

Definitions of Foodborne Illness Outbreak Contributing Factors

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Contamination Factors

Contamination contributing factors introduce or otherwise permit contamination. These factors relate to how the etiologic agent got onto or into the food.

- C1 Toxin or chemical agent naturally part of tissue in food:** A natural toxin found in a plant, fungus, or animal; OR a chemical agent of biologic origin that occurs naturally in the plant, fungus, or animal or bioaccumulates in the plant, fungus, or animal before or soon after harvest or slaughter.

Examples of this type of contributing factor include:

- Ciguatera fish poisoning due to consumption of tropical marine finfish which have bioaccumulated naturally occurring ciguatera toxins through their diet.
- Scombroid fish poisoning due to consumption of fish containing elevated levels of histamine.
- Mushroom poisoning due to consumption of toxic mushrooms.

- C2 Poisonous substance or infectious agent intentionally added to food to cause illness (does not include injury):** A poisonous substance, chemical agent, or infectious agent was intentionally/deliberately added to the food in quantities sufficient to cause illness. Poisons added because of sabotage, mischievous acts, and attempts to cause panic or for blackmail fall into this category. This CF does not apply to physical objects (such as a sharp object) intentionally added to food to cause injury.

Examples of this type of contributing factor include:

- Cyanide or phenolphthalein deliberately added to food to cause illness.
- Methomyl pesticide intentionally added to food to cause illness.
- *Salmonella* intentionally added to food to cause illness.

- C3 Poisonous substance accidentally/inadvertently added to food:** A poisonous substance or chemical agent was accidentally or inadvertently added to the food. This addition typically occurs at the time of preparation or packaging of the food. Misreading labels, resulting in either mistaking poisonous substances for foods or incorporating them into food mixtures, would also fall into this category.

Examples of this type of contributing factor include:

- Sanitizer or cleaning compound accidentally added to food or metallic ingredient accidentally added to food (e.g., copper in cake icing).

- C4 Ingredients toxic in large amounts accidentally added to food:** An approved ingredient was accidentally added in excessive quantities to the food so as to make the food unacceptable for consumption.

Examples of this type of contributing factor include:

- Excessive amount of niacin in bread.
- Excessive amount of nitrites in cured meat.
- Excessive amount of ginger powder in gingersnaps.

C5 Container or equipment used to hold or convey food was made with toxic substances: The container that held or conveyed the implicated food is made of toxic substances. The toxic substance either migrates into the food or leaches into the food through contact with highly acidic foods.

Examples of this type of contributing factor include:

- Galvanized container used to store acidic food/beverage.
- Flour stored in a container that previously held toxic materials.
- Pre-made ice stored in a toxic container.

C6 Food contaminated by animal or environmental source *at point of final preparation/sale*: The food was contaminated at point of final preparation/sale (e.g., restaurant, private home, etc.) by animal or environmental source(s), such as from dripping, flooding, airborne contamination, access of insects or rodents, and other situations conducive to contamination.

Examples of this type of contributing factor include:

- Mouse feces in pantry contaminates food.
- A leaky roof permits water to seep into a walk-in refrigerator and contaminates stored food.

C7 Food contaminated by animal or environmental source *before arriving at point of final preparation (pre- or post-harvest)*: The food was contaminated before arriving at the point of final preparation by animal or environmental sources, either pre-harvest (e.g., growing field, harvest area, irrigation water, etc.) or post-harvest (e.g., processing or distribution facility, in warehouse storage, during transit, etc.).

Note: Traceback may implicate the identification of where the food was contaminated (pre-harvest versus post-harvest). If identified, please indicate this in the Point of Contamination question in the NORS interface; otherwise, please select "before point of final/preparation/sale: unknown."

Pre-harvest examples of this type of contributing factor include:

- Shellfish from sewage polluted waters or closed beds.
- Crops watered by contaminated irrigation water.
- Produce grown in soil contaminated by geese.
- Live poultry contaminated with *Campylobacter* then slaughtered and poultry distributed to retailers.
- Eggs contaminated with *Salmonella*.

Post-harvest examples of this type of contributing factor include:

- Peanut butter contaminated by bird droppings in a processing plant.
- Cheese contaminated with *Listeria* in a cheese manufacturer plant.

C8 Cross-contamination of foods, excluding infectious food workers/handlers: The pathogen was transferred to the food source from contaminated surfaces, foods, and/or fomites to include, but not limited to, food worker's hands, cutting boards, preparation tables, utensils, processing lines, etc.

Examples of this type of contributing factor include:

- A ready-to-eat (RTE) food was prepared on the same cutting board as contaminated raw poultry.
- A food worker handled contaminated raw foods without subsequently washing their hands, and afterward handled an RTE food.
- Materials used to clean equipment (e.g., cloths, sponges, etc.) that processed contaminated raw foods were subsequently used on surfaces that came in contact with RTE foods without first being disinfected.
- Contaminated raw foods touched or dripped onto foods that were not subsequently cooked.
- Contaminated raw foods were processed on shared lines with non-contaminated food items.

C9 Contamination from infectious food worker/handler through *bare hand* contact with food: A food worker/handler, who is suspected or confirmed to be infectious, used their bare hands to touch/prepare foods that are not subsequently cooked. If it is unknown whether the food worker was wearing gloves or not, then cite C11. If there is evidence for both bare hand contact and glove-hand contact with the food, both C9 and C10 should be cited.

This is a typical situation that precedes outbreaks caused by norovirus or staphylococcal enterotoxins.

Potential reasons to suspect or confirm that a food worker is "infectious"—an all-inclusive term used to describe all persons who are colonized by, infected with, a carrier of, or ill due to a pathogen:

- They recently displayed or admitted to common enteric disease symptoms (e.g., diarrhea, vomiting, nausea, fever) that may be similar to symptoms identified in those who are ill in the outbreak investigation.
- Their household member exhibited similar symptoms directly preceding the outbreak.
- They tested positive for an enteric pathogen.
- Other epidemiologic or environmental evidence.

Examples of this type of contributing factor include:

- An infectious food worker/handler preparing deli meat without wearing gloves contaminated the food served to restaurant patrons.

C10 Contamination from infectious food worker/handler through *glove-hand* contact with food: A food worker/handler, who is suspected or confirmed to be infectious, used their glove-hands to touch/prepare foods that were not subsequently cooked. If it is unknown whether the food worker was wearing gloves or not, then cite C11. If there is evidence for both bare hand contact and glove-hand contact with the food, both C9 and C10 should be cited.

This is a typical situation that precedes outbreaks caused by norovirus or staphylococcal enterotoxins.

Examples of this type of contributing factor include:

- An infectious food worker/handler prepared deli meat while wearing gloves that were not changed after coughing into their hand, which contaminated the food served to restaurant patrons.

C11 Contamination from infectious food worker/handler through unknown type of hand contact with food

or indirect contact with food: A food worker/handler, who is suspected or confirmed to be infectious, used their hands to touch/prepare foods that were not subsequently cooked, but the epidemiologic/environmental investigation was unable to determine whether or not the food worker was wearing gloves during food preparation OR a food worker/handler, who is suspected or confirmed to be infectious, contaminated the food indirectly (no direct bare-hand or glove-hand contact with the food).

This is a typical situation that precedes outbreaks caused by norovirus or staphylococcal enterotoxins.

Examples of this type of contributing factor include:

- An infectious food worker/handler prepared deli meat, though it was unknown if gloves were worn, contaminated the food served to restaurant patrons.
- An infectious food worker/handler contaminated utensils that subsequently contaminated food served to restaurant patrons.

C12 Contamination from infectious non-food worker/handler through direct or indirect contact with food: A person other than a food handler/worker who is suspected or confirmed to be infectious, contaminated ready-to-eat foods that were later consumed by other persons, resulting in spread of the illness. A "non-food handler/worker" is considered to be any person who is not directly involved in the handling or preparation of the food before service.

Potential reasons to suspect or confirm that a non-food worker is "infectious"—an all-inclusive term used to describe all persons who are colonized by, infected with, a carrier of, or ill due to a pathogen:

- They recently displayed or admitted to common enteric disease symptoms (e.g., diarrhea, vomiting, nausea, fever, etc.) that may be similar to symptoms identified in those who are ill in the outbreak investigation.
- Their household member exhibited similar symptoms directly preceding the outbreak.
- They tested positive for an enteric pathogen.
- Other epidemiologic or environmental evidence.

Examples of this type of contributing factor include:

- An ill person attended an event and contaminated ready-to eat-foods in a buffet line by handling food before someone else consumed it.
- Pizza was prepared by a healthy food worker and arrived pathogen-free. An ill non-food worker, such as a mother, rearranged pizza slices onto plates before serving the slices to a group of children at a birthday party, and these children subsequently developed foodborne illness.
- An infectious non-food worker/handler contaminated utensils that subsequently contaminated food at a potluck.

C13 Other source of contamination (specify): A form of contamination that does not fit into the above categories; the factor should be specified in the "Contributing Factors Comments" section.

Proliferation Factors

Proliferation contributing factors allow proliferation of etiologic agents. These factors relate to how the pathogen was able to increase in numbers and/or produce toxic products before the food was ingested. These factors are only for bacterial and fungal outbreaks.

P1 Allowing foods to remain out of temperature control for a prolonged period *during food preparation*:

During food preparation, food was kept out of temperature control for a prolonged period that allowed pathogenic bacteria and/or fungi to multiply to an amount sufficient to cause illness or to produce toxins if toxigenic.

Examples of this type of contributing factor include:

- Improper thawing (such as allowing frozen food to thaw at room temperature or leaving frozen foods in standing water for prolonged periods) allowed pathogens to multiply.
- Prolonged preparation time (such as prolonging preparation time by preparing too many foods at the same time) allowed pathogens to multiply.

P2 Allowing foods to remain out of temperature control for a prolonged period *during food service or display*: During food service or display, food was kept out of temperature control for a prolonged period that allowed pathogenic bacteria and/or fungi to multiply to an amount sufficient to cause illness or to produce toxins if toxigenic.

Examples of this type of contributing factor include:

- Foods left out at ambient temperature for a prolonged time at a church supper.
- No time or temperature control measures on a buffet line.

P3 Inadequate cold holding temperature due to malfunctioning refrigeration equipment: Malfunctioning refrigeration equipment caused foods to be held at an inadequate cold holding temperature.

Examples of this type of contributing factor include:

- Walk-in cooler malfunctioned causing inadequate cold holding temperature of food.
- A broken or torn door gasket caused air leakage in a reach-in refrigerator resulting in inadequate cold holding temperature of food.

P4 Inadequate cold holding temperature due to an improper practice: Inadequate cold holding temperature occurred due to an improper practice.

Examples of this type of contributing factor include:

- Overloaded refrigerator resulting in poor air circulation.
- Inadequately iced salad bar.
- Time/Temperature Control for Safety (TCS) foods, such as tuna or egg salad, were stacked above the fill line of the cold holding wells in a deli cold holding unit.

P5 Inadequate hot holding temperature due to malfunctioning equipment: Malfunctioning hot-holding equipment caused foods to be held at an inadequate hot holding temperature.

Examples of this type of contributing factor include:

- A steam table or crockpot broke and caused food to be held at inadequate hot holding temperatures.

P6 Inadequate hot holding temperature due to an improper practice: Inadequate hot holding temperature occurred due to an improper practice.

Examples of this type of contributing factor include:

- A steam table or crockpot was not turned on or properly maintained and caused food to be held at inadequate hot holding temperatures.
- A crockpot being used to heat or reheat food was overloaded and caused food to be held at inadequate hot holding temperatures.

P7 Improper cooling of food: Foods were refrigerated in large quantities or stored in devices where the temperature was poorly controlled and allowed pathogens to multiply.

Examples of this type of contributing factor include:

- Foods were refrigerated in large masses or as large volumes of foods in containers, which did not allow proper cooling.
- Foods were stored in containers with tight-fitting lids, pans were stacked on top of others, or crowded storage in a refrigerator, all of which led to inadequate air circulation during cooling process.

P8 Extended refrigeration of food for an unsafe amount of time, relative to the food product and pathogen: This situation is a concern for psychrotrophic pathogenic bacteria (e.g., *Listeria monocytogenes*, *Clostridium botulinum* type E, *Yersinia enterocolitica*, *Aeromonas hydrophila*) that can multiply over sufficient time at ordinary refrigerator temperatures and grow to an amount sufficient to cause illness or produce toxins if toxigenic (e.g., *C. botulinum*).

Examples of this type of contributing factor include:

- *Listeria* growth after deli meat refrigeration for more than 7 days
- Kept containers of commercially prepared foods for several weeks after they were opened

P9 Inadequate reduced oxygen packaging (ROP) of food: Food was sealed using inadequate Reduced Oxygen Packaging (ROP) methods, which provided conditions conducive to growth of anaerobic or facultative bacteria in foods. ROP includes processing and packaging techniques that prevent the entry of oxygen into the container, such as vacuum packaging, modified or controlled atmosphere packaging, cook chill packaging, sous vide packaging, hermetically sealed containers (double seams/glass jar with lid), deep containers from which air is expressed, and products packed in oil.

Examples of this type of contributing factor include:

- Inadequate process applied to vacuum-packed fish
- Insufficient process applied to salad in gas-flushed bag
- Ineffective hermetically seal on can
- Garlic packaged in oil with unsatisfactory process
- Lack of controlled atmosphere packaging of beef jerky

P10 Inadequate non-temperature dependent processes (e.g., acidification, water activity, fermentation) applied to a food to prevent pathogens from multiplying: Non-temperature-dependent processes (e.g., acidification, water activity, fermentation) failed and allowed pathogens to multiply to an amount sufficient to cause illness. This situation is a concern for growth of preformed heat-stable toxins or bacterial spores (e.g., *Clostridium perfringens*, *Clostridium botulinum*, *Bacillus cereus*, *Staphylococcus aureus*).

Examples of this type of contributing factor include:

- Insufficient acidification (low concentration of acidic ingredients) in home canned foods
- Insufficiently low water activity (low concentration of salt) in smoked/salted fish
- Inadequate fermentation (starter culture failure or improper fermentation conditions) in processed meat or processed cheese

P11 Other situations that promoted or allowed microbial growth of toxic production (specify): A factor that promoted growth, proliferation, amplification, or concentration of bacterial agents but that did not fit into any of the other defined categories; the factor should be specified in the 'Contributing Factors Comments' section.

Survival Factors

Survival contributing factors allow survival or fail to inactivate the contaminant. These factors refer to processes or steps that should have killed or reduced the pathogen population to below an infectious dose but did not because of one of these factors. These factors are only for bacterial, viral, parasitic, or fungal outbreaks).

S1 Inadequate time and temperature control *during initial cooking/thermal processing of food*: The time and temperature during initial cooking/thermal processing (e.g., pasteurizing, blanching, drying, dry roasting, frying, infrared, microwave, oil roasting, steaming) was inadequate to kill or reduce the pathogen population to below an infectious dose. In reference to cooking, but not retorting, it refers to the destruction of vegetative forms of bacteria, viruses, and parasites, but not bacterial spores. If the food under investigation was retorted, then spore-forming bacteria would be included.

Examples of this type of contributing factor include:

- Inadequate cooking of meats/poultry before service
- Inadequate pasteurization of milk

S2 Inadequate time and temperature *during reheating of food*: The time and temperature during reheating or heat processing of a previously cooked food (which may have been cooled overnight) was inadequate to kill or reduce the pathogen population to below an infectious dose.

Examples of this type of contributing factor include:

- Reheating of sauces or roasts to a temperature insufficient to reduce the level of contamination to below an infectious dose

S3 Inadequate time and temperature control *during freezing of food designed for pathogen destruction*: The time and temperature during freezing was inadequate to kill or reduce the pathogen population to below an infectious dose. A freezing process may be used in order to ensure the destruction of certain parasites before raw service of some foods, such as fish.

Examples of this type of contributing factor include:

- Pacific red snapper was not sufficiently frozen before served in raw sushi, or an investigation revealed that the time and temperature requirements to kill parasites were not achieved.

S4 Inadequate non-temperature dependent processes (e.g., acidification, water activity, fermentation) applied to a food to prevent pathogens from surviving: Non-temperature depending processes (e.g., acidification, water activity, fermentation) designed to kill or reduce the pathogen population to below an infectious dose were inadequate or improperly used, allowing pathogens to survive. This situation is

more of a concern for pathogenic bacteria with low infectious doses, making pathogen survival more often the cause for illness rather than pathogen proliferation.

Examples of this type of contributing factor include:

- Inadequate acidification of seafood when preparing ceviche, allowing for pathogen survival
- Inadequate acidification of unpasteurized juice, in which the inappropriately high pH allowed survival of *E. coli*
- Inadequate salting of fresh water fish, allowing for parasite survival
- Inadequate fermentation of sauerkraut, allowing for survival of *Listeria monocytogenes*
- Inadequate chlorine concentration used for washing lettuce, allowing for survival of *E. coli*

Please note:

- Though chemicals may be added to foods to inhibit bacterial growth, at normal levels of use, most chemicals cause inhibition rather inactivation.
- Though pH is considered primarily a means of growth inhibition and not a method of destruction of existing pathogens, at low pH values, many bacterial pathogens will be destroyed if held at that pH for a significant amount of time, even if their growth is already inhibited. If the acidification procedures are inadequate, pathogenic bacteria can survive *E. coli O157:H7* and *Listeria monocytogenes*, in particular, are able to survive acidic conditions.

S5 No attempt was made to inactivate the contaminant through initial cooking/thermal processing, freezing, or chemical processes: No attempt was made to inactivate the contaminant through initial cooking/thermal processing, freezing, or chemical processes.

Examples of this type of contributing factor include:

- Unpasteurized milk or cider
- Oysters served raw

S6 Other process failures that permit pathogen survival (specify): A form of survival that does not fit into the above categories; the factor should be specified in the 'Contributing Factors Comments' section.