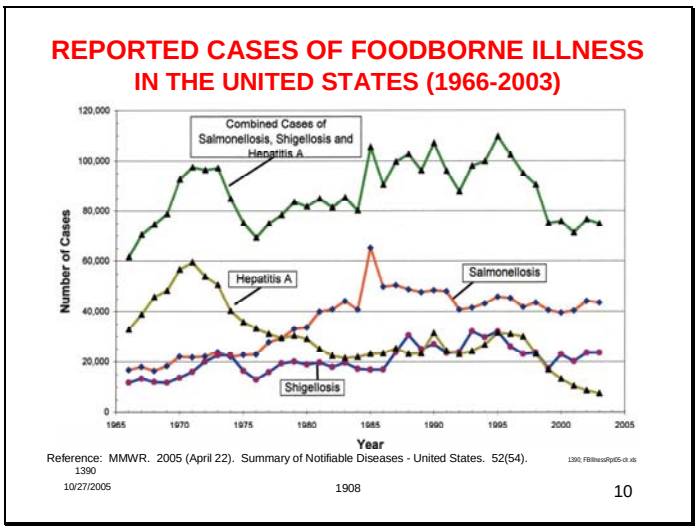


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## Foodborne Illness

Foodborne illness can occur whenever and wherever food is prepared and served in homes, restaurants, institutions, fairs, and carnivals. Foodborne illnesses are a result of the lack of understanding of the hazards by the people who prepare and serve the food, and failure to use adequate controls.

Why is foodborne illness on the rise? The most significant reason foodborne illness outbreaks continue is that animals seem to be more diseased than in the past, and anyone can grow, process, and supply food without demonstrating knowledge and control of the hazards associated with the production of raw food. People rely on government inspection to assure food safety. Government inspection of processed and cooked food is very effective. However, government inspection of raw food (meat, fish, poultry, fruits, vegetables, grains, etc.) only detects a tiny fraction of the hazards and cannot be assumed to assure food safety. Most government inspections are for quality standards or animal diseases that do not make humans ill.

## Immunity - Why More People Are Not Sick

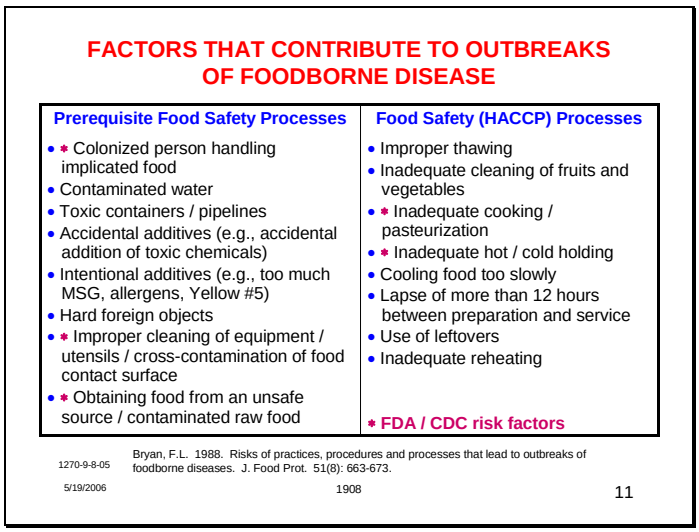
Healthy people become tolerant to certain types and levels of pathogenic bacteria within their bodies and do not become ill if they consume food or food products containing moderate levels of these pathogens. Humans can also develop resistance and tolerance to certain levels of toxins and chemicals. This is called **immunity**. Immunity usually develops after a person has become ill with a specific microorganism and has recovered.

On the other hand, infants, young children up to 5 years, the elderly, and those in weakened conditions because of illness or consumption of antibiotics have a low threshold of immunity and are susceptible to low levels of bacterial pathogens and low levels of toxic compounds. For example, as few as 1 *Salmonella typhi* per 10 grams of food can make a susceptible person ill. Healthy people normally can consume food containing greater than 10,000 *Salmonella* spp. in a meal before becoming sick.

## Prevention

Since FDA or USDA inspection of raw food does not assure safety, the most effective critical control point is to get food from suppliers who supervise or specify the growing and production conditions of the food and will certify to you the safety of their supplies. However, at this time there are virtually no suppliers of raw food who will certify their raw food as safe.

Therefore, the only effective critical control point is the establishment by owner(s)/manager(s) of operating policies, procedures, and standards that will reduce the contamination to a safe level. Employees must be trained to prepare, store and serve food according to these safety-assured policies, procedures, and standards. Owners and managers should never allow any employee to work in a foodservice establishment until that employee knows the food hazards and controls associated with the tasks he/she does.

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## Factors that Contribute to Outbreaks of foodborne Disease

The factors that contribute to foodborne disease and illness can be classified according to steps used in the production, preparation and service of food.

### Prerequisite Food Safety Processes

Colonized person handled implicated food. People can be carriers of pathogenic microorganism. Risks of contamination of food are increased whenever persons who have infected skin lesions, diarrhea, sore throats, or jaundice handle foods. Even healthy employees are a potential source of pathogenic microorganisms. Each day, 1 out of every 50 employees sheds high level of infectious pathogens in their feces. These pathogens are usually transferred to food from cuts and infections on the hands, and from inadequate hand washing after using the toilet or blowing the nose. Therefore, it must be assumed that **all** employees are a potential source of contamination. **The only control is 100% effective hand washing**.

Contaminated water. Contaminated water can transfer pathogens to food when community water supply systems fail or when contaminated well water is used to wash fruits and vegetables. It can also occur when sewage-polluted water is used for irrigation.

Toxic containers / pipelines. Defective backflow valves on soft-drink machines and other conditions that lead to back siphonage have resulted in outbreaks of copper poisoning. Zinc poisoning has resulted from highly acid foods (e.g., lemonade) being stored in galvanized containers. Acid foods should never be stored in containers that contain toxic metals (e.g., copper containers, cadmium containing containers, and enamelware containing antimony or lead).

Accidental additives. This is the accidental addition of toxic compounds to food. This occurs when personnel do not read labels of cleaning and pest control products, and they mix these toxic chemicals with food.

Intentional additives. This is the excessive addition of chemical additives (e.g., monosodium glutamate or nitrates) to foods during preparation. Incidents occur when food preparation personnel do not follow formulations or recipes.

Hard foreign objects. Incidents and injuries result from ingesting physical / hard foreign objects in food (e.g., hair, jewelry, fingernail polish, glass, and staples from packing materials). Customers are offended when they find foreign objects in their food and may never return to the foodservice unit. Lawsuits result when ingestion of a hard foreign object causes injury.

Improper cleaning of equipment / utensils / cross-contamination of food contact surface. Effective cleaning / sanitizing procedures for utensils and equipment are well established, but, lack of training of personnel and supervision by managers, short cuts, sloppiness, and carelessness contribute to contaminants remaining on "clean" surfaces. Inadequate cleaning resulting in cross-contamination can be a major problem. For example, when raw chicken is cut on a cutting board, pathogens are transferred to the board. When cooked food is placed on the unsanitized cutting board, pathogens from the raw chicken are transferred to the cooked food. Any time an unsanitized pan, knife, or hand is used to prepare or serve food, the same result will occur. Washing a cutting board with a dirty, moist wiping towel or sponge can also add pathogens to the cutting surface.

Cross-contamination occurs when:
1) a contaminated raw food is handled by someone or it contacts surfaces of utensils or equipment; 2) hands or surfaces contaminated by raw food make contact with an uncontaminated or cooked food; 3) equipment and surfaces are not washed and sanitized between raw and cooked food handling; and 4) personnel do not wash hands in between handling raw and cooked foods.

Obtaining food from an unsafe source / contaminated raw food. Examples include shellfish taken from sewage-polluted waters; raw milk (including certified raw), cheese and other dairy products made from raw milk; and wild mushrooms.

Raw foods are sources of pathogenic microorganisms, bringing them into processing areas and kitchens. All raw produce, meat, fish, and poultry, including government-inspected items, must be considered as sources of pathogenic microorganisms and therefore, hazardous. Currently, there is no government legislation that guarantees the safety of raw foods.

### Food Safety (HACCP) Processes

Improper thawing. If thawed foods remain at room temperature or in a warm water bath for a long time after they have thawed, microorganisms can multiply. Risks of illness as a result of improperly thawed raw foods are low, because the growth of spoilage microorganisms is usually sufficient to inhibit pathogen growth. Also, raw food will be cooked, which reduces pathogens to a safe level. However, if cooked foods are improperly thawed, there is a greater risk of foodborne illness due to the growth of pathogenic microorganisms and spore outgrowth, because large numbers of spoilage bacteria are destroyed during cooking, leaving too few to inhibit the growth of pathogens.

Inadequate cleaning of fruits and vegetables. Raw fruits and vegetables are sources of pathogenic microorganisms and chemical residues from pesticides and herbicides. If raw fruits and vegetables are not washed, or are inadequately washed, they can cause a foodborne disease / illness when consumed.

Inadequate cooking / pasteurization. Heat processing procedures must assure that vegetative cells of microorganisms introduced by workers, contaminated irrigation water, or poor slaughtering procedures are destroyed or are at a level that will not be a risk to any consumers of the product. Government inspection of raw foods does not detect the presence of pathogens in food. Unless foodservice operators use extraordinary care to specify the pathogenic microbiological levels in the food received, all food must be heated sufficiently to reduce at least 1,000 *Salmonella* spp. per gram to 1 per 100 grams.

Inadequate hot holding / cold holding. This occurs when foods are cooked and are then allowed to remain at temperatures that permit the outgrowth of spores and multiplication of pathogenic bacteria. Steam tables, bains marie, insulated containers, and hot-holding cabinets must keep hot, and cooked foods at or above 135°F.

For food to be of high quality, it must be served above 150°F (except beef). However, when food is kept on a steam table at 150°F for extended periods of time, it becomes overcooked and loses nutritional value. Food in this condition does not meet customers' expectations for freshly prepared food. To retain quality over long periods of time, some cooks turn down the heat in a steam table. However, when food is prepared too far ahead and is held at incubation temperatures for long periods of time, microorganisms can multiply. People eating such food will become sick.

After food is cooked, the vegetative pathogens such as *Salmonella* and *Listeria monocytogenes* have been reduced to a very low, safe level. However, there are spoilage vegetative cells and spore pathogens that must be controlled. Refrigerators are designed to operate at about 40ºF; so, a practical temperature for cold holding is about 40ºF, which prevents the outgrowth of the spore pathogens and gives a shelf life of a week to much longer for cooked, properly cooled food.

Cooling food too slowly. Conditions that cause improper cooling are responsible for over 20% of microbiological foodborne illnesses. This is predictable, because both cooked and raw foods in foodservice operations contain some pathogenic microorganisms and spores. When food becomes cross-contaminated after cooking or is cooled too slowly (particularly if food is cooled in a large container), spores outgrow and vegetative microorganisms multiply, given time and proper multiplication temperatures. When pathogenic microorganisms multiply to sufficient numbers in foods and/or produce sufficient amount of toxin in food, people become ill when the food is consumed.

Lapse of more than 12 hours between preparing and eating. Time is required for spores to germinate into vegetative cells, which then multiply, reach hazardous levels in food, and form toxins in some pathogens. At a minimum, the FDA gives 4 hours, which assumes that the food is at the fastest growing temperature for microorganisms, 95 to 105ºF. While the FDA currently does not provide for it, growth will be longer at other temperatures, depending on pH, water activity, spices, and other inhibitors in the food, or temperature. Weeks are needed for some pathogens to multiply during cold storage. If there is a lapse of time between preparation and consumption, the food must be maintained at temperatures that minimize the growth of pathogenic bacteria. The FDA Food Code recommends that: "Food will be held either cold (below 41°F) or hot (above 135°F), even while on display." However, to prevent multiplication of pathogenic bacteria, food must be kept below 29.3°F or above 130°F. If you do not want to keep food at 41ºF or below or 135ºF or above, then, the Food Code says, it can be held only for 4 hours before it is thrown away.

Use of leftovers. The FDA Food Code allows the use of leftovers, if they are cooled from 135 to 70°F within 2 hours followed by further cooling to 41°F (6 hours or less, total time), and if the food is reheated to 165°F or above for 15 seconds within 2 hours. This FDA directive is made to control the growth of microorganisms that may occur during cooling of food. USDA Guidelines for cooling are to continuously cool food, within 90 minutes after cooking, from 120°F to 55°F within 6 hours, followed by further cooling to 40°F (no time limit) before boxing.

Inadequate reheating [to 165°F]. The FDA's recommendation to reheat cooked food to 165°F or above within 2 hours and holding it for 15 seconds as a way to control the safety of food is a false assumption. Many foods that are used in cold salads and sandwiches are never reheated after cooking. Furthermore, toxins produced by the growth of *Staphylococcus aureus*, *Clostridium botulinum* or *Bacillus cereus*, if present in the food, are not destroyed when food is heated to 165°F. In order to ensure the destruction of the toxin of *Clostridium botulinum*, food must be heated to 180°F for at least 5 minutes. Toxins formed by *Staphylococcus aureus* and *Bacillus cereus* remain unchanged when food is heated at boiling temperatures (212°F for 25 minutes or more). Because of these factors, reheating food to 165°F should only be used for customer satisfaction. After food is cooked, pathogenic bacteria in the food must be kept at a safe level with process control.

## Summary

Food production facilities, foodservice units, and retail food operations must use HACCP-based programs to assess hazards and establish controls in order to diminish risks and prevent foodborne illness / disease and injury of customers. One cannot rely on government inspection programs and government information for accurate specification of safe food handling practices.

References

Bryan, F.L. 1988. Risks of practices, procedures and processes that lead to outbreaks of foodborne diseases. J. Food Prot. 51(8): 663-673.