Chapter 24
Prevention of Healthcare-associated Gastrointestinal Infections

Michael Borg

Key points

- Noroviruses are the commonest cause of healthcare-associated gastroenteritis.
- Isolation of symptomatic patients, strict attention to Contact Precautions, and prompt decontamination of spillages of vomit are critical for prevention and control.
- Good antibiotic stewardship is essential to prevent *Clostridium difficile* infections.
- In outbreaks of gastroenteritis, hand hygiene should ideally be undertaken using soap and water because of the relatively limited effect of alcohol-based hand rubs on viruses and spores.
- Food-associated outbreaks of gastrointestinal infections continue to occur in health care settings, especially in developing countries.
- Control of microbiological hazards in food production is mainly undertaken through temperature control.
- Routine testing of food handler's faeces, blood, or rectal swabs is neither cost-effective nor normally indicated.
- Inspection and auditing often reveal deficiencies in catering practices and allow corrective action to be taken.

Introduction

A variety of microbes can cause infectious gastroenteritis; most outbreaks in the health care setting are caused by viruses. Bacterial gastroenteritis can be associated with contaminated food and/or water and may spread through common vehicles or by healthcare personnel. Another major cause of healthcare-associated gastroenteritis is infection by toxigenic strains of *Clostridium difficile*. Food-borne infections continue to occur in the community and in health care institutions, especially in low resource countries during warmer months.

Diarrhoea is defined as:

- 2 or more episodes of watery stools (Bristol Stool Type 71)
  or
- 3 or more episodes of loose stools (Bristol Stool Type 6) over a period of 24 hours

It is important to exclude non-infectious causes of diarrhoea when investigating potential infections, such as:

- laxative use;
- allergic reactions, such as cases of lactose and coeliac diseases;
- chemical and physical agents;
- nasogastric feeding;
- inflammatory bowel disease;
- surgery on the gastrointestinal tract; and
- constipation associated with faecal impaction.

A food-borne outbreak should be considered when two or more persons develop gastroenteritis within 24 hours. Cases often occur in the same ward within a short time, or are linked by a common vehicle, such as contaminated food or water. Poor hygiene and non-compliance to infection prevention and control (IPC) practices can also be associated with transmission.

All cases of acute diarrhoea and/or vomiting in health care settings should be regarded as potentially infectious.

Viral Gastroenteritis[2-3]

Healthcare-associated gastroenteritis is most commonly caused by viruses, including norovirus, adenovirus, and rotavirus. Vomiting, often

sudden in onset and projectile in nature, is the major symptom. However, diarrhoea (mainly mild and short-term) can also be present, or occur on its own. Elderly patients are the most affected. Infections last 2 to 3 days and normally resolve spontaneously without the need for antibiotics. Immunosuppressed patients may shed viruses longer than others.

Outbreaks of viral gastroenteritis often have the following characteristics:
- Short incubation period (15 to 48 hours)
- Limited duration of illness (12 to 60 hours)
- Vomiting as the key symptom
- Affect both patients and staff

Noroviruses are highly infectious and can be transmitted between patients, healthcare workers, and the environment in two ways:
- Direct person to person contact (especially following hand contact)
- Indirect person-to-person spread following aerosol dispersion of viral particles during vomiting. This in turn contaminates the environment, which serves as the reservoir for subsequent contamination of hands.

Most health care outbreaks of gastroenteritis start following admission of an index symptomatic patient. For this reason, all patients admitted with gastrointestinal symptoms should be immediately isolated or cohorted.

Healthcare workers should wear gloves and an apron for all contact with these patients and their environment. Hands must be washed with soap and water after every such contact, including after removal of gloves. Alcohol-based hand rub should not be used, because the viruses that cause gastroenteritis tend to be of the non-enveloped variety and resistant to the effect of alcohol. There is no evidence to support the continuous wearing of masks when caring for patients with suspected viral gastroenteritis.

Bed linen and patient clothing should be changed daily. Removing and bagging linen should be performed in a way which minimises the dispersal of viruses from bed linen and clothes.

Environmental cleaning must be carried out to a high standard and cleanliness must be maintained. Patient rooms must be cleaned at least once a day and disinfected with an appropriate disinfectant (e.g., 1,000 ppm chlorine solution). Special attention should be given to toilets,

bathroom areas, commodes, and bedpans. Attention must also be given to horizontal and frequently touched surfaces, such as the nurses' station, nurse call system, telephones, door handles, sinks, and taps.

All spillages of vomit and faeces must be promptly decontaminated. Spillages must first be absorbed by paper towels; these should be discarded, wearing disposable gloves, apron, and a visor or mask. The contaminated area should then be washed with hot water and detergent and finally disinfected with a freshly-made chlorine solution at 10,000 ppm. All personal protective equipment should be discarded appropriately and hands then washed well with soap and water.

Cohorting of staff and patients can reduce the spread of viral gastroenteritis. Staff from wards with cases of gastroenteritis must not work in unaffected areas until 48 hours have elapsed. Affected staff should be excluded from the ward immediately; they should stay away from work until they have been symptom-free for 48 hours.

Monitor compliance with IPC practices during the outbreak. It is important to provide prompt feedback to reduce the risk of transmission. If these efforts fail, then it may be necessary to stop new admissions. Patients should not be transferred to unaffected wards or departments unless they need urgent specialist care.

In such situations, IPC staff must be consulted to assure proper precautions are in place to reduce the risk of exposure. If the agent is known, the IPC team and unit management should determine when the outbreak has stopped. Some experts believe that two complete incubations periods must go by without a new case prior to re-opening. For example, the ward could be re-opened 72 hours after the last case in a viral gastroenteritis situation with a short incubation period.

Terminal disinfection of the ward and changing of bed curtains should be performed before re-opening. The frequency of routine ward cleaning, especially bathrooms and toilets, should be increased and followed by disinfection using an appropriate disinfectant (e.g., freshly prepared 1,000 ppm chlorine solution).

Visitors should be restricted to individuals important for the well-being

of the patient. They may be asked to gown or wear an apron to reduce the risk of contamination. Visitors should be instructed in IPC practices, including hand hygiene while visiting and washing their hands on leaving the unit.

Antibiotic-associated Gastroenteritis[4]

Diarrhoea is a common complication of antibiotic treatment; it occurs due to disruption of the microbial flora in the large intestine. In some patients this microbial imbalance results in colonisation with *Clostridium difficile*. These anaerobic spore-forming bacteria can produce exotoxins that result in mucosal injury and inflammation of the large intestine. Symptoms ranging from mild diarrhoea to pseudomembranous colitis and even colonic perforation may occur. The risk of *C. difficile* infections (CDI) increases the longer the patient stays in hospital.

Antibiotic use is the major pre-disposing factor for CDI. Virtually all antibiotics, especially those with a wider spectrum, can predispose to the condition. Antibiotic stewardship initiatives that can reduce the volume of antibiotics prescribed – such as antibiotic restriction - are crucial for prevention of CDI.

If the infection does occur, effective IPC measures must be instituted promptly in order to minimise spread to other patients. Hygienic interventions, whether relating to hands or the environment, are important to achieve this goal. Hand hygiene should be undertaken using soap and water because of the lack of activity of alcohol-based hand rubs on *C. difficile* spores. Use of gloves and wearing of disposable gowns or aprons is also recommended for direct patient contact and contact with the patient's environment.

During outbreaks *C. difficile* has been cultured from numerous environmental sites, including toilets, commodes, bedding, and even cleaning equipment, such as mop heads. For this reason, a programme of thorough cleaning is critical to reduce environmental contamination with *C. difficile* spores. Chlorine-based compounds have long been the mainstay products for such applications. Recently, hydrogen peroxide mist has been used for terminal decontamination of rooms after discharge of CDI patients, with promising results.

Patients with CDI should be isolated as soon as possible in a single room with its own toilet facilities. If this is not achievable, cohorting is an acceptable alternative. Screening patients for asymptomatic carriage is not recommended. If, however, a patient's status is known, then patients with asymptomatic carriage of *C. difficile* should also be isolated, although decolonisation is not usually recommended.

It is important to ensure that equipment does not serve as a fomite to spread *C. difficile* spores. For this reason, single use items are preferred or thorough cleaning/disinfection must take place between patients. Use of rectal thermometers should be discouraged. Rectal thermometers must always be disposable and not used on another patient.

Prevention of Food-borne Gastroenteritis

The burden of food-borne illness in low resource countries is well documented. Intestinal diseases are prevalent in the community and transmission to health care facilities is common. The prevalence of healthcare-associated food-borne illness in developing countries varies; rates of healthcare-associated *Salmonella* and *Shigella* infections reaching 3% and 2.5% respectively have been reported. Fewer healthcare-associated food-borne illnesses occur in developed countries. Nevertheless, 247 outbreaks of *Salmonella* were documented in United Kingdom hospitals over a 10-year study period. Other microbes causing food-related illness include hepatitis A, *Campylobacter*, and *Yersinia*.

The role of IPC Teams (ICT) in promoting safe food hygiene practices depends on the type of catering used and the presence or absence of other stakeholders, such as catering managers and/or environmental health officers. Where the facility out-sources catering, the role of ICTs may be limited to contribution toward a due diligence approach through supervision of food distribution, as well as inspections and audits of the suppliers' kitchen premises. If food is prepared in the facility, the ICTs may need to provide a more significant contribution. Therefore, IPC personnel need to have a clear understanding of effective food hygiene.

Food Hygiene[5-6]

Food pathogens will survive and may multiply if food is left within the

temperature danger zone (6°C to 63°C). Control of microbiological hazards in food production is thus usually undertaken through temperature control.

Cold food must be served as soon as possible after removal from refrigeration. Heating food to achieve 75°C in its thickest part for 1-2 minutes will guarantee destruction of any biological hazards. When food is cooked and then cooled, cooling must be rapid; then the food should be held at temperatures that prevent microbial growth. Temperature control should be maintained until food is served.

Keeping hot food at an appropriate temperature is particularly important in systems where food is prepared in the kitchen and transported hot to be served without further re-heating. These systems are particularly risky and ICTs must pay special attention to ensuring that hot holding temperatures are maintained above 63°C.

The common causes of food-borne illness are:

- Preparing food more than a half day in advance of needs.
- Storage at room temperature.
- Inadequate cooling.
- Inadequate reheating.
- Undercooking.
- Cross contamination from raw to cooked food.
- Contamination from food handlers.

The concepts of food hygiene are similar to those used in other areas of IPC. IPC staff is therefore ideal candidates to spearhead food hygiene training. Numerous tools are available, both on the Internet and in print, to aid development of effective programs. The importance of preventing conditions for temperature and time to allow bacteria to reach infecting doses in food must be stressed. Effective personal and environmental hygiene and potential sources of contamination should also be part of any food hygiene training program.

Hazard Analysis Critical Control Points (HACCP) was pioneered in the 1960s within the United States' National Aeronautics and Space Administration program; it is incorporated into legislation of food safety both in the United States and the European Union. HACCP analyses the

food production process to determine possible microbiological, physical, or chemical hazards that may contaminate food as it is produced. Critical control points (steps in the process after which any contamination cannot be reversed) are identified. Preventive interventions are devised which are then monitored and corrected if any unacceptable deviation takes place. HACCP systems need to be recorded, audited, and verified routinely.

HACCP systems provide significant improvement in the quality and the safety of food. A successful HACCP system consists of a number of good hygiene practices, including regular equipment cleaning and maintenance, provision of effective hygiene facilities, systems to control insects and other pests, and regular training for staff on food hygiene. (See Table 24.1)

Testing of food, environment, and individuals

Food and environmental testing in the microbiology laboratory is expensive and labour intensive. It is not required to monitor food safety since a complete and functional HACCP system is more than satisfactory. Nevertheless, there are occasions when food and environmental testing is useful. It can provide confirmation of microbiological quality and safety. One useful spin-off is the impact such tests often have on food handlers, who can see visual evidence of the theoretical principles that they had been taught. A simple method of quality control that can be performed in all laboratories and is quite cost effective is semi-quantitative testing of environmental swabs taken from the production area. Routine testing for pathogens is of little benefit; it is more cost effective to count indicator microorganisms, especially *E. coli*, to identify poor hygienic food production practices.

Routine testing of food handler's faeces, blood, or rectal swabs is neither cost-effective nor generally indicated. An individual who screens negative may become a carrier; more worryingly, a negative screen may induce a false sense of security and result in negligence toward general and personal hygiene practices. It is much more cost-effective for any money set aside for food handler testing to be invested in better training of food handling personnel.

Ward kitchens

Ward kitchens should be kept clean. Refrigerators should be sited away from direct heat or sunlight and have a temperature monitoring device

Table 24.1. Adapting HACCP to health care food production

Step in Process	Foodborne Illness Concern	Prevention Methods
Receipt of food	Ready to eat foods contaminated with food poisoning bacteria or toxins.	Visual and temperature checks on food received. Accept frozen foods at <-18°C and chilled foods at < 4°C.
Storage	Growth of food poisoning bacteria, toxins on high-risk (ready to eat) foods. Further contamination.	High-risk perishable foods stored covered and dated at safe temperatures. Rotate stock and use by recommended date. Ensure a pest free environment.
Preparation	Contamination of high-risk (ready to eat) foods. Growth of pathogenic bacteria.	Limit exposure to ambient temperatures during preparation. Prepare with clean equipment used for high-risk (ready to eat) foods only. Separate cooked and raw foods. Wash hands before handling food.
Cooking	Survival of pathogenic bacteria.	Thaw frozen items completely at temperatures <15°C. Cook food (especially chicken and minced meats) to ≥75°C in thickest part for two minutes.
Cooling	Contamination. Growth of pathogens. Toxin production.	Cool foods as quickly as possible. Chill rapidly and refrigerate within 90 minutes. Do not leave out at room temperature to cool.
Chilled storage	Growth of pathogenic bacteria.	Temperature control. Date code high-risk (ready to eat) foods. Check on a periodic basis for expiration dates. Store food at least 6 inches above the floor and away from the wall. Use in rotation and always within shelf life. Consume within three days of cooking.
Hot holding/ Distribution	Growth of pathogenic bacteria. Toxin production.	Keep food hot at >63°C.
Reheating	Survival of pathogenic bacteria.	Avoid if possible. Reheat to >75°C.
Serving	Growth of pathogens. Toxin production. Contamination.	Serve cold high-risk foods as soon as possible after removing from refrigerated storage. Serve hot foods quickly. Ensure hands and equipment used to serve food are clean.

document the internal temperature at least once daily. If at any time the refrigerator temperatures fall out of appropriate range, the corrective action to fix the problem should be well documented and a decision as to whether the food should be discarded be made.

All items should be labelled, dated, and used within 72 hours. Any items that are not labelled, out-dated, or left exposed or unwrapped should be discarded. Attention should be given to separation between raw and cooked items; cooked items always being placed above the raw items if in the same refrigerator.

Kitchen Auditing

Food service practices should be established and include checklists for every day documentation of critical points. Additional inspection and auditing of kitchen practices can identify any deficiencies in catering practices and allow corrective action to be taken in a timely manner.

When undertaking an audit, particularly for the first time, the IPC professional should work with the food service team to develop critical checklists and use them to audit practice. The audit should include points related to common causes of foodborne illness. Particular attention should be given to evidence of prolonged exposure of food to warm temperatures. Other critical factors include: cross-contamination arising from lack of compliance with hygiene practices for hand or equipment cleaning; undercooking of high-risk meat products such as poultry; and cross-contamination between raw and cooked items.

If an audit is likely to be repeated regularly, an itemised audit sheet should be prepared including all the different areas in the kitchen being reviewed. In this way it is easier to achieve standardisation and reproducibility from one audit to the next and variations with time are more easily identified.

Summary

High standards of food hygiene must be maintained. A surveillance system must be able to identify potential food-borne outbreaks early and prompt outbreak investigation and control must be initiated if an outbreak is suspected.

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