Food Safety and the Origins of Foodborne Disease

HIGHLIGHTS

- Insufficient cooking temperatures, cross-contamination, inadequate refrigeration, lack of personal cleanliness and inadequate cleaning can all provide opportunities for foodborne disease.
- Safe and proper food handling practices can reduce the risk of foodborne disease.
- In 2001, approximately 70% of Peel residents felt the food in restaurants in Peel was safe to eat.

There are many opportunities in the stages of food production for food to become contaminated and subsequently cause illness. However, implementation of safe and proper food handling practices at every stage of the process can reduce the risk of foodborne diseases.

Many of the biological hazards discussed in this report are present in a variety of different food sources including uncooked meat, fruits and vegetables, eggs, oysters and filter-feeding shellfish.

The intestines of healthy animals can contain many foodborne microbes which are a source of food contamination. When meat and poultry are slaughtered, their carcasses can become contaminated if they come in contact with even the smallest amount of intestinal contents from the animals.[1]

Fresh fruits and vegetables are also sources of food contamination if they are irrigated or washed with water that is contaminated by animal or human waste. Eggs can be a source of food contamination because some types of *salmonella* can infect a hen's ovary and in turn contaminate the contents of a normal-looking egg. Oysters and filter-feeding shellfish can become concentrated with bacteria which are naturally present in sea water. In addition, they can also concentrate other microbes that are found in sewage that is dumped into the sea. When products containing these bacteria are eaten, they can cause severe illnesses.[1]

In food preparation, microbes can be introduced in a number of ways, each of which can be prevented by proper food handling:

1. *Insufficient cooking temperatures*— Microbes present in raw food can only be destroyed when foods are cooked and their internal temperatures reach 78 degrees Celsius.[1] An internal temperature of 78 degrees Celsius is sufficient to kill all bacteria, parasites and viruses except *clostridium*, which can only be killed at temperatures above the boiling point.[1] Therefore, it is recommended that meat thermometers are used to ensure food is cooked to the correct temperature.

2. *Cross contamination*— Microbes can be easily transferred from one food to another by using the same utensils such as knives, tongs or cutting boards without washing them in between uses.[1] In addition, cross contamination can occur when food that is fully cooked comes in contact with raw food or drippings from raw food which will cause the cooked food to become recontaminated.[1] Therefore, raw foods should be kept separate from ready-to-eat foods to prevent cross contamination. Cross contamination can be easily prevented through proper cleaning and sanitizing of utensils and work surfaces.

3. *Inadequate refrigeration*— If lightly contaminated food is left at room temperature overnight, microbes can multiply and become highly infectious by the next day. Refrigerated food will not allow bacteria to multiply but it can preserve the bacteria in a state of suspended duplication.[1]

4. *Lack of personal cleanliness*— Personal cleanliness is essential in preventing foodborne diseases from being transferred from a food handler to food. Hands must be washed thoroughly with soap and water before preparing any food, after using the washroom and after contact with raw food. Lack of proper hygiene can cause *shigella* or *giardia* to be introduced into food by the unwashed hands of food handlers who are infected.[5]

5. *Inadequate cleanliness/cleaning of food products*— All fruits and vegetables should be washed to remove dirt and bacteria present on the outer layer. For example, when melons are not washed they can contaminate the inside of the melon during slicing. In the United States during April 2001, melon-associated foodborne illness outbreaks were traced to cantaloupes infected with *salmonella*.[20]

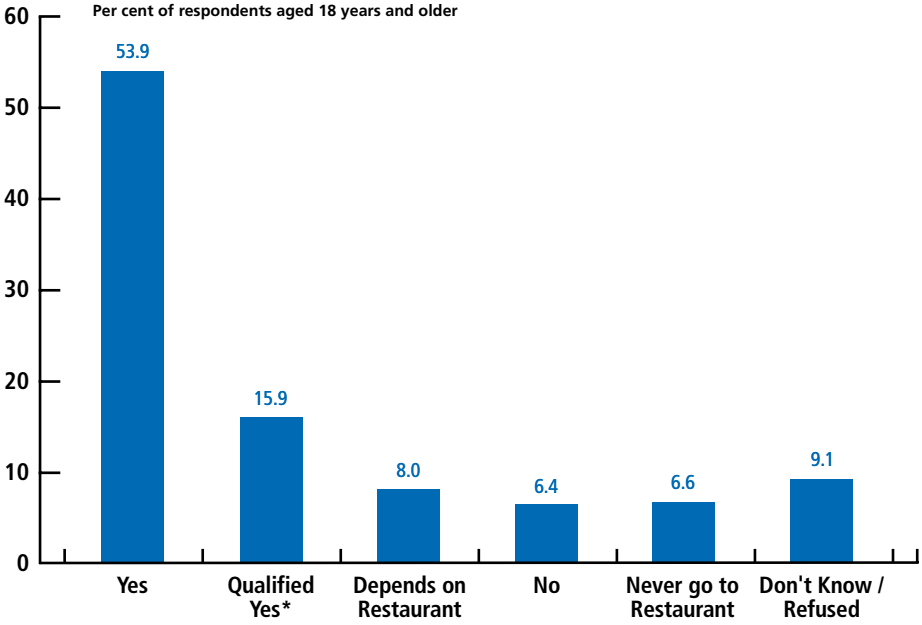
There are a number of risk settings, including private homes, commercial establishments and institutions, in which foodborne diseases have been transmitted. Any place food is prepared is a potential risk setting for foodborne disease, although levels of risk vary.

In 2001 and 2002, the Rapid Risk Factor Surveillance System (RRFSS) survey collected relevant information about dining behaviours (2001 and 2002) and perceptions of food safety (2001 only) from a random sample of Peel residents. Respondents were asked whether they had eaten in a restaurant, eaten fast food, or had ready-to-eat foods during the past week. In 2002, over half (54%) of respondents had eaten in a restaurant during the past week, while 57% reported having had fast food and 68% had consumed ready-to-eat foods during the same time period.

In the 2001 RRFSS survey, approximately 70% of respondents indicated they felt the food in restaurants in Peel was safe to eat *(see Figure 11)*.

The extent to which good food safety practices are used in homes and commercial establishments is difficult to determine because cases of foodborne diseases are significantly under-reported. For example, in the United States, recent surveys found that only 8% of people with acute diarrhea sought medical care.[21] In addition, fewer than half the physicians asked for stool specimens. The accuracy of reporting systems depends upon ill individuals seeking medical attention and having laboratories confirm the diagnosis.[22,23,24]

Figure 11: Proportion of Respondents Perceiving Restaurant Food as Safe, Region of Peel, 2001



* Respondent volunteered an affirmative answer such as, "I suppose so" or "I guess so", etc.

Source: Rapid Risk Factor Surveillance System, Region of Peel, 2001.

Additionally, some illnesses that occur in the home involve such small numbers of people that they are unlikely to be identified by public health officials.[25] Finally, many pathogens that can be transmitted through food are also transmitted through water and person-to-person contact which makes it difficult to determine if an illness was indeed foodborne.[26]

Restaurants, cafeterias and bars are locations that are frequently implicated in cases of foodborne illness. However, foodborne disease arising from foods consumed in private homes occurs three times more frequently than illness from eating foods from commercial establishments.[1,25] It has been found that home kitchen environments are more heavily contaminated with fecal bacteria than a washroom.[20,27] Pathogenic and non-pathogenic organisms are continually introduced into the home and kitchen by people, pets, food, insects, etc. Kitchens in homes are also used for purposes other than cooking, and organisms may be introduced from the various activities that occur in the space.[20]

In Ontario from 1997 to 2001, there were 44,451 sporadic cases of foodborne illness that could be attributed to eight enteric diseases: campylobacteriosis; salmonellosis; verotoxin-producing *Escherichia coli* (VTEC); yersiniosis; shigellosis; hepatitis A; *listeria*; and *Clostridium botulinum*. In 74% of the cases, foodborne contamination was identified as the cause. The most common risk settings were private homes (50.2%), travel-related illness (24.6%) and restaurants (14.1%).[28] Risk setting was reported in only about 58% of the cases.

A multi-state survey of consumer food handling and food consumption practices conducted in the United States in 1995/96 showed risky food handling behaviours were common among respondents.[29] The telephone survey involving eight states asked respondents about practices after contact with raw meat or chicken, regarding handwashing and cutting boards. In addition, they were asked about how often in the previous year they ate hamburgers that were pink at the centre, undercooked eggs and/or oysters. In terms of risky food handling, 19% of overall respondents reported not routinely washing their hands with soap after handling raw meat or chicken, although the prevalence of this behaviour varied between participating states (from 15% to 23%). Similarly, 19% of respondents reported not routinely washing cutting boards with soap or bleach after cutting raw meat or chicken. In terms of risky food consumption practices, 20% of overall respondents reported eating pink hamburgers during the previous 12 months, 50% reported eating undercooked eggs, and 8% reported eating raw oysters during that time period.[29]