking, grinding or mincing.

Contributing Factors Associated With Survival:

***Inadequate Cooking*:** The suspect food was not heated to a temperature and for a time adequate to destroy the agent or to reduce the level of contamination to below an infectious dose.

- Were the raw animal origin foods cooked to proper time/temperatures in accordance with *105 CMR 590.000?*
- Check if the establishment has a food stem thermometer and whether it is used to test

final cooking temperatures.
- If required, are cooking temperature logs maintained?

***Inadequate Reheating*:** The suspect food, which had been previously cooked and cooled, was not heated to a temperature sufficient to destroy the agent or to reduce the level of contamination to below an infectious dose.
- Determine how the suspect food was reheated.
- Check to determine if the suspect food was properly reheated in accordance with *105 CMR 590.000*.
- Determine if a thermometer was used to test the final reheat temperature of the suspect food.

c) Growth/Toxin Production.

Determine if the pathogens had ample time to GROW (G) AND/OR PRODUCE TOXIN (T). The growth of pathogens and the production of toxins can occur in PHFs which achieve temperatures between 45° and 140° F for several hours. Time/temperature abuse can result from inadequate cooling procedures, holding at room temperature and inadequate hot and cold holding units. While reheating contaminated food may destroy pathogens, it may not deactivate heat-stable toxins produced by pathogens such as S*taphylococcus aureus*. It is recommended that potentially hazardous foods be cooled from 140° F to 70° F within two hours and then to 41° F (or 45° F) or less within four hours.

Contributing Factors Associated With Growth and Production of Toxins:.
Improper Cooling: The suspect food was cooled from a cooking or ambient air temperature to a refrigeration temperature by a means that allowed the growth of a pathogen to an infectious dose or the production of toxin.
- Determine if implicated PHFs were cooled to 45° F within 4 hours by pre-chilling ingredients, using shallow containers, ice baths or reducing the size of the product.

Inadequate Refrigeration: The suspect food was not held at a temperature of 45° F or less either due to improperly functioning refrigeration equipment or because it was being held outside of refrigeration. The period of time held at an improper temperature was sufficient to permit the growth of a pathogen to an infectious dose or the production of toxin.
- Determine if there was an adequate number of refrigeration units to maintain the suspect PHF at or below 45° F.
- Determine if refrigeration units were properly operating at or below 45° F.

***Inadequate Hot Holding*:** The suspect food (PHF) was not held at or above 140° F due to improperly functioning hot holding equipment or was not being held in hot holding equipment. The period of time the food was held was sufficient to permit the multiplication and growth of the pathogen to an infectious dose.
- Determine if the suspect food was left out for storage or display at ambient air temperature.

- Determine how long the suspect food (PHF) was below 140° F.
- Determine if temperatures of suspect foods in hot holing units were at or above 140° F.
- Determine if the food workers have and use thermometers to measure temperatures of the suspect PHFs in hot holding units.
- If required, check temperature logs for hot holding units.

***Preparation Several Hours Before Service*:** The suspect food was prepared long before service, and this practice permitted a time/temperature abuse of the food.

- Determine the length of time between preparation and service of the suspect food.
- Determine how long the suspect food was stored between preparation and service.

***Anaerobic Packaging*:** The suspect food was stored in a container that provided an anaerobic environment. This environment permitted the multiplication and growth of the agent.

- Check to determine whether the suspect food was stored in an anaerobic package or container (e.g., vacuum packaging, container filled to capacity and tightly covered, hermetically sealed containers and garlic in oil products).
- If the suspect food was in a vacuum package or container, investigate at what temperature it was stored.
- Determine if the suspect food was prepared in a cook-chill or sous-vide operation.
- If the suspect food was in a vacuum package or container, review the label storage instructions.

Critical control points.

A **critical control point (CCP)** is a preparation step in which a hazard, if present, can result in a foodborne disease. For example, any step in the production of a ready-to-eat food (e.g., tuna salad), where contamination is likely to occur, may be considered a CCP since pathogens introduced during storage or preparation may survive until ingested. Thus, each step where contamination occurs in a ready-to-eat food is "critical." However, if a food worker handles raw chicken with bare hands, this step would not be critical, since the chicken would be cooked in the next step destroying all pathogens introduced into the food. In this procedure, cooking would be a "critical control point" because adequate cooking is necessary to destroy all pathogens naturally present or introduced during preparation. Failure to cook the chicken properly would allow the survival of pathogens, which could result in a foodborne illness.

STEP 4. Identify violations and initiate corrective actions.

Document Violations. This step in the investigation is critical especially if further enforcement action is necessary. Violations may be referenced on the *HACCP Risk Assessment Form* in the "Item No." column and then attach the *HACCP Risk Assessment Form* to the food establishment inspection report form. If a *HACCP Risk Assessment Form* is not completed at the time of the investigation, the violations must be documented on the

narrative section of the inspection report form. Failure to properly document violations may result in the LBOH being legally challenged for actions.

Document Corrective Actions. Indicate immediate corrective or enforcement actions taken as well as how and when existing violations will be corrected, particularly for critical control points. If violations involving critical control points are detected, a **reinspection** should be conducted within 24 - 48 hours to verify correction. In the column *Verified* on the *HAACP Risk Assessment Form* indicate the date and the inspector verifying correction. Corrective actions may include:

- *Modifying faulty food handling practices*

Initiating corrective actions is the most critical aspect of the environmental investigation if unsafe food handling practices are discovered. Ensuring that faulty food handling practices, which can result in foodborne disease, are corrected, is one of the primary objectives of the investigation. **Emphasize critical control points correction.** Discuss with the food manager monitoring procedures that can be implemented by the food establishment to ensure that steps designated as *critical* are properly carried out by employees.

Correction plans can include recommendations to improve food safety. For example, the use of raw eggs in a Caesar salad dressing is not in violation of the regulations. However, recommending that the establishment use a pasteurized product is reasonable since the use of a pasteurized product can reduce the risk of disease transmission.

- *Education*

Efforts to educate the operator on the risks posed by identified poor food handling practices should be made by the sanitarian. In some situations, it may be necessary for the operator to hire a consultant to assist in making changes or training their staff. Food operators may also be required to participate in a food safety management program if not already certified in food safety.

- *Removal of contaminated food from sale or distribution*

If it is determined that food prepared on the premises is possibly contaminated and may cause a foodborne illness, the LBOH may initiate the voluntary disposal of the food or an embargo until the food can be tested in a laboratory. Such action should be taken only with clear evidence of contamination or time/temperature abuse.

Most of the focus should be placed on foods that will not receive further cooking or reheating, since it is these foods in which bacteria and toxins, if present, may survive until ingested. However, some food poisonings, such as scombroid poisonings can occur even after food is cooked. Remember that corrective actions may not always require disposal. Corrective actions suggested for time/temperature abuse situations during cold holding, hot holding, cooling, cooking, and reheating can be found in an attachment entitled *PHF Temperatures* in Appendix E.

When there is strong evidence that contaminated food has been distributed by the establishment, it may be necessary to issue a press release warning consumers not to eat the

food. (An example of a hepatitis A press release can be found in Appendix E.) A food recall may also be initiated by the implicated food manufacturer, distributor or by federal and state food regulatory agencies.

- *Restriction of infected food workers*

If a sick food handler is noted at any time during the environmental investigation, take steps to restrict the food handler from working with food in accordance with *105 CMR 590.000: Procedures When Infection is Suspected*. Detailed procedures for restricting infected food handlers are outlined in Appendix A.

- *Emergency closure or suspension of operations*

In certain situations, it may be necessary to close an establishment or suspend a particular operation if imminent health hazards exist that cannot be corrected immediately. Failure to immediately correct violations that may result in a foodborne disease (normally associated with critical control points) should invoke an emergency closure or suspension of operation(s).

For example, if it is discovered that a mechanical salad bar refrigeration unit is not maintaining PHF temperatures at or below 45°F, and there is no ice source, the salad bar operation should be closed until the unit is repaired. Another example that may warrant an emergency closure is in an outbreak situation when it is determined that the majority of the food workers must be restricted from working with food, and there are no replacement workers. A food establishment may desire to voluntarily close to avoid negative publicity. Remember, closures and suspensions are a serious matter to all involved and should be well planned before implemented.

If a closure or suspension is initiated, the permit holder and the person-in-charge must be notified of the order in writing. The order is effective upon posting on the premises.

Afterwards, the board of health must hold a hearing within three business days after receipt of a written request for hearing. Whether or not a hearing is requested, the board of health may end the suspension at any time if the reasons for the suspension no longer exist.

Elements of an Emergency Closure Order

An emergency closure order must state the following:

- The board of health has determined that an imminent health hazard exists which requires immediate suspension of operations or closure,
- The violations leading to that determination, and
- A hearing will be held if a written request is filed with the board of health by the permit holder within 10 days of receipt of the notice of suspension.

STEP 5. Verify corrective actions undertaken by the establishment.

All corrective actions must be verified by the LBOH to ensure that steps to reduce or eliminate the hazards have actually occurred. Failure to correct critical violations or to comply with other necessary measures (e.g., food worker specimen submission or work restrictions) should result in the LBOH taking further enforcement actions such as suspension or emergency closure. Verification may be completed during the investigation by actually observing the corrective actions or by reinspection.

Conclusion

A HACCP risk assessment may require more than one contact with the food operator during site visits or telephone calls in order to obtain all the information necessary to assess the procedures. Elements in the investigation may change and can require shifts of focus in suspect procedures. Try to stay open-minded and patient. When investigating suspect foods which may have been contaminated prior to being received at the retail food establishment, it is important to obtain as much product information as possible to identify the exact source, and remove contaminated products from distribution.

Conducting a HACCP risk assessment of the implicated food is necessary in order to effectively identify potential hazards or points of contamination and time/temperature abuse. A report that reflects a HACCP-based investigation provides specific information to the reviewer (food establishment operator, complainant, board of health members, MDPH Working Group on Foodborne Illness Control, lawyers, etc.) on how the food was handled by the establishment.

Findings may demonstrate how a food establishment is employing safe food handling procedures in preparing the suspect food. Findings may also reveal critical control points in the preparation of the suspect food that were not being safely performed or monitored. In this case, a HACCP risk assessment will clearly identify faulty food handling practices as well as the recommendations to initiate corrective actions. Poor food handling practices can be replaced with safe practices and procedures, thereby averting future occurrences of foodborne disease.

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ATTACHMENT 7.1

Primary Sources of Common Foodborne Pathogens

Human beings:

Salmonella typhi - intestinal tract, feces, urine
nontyphi Salmonella - intestinal tract, feces
Shigella - intestinal tract, feces
Escherichia coli (enteroinvasive, enterotoxigenic, enteropathogenic strains) - intestinal tract (*E. coli* normal flora), feces
Staphylococcus aureus - nasal passages (normal flora), skin (normal flora), lesions containing pus
Streptococcus pyogenes - skin and throat infections
Clostridium perfringens - intestinal tract (normal flora), feces
Norwalk-like viruses - feces and respiratory tract
Hepatitis A virus - feces
Giardia lamblia - intestinal tract, feces
Pseudomonas aeruginosa - skin

Fowl and mammals (meat and poultry products):

nontyphi Salmonella - intestinal tract, feces, skin/feather contamination
Campylobacter jejuni/coli - intestinal tract (normal flora), feces, skin/feather contamination
Escherichia coli (Enterohemolytic strains) - intestinal tract (*E. coli* normal flora), feces
Clostridium perfringens - intestinal tract, (normal flora), feces
Yersinia enterocolitica - intestinal tract, feces, tongues of swine
Staphylococcus aureus - cows udder and teat canal, feathers, bruised tissue of fowl, nasal passages (normal flora), skin (normal flora), hair, lesions containing pus

Raw milk:

nontyphi Salmonella - intestinal tract, feces, skin/hair contamination, hands of milker
Campylobacter jejuni/coli - intestinal tract (normal flora), skin/hair contamination
Escherichia coli - intestinal tract (*E. coli* normal flora), feces
Clostridium perfringens - intestinal tract (normal flora), feces
Yersinia enterocolitica - intestinal tract, feces
Staphylococcus aureus - cows udder and teat canal, nasal passages (normal flora), skin (normal flora), hair, lesions containing pus, hands of milker
Brucella spp. - systemic infection, milk
Mycobacterium bovis - systemic infection, milk
Coxiella burnetii - infection, milk

Finfish, shellfish, marine crustacea:

Vibrio parahaemolyticus - sea water natural habitat, fish surfaces, shellfish
Vibrio cholerae non-O1 - sea water natural habitat, fish surfaces, shellfish
Vibrio cholerae O1 - sewage pollution of water habitat, fish surfaces, shellfish
Vibrio vulnificus - sea water natural habitat, shellfish, fish surfaces
Norwalk-like viruses - sewage pollution of water habitat
Hepatitis A virus - sewage pollution of water habitat
Paralytic shellfish poison - toxic marine plankton
Ciguatoxin - toxic marine plankton and certain fish in region
Scombroid toxin - finfish containing high levels of histidine and improper cooling of fish after catching that allows growth of certain bacteria that break down histidine to histamine compounds

Soil and soil-grown vegetables, cereals, spices:

Listeria monocytogenes - soil natural habitat, moisture on floors
Clostridium botulinum - soil natural habitat
Clostridium perfringens - soil natural habitat, and fecal droppings
Bacillus cereus - soil natural habitat
All enteric pathogens listed above if right soil or sewage fertilization

Water:

Aeromonas hydrophila
Pseudomonas aeruginosa
Yersinia enterocolitica - stream water contaminated by animals
Giardia lamblia
All enteric pathogens listed above if sewage pollution occurs

Source: Used with permission from Frank Bryan, Ph.D., MPH, Food Safety Consultation and Training, 8233 Pleasant Hill Road, Lithonia, GA 30058, (770-760-1569), 1996.

ATTACHMENT 7.2

Effects of pH

The ph of a food can be used to either encourage or discourage the growth of microorganisms. In general, bacteria multiply most rapidly when the ph is near neutrality. Few pathogenic foodborne organisms can grow at a ph as low as 4.5 and none, except the toxigenic fungi, when the ph drops below 4.0. The ph of a food has a strong bearing on the time/temperature equation necessary to destroy foodborne pathogens. In general, for any given temperature, the lower the ph of the food product, the more rapidly the pathogens will be killed.

pH of Selected Foods

Food	ph
Limes	2.0
Lemons	2.2
Vinegar, plums	2.9
Prunes, apples, grapefruit (3.0-3.3)	3.1
Rhubarb, dill pickles	3.2
Strawberries, lowest acidity for jelly	3.4
Peaches	3.5
Raspberries, sauerkraut	3.6
Sweet cherries	3.8
Pears	3.9
Acid fondant, acidophilus milk	4.0
Tomatoes (4.0-4.6)	4.2
Lowest acidity for processing at 1000	4.4
Buttermilk	4.5
Bananas, egg albumin, figs, isoelectric point for casein	4.6
Pumpkins, carrots	5.0
Turnips, cabbage, squash	5.2
Sweet potatoes, bread	5.4
Asparagus, cauliflower	5.6
Meat, ripened	5.8
Tuna	6.0
Potatoes	6.1
Corn, oysters, dates	6.3
Egg yolk	6.4
Milk (6.5-6.7)	6.6
Shrimp	6.9
Meat, unripened	7.0
Egg white	8.0

Source: George, Harvey. Inspecting The Food Service Establishment: Microbiological Considerations, *MDPH, Food and Drug Reporter*, July 1987, Vol. 5, Issue 87-3.

CHAPTER 7

Effects of Water

Effective growth of microorganisms in food products requires the presence of a minimum water content. This minimal water content or water availability is referred to as the *water activity* of the food or Aw. The maximum theoretical value for Aw is 1.0, which is that of pure water. As a solution becomes more concentrated or a food becomes more dry, its vapor pressure decreases and hence its Aw decreases. Most foodborne pathogens have a very narrow Aw range, with rapid growth taking place in a Aw range from 0.98 to 0.999, and growth ceasing when the Aw drops below 0.94 to 0.96. Many organisms have the ability to remain viable for long periods in dried foods with a low Aw, but die rapidly in heavily salted foods that have a low Aw. The Aw of a food is an integral factor in the time-temperature sterilization equation required to kill foodborne pathogens; for example, at any given lethal temperature, the lower the Aw, the longer the exposure time required for killing.

Approximate Aw values of Selected Foods

Aw	Foods
1.00 - 0.95	Fresh meat, fruit, vegetables, canned fruit in syrup, canned vegetables in brine, frankfurters, liver sausage, margarine, butter, low-salt bacon
0.95 - 0.90	Processed cheese, bakery goods, high-moisture prunes, raw ham, dry sausage, high-salt bacon, orange juice concentrate
0.90 - 0.80	Aged cheddar cheese, sweetened condensed milk, Hungarian salami, jams, candied peel
0.80 - 0.70	Molasses, soft dried figs, heavily salted fish
0.70 - 0.60	Parmesan cheese, dried fruit, corn syrup, licorice
0.60 - 0.50	Chocolate, confectionery, honey, noodles
0.40	Dried egg, cocoa
0.30	Dried potato flakes, potato crisps, crackers, cake mixes, pecan halves
0.20	Dried milk, dried vegetables, chopped walnuts

Source: George, Harvey. Inspecting The Food Service Establishment: Microbiological Considerations. *MDPH, Food and Drug Reporter*. July 1987, Vol. 5, Issue 87-3.

ATTACHMENT 7.4

Traceback Methodology - *Cyclospora Cayetanensis* Outbreak Example

Traceback information is essential in many foodborne illness outbreaks. Tracebacks are necessary to identify possible sources of contamination and to quickly identify and correct an undesirable situation. Many individual case reports of foodborne illness have been linked to a common source of contamination through the process of a traceback investigation. Specific codes assigned to a particular food product as well as specific invoice information relative to each and every distributor should be included in the tracing back of a particular food item. Every step of a traceback investigation needs to be properly identified and properly documented. A conventional traceback usually begins with the information available at the time of purchase of a specific food item by a consumer and extends back to the very beginning of its production. Traceback has been especially beneficial in those outbreaks that have been the result of contamination caused by both S*almonella* and *E. coli* O157:H7.

The outbreak of cyclospora infection that occurred this past summer (1997) in Massachusetts was associated with similar outbreaks occurring in fourteen other states and Canada. Multiple epidemiologic analyses strongly implied that the consumption of contaminated fruit, specifically raspberries, was responsible for causing illness. Onset times and symptomatology of illness was similar in most reported cases. Traceback information was used to help identify the source and site of product contamination. Information relevant to each and every step was considered in the process of tracing back this specific food item. All of the steps from harvesting to consumption were considered in the traceback of the implicated fruit. The Centers for Disease Control and Prevention (CDC) coordinated the traceback investigation of all the states associated with this outbreak and provided a database that was useful in tabulating and summarizing pertinent information relative to the investigation.

Local health departments may also be asked for participation in tracebacks. They will generally work in conjunction with the State Health Department in obtaining information relevant to the origin of a specific food product.

Tracing back a product to its point of origin requires obtaining certain basic and essential information which should include the following:

- Code numbers
- Lot numbers
- Sell by dates
- Expiration dates
- Wholesalers
- Distributors
- Dates received

The complete product name as well as the identity and the location of each distributor needs to be included in the traceback. The size of a package or container and type of packaging should be recorded. Invoices from each distributor should be provided. Invoice information should include the identity of a product as well as the exact origin of the product. The quantity of product purchased and the date of purchase should also be included as relevant information. Traceback should start with the purchase of the product by the consumer. The validity of a traceback is strongly dependent upon proper documentation. Receipts and labels are essential in a meaningful traceback. If a label or statement of purchase is not available, then every attempt should be made to seek accurate information relative to date and location of the purchase of the food item in question. Traceback should include all of the locations that a particular product was purchased by the consumer. For example, in many cases, raspberries were purchased from several different locations by the same consumer for the same event. All of these establishments were in fact included in the traceback of raspberries.

Surveillance data indicated that the illness caused by the protozoal parasite *Cyclospora cayetanensis* was due to the ingestion of contaminated raspberries. Traceback information indicated that the contaminated raspberries originated in Guatemala. The Massachusetts traceback investigation also implicated Guatemalan raspberries. Several different distributors were involved with the handling of raspberries. Most of the distributors were housed in one central location. Since the shelf life of this fruit was approximately five days, the time of distribution was rather limited. Invoices from all distributors were collected and examined.

Traceback data indicated that Guatemala was responsible for producing the contaminated raspberries. A cooperative system of farming and the intermingling of produce at one point of collection in Guatemala has made the identification of the exact source and site of contamination difficult. Even though contaminated raspberries from Guatemala have been strongly implicated as the reason for illness occurring, product testing as well as environmental sample testing has not identified the exact cause of contamination. Traceback investigation was in fact very helpful in identifying Guatemala as the source of contaminated raspberries and did rule out the possibility of other countries providing contaminated fruit.

Source: Leonard J. Letendre D.V.M., M.S., R.S., Massachusetts Department of Public Health, Food Protection Program. 1997.

Chapter 8

SUMMARIZING THE INVESTIGATION

1) The Report
2) Purpose of The Report
3) Outbreak Report Format
4) Examples of Reports

SUMMARIZING THE INVESTIGATION

Introduction
When an investigation is complete, the final responsibility is to provide written documentation of events. This is necessary not only for large outbreaks involving many people but also for single complaints of possible foodborne illness. This chapter explains the importance of the report and its possible uses. Also included is a detailed explanation of a workable format for writing a report, what should be included in the report and who should receive it. Finally, samples of outbreak reports of differing complexity are included as a guide.

While this chapter focuses on a report written for a more complex outbreak, even single complaints should be documented as completely as possible. The single complaint must always be regarded as the possible first indication of a larger problem.

1) The Report

The report documents what happened in a foodborne illness investigation. It is public record and must be objective, accurate, clear, and timely.

Detail in the document should reflect the complexity of the incident under investigation. A single complaint might result in a "complaint form" (e.g., the *Foodborne Illness Complaint Worksheet)* being completed with a list of action steps and any follow-up. (See Chapter 4, Section 4-A for more information on the *Foodborne Illness Complaint Worksheet*.)

A more complicated occurrence (i.e., a large outbreak) might involve people outside your local jurisdiction and require a more comprehensive report. It may be necessary to enlist all involved parties when writing a final report. It is the responsibility of the local board of health (LBOH), however, to recruit state agency personnel or others to assist in completion of the report.

2) Purpose of the Report

Whether the report is being written in response to an outbreak or a single complaint, complete documentation is important for the following reasons:

A document for action.

In some cases, control and prevention measures will only be instituted in response to a written report. Until an outbreak is documented and summarized in a formal "outbreak report," it is easy for the implicated establishment operator to shift responsibility. The document contains the "official" findings. It should be used in refuting rumors and speculation.

A record of performance.

A well-written report documents the magnitude of health problems and justifies program activities. A report clearly states events that occurred and the process that was followed. It should include all steps undertaken by everyone involved. The person writing the report will need to gather that information. The comprehensiveness of the outbreak report should reflect the complexity of the investigation. This accurately documents events and also clearly illustrates staffing resources required to undertake the investigations.

A document for potential legal issues.

An investigative report written by health professionals must be written objectively, honestly and fairly. Information in these investigations is frequently used in legal actions. Thus, it is very important that a record exists that accurately documents events in a timely manner to aid in any legal investigations that might ensue.

An enhancement of the quality of the investigation.

The process of writing a report and viewing the data in written form may result in new insights. It could precipitate new questions to be answered before a conclusion is reached. The more investigations and outbreaks one writes up, the better the understanding of process and results.

An instrument to present control and preventive measures.

The primary reason to undertake an investigation is to control and prevent disease. The written report is an official medium to present control and preventive measures, and perform needs assessments. One may identify new trends, introduce new regulations or policies, identify training needs and reinforce existing regulations. When the report is presented to the owners and managers, encourage them to use it as a catalyst for change. This document is an educational tool and may help to prevent the same problems from reoccurring. (For example, operators who have been educated about the availability and safety of a pasteurized egg product will probably choose that over pooled whole, shell eggs.)

3) Outbreak Report Format

There are a variety of ways to compile the information obtained during an investigation into a professional, understandable and usable document. Below is the standard outline used by the Massachusetts Department of Public Health (MDPH) to write an outbreak report. The MDPH staff usually follow this format because it logically describes the events that occur during an investigation.

NOTE: This format can be modified to reflect the complexity of the outbreak.

NOTE: Three outbreak report examples (8.1, 8.2, and 8.3) are provided at the end of this chapter. Please note the varying complexity of each report.

Even if you do not get the opportunity to compile a complex "outbreak report," you might be the recipient of one if a large outbreak occurs in your jurisdiction. It would be helpful for you to be familiar with the following format and understand what information is contained in each section. It will then be easier for you to adopt any or all of the sections for use when responding to and documenting smaller scale incidents.

A foodborne illness outbreak report should include the following sections:

I. Summary
II. Introduction
III. Background
IV. Methods
- **A) Epidemiologic**
- **B) Environmental**
- **C) Laboratory and Clinical**

V. Results
- **A) Epidemiologic**
- **B) Environmental**
- **C) Laboratory and Clinical**

VI. Discussion
VII. Recommendations
VIII. Acknowledgments
IX. Supporting Documentation

I. Summary

The summary should consist of a paragraph or two that provide the reader with an overview of the investigation (i.e., the WHO, WHAT, WHERE and WHEN of the outbreak). It should describe what caused the outbreak or the causal hypothesis based on the evidence.

II. Introduction

Include the specific events that led to the investigation. Include:
1) how the outbreak was first reported,
2) steps undertaken to confirm its existence, and
3) all who assisted in the investigation.

III. Background

Background information is important. This section identifies the type of establishment involved in the outbreak (e.g., take-out restaurant, banquet facility, caterer, fast food establishment, retail store). Also include whether the establishment is part of a national chain, a commissary, a dormitory or a buffet where attendees are likely to eat multiple foods. In this section discuss the capacity of the food service operation, which may help to determine the possible extent of the outbreak.

IV. Methods

A. Epidemiologic

Explain how cases were defined. For example, even if you are investigating an outbreak of salmonella you are probably not confining yourself to only laboratory confirmed cases. Does a case have to experience diarrhea or is abdominal cramping sufficient? The issues should be determined and explained in detail. Also describe how cases became known, questions you asked, and how asked. Include descriptions of interview techniques and copies of questionnaires or surveys if used.

B. Environmental

Clearly outline the number and kinds of environmental investigations that occurred and who conducted them. Was a HACCP risk assessment conducted of suspect foods as well as physical facility inspections? Were there any tracebacks of food products?

C. Laboratory and Clinical

Discuss any analyses performed. It is important to note what kinds of and how many specimens were submitted for laboratory analysis. Was food available for testing? Did cases submit stool specimens or other clinical specimens for analysis? Were food handlers required to submit stool samples for testing? Note where the specimens were sent, what kinds of analyses were performed and who completed the testing. This could involve private, state or federal laboratories.

V. Results

In the previous section you outlined what steps you took to investigate the outbreak. This section is where you tell your readers what you discovered. These results can be presented in tables, graphic figures and/or text:

A. Epidemiologic

- number of questionnaires mailed and returned
- number of people fitting the case definition

- symptoms experienced by cases
- duration of symptoms
- incubation period
- food or meal-specific attack rates
- statistical significance of foods eaten
- epidemic curve of the outbreak
- relationships among cases (if any)

B. Environmental

- results of any HACCP risk assessments conducted
- the results of the physical facilities inspection (e.g., violations noted)
- the results of any food tracebacks

C. Laboratory and Clinical

- culture or other laboratory results on food handlers, patrons, or other individuals connected to the outbreak
- results on foods tested

VI. Discussion

This section is where all aspects of the investigation are brought together and a conclusion is drawn.

NOTE: Not all outbreaks have a resolution. In fact, it is rare when everything comes together and a cause can be definitively determined. Do not be discouraged. In most cases, there will be enough evidence to present a plausible hypothesis (see Chapter 6, Section 3). Be clear and present a detailed explanation on what has contributed to the conclusion.

VII. Recommendations

This is the opportunity to educate. Be detailed because these recommendations hopefully will be read by many people in the establishment that was investigated. The establishment has a vested interest in following the suggestions. If the outbreak has been large and disruptive, the establishment will not want it to reoccur. In addition to listing general recommendations on good food handling procedures, include specific recommendations that address what might have been overlooked in the particular outbreak (e.g., attempting to transport food long distances at inadequate temperatures).

VIII. Acknowledgments

In the spirit of cooperation, it is proper to thank those who assisted in the investigation. This might include health care personnel, the food handlers and/or management of the establishment or other local or state officials.

IX. Supporting Documentation

When compiling the report, attach copies of all items that are relevant. These would include the following:

- inspection reports
- blank samples of the surveys or questionnaires
- letters to management
- menus
- copies of posted notices
- food testing results
- foodborne illness worksheet(s) (without names or other personal identifiers)

When compiling material, be aware of confidentiality issues (see Chapter 4, Section 5). **Information that can lead to the identification of individual cases (e.g., test results that include personal identifiers), should not be included in the outbreak report.** The name of the establishment under question is part of the public record and can be disclosed. Data that *cannot* be used to identify individuals can be presented. People cooperate in investigations on the basis of protected confidentiality, and this should be respected.

Distributing the Report

Copies of the report should be made available to all parties involved in the investigation. This would include, but not be limited to, the owner and/or managers of the establishment, the MDPH, and any other local or state agencies affected by or involved in the outbreak or the investigation.

4) Examples of Reports

Three examples of outbreak reports are provided at the end of this chapter (Examples 8.1, 8.2 and 8.3).

Example 8.1 - This sample report summarizes a situation that occurred in which two different types of salmonella were reported in patrons who ate at a specific establishment. This report is not as comprehensive as Example 8.3. The association of illness with this establishment was subtle. The response in this case was abbreviated. However, it is still necessary to document the events that took place during the course of the investigation.

Example 8.2 - This sample report summarizes an event-associated outbreak of salmonellosis that occurred in a private home. This report is also not as comprehensive as Example 8.3. The investigation consisted of a HACCP risk assessment along with food and stool sample submission. The stool and food samples (lasagna and chicken) both tested positive for *atypical Salmonella enteritidis*. The findings of the HACCP risk assessment suggest contamination of lasagna and possibly chicken. The findings of this investigation illustrate that outbreaks of *Salmonella enteritidis* are a public health problem

in homes as well as food-service establishments. It is important to encourage participation in investigations of home outbreaks and document events that took place.

Example 8.3 - This sample is a report summarizing the investigation of a large point-source outbreak of an unidentified gastrointestinal illness that occurred at a wedding. This investigation included the use of questionnaires and data analysis to identify a suspect food item. In an outbreak of this magnitude, it is important to be as complete as possible because years later one could be asked to provide information on the investigation.

Foodborne Illness Complaint Worksheet. Another type of report would be a completed *Foodborne Illness Complaint Worksheet.* In some situations, a follow-up investigation of a complaint may not be warranted or minimal follow-up may be sufficient (e.g., complaints involving one person or for complaints where it is obvious that the symptoms or diagnosis are clearly unrelated to the food which the complainant believes to be causal and no other information is available). Documentation can consist of a completed *Foodborne Illness Complaint Worksheet* with an inspection report attached, if applicable. This form comprises the entire "report." If no violations were noted during the environmental inspection and no other complaints about the establishment were received, close the investigation. (More information on the *Foodborne Illness Complaint Worksheet* can be found in Chapter 4, Section 4-A.)

References

Bryan, F. *Guide for Investigating Foodborne Disease Outbreaks and Surveillance Data,* U.S. Department of Health and Human Services, CDC. Atlanta, Georgia, 1981.

Holland, W. et al. *Oxford Textbook of Public Health*, Oxford University Press, 1985; 3: 284-289.

EXAMPLE 8.1
OUTBREAK REPORT

MEMORANDUM

To: The File

From: [Writer of the Report]

Date: January 2, 1996

Re: Outbreak of *Salmonella tyvar-copenhagen* and *atypical Salmonella enteritidis* among patrons of Restaurant X during the month of September, 1995.

I. Summary

On November 16, 1995, the Division of Epidemiology of the Massachusetts Department of Public Health (MDPH) was notified by a resident of Town Y who had been confirmed with *Salmonella tyvar copenhagen* that she and a friend had eaten at Restaurant X on September 9, 1995 and had become sick on September 10th and 11th respectively. Upon further investigation of *Salmonella tyvar copenhagen* cases reported to the bacteriology lab of the State Lab Institute (SLI) during September and October, 1995, nine other cases were reported in the vicinity of Town Y, including four from a nearby town of only 3,000 people. Eight of these cases were eventually contacted, and all reported eating at Restaurant X previous to their illness with six reporting eating there in the two to three days before their illness. An additional case was identified from a complaint received from a resident of a distant town who had eaten at the restaurant in September and was later diagnosed with *S. tyvar-copenhagen*. Illness onset dates ranged from September 6 to September 25. A secondary case had an onset date of October 5. The cases ate a variety of food items including chicken, French toast, soup, salad, and a cheese steak sandwich. Seventeen food handlers submitted stool samples during December. All tested negative, but it was almost three months after the outbreak. There were, however, anecdotal reports of two food handlers being ill during the month of September.

IV and V Methods and Results

A. Epidemiologic

Attempts were made to contact all *S. tyvar-copenhagen* cases reported to the MDPH during September and October 1995. Eleven cases were reported in the vicinity of

Town Y, two of which had been the original complainants. Eight of the remaining nine cases had reported eating at Restaurant X previous to their illness. They had eaten a variety of foods on different days. The ninth case was unable to be contacted but an additional case was identified from a complaint received from a resident of a geographically distant town who was later diagnosed with *S. tyvar-copenhagen*. The Town Y health agent reported that there had been another separate complaint against the restaurant in September which involved a father and daughter, both of whom were ill, although only the daughter was confirmed with *atypical Salmonella enteritidis.* There were no other atypical *Salmonella enteritidis* cases reported to the SLI in the area of Town Y involving Restaurant X.

B. Environmental

The Food Protection Program (FPP) inspected the restaurant on November 20, 1995. The following deficiencies were noted: no hand washing sink with soap and paper towels in the kitchen, poor lighting in walk-ins, chowder cooling in four gallon pails, and no light shields in side preparation area. FPP reviewed various aspects of food temperatures, handling, storage, preparation, hygiene, and sanitizing. FPP did not observe any food preparation since the inspection occurred between meal times (See Attachment 1).

C. Laboratory

No food items were available for testing. Seventeen food handlers submitted negative stool samples during December.

VI Discussion

There appeared to be eleven cases of *S. tyvar-copenhagen* associated with Restaurant X during the month of September, 1995. These cases did not eat a common food item and did not eat on a common day. This supports the theory that contamination occurred in the restaurant. This contamination could have occurred as a result of poor food handling among *Salmonella*-infected food handlers or contamination of environmental surfaces by *Salmonella*-infected food items. The inspection report mentions no hand washing sink in the kitchen. The food handlers who submitted stool specimens tested negative, but this was two to three months after the outbreak, ample time for the *Salmonella* bacteria to be completely cleared from the stool of a previously infected person.

VII. Recommendations

1) To prevent outbreaks, efforts should be directed at optimizing conditions for sanitation, preventing contamination of foods or water, and cleaning environmental surfaces that may be at risk for contamination.

2) Any food handler who experiences any type of gastrointestinal illness must report it to a supervisor and must refrain from participating in foodhandling activities. Food handlers should be aware of the importance of good hygiene in preventing the spread of foodborne illness. Handwashing should be done frequently, especially after toilet use.

3) All foods to be served to the public should be stored and prepared in a facility specifically for that purpose.

4) Potentially hazardous foods which contain poultry and/or poultry products shall be cooked to an internal temperature of at least 165^0F.

5) Potentially hazardous foods should be transported and held at suitable temperatures, if hot, at > 140^0F, if cold, at < 45^0F.

6) Potentially hazardous foods should be prepared as close to service time as possible. Advance preparation should be discouraged.

7) Food that will not be cooked before serving should be handled using a utensil or wearing gloves.

EXAMPLE 8.2
OUTBREAK REPORT

MEMORANDUM

To: The File

From: [Writer of the Report]

Date: February 6, 1996

Re: Outbreak of *atypical Salmonella Enteritidis* at a Private Home in XXXXX, MA on December 24, 1995.

Introduction:

On December 26, 1995, the Division of Epidemiology was notified by the XXXXX Board of Health that 11 out of 25 people who attended a private family holiday dinner in Town X during the late afternoon of December 24 had become ill with nausea, diarrhea, abdominal cramps, and fever the next day. All of the ill people were reported to have eaten lasagna at the dinner party. Other food items at the dinner included eggplant parmesan, chicken, and antipasto. The lasagna had been prepared at home by a resident of Town Y who initially contacted the board of health.

Food Preparation:

The Food Protection Program (FPP) reviewed the preparation process (HACCP risk assessment) for the lasagna with the resident. Eight shelled eggs were mixed with ricotta cheese during the preparation process. The lasagna was refrigerated overnight at the resident's house. It was transported to Town X in an unrefrigerated car for 20 minutes and then left out on a porch, unrefrigerated, for approximately two hours. The lasagna was then put in a preheated oven at 350^0F for approximately 30 minutes. Finally, the cooked lasagna was left out on a table at room temperature for more than two hours. Please refer to attachment 1 for more details.

Laboratory Results:

Eleven ill guests of the holiday dinner submitted stool specimens which tested positive for *atypical Salmonella enteritidis*. The guests of the

party were never queried as to their food history at the party, but anecdotal reports indicated that all the ill people ate the lasagna. A sample of the lasagna and chicken from the party were transported to the State Lab Institute (SLI) for analysis. Both food items had violative standard plate count levels (2,500,000 for the lasagna and 190,000 for the cooked chicken) and tested positive for *atypical Salmonella enteritidis*. Please refer to attachment 2 for more details.

Conclusions:

Lasagna appears to be the food item which caused this Salmonella outbreak based on the information that all ill people apparently ate the lasagna, both the lasagna and ill people tested positive for *atypical Salmonella enteritidis,* and the lasagna, which was prepared with raw eggs, did not appear to have been cooked long enough to sufficiently kill the Salmonella bacteria. The chicken also tested positive for Salmonella, but both leftover the leftover chicken and the leftover lasagna had been submitted in the same container where cross contamination could have occurred. Since no specific food histories were obtained from the guests at the party, no food item could be statistically implicated in this outbreak.

EXAMPLE 8.3
OUTBREAK REPORT

MEMORANDUM

To: The File

From: [Report Writer]

Date: January 27, 1996

Re: Outbreak of Gastrointestinal illness at a wedding reception at Restaurant X, Town Y, MA on October 14, 1995.

I. Summary

An outbreak of gastrointestinal illness began October 15, 1995 among attendees of a wedding reception held at Restaurant X in Town Y, MA. Approximately 140 people attended the reception. Of 76 attendees who responded to a questionnaire, 41 (54%) fit the case definition. Epidemiologic analysis of the questionnaires indicated that illness was primarily associated with the consumption of gravy and stuffed turkey. An evaluation of procedures used to prepare reception foods identified improper cooling, storage, and reheating techniques which could have resulted in time-temperature abuse of both gravy and stuffing, and cross-contamination of turkey. Neither food nor clinical specimens were available for testing. Clinical, epidemiologic, and environmental evidence suggests that this outbreak occurred as a result of consumption of gravy and/or stuffed turkey contaminated with *Clostridium perfringens* or *Bacillus cereus*.

II. Introduction

On November 2, 1995, the Food Protection Program (FPP) of the Massachusetts Department of Public Health (MDPH) was notified by the Town Y Board of Health (BOH) of sixty-six of approximately 140 attendees of a wedding reception who became ill with abdominal cramps and diarrhea. The reception was held at Restaurant X in Town Y, MA on 10/14/95. The majority of ill attendees reported an onset of symptoms during the morning of 10/15/95. The reception consisted of appetizers (chicken fingers, cheese and crackers, bacon squares, deviled eggs, and stuffed celery) and a sit-down dinner including stuffed turkey, gravy, mashed potatoes, corn, cranberry sauce, rolls, salad, and cake. Beverages included home made hard apple cider. In response to the initial report, the MDPH Working Group on Foodborne Illness Control (WGFIC) initiated an investigation in cooperation with the Town Y BOH.

III. Background

Restaurant X, located in Town Y, MA, is a large restaurant including a banquet and conference room. Up to 225 patrons can be accommodated in a banquet setting.

IV. Methods

A. Epidemiologic

A case was preliminarily defined as any person who attended the wedding reception on October 14 (or ate leftovers from the reception) and who had onset of abdominal cramps, diarrhea, nausea, or vomiting during the next seven days. This definition was subsequently narrowed to only include those who had onset of symptoms within three days of the reception.

One hundred thirty-eight questionnaires regarding symptomatology, medical care, and food item consumption history were sent to a list of reception attendees obtained from the Town Y BOH (Attachment 1). Completed questionnaires were entered into a database analysis system (EPI INFO, Version 6.02). Descriptive case statistics were calculated and a retrospective cohort analysis was performed.

B. Environmental

An on-site investigation was conducted by the Town Y BOH at Restaurant X on November 2, 1995, in which procedures used in the preparation of foods served at the function were reviewed. The groom was interviewed by the Food Protection Program regarding procedures he used to manufacture hard cider served at the reception.

V. Results

A. Epidemiologic

Of 138 questionnaires sent out, 78 (57%) were received. Seventy-six of the 78 were completed and used in data analysis. Forty-one of the 76 respondents fit the case definition.

Descriptive analyses of the cases revealed that 21 (51%) were female and that ages ranged from 20 to 77 with a median age of 41 years. The incubation period between food consumption and illness ranged from two to fifty-eight hours with a median time of 12 hours (Table 1). Major case symptoms included diarrhea (93%), abdominal cramping (73%), nausea (37%), and fatigue (24%). Fever and vomiting were very infrequent and no bloody stools were reported by the cases

(Table 2). Medical care was sought by one case. The reported duration of illness ranged from 2 hours to 10 days, with a median of 24 hours and most frequently reported duration of 48 hours (24%) (Table 1).

The epidemic curve shown in Figure 1 suggests that this outbreak occurred after the reception attendees were exposed to a common source. A retrospective cohort analysis of completed questionnaires indicates that the consumption of each of five items, including turkey, stuffing, gravy, corn, and ranch dressing, was statistically associated with illness (Table 3). All cases consumed turkey (estimated risk ratio [RR] = 10.83, 95% confidence[CI] = Undefined, p-value = 0.001), stuffing ([RR] = 8.18, [CI] = Undefined, p-value = 0.007), and gravy ([RR] = 10.83, [CI] = Undefined, p-value = 0.001). The observed association with illness for both corn and ranch dressing consumption is likely confounded by stuffed turkey or gravy consumption. Due to low cell counts, however, stratification did not reveal further meaningful statistics.

Food and beverage consumption dose data was obtained for most items listed on the questionnaire. Results from a chi square analysis for trend indicated that the reported quantity of turkey, stuffing, and gravy consumed was linearly associated with illness (Table 4).

B. Environmental

The following high risk factors were revealed during the environmental investigation of Restaurant X by the Town Y BOH combined with subsequent follow-up by the Food Protection Program: 1) Stuffing made with sautéed onions, celery, butter, bread crumbs, and seasoning may have been prepared the day before service. Hot stuffing prepared ahead of time was placed in five-gallon plastic containers, covered with saran wrap, and placed in the walk-in refrigerator overnight. This may have resulted in improper cooling; 2) Seven gallons of gravy consisting of chicken stock, flour, and butter was prepared at noon the day before service, covered, and stored overnight in two five gallon plastic buckets, possibly delaying cooling and allowing the growth of vegetative bacterial cells. The gravy was then reheated in a double boiler prior to service. Lower cooking temperatures and/or shorter cooking time in the double boiler may have been insufficient to destroy vegetative cells present. Thermometers were not used by the establishment to monitor cooking and cooling temperatures; 3) Raw beef was stored over cooked food products which may have resulted in cross-contamination. No other significant findings were noted relative to the preparation of foods or to employee health and hygiene (Attachments 2 and 3).

A Hazard Analysis Critical Control Point (HACCP) evaluation of the hard cider preparation was conducted by the Food Protection Program, but no high risk factors were revealed. The hard cider was a fermented alcoholic beverage made with fresh cider from an approved source, yeast, sugar, and maple syrup. The

cider was fermented with carbon dioxide and aged for approximately two and one-half years.

VI. Discussion

The gastrointestinal illness observed in this outbreak was characterized primarily by diarrhea, abdominal cramps, and nausea, with very little vomiting or fever reported. The median incubation and duration periods were calculated as 12 and 24 hours respectively. These clinical features closely resemble those of both *Clostridium perfringens* and long incubation *Bacillus cereus* infections, although a viral or other bacterial etiology remains possible.

Epidemiologic analysis of food consumption histories obtained from questionnaires suggests that the consumption of gravy and/or stuffed turkey was most significantly associated with illness. These findings are supported by environmental evidence indicating that improper cooling procedures for both stuffing and gravy could have resulted in the growth of bacterial organisms. In addition, the subsequent reheating of gravy may not have destroyed any bacteria present, following cooling. Corn and ranch dressing consumption, shown to have a weaker association with illness, are more likely associated with the consumption of stuffed turkey or gravy. No violative procedures were noted regarding the preparation of corn or ranch dressing.

Homemade hard cider was a suspect item along with the foods and beverages prepared by Restaurant X. No epidemiologic association was found between hard cider consumption and illness. While there have been cases of mycotoxin contamination of apple juice, hard cider has not been identified as a common vehicle in foodborne illness outbreaks.

Gravy prepared from meat stock in cafeteria, restaurant, or institutional settings (large volume) is one of the most frequently implicated foods in *Clostridium perfringens* outbreaks. Heat-resistant spores may survive initial cooking. During slow cooling processes, spores can germinate and multiply to levels high enough to cause illness. Inadequate reheating (at temperatures less than 165^0F) can result in failure to kill the bacteria present.

VII. Recommendations

1. Prepare potentially hazardous foods as close to service time as possible.

2. Rapidly cool hazardous foods to 45^0F within 4 hours. Use shallow containers or icebaths to facilitate rapid cooling. Stainless steel containers rather than plastic are recommended for cooling. Loosely wrap the containers while cooling to allow for air circulation and refrigerate foods to be cooled immediately. Use food stem-type

thermometers to monitor temperatures while cooling.

3. Reheat foods to 165^0F within one hour. Use a thermometer to measure temperature after reheating.

VIII. Acknowledgments

The MDPH Working Group on Foodborne Illness Control thanks the Town Y Board of Health for their participation and assistance in this investigation. In addition, Restaurant X and the wedding reception organizers are thanked for their cooperation.

TABLE 1.
INCUBATION PERIOD AND DURATION OF ILLNESS
GI Outbreak, Town Y, MA - October 1995

INCUBATION PERIOD (HOURS)
n = 41

RANGE	2-58
MEAN	12.9
MEDIAN	12
SD	8.4

DURATION OF ILLNESS (HOURS)
n =41

RANGE	2-240
MEAN	34.8
MEDIAN	24
MODE	48
SD	39.7

TABLE 2.
SYMPTOMS OF CASES (n = 41)
GI Outbreak, Town Y, MA - October 1995

SYMPTOM	NUMBER (PERCENT)
Diarrhea	38 (92.7%)
Bloody	0 (0%)
Abdominal Cramps	30 (73.2%)
Nausea	15 (36.6%)
Fatigue	10 (24.4%)
Loss of Appetite	7 (17.1%)
Headache	6 (14.6%)
Muscle Aches	4 (9.8%)
Vomiting	3 (7.3%)
Chills	3 (7.3%)
Dizziness	2 (4.9%)
Fever	1 (2.4%)

TABLE 3.
ATTACK RATE BY FOOD CONSUMED
GI Illness, Town Y, MA - October 1995

		Attack Rates				
		Exposed	Unexposed			
Food Item	**Total Exposed**			**Risk Ratio**	**95% C.I.**	**p-value ***
Turkey	68	60%	0%	10.83 ***	Undef	0.001 **
Stuffing	70	59%	0%	8.18 ***	Undef	0.007 **
Gravy	68	60%	0%	10.83 ***	Undef	0.001 **
Mashed Potatoes	69	57%	29%	1.98	0.60, 6.5	0.238 **
Corn	62	61%	21%	2.86	1.03, 7.95	0.016
Cranberry Sauce	47	57%	48%	1.19	0.76, 1.87	0.588
Rolls	47	57%	48%	1.19	0.76, 1.87	0.588
Butter	53	57%	48%	1.18	0.73, 1.93	0.649
Salad	60	55%	50%	1.1	0.64, 1.89	0.941
Italian Dressing	28	43%	60%	0.71	0.44, 1.15	0.214
Ranch Dressing	32	69%	43%	1.59	1.05, 2.40	0.048
Chicken Fingers	3	67%	53%	1.25	0.55, 2.86	1.000 **
Bacon Squares	14	43%	57%	0.76	0.40, 1.44	0.532
Deviled Eggs	19	63%	51%	1.24	0.81, 1.90	0.506
Stuffed Celery	27	44%	59%	0.75	0.46, 1.22	0.321
Crackers	40	55%	53%	1.04	0.69, 1.58	0.971
Cheese	37	51%	56%	0.91	0.60, 1.38	0.832
Water	52	52%	58%	0.89	0.58, 1.36	0.784
Ice	46	54%	53%	1.02	0.66, 1.56	0.882
Hard Cider	25	60%	51%	1.18	0.77, 1.79	0.62
Beer	25	48%	57%	0.84	0.53, 1.35	0.629
Wine	14	71%	50%	1.43	0.94, 2.16	0.248
Coffee	41	46%	63%	0.74	0.49, 1.12	0.227
Cake	38	61%	47%	1.28	0.84, 1.95	0.357

* Yates Corrected unless otherwise noted
** Fisher's Exact (2-sided)
*** Risk Ratio Estimate (0.5 added to each cell)

TABLE 4.
CHI SQUARE ANALYSIS FOR TREND
(Turkey, Stuffing, and Gravy Consumption)
GI Outbreak, Town Y, MA - October 1995

Turkey Consumption

Amount Consumed	Attack Rate	p-value
None	0%	0.00007 *
Some	31.6%	
All	71.4%	

Stuffing Consumption

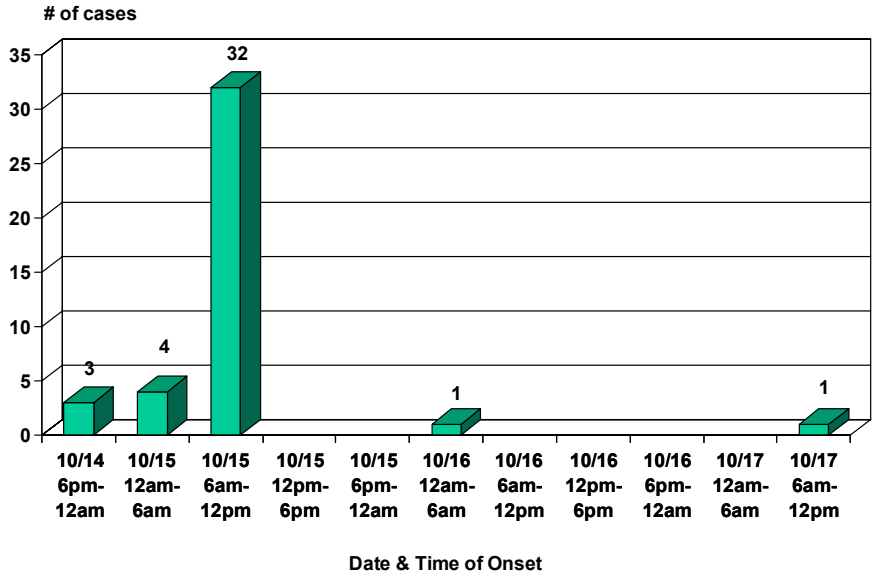
Amount Consumed	Attack Rate	p-value
None	0%	0.007 *
Some	30%	
All	70%	

Gravy Consumption

Amount Consumed	Attack Rate	p-value
None	0%	0.00006 *
Some	33.3%	
All	72.3%	

*Mantel Extension

Figure 1 - Epidemic Curve



Appendix A

INFECTED FOOD WORKER POLICY

1) **Local Board of Health Responsibility**
2) **Definition of a Food Worker**
3) **What To Do If You Discover a Sick Food Worker?**
4) **Specific Disease Control Measures**
5) **Hepatitis A Control Measures**

INFECTED FOOD WORKER POLICY

1) Local Board of Health Responsibility

According to *105 CMR 590.000: Employee Health*, "No employee, while infected with a disease in a communicable form that can be transmitted by foods, or who is a carrier of organisms that can cause such a disease or while affected with a boil, infected wound, or acute respiratory infection, shall work in a food establishment in any capacity in which there is a likelihood of such person contaminating food or food-contact surfaces with pathogenic organisms or transmitting disease to other persons."

Infected food handlers are a significant contributing factor in foodborne illness outbreaks. Fecal-oral transmission by food workers with gastrointestinal symptoms such as nausea, cramps, vomiting and diarrhea is possible since they shed the pathogen during illness as well as after symptoms disappear. Infected skin lesions on food handlers may also be reservoirs of pathogens, such as *Staphylococcus aureus*, which can be transmitted to food when there is direct contact between the food and the infected lesion.

When a local health department receives a report of a food worker who is a carrier of a suspected or confirmed communicable disease that can be spread through food, it should be investigated immediately. The key to effective intervention is timeliness. Precautionary actions, specific to the disease agent involved, must be taken, and in some cases, rapid public notification must also be implemented.

2) Definition of a Food Worker

A food worker is any person directly preparing or handling food. This could include the owner, individual having supervisory or management duties, other person on the payroll, family member, volunteer, person performing work under contract, or any other person working in a foodhandling facility. In health care facilities, this includes those who setup trays for patients to eat, feed or assist patients in eating, give oral medications or give mouth/denture care. In day care facilities, schools, and community residential programs, this includes those who prepare food for clients to eat, feed or assist clients in eating, or give oral medications.

3) What To Do If You Discover A Sick Food Worker?

a. Confirm the Illness. Whenever a food worker is reported to have a disease capable of being spread through food, the diagnosis and/or symptomatology should be confirmed immediately.

If the initial report is received from a health care provider, confirmatory laboratory tests from an approved laboratory should be requested. If laboratory tests are negative for common enteric pathogens (i.e., salmonella, shigella, campylobacter, giardia, cryptosporidium, *E. coli* O157:H7), symptoms should be confirmed by the health care provider and be compatible with a communicable enteric illness.

If the initial report is received from a qualified laboratory, health care provider confirmation is not necessary to proceed with the implementation of public health measures (see steps below).

NOTE: If the illness is a reportable disease, complete the appropriate MDPH c*ase report form*. More information on reportable diseases and *case report forms* can be found in Chapter 4, Section 4-B.

b. Exclude the Food Worker. Restriction or exclusion actions that should be taken for each specific disease or syndrome are outlined in: Section 3 of this appendix, *105 CMR 590:000 Minimum Sanitation Standards For Food Establishments* and *105 CMR 300: Reportable Diseases* and *Isolation and Quarantine Requirements.* An excluded food worker may return to work when the criteria prescribed in *105 CMR 590* and *105 CMR 300* are met, and when the local health officer determines that no further public health threat is posed by that individual working as a food handler.

c. Identify and Dispose of Food Contaminated by Infected Food Worker. Collect specific information about the food worker's duties and responsibilities at the food service establishment. Determine if food on the premises prepared or served by the sick food handler should be discarded based on: hygienic practices observed (poor hygiene increases the risk for disease transmission through food), foods handled, and method of preparation. Be specific as to food handled and dates on which it was handled for the entire time the food handler was symptomatic while working. (Exception: With a hepatitis A case, the person is considered to be infectious with HAV two weeks prior to onset of symptoms and up to one week after onset.)

Questions to keep in mind are:

- What dates did the employee work while he/she was symptomatic?
- What specific foods were touched by the employee's bare hands and were not subsequently cooked prior to service?
- Describe the food worker's hygienic practices.

- Does the food worker wash his/her hands after using the bathroom?
- Does the food handler wash his/her hands as necessary during the day?
- Does the food handler use disposable gloves? If so, are they used properly?

Foods which may have become contaminated by an infected food handler should be embargoed or disposed of in accordance with *105 CMR 590.000.*

d. Interview and Educate Other Food Workers Other food handlers in the food establishment should be interviewed about their health status and, if symptomatic, excluded and referred to their health care provider. The food establishment employees should also be educated about the disease (i.e., symptoms, mode of transmission, prevention). Provide the employees with fact sheets. (Copies of the MDPH enteric disease fact sheets are provided in Appendix D.)

- Stress the importance of thorough handwashing. (An informational poster on handwashing for food workers can be found in Appendix E.)
- Stress the importance of employees not working if they are ill.
- If the establishment is using gloves, educate about the proper use of gloves.

Proper handwashing procedures

1) Wet hands with warm water and apply enough soap to attain a good lather.
2) Wash the palms and backs of your hands, wrists, between the fingers, and under the fingernails. Washing for at least 20 seconds is necessary.
3) Rinse thoroughly under running water.
4) A second handwashing would be beneficial, especially after completing a dirty job.
5) Dry hands with a paper towel. Use the paper towel to shut off the water.

e. Testing all Food Workers in Outbreak Situations. In an outbreak situation, especially when there are multiple foods implicated, the LBOH must provide all **symptomatic and asymptomatic** food workers with enteric kits and request them to submit stool specimens within 24-48 hours. This is to ensure the removal of a food worker who may be a continuous source of contamination. In addition, it may help to determine if infected food workers contributed to or were the cause of an outbreak. Food handlers who fail to submit stool specimens within 24-48 hours must be restricted from work until they comply. (A copy of a sample letter that can be used by the LBOH to request employee submission of stool specimens can be obtained by calling the MDPH Division of Food and Drugs at 617-983-6712.) If the LBOH coordinates stool submission to the state laboratory institute (SLI), information on how to obtain stool kits and submit stool specimens can found in Chapter 6, Section 4.

f. If Applicable, Notify the Public. When a public notice is anticipated, such as in a hepatitis A exposure, food preparation facilities and the medical community must be notified first in order to be prepared to respond. (A sample public notice is provided in

Appendix E.) All public inquiries should be directed to the local Board of Health, the Division of Epidemiology and Immunization or the Division of Food and Drugs of the Massachusetts Department of Public Health (MDPH).

4) Specific Disease Control Measures

Disease control measures for some of the more common diseases are listed below. Please refer to *105 CMR 300.000* and *105 CMR 590.000* for a more complete listing of diseases and conditions applicable to food handlers.

Campylobacteriosis: An infected food handler may return to work once diarrhea has resolved *and* one negative stool specimen has been produced. If the food handler has been treated with an antimicrobial, the stool specimen shall not be submitted until at least 48 hours after cessation of therapy. In outbreak situations, a second consecutive negative stool specimen will be required before returning to work.

Hepatitis A: See next section, Section 5, for detailed information on hepatitis A.

Salmonellosis (excluding *S. typhi* infections, i.e., typhoid fever): An infected food handler may return to work once diarrhea has resolved *and* one negative stool specimen has been produced. If the food handler has been treated with an antimicrobial, the stool specimen shall not be submitted until at least 48 hours after cessation of therapy. In outbreak situations, a second consecutive negative stool specimen will be required before returning to work.

Salmonellosis caused by *S. typhi* (i.e., typhoid fever): An infected food handler may return to work only after producing *three negative* stool specimens, each taken at least 48 hours apart. If the food handler has been treated with an antimicrobial, the first stool specimen shall not be submitted until at least 48 hours after cessation of therapy.

Shigellosis: An infected food handler may return to work once diarrhea has resolved *and* one negative stool specimen has been produced. If the food handler has been treated with an antimicrobial, the stool specimen shall not be submitted until at least 48 hours after cessation of therapy. In outbreak situations, a second consecutive negative stool specimen will be required before returning to work.

***E. coli* O157:H7**: An infected food handler may return to work once diarrhea has resolved *and* one negative stool specimen has been produced. If the food handler has been treated with an antimicrobial, the stool specimen shall not be submitted until at least 48 hours after cessation of therapy. In outbreak situations, a second consecutive negative stool specimen will be required before returning to work.

Skin Infections: An infected food handler may return to work after the risk of transmitting bacteria has been eliminated. Any lesions must be completely healed or be adequately covered.

Undiagnosed Diarrhea and Vomiting: Employees with diarrhea and/or vomiting may only return to work after 48 hours, but preferably 72 hours, after clinical symptoms have resolved or until a noninfectious cause has been determined.

NOTE: If you have questions regarding exclusion, contact the MDPH Division of Epidemiology and Immunization at (617) 983-6800.

5) Hepatitis A Control Measures

Reports of hepatitis A cases should be acted upon immediately. A confirmed case of hepatitis A in a food handler is a serious event and requires that risk for both co-workers and the public be assessed as quickly as possible.

Since the incubation period for hepatitis A can be as long as 50 days, a prevention measure is available for those who might have been exposed. Immune globulin (IG), if administered within 2 weeks of exposure, is 80-90% effective in preventing the illness completely or making the symptoms less severe. This is particularly important when trying to prevent further cases among co-workers of a positive food handler. The sooner IG is given the more effective it is in preventing infection. Food handlers who have previously received two doses of hepatitis A vaccine can be considered immune. These food handlers will not need to receive IG nor be restricted.

The infectious period, hygiene, work habits, foods prepared, methods of food preparation and symptoms can help to determine the likelihood that consumers were exposed to contaminated food. If the risk is considered high, based on established criteria, efforts must be made to find those consumers and advise them to be evaluated for preventive treatment (i.e., IG).

Follow the recommendations below when you receive a call regarding a suspect case of hepatitis A in a food handler.

NOTE: A MDPH *Hepatitis A Worksheet* is provided at the end of this appendix to assist local boards of health in recording pertinent information and initiating control and prevention measures. This worksheet is for LBOH use, does not need to be sent to the MDPH, and can be filed accordingly.

POLICY

a. Confirm The Case. The confirmation of hepatitis A requires serologic testing to detect antibodies against HAV (anti-HAV). The antibody response to HAV consists initially of the IgM class antibody which usually becomes detectable at the time of illness (approximately 30 days post-exposure.) Therefore, the presence of IgM is associated with active or recent HAV infection. **In order to have a confirmed case of hepatitis A, the patient must be IgM anti-HAV positive**. The appearance of the IgG class of anti-HAV follows the IgM response by several weeks. IgG antibody to HAV persists for life in most cases.

NOTE: HAV stands for hepatitis A virus.

Typically, HAV serology is performed by first testing the serum for the presence of total antibody against HAV (i.e., IgM and IgG combined). If this test is negative, no further tests need to be done on that sample. If it is positive for total HAV antibody, the serum should then be tested for IgM specifically.

Thus, three results are possible when testing for antibody against HAV:

1) Total antibody negative = No evidence of HAV infection = susceptible

2) Total antibody positive and IgM negative = Prior infection with HAV (possibly years ago) or immunized, currently immune, not an active case, not infectious

3) Total antibody positive and IgM positive = A case of active hepatitis A, recent infection and possibly infectious, follow-up is necessary

Occasionally, a laboratory will report a HAV serology as "IgM and IgG positive." Although this wording can be confusing, typically, this means the specimen was total antibody positive. One should always confirm that a specific test for IgM anti-HAV was performed and that it was positive.

NOTE: Remember, if a suspect case of hepatitis A in a food handler becomes confirmed, a MDPH *Hepatitis Case Report Form* must be completed and sent to the MDPH, Division of Epidemiology and Immunization, Surveillance Program. (See Chapter 4, Section 4-B for further information on *case report forms*.)

b. Determine The Period Of Infectivity. Fecal shedding of the virus peaks during the week prior to onset of symptoms. For purposes of public health intervention, a patient should be considered to be infectious for 14 days prior to the onset of symptoms to 7 days after onset of symptoms. If symptom onset is unclear, use the date when jaundice was first

noticed. If no symptoms were noted, the date the blood was drawn is considered the date of onset.

c. Report to the MDPH. Notify The MDPH, Division of Epidemiology and Immunization at (617) 983-6800 as soon as you hear of a suspect/confirmed hepatitis A case in a food handler.

d. Exclude The Food Worker. No case shall engage in the handling of any food until one week after onset of symptoms, providing all symptoms have subsided.

e. Inspect The Food Establishment. The food establishment inspection should involve the following:

- Focus on handwashing practices and rest room facilities, the types of foods and beverages that are served, and how these foods and beverages are handled.
- Obtain a very **careful history** of which days and shifts the infected person worked, exact duties, types of food handled, any use of disposable gloves, as well as an assessment of the employee's hygiene. Inquire about tasks performed by the infected employee during his/her infectious period which may have differed from normal job duties. Ascertain if food prepared on one shift is carried over to the next shift or to the next day. Determine if other employees eat food prepared by the index case. Ask the case whether she/he worked while symptomatic with diarrhea; if so, note the dates on which this occurred**. Ask the case if he/she is a food handler at other establishments.**
- Institute rigid handwashing and minimize bare hand contact with high risk foods. High risk foods are items which are served raw or which are handled after being cooked. Examples of high risk foods include but are not limited to:
  - lettuce, tomatoes, etc. on sandwiches that receive no further heating
  - salads, vegetables, and fruits at salad bars
  - sliced cooked foods which may be contaminated during boning or slicing procedures
  - cold cuts
  - cake icing
  - ice that is scooped by hand or with a contaminated scoop
  - condiments for drinks (olives, lime wedge, etc.)
- Ensure that the food handler is excluded from work until no longer infectious, i.e., one week after symptom onset.
- Obtain a list of all employees. Survey other employees for symptoms consistent with hepatitis A. If other employees are symptomatic, they should also be excluded from work and tested for hepatitis A.

f. Immunize Contacts with IG. Hepatitis A can be transmitted by food contaminated with feces from an infected food worker. When a food worker has a confirmed case of hepatitis A, **other food handling facility employees that worked with the infected person or had contact with the food he/she prepared, must receive immune globulin**

(IG). IG provides temporary protection (three months) and is 80-90% effective in preventing hepatitis A if administered within 14 days after exposure to HAV. IG given more than 14 days after exposure is unlikely to prevent secondary cases of hepatitis A.

The LBOH must ensure that other employees receive IG. If an employee elects not to receive IG, the employee must be excluded from working for 28 days according to *105 CMR 300.000: Reportable Diseases and Isolation and Quarantine Requirements.* The exception to this exclusion is if documentation of HAV vaccination can be produced or serologic immunity to HAV demonstrated. Receipt of IG will not interfere with subsequent serologic tests for HAV.

g. Assess The Likelihood Of Transmission To The Patrons Of The Food Establishment. A determination should be made whether or not there is a sufficient risk of HAV transmission to the public to warrant notification of the establishment's patrons. IG administration to patrons is usually not recommended, but should be considered if the following conditions exist:

- the infected person is directly involved in handling, without gloves, foods that will not be cooked before eaten, and
- the infected person is assessed to have less than adequate personal hygiene OR worked while symptomatic with diarrhea, and
- patrons can be identified and provided IG within 2 weeks of exposure.

In settings where repeated exposures to HAV may have occurred (e.g., institutional settings), stronger consideration of IG use may be warranted.

h. If Applicable, Notify The Public. If it is determined that patrons would benefit from IG administration (see step g above), the local health department will be involved in posting public notices, issuing press releases and/or holding press conferences to identify and inform patrons at risk. IG will be provided free-of-charge from the MDPH, but the LBOH will coordinate the administration of IG to individuals. (A sample public notice and press release can be found in Appendix E.)

i. Maintain Surveillance. The manager of the establishment should monitor employees daily for the presence of signs and symptoms of hepatitis A (nausea, vomiting, diarrhea, abdominal pain, fever and jaundice). If symptoms appear in other employees, they should be referred to their health care provider for testing and excluded from work until they test negative and symptoms have subsided. This monitoring should continue for 50 days (one incubation period) past the last day the food handler worked while infectious. The local health department should also visit the establishment during this time to confirm compliance with all recommended control measures.

j. Take Steps For Prevention. As stated in Section 3 of this appendix, the food establishment employees should be educated about the disease, its signs and symptoms and the importance of not working while ill. The education should also include the importance of good hygiene (i.e., frequent handwashing) and no bare-hand contact with

ready to eat foods. (An informational poster on handwashing for food workers can be found in Appendix E.)

Hepatitis A Vaccine. Hepatitis A vaccination provides preexposure protection against HAV infection, and is recommended for persons who are at increased risk for infection and for any person wishing to attain immunity. The populations at increased risk for HAV infection or the adverse consequences of infection are:

- persons traveling to or working in countries that have high or intermediate endemicity of infection,
- children in communities that have high rates of hepatitis A and periodic hepatitis A outbreaks,
- men who have sex with men,
- illegal-drug users,
- persons who have occupational risk for infection,
- persons who have chronic liver disease,
- persons who have clotting-factor disorders, and
- others groups (consideration is now being given to food handlers).

More information on each of these populations is provided in "Prevention of Hepatitis A Through Active or Passive Immunization" (*MMWR*, Vol. 45, No. RR-15, December 27, 1996).

References

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FDA, *Foodborne Pathogenic Microorganisms and Natural Toxins*, U.S. FDA Center for Food Safety and Applied Nutrition, Washington DC., 1992.

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International Association of Milk, Food and Environmental Sanitarians, *Procedures to Investigate Foodborne Illness, Fourth Edition*, Iowa: IAMFES, Inc., 1987.

POLICY

Massachusetts Department of Public Health. *Regulation 105 CMR 300.000: Reportable Diseases and Isolation and Quarantine Requirements*, Massachusetts Department of Public Health, July 1994.

Massachusetts Department of Public Health. *Regulation 105 CMR 590.000: Minimum Sanitation Standards for Food Establishments - Article X*, Massachusetts Department of Public Health, April 1994.

HEPATITIS A
WORKSHEET (THIS IS NOT A CASE REPORT FORM)

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
DIVISION OF EPIDEMIOLOGY AND IMMUNIZATION (617) 983-6800
FAX (617)983-6813

Person Completing the Form: _____ **Date/Time:**_____

Name of Person Reporting: _____ **Phone: (____)**_____

Affiliation of Person Reporting: _____

I. Case Information

IgM result: _____ **(date)**
IgG result: _____ **(date)**

Symptom Onset Date: _____
(if specific onset is unknown, use date of blood draw, see pg. 2)

******Laboratory results must confirm antiHAV IgM+ to proceed with case investigation******

Name	**Date of birth/age**	**Sex**	**Race/Ethnicity**
Address	**City**		
Parents'/guardians' names (if applicable)	**Phone number ( )**		
Occupation (if student, specify grade or daycare)	**Name and Address of Place of Employment/School/Daycare**		
Contact name and phone for place of employment/school/daycare	**Medical Record Number**		
Was Local Board of Health Notified? Y N **BOH Contact Name and Phone Number:**			

II. Clinical Information

Physician's name/phone number: _____ **(**_____**)**_____

Was the case hospitalized? **Y N** Name of hospital:_____

Diarrhea: YES NO

Other Symptoms: _____

_____

_____

_____

_____

Determining "Period of Infectivity"

Fecal shedding of the virus peaks during the week prior to onset of symptoms. For purposes of public health intervention, a patient should be considered to be infectious for 14 days prior to the onset of symptoms to 7 days after onset of symptoms. If symptom onset is unclear, use the date when jaundice was first noted. If no symptoms were noted, the date the blood was drawn is considered the date of onset.

Symptom onset date: _____/_____/_____

Period of Infectivity: _____/_____/_____ **to** _____/_____/_____
(two weeks prior to sx. onset) (one week after sx. onset)

III. Work History

NOTE: Because hepatitis A transmission is through the fecal - oral route, it is very important to determine whether the case is a food worker. A food worker is any person directly preparing or handling food. A food worker may also include those who feed or assist others in eating, give oral medications or give mouth/dental care. This includes health care workers, daycare providers and dental hygienists.

1) **During the period of infectivity (see above) has the case worked or volunteered at any of the following:**

Daycare Center	_____	Dates worked: _____
Food Service Industry	_____	Dates worked: _____
Guesthouse/Inn/ B& B	_____	Dates worked: _____
Bartender	_____	Dates worked: _____
Patient Care	_____	Dates worked: _____
Baby-sitting	_____	Dates worked: _____

NOTES:_____

_____

_____

_____

_____

2) **If yes was answered to any of the above, please answer the following questions:**

a. While working in the above position(s), did the case prepare/serve/ or handle foods, assist others in eating, or give oral medications? **Y N**

b. If foods were prepared/handled/served, were they foods that would not be cooked before being eaten? **Y N**
Please list all foods prepared/handled/served (eg. salads, ice cream, sandwiches):

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

c. While working in the above position(s), did the case have bare hand contact with foods or medications. In other words, were there times when the case did not wear protective gloves or use serving utensils? **Y N**

IV. Control Measures

Control measures are implemented through the administration of immune globulin (IG) to individuals who have been in "contact" (see definition below) with a case during the **"**period of infectivity**"** (see definition pg. 2). IG should be initiated as soon as possible after exposure and is 80-90% effective in preventing hepatitis A if administered within 14 days. Food workers, co-workers of food workers, and other contacts who are food workers must follow special control measures according to **105 CMR 300.000: Reportable Diseases and Isolation and Quarantine Regulations** (see "food worker control measures" below).

Note: IG is provided by the MDPH. If large numbers of individuals require prophylaxis, please call the Division of Epidemiology and Immunization (617-983-6800) to arrange the shipment of IG. Coordination of the administration of IG will be the responsibility of the local health department.

How to Define a "Contact"

"Contacts" include:

- **all household members**
- sexual contacts during the period of infectivity
- anyone sharing food or eating or drinking utensils with a case during the period of infectivity
- anyone consuming ready to eat foods (foods that are not cooked between when they are handled by the food worker and when they are eaten) prepared by an infected food worker with diarrhea during the period of infectivity

"Food Worker Control Measures"

If a food worker is a confirmed case of hepatitis A, all other foodhandling employees in the facility must receive IG within two weeks of exposure. Unless the foodhandling facility employee contacts can produce documentation of HAV vaccination or can show serologic immunity to HAV, they must be excluded from work for 28 days if they do not receive IG within 2 weeks. The same exclusion criteria apply to *any* foodhandling "contacts" of *any* confirmed case.

"Daycare Control Measures"

If a daycare student or staff member is diagnosed as a hepatitis A case, please refer to the *Health and Safety in Child Care* manual for control guidelines. Exclusion requirements and examples of parental notification letters are included in this document.

NOTES:_____

V. Other Control Considerations

Surveillance

The incubation period for hepatitis A is 15-50 days with an average of one month. Because fecal shedding of the virus occurs for up to several weeks before antibodies can be detected in the blood, **it is not recommended** that serologic testing be performed prior to administration of IG for contacts of a case. Contacts should be monitored for a period of 50 days (one incubation period) for symptoms compatible with hepatitis A.

Surveillance Timeframe: _____/_____/_____
(50 days after last day of contact with an infectious case)

Public Notification

If the case is a food worker who worked while infectious, a determination will be made by the MDPH and the local health department as to whether or not the risk to the public is sufficient enough to warrant public notification. Please call the Division of Epidemiology and Immunization at 617-983-6800.

1. During the period of infectivity, did the case directly handle, without gloves, foods that were not cooked before they were eaten? **Y N**

2. During the period of infectivity, did the case have diarrhea while working? **Y N**

3. Can the public be given IG within 2 weeks of exposure? **Y N**

Period of Public Exposure: _____/_____/_____ to _____/_____/_____
(can be specific days or up to two week period of infectivity)

Last date public can receive IG: _____/_____/_____
(two weeks after last date of exposure)

NOTES:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

NOTE: Hepatitis A is a reportable disease. Please report all cases of hepatitis A via the viral hepatitis case report form. Please report within 24 hours all confirmed or suspect cases in food workers to the MDPH Division of Epidemiology and Immunization at 617-983-6800.

Appendix B

FOOD SAMPLE COLLECTION

Food Sample Collection Procedures

Food Sample Submission Form

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH
Working Group on Foodborne Illness Control

Division of Diagnostic Laboratories (617)983-6600
Division of Food and Drugs (617)983-6712
Division of Epidemiology and Immunization (617)983-6800

FOOD SAMPLE COLLECTION PROCEDURES

All food sample submissions require pre-approval before delivery to the State Laboratory Institute in Jamaica Plain. If you have foods which need to be submitted for microbiological analysis, please contact the Food Laboratory at (617)-983-6600. If you have foods which need to be analyzed for chemicals, toxins and heavy metals, please contact the Environmental Laboratory at (617)983-6651. All pertinent paperwork such as sample submission forms, foodborne illness complaint worksheets and investigation reports must accompany samples. Food samples will not be accepted without a properly completed sample submission form. Since these forms are routinely updated, make sure that you are using the most updated version.

1. SAMPLES TO BE COLLECTED ASEPTICALLY: TEMPERATURE RANGE (32°-45° F)

a) Use sterile containers.
b) Make sure caps are tight, to prevent leakage.
c) Do not handle or touch the inside of the container.
d) Use sterile utensils, tongs, spoons, etc.
e) Use polypropylene containers. Try not to use Whirlpack bags for liquids, which can leak and spill easily.
f) Whirlpack bags may be used for solid foods, such as dry milk, meat, etc.
g) Collect adequate amount of sample - at least 100-150 grams or milliliters, (4-6 oz.).
h) Fill containers no more than ¾ full, to allow for proper mixing of the sample. This applies to liquid samples, milk, water, etc.
i) When collecting water from spigots, let the water run for 2 minutes, before collecting.

2. TRANSPORTATION:

a) Use dry ice for ice cream or frozen food samples.
b) Use plenty of ice cubes or crushed ice in a well insulated ice chest (for PHFs or perishable foods).
c) Place container in chest so that cover or lid is just above ice level.
d) If possible, wrap sample in a plastic bag and place in chest. This will help prevent leakage into the container.
e) Pre-frozen ice packs may be used for food samples.

3. LABELS:

a) Write clearly with waterproof marker (or use waterproof labels with a ball-point pen).
b) Tags may be used - especially on glass bottles (use wire tags).
c) Be careful to number each container, watch sequence, be careful not to skip numbers.
d) Clearly state contents of container, i.e., raw milk, pasteurized, bulk, cultured, etc.

4. DELIVERY:

a) Preferably bring food samples for microbiological testing to the Food Laboratory on plating days, (Mon.-Wed.). This includes water samples.
b) Samples that are to be plated on the same date as collection should be brought in by 12:30 PM.
c) Make sure that all samples are kept refrigerated or frozen. When removed from the ice chest, they should be immediately moved to the refrigerator in the Food Laboratory.

SAMPLING EQUIPMENT

A sampling kit, including the following, should be kept stocked at all times:

1. Sterile Sample Containers
- Plastic bags (disposable or Whirl-Pak) 2oz., 18 oz., 24 oz.
- Wide mouth plastic and glass jars (6oz. - 1 qt) with screw caps

2. Sterile and Wrapped Sample Collection Implements
- Spoons, scoops, tongue-depressor blades, spatula, swabs

3. Supporting Equipment
- Fine-point felt-tip marking pen, role of adhesive or masking tape, waterproof labels/tags, sample forms

4. Sterilizing and Sanitizing Agents
- 95 % ethyl alcohol, propane torch, sodium or calcium hypochlorite, test papers and alcohol swabs

5. Refrigerants
- Ice packs (refrigerant in heavy plastic bags, rubber or plastic bags which can be filled with water and frozen, heavy-duty plastic bags for ice) thermometer (0 - 220 °F), insulated container

6. Clothing (Optional)
- Laboratory coat, hair restraint, disposable plastic gloves, disposable plastic boots

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH SAMPLE SUBMISSION FORM DIVISION OF FOOD & DRUGS OTHER _____

Signature of Inspector delivering sample to Laboratory	Laboratory Number
Sample Numbers of Inspector who collected samples	Date Collected
Name of Establishment / Plant / Individual and Address	Date Received in Laboratory : _____ Time _____ Initials _____ Condition received in Lab. On ice _____ Frozen ____ Room Temp _____ Other _____
Send results to: Results sent:	Date results submitted:

SPECIFIC INSTRUCTIONS: ASSIGNMENT DATE: _____

Reason for sample submission: Inspection: ____ Salvage: _____ Embargo ___ (Tag #) Complaint __ General Complaint # _____

or Foodborne Illness Complaint # _____ Date purchased _____

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH MASSACHUSETTS STATE LABORATORY INSTITUTE FOOD MICROBIOLOGY LABORATORY

PRODUCT INFORMATION LAB RESULTS

Lab. Number	Inspector Number	Sample Description	Type of Container	Code / Date	Net Wt. or Net Vol.	**Results**

REMARKS: *** = Violation** **NF = Not Found**

< 10 = not found at 10^{-1} dilution < 100 = not found at 10^{-2} dilution < 1000 = not found at 10^{-3} dilution

Date Reported: _____ Analyst: _____ Reviewed By: _____

SAMPLE CONTINUATION SHEET

PRODUCT INFORMATION						LAB RESULTS
Lab. Number	Inspector Number	Sample Description	Type of Container	Code / Date	Net Wt. or Net Vol.	**Results**

REMARKS:

*** = Violation**

NF = Not Found

< 10 = not found at 10^{-1} dilution < 100 = not found at 10^{-2} dilution < 1000 = not found at 10^{-3} dilution

Date Reported: _____ Analyst: _____

Reviewed By: _____

Appendix C

HACCP FOODBORNE DISEASE DATA

Confirmed, Suspected & Unknown Etiology Foodborne Disease Outbreaks by Method of Preparation, Significant Ingredient, Agent and Contributing Factor (Cumulative: 01/01/80 through 12/31/95)

NOTE: For assistance in interpreting the data below, call the MDPH Food Protection Program at (617) 983-6712.

1) COOK/SERVE FOODS*

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Eggs	Gastrointestinal Virus (GI)	(1)+	Inadequate Refrigeration	(23)#
	Salmonella	(26)	Inadequate Hot-Holding	(4)
			Food Prep Several Hours Before Serving	(7)
			Inadequate Cooking	(20)
			Inadequate Reheating	(5)
			Contaminated Ingredients	(22)
			Cross-Contamination	(2)
			Hand Contact w/ Implicated Food	(2)
			Consumption: Raw/Ltly Heated (Animal Origin	(3)
Beef	*Escherichia coli* O157:H7	(5)	Inadequate Refrigeration	(3)
	Campylobacter	(2)	Inadequate Cooking	(9)
	Clostridium perfringens	(2)	Contaminated Ingredients	(3)
	Salmonella	(5)	Cross-Contamination	(3)
	Other Chemical	(1)	Unknown	(10)
	Unknown	(6)		
Pork	*Salmonella*	(2)	Inadequate Refrigeration	(2)
	Staphylococcus aureus	(2)	Inadequate Hot-Holding	(1)
	Trichinella spiralis	(4)	Inadequate Cooking	(5)
	Yersinia enterolytica	(2)	Unapproved Source	(1)
			Contaminated Ingredients	(3)
			Cross-Contamination	(2)
			Unclean Equipment	(1)
			Unknown	(2)
Poultry	*Campylobacter*	(1)	Inadequate Refrigeration	(5)
	Clostridium perfringens	(1)	Inadequate Hot-Holding	(2)
	Salmonella	(6)	Food Prep Several Hrs Before Serving	(1)
	Staphylococcus aureus	(2)	Inadequate Cooking	(7)
	Unknown	(10)	Contaminated Ingredients	(1)
			Infected Person	(1)
			Cross-Contamination	(4)
			Unclean Equipment	(3)
			Improper Cooling	(1)
			Hand Contact w/ Implicated Food	(1)
			Unknown	(9)
Fin Fish	Scombrotoxin	(1)	Natural Toxicant	(1)
	Other Chemical	(1)	Unknown	(3)
	Unknown	(2)		
Shellfish	Gastrointestinal Virus	(1)	Unknown	(1)
Other Seafood	Gastrointestinal Virus	(1)	Inadequate Refrigeration	(1)
	Plesiomonas shigelloides	(1)	Unknown	(10)
	Salmonella	(2)		

	Staphylococcus aureus	(1)		
	Other Chemical	(1)		
	Unknown	(5)		
Starchy Foods	*Bacillus cereus*	(1)	Inadequate Refrigeration	(1)
	Staphylococcus aureus	(1)	Inadequate Hot-Holding	(1)
			Unclean Equipment	(1)
			Improper Cooling	(1)
			Other	(1)
Dairy	Gastrointestinal Virus (GI)	(1)	Unknown	(1)
Infected Worker	*Salmonella*	(2)	Infected Person	(3)
	Shigella	(1)		
No Specific Ingredient	*Clostridium perfringens*	(2)	Inadequate Refrigeration	(3)
	Gastrointestinal Virus (GI)	(2)	Inadequate Hot-Holding	(4)
	MSG	(1)	Inadequate Cooking	(2)
	Salmonella	(2)	Inadequate Reheating	(1)
	Staphylococcus aureus	(5)	Unclean Equipment	(1)
	Other Chemical	(2)	Added Poisonous Chemicals	(1)
	Unknown	(22)	Improper Cooling	(1)
			Unknown	(28)

2) ROASTED MEAT/POULTRY

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Beef	*Clostridium perfringens*	(15)	Inadequate Refrigeration	(4)
	Gastrointestinal Virus (GI)	(4)	inadequate Hot-Holding	(11)
	Salmonella	(3)	Food Prep Several Hrs Before Serving	(7)
	Staphylococcus aureus	(1)	Inadequate Cooking	(5)
	Unknown	(12)	Inadequate Reheating	(9)
			Cross-Contamination	(2)
			Unclean Equipment	(2)
			Improper Cooling	(5)
			Unknown	(13)
Pork	*Campylobacter*	(1)	Inadequate Refrigeration	(2)
	Clostridium perfringens	(3)	Inadequate Hot-Holding	(3)
	Salmonella	(2)	Food Prep Several Hrs Before Serving	(1)
	Staphylococcus aureus	(3)	Inadequate Cooking	(4)
	Trichinella spiralis	(2)	Inadequate Reheating	(2)
	Unknown	(2)	Contaminated Ingredients	(1)
			Infected Person	(1)
			Cross-Contamination	(2)
			Unclean Equipment	(1)
			Improper Cooling	(5)
			Hand Contact W/ Implicated Food	(1)
			Unknown	(1)
Poultry	*Bacillus cereus*	(1)	Inadequate Refrigeration	(8)
	Bacillus subtilis	(1)	Inadequate Hot-Holding	(7)
	Campylobacter	(4)	Food Prep Several Hrs Before Serving	(7)
	Clostridium perfringens	(7)	Inadequate Cooking	(14)
	Salmonella	(18)	Inadequate Reheating	(5)
	Staphylococcus aureus	(1)	Contaminated Ingredients	(2)
	Unknown	(5)	Infected Person	(1)
			Cross-Contamination	(2)
			Unclean Equipment	(1)
			Improper Cooling	(9)
			Hand Contact W/ Implicated Food	(2)
			Unknown	(10)

Infected Worker	*Salmonella*	(1)	Inadequate Hot-Holding	(1)
	Unknown	(1)	Infected Person	(1)
			Cross-Contamination	(1)

3) SOLID MASSES OF POTENTIALLY HAZARDOUS FOODS

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Eggs	*Salmonella*	(20)	Inadequate Refrigeration	(15)
			Inadequate Hot-Holding	(3)
			Food Prep Several Hrs Before Serving	(1)
			Inadequate Cooking	(20)
			Inadequate Reheating	(6)
			Contaminated Ingredients	(14)
			Cross-Contamination	(2)
			Unclean Equipment	(2)
			Improper Cooling	(5)
			Hand Contact w/ Implicated Food	(1)
Beef	Fecal Streptococcus	(1)	Inadequate Refrigeration	(5)
	Bacillus cereus	(1)	Inadequate Hot-Holding	(7)
	Clostridium perfringens	(14)	Food Prep Several Hrs. Before Serving	(1)
	Salmonella	(2)	Inadequate Cooking	(2)
	Unknown	(2)	Inadequate Reheating	(7)
			Infected Person	(1)
			Cross Contamination	(1)
			Unclean Equipment	(3)
			Improper Cooling	(10)
			Hand Contact W/ Implicated Food	(2)
			Unknown	(2)
Pork	*Bacillus cereus*	(1)	Unapproved Source	(1)
	Trichinella spiralis	(1)	Contaminated Ingredients	(1)
			Consumption: Raw/Ltly Htd (Animal Ori)	(1)
			Unknown	(1)
Poultry	*Clostridium perfringens*	(6)	Inadequate Refrigeration	(3)
	Salmonella	(3)	Inadequate Hot-Holding	(2)
	Shigella	(1)	Food Prep Several Hrs Before Serving	(4)
	Unknown	(1)	Inadequate Cooking	(1)
			Inadequate Reheating	(4)
			Contaminated Ingredients	(1)
			Infected Person	(1)
			Cross-Contamination	(1)
			Improper Cooling	(5)
			Unknown	(2)
Other Seafood	*Salmonella*	(1)	Inadequate Refrigeration	(1)
	Other Chemical	(1)	Cross-Contamination	(1)
			Hand Contact W/ Implicated Food	(1)
			Unknown	(1)
Starchy Foods	*Bacillus cereus*	(34)	Inadequate Refrigeration	(9)
	Campylobacter	(1)	Inadequate Hot-Holding	(19)
	Clostridium perfringens	(1)	Food Prep Several Hrs Before Serving	(6)
	Staphylococcus aureus	(1)	Inadequate Reheating	(1)
	Unknown	(8)	Cross-Contamination	(1)
			Unclean Equipment	(2)
			Improper Cooling	(11)
			Unknown	(11)
Other Vegetables	*Clostridium perfringens*	(2)	Inadequate Refrigeration	(3)
	Staphylococcus aureus	(1)	Inadequate Hot-Holding	(1)
	Unknown	(1)	Food Prep Several Hrs Before Serving	(2)
			Inadequate Cooking	(1)

			Inadequate Reheating	(2)
			Cross-Contamination	(1)
Infected Worker	Gastrointestinal Virus (GI)	(1)	Inadequate Refrigeration	(1)
	Salmonella	(2)	Inadequate Hot-Holding	(1)
	Unknown	(1)	Inadequate Cooking	(1)
	Rotavirus	(1)	Infected Person	(5)
No Specific Ingredient	*Bacillus cereus*	(6)	Inadequate Refrigeration	(10)
	Clostridium perfringens	(15)	Inadequate Hot-Holding	(23)
	Gastrointestinal Virus (GI)	(4)	Food Prep Several Hrs Before Serving	(9)
	Hepatitis A	(1)	Inadequate Cooking	(5)
	MSG	(1)	Inadequate Reheating	(10)
	Salmonella	(9)	Unapproved Source	(1)
	Shigella	(1)	Infected Person	(3)
	Staphylococcus aureus	(7)	Cross-Contamination	(5)
	Unknown	(35)	Unclean Equipment	(3)
			Improper Cooling	(9)
			Hand Contact w/ Implicated Food	(4)
			Unknown	(41)

4) LIQUID/SEMI-SOLID MIXTURES POTENTIALLY HAZARDOUS FOODS

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Eggs	*Salmonella*	(4)	Inadequate Refrigeration	(4)
			Inadequate Hot-Holding	(2)
			Inadequate Cooking	(1)
			Contaminated Ingredients	(4)
			Consumption: Raw/Ltly Htd (Animal Ori)	(3)
Beef	*Clostridium perfringens*	(5)	Inadequate Refrigeration	(3)
	Salmonella	(1)	Inadequate Hot-Holding	(1)
	Staphylococcus aureus	(2)	Food Prep Several Hrs Before Serving	(2)
	Unknown	(1)	Inadequate Cooking	(1)
			Inadequate Reheating	(2)
			Cross-Contamination	(1)
			Unclean Equipment	(1)
			Improper Cooling	(5)
			Unknown	(2)
Poultry	*Campylobacter*	(1)	Inadequate Refrigeration	(3)
	Clostridium perfringens	(7)	Inadequate Hot-Holding	(3)
	Salmonella	(4)	Food Prep Several Hrs Before Serving	(3)
			Inadequate Cooking	(4)
			Inadequate Reheating	(5)
			Cross-Contamination	(1)
			Improper Cooling	(6)
			Unknown	(1)
Other Seafood	*Bacillus cereus*	(1)	Inadequate Hot-Holding	(1)
	Clostridium perfringens	(1)	Inadequate Cooking	(1)
	Unknown	(1)	Inadequate Reheating	(1)
			Improper Cooling	(2)
Dairy	*Staphylococcus aureus*	(1)	Inadequate Hot-Holding	(1)
			Infected Person	(1)
			Hand Contact w/ Implicated Food	(1)
Other Vegetables	*Clostridium botulinum*	(2)	Inadequate Refrigeration	(2)
	Clostridium perfringens	(1)	Anaerobic Packaging	(2)
			Inadequate Cooking	(2)
			Inadequate Reheating	(1)
			Improper Cooling	(1)

Other Vehicle	*Clostridium perfringens*	(1)	Inadequate Hot-Holding	(1)
	Salmonella	(1)	Food Prep Several Hrs Before Serving	(1)
			Inadequate Cooking	(1)
			Inadequate Reheating	(2)
Infected Worker	Gastrointestinal Virus (GI)	(1)	Infected Person	(2)
	Norwalk	(1)		
No Specific Ingredient	Fecal Streptococcus	(1)	Inadequate Refrigeration	(4)
	Bacillus cereus	(1)	Inadequate Hot-Holding	(9)
	Campylobacter	(1)	Food Prep Several Hrs Before Serving	(8)
	Clostridium perfringens	(10)	Inadequate Cooking	(1)
	Salmonella	(2)	Inadequate Reheating	(5)
	Staphylococcus aureus	(2)	Infected Person	(1)
	Unknown	(15)	Cross-Contamination	(3)
			Unclean Equipment	(1)
			Improper Cooling	(12)
			Unknown	(11)

5) SALADS PREPARED WITH ONE OR MORE COOKED INGREDIENTS

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Eggs	*Salmonella*	(4)	Inadequate Refrigeration	(4)
	Unknown	(1)	Food Prep Several Hrs Before Serving	(1)
			Inadequate Cooking	(2)
			Contaminated Ingredients	(3)
			Cross-Contamination	(1)
			Unclean Equipment	(1)
			Improper Cooling	(1)
			Unknown	(1)
Poultry	*Clostridium perfringens*	(1)	Inadequate Refrigeration	(5)
	Gastrointestinal Virus (GI)	(1)	Inadequate Hot-Holding	(1)
	Salmonella	(4)	Food Prep Several Hrs Before Serving	(2)
	Staphylococcus aureus	(3)	Inadequate Cooking	(1)
	Unknown	(2)	Cross-Contamination	(4)
			Unclean Equipment	(1)
			Improper Cooling	(1)
			Unknown	(3)
Fin Fish	*Campylobacter*	(1)	Unknown	(1)
Other Seafood	Unknown	(3)	Infected Person	(1)
	Vibrio cholera	(1)	Unknown	(3)
Dairy	Gastrointestinal Virus (GI)	(1)	Unknown	(1)
Green Leafy Vegetables	Gastrointestinal Virus (GI)	(1)	Unknown	(1)
Infected Worker	Gastrointestinal Virus (GI)	(2)	Inadequate Refrigeration	(3)
	Salmonella	(3)	Infected Person	(7)
	Shigella	(1)	Cross-Contamination	(1)
	Unknown	(1)	Improper Cooling	(2)
			Hand Contact w/ Implicated Food	(3)
No Specific Ingredient	*Escherichia coli* O157:H7	(1)	Inadequate Refrigeration	(8)
	Bacillus cereus	(1)	Inadequate Hot-Holding	(3)
	Clostridium perfringens	(1)	Food Prep Several Hrs Before Serving	(5)
	Gastrointestinal Virus (GI)	(8)	Inadequate Reheating	(1)
	Salmonella	(10)	Infected Person	(3)

	Shigella	(1)	Cross-Contamination	(7)
	Staphylococcus aureus	(8)	Unclean Equipment	(6)
	Unknown	(15)	Added Poisonous Chemicals	(2)
			Improper Cooling	(2)
			Hand Contact w/ Implicated Food	(3)
			Unknown	(23)
			Other	(1)

6) SALADS WITH RAW INGREDIENTS

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Eggs	*Salmonella*	(1)	Inadequate Refrigeration	(1)
			Contaminated Ingredients	(1)
			Consumption: Raw/Ltly Htd (Animal Ori)	(1)
Fruits	Gastrointestinal Virus (GI)	(3)	Unknown	(3)
Green Leafy Vegetable	Gastrointestinal Virus (GI)	(7)	Infected Person	(2)
	Unknown	(3)	Cross-Contamination	(1)
	Rotavirus	(1)	Hand Contact w/ Implicated Food	(4)
			Unknown	(6)
			Other	(1)
Other Vegetables	Gastrointestinal Virus (GI)	(1)	Unknown	(2)
	Unknown	(1)		
Other Vehicle	Gastrointestinal Virus (GI)	(1)	Infected Person	(1)
Infected Worker	Gastrointestinal Virus (GI)	(8)	Infected Person	(12)
	Hepatitis A	(1)	Cross-Contamination	(1)
	Unknown	(1)	Hand Contact W/ Implicated Food	(5)
	Norwalk	(2)		
No Specific Ingredient	Gastrointestinal Virus (GI)	(4)	Infected Person	(1)
	Salmonella	(1)	Cross-Contamination	(1)
	Unknown	(7)	Improper Cooling	(1)
			Hand Contact W/ Implicated Food	(1)
			Unknown	(10)

7) SANDWICHES

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Eggs	*Salmonella*	(2)	Inadequate Refrigeration	(2)
			Contaminated Ingredients	(2)
			Cross-Contamination	(2)
			Unclean Equipment	(2)
Beef	*Escherichia coli* O157:H7	(1)	Inadequate Cooking	(1)
	Staphylococcus aureus	(1)	Infected Person	(1)
Pork	*Staphylococcus aureus*	(1)	Inadequate Refrigeration	(1)
			Food Prep Several Hrs Before Serving	(1)
Poultry	Gastrointestinal Virus (GI)	(1)	Inadequate Refrigeration	(2)
	Staphylococcus aureus	(1)	Food Prep Several Hrs Before Serving	(1)
	Unknown	(2)	Infected Person	(1)

			Hand Contact w/ Implicated Food	(1)
			Unknown	(1)
			Other	(1)
Green Leafy Vegetables	Gastrointestinal Virus (GI)	(1)	Cross-Contamination	(1)
	Salmonella	(1)	Unknown	(1)
Other Vehicle	*Staphylococcus aureus*	(1)	Inadequate Refrigeration	(1)
Infected Worker	Gastrointestinal Virus (GI)	(5)	Inadequate Refrigeration	(2)
	Hepatitis A	(1)	Food Prep Several Hrs Before Serving	(1)
	Salmonella	(1)	Infected Person	(6)
	Staphylococcus aureus	(1)	Cross-Contamination	(2)
			Hand Contact W/ Infected Food	(2)
No Specific Ingredient	*E. coli* - No Verotoxin: ? type	(1)	Inadequate Refrigeration	(2)
	Gastrointestinal Virus (GI)	(5)	Food Prep Several Hrs Before Serving	(1)
	Hepatitis A	(1)	Infected Person	(5)
	Salmonella	(4)	Cross-Contamination	(1)
	Shigella	(2)	Unclean Equipment	(1)
	Staphylococcus aureus	(2)	Improper Cooling	(1)
	Unknown	(6)	Hand Contact w/ Implicated Food	(5)
			Unknown	(11)
Unknown	Gastrointestinal Virus (GI)	(1)	Unknown	(1)

8) BAKED GOODS

SIGNIFICANT INGREDIENTS	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Eggs	*Salmonella*	(12)	Inadequate Refrigeration	(12)
			Inadequate Cooking	(10)
			Contaminated Ingredients	(12)
			Cross-Contamination	(2)
			Consumption: Raw/Ltly Htd (Animal Ori)	(2)
Dairy	*Bacillus cereus*	(1)	Unknown	(2)
	Unknown	(1)		
Other Vehicle	Other Chemical	(1)	Added Poisonous Chemicals	(1)
Infected Worker	Gastrointestinal Virus (GI)	(1)	Infected Person	(4)
	Hepatitis A	(1)	Hand Contact W/ Implicated Food	(2)
	Unknown	(1)	Unknown	(1)
	Rotavirus	(1)		
	Norwalk	(1)		
No Specific Ingredient(s)	*Bacillus cereus*	(1)	Inadequate Refrigeration	(7)
	Gastrointestinal Virus (GI)	(4)	Food Prep Several Hrs Before Serving	(1)
	Hepatitis A	(1)	Inadequate Cooking	(2)
	Salmonella	(7)	Contaminated Ingredients	(2)
	Staphylococcus aureus	(5)	Infected Person	(2)
	Giardia lamblia	(1)	Cross-Contamination	(2)
	Other Chemical	(5)	Added Poisonous Chemicals	(2)
	Unknown	(13)	Improper Cooling	(1)
			Unknown	(22)

9) FOODS EATEN RAW OR LIGHTLY COOKED

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS
Eggs	*Salmonella*	(4)	Inadequate Refrigeration (3) Inadequate Cooking (2) Contaminated Ingredients (3) Cross-Contamination (1) Consumption: Raw/Ltly Htd (Animal Ori) (2)
Beef	*Trichinella spiralis*	(1)	Unclean Equipment (1) Consumption: Raw/Ltly Htd (Animal Ori) (1) Other (1)
Pork	*Trichinella spiralis*	(2)	Contaminated Ingredients (2) Consumption: Raw/Ltly Htd (Animal Ori) (2)
Fin Fish	*Clostridium botulinum* (1) *Salmonella* (1) Other Chemical (1) Unknown (2)		Inadequate Refrigeration (1) Food Prep Several Hrs Before Serving (1) Improper Cooling (1) Consumption: Raw/Ltly Htd (Animal Ori) (2) Unknown (2) Other (1)
Shellfish	Gastrointestinal Virus (GI) (127) Hepatitis A (5) Unknown (11) Norwalk (63) *Vibrio parahaemolyticus* (1) Snow Mountain Agent (4) *Vibrio vulnificus* (4) Other Chemical (1)		Inadequate Cooking (1) Unapproved Source (198) Contaminated Ingredients (200) Cross-Contamination (1) Consumption: Raw/Ltly Htd (Animal Ori) (202) Unknown (11)
Other Seafood	Unknown	(1)	Unknown (1)
Dairy	Staphylococcus Aureus	(1)	Inadequate Refrigeration (1) Unapproved Source (1) Consumption: Raw/Ltly Heated (Animal Ori) (1)
No Specific Ingredient	Gastrointestinal Virus (GI)	(1)	Unknown (1)

10) COMMERCIALLY PROCESSED FOODS

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS
Eggs	*Salmonella*	(1)	Inadequate Cooking (1)
Beef	Gastrointestinal Virus (GI) (1) *Salmonella* (5) *Staphylococcus aureus* (1) Unknown (1)		Inadequate Hot-Holding (1) Inadequate Cooking (3) Contaminated Ingredients (2) Infected Person (1) Unknown (1)
Pork	Unknown	(1)	Unknown (1)
Beverage	Other Chemical (1) Unknown (1)		Added Poisonous Chemicals (1) Unknown (1)

Poultry	Gastrointestinal Virus (GI)	(2)	Inadequate Hot-Holding	(1)
	Unknown	(1)	Unknown	(2)
Fin Fish	*Clostridium botulinum*	(1)	Inadequate Refrigeration	(1)
	Staphylococcus aureus	(1)	Inadequate Hot-Holding	(1)
	Other Chemical	(1)	Anerobic Packaging	(1)
	Unknown	(1)	Inadequate Cooking	(1)
			Contaminated Ingredients	(1)
			Improper Cooling	(1)
			Other	(2)
Starchy Foods	*Salmonella*	(1)	Natural Toxicant	(1)
	Unknown	(1)	Unknown	(1)
Dairy	Gastrointestinal Virus (GI)	(2)	Inadequate Cooking	(1)
	Salmonella	(1)	Unknown	(3)
	Staphylococcus aureus	(1)		
Other Vegetables	*Clostridium botulium* (1)		Inadequate Refrigeration	(1)
			Contaminated Ingredients	(1)
Mushrooms	*Staphylococcus aureus*	(1)	Contaminated Ingredients	(1)
Other Vehicle	*Clostridium botulinum*	(1)	Contaminated Ingredients	(1)
	Other Chemical	(3)	Unknown	(3)
Infected Worker	*Staphylococcus aureus*	(2)	Unapproved Source	(2)
			Contaminated Ingredients	(2)
No Specific Ingredients	*Beta Hemolytic Streptococcus*	(1)	Inadequate Refrigeration	(1)
	Salmonella	(1)	Hand Contact w/ Implicated Food	(1)
	Staphylococcus aureus	(1)	Unknown	(4)
	Unknown	(3)		

11) NATURAL TOXICANT

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS	
Beverage	Other Chemical	(1)	Contaminated Ingredients	(1)
			Natural Toxicant	(1)
Fin Fish	Ciguatera Toxin	(1)	Inadequate Refrigeration	(2)
	Scombrotoxin	(95)	Natural Toxicant	(3)
			Unknown	(92)
Shellfish	Other Chemical	(1)	Unknown	(1)
Other Seafood	Other Chemical	(1)	Natural Toxicant	(1)
Diary	Scombrotoxin	(1)	Unknown	(1)
Other Vegetables	Other Chemical	(1)	Inadequate Cooking	(1)
			Natural Toxicant	(1)
Mushrooms	Mushrooms	(15)	Unapproved Source	(5)
			Natural Toxicant	(8)
			Unknown	(2)
			Other	(1)

12) MULTIPLE FOODS

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS
Eggs	*Salmonella*	(5)	Inadequate Refrigeration (4) Inadequate Cooking (4) Contaminated Ingredients (2) Cross-Contamination (4) Unclean Equipment (2) Improper Cooling (1)
Beef	Gastrointestinal Virus (GI)	(1)	Other (1)
Poultry	*Salmonella*	(1)	Inadequate Refrigeration (1) Inadequate Cooking (1) Inadequate Reheating (1)
Fin Fish	Scombrotoxin	(1)	Unknown (1)
Shellfish	Unknown Norwalk	(2) (2)	Inadequate Refrigeration (1) Inadequate Cooking (1) Unapproved Source (3) Contaminated Ingredients (2) Unclean Equipment (1) Consumption: Raw/Ltly Htd (Animal Ori) (2) Unknown (1) Other (1)
Other Vehicle	Hepatitis A Unknown	(1) (1)	Infected Person (1) Other (1)
Infected Worker	*Campylobacter* Gastrointestinal Virus (GI) Hepatitis A *Salmonella* *Staphylococcus aureus* *Shigella* Unknown	(1) (13) (2) (6) (1) (1) (1)	Food Prep Several Hrs Before Serving (1) Infected Person (23) Cross-Contamination (2) Hand Contact w/ Implicated Food (5) Unknown (2)
No Specific Ingredients	*Bacillus cereus* Pesticide *Campylobacter* *Clostridium perfringens* Gastrointestinal Virus (GI) Hepatitis A Heavy Metal MSG *Salmonella* *Shigella* *Staphylococcus aureus* Unknown Rotavirus *Yersinia enterolytica* (1)	(4) (1) (1) (3) (25) (1) (1) (1) (16) (1) (6) (61) (5)	Inadequate Refrigeration (9) Inadequate Hot-Holding (16) Food Prep Several Hrs Before Serving (6) Inadequate Cooking (7) Inadequate Reheating (7) Unapproved Source (1) Infected Person (21) Cross-Contamination (7) Unclean Equipment (3) Added Poisonous Chemicals (2) Improper Cooling (3) Hand Contact W/ Implicated Food (11) Consumption: Raw/Ltly Htd (Animal Ori) (2) Unknown (69) Other (2)
Unknown	Hepatitis A	(1)	Infected Person (1)

13) BEVERAGES

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS
Eggs	*Salmonella*	(3)	Inadequate Refrigeration (1) Contaminated Ingredients (3) Consumption: Raw/Ltly Htd (Animal Ori) (3)
Beverage	Pesticide (1) Gastrointestinal Virus (GI) (4) Heavy Metal (1) Other Chemical (3) Unknown (2)		Unapproved Source (2) Contaminated Ingredients (2) Infected Person (1) Added Poisonous Chemicals (3) Hand Contact w/ Implicated Food (1) Unknown (2) Other (2)
Dairy	*Campylobacter* (3) Gastrointestinal Virus (GI) (2) *Salmonella* (1) Unknown (3)		Unapproved Source (4) Contaminated Ingredients (1) Hand Contact w/ Implicated Food (1) Consumption: Raw/Ltly Htd (Animal Ori) (3) Unknown (4)
Infected Worker	Gastrointestinal Virus (GI) (3) *Salmonella* (1) Unknown (3)		Infected Person (6) Improper Cooling (1) Hand Contact w/ Implicated Food (2) Unknown (1)
No Specific Ingredient	Pesticide (1) Other Chemical (1) Unknown (1)		Unknown (3)
Unknown	*Salmonella*	(1)	Unknown (1)

14) UNKNOWN

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACTORS
Eggs	*Salmonella*	(1)	Unknown (1)
Beef	*Salmonella*	(1)	Inadequate Hot-Holding (1) Food Prep Several Hrs Before Serving (1) Inadequate Cooking (1) Unapproved Source (1)
Poultry	Gastrointestinal Virus (GI) (1) Unknown (4)		Unknown (5)
No Specific Ingredient	*Clostridium perfringens* (1) Gastrointestinal Virus (GI) (1) Unknown (3)		Infected Person (1) Unclean Equipment (1) Hand Contact w/ Implicated Food (1) Unknown (3)
Unknown	*Beta Hemolytic Streptococcus* (3) *Escherichia coli* O157:H7 (3) *Bacillus cereus* (5) *Clostridium botulinum* (2) *Campylobacter* (14) *Clostridium perfringens* (13) Gastrointestinal Virus (GI) (89) Hepatitis A (7) MSG (1) *Pseudomonas aeruginosa* (1) *Salmonella* (85)		Inadequate Refrigeration (15) Inadequate Hot-Holding (14) Food Prep Several Hrs Before Serving (4) Inadequate Cooking (8) Inadequate Reheating (5) Infected Person (52) Cross-Contamination (9) Unclean Equipment (13) Added Poisonous Chemicals (2) Improper Cooling (5) Hand Contact w/ Implicated Food (5)

	Shigella	(5)	Unknown	(445)
	Staphylococcus aureus	(4)	Other	(4)
	Giardia lamblia	(2)		
	Other Chemical	(4)		
	Parasite	(1)		
	Unknown	(283)		
	Rotavirus	(5)		
	Norwalk	(9)		

15) CHEMICAL CONTAMINATION

SIGNIFICANT INGREDIENT	AGENTS	OUTBREAKS	CONTRIBUTING FACOTRS	
Beef	Other Chemical	(1)	Added Poisonous Chemicals	(1)
Beverage	Heavy Metal	(10)	Toxic Container	(4)
	Other Chemical	(8)	Added Poisonous Chemicals	(7)
			Unknown	(6)
			Other	(3)
Other Seafood	Other Chemical	(1)	Unknown	(1)
Starchy Foods	Pesticide	(1)	Added Poisonous Chemicals	(2)
	MSG	(1)	Unknown	(3)
	Other Chemical	(4)	Other	(1)
Dairy	Pesticide	(1)	Toxic Container	(1)
	Other Chemical	(4)	Added Poisonous Chemicals	(1)
			Unknown	(3)
Green Leafy Vegetable	Other Chemical	(3)	Added Poisonous Chemicals	(1)
			Unknown	(2)
Other Vegetables	Pesticide	(1)	Natural Toxicant	(1)
Other Vehicle	Heavy Metal	(1)	Toxic Container	(1)
	Other Chemical	(1)	Added Poisonous Chemicals	(1)
No Specific Ingredients	MSG	(1)	Added Poisonous Chemicals	(12)
	Other Chemical	(18)	Unknown	(6)
			Other	(1)

16) OTHER

SIGNIFICANT INGREDIENT	AGNETS	OUTBREAKS	CONTRIBUTING FACTORS	
Eggs	*Salmonella*	(1)	Inadequate Refrigeration	(1)
			Inadequate Cooking	(1)
			Contaminated Ingredients	(1)
			Cross-Contamination	(1)
Dairy	Gastrointestinal Virus (GI)	(1)	Unknown	(1)

Other Vegetables	*Clostridium botulinum*	(1)	Food Prep Several Hrs Before Serving	(1)
Other Vehicle	*Salmonella*	(1)	Inadequate Refrigeration	(1)
Infected Worker	*Shigella* Unknown	(1) (1)	Infected Person	(2)
No Specific Ingredient	*Campylobacter* Gastrointestinal Virus (GI)	(1) (2)	Cross-Contamination Unclean Equipment Unknown	(1) (1) (2)

* Each Method of Preparation category is defined on the last page of this appendix.

\+ Number of reported outbreaks for specific agent in above category.

\# Number of outbreaks where specific contributing factor was reported with above category. Any outbreak may report none or more than one contributing factor.

Source: New York State Department of Health, Bureau of Community Sanitation and Food Protection, II University Place, Room 404, Albany, New York 12203. July 1997. Used with permission.

Method of Preparation Categories*

Cook/Serve Foods: Preparation steps limited to cook/serve or cook/hot hold/serve; cooking is likely to destroy vegetative microbial pathogens; a potentially hazardous food (as per FDA Food Code) is often an ingredient; the foods are completely cooked within 30 min. and usually served within 1 hour, e.g., fish fillets, lobster, eggs prepared individually, steaks, chops, sausage, chicken pieces and pizza.

Roasted Meat/Poultry: Roasted, baked, etc., solid pieces of meat/poultry and/or formed masses of ground or chipped meat or poultry that are greater than 3 in. thick. Usually cooked longer than 30 min., e.g., roast beef, whole turkey, broiler chickens, baked ham, gyro, stuffed chicken breasts, meat loaf and turkey roll.

Solid Masses of Potentially Hazardous Foods: Food preparation steps sometimes involve combining of several ingredients prior to cooking the food followed by hot-holding and service. This category also includes solid masses of single potentially hazardous foods, such as rice and refried beans, e.g., casseroles, lasagna, baked ziti, meatballs and crabmeat stuffing.

Liquid or Semi-Solid Mixture of Potentially Hazardous Foods: Food preparation steps usually involve combining of several ingredients prior to or during cooking followed by hot holding and service of cooling, reheating, hot-holding and service, e.g., sauce, soup, gravy, chili, stew and chowder.

Salads Prepared with One or More Cooked Ingredients: One or more ingredients are cooked prior to combining with raw ingredients and then served cold. These salads usually include one or more potentially hazardous ingredients, e.g., egg, chicken, turkey, ham, tuna, potato, antipasto, macaroni and pasta salad.

Salads with Raw Ingredients: Ingredients are generally not cooked and are served cold. These salads do not usually contain a potentially hazardous ingredient except possibly the dressing, e.g., green salads, fresh tomatoes, fruit salad, relish tray, cole slaw and raw vegetables.

Sandwiches: Ingredients are assembled and served between two slices of bread or other baked goods and served hot or cold. This category is selected when the investigation determines that the preparation error that led to the outbreak occurred at the time of assembly or serving of the food, e.g., hamburger, hot dog, bacon-lettuce-tomato (BLT), toasted cheese sandwich, club sandwich and Monte Cristo sandwich.

Baked Goods: Baking, cooking, icing or filling and cold and/or hot-holding are preparation steps. Some ingredients may be potentially hazardous e.g., meat-filled pastries, such as calzones, croissants and other pastries, such as cakes, pies, cookies, breads, rolls, icing, non-diary whipped toppings, and eclairs.

Foods Eaten Raw or Lightly Cooked: These are served uncooked or after a heating that would not destroy vegetative pathogens. Preparation steps involve cold storage, cleaning, opening, steaming or other light cooking and service. This category does not include commercially canned foods, e.g., hard-shell clams, oysters, mussels - consumed whole raw or steamed, steak tartar, Caesar salad with raw egg, lightly cooked eggs and hollandaise sauce.

Commercially Processed Foods: A food that has been processed in another facility prior to the locations where it was served e.g., pasteurized milk, precooked roast beef, precooked poultry, surimi (processed and formed fish), canned fruits and vegetables and ice cream.

Natural Toxicant: A toxin of biologic origin that either develops or bioaccumulates in the food prior to final preparation and service, e.g., poisonous mushrooms, shellfish containing toxins capable of causing paralytic shellfish poisoning, neurotoxic shellfish poisoning, diarrhetic shellfish poisoning and amnesic shellfish poisoning, reef fish containing ciguatoxin, scombrotoxin (histamine), mycotoxins and plant toxins.

Multiple Foods: More than one food statistically implicated; does not fit any single category; foods from more than one category implicated, e.g., salad bar, smorgasbord and buffet.

Beverages: Preparation steps include reconstitution, mixing, dispensing and serving. Foods in liquid from served with or without ice. Contamination and/or multiplication occurs at the point of service, e.g., carbonated and non-carbonated beverages, alcohol, milk, ice, juices and hand-dipped ice cream.

Unknown: An implicated vehicle was not identified and contributing factors were not determined.

Chemical Contamination: A substance of non-biologic origin that is introduced at toxic levels during harvest, processing or service, e.g., heavy metals, pesticides, food additives (niacin).

Other: Food implicated, but does not fit any of the above categories.

* Foods are assigned to the category that best describes the step or process where contributing factors that lead to the outbreak occurred.

Source: Weingold, S. et al, Use of Foodborne Disease Data for HACCP Risk Assessment, *Journal of Food Protection*, Vol. 57, Sept., 1994.

Appendix D
Enteric Disease Fact Sheets

Public Health
Massachusetts Department of Public Health
305 South Street
Boston, MA 02130

- **Campylobacter***
- **Cryptosporidium***
- **Cyclospora**
- **E. coli O157:H7***
- **Giardia***
- **Hepatitis A***
- **Salmonella***
- **Shigella***

*Also provided in Spanish

Fact Sheets

Campylobacter

What is campylobacter?
Campylobacter is a germ (a bacterium) that can infect the bowel in people and animals. The disease it causes (called "campylobacteriosis") is one of the most common causes of infection of the bowel in the U.S. Most people infected with campylobacter do not get serious medical problems. However, in rare cases the infection can spread to other parts of the body such as the blood.

What are the symptoms of campylobacteriosis?
The most common symptoms are diarrhea (sometimes bloody), abdominal (stomach) pain, tiredness, fever, nausea, and vomiting. These symptoms can start within one to ten days, but most often will show up within two to five days, after the germs have been swallowed. In otherwise healthy people, the symptoms usually last one to four days, but sometimes longer. If you have any of these symptoms, see a doctor.

How is campylobacter spread?
The campylobacter germ must be swallowed to cause disease. This usually happens when someone eats food that has been contaminated with campylobacter and has not been well cooked or pasteurized (treated to kill germs). It also can happen if someone drinks contaminated water. Campylobacter is found in the stool (feces) of infected people. Campylobacteriosis can be spread from one person to another if an infected person prepares food for other people without thoroughly washing his or her hands after using the toilet. The infection sometimes spreads in day-care centers and other institutions

because very young children and disabled adults may not always be able to wash their hands well. People can also be infected by their pets, especially puppies and kittens.

What kinds of food are most likely to be contaminated?
Campylobacter is most commonly found in uncooked food products from animals, such as poultry (chicken, turkey, etc.), and in unpasteurized milk. Some people have been infected by eating raw shellfish. However, thorough cooking or pasteurizing will kill the bacteria and make these foods safe to eat.

Can campylobacter be spread by animals?
Yes! Campylobacter has been found in the stool (feces) of infected farm animals and pets (including cattle, poultry, cats and dogs), whether they are sick or healthy. The bacteria have also been found in different kinds of wild animals. Therefore, you should wash your hands well with soap and water after touching animals or their stools.

How is campylobacteriosis diagnosed and treated?
Your doctor, nurse, or health center must send your stool sample to a laboratory. The lab then grows germs from it and tests them to see if any of the germs are campylobacter. It takes several days to do this test. Most people get well without any treatment, but some people can get very sick. If you think you or someone in your family has this disease, see a doctor or go to a health center as soon as you can. People who get very sick for longer than usual, or whose work or living situations make it likely that their infection will spread to others, are usually treated with antibiotics.

How can you prevent campylobacteriosis?
The two most important things to remember are that the germ can only make you sick if you swallow it and that thorough cooking will kill it. Be extra careful when using food products from animals. Follow the tips below; if you make them habits, you can prevent campylobacteriosis, as well as other diseases:

- Always wash your hands **thoroughly** with soap and water before eating, before handling food, after using the toilet, after changing diapers, and after handling your pets or cleaning up after them.
- Cook all food from animal sources thoroughly, especially poultry. If the meat or poultry is still pink in the center, it is not thoroughly cooked.
- Use only clean utensils, dishes and cutting boards to prepare food that is already cooked or will be eaten raw. Anything you use to prepare raw meat, seafood, or poultry, including your hands and the table or counter top, should be washed **thoroughly** before you touch any other food.
- Do not eat raw shellfish or unpasteurized dairy products (such as cheese). Do not drink unpasteurized milk or eat anything made with unpasteurized milk.
- Do not drink from untreated water supplies when you go camping or hiking.
- If you are taking care of someone who has campylobacteriosis or diarrhea, scrub your hands with plenty of soap and water after cleaning the bathroom, helping the person use the toilet, or changing diapers, soiled clothes or soiled sheets.

- If you or your child has persistent diarrhea (with or without a fever), or if the diarrhea is very bad, call your doctor or health center for advice.

Are there any health regulations for people with campylobacteriosis?
Yes. Because campylobacteriosis is a disease that can easily spread to other people, health care providers are required by law to report cases of campylobacteriosis to the local board of health.

In order to protect the public, workers at food-related businesses who have campylobacteriosis must stay out of work until they don't have diarrhea and one lab test on a stool sample shows that there are no campylobacter germs. Workers in food-related businesses who have diarrhea and live with someone who has campylobacteriosis must also show that they have no campylobacter germs in their stool. Food-related businesses include restaurants, sandwich shops, hospital kitchens, supermarkets, dairy or food-processing plants. This regulation also includes workers in schools, residential programs, day-care and health facilities who feed, give mouth care or dispense medications to clients.

Where can you get more information?

- The Massachusetts Department of Public Health
  Division of Epidemiology (617) 983-6800
- Your local board of health
  Listed in the telephone book under local government
- Your doctor, nurse or health center

October 1996

Cryptosporidiosis

What is cryptosporidiosis?
Cryptosporidiosis is a disease of the bowel caused by a germ (a parasite) called *Cryptosporidium parvum*. It was first recognized as a cause of human illness in 1976. It wasn't until the spring of 1993 that cryptosporidiosis gained national attention after 400,000 people in Milwaukee became ill with diarrhea after drinking water that contained this parasite.

What are the symptoms?
The most common symptom is watery diarrhea. Other signs and symptoms include weight loss, stomach cramps, nausea, vomiting, headache and low-grade fever. These symptoms usually appear within 2 to 14 days of swallowing the parasite. In otherwise healthy people, these symptoms usually go away on their own in about 1 to 20 days (average 10). Some people might not have any symptoms at all. In people with weakened immune systems (e.g., people with HIV infection, on chemotherapy or other medications), the symptoms are more severe, last longer and can lead to severe dehydration and even death.

How is cryptosporidiosis spread?
The parasite is found in the stool (feces) of infected humans, domestic animals (especially cattle) and wild animals. Infection occurs after the parasite is swallowed. This is called fecal-oral spread and can happen from person-to-person and from animal-to-animal. Person-to-person spread is likely to occur following poor handwashing among infected persons with diarrhea, persons who are incontinent of stool, persons with poor personal hygiene and diapered children. Fecal-oral spread can also occur by drinking contaminated water, but this is less likely.
In rare cases, cryptosporidiosis can be spread through lakes and swimming pools when people who have diarrhea swim in the lake or pool. The parasites can live in water in the water and infect other swimmers who swallow it or get their lips wet.

Who gets cryptosporidiosis?
Anyone can get a cryptosporidium infection. People at greatest risk for severe illness are those with weakened immune systems such as people with HIV infection, on chemotherapy or on high-dose steroid therapy after organ transplantation.

How is the disease diagnosed and treated?
Cryptosporidiosis is diagnosed by identifying the parasite in a stool sample.

There is no specific treatment that is recommended for cryptosporidiosis. Fluid replacement is needed if dehydration is a problem. There are some drugs currently being tested for persons with weakened immune systems. Consult your health care provider for more information.

Can cryptosporidiosis be prevented?
The following steps can be taken to minimize your chance of getting and spreading infection:

- Always wash your hands after using the toilet, changing diapers and before handling food. Wash your hands after contact with cattle.
- Avoid drinking raw milk, other unpasteurized dairy products or apple cider made from unwashed apples.
- Do not drink directly from streams, brooks or lakes when hiking or camping.
- Avoid drinking unboiled water when traveling in developing countries or whenever else you are unsure of the drinking water quality. Bringing water to a rolling boil for one minute is sufficient to eliminate cryptosporidium.
- Comply with any water advisories issued by local and state authorities.
  In Massachusetts, the likelihood that cryptosporidium would be a problem in regulated, public drinking water is low. However, people who are having problems with their immune system may have a more severe illness if they are infected with the parasite, and they may want to consider following these additional recommendations:
- Be particularly careful to avoid fecal contact (e.g., contact with stool).
- Avoid sexual practices that may involve direct contact with feces (stool).

- Bring tap water to a rolling boil for one minute before drinking it or making ice cubes with it.
- Consider the use of a home water filtering system with a very fine filter (with an absolute pore size of 1 micron or smaller). Such filters include: reverse-osmosis filters; filters labeled as "absolute" 1 micron filters; and those labeled as meeting National Sanitation Foundation (NSF) standard #53 for cyst removal. Use the home water filtering system according to manufacturers instructions.
- Avoid swallowing water when swimming. Lakes, streams (and other surface waters) and swimming pools may be contaminated with cryptosporidium, and chlorination is not effective in eliminating the parasite.

Note: Commercial bottled water may be used, but it is not checked for cryptosporidium and cannot be guaranteed to be free of this parasite. For more information about water filters, contact the NSF at 3475 Plymouth Road, P.O. Box 130140, Ann Arbor, Michigan 48113-0140. Telephone: (800) 673-8010.

Are there any restrictions for people with cryptosporidiosis?
Yes. Because cryptosporidiosis is a disease that can easily spread to other people, health care providers are required by law to report cases of cryptosporidiosis to the local board of health.
In order to protect the public, workers at food-related businesses who have cryptosporidiosis must stay out of work until they don't have diarrhea and one lab test on a stool sample shows that there are no cryptosporidium germs. Workers in food-related businesses who have diarrhea and live with someone who has cryptosporidiosis must also show that they have no cryptosporidium in their stool. Food-related businesses include restaurants, sandwich shops, hospital kitchens, supermarkets, dairy or food-processing plants. This regulation also includes workers in schools, residential programs, day-care and health care facilities who feed, give mouth care or dispense medications to clients.

Where can I get more information?

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  Division of Epidemiology and Immunization (617) 983-6800
- Your local board of health (listed in the phone book under local government)
- Your doctor, nurse or health center

October 1996

Cyclospora

What is cyclospora?
Cyclospora is a parasite (germ) that can make people sick. Cyclospora infection is called cyclosporiasis. Cyclospora is new to most doctors and scientists, so not everything is known about all the ways it can be spread or make people sick. The parasite is too small to see without a microscope.

What are the symptoms of having cyclospora?
The most common symptom is watery diarrhea. Other symptoms can include weight loss, bloating, lots of gas, cramps, nausea, vomiting, being tired, sore muscles, fever, and not feeling hungry. These symptoms can also be caused by a lot of other diseases. Some people who become infected with cyclospora may not get symptoms. Sometimes people who seem to be getting better may get sick again (relapse). For most people, the diarrhea will last for about a few days, but if not treated, some people can be sick for several weeks. It usually takes about 5 to 7 days to get sick after you have eaten a food with cyclospora.

How is cyclospora spread?
The parasite is spread when people eat food or water that has come into contact with infected feces (stool). Cyclospora germs need time (days or even weeks) after being passed in the stool to become able to make a person sick. Because of this, cyclospora infection probably does not spread directly from person to person. It is unknown whether animals can be infected or spread the infection to people.

What kind of foods are likely to have cyclospora?
People have gotten cyclospora infections from some fresh fruits and vegetables that probably came into direct contact with an infected person or contaminated water. Fruits and vegetables grown or packed outside of the United States may have a higher risk of having cyclospora on them. Washing fruits and vegetables with water and a brush may help get rid of cyclospora. Cooking will kill the cyclospora germs. Fruits and vegetables that are peeled should be safe to eat.

How is cyclospora diagnosed and treated?
If you think you have cyclospora, you should see a doctor. Your doctor can take a stool sample and send it to a lab for testing. If you have cyclospora, you may be treated with antibiotics or a combination of antibiotics. If you have diarrhea, you should rest and drink plenty of clear fluids. Do not take any medicine until asking your doctor about it. People who have already had a cyclospora infection can get it again.

Are there any restrictions for people infected with cyclospora?
There are no special restrictions for people diagnosed with cyclospora infection. However, in order to protect the public, people who have diarrhea who work in food-related jobs must stay out of work until they are completely well. Food-related jobs include: working in a restaurant, sandwich shop, hospital kitchen, cafeteria, supermarket or grocery store, dairy or food-processing plant. People who feed, give mouth care, or give medicine to patients or clients in schools, residential programs, day-care, and health facilities could also put the public at risk, and these people must also stay out of work until they are completely well.

How can the spread of cyclospora be prevented?
Careful handwashing helps prevent the spread of cyclospora and other diseases. Always wash your hands after going to the bathroom, changing a diaper, or before touching food.

Use plenty of soap and warm water, and get a good soap lather on your hands. Use a lot of friction (rubbing) to loosen and wash away germs.

Where can I get more information?

- The Massachusetts Department of Public Health
  Division of Epidemiology and Immunization (617) 983-6800
- Your local board of health, listed in the phone book under government.
- Your family doctor or nurse.
- Your doctor, nurse, or health center.

August 1997

E. coli O157:H7

What is E. coli O157:H7?
E. coli are germs (bacteria) that normally live in the bowel of people and animals. Most strains of this germ are harmless, but the strain called *E. coli* O157:H7 can make people sick.

What are the symptoms?
The most common symptoms are severe stomach cramps and diarrhea. Some people vomit or run a fever, but these are less common. Sometimes the diarrhea turns bloody after 2 or 3 days. These symptoms usually go away by themselves after 6 to 8 days. In a small number of people, this strain of *E. coli* can cause a rare but serious problem called hemolytic uremic syndrome (HUS).

What is HUS?
HUS is a disease that affects the kidneys and the blood clotting system. It starts about a week after the diarrhea begins and affects more children than adults. In bad cases, dialysis is used for a while to do the kidney's work. Some people also develop a bleeding problem or low blood count (anemia). Most people who get HUS will regain their health with no remaining blood or kidney problems.

Where is E. coli O157:H7 found?
It lives in the gut of healthy cattle and can get into the meat when cattle are slaughtered. The germs are killed when the meat is thoroughly cooked. The most common food source is ground beef (hamburg), because the grinding spreads the germs throughout the meat. These germs have also been found in raw milk, roast beef, apple cider, salami, and sometimes on vegetables fertilized with contaminated cow manure.

How is it spread?
E. coli O157:H7 must be swallowed to cause infection. This can happen if you eat or drink something that contains these germs and is not properly cooked or pasteurized. The germs can be spread from person to person if someone who is infected does not thoroughly wash his or her hands with soap or water before preparing food for others.

Spreading E. coli germs this way is more common in families and day-care centers than in schools and restaurants.

How is E. coli O157:H7 diagnosed?
Infection with this germ can only be diagnosed by testing a stool sample. It is not a routine test, so if your doctor or nurse thinks you may have E. coli O157:H7, she or he must ask the lab to test for it.

How is the disease treated?
There is no treatment for E. coli O157:H7. Antibiotics do not help and may even be harmful. Do not try to stop the diarrhea, which should go away by itself after a few days. Just drink plenty of liquids to replace the fluids being lost. For severe cases of HUS, dialysis or transfusions are sometimes used until the patient's kidneys and blood return to normal.

How can you prevent it?
The most important things to remember are that the germs can only make you sick if you swallow them, and that the germs are killed by thoroughly washing your hands with soap and water and by thorough cooking. Follow the tips below; if you make them your habits, you can prevent E. coli O157:H7—as well as other diseases:

- Do not eat unpasteurized dairy products (such as cheese) or undercooked or rare ground beef. Do not drink raw milk or cider made from unwashed apples.
- Always cook meat until the center is brown, not pink. Cook hamburgers until the center is 155ºF.
- Do not put cooked meat or other prepared food on a dish or cutting board that held raw meat.
- Always wash your hands with soap and water after going to the bathroom or changing a diaper. Wash them again before touching or eating food.

Are there any restrictions for people with E. coli O157:H7?
Yes. Because E. coli O157:H7 is a disease that can easily be spread to other people, health care providers are required by law to report cases of E. coli O157:H7 to the local board of health.

In order to protect the public, workers at food-related businesses who have E. coli O157:H7 must stay out of work until they don't have diarrhea and one lab test on a stool sample shows that there are no E. coli O157:H7 germs. Workers in food-related businesses who have diarrhea and live with someone who has E. coli O157:H7 must also show that they have none of the germs in their stool. Food-related businesses include restaurants, sandwich shops, hospital kitchens, supermarkets, dairy or food-processing plants. This regulation also includes workers in schools, residential programs, day-care and health care facilities who feed, give mouth care or dispense medications to clients.

Where can I get more information?

- Massachusetts Department of Public Health
  Division of Epidemiology (617) 983-6800
- Your local board of health (listed in the phone book under local government)
- Your doctor, nurse or health center

October 1996

Giardiasis

What is giardia?

Giardia is germ (a parasite) that causes an infectious disease (called "giardiasis") that affects the stomach and bowels. The giardia germ is a common cause of diarrhea in the United States.

What are the symptoms of giardiasis?

The most common symptoms are diarrhea, foul-smelling soft stools, abdominal cramps, bloating, increased gas, weakness, loss of appetite and weight loss. Symptoms of giardiasis usually appear seven to ten days (but sometimes as long as four weeks) after the germs are swallowed. The symptoms may come and go for weeks in a person who is not treated.

Do all people who are infected with giardia get sick?

No. Some people who are infected with the parasite may only have minor symptoms and some people may not have any symptoms at all.

How is giardiasis spread?

The parasites must be swallowed to cause disease. You can get a giardia infection if you swallow food or water which has been contaminated with the germ. The parasites multiply in the small intestine and are passed out with bowel movements. Giardiasis is often spread when people do not wash their hands with soap and water after using the toilet or changing a diaper. People who get the germs on their hands can infect themselves by eating, smoking, or touching their mouths. They can also spread the germs to things they touch, including food, which can then make others sick. The giardia parasites are mainly spread from person to person, such as in day-care centers and institutions where personal hygiene may be poor due to age (infancy, elderly) or disability. Giardiasis can also be spread this way in a household setting.

Can giardiasis be spread by animals?

Yes. Giardia parasites have been found in the stools of many animals, including rodents, dogs, cats, cattle, and wild animals. Animals living near water supplies, such as beavers and muskrats, have been found to be infected with giardia. When those animals contaminate the water with their stool, people can get sick if they drink or swim in the water.

How can you know for sure if you have giardiasis?
Your doctor, nurse, or health center must send your stool sample to a laboratory. The laboratory will look at the sample with a microscope to see if there are any giardia parasites in it. The germs are often hard to see, so they may need several stool samples from you. This is the most common way of finding out if someone has giardiasis. Giardia can also be diagnosed by a laboratory test of a sample of fluid or a biopsy from the small intestine.

What is the treatment for giardiasis?
There are several medicines that are used to treat giardia infection. They are only available by prescription from your physician. Other treatments for diarrhea, such as drinking more fluids, may also be recommended by your physician.

How can giardiasis be prevented?
Giardiasis can be prevented by practicing good hygiene and by using caution before drinking water from an unknown source.

Some general guidelines are:

- Always wash your hands thoroughly with soap and water before meals, before preparing food, after using the toilet, after changing diapers, and after handling your pets.
- Do not drink untreated water from a surface water supply, such as a pond, lake, or stream. Although the water may appear to be clean, it may contain giardia parasites, which cannot be seen without a microscope. If untreated water is all that is available, boil the water for 1 minute before drinking it.
- If you are taking care of a person with giardiasis, scrub your hands with plenty of soap and water after contact with the person's stool (for example, after changing diapers). Promptly and carefully dispose of any material which has been contaminated with stool, and always wash your hands after such contact.
- If your source of drinking water is a well or a private surface water supply, do not allow humans or animals to defecate (have bowel movements) near the water. Contact your health department for advice on how keep your water supply safe. Also, some water filters can help to get rid of giardia parasites from contaminated water.

Are there any health regulations for people with giardiasis?
Yes. Because giardiasis is a disease that can easily spread to other people, health care providers are required by law to report cases to the local board of health.
In order to protect the public, workers at food-related businesses who have giardiasis must stay out of work until they don't have diarrhea and a lab test on a stool sample shows that there are no giardia parasites. Workers in food-related businesses who have diarrhea and live with someone who has giardiasis must also show that they have no giardia parasites in their stool. Food-related businesses include restaurants, sandwich shops, hospital kitchens, supermarkets, dairy or food processing plants. This regulation

also includes workers in schools, residential programs, day-care and health care facilities who feed, give mouth care or dispense medications to clients.

Where can I get further information?

- Massachusetts Department of Public Health
  Division of Epidemiology (617) 983-6800
- Your local board of health
- Listed in the phone book under local government
- Your doctor, nurse or health center

October 1996

Hepatitis A

What is Hepatitis A?
Hepatitis A, also called infectious hepatitis, is a contagious viral disease that makes the liver swell. It can take from 15 to 50 days to get sick after being exposed to the hepatitis A virus. The average is about a month.

What are the symptoms?
The symptoms depend on the person's age. Adults and teens are more likely to have the classic symptoms of fever, fatigue, loss of appetite, nausea, and jaundice. The signs of jaundice include dark brown urine and pale stools (feces). The whites of the eyes turn yellow, as can the skin of light-skinned people. Young children with hepatitis A often have mild flu-like symptoms, an upset stomach, or no symptoms at all. They seldom get jaundice. Hepatitis A symptoms last a week or two. Some adults can feel sick for as long as a few months, but this is rare.

How is it spread?
The hepatitis A virus is usually found in the stools (feces) of infected people. The virus is most likely to be spread when people do not wash their hands after using the toilet or changing a diaper or soiled sheets, then touch their own mouths, prepare food for others, or touch others with their contaminated hands. This spreads the disease from person to person. It can also be spread by contaminated food (such as shellfish) or water.
The time of highest risk for spreading the virus to others is during the two weeks before symptoms begin. Most people stop being contagious one week after their symptoms start. Unlike other hepatitis viruses, hepatitis A virus is usually not spread by blood.

Who gets Hepatitis A?
Anyone can. People who live with or have sex with people who have the disease are at high risk of catching it. Hepatitis A sometimes spreads among young children in day care because many are in diapers and cannot wash their own hands, and no one knows they have the disease because they have no symptoms. Spreading among school-aged children is less common because they are more likely to have symptoms, and most have learned to wash their hands before eating and after using the toilet.

How is it diagnosed?
A blood test looks for antibodies that fight the virus. This blood test can tell the difference between a current infection and a past one. There are also blood tests to measure how much damage has been done to the liver, but these tests do not show what caused the damage.

How is Hepatitis A treated?
There is no treatment for the disease, and most people do not need any. Problems such as retaining fluid and blood abnormalities are rare, but they can be treated.

How can you prevent hepatitis A?

- **Wash your hands.**
  Good handwashing protects you against hepatitis A and many other diseases. **Always** wash your hands thoroughly with soap and water before touching food or eating and after using the toilet or changing a diaper.
- **Cook shellfish.**
  Don't eat raw or undercooked shellfish. Thorough cooking destroys the hepatitis A virus.
- **Get hepatitis A vaccine if:**
  - You plan to travel to or work in a country with high rates of hepatitis A (Mexico; all Central and South American countries; all African, Caribbean and Asian countries except Japan; and the countries of southern and eastern Europe).
  - You live in a community with high rates of hepatitis A (Native American reservations, Alaskan Native villages, Pacific Islander villages, and some Hispanic and religious communities).
  - You have chronic liver disease.
  - You have a bleeding disorder and get clotting factors.
  - You use street drugs of any kind.
  - You are a man who has sex with other men.
- **Get immune globulin (IG) if:**
  - You did not get the vaccine and become exposed to hepatitis A. IG works best if you get it within 2 weeks after being exposed.
  - You are allergic to the vaccine or chose not to get it, and you will be traveling in an area with high rates of hepatitis A.
- **Get immune globulin (IG) for your children if:**
  - They are under 2 years old and will be traveling or living with you in an area with high rates of hepatitis A. They will need IG because the vaccine cannot be given to children until they are 2 years old.

Will IG make you immune to Hepatitis A?
No. IG only partly protects you against hepatitis A virus for 3-5 months. You can still get the disease and spread it to others, but IG can make your symptoms milder. If you think you might be exposed again, you should talk to your doctor about getting hepatitis A vaccine, which protects for many years.

Are there any health regulations for people with Hepatitis A?
Yes. Because hepatitis A can easily be spread to other people, doctors are required by law to report cases of hepatitis A to the local board of health. To protect the public, workers who have hepatitis A cannot work in any food business until their fevers are completely gone and a week has passed since their symptoms started. Coworkers may need to get IG. The term "food business" includes restaurants, sandwich shops, hospital kitchens, dairy or food-processing plants, and any other place where workers handle food or drinks, give oral care (such as brushing people's teeth), or dispense medicines.

Where can you get more information?

- Your doctor, nurse or clinic
- Your local board of health (listed in the phone book under local government)
- The Massachusetts Department of Public Health
  Division of Epidemiology and Immunization (617) 983-6800

October 1996

Salmonella

What is salmonella?
Salmonella are germs (bacteria) that cause an infectious disease (called "salmonellosis") of the bowel in humans and animals. Although the disease is usually limited to the bowel and most infected people do not have any serious medical complications, the salmonella germ can spread to other systems of the body, such as the blood and bone. This may cause serious complications in infants and in people who are very old or are immunocompromised.

What are the symptoms?
The most common symptoms are stomach cramps, diarrhea, fever, nausea, and sometimes vomiting. Symptoms can take up to three days to show up, but most often begin 12 to 36 hours after the germs are swallowed. Symptoms generally last for several days. Some people with salmonellosis become sick enough to require hospitalization.

How is salmonella spread?
The germs must be swallowed to cause disease. Usually this happens when someone eats food that has been contaminated with the germs and has not been properly handled, prepared or cooked. The germs can also spread when people do not wash their hands thoroughly with soap and water after using the toilet, changing diapers, or handling reptiles. People who get the germs on their hands can infect themselves by eating, smoking, or touching their mouths. They can also spread the germs to anyone or anything they touch, especially food, which can then make others sick if not cooked enough to kill the germs. Salmonella is commonly spread from person to person in day-care centers and other environments where hygiene may be poor.

What types of food are most likely to spread salmonella?
Salmonella germs are common in uncooked food products from animals, such as eggs, egg products, meat, meat products, poultry, unpasteurized milk and other unpasteurized dairy products. However, thorough cooking and processing will kill the germ. Salmonella can be in any type of food if salmonella germs get on the food. For example, a food handler with salmonella may get germs on the food if his or her hands are not washed thoroughly before preparing food.

Can salmonella be spread by animals?
Yes. Salmonella germs have been found in the stool (feces) of both sick and apparently healthy animals (and even apparently healthy people). Most common pets and farm animals, including poultry (chickens, geese, etc.), cows, pigs, dogs, cats and reptiles (such as turtles and iguanas) have been found to carry the germ. Salmonella has also been found in some wild animals. Therefore, it is very important to wash your hands well, with plenty of soap and water, after handling these animals.

How can you know for sure if you have salmonellosis?
Your doctor, nurse or health center must send your stool sample to a laboratory. The laboratory then grows germs and tests them to see if any of the germs are salmonella. It takes the lab several days to do this test.

How is the disease treated?
Usually, people who are otherwise healthy will get over the illness without having to be treated. Antibiotics are used to treat salmonellosis only in people whose bodies may not be able to fight off the germ on their own, such as the very young, very old or immunocompromised. If otherwise healthy people take antibiotics to fight salmonella, the germs might actually stay in the body longer than if they had not taken antibiotics. If you think you might have this disease, you should see your doctor or go to your health center. People with diarrhea or vomiting need extra fluids.

How can you prevent salmonellosis?
The most important things to remember are that the germs can only make you sick if you swallow them, and that the germs are killed by thoroughly washing your hands with soap and water and by thorough cooking. Be extra careful when using food products from animals, such as eggs, poultry, meats, and dairy products.

Follow the tips below; if you make them your habits, you can prevent salmonellosis - as well as other diseases:

- Always wash your hands thoroughly with soap and water before eating or preparing food, after using the toilet, after changing diapers, and after touching your pets or other animals (especially reptiles).
- Make sure to thoroughly cook all food products from animals, especially poultry and eggs. Do not eat raw or cracked eggs, unpasteurized milk, or other unpasteurized dairy products.

- Keep food that will be eaten raw, such as vegetables, from becoming contaminated by animal-derived food products. For example, scrub your hands, all utensils and surfaces that have been in contact with raw poultry before you make a salad.
- Avoid letting infants or young children come into contact with reptiles, such as turtles or iguanas. If they do, make sure to wash their hands thoroughly with soap and water.
- If you are taking care of someone with diarrhea, scrub your hands with plenty of soap and water after cleaning the bathroom, helping the person use the toilet, or changing diapers, soiled clothes or soiled sheets.
- If you or your child has persistent diarrhea (with or without a fever), or the diarrhea is very bad, call your doctor or health center for advice.

Are there any restrictions for people with salmonellosis?
Yes. Because salmonellosis is a disease that can easily spread to other people, health care providers are required by law to report cases of salmonellosis to the local board of health. In order to protect the public, workers at food-related businesses who have salmonellosis must stay out of work until they don't have diarrhea and one lab test on a stool sample shows that there are no salmonella germs. Workers in food-related businesses who have diarrhea and live with someone who has salmonellosis must also show that they have no salmonella in their stool. Food-related businesses include restaurants, sandwich shops, hospital kitchens, supermarkets, dairy or food-processing plants. This law also includes workers in schools, residential programs, day-care and health care facilities who feed, give mouth care or dispense medications to clients.

Where can I get more information?

- Massachusetts Department of Public Health
  Division of Epidemiology (617) 983-6800
- Your local board of health
- Listed in the phone book under local government
- Your doctor or health care provider

October 1996

Shigella

What is shigella?
Shigella is a germ (one of the bacteria) that causes an infectious disease (called "shigellosis" or "dysentery") of the bowel. This disease can be treated and most people get better quickly. Severe diarrhea can cause dehydration that can be dangerous for the very young, very old or the chronically ill. In rare cases, the germ can cause problems in other parts of the body.

What are the symptoms?
The most common symptoms are diarrhea, fever, nausea, vomiting, stomach cramps, and straining to have a bowel movement. The stool (feces) may contain blood, mucus or pus. In rare cases, young children with the disease can have seizures. Symptoms can take as long as a week to show up, but most often begin 2 to 4 days after the germs are swallowed. The symptoms usually last for several days, but can last for weeks.

Do all infected people get sick?
No. Some only have mild symptoms and others do not get sick at all. However, these people still shed the germs in their stool and can spread them to others if they are not careful.

How is shigella spread?
The germs must be swallowed to cause disease. They are often spread when people do not wash their hands with soap and water after using the toilet or changing a diaper. People who get the germs on their hands can infect themselves by eating, smoking, or touching their mouths. They can also spread the germs to anyone or anything they touch, even food, which if not cooked thoroughly, can then make others sick.
In rare cases, shigella germs can also be spread through ponds and swimming pools without enough chlorine. When people who have diarrhea swim in the pool or pond, the germs can live in the water and infect other swimmers who then swallow the water or even get their lips wet.

Can shigella be spread by animals?
No. Common pets, farm animals, and wild animals cannot spread these germs; only monkeys and people can.

How can you know for sure if you have shigella?
Your doctor, nurse or health center must send your stool sample or rectal swab to a laboratory. The laboratory then grows germs and tests them to see if any of the germs are shigella. It takes the lab a few days to grow enough germs to test.

How is the disease treated?
Antibiotics are used to treat shigellosis. If you think you might have this disease, you should see your doctor or go to your health center as soon as you can. People with diarrhea or vomiting need extra fluids.

How can you prevent shigellosis?
The two most important things to remember are that shigella can only make you sick if you swallow it and that soap will kill the germ. Follow the tips below; if you make them your habits, you can prevent shigellosis - as well as other diseases.

- Always wash your hands thoroughly with soap and water before eating or touching food and after using the toilet or changing diapers.

- If you are taking care of someone with diarrhea, scrub your hands with plenty of soap and water after cleaning the bathroom, helping the person use the toilet, or changing diapers, soiled clothes or soiled sheets.
- Don't share food, drinks, spoons or straws.
- If you have a child in day-care who has diarrhea, tell the day-care providers so they can make sure the germs are not spread to other children
- Don't let anyone who has diarrhea use a pool or swim in a pond while they are still sick. Be extra careful with small children, even if they are in diapers.
- If you or your child have persistent diarrhea (with or without a fever), or if the diarrhea is very bad, call your doctor or health center for advice.

Are there any health regulations for people with shigellosis?
Yes. Because shigellosis is a disease that can easily spread to other people, health care providers are required by law to report cases of shigellosis to the local board of health. In order to protect the public, workers at food-related businesses who have shigellosis must stay out of work until they don't have diarrhea and one lab test on a stool sample shows that there are no shigella germs. Workers in food-related businesses who have diarrhea and live with someone who has shigellosis must also show that they have no shigella germs in their stool. Food-related businesses include restaurants, sandwich shops, hospital kitchens, supermarkets, dairy or food-processing plants. This law also includes workers in schools, residential programs, day-care and health care facilities who feed, give mouth care or dispense medications to clients.

Where can you get more information?

- Massachusetts Department of Public Health
  Division of Epidemiology (617) 983-6800
- Your local board of health
- Listed in the telephone book under local government
- Your doctor, nurse or health center

October 1996

Fact Sheets in Spanish

Campilobacter

¿Qué es campilobacter (campylobacter)?
El campilobacter es un germen (bacteria) que infecta el intestino en personas y animales. La enfermedad que causa (llamada "campilobacteriosis") es una de las causas más comunes de infección del intestino en los E.E.U.U. La mayoría de las personas infectadas con campilobacter no desarrollan problemas médicos serios. Sin embargo, en casos raros la infección se puede propagar a otras partes del cuerpo tal como a la sangre.

¿Cuáles son los síntomas de campilobacteriosis?
Los síntomas más comunes son diarrea (algunas veces con sangre), dolor abdominal (estómago), cansancio, fiebre, náusea y vómitos. Los síntomas pueden aparecer dentro de 1 a 10 días, pero por lo general empiezan de 2 a 5 días después de haber ingerido los gérmenes. En personas con buena salud, los síntomas usualmente duran de 1 a 4 días, pero a veces duran más tiempo. Si usted tiene alguno de los síntomas mencionados anteriormente debe ver a un médico.

¿Cómo se propaga el campilobacter?
Los gérmenes de campilobacter tienen que ser ingeridos para causar la enfermedad. Usualmente, esto pasa cuando se comen alimentos contaminados con los gérmenes de compilobacter y los cuales no se cocinaron correctamente o no fueron pausterizados (tratamiento para destruir los gérmenes). También puede pasar si alguien toma agua contaminada. El campilobacter se puede encontrar en el excremento (heces) de personas infectadas. La campilobacteriosis se puede propagar de una persona a otra, si la persona infectada prepara la comida para otras personas sin haberse lavado bien las manos después de usar el inodoro. La infección a veces se propaga en centros de cuidado de niños y en otras instituciones porque los niños pequeños o adultos con incapacidades no siempre pueden lavarse bien las manos. Las personas también pueden infectarse a través de sus animales domésticos, especialmente perritos o gatitos.

¿Qué alimentos están contaminados mayormente?
Los gérmenes de campilobacter se encuentran frecuentemente en productos derivados de animales que no están cocinados, tales como las aves (pollo, pavo, etc.), y en la leche sin pasteurizar. Algunas personas han sido infectadas al comer mariscos crudos. Sin embargo, si los alimentos se cocinan completamente y se procesan, esto destruye la bacteria y así se elimina el peligro de contaminación.

¿Pueden los animales propagar el campilobacter?
Sí! Los gérmenes de campilobacter se han encontrado en el excremento (heces) de los animales domésticos y animales de granja (incluyendo ganado, aves, gatos y perros), estén o no enfermos. La bacteria también se ha encontrado en animales salvajes. Por lo tanto, es muy importante el lavarse bien las manos con agua y jabón después de haber tocado los animales o su excremento.

¿Cómo se diagnóstica y cuál es el tratamiento para campilobacteriosis?
Su médico, enfermera, o centro de salud deberá enviar una muestra de su excremento a un laboratorio. El laboratorio hace que los gérmenes se reproduzcan y los analizan para ver si hay gérmenes de campilobacter. Esta prueba toma varios días. La mayoría de las personas se recuperan sin tratamiento, pero algunas personas se pueden enfermar de gravedad. Si cree que usted o alguien en su familia tiene esta enfermedad, vea a un médico o vaya a un centro de salud inmediatamente. Se trata con antibióticos, a las personas que se enferman por un tiempo más largo de lo normal, o cuya situación de trabajo o vivienda aumentan el riesgo de infectar a otros.

¿Cómo puede prevenir la campilobacteriosis?
Lo más importante que debe recordar es que los gérmenes solamente pueden enfermarlo/a si los ingiere y que cocinando completamente las comidas, destruirá el germen. Tenga mucho cuidado cuando use productos derivados de animales. Siga los consejos que le mencionamos en adelante; si se acostumbra hacerlos parte de su rutina diaria, usted podrá prevenir no sólo la campilobacteriosis, sino también otras enfermedades:

- Siempre lávese bien las manos con agua y jabón antes de comer o de preparar los alimentos, después de usar el inodoro, cambiado pañales y de haber tocado sus animales domésticos o limpiado áreas donde éstos han evacuado.
- Cocine completamente todos los alimentos que son productos derivados de animales, especialmente las aves. Si la carne o ave está de color rosado en el centro, esto quiere decir que no está cocida completamente.
- Utilice solamente utensilios limpios, platos y tablas de cortar para preparar la comida que ya se ha cocinado o que se comerá cruda. Lo que haya utilizado para preparar la carne cruda, mariscos, o aves, incluyendo sus manos y la mesa, o la superficie donde los preparó deberán ser lavados antes de tocar otro alimento.
- No coma mariscos crudos o productos lácteos que no han sido pasteurizados (tal como el queso). No tome leche sin pausterizar o coma nada hecho con leche sin pasteurizar.
- No tome de suministros de agua que no han sido tratados cuando vaya de campamento o de excursión.
- Si usted está cuidando a una persona que tiene campilobacteriosis o diarrea, lávese bien las manos con agua y jabón, también deberá lavarse las manos después de limpiar el baño, si ayudó a una persona a usar el inodoro, si cambió pañales, ropa o sábanas sucias.
- Si usted o su niño/a tiene diarrea continua (con o sin fiebre), o si la diarrea es muy severa, llame a su médico o centro de salud para que le digan que debe hacer.

¿Hay algunas regulaciones de salud para las personas con campilobacteriosis?
Sí. Como la campilobacteriosis es una enfermedad que se puede propagar fácilmente a otras personas, la ley requiere que los proveedores de salud reporten los casos de campilobacteriosis al departamento de salubridad local.
Para proteger al público, las personas que tienen campilobacteriosis y que trabajan en sitios donde están en contacto con comida (alimentos), deberán quedarse fuera del trabajo hasta que la diarrea haya desaparecido completamente y una prueba de laboratorio demuestre que no hay gérmenes de campilobacter en el excremento. Si estas personas que diarrea y viven con alguien que tiene campilobacteriosis, también deberán demostrar que no tienen gérmenes de campilobacter en el excremento. Los lugares relacionados con comida incluyen restaurantes, tiendas de sandwishes (emparedados), cocinas en hospitales, supermercados, fábricas para el tratamiento de alimentos o productos lácteos. Esta regulación también incluye a trabajadores en las escuelas, programas residenciales, centros de cuidado de niños y centros de salud los cuales alimentan, proporcionan higiene dental (lavan los dientes de las personas) o dan medicamentos a clientes.

¿Dónde puede obtener más información?

- El Departamento de Salud Pública de Massachusetts (Massachusetts Department of Public Health)
  División de Epidemiología (Division of Epidemiology) 617-983-6800
- Su departamento de sanidad local (your local board of health), enlistado en la guía telefónica bajo gobierno
- A través de su médico, enfermera o centro de salud

March 1997

Criptosporidiosis

¿Qué es criptosporidiosis (cryptosporidiosis)?
Criptosporidiosis es una enfermedad del intestino causada por un germen (un parásito) llamado Cryptosporidium parvum. En 1976 se reconoció por primera vez como el causante de una enfermedad. No fue hasta la primavera del 1993 que la criptosporidiosis ganó atención nacional después de que 400,000 personas en Milwaukee se enfermaron con diarrea por haber tomado agua que contenía este parásito.

¿Cuáles son los síntomas?
Los síntomas más comunes son diarrea aguada. Otras señales y síntomas incluyen pérdida de peso, calambres (retortijones) en el estómago, náusea, vómitos, dolor de cabeza y fiebre leve. Estos síntomas usualmente aparecen entre 2 y 14 días después de ingerir el parásito. En personas que por lo general son saludables, estos síntomas podrían desaparecer por sí mismos entre 1 y 20 días (el promedio es 10 días). Algunas personas no tienen síntomas. En las personas con un sistema inmunológico débil (e.g., personas infectadas con el VIH (HIV), en quimoterapia, o en otros medicamentos), los síntomas son más severos, duran más tiempo y pueden causar deshidratación y hasta la muerte.

¿Cómo se propaga la criptosporidiosis?
El parásito se encuentra en el excremento (heces) de personas infectadas, animales domésticos (especialmente el ganado vacuno) y animales salvajes. La infección ocurre después de ingerirse el parásito. Esto se llama propagación oral-fecal y puede pasar de persona a persona y de animal a animal. La propagación de persona a persona puede suceder cuando las personas infectadas con diarrea, que no pueden controlar las heces, que no tienen buena higiene personal y los niños en pañales no se lavan bien las manos. La propagación oral-fecal también puede ocurrir al tomar agua contaminada, pero es menos probable.
En casos raros, la criptosporidiosis se puede propagar a través de lagos y piscinas si las personas con diarrea nadan en los mismos. Los parásitos pueden vivir en el agua e infectar a otros nadadores al tragarse el agua o mojarse los labios.

¿Quién puede contraer criptosporidiosis?
Cualguier persona puede contraer la infección de criptosporidiosis. Las personas que están en un riesgo mayor de enfermarse seriamente son aquéllas con el sistema

inmunológico débil, tales como las personas infectadas con VIH (HIV), en quimoterapia, o que han recibido un transplante de un órgano y reciben altas dosis de esteroides.

¿Cómo se diagnóstica y cuál es el tratamiento para esta enfermedad?
La criptosporidiosis se diagnostica identificando el parásito en una muestra del excremento.
Para la criptosporidiosis no hay un tratamiento específico que se recomiende. Si la persona está deshidratada habrá que reponer los líquidos. Actualmente hay algunas drogas que se están probando para personas que tienen el sistema inmunológico débil. Para más información hable con su proveedor de salud.

¿Cómo se puede prevenir la criptosporidiosis?
Para reducir sus riesgos de enfermarse o de propagar la infección, siga los siguientes pasos:

- Siempre lávese las manos después de haber usado el inodoro, cambiado pañales y antes de comer o de preparar la comida. Lávese las manos después de tocar animales vacunos.
- No tome leche sin pasteurizar, otros productos lácteos sin pasteurizar o zumo de manzana hecho con manzanas sin lavar.
- No tome agua de riachuelos, arroyos o lagos cuando vaya de excursión o de campamento.
- No tome agua sin hervir cuando vaya de viaje a países en desarrollo o cuando no esté seguro/a de la calidad del agua. Cuando hierva el agua debe hacerlo por un minuto, esto será suficiente para destruir el criptosporidium.
- Siga cualquier recomendación sobre el agua hecha por las autoridades locales y estatales.
  En Massachusetts, las probalidades de que criptosporidium sea un problema en el agua potable que el público toma es baja. Sin embargo, las personas que tienen problemas con el sistema inmunológico podrían enfermarse de gravedad si se infectan con este parásito, por lo tanto en adelante le mencionamos otras recomendaciones adicionales que debe considerar:
- Debe ser muy cuidadoso/a particularmente evitando el contacto con heces (e.g., contacto con el excremento).
- Evite las prácticas sexuales que envuelvan contacto directo con materia fecal (excremento).
- Debe hervir el agua del grifo (pluma) por un minuto antes de tomarla o de hacer hielo.
- Considere usar un sistema de filtración para el agua con un filtro fino (tamaño exacto de un poro de un micrón o más pequeño). Estos filtros incluyen: filtros de osmosis reversibles; filtros con la etiqueta de "absolute" filtro de un micrón; y los que están con la etiqueta de aprobación del National Sanitation Foundation (NSF) estándar #53 para remover quistes. Use el sistema de filtración del agua de acuerdo a las instrucciones del fabricante.

- Evite tragar agua cuando nade. Los lagos, riachuelos (y otras superficies de agua) y piscinas podrían estar contaminadas con criptosporidium, y el cloro no destruye al parásito.

Aviso: El agua en botella se puede usar, pero a ésta no le hacen pruebas para ver si tiene criptosporidium y por lo tanto no se puede garantizar que esté libre de parásitos. Para más información acerca de filtros para el agua, escriba una carta a la siguiente dirección: NSF 3475 Plymouth Road, P.O. Box 130140, Ann Arbor, Michigan 48113-0140. El número de teléfono es: (800) 673-8010.

¿Hay algunas regulaciones de salud para las personas con criptosporidiosis?
Sí. Como la criptosporidiosis es una enfermedad que se puede propagar fácilmente a otras personas, la ley requiere que los proveedores de salud reporten los casos de criptosporidiosis al departamento de salubridad local.
Para proteger al público, las personas que tienen criptosporidiosis y que trabajan en sitios donde están en contacto con comida (alimentos), deberán quedarse fuera del trabajo hasta que la diarrea haya desaparecido completamente y una prueba de laboratorio demuestre que no hay gérmenes de criptosporidium en el excremento. Si estas personas tienen diarrea y viven con una persona que tiene criptosporidiosis, también deberán demostrar que no tienen criptosporidium en el excremento. Los lugares relacionados con comidas incluyen restaurantes, tiendas de sandwiches (emparedados), cocinas en hospitales, supermercados, fábricas para el tratamiento de comidas o productos lácteos. Esta regulación también incluye a trabajadores en las escuelas, programas residenciales, centros de cuidado de niños y centros de salud los cuales alimentan, proporcionan higiene dental (lavan los dientes de las personas) o dan medicamentos a clientes.

¿Dónde puede obtener más información?

- El Departamento de Salud Pública de Massachusetts (Massachusetts Department of Public Health)
  División de Epidemiología (Division of Epidemiology) 617-983-6800
- Su departamento de sanidad local (your local board of health), enlistado en la guía telefónica bajo gobierno
- A través de su médico, enfermera o centro de salud

March 1997

E. coli O157:H7

¿Qué es E. coli 0157:H7?
E. coli es un germen (bacteria) que por lo general vive en el intestino de las personas y animales. La mayoría de estos gérmenes son inofensivos, pero el tipo que se llama *E. coli* 0157:H7 puede enfermar a las personas.

¿Cuáles son los síntomas?
Los síntomas más comunes son calambres (retortijones) en el estómago y diarrea. Algunas personas vomitan o tienen fiebre, pero estos síntomas no son comunes. A veces la diarrea puede contener sangre después de 2 ó 3 días. Estos síntomas usualmente desaparecen solos después de 6 ó 7 días. En pocas personas, este tipo de E. coli puede causar un problema poco común, pero serio llamado síndrome hemolítico urémico/SHU (hemolytic uremic syndrome/HUS).

¿Qué es SHU (HUS)?
SHU (HUS) es una enfermedad que afecta los riñones y el sistema de coagulación de la sangre. Empieza alrededor de una semana después de la diarrea y afecta más a los niños que a los adultos. En casos severos, se utiliza la diálisis para hacer el trabajo de los riñones. Algunas personas también desarrollan problemas de sangramiento o conteo bajo de sangre (anemia). La mayoría de las personas que se enferman con SHU (HUS) se recuperan sin problemas de sangramiento o de los riñones.

¿Dónde se encuentra el E. coli 0157:H7?
El E. coli 0157:H7 vive en las entrañas del ganado vacuno que es saludable y se puede meter en la carne durante la matanza. Los gérmenes se destruyen cuando la carne se cocina completamente. La fuente de transmisión más común es la carne molida (hamburguesa), porque al ser molida riega los gérmenes en toda la carne. Estos gérmenes también se han encontrado en la leche sin pasteurizar, carne asada cruda, zumo de manzana sin pasteurizar, salami y a veces en vegetales que se fertilizaron con estiércol (abono) de la vaca.

¿Cómo se propaga?
El E.coli 0157:H7 tiene que ser tragado para causar la enfermedad. Esto puede pasar si usted come o bebe algo que contiene estos gérmenes y que no se cocinó o pasteurizó correctamente. Los gérmenes se pueden propagar de persona a persona si alguien que está infectado no se lava bien las manos con agua y jabón antes de preparar la comida para otros. La propagación del E. coli es más común de esta manera en familias y centros de cuidado de niños, que en escuelas y restaurantes.

¿Cómo se diagnóstica el E. coli 0157:H7?
La infección con este germen solamente se puede diagnosticar por medio de una prueba del excremento. No es una prueba de rutina, así que si su médico o enfermera piensa que usted tiene E. coli 0157:H7, el/ella le pedirá al laboratorio que le hagan una prueba.

¿Cuál es el tratamiento para la enfermedad?
No hay tratamiento para el E. coli 0157:H7. Los antibióticos no ayudan y pueden ser peligrosos. No trate de parar la diarrea, la cual desaparecerá por si misma en pocos días. Solamente tome muchos líquidos para reemplazar los líquidos que se han perdido. En los casos más severos de SHU (HUS), a veces se usa diálisis o transfusiones hasta que los riñones y sangre vuelven a la normalidad.

¿Cómo puede prevenirla?
Lo más importante que debe recordar es que los gérmenes solamente pueden enfermarlo/a si los ingiere, que puede destruirlos si se lava bien las manos con agua y jabón, y si cocina completamente las comidas. Siga los consejos que le mencionamos en adelante; si se acostumbra hacerlos parte de su rutina diaria, usted podrá prevenir no sólo el E. coli 0157:H7, sino también otras enfermedades:

- No coma productos lácteos sin pasteurizar (tal como el queso) o carne molida a medio cocinar o cruda. No tome leche sin pasteurizar o zumo hecho con manzanas sin lavar.
- Cocine la carne hasta que el centro este marrón, no rosa. Cocine las hamburguesas hasta que el centro esté a 155°F.
- No ponga carne cocida o cualquier otra comida que esté preparada en un plato o tabla de cortar donde hubo carne cruda.
- Siempre debe lavarse bien las manos con agua y jabón después de haber usado el inodoro o cambiado un pañal. Lávese las manos nuevamente antes de tocar los alimentos o comer.

¿Hay algunas restricciones para las personas con *E. coli* 0157:H7?
Sí. Como el E. coli 0157:H7 es una enfermedad que se puede propagar fácilmente a otras personas, la ley requiere que los proveedores de salud reporten los casos de E. coli 0157:H7 al departamento de salubridad local.
Para proteger al público, las personas que tienen E. coli 0157:H7 y que trabajan en sitios donde están en contacto con comida (alimentos), deberán quedarse fuera del trabajo hasta que la diarrea haya desaparecido completamente y una prueba de laboratorio demuestre que no hay gérmenes de E. coli 0157:H7 en el excremento. Si estas personas tienen diarrea y viven con alguien que tiene *E. coli* 0157:H7, también deberán demostrar que no tienen gérmenes en el excremento. Los lugares relacionados con comidas incluyen restaurantes, tiendas de sandwiches (emparedados), cocinas en hospitales, supermercados, fábricas para el tratamiento de comidas o productos lácteos. Esta regulación también incluye a trabajadores en las escuelas, programas residenciales, centros de cuidado de niños y centros de salud los cuales alimentan, proporcionan higiene dental (lavan los dientes de las personas) o dan medicamentos a clientes.

¿Dónde puede obtener más información?

- El Departamento de Salud Pública de Massachusetts (Massachusetts Department of Public Health)
  División de Epidemiología (Division of Epidemiology) 617-983-6800
- Su departamento de sanidad local (your local board of health), enlistado en la guía telefónica bajo gobierno
- A través de su médico, enfermera o centro de salud

March 1997

Giardiasis

¿Qué es giardia?
Giardia es un germen (un parásito) que causa una enfermedad infecciosa ("giardiasis") que afecta al estómago y al intestino. El germen de giardia es la causa más común de la diarrea en los Estados Unidos.

¿Cuáles son los síntomas de giardiasis?
Los síntomas más comunes son diarrea, excremento blando con mal olor, calambres (retortijones) en el estómago, hinchazón, aumento de gases, pérdida de apetito y peso. Los síntomas de giardiasis usualmente aparecen entre 7 y 10 días (pero a veces pueden tomar hasta 4 semanas en aparecer) después de haber ingerido los gérmenes. Los síntomas pueden aparecer y desaparecer por semanas en una persona que no ha recibido tratamiento.

¿Se enferman todas las personas infectadas con giardia?
No. Algunas personas infectadas con el parásito, solamente tienen síntomas leves y otras no tienen síntomas de ninguna clase.

¿Cómo se propaga la giardiasis?
El parásito tiene que ser ingerido para causar la enfermedad. Usted puede infectarse con giardia si come alimentos o toma agua contaminada con el germen. Los parásitos se multiplican en el intestino delgado y se pasan con la evacuación. La giardiasis por lo general se propaga cuando las personas no se lavan las manos con agua y jabón después de usar el inodoro o de cambiar un pañal. Las personas que tienen los gérmenes en sus manos pueden infectarse a sí mismos al comer, fumar, o cuando se tocan la boca. También pueden propagar el germen a cualquier cosa que toquen, incluyendo la comida, la cual puede enfermar a otros. Los parásitos de giardia mayormente se propagan de persona a persona, tal como en centros de cuidado de niños y en instituciones donde la higiene personal no es buena debido a la edad (infancia o ancianidad) o por incapacidad. La giardiasis también puede propagarse de esta manera en el hogar.

¿Pueden los animales propagar la giardiasis?
Sí. Los parásitos de giardia se han encontrado en el excremento (heces) de muchos animales, incluyendo roedores, perros, gatos, ganado y animales salvajes. También se han encontrado en animales que viven cerca de suministros de agua, tales como el castor y la rata almizclada. Si estos animales contaminan el agua con su excremento, las personas se pueden enfermar si toman o nadan en el agua.

¿Cómo puede saber con seguridad si tiene giardiasis?
Su médico, enfermera o centro de salud deberá mandar una muestra de su excremento al laboratorio. El laboratorio mirará la muestra con un microscopio para ver si hay parásitos de giardia. Los gérmenes por lo general son difíciles de ver, por lo tanto ellos podrían necesitar más muestras de su excremento. Esta es la manera más común para averiguar si alguien tiene giardiasis. La giardia también se puede diagnosticar con una prueba de laboratorio utilizando una muestra del fluído o una biopsia del intestino delgado.

¿Cuál es el tratamiento para la giardiasis?
Hay varios medicamentos que se usan para el tratamiento de la infección por giardia y solamente se obtienen con una receta médica. Su médico también le puede recomendar que tome muchos líquidos como tratamiento para la diarrea.

¿Cómo se puede prevenir la giardiasis?
La giardiasis se puede prevenir por medio de una buena higiene y si usa precaución antes de tomar agua de origen desconocido.

Algunas reglas prácticas son:

- Siempre lávese bien las manos con agua y jabón antes de comer o de preparar las comidas, después de usar el inodoro, cambiado pañales y de haber tocado a sus animales domésticos.
- No tome agua que no ha sido tratada de la superficie de un suministro de agua, tal como de un estanque, lago o riachuelo (arroyo). Aunque el agua se vea limpia, puede contener parásitos de giardia, los cuales no se pueden ver sin un microscopio. Si ésta es la única agua que hay para beber, deberá hervirla por un minuto antes de tomarla.
- Si está cuidando a una persona con giardiasis, lávese bien las manos con agua y jabón después de haber tenido contacto con el excremento de esa persona (por ejemplo, después de haber cambiado pañales). Inmediatamente y con cuidado deshágase de cualquier material contaminado con el excremento, y siempre lávese las manos después de haber hecho esto.
- Si toma agua de un pozo o de la superficie de un sumistro de agua privada, no permita defecar (evacuar, hacer necesidades) a personas o animales cerca del agua. Comuníquese con su departamento de salubridad para que le aconsejen como mantener su suministro de agua limpio. Si usa filtros para el agua, esto también podrá ayudar para deshacerse de los parásitos de giardia en el agua contaminada.

¿Hay algunas regulaciones de salud para las personas con giardiasis?
Sí. Como la giardiasis es una enfermedad que se puede propagar fácilmente a otras personas, la ley requiere que los proveedores de salud reporten los casos de giardia al departamento de salubridad local.
Para proteger al público, las personas que tienen giardiasis y que trabajan en sitios donde están en contacto con comida (alimentos), deberán quedarse fuera del trabajo hasta que la diarrea haya desaparecido completamente y una prueba de laboratorio demuestre que no hay parásitos de giardiasis en el excremento. Si estas personas tienen diarrea y viven con alguien que tiene giardiasis, también deberán demostrar que no tienen parásitos de giardia en el excremento. Los lugares relacionados con comidas incluyen restaurantes, tiendas de sandwiches (emparedados), cocinas en hospitales, supermecados, fábricas para el tratamiento de comidas o productos lácteos. Esta regulación también incluye a trabajadores en las escuelas, programas residenciales, centros de cuidado de niños y centros de salud los cuales alimentan, proporcionan higiene dental (lavan los dientes de las personas) o dan medicamentos a clientes.

¿Dónde puede obtener más información?

- El Departamento de Salud Pública de Massachusetts (Massachusetts Department of Public Health)
  División de Epidemiología (Division of Epidemiology) 617- 983-6800
- Su departamento de sanidad local (your local board of health), enlistado en la guía telefónica bajo gobierno
- A través de su médico, enfermera o centro de salud

March 1997

Hepatitis A

¿Qué es hepatitis A?
Hepatitis A, también llamada hepatitis infecciosa, es una enfermedad contagiosa ocasionada por un virus que hace que se hinche el hígado. Puede tomar de 15 a 50 días el enfermarse después de haber estado expuesto al virus de la hepatitis A. El promedio es alrededor de un mes.

¿Cuáles son los síntomas?
Los síntomas dependen de la edad de la persona. Los adultos y adolescentes son las personas más probables de tener los síntomas típicos de fiebre, fatiga, pérdida de apetito, náusea e ictericia. Las señales de ictericia incluyen orín marrón obscuro y excremento (heces) claro. El área blanca de los ojos se pone amarilla, como también podría ponerse la piel de personas de tez clara. Los niños pequeños que tienen hepatitis A por lo general tienen síntomas como los de la gripe, malestar en el estómago, o ningún síntoma. Es bien raro que les dé ictericia. Los síntomas de hepatitis A pueden durar de una a dos semanas. Algunos adultos pueden sentirse enfermos por varios meses, pero es raro que esto ocurra.

¿Cómo se propaga?
El virus de la hepatitis A se encuentra usualmente en el excremento (heces) de las personas infectadas. El virus se propaga por lo general cuando las personas no se lavan las manos después de haber usado el inodoro, cambiado un pañal o sábanas sucias, luego se tocan la boca, preparan las comidas para otros, o tocan a otras personas con sus manos contaminadas. Esto propaga la enfermedad de persona a persona. También se puede propagar a través de la comida (tal como mariscos) o agua contaminada.
El momento de mayor riesgo de propagar el virus a otros es durante las dos semanas antes de que los síntomas empiecen. La mayoría de las personas dejan de ser contagiosas después de haber tenido los síntomas por una semana. A diferencia de otros virus de hepatitis, la hepatitis A usualmente no se propaga por medio de la sangre.

¿Quién puede contraer la hepatitis A?
Cualquier persona puede contraerla. Las personas que viven o tienen relaciones sexuales con personas que tienen la enfermedad están en un riesgo mayor de contagiarse. La hepatitis A se propaga entre los niños pequeños en los centros de cuidado de niños porque muchos están en pañales y todavía no se pueden lavar las manos. La mayoría de

las veces nadie sabe que ellos tienen la enfermedad porque no tienen síntomas. La enfermedad se propaga menos entre niños que están en edad escolar porque éstos sí demuestran síntomas, además la mayoría ha aprendido a lavarse las manos antes de comer y después de usar el inodoro.

¿Cómo se diagnóstica?
En una prueba de sangre se mira para ver si hay anticuerpos que combaten el virus. Esta prueba de sangre puede diferenciar entre una infección actual y una anterior. También hay pruebas de sangre para medir cuanto daño ha tenido el hígado, pero éstas no indican que causó el daño.

¿Cuál es el tratamiento para la hepatitis A?
No hay cura para esta enfermedad y la mayoría de las personas no necesitan una. Problemas tales como los de la retención de líquido y anormalidades en la sangre son raras, pero éstas pueden ser tratadas.

¿Cómo puede prevenir la hepatitis A?

- **Lávese las manos.**
  Al lavarse bien las manos, se estará protegiendo contra la hepatitis A y muchas otras enfermedades. **Siempre** lávese las manos bien con agua y jabón antes de tocar la comida o comer y después de usar el inodoro o de cambiar un pañal.
- **Cocine los mariscos.**
  No coma mariscos crudos o a medio cocinar. Cuando se cocinan completamente ésto destruirá el virus de la hepatitis A.
- **Deberá vacunarse contra la hepatitis A si:**
  - Tiene planeado viajar o trabajar en un país con una incidencia alta de hepatitis A (Méjico; todos los países de Centroamérica y Suramérica; los países Africanos, del Caribe y Asiáticos exceptuando al Japon; y los países de Europa del Sur y del Este).
  - Vive en una comunidad con una incidencia alta de hepatitis A (Reservaciones de Nativos Americanos, Villas de Nativos de Alaska, Villas de las Islas del Pacífico, y algunas comunidades Hispanas y religiosas).
  - Tiene una enfermedad crónica del hígado.
  - Tiene un problema de sangramiento y está recibiendo un factor de coagulación.
  - Usa cualquier tipo de drogas ilegales.
  - Es un hombre que tiene relaciones sexuales con otros hombres.
- **Deberá recibir immune globulin (IG) inmunoglobulina si:**
  - No se ha vacunado y ha estado expuesto a la hepatitis A. La IG funciona mejor si la recibe en un período de dos semanas después de haber estado expuesto.
  - Es alérgico a la vacuna y decidió no recibirla y va a viajar a un área donde hay incidentes altos de hepatitis A.
- **Sus niños deberán recibir immune globulin (IG) inmunoglobulina si:**

- Son menores de dos años y van a viajar o vivir con usted en un área con alta incidencia de hepatitis A. Ellos necesitarán IG, porque la vacuna no se le puede poner a niños menores de dos años edad.

¿La IG me hará inmune a la hepatitis A?
No. La IG sólo protege parcialmente de 3 a 5 meses contra el virus de la hepatitis A. Usted todavía puede contraer la enfermedad y contagiar a otros, pero la IG puede hacer que los síntomas sean más leves. Si cree que existe riesgo de exponerse de nuevo, debe hablar con su médico acerca de recibir la vacuna para la hepatitis A, la cual lo/la puede proteger por muchos años.

¿Hay algunas regulaciones de salud para las personas con hepatitis A?
Sí. Como la hepatitis A se puede propagar fácilmente a otras personas, la ley requiere que los médicos reporten los casos de hepatitis A al departamento de salubridad local. Para proteger al público, las personas que tienen hepatitis A y que trabajan en sitios donde están en contacto con comida (alimentos), no podrán trabajar hasta que la fiebre haya desaparecido completamente y haya pasado una semana desde que los síntomas empezaron. Los compañeros de trabajo podrían necesitar la IG. Los lugares relacionados con comidas incluyen restaurantes, tiendas de sandwiches (emparedados), cocinas en hospitales, fábricas para el tratamiento de alimentos o productos lácteos y cualquier otro establecimiento donde los trabajadores estén en contacto con alimentos o bebidas, proporcionen higiene dental (tal como lavándole los dientes a las personas), o den medicinas.

¿Dónde puede obtener más información?

- A través de su médico, enfermera o centro de salud
- Su departamento de sanidad local (your local board of health), enlistado en la guía telefónica bajo gobierno
- El Departamento de Salud Pública de Massachusetts (Massachusetts Department of Public Health),
  División de Epidemiología e Inmunización (Division of Epidemiology and Immunization) 617-983-6800

March 1997

Salmonela

¿Qué es salmonela (salmonella)?
La salmonela son gérmenes (bacteria) que ocasionan una enfermedad infecciosa (llamada "salmonelosis") del intestino en personas y animales. Aunque la enfermedad usualmente se mantiene en el intestino y la mayoría de las personas infectadas no tienen complicaciones médicas serias, el germen de la salmonela se puede propagar a otras partes del cuerpo, tal como a la sangre o huesos. Esto puede causar complicaciones serias en infantes y ancianos (personas mayores) o en personas que tienen problemas con el sistema inmunológico.

¿Cuáles son los síntomas?
Los síntomas más comunes son calambres (retortijones) en el estómago, diarrea, fiebre, náusea y a veces vómitos. Los síntomas pueden tardar hasta 3 días en aparecer, pero por lo general empiezan de 12 a 36 horas después de haberse tragado los gérmenes. Los síntomas pueden durar varios días. Algunas personas con salmonelosis pueden enfermarse seriamente y tiene que ser hospitalizados.

¿Cómo se propaga la salmonela?
Los gérmenes tienen que ser ingeridos para causar la enfermedad. Usualmente esto pasa cuando se comen alimentos que han sido contaminados con los gérmenes porque no fueron manejados, preparados o cocinados correctamente. Los gérmenes también pueden transmitirse cuando las personas no se lavan bien las manos con agua y jabón después de usar el inodoro, cambiado pañales, o tocado reptiles. Las personas que tienen los gérmenes en sus manos pueden infectarse a sí mismos al comer, fumar o al tocarse la boca. También pueden propagar el germen a cualquier persona o cosa que toquen, especialmente los alimentos, los cuales pueden enfermar a otros si no se cocinan completamente para destruir los gérmenes. La salmonela se propaga de persona a persona en centros de cuidado de niños y en otros ambientes donde el cuidado de higiene no es bueno.

¿Qué alimentos propagan la enfermedad mayormente?
Los gérmenes de salmonela son más comunes en productos derivados de animales que no están cocinados, tal como los huevos, productos del huevo, carne, productos de la carne, aves, leche sin pasteurizar y otros productos lácteos. Sin embargo, cuando se cocinan completamente y se procesan esto destruye el germen. La salmonela puede estar en cualquier tipo de alimento si estos se contaminan con los gérmenes de salmonela. Por ejemplo, una persona que maneja alimentos y tiene salmonela puede pasar sus gérmenes a la comida que está preparando si no se lava bien las manos antes de tocarla.

¿Pueden los animales propagar la salmonela?
Sí. Los gérmenes de salmonela se han encontrado en el excremento (heces) de ambos, animales enfermos y aparentemente saludables (y hasta en personas que se ven saludables). Los animales domésticos y de granja más comunes, incluyendo aves (gallinas, gansos y demás aves), vacas, puercos, perros, gatos y reptiles (tortugas e iguanas) han tenido el germen. La salmonela también se ha encontrado en animales salvajes. Por lo tanto, es muy importante el lavarse bien las manos con agua y jabón después de haber tocado a estos animales.

¿Cómo puede saber con seguridad si tiene salmonelosis?
Su médico, enfermera o centro de salud deberá mandar una muestra de su excremento al laboratorio. En el laboratorio hacen que los gérmenes se reproduzcan y los analizan para ver si alguno de los gérmenes es salmonela. Al laboratorio le toma varios días el hacer esta prueba.

¿Cuál es el tratamiento para esta enfermedad?
Usualmente, las personas que tienen buena salud se recuperan de la enfermedad sin necesidad de tratamiento. Se utilizan antibióticos para tratar la salmonelosis solamente en personas que tienen dificultad en combatir la enfermedad, tales como personas muy jóvenes, ancianos (mayores de edad) o que tienen problemas con su sistema inmunológico. Si las personas que son saludables toman antibióticos para combatir la salmonela, esto podría hacer que los gérmenes se quedaran en el cuerpo más tiempo de lo que se hubieran quedado si no hubieran tomado antibióticos. Si usted cree que tiene esta enfermedad, debe ver a su médico o ir a su centro de salud. Las personas que tienen diarrea o vómitos necesitan muchos líquidos.

¿Cómo puede prevenir la salmonelosis?
Lo más importante que debe recordar es que los gérmenes solamente pueden enfermarlo/a si los ingiere, y que los gérmenes se destruyen al lavarse bien las manos con agua y jabón, y cuando cocina completamente la comida (los alimentos). Tenga mucho cuidado cuando use productos derivados de animales, tales como huevos, aves, carnes y productos lácteos. Siga los consejos que le mencionamos más adelante; si se acostumbra a hacerlos parte de su rutina diaria, usted podrá prevenir no sólo la salmonelosis, sino también otras enfermedades:

- Lávese bien las manos con agua y jabón antes de comer o de preparar comida, después de usar el inodoro, cambiado pañales y de haber tocado sus animales domésticos u otros animales (especialmente reptiles).
- Cocine completamente todas las comidas que son productos de animales, especialmente las aves y huevos. No coma huevos crudos o rotos, leche sin pasteurizar, u otros productos lácteos que no estén pasteurizados.
- Mantenga la comida que se comerá cruda, tales como los vegetales, en otro sitio donde no puedan ser contaminados por alimentos derivados de animales. Por ejemplo, lávese bien las manos, lave los utensilios de cocina y las superficies que han estado en contacto con carne cruda antes de hacer la ensalada.
- Debe evitar que los infantes o niños pequeños tengan contacto con reptiles, tales como las tortugas o iguanas. Si tienen contacto con éstas, deberá lavarle bien las manos con agua y jabón.
- Si usted está cuidando a una persona que tiene diarrea, lávese bien las manos con agua y jabón, también deberá lavarse las manos después de limpiar el baño, si ayudó a una persona a usar el inodoro, o si cambió pañales, ropa sucia o sábanas sucias.
- Si usted o su niño/a tiene diarrea continua (con o sin fiebre), o la diarrea es muy severa, llame a su médico o centro de salud para que le digan que debe hacer.

¿Hay algunas restricciones para las personas con salmonelosis?
Sí. Como la salmonelosis es una enfermedad que se puede propagar fácilmente a otras personas, la ley requiere que los proveedores de salud reporten los casos de salmonelosis al departamento de salubridad local.
Para proteger al público, las personas que tienen salmonelosis y que trabajan en sitios donde están en contacto con comida (alimentos), deberán quedarse fuera del trabajo hasta

que la diarrea haya desaparecido completamente y una prueba de laboratorio demuestre que no hay gérmenes de salmonela en el excremento. Si estas personas tienen diarrea y viven con alguien que tiene salmonelosis, también deberán demostrar que no tienen salmonela en el excremento. Los lugares relacionados con comidas incluyen restaurantes, tiendas de sandwiches (emparedados), cocinas en hospitales, supermercados, fábricas para el tratamiento de alimentos o productos lácteos. Esta ley también incluye a trabajadores en las escuelas, programas residenciales, centros de cuidado de niños y centros de salud los cuales alimentan, proporcionan higiene dental (lavan los dientes de las personas) o dan medicamentos a clientes.

¿Dónde puede obtener más información?

- El Departamento de Salud Pública de Massachusetts (Massachusetts Department of Public Health)
  División de Epidemiología (Division of Epidemiology) 617-983-6800
- Su departamento de sanidad local (your local board of health), enlistado en la guía telefónica bajo gobierno
- A través de su médico, enfermera o centro de salud

March 1997

Shigela

¿Qué es shigela (shigella)?
Shigela es un bacilo (una bacteria) que causa una enfermedad infecciosa (llamada "shigelosis" o "disentería bacilar") del intestino. Esta enfermedad se puede curar y la mayoría de las personas se mejoran rápidamente. Si la diarrea es muy severa puede causar deshidratación, la cual puede ser peligrosa en los niños pequeños, ancianos o personas con enfermedades crónicas. En casos raros, el germen puede causar problemas en otras partes del cuerpo.

¿Cuáles son los síntomas?
Los síntomas más comunes son diarrea, fiebre, náusea, vómitos, calambres (retortijones) en el estómago y el hacer esfuerzo para poder evacuar. El excremento (heces) puede tener sangre, mucosidad o pus. En casos raros, los niños pequeños que tienen la enfermedad pueden tener convulsiones. Los síntomas pueden tardar hasta una semana en aparecer, pero por lo general aparecen entre 2 y 4 días después de haber ingerido los gérmenes. Los síntomas usualmente duran varios días, pero pueden durar por semanas.

¿Se enferman todas las personas que se han infectado?
No. Algunas personas infectadas tienen síntomas leves y otras ninguno. Sin embargo, estas personas pasan el germen por el excremento y pueden infectar a otras personas si no tienen cuidado.

¿Cómo se propaga la shigela?
Los gérmenes tienen que ser ingeridos para causar la enfermedad. La shigela por lo

general se propaga cuando las personas no se lavan bien las manos con agua y jabón después de usar el inodoro o cambiado un pañal. Las personas que tienen los gérmenes en sus manos pueden infectarse a sí mismos al comer, fumar, o al tocarse la boca. También pueden propagar el germen a cualquier persona o cosa que toquen, incluyendo los alimentos, los cuales pueden enfermar a otros si no se cocinan completamente para destruir los gérmenes.
En casos raros, los gérmenes de shigela también se pueden propagar a través de los estanques y piscinas que no contienen suficiente cloro. Los gérmenes de las personas que nadan en las piscinas o estanques, pueden vivir en el agua e infectar a otros nadadores al tragarse el agua o mojarse los labios.

¿Pueden los animales propagar la shigela?
Los animales domésticos, animales de granja y animales salvajes no pueden propagar estos gérmenes; solamente los monos y personas.

¿Cómo puede saber con seguridad si tiene shigela?
Su médico, enfermera o centro de salud debe mandar una muestra de su excremento al laboratorio. En el laboratorio hacen que los gérmenes se reproduzcan y los analizan para ver si alguno de los gérmenes es shigela. Al laboratorio le toma varios días el reproducir suficientes gérmenes para la prueba.

¿Cuál es el tratamiento para esta enfermedad?
Los antibióticos se utilizan para el tratamiento de la shigelosis. Si cree que tiene esta enfermedad, debe ver a su médico o ir a su centro de salud lo antes posible. Las personas con diarrea o vómitos necesitan tomar muchos líquidos.

¿Cómo puede prevenir la shigelosis?
Lo más importante que debe recordar es que los gérmenes de shigela solamente puede enfermarlo/a si usted los ingiere, y se destruyen al lavarse bien las manos con agua y jabón. Siga los consejos que le mencionamos en adelante; si se acostumbra hacerlos parte de su rutina diaria, usted podrá prevenir no sólo la shigelosis, sino también otras enfermedades:

- Lávese bien las manos con agua y jabón antes de comer o de preparar la comida y después de usar el inodoro o cambiado pañales.
- Si usted está cuidando a una persona con diarrea, lávese bien las manos con agua y jabón después de limpiar el baño o de ayudar a la persona a usar el inodoro y de haber cambiado pañales, ropa o sábanas sucias.
- No comparta comidas, bebidas, cucharas o sorbetos.
- Si usted tiene un niño/a con diarrea en un centro de cuidado de niños, dígaselo a las personas encargadas para que ellas se aseguren de que los otros niños no se contagien.
- No permita que ninguna persona con diarrea use su piscina o nade en un estanque mientras estén enfermas. Tenga mucho cuidado con los niños pequeños, aunque usen pañales.

- Si usted o su niño/a tiene diarrea continua (con o sin fiebre), o la diarrea es muy severa, llame a su médico o centro de salud para que le digan que debe hacer.

¿Hay algunas regulaciones de salud para las personas con shigelosis?
Sí. Como la shigelosis es una enfermedad que se puede propagar fácilmente a otras personas, la ley requiere que los proveedores de salud reporten los casos de shigelosis al departamento de salubridad local.
Para proteger al público, las personas que tienen shigelosis y que trabajan en sitios donde están en contacto con comida (alimentos), deberán quedarse fuera del trabajo hasta que la diarrea haya desaparecido completamente y una prueba de laboratorio demuestre que no hay gérmenes de shigela en el excremento. Si estas personas tienen diarrea y viven con una persona que tiene shigelosis, también deberán demostrar que no tienen gérmenes de shigela en el excremento. Los lugares relacionados con comidas incluyen restaurantes, tiendas de sandwishes (emparedados), cocinas en hospitales, supermercados, fábricas para el tratamiento de comidas o productos lácteos. Esta ley también incluye a trabajadores en las escuelas, programas residenciales, centros de cuidado de niños y centros de salud los cuales alimentan, proporcionan higiene dental (lavan los dientes de las personas) o dan medicamentos a clientes.

¿Dónde puede obtener más información?

- El Departamento de Salud Pública de Massachusetts (Massachusetts Department of Public Health)
  División de Epidemiología (Division of Epidemiology) 617-983-6800
- Su departamento de sanidad local (your local board of health), enlistado en la guía telefónica bajo gobierno
- A través de su médico, enfermera o centro de salud

March 1997

Appendix E

SAMPLE FORMS AND LETTERS

Food Establishment Inspection Report

Inspection Equipment Checklist

Embargo Notice/Embargo Tag

Order Letter for Submission of Stool Specimens

Official Order for Correction

Food Handler Handwashing Notice

Enteric Culture Instruction Form

Press Release

Public Notice

HACCP Risk Assessment Forms

PHF Temperatures

For other forms, see:

Chapter 4 - Diseases Reportable by Healthcare Providers
Appendix A - Hepatitis A Worksheet
Appendix B - Food Sample Collection Procedures
Food Sample Submission Form

NOTE: The following forms are unavailable by the internet. A copy of each can be obtained by calling the Massachusetts Department of Public Health, Food Protection Program: 617-983-6712.

- **Food Establishment Inspection Report**
- **Embargo Notice/Embargo Tag**
- **Order Letter for Submission of Stool Specimens**

INSPECTION EQUIPMENT CHECKLIST

TYPE OF EQUIPMENT	***USE/TIPS***
1. Picture I.D.	1. Always identify yourself
2. Business Cards	2. Assists in access to you and your department
3. Inspection Forms	3. Documentation, documentation, documentation!!!
- 52 Item Report, page 1	- inspection checklist
- Narrative page 2	- descriptive writing
- Correction Order	- additional language for enforcement purposes
- Voluntary Condemnation	- for voluntary disposal of food
- Embargo	- for mandatory embargo of food
4. Regulations (i.e., "590")	4. For reference
5. Educational materials	5. For distribution and reinforcement
6. Clipboard	6. To hold forms and paper
7. Pens & Pencils & Markers	7. Report writing and marking sample bags
8. Flashlight	8. To inspect poorly lit areas
9. Thermometers	9. To monitor food & equipment temperatures
- probe/bayonet (0-220^0 F)	- food temperature/calibrate routinely
- maximum registering or	- high temperature dishmachines final rinse
- thermolables (160^0 F)	-a wash/rinse of 150^0/180^0 F or 165^0/165^0 F provides a plate temperature of 160^0 F. Don't store in a hot car!
- T-stick	- disposable hamburger thermometer
10. Alcohol swabs	10. To disinfect food thermometer
11. Sanitizer Test Kits	11. Don't store these in a hot car
- Chlorine	- 50 - 200 ppm/white kit turns blue-grey
- Quaternary ammonia	- generally 200 ppm/orange kit turns brownish green
- Iodine	- 12.5 - 50 ppm/white kit turns blue-grey
12. Ruler & Tape Measure	12. To take measurements
13. Hair Restraint	13. Use during inspection/sets a good example!
14. White Lab Coat	14. Professional appearance
15. Disposable Gloves	15. For handling food
HAVE ACCESS TO:	
1. Sterile Bags & Vials	1. For sampling
2. Embargo Tags & Notices	2. To embargo food
3. Cooler & Ice Packs	3. For transporting & storing samples
4. Camera & Film	4. Evidence
5. Black Light	5. To detect rodent urine/use with glo-germ for handwashing demonstrations
6. Flashlight Bulbs & Batteries	

Source: MA Health Officers Association (MHOA), Reference Manual for Food Protection Programs, August 1997.

OFFICIAL ORDER FOR CORRECTION

Food Establishment Permit Holder Permit No.:
Establishment Name
Establishment Address

Dear (*permit holder):*

A sanitary inspection of (*establishment name*) located at (*address*) was conducted on by (*inspector name, title*) on (*inspection date*). A copy of the inspection report which lists specific provisions of 105 CMR 590.000 - Minimum Sanitation Standards for Food Establishments, Article X that are in violation is attached.

This order, when signed by a Board of Health member or its agent constitutes an order of the Board of Health to correct violations within the time period designated. A re-inspection will be conducted on (*date*) to determine if the violations have been corrected. Failure to correct violations may result in suspension or revocation of the food establishment permit and cessation of food establishment operations.

You may request a hearing before the Board of Health. Your request must be in writing and be submitted to the following office by (*date*).

Signature: (*Board of Health member or agent*)

Title:

Date:

NOTICE TO FOODHANDLERS:

Handwashing is one of the MOST IMPORTANT factors in preventing the spread of infection.

ALWAYS wash your hands after using the toilet, and ALWAYS before handling food, equipment and utensils.

Put your board of health or town logo here.

State Laboratory Institute - Massachusetts Department of Public Health
305 South Street, Boston, MA 02130
(617) 522-3700 / (617) 983-6200

INSTRUCTIONS FOR SUBMITTING ENTERIC SPECIMENS

Stool cultures are important aids for diagnosing acute diarrheal disease. The pathogenic organisms most frequently cultured from stool are **Campylobater sp**., **enterohemorrhagic Escherichia coli (SLT producers), Salmonella sp**., **Shigella sp**., and **Yersinia sp**.

The State Laboratory provides the following types of collection/transport kits for the submission of specimens:

A. Transport for **Salmonella sp**., **Shigella sp**., **Yersinia sp**.: a clear plastic bottle with a **white label** and green top.

B. Transport for **Campylobacter sp.** only: a clear plastic bottle with an **orange label** and green top.

C. The Combined Kit contains both types of transport bottles.

If the transport solution in the bottle(s) has turned yellow, **DO NOT USE**. Return unused kit(s) and call (617) 983-6640 for replacements(s).

Guidelines for stool collection and specimen submission:

(Instructions for the submission of specimens suspected of containing **Vibrio sp**. can be obtained by calling the Enteric Laboratory at (617) 983-6609.

1. Collect stool from patient as soon after onset of illness as possible **(before antibiotic treatment begins).**
2. Using the spoon attached to the screw cap top, add a small amount of stool (approximately dime size) to the appropriate transport container. If stool is liquid, transfer enough of the stool specimen to raise the level of the pink liquid approximately ¼ inch. **DO NOT OVERFILL!**
3. Secure bottle top(s) tightly to prevent leakage in transit. Complete information requested on the bottle label.
4. **Complete the culture requisition slip, included with each kit, filling in all requested information completely.**
5. Place culture bottle(s) in the metal container provided and tighten cap securely.
6. Wrap completed requisition slip around the outside of the metal container and place in cardboard shipping container. Secure shipping container top.
7. Mail or deliver promptly to: **Attn: Bacteriology Laboratory**
   State Laboratory Institute
   305 South Street, Boston, MA 02130

(more)

Culturing for enterohemorrhagic Escherichia coli (EHEC)

Please Note: The most prevalent serotype of **EHEC** encountered in the United States is O157:H7. The preferred specimen for recovery of **EHEC** is a fresh stool placed in a sterile container on wet ice. This should be submitted to the laboratory as soon as possible after collection*. If this method of specimen submission is not possible, please contact:

Enteric Laboratory: (617) 983-6609

* The collection kit listed under A (Salmonella sp., Shigella sp. and Yersinia sp.) on the previous page may be used for the recovery and isolation of EHEC when the fresh stool method is not possible.

Rectal swabs are not recommended for testing because the sample size is usually too small. If the stool specimen can only be obtained with a rectal swab, care should be taken to insert the swab past the sphincter muscle to obtain a representative fecal specimen. Transfer the swab to the appropriate transport container, rotate the swab in the medium, press the swab vigorously against the side of the container and discard swab, as hazardous waste. Submit transport kit as noted above.

SAMPLE PRESS RELEASE

Massachusetts Department of Public Health
Division of Epidemiology & Immunization
305 South St.
Jamaica Plain, MA 02130
Phone 617 983-6800

Hepatitis A

[**Insert appropriate town and date]:** Today Massachusetts State and Local Public Health Authorities announced that a case of hepatitis A occurred in a food worker at the **[insert appropriate facility name]**, located in **[insert appropriate town].**

Health officials warn that people who ate cold or uncooked foods at this restaurant between the dates of [**insert appropriate dates**] may be at risk for developing hepatitis A. Cold or uncooked foods include salads and salad items, rolls, breads, hamburger and hot dog buns, fruit or vegetable garnishes, cold desserts, hamburger or sandwich condiments such as pickles and onions, chips, and ice or beverages containing ice. Immune globulin (IG) provides immediate protection lasting for as long as 3-5 months when given within two weeks after a person has been exposed. Therefore, people who ate cold or uncooked foods or are unsure of what they ate from this restaurant between [**insert appropriate dates**] should contact their health care provider and receive IG as soon as possible. Health care providers may obtain IG from **[insert appropriate locations]** or the Massachusetts Department of Public Health.

The early signs and symptoms of hepatitis A are fever, fatigue, loss of appetite, nausea, vomiting, diarrhea, dark urine and jaundice (yellowing of eyes or skin). The illness varies in severity, with mild cases lasting two weeks or less and more severe cases lasting 4-6 weeks or longer. Some individuals, especially children, may not develop jaundice, and may have an illness so mild that it can go unnoticed. However, even mildly ill persons can still be highly infectious. Persons with illness suggestive of hepatitis should consult a physician even if symptoms are mild.

Hepatitis A virus is spread as a result of fecal contamination (fecal-oral route) and may be spread from person to person through close contact or through food handling. The virus can be spread by contaminated food and beverages.

Persons who ate cold or uncooked foods from **[insert appropriate restaurant]** between [**insert appropriate dates**] are urged to be particularly thorough in handwashing after toileting and prior to food preparation to avoid any potential further spread of disease. Handwashing should include vigorous soaping of the hands. All surfaces should be washed including the back of the hands, wrists, between fingers and under fingernails. Hands should be thoroughly rinsed with running water.

Further information can be obtained from local health departments, health care providers or the Massachusetts Department of Public Health, Division of Communicable Disease Control (617) 983-6800.

SAMPLE PUBLIC NOTICE

DEAR GUEST:

An employee of this restaurant was recently diagnosed as having hepatitis A. As a precautionary measure, all of the restaurant employees have received immune globulin (IG). Please be assured that we will continue to take every precautionary step to ensure the health and safety of our employees and guests.

As a result of this, we have been asked by state and local health officials to post the following information:

Exposure: It is of the opinion of state and local health departments that patrons who ate uncooked or cold food served from this restaurant anytime between [**insert appropriate dates**] and [**insert appropriate dates**] have potentially been exposed to hepatitis A.

Cold or uncooked foods include salads and salad items, rolls, breads, hamburger and hot dog buns, fruit or vegetable garnishes, cold desserts, hamburger or sandwich condiments such as pickles and onions, chips, and ice or beverages containing ice.

Prevention: Persons who ate cooked or uncooked foods at the restaurant from [**insert appropriate dates**] to [**insert appropriate dates**] should contact a health care provider and receive IG as soon as possible but no later than [**insert appropriate dates**]. IG provides protection when given as late as two weeks after a person has been exposed to hepatitis A. Health care providers can obtain IG from **[insert appropriate locations**] or the Massachusetts Department of Public Health.

Symptoms of hepatitis A: Symptoms of hepatitis A are age-related, with adults and adolescents more likely to develop the "classic" symptoms of fever, fatigue, loss of appetite, nausea and jaundice (dark brown urine and yellow skin and whites of eyes). In children, hepatitis A infections usually have minimal flu-like symptoms or upset stomach symptoms or no symptoms at all, and children usually do not develop jaundice. When symptoms do occur they generally last one to two weeks, although on rare occasions adults can feel sick for as long as several months.

Where to obtain information about hepatitis A?

Health care provider

Local board of health
in the phone book under local government

Massachusetts Department of Public Health
Division of Communicable Disease Control (617) 983-6800

HACCP RISK ASSESSMENT FORM

FOOD ITEM:		**ESTABLISHMENT NAME:**	
INGREDIENTS:		**PERSON IN CHARGE:**	
		CONDUCTED BY:	**DATE:**
WEIGHT/VOLUME:		☐ **INTERVIEW AND ON SITE INSPECTION** ☐ **PREPARATION OBSERVED**	
CERTIFIED FOOD MANAGER: YES NO **DATE OF LAST ROUTINE INSPECTION:**		**SAMPLES COLLECTED:**	

PLEASE PRINT CLEARLY

IDENTIFY PREPARATION STEPS Date Time	**EXPLAIN HOW SUSPECT FOOD WAS HANDLED AT EACH STEP. (Who, What, Where)** **IDENTIFY ANY UNSAFE FOOD HANDLING PRACTICES** (* Violation of 105 CMR 590.000)	**ITEM No.** VIOLATION 105 CMR590	**HAZARDS** -**C**ontamination -**S**urvival -**G**rowth/**T**oxin **IDENTIFY CCP**	**PLAN OF CORRECTION** *Include changes in procedures, embargos, disposals, food worker restrictions, training, emergency suspensions and closures, and regulatory samples collected.	**Verified** Date Initials

OTHER OBSERVATIONS / EMPLOYEE HEALTH/ ACTIONS TAKEN:

September 1997

IDENTIFY PREPARATION STEPS Date Time	**EXPLAIN HOW SUSPECT FOOD WAS HANDLED AT EACH STEP. (Who, What, Where)** **IDENTIFY ANY UNSAFE FOOD HANDLING PRACTICES** (* Violation of 105 CMR 590.000)	**ITEM No.** VIOLATION 105 CMR590	**HAZARDS** - **C**ontamination -**S**urvival -**G**rowth/**T**oxin **IDENTIFY CCP**	**PLAN OF CORRECTION** *Include changes in procedures, embargos, disposals, food worker restrictions, training, emergency suspensions and closures, and regulatory samples collected.	**Verified** Date Initials

OTHER OBSERVATIONS / EMPLOYEE HEALTH / ACTIONS TAKEN:

September 1997

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

HACCP RISK ASSESSMENT FORM

FOOD PROTECTION PROGRAM

FOOD ITEM:	**Tuna Salad Sandwich**	**ESTABLISHMENT NAME: Madhouse Restaurant**	
INGREDIENTS:	**canned tuna, commercial mayonnaise, celery, spices, bread**	**PERSON IN CHARGE: Chef Benny Rothchild**	
		CONDUCTED BY: Food Inspector Barbara Smith	**DATE: 12/8/96**
WEIGHT/VOLUME:	**50 lbs. (approximately 200 servings)**	☒ **INTERVIEW AND ON SITE INSPECTION** ☐ **PREPARATION OBSERVED**	
CERTIFIED FOOD MANAGER: YES / NO **DATE OF LAST ROUTINE INSPECTION: 10/15/96**		**SAMPLES COLLECTED: No**	

PLEASE PRINT CLEARLY

IDENTIFY PREPARATION STEPS Date Time	**EXPLAIN HOW SUSPECT FOOD WAS HANDLED AT EACH STEP. (Who, What, Where)** **IDENTIFY ANY UNSAFE FOOD HANDLING PRACTICES** (* Violation of 105 CMR 590.000)	**ITEM No.** VIOLATION 105 CMR590	**HAZARDS** -**C**ontamination -**S**urvival -**G**rowth/**T**oxin **IDENTIFY CCP**	**PLAN OF CORRECTION** *Include changes in procedures, embargoes, disposals, food worker restrictions, training, emergency suspensions and closures, and regulatory samples collected.	**Verified** Date Initials
Store Ingredients -Dry/storage -Refrigeration	**Tuna and unopened mayonnaise stored in dry storage room at 72 °F. Open mayonnaise stored in walk-in refrigerator at 41° F.** ***Celery in walk-in stored on shelf under dripping thawing chicken.**	**# 9**	**C-chicken** **ccp - yes**	**Celery removed, washed and diverted to stock production. Different space designated for produce storage.**	**12/10/96** **BS**
Chop Celery 12/4(AM)15MIN	**Celery washed with water and chopped in buffalo chopper.** ***Chopper is washed but not sanitized.** ***Employee (LR) uses bare hands to scoop celery into mixing bowl.**	**#16** **# 5**	**C-chopper** **C-hands** **CCP - yes**	**Sanitizing after each use to begin immediately.** **Employees will be trained and required to use gloves/utensils when handling read-to-eat foods.**	**12/10/96** **BS**
Mix Ingredients Together 12/4(AM) 30 min.	***Can of tuna taken from dry storage and opened with manual can opener. Can opener is encrusted with old food build up and is not cleaned and sanitized daily.** **Sealed containers of mayonnaise are taken from dry storage. Ingredients mixed in floor mixer. Mixer bowls and paddles are manually cleaned and sanitized after each use.**	**#16**	**C-can opener** **CCP - yes**	**Daily sanitizing of can opener to begin immediately**	**12/10/96** **BS**

OTHER OBSERVATIONS / EMPLOYEE HEALTH/ ACTIONS TAKEN: Equipment, utensils and food contact surfaces, unless noted, are cleaned and sanitized in dishwashing machine or manually in a 3-compartment sink with sanitizer. Employee (LR) claimed he was ill with fever, vomiting and diarrhea 3 days before preparing tuna but did not seek medical attention. He has been instructed to submit a stool specimen within 48 hours and will be restricted from working pending specimen results.

IDENTIFY PREPARATION STEPS Date Time	**EXPLAIN HOW SUSPECT FOOD WAS HANDLED AT EACH STEP. (Who, What, Where)** **IDENTIFY ANY UNSAFE FOOD HANDLING PRACTICES** (* Violation of 105 CMR 590.000)	**ITEM No.** VIOLATION 105 CMR590	**HAZARDS** -**C**ontamination -**S**urvival -**G**rowth/**T**oxin **IDENTIFY CCP**	**PLAN OF CORRECTION** *Include changes in procedures, embargoes, disposals, food worker restrictions, training, emergency suspensions and closures, and regulatory samples collected.	**Verified** Date Initials
Store in Walk-in Refrigerator 12/4 - 12/5	*** Tuna salad (made from ingredients at room temperature) placed in 5 gallon buckets and stacked in walk-in refrigerator (41°F).**	**#10**	**G/T - cooling** **CCP - yes**	**Tuna and other PHF salads will be made from pre-chilled ingredients.**	**12/10/96** **BS**
Prepare Tuna Sandwiches 12/5 11AM-12PM	**Tuna salad (4oz. Portions) placed on bread with scooper. Sandwiches sliced in half with knife and placed on tray.** ***Foodhandlers (RB and OL) do not use gloves, papers etc.**	**#11**	**C- hands** **CCP - yes**	**Employees will be required to use gloves.**	**12/10/96** **BS**
Serve on Buffet 12/5 12-3PM	**Trays are uncovered and placed on buffet lines.** ***No ice or refrigeration used to maintain temperature at or below 45°F.**	**# 4**	**G/T- holding** **CCP - yes**	**PHFs leftover on buffet lines without ice/refrigeration will be time marked and discarded if not used or served within 4 hours..**	**12/10/96** **BS**
Serve Leftover Sandwiches in Employee Cafeteria 12/5 3PM - ?	**Leftover sandwiches brought to employee cafeteria and placed on serving line until gone.** *** No refrigeration or ice used to maintain sandwiches at or below 45°F.**	**# 4**	**G/T- holding** **CCP - yes**	**Reach-in cooler for self-service of cold PHFs will be obtained for employee cafeteria line.**	**12/10/96** **BS**

OTHER OBSERVATIONS / EMPLOYEE HEALTH / ACTIONS TAKEN:

POTENTIALLY HAZARDOUS FOOD (PHF) TEMPERATURES
CRITICAL CONTROL POINTS, MONITORING PROCEDURES AND CORRECTIVE ACTIONS

CRITICAL CONTROL POINT	MONITORING PROCEDURES	EXAMPLES OF VIOLATIONS and CORRECTIVE ACTIONS	
COLD HOLDING/DISPLAY *Cold PHFs at or below 45 ºF during storage, display and service*.	• Measure temperatures of coldholding units. • Measure temperatures of cold PHFs. • Check accuracy of refrigeration unit thermometers. • Review temperature logs, if maintained.	Cold PHFs found between 45°F - 70° for less than 2 hours.	Serve immediately or implement procedures for rapid cooling.
		Cold PHFs found between 45 - 70° for 2 to 4 hours..	Serve immediately or discard.
		Cold PHFs found above 70 °F for 2 or more hours..	Discard.
HOT HOLDING/DISPLAY *Hot PHFs at or above 140 °F during hot holding*.	• Measure temperatures of hot PHFs. • Measure temperatures of hot holding units, if possible. • Review temperature logs, if maintained.	Hot PHFs found between 120 - 140°F less than four hours.	Rapidly reheat to 165 °F and hold at or above 140 °F or serve immediately.
		Hot PHFs found below 120° F for less than two hours.	Rapidly reheat to 165 °F and hold at or above 140 °F or serve immediately.
		Hot PHFs found below 120 °F for more than 2 hours or under 140 °F for more than 4 hours.	Discard.

CRITICAL CONTROL POINT	MONITORING PROCEDURES	EXAMPLES OF VIOLATIONS and CORRECTIVE ACTIONS	
COOLING *PHFs cooled to 70° F within 2 hours and then to 45° F within 4 hours..*	• Review cooling procedures to determine if methods facilitate rapid cooling (e.g. shallow pans, ice baths, blast chillers). • Measure PHF temperatures while cooling when possible.	PHFs found between 70° - 140 F after cooling less than two hours. PHFs found between 70° - 140° F after cooling more than 2 to 4 hours. PHFs found between 70° - 140° F after cooling more than 4 hours. PHFs found between 45° and 70° F after cooling more than 6 hours..	Implement procedures to rapidly cool. Reheat to 165° F and implement procedures to rapidly cool. Discard. Discard.
COOKING/ REHEATING *PHFs cooked and/or reheated to proper temperatures.*	• Measure PHF temperature after cooking/reheating. • Review cooking logs, if maintained • Review procedures for rapidly reheating PHFs to 165 °F within 2 hours.	PHFs not cooked/reheated to proper temperature.	Continue cooking until required temperature is reached. Continue reheating until required temperature is reached.

NOTE: During inspections when temperature violations are noted, corrective actions such as initiating changes in procedures, embargoing and discarding food as well as documenting violations may be necessary.This chart is intended only as a guideline to determine when and what corrective actions may need to be taken to prevent a possible foodborne illness due to temperature abuse of a PHF Each situation should be evaluated based on the potential for contamination and intended use of the food as well as temperature abuse. If the person-in-charge refuses to discard food which was mishandled, it will be necessary to embargo the food product and collect samples for analysis.