

# Foodborne Poisonings and Toxicity

(Includes Ciguatera, Scombroid, Mushroom Toxins, Tetrodotoxin, Paralytic Shellfish Poisoning [PSP], and Amnesic Shellfish Poisoning [ASP])



## Section 1:

### ABOUT THE DISEASE

#### A. Etiologic Agent

Foodborne poisoning results from ingestion of foods contaminated with toxins. These toxins may occur naturally, may be chemical or biological contaminants, or may be metabolic products of infectious agents that are present in the food.

For the purposes of this manual, surveillance and reporting of foodborne poisonings will be limited to poisonings resulting from ingestion of the following foods containing naturally-occurring toxins that cause illness:

- ◆ Ciguatera poisoning is caused by the consumption of tropical and subtropical finfish that have accumulated naturally occurring toxins through their diet. These toxins are produced in tropical areas by reef algae.
- ◆ Scombroid poisoning is caused by the ingestion of foods that contain high levels of histamine and other active agents. Initially, the syndrome was associated with fish in the Scombroidea family (tuna, mackerel, skipjack, and bonito); however, non-scombroid fish (mahi-mahi, bluefish, and salmon) have also been associated with this illness. While scombroid poisoning is usually associated with spoilage of fish, any foods that have certain bacterial contamination and growth leading to chemical action on amino acids may lead to scombroid poisoning when ingested.
- ◆ Mushroom toxin poisoning is caused by the consumption of raw or cooked fruiting bodies of a number of species of wild fungi.
- ◆ Tetrodotoxin poisoning is caused by the consumption of tetrodotoxin, found most commonly in the liver, intestines, and skin of puffer fish. Tetrodotoxin has also been found in other fish and non-fish species including parrotfish, porcupine fish, ocean sunfish, newts and salamanders, frogs, blue-ringed octopus, starfish, and xanthid crabs. There is evidence that toxin production is caused by several bacterial species including *Pseudomonas* species and *Vibrionaceae*.
- ◆ Paralytic shellfish poisoning (PSP) is caused by the consumption of shellfish that have ingested dinoflagellates that produce toxins. High concentrations of these toxins occur primarily during periods of algae blooms, known as “red tides.”
- ◆ Amnesic shellfish poisoning (ASP) is caused by the consumption of shellfish containing domoic acid, a toxin produced by algae known as *Pseudonitzschia* species.

## B. Clinical Description

### *Ciguatera*

Symptoms occur within 24 hours of eating tropical or subtropical finfish, with gastrointestinal (GI) symptoms occurring as early as 1 hour after consumption. Predominant GI symptoms include vomiting, diarrhea, and abdominal pain. Neurologic symptoms, including paresthesia (discomfort, numbness, and tingling), pain and weakness in the lower extremities, “aching teeth,” attacks of hot and cold temperature sensations, headache, vertigo, and myalgias, are common and may occur at the same time as the GI symptoms or may follow 1–2 days later. In severe cases, persons may also develop hypotension (low blood pressure). Most persons recover within a few weeks; however, in severe cases, neurologic symptoms may persist for weeks to months.

### *Scombroid*

The initial symptoms of mouth tingling or burning, facial flushing, sweating, palpitations, dizziness, rash, headache, and itching of the skin occur rapidly and often progress to nausea, vomiting, and diarrhea within a few hours. Symptoms resolve completely within 12 hours, with no long-term sequelae.

### *Mushroom Poisoning*

Clinical disease varies with the type of mushroom and dose ingested. Mushroom poisoning can be fatal. Incubation periods can be as short as 15 minutes to as long as 2 weeks. There are four general categories of mushroom toxins. The first are the protoplasmic toxins. Characteristic symptoms include sudden or severe seizures of abdominal pain, persistent vomiting, extreme thirst, reduced urine production, and headache. More than 50% of cases will experience liver, kidney, heart, or muscle damage. Protoplasmic toxins are the most likely of the mushroom toxins to cause death or irreversible organ damage. The second category of mushroom toxins is neurotoxin. Neurotoxins may cause dizziness, periods of drowsiness followed by periods of hyperactivity, delusions, delirium, and hallucinations. The third category is GI irritants, which cause diarrhea, vomiting, and nausea. The fourth category is disulfiram-like toxins, which are generally non-toxic, unless alcohol is consumed within 72 hours of ingestion of the toxin, in which case, a short-lived, acute toxic syndrome, with nausea and vomiting, can occur.

### *Tetrodotoxin*

The first symptoms of intoxication usually appear within 20 minutes to 3 hours and include numbness of the lips and tongue, spreading to the face and extremities. Dizziness, ataxia, headache, nausea, and diarrhea may also occur. Paralysis, convulsions, mental impairment, and cardiac arrhythmia cause death in up to 60% of cases.

### *Paralytic Shellfish Poisoning (PSP)*

Ingestion of contaminated shellfish results in symptoms appearing within minutes to several hours. Symptoms are predominantly neurological, including paresthesias of the mouth and extremities, drowsiness, and incoherent speech. These symptoms are also frequently accompanied by GI symptoms. Symptoms usually resolve within a few days. Severe cases involving ataxia, muscle paralysis, and respiratory arrest may result in death.

### *Amnesic Shellfish Poisoning (ASP)*

Symptoms can be both GI and neurological. GI symptoms include nausea, vomiting, abdominal cramps, and diarrhea, and they usually develop within 24 hours of the consumption of toxic shellfish. In severe cases, neurological symptoms also appear, usually within 48 hours of toxic shellfish consumption. These symptoms include dizziness, headache, seizures, disorientation, short-term memory loss, peripheral neuropathy, respiratory difficulty, and coma. Some persons develop permanent neurological deficits, especially dementia.

### C. Vectors and Reservoirs

Foodborne poisonings covered in this chapter occur as a result of consuming preformed toxins found in food.

### D. Modes of Transmission

Foodborne poisonings are caused by the ingestion of preformed toxins and are not transmitted from person to person.

### E. Incubation Period

<b>Ciguatera</b>	1–24 hours.
<b>Scombroid</b>	Immediate to 2 hours.
<b>Mushroom Toxins</b>	Immediate to 14 days.
<b>Tetrodotoxin</b>	Immediate to 3 hours.
<b>Paralytic Shellfish Poisoning (PSP)</b>	Usually within 2 hours.
<b>Amnesic Shellfish Poisoning (ASP)</b>	GI symptoms usually develop within 24 hours, neurological symptoms within 48 hours.

### F. Period of Communicability or Infectious Period

These toxins are preformed when ingested and only affect the person who has consumed them. However, as long as the contaminated sources are available for consumption, foodborne poisoning is a threat. These toxins are not killed by heat or cold storage. These foodborne poisonings are not transmitted from person to person.

### G. Epidemiology

Ciguatera poisoning is a significant public health threat in areas of the world where consumption of reef fish is common. It is estimated that more than 400 species of fish have the potential for becoming toxic, with large predatory fish being the most toxic. Numerous cases of ciguatera poisoning are reported each year from Hawaii, Florida, Puerto Rico, and the U.S. Virgin Islands.

All humans are susceptible to scombroid poisoning, and it remains one of the most common causes of fish poisoning in the U.S. Occurrence of scombroid poisoning is worldwide. Because of the global nature of fish processing and packaging, there are no geographic boundaries for fresh, processed, or frozen products. Risks appear to be greatest, however, from fish caught by recreational fishermen or fish held without adequate refrigerated storage.

All humans are susceptible to mushroom toxins. Poisoning resulting from consuming mushrooms occurs most often among novice mushroom hunters who misidentify and consume toxic species. Poisonings have also occurred among immigrants who consume poisonous North American mushroom species that closely resemble edible species from

their native lands. Mushroom poisonings tend to be more frequent in the spring and fall, when most species are at the height of their fruiting stage.

Cases of tetrodotoxin poisoning are rarely reported in the U.S. Outbreaks have occurred in the Indo-Pacific region of the world, with numerous cases reported from Japan annually.

All humans are susceptible to PSP. High concentrations of these neurotoxins occur most frequently during algae blooms known as “red tides” and are particularly common in shellfish harvested from colder waters. Most cases of PSP occur in those who gather shellfish for their own consumption, perhaps while unaware of or disregarding local shellfish harvesting warnings and regulations applying to commercial shellfish operations.

ASP was first identified in late 1987 in Canada and later was also observed in Washington State, Oregon, and along the coast of Texas. All humans are susceptible to this shellfish poisoning. The elderly are particularly predisposed to serious neurological deficits. All fatalities to date have involved elderly persons.

## H. Bioterrorist Potential

While these pathogens are not considered to be of risk for use in bioterrorism, some of the toxins discussed in this chapter are relatively easy to obtain and could be used with criminal intent.



## Section 2:

# REPORTING CRITERIA AND LABORATORY TESTING

## A. What to Report to the Massachusetts Department of Public Health (MDPH)

Report clinically compatible cases of ciguatera poisoning, scombroid, mushroom toxin poisoning, tetrodotoxin poisoning, PSP, or ASP diagnosed by a health care provider.

*Note: See Section 3C for information on how to report a case.*

## B. Laboratory Testing Services Available

The MDPH State Laboratory Institute (SLI), Environmental Laboratory currently performs food testing for scombroid (histamine levels) and PSP (PSP neurotoxins). Other environmental food testing available includes ASP (domoic acid levels), mercury in fish, lead in maple syrup, and tests for metals and inorganics on a case-by-case basis. In some cases, additional testing can be done by the Food and Drug Administration (FDA) on implicated food sources.

**For more information on submitting specimens, contact the SLI Environmental Laboratory at (617) 983-6651 or (617) 983-6657.**

*Note: The SLI Environmental Laboratory does not provide foodborne poison testing of human specimens.*



## Section 3:

# REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

## A. Purpose of Surveillance and Reporting

- ◆ To identify transmission sources of public health concern (e.g., a restaurant or commercially distributed food product), and to stop transmission from such sources.

## B. Laboratory and Health Care Provider Reporting Requirements

Foodborne poisonings are reportable to the local board of health (LBOH). The MDPH requests that health care providers immediately report to the LBOH in the community where the case is diagnosed, all confirmed or suspect cases of foodborne poisonings, as defined by the reporting criteria in Section 2A.

Laboratories performing examinations on any specimens derived from Massachusetts residents that yield evidence of foodborne poisoning shall report such evidence of infection directly to the MDPH within 24 hours.

## C. Local Board of Health (LBOH) Reporting and Follow-Up Responsibilities

### *Reporting Requirements*

MDPH regulations (*105 CMR 300.000*) stipulate that foodborne poisoning is reportable to the LBOH and that each LBOH must report any confirmed case of foodborne poisoning or suspect case of foodborne poisoning, as defined by the reporting criteria in Section 2A. Cases should be reported to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services (ISIS) using a MDPH *Generic Confidential Case Report Form*, with a MDPH *Foodborne Illness Complaint Worksheet* attached (both forms are found at the end of this chapter). Refer to the *Local Board of Health Timeline* at the end of this manual's *Introduction* section for information on prioritization and timeliness requirements of reporting and case investigation.

### *Case Investigation*

1. It is the responsibility of the LBOH to complete both a MDPH *Generic Confidential Case Report Form* and a MDPH *Foodborne Illness Complaint Worksheet* (both forms are found at the end of this chapter) by interviewing the case and others who may be able to provide pertinent information. Because of the potential for numerous exposures to a contaminated food source, cases require prompt follow-up.
2. Use the following guidelines to assist in completing the MDPH *Generic Confidential Case Report Form*:
  - a. Accurately record the demographic information.
  - b. Accurately record clinical information, including “foodborne poisoning” as the disease being investigated, date of symptom onset, symptoms, whether hospitalized, and hospital and clinician contact information.
  - c. Include all available diagnostic laboratory test information.
  - d. Information relevant to prevention and control: Using the minimum and maximum incubation period for the specific foodborne poisoning (see Section 1E for more information), document the following exposures:
    - i. Travel history: Determine the date(s) and geographic area(s) traveled to by the case.
    - ii. Outdoor activities: Determine the date(s) and geographic areas of the outdoor activities of the case during the incubation period.

These two questions are asked to help identify where the case became infected.

*Note: If no agent is identified, use a 72-hour incubation period.*

- e. Include any additional comments regarding the case.
  - f. If you have made several attempts to obtain case information but have been unsuccessful (e.g., the case or health care provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as you have gathered. Please note on the form the reason(s) why it could not be filled out completely.
3. After completing the forms, attach laboratory report(s) and fax or mail (in an envelope marked "Confidential") to ISIS. The confidential fax number is (617) 983-6813. Call ISIS at (617) 983-6801 to confirm receipt of your fax. The mailing address is:

**MDPH, Office of Integrated Surveillance and Informatics Services (ISIS)**  
**305 South Street, 5<sup>th</sup> Floor**  
**Jamaica Plain, MA 02130**  
**Fax: (617) 983-6813**

4. Use the following guidelines to assist in completing the MDPH *Foodborne Illness Complaint Worksheet* and fax or send the form to the MDPH Center for Environmental Health, Food Protection Program (FPP); see top of worksheet for fax number and address. This information is entered into a database to link complaints and to help identify foodborne illness outbreaks. *Note: This worksheet does not replace the MDPH Generic Confidential Case Report Form.*
- a. Record the name and affiliation of the person completing the worksheet (yourself) and the person reporting the illness (complainant).
  - b. Record the number of persons ill, symptoms, date(s) of symptom onset, names of ill persons, and other medical and laboratory information.
  - c. Obtain a food history for 72 hours prior to symptoms, or if the agent was identified, between the minimum and maximum incubation periods (refer to Section 1E for more information). If two or more persons became ill, attempt to focus on the suggested time frame for common meals/food items. Include the date and time food was consumed, number of persons exposed (both ill and well), food item(s) consumed, name of establishment (e.g., restaurant or store) where food was obtained, and the place where the food was consumed.  
  
*Note: If mushrooms or fish are implicated, indicate the species/type suspected, if known.*
  - d. Other persons who have eaten the implicated food should be interviewed regarding their exposure. In most cases, illness would have already occurred, but in some instances, such as mushroom ingestion, the potential cases should be advised to seek medical attention.
  - e. Determine whether any food (leftovers or unopened) is available for testing. See Section 4 for more information.
  - f. If the investigation points to a commercially processed food item, attempt to obtain the product and the manufacturer information.

- g. Include any other comments received during the initial complaint in the “Notes” section.
- h. If you have made several attempts to obtain case information but have been unsuccessful (e.g., the case or health care provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as you have gathered. Please note on the form the reason(s) why it could not be filled out completely.

*Note: Refer to the MDPH's Foodborne Illness Investigation and Control Reference Manual for comprehensive information on investigating foodborne illness complaints and outbreaks. Copies of this manual have been made available to LBOH. It can also be located on the MDPH website in PDF format at [www.mass.gov/dph/fpp/refman.htm](http://www.mass.gov/dph/fpp/refman.htm). For the most recent changes to the Massachusetts Food Code, contact the FPP at (617) 983-6712 or through the MDPH website at [www.mass.gov/dph/fpp](http://www.mass.gov/dph/fpp).*

5. Institution of disease control measures is an integral part of case investigation. It is the responsibility of the LBOH to understand, and if necessary, institute the control guidelines listed in Section 4.



## Section 4:

# CONTROLLING FURTHER SPREAD

### A. Isolation and Quarantine Requirements (105 CMR 300.200)

None.

### B. Protection of Contacts of a Case

None.

### C. Managing Special Situations

#### *Reported Incidence Is Higher Than Usual/Outbreak Suspected*

Any case of foodborne illness may indicate an outbreak, and if you suspect an outbreak, investigate to determine the mode of transmission. A common vehicle (e.g., contaminated shellfish) should be sought, and applicable preventive or control measures should be instituted (e.g., removing implicated food items). Consult with the epidemiologist on-call at the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850. The Division can help determine a course of action to prevent further cases and can perform surveillance for cases across town lines, which would otherwise be difficult to identify at the local level.

### D. Preventive Measures

#### *Environmental Measures*

Implicated food items must be removed from consumption. A decision about testing implicated food items can be made in consultation with the FPP or the MDPH Division of Epidemiology and Immunization. The FPP can help coordinate pickup and testing of food samples. If a commercial product is suspected, the FPP will coordinate follow-up with relevant outside agencies. The FPP can be reached at (617) 983-6712.

*Note: The role of the FPP is to establish policy and to provide technical assistance with the environmental investigation, such as interpreting the Massachusetts Food Code, conducting a Hazard Analysis and Critical Control Point (HACCP) risk assessment, initiating enforcement actions, and collecting food samples.*

#### *Personal Preventive Measures/Education*

In most cases, there are no tell-tale signs to indicate the presence of toxins in food. Individuals can educate themselves, however, about edible mushrooms before collecting and consuming them. If gathering shellfish for personal consumption, individuals should pay attention to local warnings and ordinances. They should buy seafood products from licensed, commercial vendors and should handle these products appropriately (refrigerate immediately, and cook and serve as soon as possible).



## ADDITIONAL INFORMATION

There is no formal Centers for Disease Control and Prevention (CDC) surveillance case definition for foodborne poisoning. Diagnostic decisions are made based on clinical presentation and history when there are no alternative explanations for illness. For reporting to the MDPH, always use the criteria outlined in Section 2A of this chapter.



## REFERENCES

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## **FORMS & WORKSHEETS**

*Foodborne Poisonings and Toxicity*

*(Includes Ciguatera, Scombroid, Mushroom Toxins,  
Tetrodotoxin, Paralytic Shellfish Poisoning [PSP], and  
Amnesic Shellfish Poisoning [ASP])*

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## LBOH Action Steps

*This form does not need to be submitted to the MDPH with the case report form. It is for LBOH use and is meant as a quick-reference guide to foodborne poisoning case investigation activities.*

LBOH staff should follow these steps when foodborne poisoning is suspected or confirmed in the community. For more detailed information, including disease epidemiology, reporting, case investigation, and follow-up, refer to the preceding chapter.

- Notify the MDPH Division of Epidemiology and Immunization, at (617) 983-6800 or (888) 658-2850, to report any suspect or confirmed case(s) of foodborne poisoning.
- Obtain laboratory confirmation.
- Complete a MDPH *Foodborne Illness Complaint Worksheet* and forward to the MDPH Center for Environmental Health, Food Protection Program (FPP).
- Identify and remove any suspect food item(s).
- Consult with the MDPH Division of Epidemiology and Immunization or the FPP regarding the submission of suspect food items for testing.
- Identify other potentially exposed persons.
- Fill out the case report form (attach laboratory results).
- Send the completed case report form (with laboratory results) to the MDPH Bureau of Communicable Disease Control, Office of Integrated Surveillance and Informatics Services (ISIS).