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HEALTH PROMOTION *FOR* NURSING ASSOCIATES

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Contents

Chapter 6

Infection control in settings

Gillian Rowe and Debbie Gee

NMC STANDARDS OF PROFICIENCY FOR NURSING ASSOCIATES

This chapter will address the following platforms and proficiencies:

Platform 2 Promoting health and preventing ill health

2.3 Describe the principles of epidemiology, demography and genomics and how these may influence health and wellbeing outcomes.
2.9 Protect health through understanding and applying the principles of infection prevention and control, including communicable disease surveillance and antimicrobial stewardship (AMS) and resistance.

Platform 3 Provide and monitor care

3.6 Demonstrate the knowledge, skills and ability to perform a range of nursing procedures and manage devices, to meet people's need for safe and effective person-centred care.
3.7 Demonstrate and apply an understanding of how and when to escalate to the appropriate professional for expert help and advice.
3.11 Demonstrate the ability to recognise when a person's condition has improved or deteriorated by undertaking health monitoring. Interpret, promptly respond, share findings and escalate as needed.

Chapter aims

After reading this chapter, you will be able to:

- understand the importance of good infection control;
- identify and apply the legislation, protocols and procedures that govern infection control;
- define the core principles that ensure safe, effective work for patients, colleagues and the environment;
- understand how infection control supports the promotion of good health.

Introduction

> *Good infection prevention (including cleanliness) is essential to ensure that people who use health and social care services receive safe and effective care. Effective prevention and control of infection must be part of everyday practice and be applied consistently by everyone.*
>
> (DH, 2015)

The importance of good infection control, AMS and vaccination entered public consciousness in 2020 with the COVID-19 pandemic. Members of the public have had to develop an awareness of infection control and the importance of handwashing. Now that COVID-19 has become endemic, we still need to incorporate infection control measures at home, at work and while out and about. This chapter will examine the history of public health and infection prevention, personal protective equipment (PPE) and AMS. We will then consider the chain of infection and sepsis. We will also consider the safe handling of contaminated material and safe food hygiene.

COVID-19 apart, why do we still need to reinforce the principles of infection control? Guest et al. (2020) estimated that 653,000 (2017 figures) patients a year in England acquire a healthcare-associated infection (HAI), of which 22,800 patients died because of their infection (figures for Scotland, Wales and Northern Ireland not given). Included within those figures are a significant number of National Health Service (NHS) employees who acquired a HAI at their workplace. The most common types of HAI are respiratory infections (including pneumonia and infections of the lower respiratory tract; 22.8 per cent), urinary tract infections (17.2 per cent) and surgical site infections (15.7 per cent) (NICE, 2020c). The growth in HAIs can be attributed to invasive procedures and diagnostic tests, mixing of patient populations as hospitals take in from wider catchment areas and pressure on beds leading to higher levels of in-hospital patient movements.

Pressure for beds can lead to rushed bed cleansing between patients resulting in weaker standards of cleanliness and hygiene (Figure 6.1), and the growth of antimicrobial-resistant organisms. Therefore, infection control is about preventing premature deaths and caring for people in a safe environment and protecting them from avoidable harm. Infection control is a health-promoting activity.

History of public health and infection control

The United Kingdom has a long history of attempting to control infections. Arguably the greatest public health event was the recognition that sewerage and drinking water should be separated. Cities like London had a patchwork approach to dealing with sewerage. The tributary rivers of the Thames such as the Tyburn and the Fleet were open sewers. Night soil men collected buckets of human waste which were dumped in the Thames. During the hot summer of 1858, the smell from the river was so bad that Parliament considered abandoning the city. Called 'the great stink', the city was plagued by cholera, typhus, flies and rats. Parliament rushed through a bill in 18 days to provide the money for a public sewerage scheme which costs £2.4 million (about £1 billion in current money). Under the Public Health Act 1848, there had been many previous attempts at building sewers in the United Kingdom, but the legislation was ineffective, and government policy was 'laissez-faire' (leave well alone). However,

the act did set up health boards based on the recommendations made by Edwin Chadwick in his report 'On the sanitary conditions of the labouring population of Great Britain' (1838). The health boards were obliged to report to parliament on sewerage, clean water and infectious diseases. From then on, incremental improvements were made in the prevention and control of disease. The remit was widened to include inadequate housing, poor and adulterated food (poor nutrition), hazardous workplaces and pollution.

Change also came slowly to the medical profession, who are not noted as early adopters of progressive ideas. For instance, Snow's assertion that cholera is waterborne was not accepted until after his death. Semmelweis's (1847) theory that doctors' hands carried decaying bacteria between autopsies and pregnant women and thus caused puerperal fever, so physicians should wash their hands, was totally rejected. It was not until the work of Lister in 1870 that handwashing became an accepted practice.

Joseph Lister (1827–1912) and Florence Nightingale (1820–1910) pioneered many of the hospital infection control measures we still use today. Lister, following on from the work of Semmelweis, pioneered antiseptic surgery and promoted the notion of sterile surgery. He also championed the use of carbolic acid (phenol) as an antiseptic to clean wounds. Famously, Nightingale took 38 nurses to the Crimean War in Russia and set up a hospital where she introduced basic infection control measures (handwashing and clean drinking water). Nightingale was credited with reducing the death rate from 42 per cent to 2 per cent. During the COVID-19 pandemic, many resisted wearing face coverings as they did not understand viral transmission, and government messaging was unclear and contradictory.

Antimicrobial resistance and infection prevention

Hand hygiene is an important factor in reducing the spread of HAIs.

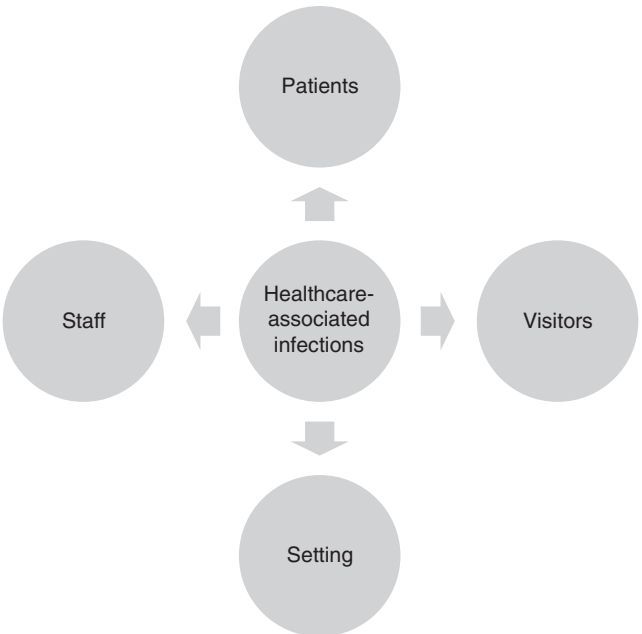


Figure 6.1 Healthcare-associated infections

Antimicrobial resistance (AMR) is the ability of microorganisms to resist antimicrobial treatments such as antibiotics. The risk of treatment failure and reduced treatment options have led to reduced prescribing of antibiotics to diminish antibiotic resistance. HAIs (previously known as hospital-acquired infections) are infections a patient acquires in a healthcare setting. These impact negatively on those who suffer the pain and distress of the infection, leading to long-term complications and lengthened hospital stays.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a case in point. *S. aureus* become resistant to penicillin in the 1940s, shortly after the introduction of the drug. Methicillin was developed in 1959 as a semi-synthetic pharmacokinetic to evade resistance mechanisms to treat penicillin-resistant infections. However, by the early 1960s, reports came from the United Kingdom and Europe that *S. aureus* had mutated and become resistant. Methicillin was superseded by oxacillin due to renal complications caused by the drug, so although the drug is no longer in general use, somehow the name stuck. Adverse publicity regarding MRSA deaths in healthcare settings led to a loss of public confidence and staff morale suffered consequently.

MRSA, popularly labelled a 'superbug', became a problem, as it thrives in healthcare settings. It usually colonises the skin and nose, leading to complications and premature death after surgical intervention or treatment for open wounds. It is prevalent in hospitals, prisons and nursing homes, where people with open wounds, invasive devices such as cannula, nasogastric tubes, catheters and weakened immune systems are at greater risk.

The Panton–Valentine leucocidin (PVL-MRSA) toxin destroys white blood cells when it colonises an open wound. It can cause necrotising pneumonia, which rapidly destroys lung tissue and is lethal in 75 per cent of cases. PVL-MRSA microbes contain high levels of proteins which make them stickier, therefore easier to adhere to skin and thus spread via contaminated hands.

MRSA has now escaped into the community (community-acquired MRSA) and has gone on to infect not just humans but livestock also.

Prevention and control rely on effective early detection, so contact precautions need to be put into place to prevent **transmission**. MRSA reveals itself by spots that look like a pimple or acne, but quickly turns into a hard, painful red lump filled with pus or a cluster of pus-filled blisters (boils). Further on in the chapter we will discuss transmission prevention measures.

Other antibiotic-resistant organisms include extended-spectrum beta-lactamase and carbapenemase-producing Enterobacteriaceae, these are enzymes normally produced by microorganisms in the gut, such as *Escherichia coli* and *Klebsiella*. In a healthy person, they are usually harmless, but they can cause infections in the gut and in the bloodstream. These bacteria are spread through direct contact (person to person) or by touching equipment. They are difficult to treat, and PPE should always be worn, and handwashing vigilance maintained. Vancomycin-resistant *Enterococcus* (VRE) generally affects those who have been taking antibiotics over an extended period of time, or who have had abdominal or chest surgery or have an indwelling catheter. It can lead to meningitis and endocarditis. Usually, patients with VRE are nursed in a private room and the care team should wear PPE to convention. As VRE is spread by direct contact, care should be taken cleansing any equipment and vigilant handwashing is essential.

Other HAIs include norovirus (winter vomiting), *Clostridium difficile*, *E. coli*, *Klebsiella* and gram-negative bacterial infections. These are currently under surveillance by the UK Health Surveillance Agency (formerly Public Health England) in order to issue alerts when outbreaks affect populations.

The NHS produced an infection prevention and control education framework (2023) which is a code of practice on the prevention and control of infections and related guidance. Based on

knowledge, skills and behaviours across all health and social care sectors, it is important to support the provision of safe and effective care and deliver on the actions outlined in the NHS Long-Term Plan (2019) and the Five-year AMR National Action Plan (2019).

All staff must:

Knowledge: Staff will be able to apply the theory underpinning standard infection prevention and control (SIPC) and how this should be applied within their role and workplace.

Staff will understand the infection risks from invasive devices and breaches to the skin/the body's natural barriers to infection, the role of aseptic technique and other evidence-based practice for preventing HCAI-associated infections relevant to their role and workplace.

Skills: Staff will be able to apply the identified range of skills needed, appropriate to their role, practice and environment, as well as being able to adapt practice as required.

Staff will be skilled in applying techniques for the prevention of infection in invasive devices or wounds (e.g. aseptic technique).

Behaviours: All health and social care staff will demonstrate the effective application of SIPCs, asepsis technique and other evidence-based IPC practice as part of their working practice.

Staff will act as a role model for others in the prevention of infection.

(nhsuk.org, 2019, 2023)

Standard infection prevention control precautions

The NHS has various directives regarding infection control and each trust and clinical setting will have their own policies in effect. It is recommended that settings adopt a 'bare below the elbow' approach with attention on the hands, no stoned rings (plain bands), no false nails or nail extensions and preferably no wrist watches, a nurse's fob watch being ideal. Some settings use EPIC3 (2014) guidelines which relate to five areas of activity:

1. Hospital environmental hygiene;
2. Hand hygiene;
3. Use of PPE;
4. Safe use and disposal of sharps;
5. Principles of asepsis.

However, these guidelines do not address the additional infection control requirements of specialist settings, such as the operating department or outbreak situations.

Hand hygiene

The World Health Organization (WHO, 2021a) maintains that hands are the main pathways of germ transmission during healthcare. Examine the image of the WHO handwashing guide (Figure 6.2) in order to ensure your handwashing technique is correct and no areas of your hands are unwashed, ensure you remove any rings first. The best handwashing uses soap and hot water and hands dried using disposable paper towels. Gels with 70+ per cent alcohol should be used as a backup, rather than replacing handwashing (Figure 6.3).

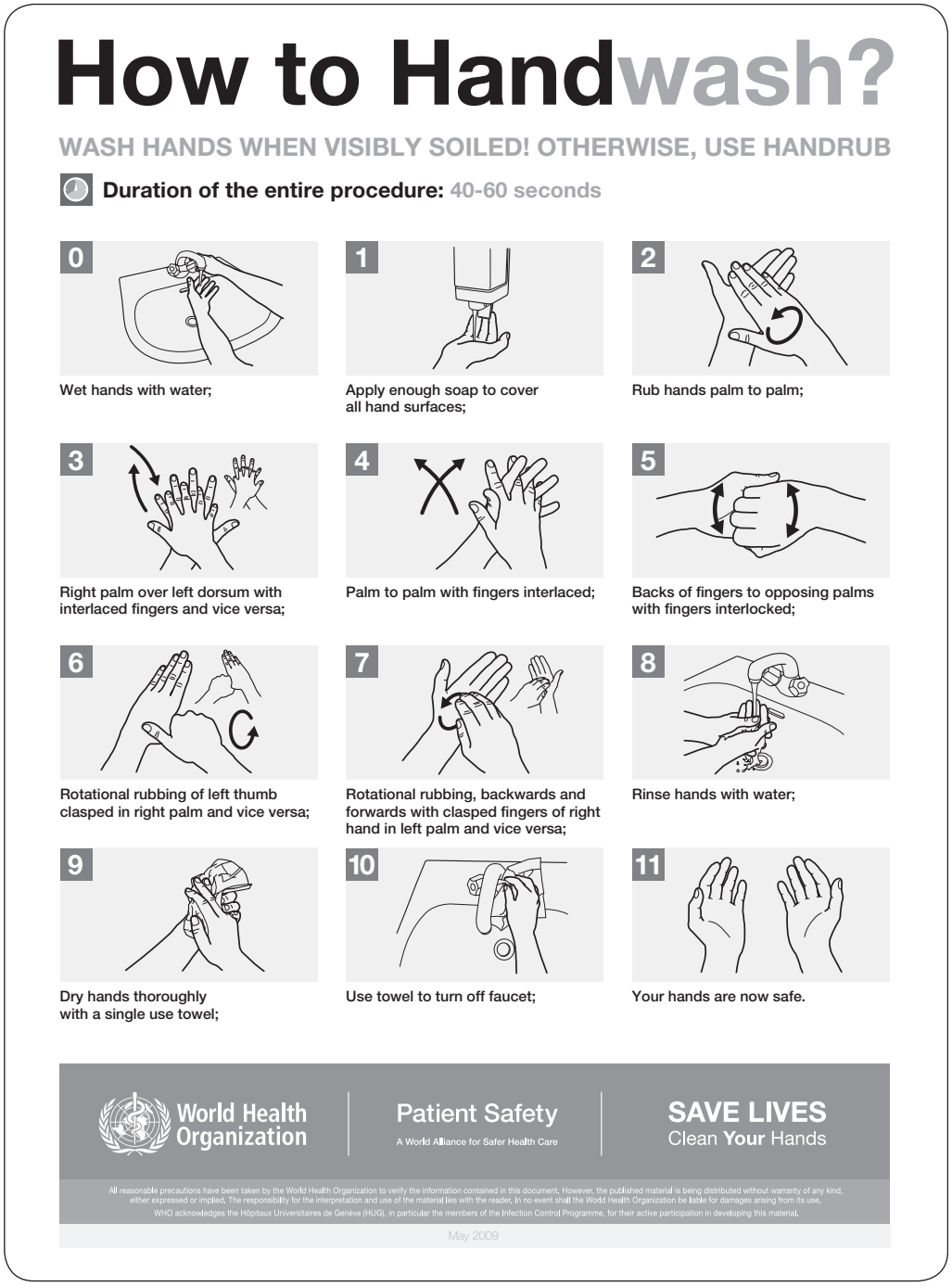


Figure 6.2 WHO handwashing guide

WHO (2021b) states that handwashing should take place:

1. Before patient contact, including arrival on duty.
2. After using toilet facilities.
3. Before undertaking an aseptic task, e.g. dressings, intravenous fluid administration.

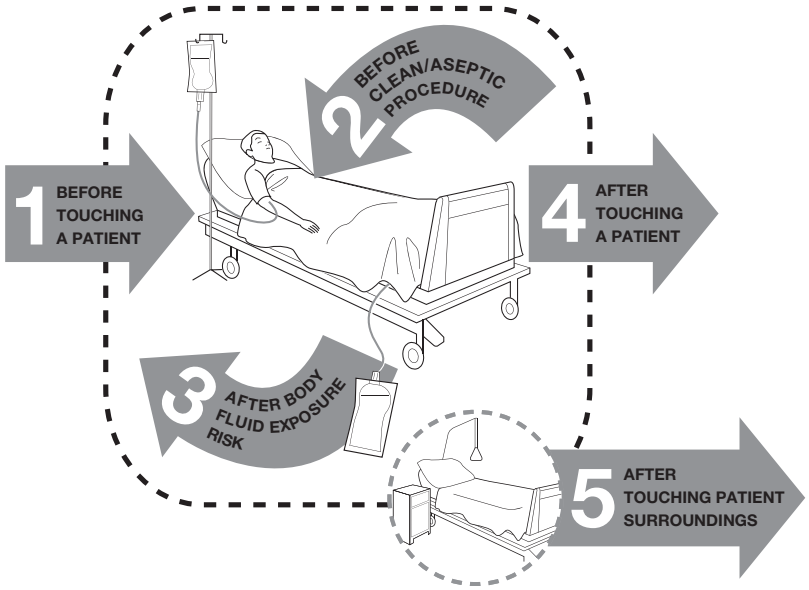


Figure 6.3 Five moments for hand hygiene (WHO, 2021a)

4. After body fluid exposure risk, including after gloves are removed. Remember gloves may become damaged in use (the damage may be visible or microscopic); therefore, hands may also be contaminated accidentally when gloves are being removed and the environment inside the glove may promote microbial growth on the user's hands.
5. Handwashing after taking off gloves may also remove particles of the material that the gloves are made of, such as latex, and so reduce the risk of developing an allergy.
6. After patient contact, such as moving and handling.
7. After contact with patient surroundings, such as the bed and bedding.
8. Before and after any intervention involving body fluid exposure risk, irrespective of whether gloves are worn or not. Gloves do not replace the need for handwashing.

Winter respiratory and cough prevention offers enhanced handwashing advice such as handwashing after you blow your nose, sneeze, cough and before you handle or eat food. WHO (2021b) promotes water, sanitation and hygiene (WASH) practices and recommends frequent and proper handwashing to prevent infection transmission. WHO recommends hygiene stations should be available at all points of care and in areas where PPE is put on or taken off (donning and doffing). Hand hygiene should also be available to visitors such as family and friends.

There are two types of microorganisms that carry the risk of infection and contamination.

1. Transient: Found on skin surface, readily acquired from contact with other body sites, people and the environment, easily transferred to others.
2. Resident microorganisms: Normal skin flora found in deeper skin layers, hair follicles and sweat glands, more difficult to remove than transient microorganisms.

Extra protection once hands have been washed would be advocated by the infection control team (ICT) during outbreaks of infection. Antiseptic solutions include chlorhexidine gluconate, povidone iodine and alcohol hand rub (70+ per cent). There is a risk from these products such as skin irritation, accidental eye splashes, ingestion and fire hazard (alcohol hand rub).

Promoting your own health

Skin protection is essential as damaged skin is a portal for infection. Facial PPE worn for extended periods of time can cause facial skin damage due to pressure effects, so your mask should be removed as often as possible. Barrier cream can be applied, and the skin gently massaged, although you must do this 30 minutes before donning a fitted respirator mask. A skin barrier film or liquid skin protectant could be applied on the bridge of your nose, your cheekbones and behind your ears. Check your hands regularly for signs of redness and abrasion and use a good quality hand moisturiser as often as possible.

Personal protective equipment

Employers have duties concerning PPE. The Personal Protective Equipment at Work Regulations (1992) Regulation 4 states 'PPE' means all equipment (including clothing affording protection against the weather) which is intended to be worn or held by a person at work and which protects them against one or more risks to their health or safety. The primary uses of PPE are to protect staff and patients in NHS and community settings. The National Institute for Clinical Excellence (NICE, 2014, 2017) states that 'The decision to use or wear personal protective equipment must be based upon an assessment of the level of risk associated with a specific patient care activity or intervention and take account of current health and safety legislation'. Each setting and care provider will have protocols and policies that determine under what circumstance PPE is to be worn. It is for you to familiarise yourself with your settings' guidelines. Each employer must provide, at no cost to you, PPE to ensure your safety and your patient's safety and to reduce the transmission of microorganisms which could cause HAIs. Other legislation includes the Health and Safety at Work Act (1974), the Control of Substances Hazardous to Health Regulations (2002) and the Management of Health and Safety at Work Regulations (1999).

Most PPE is single use only and disposable. Single-use equipment such as gowns or coveralls should never be washed, as it removes the protective elements. Some masks, respirators and hoods are reusable, and these are discussed further in the chapter.

Gloves

Gloves used for invasive procedures, contact with sterile sites and non-intact skin or mucous membranes, as well as all activities with risk of exposure to blood, body fluids, secretions and excretions, and when handling sharp or contaminated instruments (more on sharps further in the chapter). Gloves should not be worn unnecessarily as their prolonged and indiscriminate use may cause adverse reactions and skin sensitivity. Figure 6.4 shows you the WHO glove pyramid, which indicates what kind of glove should be worn and when. Gloves should be strictly single use only and should be disposed of to convention. Be mindful how you remove your gloves, contamination can happen, so ensure you wash your hands carefully after removing gloves.

Aprons

Aprons used when in close contact with patients, materials or equipment where clothing may be contaminated with pathogenic microorganisms or blood, body fluids, secretions or excretions (excluding perspiration). Aprons have a demonstrable role in prevention of cross infection, so aprons should be changed when moving between patients and at the end of an activity. Apron removal should be to convention, and they should be disposed of according to your setting's protocols.

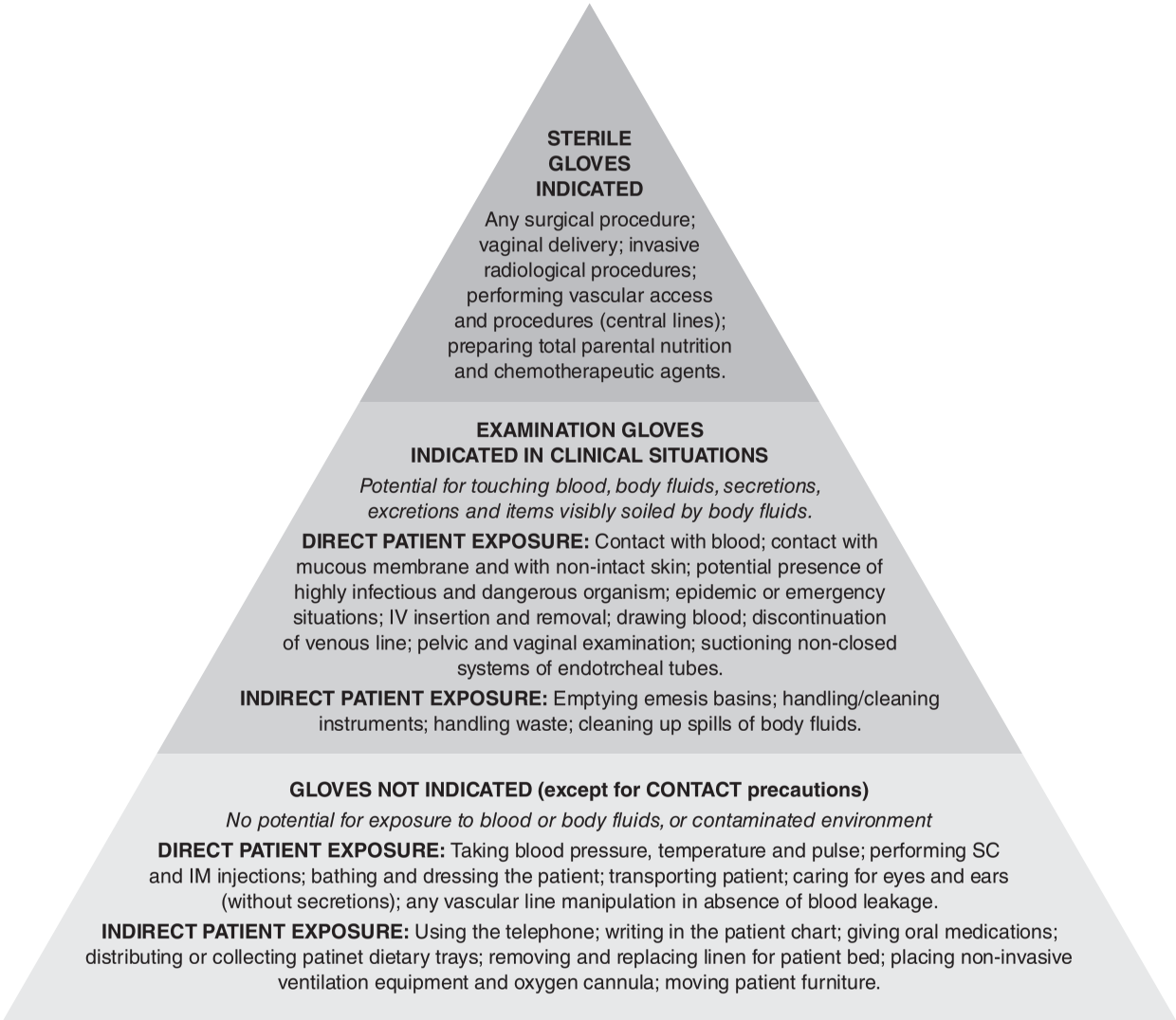


Figure 6.4 WHO glove pyramid

Full-body fluid-repellent gowns or coveralls

These are used when there is a risk of extensive splashing onto your skin or clothing of blood, body fluids, secretions or excretions. These gowns should always be worn in COVID-19 'hot' areas due to risk of droplet/aerosol contamination.

Eye protection

This should be worn when there is a risk of blood, body fluids, secretions or excretions splashing into the face and eyes. Face visors are a type of face shield made from a transparent material and can be held in place by a band that goes around the head, or by sliding the visor onto glasses.

Face masks

Under normal circumstances, surgical face masks are only worn when undertaking procedures that carry a risk of contamination. Clear face masks should be available for those who work with patients who lip read or who use facial expressions as a primary form of communication.

Surgical face masks are loose fitting, cover the nose and mouth and are designed to protect the patient from bacteria shed in liquid droplets and aerosols coming from your nose and mouth. They are single use and are generally changed every two hours, and they are disposed of in clinical waste bags. They are classified as Class 1 Medical Devices under the Medical Devices Directive (93/42/EEC).

Respiratory masks must meet the more rigorous European safety standard EN149, the standard being FFP1, 2(II), 3 (IIR), and the difference between the masks lies within their bacterial filtration efficiency. All filter a differing percentage of particles. Type I face masks have a bacterial filtration efficiency of >=95 per cent, whereas type II and type IIR face masks have a bacterial filtration efficiency of >=98 per cent. Type IIR are splash resistant and should be used in 'hot' areas. They can be valved or non-valved and can be single use or reusable. Valved masks make exhaling easier and so are a little more comfortable than non-valved. Respirator masks are usually used during aerosol-generating procedures. These require a fit test.

Reusable respiratory protective equipment must be correctly sized and fitted (the fit test) and used when nursing patients with airborne respiratory infections. Personal respiratory protection is required in certain respiratory diseases, e.g. COVID-19, HIV-related and multiple drug-resistant tuberculosis. Reusable respirators should never be shared, and yours should be labelled and stored in a manner that reduces risk of transmission.

Fit test

There are two types of fit tests: Qualitative and quantitative fit.

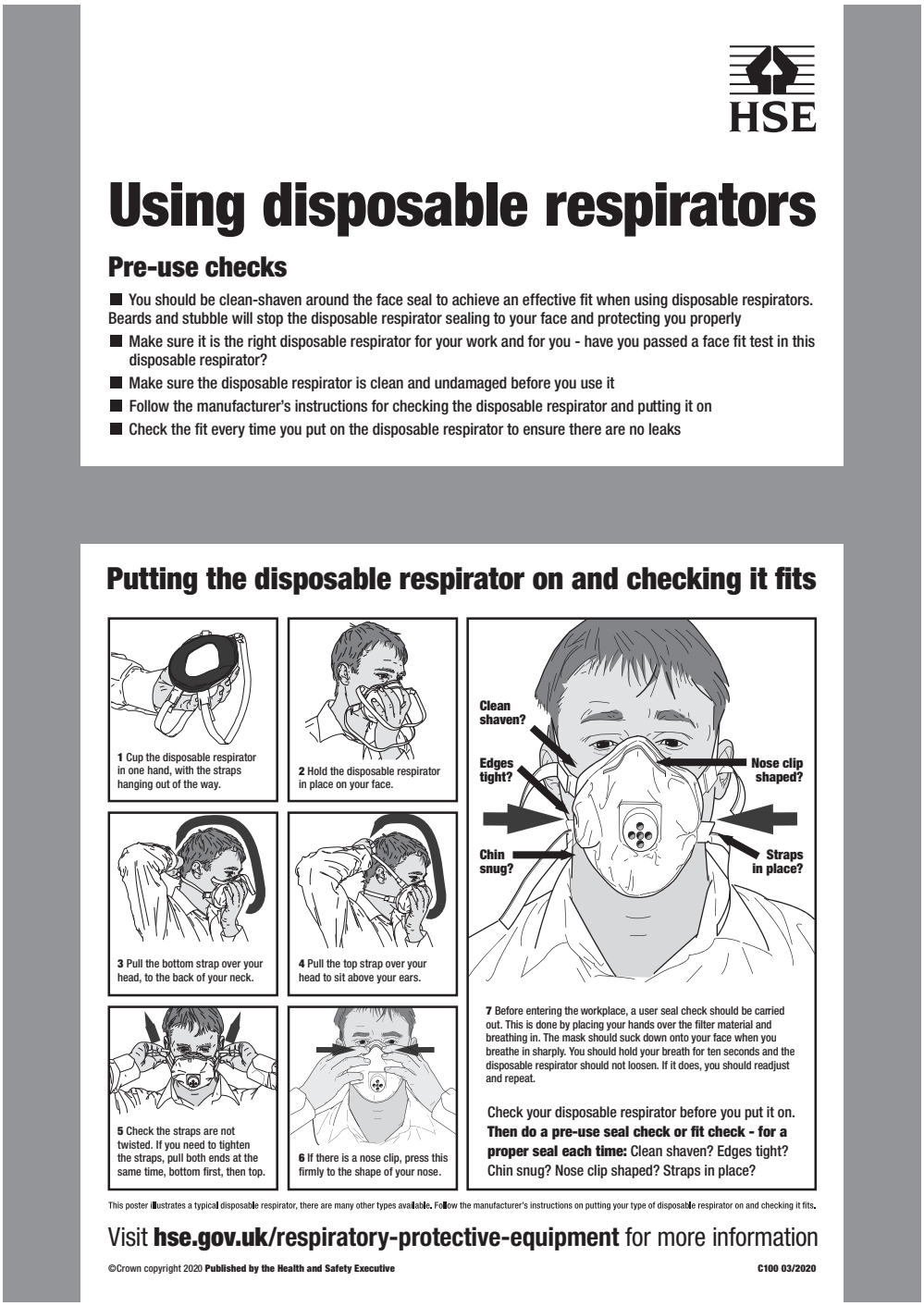
Qualitative fit testing is a pass–fail test that uses the sense of taste or smell and the user's reaction to an irritant in order to detect leakage into the respirator's face piece.

Quantitative fit testing uses a machine to measure the actual amount of leakage into the face piece.

The qualitative fit test requires you to check if the mask has a tight seal to your skin, a bitter (or sweet) tasting agent is sprayed on the mask, and if you detect it, the mask has failed the test. The fit test should be undertaken by someone assessed as competent to undertake fit tests. This is to ensure that the respiratory protective equipment will protect you. If you gain or lose weight, you may need a different type of FFP mask. A fit check should be undertaken each time a new mask is put on (donned)

and you should be trained on how to do the fit check. The Health and Safety Executive (HSE) has a training video to watch to ensure your knowledge is correct and up to date.

The web address is given at the end of this chapter in the useful websites section. The HSE poster (Figure 6.5) shows you how to correctly fit the respirator. Reusable masks should be cleaned to convention, and you should be trained in the correct cleaning methods.


HSE

Using disposable respirators

Pre-use checks

- You should be clean-shaven around the face seal to achieve an effective fit when using disposable respirators. Beards and stubble will stop the disposable respirator sealing to your face and protecting you properly
- Make sure it is the right disposable respirator for your work and for you - have you passed a face fit test in this disposable respirator?
- Make sure the disposable respirator is clean and undamaged before you use it
- Follow the manufacturer's instructions for checking the disposable respirator and putting it on
- Check the fit every time you put on the disposable respirator to ensure there are no leaks

Putting the disposable respirator on and checking it fits

7 Before entering the workplace, a user seal check should be carried out. This is done by placing your hands over the filter material and breathing in. The mask should suck down onto your face when you breathe in sharply. You should hold your breath for ten seconds and the disposable respirator should not loosen. If it does, you should readjust and repeat.

Check your disposable respirator before you put it on. **Then do a pre-use seal check or fit check - for a proper seal each time:** Clean shaven? Edges tight? Chin snug? Nose clip shaped? Straps in place?

This poster illustrates a typical disposable respirator, there are many other types available. Follow the manufacturer's instructions on putting your type of disposable respirator on and checking it fits.

Visit **hse.gov.uk/respiratory-protective-equipment** for more information

C100 03/2020

Figure 6.5 Using disposable respirators

If you cannot wear a respirator, you could be offered a non-disposable powered hood, as these do not require a fit test. Powered hoods should be cleaned with a recommended disinfectant wipe, inside and out, and left to air dry. If it has a nebuliser, this should be removed and immersed in a disinfectant liquid, along with any tubing, then left to air dry. Attention should be paid to the cleaning process, as quite often this piece of PPE is shared due to shortages.

Antimicrobial stewardship

In order to understand what an antimicrobial is, we need to understand what microbes are. These are microscopic single-celled living things that are categorised into groups of micro-organisms: bacteria, fungi (yeasts and moulds), protozoa and algae. While viruses and prions are microscopic, they are not classed as living things. The human body is colonised by millions of microorganisms collectively known as the human microbiota. They are found on the skin, and all the orifices (nose, mouth, ears, penis, vagina and urethra). Bacteria are larger than viruses and are capable of reproducing on their own. Viruses (see Figure 6.6) cannot reproduce on their own. Instead, they reproduce by infecting a host and using the host's DNA replication systems to make copies of itself.

You have on average about 100,000 bacteria on every square centimetre of your skin. These dine on the ten billion flakes of skin that you shed every day, plus all the oils and minerals that you secrete. There are trillions more inside your gut, and they reproduce in less than ten minutes, so in 24 hours one can become 280,000 billion. Bacteria come in three basic shapes: rod-shaped (bacilli), spherical (cocci) or helical (spirilla) (see Figure 6.7 for various types of bacteria). Bacteria are also classified as gram-positive or gram-negative. Gram-positive bacteria have a thick cell wall, while gram-negative bacteria do not.

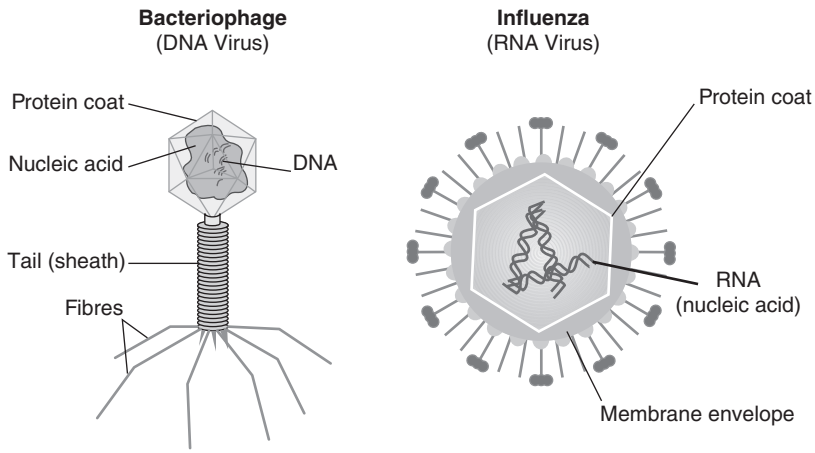


Figure 6.6 A virus

Some bacteria are essential for body functioning. These are called commensals as they co-exist peacefully with us, supporting digestion, production and synthesis of vitamins B and K, promoting the development of the immune system and detoxifying harmful chemicals.

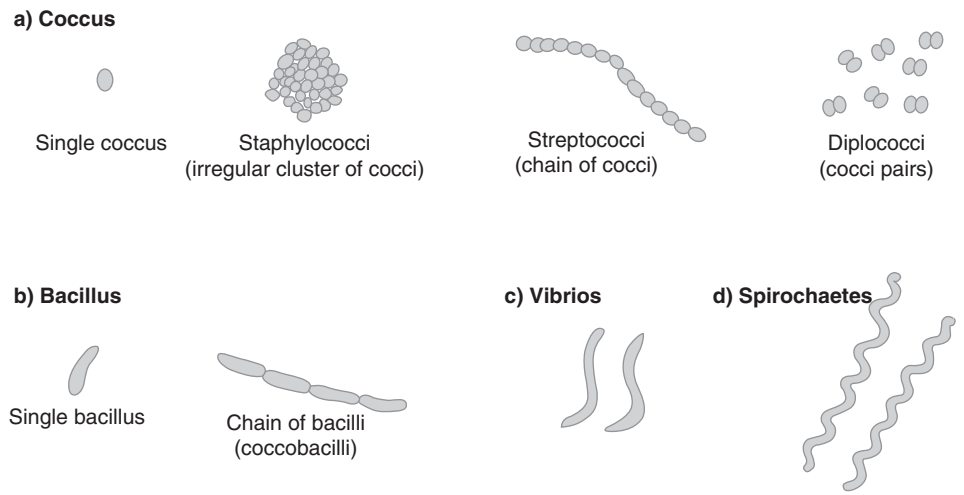


Figure 6.7 Bacteria

Some bacteria and yeasts are harmless until the environment is disturbed. An example of this is *Candida albicans*, which can cause candidiasis, better known as thrush (oral, vaginal and penile). Usually mild and irritating, *Candida* can become invasive via the vascular system and infect the brain or organs. This is problematic for those with compromised immune systems. *Candida auris* is an emerging fungus that presents a serious global health threat as it is multi-resistant to all classes of antifungals.

Harmful strains of bacteria can infect any part of the body. See Table 6.1 for examples of different common bacterial infections and the ailments they cause.

Antibiotic resistance

Antibiotic resistance occurs when bacteria are no longer sensitive to a medication that should eliminate an infection. This dangerous situation has occurred for several reasons:

1. Over-prescription of antibiotics: Also, in some countries, antibiotics are available over the counter.
2. Patients not finishing the entire antibiotic course: People stopped taking the medication when they felt better or because it upsets their stomachs. This allowed live bacteria the opportunity to mutate so that the drug became ineffective.
3. Overuse of antibiotics in livestock and fish farming: Antibiotics were given to livestock as a prophylactic to prevent disease, but it was found they encouraged growth in animals and fish, so antibiotics were routinely added to food.
4. Undercooked meat and raw fish allowed pathogenic-resistant organisms into the food chain, and they may act as **reservoirs** for resistant bacteria.
5. Poor infection control in healthcare settings: Larger hospitals are taking patients from wider geographic areas bringing more patients into contact who then spread pathogens into their own community. Rapid churn of patients and demand for beds means that time spent cleaning the environment is skimped, allowing pathogenic spread.
6. Lack of new antibiotic drugs coming to market: Drug companies feel the returns for developing new antibiotics are not worth the investment, and this is because most governments around the world cap the price they will pay for drugs.

Table 6.1 Examples of bacterial infections

Common bacterial infections	Related ailments
Staphylococcus	Boils, cellulitis, bacteraemia, food poisoning, endocarditis, toxic shock syndrome, pneumonia
Streptococcus	Pneumonia, endocarditis, sepsis, impetigo, throat infections (strep throat)
Campylobacter jejuni	Diarrhoea cramp, fever
Clostridium botulinum (botulism)	Diarrhoea, produces neurotoxins
Clostridium difficile	Diarrhoea, colitis, sepsis
Escherichia coli	Diarrhoea cramp fever
Listeria monocytogenes	Diarrhoea cramp fever
Chlamydia	Pelvic inflammatory disease, infertility
Bacterial meningitis	Inflammation of the meninges (lining of the brain)
Tuberculosis	Respiratory tract infection

Viruses are small particles of genetic material (either DNA or RNA) that are surrounded by a protein coat. Some viruses also have a fatty envelope covering. Common viral infections include influenza, measles, mumps and rubella, HIV/AIDS, hepatitis (B and C), croup, noro- and rotor virus and COVID-19. Viruses are also implicated in the development of cancer. Some viruses have the ability to go dormant (or quiescent) and then reactivate after a trigger. The herpes simplex virus can reactivate in reaction to stress, fever, menstruation and exposure to sunlight.

As viruses are not entirely alive, they are difficult to destroy. The search for drugs that could kill viruses came out of the HIV/AIDS **epidemic**. HIV/AIDS are zoonotic virus that moved from the monkey population to humans in the Democratic Republic of Congo. The disease spread slowly during the 1970s but then it entered the American gay population, and it was originally called a gay plague. By 1983, the novel disease was given the name of 'acquired immune deficiency syndrome'. AIDS, however, is not contagious. It was later found that the retrovirus human immunodeficiency virus (HIV) was the causative of AIDS. While a person who has AIDS has HIV, not every person with HIV will develop AIDS.

Huge sums of money and many institutions have been engaged in developing antiretroviral drugs and vaccines. While a cure for HIV has yet to be found, drugs are slowing down the effects of the disease. With the challenge of finding drugs to combat SARs-CoV-2, antiretrovirals are being repurposed. Research efforts are building on previous research on severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome, which also are caused by coronaviruses. Hopefully, bringing these research capabilities together will bridge knowledge gaps and lead to a positive outcome.

NICE (2015, 2020) defined AMS as 'an organisational or healthcare-system-wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness'. According to Resman (2020), 'work in antimicrobial stewardship is complex and includes not only aspects of infectious disease and microbiology, but also of epidemiology, genetics, behavioural psychology, systems science, economics and ethics'. It is well-established that increased use of antibiotics has led to increased antibiotic resistance. Agricultural use of antibiotics has led to both food and the environment being contaminated with antibiotic residues. Antibiotic overuse and misuse through prescribing practice has increased microorganisms resistant to antibiotics in both populations and individuals. Quite often, patients will

ask for antibiotics when they are not needed but do not understand why their request has been refused. Read Activity 6.1 and consider your responses to Valerie.

Activity 6.1 Critical thinking

Valerie complains to you that her GP will no longer prescribe antibiotics for a sore throat. She then says she does not think the antibiotics work anyway and she doesn't always complete the course as they upset her stomach.

From the information Valerie has given you, surmise what is likely causing her upset stomach and what advice would you give her to protect herself in future.

Compare your answer with the answer given at the end of the chapter.

What Valerie does not understand is that taking unnecessary antibiotics can lead to unwanted side effects. Antibiotics are not very specific and can kill helpful bacteria leaving the body open to opportunistic invasive bacteria and yeast infections such as *C. difficile* and thrush. Research by Palleja et al. (2018) showed that a diverse gut microbiota is considered to promote health, but that poor microbial diversity has a relationship with chronic ailments such as obesity, diabetes, asthma and alimentary inflammatory disorders. Their research also showed that the gut can take up to six months to recover from antibiotic therapy and that colonisation by non-desirable bacteria occurs.

Antibiotic reaction

According to Blumenthal et al. (2019), antibiotics are the commonest cause of life-threatening immune-mediated drug reactions. However, they go to state that very few patient-reported allergies are thoroughly investigated. Patients who report allergies to antibiotics frequently cannot remember which antibiotic provoked a reaction, so they often cite an allergy to penicillin. This reduces their access to therapeutic intervention. Antibiotic reactions range from nausea, bloating, diarrhoea, lip swelling, urticaria, wheezing, tightness around the throat and anaphylaxis (difficulty breathing and collapse). Quite often, an antihistamine is sufficient to mediate the symptoms; however, fluoroquinolone can provoke muscle and joint pain, tingling and numbness, which are considered serious side effects. Accurate documentation is essential when a patient reports side effects. You should listen to their concerns and if the patient experiences any serious symptoms, you should escalate to the clinical team.

The chain of infection

As you can see, the chain of infection is an interlocking sequence of events that allow infection to be spread. If the chain is broken at any point, the opportunity for contagion is reduced (Figure 6.8).

1. The infectious agent: These are the pathogens that cause diseases, these can be bacteria, virus, fungi or parasites.
2. The reservoir: This is the host that allows the pathogen to reproduce. Humans, animals, insects, fish, water and the environment are all possible hosts.

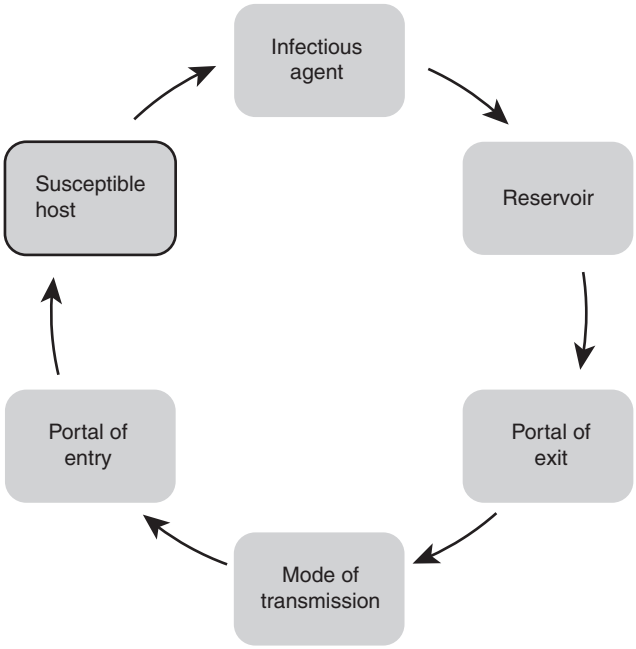


Figure 6.8 Chain of infection

3. The portal of exit: This is the route the agent takes to leave the host, an example might be sneezing, coughing, blood or faeces.
4. Mode of transmission: This could be direct contact with the agent (insect bite) or indirect contact by airborne transmission, ingestion or fomites (objects likely to be contaminated, e.g. bedding, equipment).
5. Portal of entry: This could be absorption into a mucus membrane, ingestion via the GI tract, inhalation into the respiratory tract, broken skin such as injury, injection, small cut and abrasion or clinical procedures such as catheterisation.
6. Susceptible host: Someone who is immunocompromised, post-surgery, open wounds, cardiopulmonary disease and predisposing factors.

Breaking the chain:

1. The infectious agent: Early identification of the causative agent means correct and effective treatment.
2. The reservoir: Environmental sanitation (clean water, clean air), healthy uncontaminated food and clean working environment.
3. The portal of exit: Control of excretions, proper handwashing, effective waste disposal and wearing PPE.
4. Mode of transmission: Food handling training, effective surface cleaning, wearing PPE for disposal of contaminated materials, good laundry care (washing at 70° temperature) and control of airflow in settings.
5. Portal of entry: Handwashing, wearing PPE, aseptic technique for wound dressing, catheter care and safe infection control.
6. Susceptible host: Separate patients (elderly, children, immunocompromised) from those with known infections. For patients with open wounds, use appropriate wound care protocols and vaccinations and maintain sanitation.

Sepsis

Sepsis is an extreme reaction to infection and is a life-threatening emergency, defined by organ dysfunction and a dysregulated immune response. Those most at risk of sepsis are those who have recently had surgery, breaches of skin integrity (such as pressure sores or leg ulcers), the young, elderly, the immunocompromised or immunosuppressed and those with existing chronic ailments (NICE, 2023). Sepsis can be life changing, with 40 per cent of patients suffering from lifelong associated ailments and susceptibility to infection. Many sepsis survivors also suffer cognitive decline and poor mental health (PTSD). Sepsis can be caused by a bacterial, viral or fungal infection, although generally the cause is bacterial. Sepsis can progress from sepsis to severe sepsis (organ dysfunction) to septic shock (sustained reduction in arterial blood pressure leading to lack of oxygen in the tissues) quite rapidly. If you suspect sepsis, you must swiftly escalate your concerns to the clinical team and document events.

The Sepsis Trust (sepsisturst.org) defines the signs and symptoms using sepsis as an acronym:

Slurred speech or confusion.

Extreme shivering or muscle pain.

Passing no urine (in a day).

Severe breathlessness.

It feels like you're going to die.

Skin mottled or discoloured.

The UK Sepsis Trust developed the 'Sepsis Six' – a set of six tasks including oxygen, cultures, antibiotics, fluids, lactate measurement and urine output monitoring – to be instituted within one hour by non-specialist practitioners at the frontline, while nursing associates do not administer IV drugs and fluids, monitoring the patient's condition is critical to outcomes. The Sepsis Six Care Bundle as a whole has been shown to reduce the relative risk of death by 46.6 per cent when delivered to patients with severe sepsis within one hour.

The symptoms for children are:

- rapid respirations;
- convulsions;
- cyanosed (blue) mottled skin;
- a rash that does not fade when pressed (the glass test);
- lethargic and difficult to rouse;
- may be floppy;
- feels cold to the touch;
- temperature above 38°;
- not passed urine for 12 hours.

Children's condition should be monitored using the Paediatric Early Warning Score.

Septic shock is a subset of sepsis, which describes circulatory, cellular and metabolic abnormalities which are associated with a greater risk of mortality than sepsis alone.

In the United Kingdom, the National Early Warning Score (NEWS2) is a diagnostic track and trigger for the deteriorating patient. Any patient who scores three and above is at risk of

sepsis. This is in line with the NICE quality statement (NICE, 2020c). Elderly patients with pneumonia or a urinary tract infection account for 70 per cent of sepsis and so these patients should be closely monitored, any changes documented and concerns escalated to the medical team.

Isolation nursing

Sometimes, patients need to be cared for in isolation, called source isolation, because the patient is the source of infection. During the time of COVID-19, cohort isolation was used. Wards became COVID-19 wards, as there were too many patients with COVID-19 and not enough single rooms. Preferably, isolated patients should be nursed by designated staff who are not caring for other patients. The patient should be risk assessed, which considers the source of infection, route of transmission and susceptibility of others.

Precautions include:

- hand hygiene;
- wearing PPE, and safe disposal;
- safe removal of contaminated waste;
- safe removal of bed linen;
- decontamination of reusable equipment.

When single rooms are used, ventilation systems can be utilised to create negative pressure in the isolation room (i.e. the pressure in the room is less than surrounding areas). The aim of this is to prevent air from the room escaping into other areas of the ward. Air from the room is extracted outside of the building. If possible, the use of fans should be avoided to prevent infection transmission. You should understand that patients in isolation will become bored and lonely. If they become anxious, they are less likely to recover well. Activity 6.2 will help you to reflect on what it feels like to be scared and on your own. Patients should be regularly assessed so that they do not stay in isolation longer than they need to. Any visitors should be shown how to wear protective equipment so that they do not become infected.

Activity 6.2 Reflection

Reflect on what it might be like to be cared for in isolation and what you would want from healthcare staff in these circumstances. Think about the things you could do to support a patient in isolation.

A model answer is given at the end of the chapter.

Many people in hospital, but especially those in isolation, become frustrated that their routines have been disrupted, such as being able to get a drink or snack when they want one. Patients' relatives should be encouraged to bring items in for the patient to ease their discomfort.

Safe handling of contaminated material

Laundry

There are three types of contaminated laundry:

- soiled: used linen generally;
- fouled: urine, mucus, vomit, faeces, diarrhoea, blood (and blood in vomit);
- infected: diarrhoea caused by an infectious agent, pus, leakage from wounds, blood from an infectious patient.

Safe handling requires PPE (apron and gloves), depending on the setting and conventions. Many settings use soluble alginate bags, which are bags that dissolve in a hot wash. Alginate bags that are used in a domestic washing machine should have 'seam burst' as they do not fully dissolve in lower domestic machine temperatures and can clog the machine.

All soluble bags must be placed directly into the washing machine to minimise contact, and prevent transmission of infection to laundry staff, or contamination of the environment. Soluble bags are then placed into a red linen bag.

Use a linen skip with an appropriately coloured bag(s) and used linen must always be bagged at the bedside. Used linen should not be placed on the floor or furniture, also it should never be carried through the ward or corridors to the sluice/dirty utility room or laundry. Without shaking the linen, you should check that foreign objects have not been forgotten (syringes, equipment, dressings, etc.) before it goes into the linen bag. Finally, laundry bags must never be more than two-thirds full, so that they can be tied properly. Always carry bags by the neck. Do not hold them against your body and do not throw them, as the bags might burst, spilling the contents.

Used laundry bags should be safely stored until collection, or in non-NHS settings, to company convention.

Some settings encourage residents to do their own laundry, either as a therapeutic activity or to encourage autonomy. This is a good opportunity for you to teach the principles of infection control health education, and to ensure other residents are not exposed to an infection risk.

Waste management and decontamination of reusable equipment

Waste can be classified as clinical, hazardous, offensive and waste. Each category is governed by different legislation and statutory instruments. The main legislation is the Health and Safety at Work Act (1974), the Control of Substances Hazardous to Health Regulations (2002), the Environmental Protection Act (1990) and the Hazardous Waste Regulations (2005), each of these acts have various amendments, and each setting will have protocols and procedures for implementing them. You should find where your employer keeps this information and ensure that you have read and understood it. Breaking these laws can have serious consequences for you, your registration and for your patients. You should have been given waste management training by your employer and instructed as to waste protocols and the risks associated with waste management (Figure 6.9).

Figure 6.9 Waste bags

Clinical and hazardous waste comprises anything infectious, chemical hazards and waste drug containers (such as used infusion giving sets, empty infusion bags) which contain active pharmacological materials hazardous to the environment. Clinical waste should be contained in a yellow waste bag, and infectious waste in an orange bag and sent for incineration.

Unused medications and any prescribed lotions and creams should be returned to the pharmacy for safe disposal. Except cytostatic/cytotoxic medicines, which should be placed in identified rigid and sealable containers and sent for incineration.

Offensive waste is non-hazardous hygiene waste, such as used paper hand wipes, and is placed in black and yellow bags for collection and disposal by approved methods. Confidential waste should be placed in identifiable waste containers (usually blue bags) for licenced confidential waste disposal agents.

All waste bags should be tagged or labelled with the name of the generating department, ward or setting so that it can be identified in the event of mishap.

Sharps and needle stick injuries

Disposal of needles and other sharp instruments is governed by the Health and Safety (Sharp Instruments in Healthcare) Regulations (2013). The Care Quality Commission states that employers must meet essential standards of quality and safety in keeping patients and staff safe. Employers should have a safer sharps policy where possible. This means using needles safety engineered protection such as a shield or cover that slides or pivots to cover the needle after use.

Regulation 5(1) (c) considers that injuries can occur after a needle has been used if the healthcare worker holds the needle in one hand and attempts to place a cap on the needle with the other hand (the so-called two-handed recapping) (hse.gov.uk, 2019). Therefore, needles should never be re-sheathed, but disposed of in a yellow sharps box at the point of use. Other sharps such as lancets, cannulas and suturing needles should also be disposed of in a portable sharps box and not passed hand to hand for disposal.

Needle stick injuries resulting from exposure-prone procedures carry the risk of hepatitis B virus, hepatitis C virus and HIV. Although rare, healthcare workers have been infected, with life-changing effects.

Decontamination

There are three types of decontamination, depending on the item being cleansed and the level of hygiene required:

- cleaning: removal of dirt and other physical contamination and some microorganisms;

- disinfection: reduction in numbers of microorganisms but not bacterial spores;
- sterilisation: destruction or removal of all microorganisms including bacterial spores.

Decontamination of communal equipment such as commodes and hoists should be undertaken after each use, using appropriate cleaning fluids and wipes. Your employer will have 'Cleaning and Disinfection' or 'Decontamination' policies which identify the correct methods for decontaminating equipment. Some settings use 'I am clean' tape or cleaning sheets that require a signature to confirm cleaning has taken place. A visible inspection should also be undertaken and if any part of the equipment is found to be faulty then it should not be used. A notice should be put on the equipment, and the repair escalated to the maintenance team.

Cleaning up spills should take place to NHS cleaning standards, and cleaning protocols should include responsibility for cleaning, frequency of cleaning and method of environment decontamination (nhs.uk, 2019). All spillages of blood, body fluids and excreta must be regarded as potentially hazardous and cleared immediately by appropriately trained staff.

Infectious agents on flat surfaces can be cleaned with packs such as 'Clinell™' wipe packs and walls should be decontaminated using such products as 'Actichlor Plus™'. You should remember that chlorine-based products (including bleach) should not be used to clean up urine or vomit. Chlorine and the acid in urine and vomit combined release poisonous chlorine gas.

Protecting yourself

You need to protect yourself from occupational exposure, such as percutaneous injury, exposure of non-intact skin, e.g. cuts, eczema and exposure of your mucous membranes including your eyes. If you do cut or stick yourself, immediately wash the wound or non-intact skin thoroughly with soap and water (do not scrub), gently encourage bleeding of puncture wounds (do not suck) and apply a waterproof dressing. Use copious amounts of water to wash your eyes, if affected. It is then essential that you report the incident to your line manager and complete an incident form. You should then attend Occupational Health (or A&E if out of hours).

Food hygiene

Nursing associates do not usually hold a food hygiene certificate unless your role requires you to support food preparation with your clients. However, you do have an important role to play in maintaining standards of food hygiene, this work is covered by the Food Safety Act (1990) and the Food Hygiene (England) Regulations (2006). Hospital and care setting patients are more vulnerable than healthy people to microbiological and nutritional risks.

Catering is often contracted out to private providers, and snack provision provided by a league of friends; however, they are expected to adhere to Hazard Analysis Critical Control Point principles. Food is categorised as low and high risk. Low-risk foods are things such as bread, biscuits and cereals. High-risk foods are ready-to-eat foods which support the growth of microorganisms, such as cooked meat and fish, dairy products, baby foods and enteral feeding products.

The ICT handles food complaints or allegations of food poisoning arising from food/drink provided by trusts and primary care teams. If you give out meals or hot drinks and snacks to patients, you will be classified as a food handler and you will be expected to know the basic principles for handling food. These are based on the NHS food hygiene policy.

- Wash your hands before handling food or kitchen/serving equipment.
- Wash your hands after using the toilet, after sneezing, coughing or using a handkerchief, or after touching your ears, nose, mouth or hair.

- Avoid unnecessary handling of food.
- Keep all equipment and surfaces clean.
- Follow any food safety instructions on food packaging or ask your line manager.
- Tell your line manager if you see something wrong.
- Patients and visitors are not permitted to use ward kitchens.
- Kitchens in other settings must be secure to ensure that pets, strays, wild animals and birds cannot enter the area.
- Cleaning chemicals and disinfectants must not be stored in areas where food is handled.

You should not handle food if you have any open wounds on your hands, even if they are covered with a waterproof dressing. You should not attend work if you have had a bout of vomiting and diarrhoea until you have been clear of symptoms for 48 hours.

Activity 6.3 Work-based learning

You are working in a residential care setting for young people with a learning disability. It is 2pm in the afternoon and visitors have arrived for Ricky Woodman. His father hands you a carrier bag within which are several plastic food containers. He tells you this is for his son's tea; it is from Ricky's favourite Indian takeaway, and it is chicken tikka masala and rice. Mr Woodman asks you to warm it up for his son at teatime.

How would you ensure the food provided by Mr Woodman for his son is hygienic and fit to safely be consumed?

Compare your answers with the answers at the end of the chapter.

Chapter summary

This chapter has introduced you to the theories, legislation and practice of infection control. You will have learnt how to promote safe working practice for yourself, your colleagues and your patients. The key takeaways from this chapter are that infection control works within a framework of legislation, protocols and procedures. It is important that you keep yourself up to date when changes are made. When you go to a new placement or employment, you need to understand local policies and how they are implemented. Talk to your mentor or supervisor so that you feel confident in your work.

Activities: Brief outline answers

Activity 6.1 Critical thinking

The broad-spectrum antibiotics her GP prescribes could be causing her upset stomach, due to them killing the helpful bacteria and leading to abdominal pain, bloating and diarrhoea. You explain the importance of completing any course of antibiotics, that by

stopping taking the antibiotic, some of the bacteria could still be active and this could allow the bacteria to mutate and then the antibiotic would be useless. This is an opportunity to discuss why Valerie is suffering sore throats and to offer advice, self-management strategies and homely remedies (over-the-counter throat pastilles, gargles, paracetamol, when needed, and fluids).

Activity 6.2 Reflection

Disconnection from the outside world and being away from families and friends can lead to anxiety related to the uncertainties of the situation. Some fear stigmatisation, as they have been contagious. For those with challenges in communication, isolation is an added stressor.

Give psychological support and reassurance to support recovery. Tell the patient they will be warded as soon as it is safe to do so. Monitor your patient for signs of distress and anxiety. If patients become bored and lonely, where possible use technology, such as smart phones and tablets, to maintain communication with relatives and friends, and for patient entertainment.

Activity 6.3 Work-based learning

You should ask Mr Woodman when the meal was purchased and how it has been stored. If the meal was purchased the previous evening, even if kept in a domestic fridge, it is unlikely to be safe to eat because rice contains the bacterium *Bacillus cereus* which can produce gastrointestinal toxins. If it had been purchased on the way to visit the home, within 90 minutes of being cooked, it should be put into a cold store at −5° until it is time to reheat it. The food should be reheated at a temperature above 73° in order to destroy any bacteria. You should use a food temperature probe to ensure it has been heated to the correct temperature. You should record what the food is, where it was purchased and who brought the food into the home, in the event of any untoward occurrence.

Further reading

NHS Standard infection control precautions: essential knowledge and a good place to check your knowledge is up to date. Found at www.england.nhs.uk/patient-safety/standard-infection-control-precautions-national-hand-hygiene-and-personal-protective-equipment-policy/

NICE infection control and prevention quality standards: it covers adults, young people and children and it includes preventing healthcare-associated infections that develop because of treatment, or from being in a healthcare setting. This is found at www.nice.org.uk/guidance/qs61

Rowe et al. (2023) *The Handbook for Nursing Associates and Assistant Practitioners,* 3rd edition. London: Sage, Chapter 8.

Further information and links to videos can be found in the handbook.

Useful websites

HSE guidance on fit checking your mask: **https://www.hse.gov.uk/respiratory-protective-equipment/fit-testing-basics.htm**

Sepsis document from the Sepsis Trust: **sepsistrust.org/wp-content/uploads/2020/01/5th-Edition-manual-080120.pdf**

Best practice guide to food hygiene in care settings. Found at **gov.wales/sites/default/files/publications/2019-12/food-and-nutrition-care-homes-older-people-food-hygiene-and-safety.pdf**