

CHAPTER 1, FOOD SAFETY

Table 1-10. Guidelines for confirmation of food borne disease outbreaks

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Bacterial			
1. <i>Bacillus cereus</i>			
a. Vomiting toxin	1-6 hrs	Vomiting, some patients with diarrhea; fever uncommon	Isolation of organism from stool of two or more ill persons and not from stool of controls OR Isolation of $\geq 10^5$ organisms/g from epidemiologically implicated food, provided specimen properly handled
b. Diarrheal toxin	6-24 hrs	Diarrhea, abdominal cramps, and vomiting in some patients; fever uncommon	Isolation of organism from stool of two or more ill persons and not from stool of controls OR Isolation of $\geq 10^5$ organisms/g from epidemiologically implicated food, provided specimen properly handled
2. <i>Brucella</i>	Several days to several mos, usually >30 days	Weakness, fever, headache, sweats, chills, arthralgia, weight loss, splenomegaly	Two or more ill persons and isolation of organism in culture of blood or bone marrow, greater than fourfold increase in standard agglutination titer (SAT) over several wks, or single SAT titer $\geq 1:160$ in person who has compatible clinical symptoms and history of exposure
3. <i>Campylobacter</i>	2-10 days, usually 2-5 days	Diarrhea (often bloody), abdominal pain, fever	Isolation of organism from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food
4. <i>Clostridium botulinum</i>	2 hrs-8 days, usually 12-48 hrs	Illness of variable severity; common symptoms are diplopia, blurred vision, and bulbar weakness; paralysis, which is usually descending and bilateral, may progress rapidly	Detection of botulinum toxin in serum, stool, gastric contents, or implicated food OR Isolation of organism from stool or intestine

CHAPTER 1, FOOD SAFETY

Rev Aug 99

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Bacterial (cont'd)			
5. <i>Clostridium perfringens</i>	6-24 hrs	Diarrhea, abdominal cramps, vomiting and fever are uncommon	Isolation of $\geq 10^6$ organisms/g in stool of two or more ill persons, provided specimen properly handled OR Demonstration of enterotoxin in the stool of two or more ill persons OR Isolation of $\geq 10^5$ organisms/g from epidemiologically implicated food, provided specimen properly handled
6. <i>Escherichia coli</i>			
a. Enterohemorrhagic (<i>E. coli</i> 0157:H7 and others)	1-10 days, usually 3-4 days	Diarrhea (often bloody), abdominal cramps (often severe), little or no fever	Isolation of <i>E. coli</i> 0157:H7 or other Shiga-like toxin-producing <i>E. coli</i> from clinical specimen of two or more ill persons OR Isolation of <i>E. coli</i> 0157 or other Shiga-like toxin-producing <i>E. coli</i> from epidemiologically implicated food
b. Enterotoxigenic (ETEC)	6-48 hrs	Diarrhea, abdominal cramps, nausea; vomiting and fever are less common	Isolation of organism of same serotype, which are demonstrated to produce heat stable (ST) and/or heat labile (LT) enterotoxin, from stool of two or more ill persons
c. Enteropathogenic (EPEC)	Variable	Diarrhea, fever, abdominal cramps	Isolation of same enteropathogenic serotype from stool of two or more ill persons
d. Enteroinvasive (EIEC)	Variable	Diarrhea (may be bloody), fever, abdominal cramps	Isolation of same enteroinvasive serotype from stool of two or more ill persons
7. <i>Listeria monocytogenes</i>			
a. Invasive disease	2-6 wks	Meningitis, neonatal sepsis, fever	Isolation of organism from normally sterile site
b. Diarrheal disease	Unknown	Diarrhea, abdominal cramps, fever	Isolation of organism of same serotype from stool of two or more ill persons exposed to food that is epidemiologically implicated or from which organism of same serotype has been isolated

CHAPTER 1, FOOD SAFETY

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Bacterial (cont'd)			
8. Nontyphoidal <i>Salmonella</i>	6 hrs-10 days, usually 6-48 hrs	Diarrhea, often with fever and abdominal cramps	Isolation of organism of same serotype from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food
9. <i>Salmonella typhi</i>	3-60 days, usually 7-14 days	Fever, anorexia, malaise, headache, and myalgia; sometimes diarrhea or constipation	Isolation of organism from clinical specimens of two or more ill persons OR Isolation of organism from epidemiologically implicated food
10. <i>Shigella</i>	12 hrs-6 days, usually 2-4 days	Diarrhea (often bloody), frequently accompanied by fever and abdominal cramps	Isolation of organism of same serotype from clinical specimens from two or more ill persons OR Isolation of organism from epidemiologically implicated food
11. <i>Staphylococcus aureus</i>	30 min-8 hrs, usually 2-4 hrs	Vomiting, diarrhea	Isolation of organism of same phage type from stool or vomits or two or more ill persons OR Detection of enterotoxin in epidemiologically implicated food OR Isolation of $\geq 10^5$ organisms/g from epidemiologically implicated food, provided specimen properly handled
12. <i>Streptococcus</i> Group A	1-4 days	Fever, pharyngitis, scarlet fever, upper respiratory infection	Isolation of organism of same M- or T-type from throats of two or more ill persons OR Isolation of organism of same M- or T-type from epidemiologically implicated food

CHAPTER 1, FOOD SAFETY

Rev Aug 99

Etiologic agent	Incubation period	Clinical syndrome	Confirmation
Bacterial (cont'd)			
13. <i>Vibrio cholerae</i>			
a. 01 or 0139	1-5 days	Watery diarrhea, often accompanied by vomiting	Isolation of toxigenic organism from stool or vomitus or two or more ill persons OR Significant rise in vibriocidal, bacterial-agglutinating, or antitoxin antibodies in acute and early convalescent phase sera among persons not recently immunized OR Isolation of toxigenic organism from epidemiologically implicated food
b. non-01 and non-0139	1-5 days	Watery diarrhea	Isolation of organism of same serotype from stool of two or more ill persons
14. <i>Vibrio parahaemolyticus</i>	4-30 hrs	Diarrhea	Isolation of kanagawa positive organism from stool of two or more ill persons OR Isolation of $\geq 10^5$ kanagawa positive organisms/g from epidemiologically implicated food, provided specimen properly handled
15. <i>Yersinia enterocolitica</i>	1-10 days, usually 4-6 days	Diarrhea, abdominal pain (often severe)	Isolation of organism from clinical specimen of two or more ill persons OR Isolation of pathogenic strain or organism from epidemiologically implicated food

CHAPTER 1, FOOD SAFETY

Etiologic Agent	Incubation period	Clinical syndrome	Confirmation
Chemical			
1. Marine toxins			
a. Puffer fish, tetrodotoxin	10 min-3 hrs, usually 10-45 min.	Parasthesia of lips, tongue, face, or extremities, often following numbness; loss of proprioception or "floating" sensations	Demonstration of tetrodotoxin in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten puffer fish
b. Paralytic or neurotoxic shellfish poison	30 min-3 hrs	Parasthesia or lips, mouth or face, and extremities; intestinal symptoms or weakness, including respiratory difficulty	Detection of toxin in epidemiologically implicated food OR Detection of large numbers of shellfish poisoning associated species of dinoflagellates in water from which epidemiologically implicated mollusks are gathered
c. Scombroid toxin (histamine)	1 min-3 hrs, usually <1 hr	Flushing, dizziness, burning of mouth and throat, headache, gastrointestinal symptoms, urticaria, and generalized pruritus	Demonstration of histamine in epidemiologically implicated food OR Clinical syndrome among persons who have eaten type of fish previously associated with histamine fish poisoning (e.g., mahi-mahi or fish of order Scomboidei)
d. Ciguatoxin	1-48 hours, usually 2-8 hrs	Usually gastrointestinal symptoms followed by neurologic symptoms (including parasthesia of lips, tongue, throat, or extremities) and reversal of hot and cold sensation	Demonstration of ciguatoxin in epidemiologically implicated fish OR Clinical syndrome among persons who have eaten a type of fish previously associated with ciguatera fish poisoning (e.g., snapper, grouper, or barracuda)

CHAPTER 1, FOOD SAFETY

Rev Aug 99

Etiologic Agent	Incubation period	Clinical syndrome	Confirmation
Chemical (cont'd)			
2. Heavy metals	5 min-8 hrs,	Vomiting, often metallic taste	Demonstration of high concentration of metal in epidemiologically implicated food
a. Antimony	usually <1 hr		
b. Cadmium			
c. Copper			
d. Iron			
e. Tin			
f. Zinc			
3. Monosodium glutamate (MSG)	3 mins-2 hrs, usually <1 hr	Burning sensation in chest, neck, abdomen, or extremities; sensation of lightness and pressure over face or heavy feeling in chest	Clinical syndrome among persons who have eaten food containing MSG (i.e., usually ≥ 1.5 g MSG)
4. Mushroom toxins			
a. Shorter acting toxins:	≤ 2 hrs	Usually vomiting and diarrhea, other symptoms differ with toxin:	Clinical syndrome among persons who have eaten mushroom identified as toxic type
<i>Muscimol</i>		Confusion, visual disturbance	OR
<i>Muscarine</i>		Salivation, diaphoresis Hallucinations	Demonstration of toxin in epidemiologically implicated mushroom or mushroom containing food
<i>Psilocybin</i>			
<i>Coprinus atreticamentaria</i>		Disulfiram like reaction	
<i>Ibotenic acid</i>		Confusion, visual disturbance	
b. Longer acting toxin (e.g., <i>Amanita</i> spp.)	6-24 hrs	Diarrhea and abdominal cramps for 24 hrs followed by hepatic and renal failure	Clinical syndrome among persons who have eaten mushroom identified as toxic type
			OR
			Demonstration of toxin in epidemiologically implicated mushroom or mushroom containing food

CHAPTER 1, FOOD SAFETY

Etiologic Agent	Incubation period	Clinical syndrome	Confirmation
Parasitic			
1. <i>Cryptosporidium parvum</i>	2-28 days, median: 7 days	Diarrhea, nausea, vomiting, fever	Demonstration of organism or antigen in stool or in small bowel biopsy of two or more ill persons OR Demonstration of organism in epidemiologically implicated food
2. <i>Cyclospora cayetanensis</i>	1-11 days, median: 7 days	Fatigue, protracted diarrhea, often relapsing	Demonstration of organism in stool of two or more ill persons
3. <i>Giardia lamblia</i>	3-25 days, median: 7 days	Diarrhea, gas, cramps, nausea, fatigue	Two or more ill persons and detection of antigen in stool; or demonstration of organism in stool, duodenal contents, or small bowel biopsy specimen
4. <i>Trichinella</i> spp.	1-2 days for intestinal phase; 2-4 wks for systemic phase	Fever, myalgia, periorbital edema, high eosinophil count	Two or more ill persons and positive serologic test or demonstration of larvae in muscle biopsy OR Demonstration of larvae in epidemiologically implicated meat

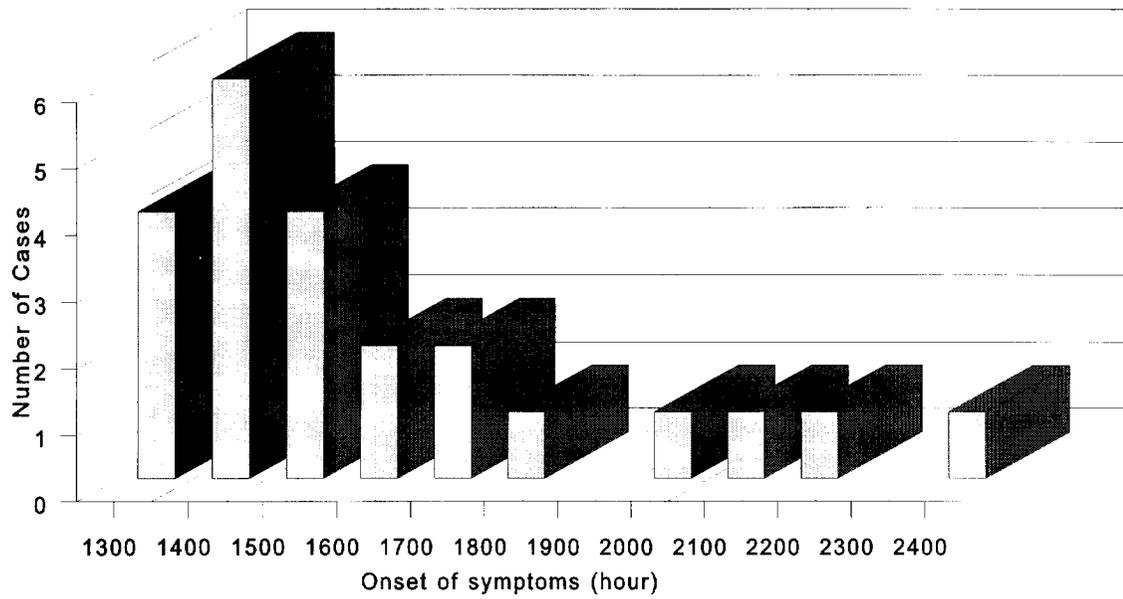
CHAPTER 1, FOOD SAFETY

Rev Aug 99

Etiologic Agent	Incubation period	Clinical syndrome	Confirmation
Viral			
1. Hepatitis A	15-50 days, median: 28 days	Jaundice, dark urine, fatigue, anorexia, nausea	Detection of IgM anti-hepatitis A virus in serum from two or more persons who consumed epidemiologically implicated food
2. Norwalk family of viruses, small round structured viruses (SRSV)	15-77 hrs, usually 24-48 hrs	Vomiting, cramps, diarrhea, headache	More than fourfold rise in antibody titer to Norwalk virus or Norwalk like virus in acute and convalescent sera in most serum pairs OR Visualization of small, round-structured viruses that react with patient's convalescent sera but not acute sera - by immune electron microscopy. Assays based on molecular diagnostic (e.g., polymerase chain reaction [PCR], probes, or assays for antigen and antibodies from expressed antigen) are available in reference laboratories.
3. Astrovirus, calicivirus, others	15-77 hrs, usually 24-48 hrs	Vomiting, cramps, diarrhea, headache	Visualization of small, round structured viruses that react with patient's convalescent sera but not acute sera - by immune electron microscopy. Assays based on molecular diagnostics (e.g., PCR, probes, or assays for antigen and antibodies from expressed antigen) are available in reference laboratories.

CHAPTER 1, FOOD SAFETY

Figure 1-11. Example of an epidemic histogram of cases by time of symptom onset



CHAPTER 1, FOOD SAFETY

Rev Aug 99

Table 1-12. Example of incubation periods, onset, and meal times by patient for a staphylococcal food poisoning outbreak

Patient (number)	Ate Meal (time)	Became Ill (time)	Incubation Period (hours)
8	1300	1345	0.75
20	1130	1300	1.50
2	1130	1330	2.00
12	1130	1345	2.25
21	1200	1415	2.25
13	1130	1415	2.75
9	1130	1430	3.00
10	1145	1445	3.00
7	1130	1430	3.00
4	1130	1445	3.25
5	1130	1500	3.50
14	1200	1530	3.50 Median
16	1130	1515	3.75
22	1230	1615	3.75
23	1200	1600	4.00
3	1130	1545	4.25
11	1230	1715	4.75
15	1200	1730	5.50
18	1300	1845	5.75
1	1200	2000	8.00
6	1300	2115	8.25
17	1130	2230	11.00
19	1130	0030	13.00
Total (23 Cases)			102.75

Incubation period:

Range: 0.75 hours (shortest)

To 13.00 hours (longest)

Median: 3.5 hours

Mean: 4.5 hours (102.75 ÷ 23)

CHAPTER 1, FOOD SAFETY

Table 1-13. Example of incubation periods grouped by two hour intervals for a staphylococcal food poisoning outbreak

Incubation Period	Number of Cases
First 2 Hours	2
2nd-3rd Hours	12
4th-5th Hours	5
6th-7th Hours	0
8th-9th Hours	2
10th-11th Hours	1
12th-13th Hours	1

Table 1-14. Example of food specific attack rates for an outbreak investigation

Food Item	Persons Exposed (ate food)			Persons Not Exposed (did not eat food)			
	Total	# Ill	% Ill	Total	# Ill	% Ill	Difference in % Ill
Potato salad	246	192	78.0	58	4	6.9	71.1
Tomatoes	253	127	50.2	51	19	37.3	12.9
Ice cream	201	98	48.8	103	48	46.6	2.2
Beans	258	129	50.0	46	17	37.0	13.0
Ham	230	108	47.0	74	38	51.4	-4.4
Crab Cakes	235	124	52.8	69	22	31.9	20.9