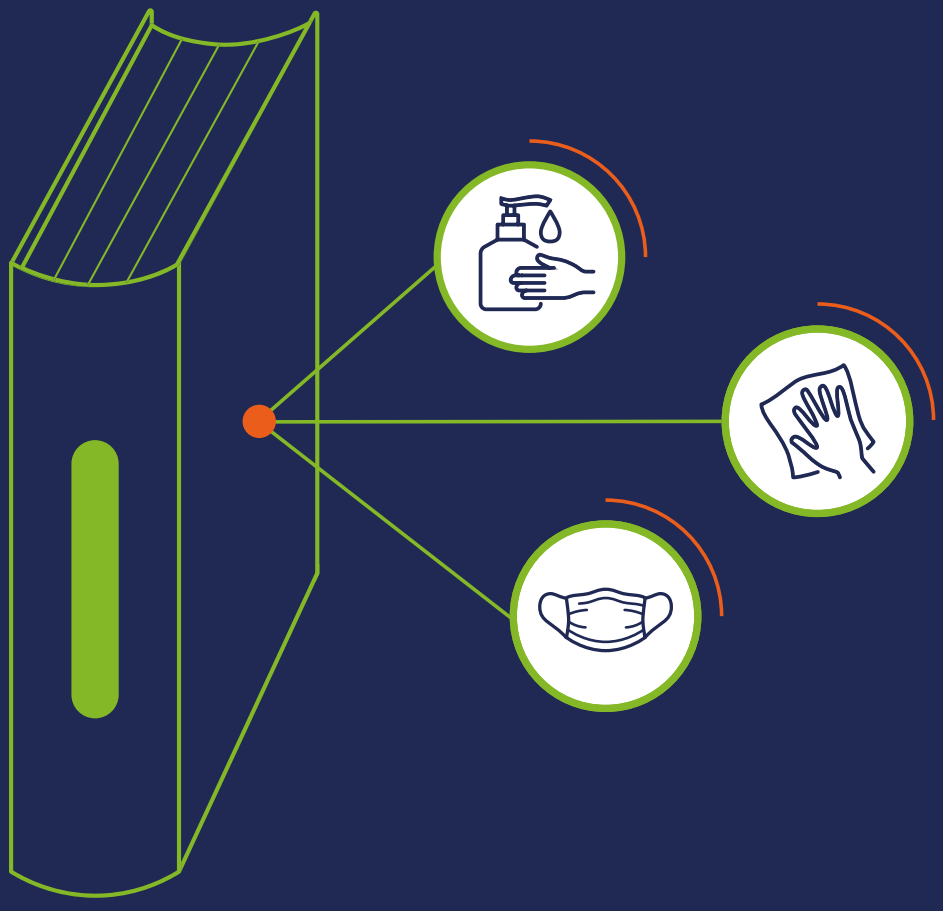
# Infection prevention and control pre-service education and training curriculum

## Foundational learning for all health and care workers



World Health Organization

# Infection prevention and control pre-service education and training curriculum

Foundational learning
for all health and care workers

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Infection prevention and control pre-service education and training curriculum: foundational content for all health and care workers

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# Contents

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# Abbreviations and acronyms

| | |
|---|---|
| **AMR** | antimicrobial resistance |
| **HAI** | health care-associated infection |
| **HCW** | health and care worker |
| **IPC** | infection prevention and control |
| **PPE** | personal protective equipment |
| **PSF** | Professional Standards Framework |
| **TBP** | transmission-based precautions |
| **WHO** | World Health Organization |

# Glossary

**Allied health professions:** defined by the organization of International Chief Health Professions Officers as a distinct group of health professionals who apply their expertise to prevent disease transmission, diagnose, treat and rehabilitate people of all ages and all specialties. Together with a range of technical and support staff, they may deliver direct patient care, rehabilitation, treatment, diagnostics and health improvement interventions to restore and maintain optimal physical, sensory, psychological, cognitive and social functions *(1)*.

**Antimicrobial resistance (AMR):** AMR threatens the effective prevention and treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses and fungi. AMR occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines, making infections harder to treat and increasing the risk of disease spread, severe illness and death. As a result, the medicines become ineffective and infections persist in the body, increasing the risk of spread to others. Antimicrobials, including antibiotics, antivirals, antifungals and antiparasitics, are medicines used to prevent and treat infections in humans, animals and plants. Microorganisms that develop AMR are sometimes referred to as "superbugs" *(2)*.

**Antimicrobial stewardship:** refers to the effort to measure and improve how antibiotics are prescribed by clinicians and used by patients. Improving antibiotic prescribing and use is critical to effectively treat infections, protect patients from harms caused by unnecessary antibiotic use, and combat AMR.

**Aseptic technique:** used to carry out a procedure in a way that minimizes the risk of contamination that may cause infection. It includes placing barriers, using sterile equipment and creating an environment that minimizes exposure to organisms *(3)*.

**Asynchronous learning:** a general term used to describe forms of education, instruction and learning that do not occur in the same place or at the same time. The term is most commonly applied to various forms of digital and online learning in which students learn from instruction—such as prerecorded video lessons or game-based learning tasks that students complete on their own—that is not being delivered in person or in real time.

**Attitude:** a person's feelings, values and beliefs, which influence their behaviour and the performance of tasks *(4)*.

**Behaviour:** observable conduct towards other people or tasks that expresses a competency. Behaviours are measurable in the performance of tasks *(4)*.

**Competencies:** the abilities of a person to integrate knowledge, skills and attitudes in their performance of tasks in a given context. Competencies are durable, trainable and, through the expression of behaviours, measurable *(4)*.

**Competency-based curriculum:** a curriculum that emphasizes the complex outcomes of learning rather than mainly focusing on what learners are expected to learn about in terms of traditionally defined subject content. In principle, such a curriculum is learner-centred and adaptive to the changing needs of students, teachers and society. It implies that learning activities and environments are chosen so that learners can acquire and apply the knowledge, skills, and attitudes to situations they encounter in work environments *(5)*.

**Curriculum:** the totality of organized educational activities and environments that are designed to

achieve specific learning goals/objectives. The curriculum encompasses the content of learning, the organization and sequencing of content, the learning experiences, teaching methods, the formats of assessment, and quality improvement and programme evaluation *(4).*

**Formative assessment:** the goal of formative assessment is to monitor student learning to provide ongoing feedback that can be used by instructors to improve their teaching and by students to improve their learning.

**Gamification:** the process of applying gaming designs and concepts to learning or training scenarios in order to make them more engaging and entertaining for the learner.

**Hand hygiene:** a general term referring to any action of hand cleansing, that is, the action of performing hand hygiene for the purpose of physically or mechanically removing dirt, organic material, and/or microorganisms *(6).*

**Health and care workers (HCWs):** care workers provide direct personal care services in the home, in health care and in residential settings, assisting with routine tasks of daily life, and performing a variety of other tasks of a simple and routine nature. Health workers are all people primarily engaged in actions with the primary intent of enhancing health *(7)*.

**Healthcare-associated infection (HAI):** an infection occurring in a patient during the process of care in a hospital or other health care facility, which was not present or incubating at the time of admission. HAI can also appear after discharge. They represent the most frequent adverse event associated with patient care *(8).*

**Infection prevention and control (IPC):** a practical, evidence-based approach which prevents patients and HCWs from being harmed through acquisition of an infectious disease.

**IPC minimum requirements:** IPC standards that should be in place at both national and health facility level to provide minimum protection and safety to patients, health care workers and visitors, based on the WHO core components for IPC programmes. The existence of these requirements constitutes the initial starting point for building additional critical elements of the IPC core components according to a stepwise approach based on assessments of the local situation *(9).*

**IPC professional:** health care professional (medical doctor, nurse, or other health-related professional) who has completed a certified postgraduate IPC training course, or a nationally or internationally recognized postgraduate course on IPC, or another core discipline including IPC as a core part of the curriculum as well as IPC practical and clinical training *(10).*

**IPC link person:** nurse or doctor (or other health professional) in a ward or within the facility (for example, staff working in clinical services such as intensive care unit or maternal and neonatal care, or water, sanitation and hygiene or occupational health professionals) who has been trained in IPC and links to an IPC focal point/team at a higher level in the organization (for example, IPC focal point/team at the facility or district level). IPC is not the primary assignment of this professional but, among others, he/she may undertake tasks in support to IPC, including for example supporting implementation of IPC practices; providing mentorship to colleagues; monitoring activities; and alerting on possible infectious risks *(10).*

**IPC focal point:** an individual (according to the above definition) appointed to be in charge of IPC at the national, sub-national or facility/organization level *(10).*

**In-service education:** any structured learning activity for persons already employed in a service setting *(4).*

**Knowledge:** the recall of specifics and universals, the recall of methods and processes, or the recall of a pattern, structure or setting *(11).*

**Learning aim:** concise descriptions of the overall goals or purposes of a piece of learning (a programme, a module or even an individual lecture or seminar) *(12)*.

**Learning outcome:** learning outcomes are specific statements of what learners will be able to do when they successfully complete a learning experience (whether it is a project, course or programme). They are always written in a student-centred, measurable fashion that is concise, meaningful, and achievable *(13).*

**Performance:** a function of competence, motivation and opportunity to participate or contribute where competence reflects what a HCW can do, performance is what a health and care worker does do *(4).*

**Pre-service education:** any structured learning activity that takes place prior to and as a requisite for employment in a service setting *(4).*

**Risk assessment:** assessment of the risk of exposure to hazards and selection of appropriate actions to reduce exposure risk *(14).*

**Standard precautions:** the minimum standard of IPC practices that should be used by all HCWs during the care of all patients at all times in all settings. When applied consistently, standard precautions can prevent the transmission of microorganisms between patients, HCWs and the environment *(14).*

**Skill:** a specific cognitive or motor ability that is typically developed through training and practice and is not context-specific *(4).*

**Summative assessment:** the goal of summative assessment is to *evaluate student learning* at the end of an instructional unit by comparing it against some standard or benchmark.

**Surveillance:** the ongoing, systematic collection, analysis, interpretation and evaluation of data closely integrated with the timely dissemination of these data to those who need it. Conducting high quality surveillance is crucial to identify how big a problem is and to assess the impact of any prevention or improvement intervention.

**Synchronous learning:** refers to all types of learning in which learner(s) and instructor(s) are in the same place at the same time in order for learning to take place. This includes in-person classes and live online meetings when the whole class or smaller groups get together.

**Transmission based precautions (TBP):** these are used in addition to standard precautions for patients with known or suspected infection or colonization, with transmissible and/or epidemiologically significant pathogens *(14).*

**Training:** aims at improving the level of a trainee's competence in a specific area and may be defined as the process of developing, changing or strengthening knowledge, skills and attitudes of a target group *(15).*

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# Executive summary

In May 2022, the Seventy-fifth World Health Assembly adopted a global strategy on infection prevention and control (IPC) advocating for the implementation of IPC curricula that meets high quality standards throughout the lifelong learning continuum in health care (pre-service, in-service and postgraduate education). This curriculum responds to that call by providing a comprehensive guide for targeted pre-service education on IPC for all future health and care workers with the goal to ensure that undergraduate programmes incorporate IPC into their curriculum.

The primary objective of this curriculum is to equip pre-service students in health-related programmes with the essential knowledge, skills and behavioural competencies necessary for delivering safe health care so as to protect everyone accessing the health care system, thereby reducing health care-associated infections and combating antimicrobial resistance.

This curriculum is designed to meet the needs of educators who develop learning resources and oversee training within health and care worker educational institutions targeted at pre-service health science students, such as nursing, medicine, midwifery, dentistry, public health and allied health care professions, for example, paramedicine, physiotherapy and others. It is also designed to be flexible, allowing for adaptation to various educational and practical contexts to meet specific national and local IPC requirements and policies.

The curriculum currently provides comprehensive **foundational content**, introducing essential IPC principles applicable to all health science students. In addition, **targeted modules** tailored to the needs of various health care professional groups—such as nursing, medicine, dentistry, midwifery, and allied health professions—are being developed and will be introduced progressively. These modules provide deeper insights and practical applications relevant to each discipline.

Notably, this curriculum serves as an essential reference tool to support the planning, development and inclusion of IPC content within health science courses, aligning with the World Health Organization global IPC strategy and strategic directions. By strengthening the IPC competencies of future health and care workers, this guide enhances the health care system's capacity to prevent and manage infections, improve patient and health and care workers safety, address antimicrobial resistance, and improve the overall quality and safety of care. These objectives extend beyond lessons learned from recent global health crises, underscoring the broader importance of IPC in fostering resilient and effective health care systems.

The expected outcome of the introduction of this curriculum is the enhancement of the professional knowledge and skills of future health and care workers, thereby making a significant positive impact on learners, health and care workers and patients.

# 1.

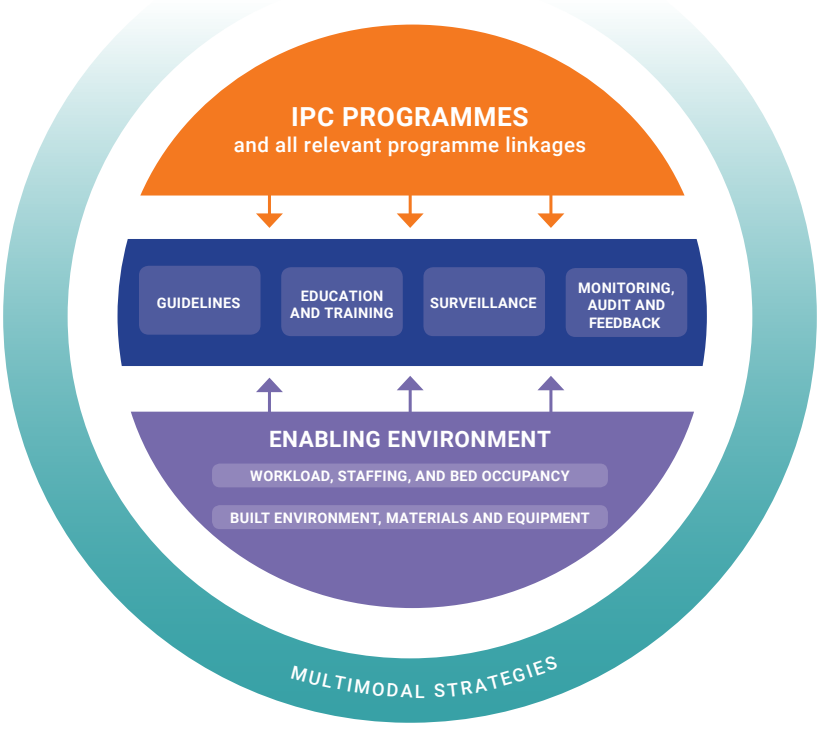
# Introduction and proposed framework

# Introduction and proposed framework

Infection prevention and control (IPC) significantly contributes to ensure high-quality care delivery and serves as a fundamental pillar of health system resilience and outbreak preparedness, underscoring its critical importance in safeguarding both patients and health and care workers. Having active IPC programmes in place and performing best IPC practices at the point of care are effective ways to protect patients, health and care workers and visitors by preventing avoidable infections acquired during care provision, including those caused by antimicrobial resistance (AMR) and pandemic-prone pathogens. A continuous and strong implementation of IPC measures in health care facilities is crucial to prevent and control outbreaks and protect communities at large.

In 2016, recognizing this need, the World Health Organization (WHO) outlined the core components of IPC programmes *(1)*. Six core components are recommended at national level and eight core components at the facility level (Fig. 1.1). Core component three is dedicated to 'IPC education and training', emphasizing the integration of IPC knowledge, skills and behaviour across all levels of health care service delivery. Based on scientific evidence, expert consensus and country experiences, the core components are the foundation for establishing or strengthening effective programmes at the national and facility level. The successful implementation of the IPC core components is dependent upon the competence and skills of all health and care workers, who must possess an understanding of key IPC principles and demonstrate the ability to effectively implement them into their health care practices. Thus, the creation and integration of IPC curricula that meet high-quality standards in pre-service education is essential.

**Fig. 1.1. Visual representation of the WHO core components of IPC programmes**




*Source*: WHO *(2)*.

The content of this document is based on the principles, recommendations and minimum requirements related to the WHO core component three for IPC programmes at national and facility levels, that is, 'IPC training and education' (Table 1.1).

**Table 1.1 WHO recommendations and minimum requirements for IPC training and education**

| | NATIONAL LEVEL | FACILITY LEVEL |
|---|---|---|
| **CORE COMPONENT 3 RECOMMENDATIONS** | At the national level, the national IPC programme should support education and training of the health workforce as one of its core functions. | At facility level, IPC education should be in place for all HCWs by using team- and task-based strategies that are participatory and include bedside and simulation training to reduce the risk of health care-associated infection (HAI) and antimicrobial resistance (AMR). |
| **MINIMUM REQUIREMENTS** | **National training policy and curriculum**<br>• National policy that all HCWs are trained in IPC (in-service training).<br>• An approved IPC national curriculum aligned with national guidelines and endorsed by the appropriate body.<br>• National system and schedule of monitoring and evaluation to check on the effectiveness of IPC training and education (at least annually). | ■ **PRIMARY CARE: IPC training for all clinical practitioners and cleaners upon hire**<br>• All clinical practitioners and cleaners must receive education and training on the facility IPC guidelines/standard operating procedures (SOPs) upon employment.<br>• All IPC link persons in primary care facilities and IPC officers at the district level (or other administrative level) need to receive specific IPC training.<br>■ **SECONDARY CARE: IPC training for all front-line clinical staff and cleaners upon hire**<br>• All clinical practitioners and cleaners must receive education and training on their IPC guidelines/SOPs upon employment.<br>• All IPC staff need to receive specific IPC training.<br>■ **TERTIARY CARE: IPC training for all front-line clinical staff and cleaners upon hire and annually**<br>• All clinical practitioners and cleaners must receive education and training on the facility IPC guidelines/SOPs upon employment and annually.<br>• All IPC staff need to receive specific IPC training either online or participate in courses. |

*Source*: WHO *(2)*.

In May 2022, resolution WHA.75.13 for a global strategy on IPC was approved at the Seventy-fifth World Health Assembly *(3)*. This strategy specifically called on Member States to take steps toward creating and implementing IPC curricula within pre-service, postgraduate and in-service continuous education for all relevant disciplines, IPC professionals and HCWs, respectively, where and as appropriate in national contexts. To deliver this strategy, countries need to take a stepwise approach to implement the WHO core components for effective IPC programmes, starting with the minimum requirements.

IPC capacity and expertise in a country depend on the level of implementation of IPC core component three. However, in a WHO survey conducted at the facility level in 2019, the core component of IPC programmes that scored the lowest across 4440 health care facilities from 81 countries was IPC education and training, that is, core component three *(4)*.

Strengthening IPC knowledge, skills and competencies for future HCWs is a priority action to support the provision of clean, safe and effective care and deliver on the actions outlined in the WHO IPC global strategy, action plan and monitoring framework *(5),* where clear actions, indicators and targets are indicated regarding IPC curricula development and implementation (Table 1.2).

**Table 1.2. 2024–2030 WHO global action plan and monitoring framework key actions, core indicators and targets: pre-service IPC curriculum**

| Actions | Indicators | Global target |
|---|---|---|
| Strategic direction #4. Knowledge about IPC among HCWs and career pathways for IPC professionals | | |
| **Key action 3:** Develop and establish a national curriculum on IPC (or adopt an international one) for pre-service training and education for all relevant health care disciplines (for example, in medical, nursing and midwifery schools) endorsed by the appropriate national or international body and integrate it within health educational curricula with embedded evaluation mechanisms. | 1. IPC pre-service curriculum for all relevant health care disciplines developed and endorsed by the appropriate national or international body and ensuring that (national/ international) quality and standards are met (by 2028). | Increase of the proportion of countries with an IPC training programme for HCWs (to 30% by 2026, 50% by 2028 and >80% by 2030). |
| | 2. IPC pre-service curriculum integrated within health educational curricula, with embedded evaluation mechanisms (by 2030). | |

## Purpose of the document

The purpose of this pre-service curriculum guide is to support health care educational institutions and national IPC programmes to design, develop and deliver programmes aimed at equipping future HCWs workers with the necessary competencies to implement IPC principles and practices effectively during their future careers, while also ensuring that IPC is a core component of all pre-service education. This will ensure that evidence-based IPC is consistently integrated into and delivered within all health care-related educational programmes, for example, foundational coursework, clinical training and specialized modules. In addition, it will eventually enable pre-service students to understand expectations and demonstrate competencies for effective and safe IPC practice.

## Objectives and scope

This curriculum guide establishes a structured framework for developing core competencies in IPC for pre-service health science students, equipping them with the knowledge, skills and professional attitudes required to deliver safe, high-quality care, while mitigating the risks of HAIs and AMR.

It serves as a **comprehensive resource for educators** by supporting the **design, adaptation and evaluation** of IPC curricula and training approaches across diverse health care educational institutions and care settings. Clearly defined learning aims and outcomes around core IPC subjects relevant to HCWs with direct patient contact are included. Recognizing variations in health care education systems and clinical practice environments, this guide is **flexible** and encourages adaptation to align with **national IPC policies and frameworks, local contexts and institutional priorities**.

Beyond foundational IPC principles, this guide promotes **evidence-based practices, critical thinking and interprofessional collaboration**, ensuring that future HCWs are prepared to **implement, advocate for and sustain** effective IPC measures within their respective fields.

Annex 3 lists existing additional relevant curricula that would be critical to consider when identifying the content to be included in pre-service curricula for health sciences.

## Methodology and approach to curriculum development

This curriculum was developed through a multi-phase process grounded in best practices in curriculum design, evidence synthesis, and adult learning principles.

Evidence review

A review of global curricula, peer-reviewed literature, and existing training and education frameworks was undertaken. Key sources included:

- WHO guidelines and technical documents on IPC, antimicrobial resistance (AMR), and health workforce education.
- Peer-reviewed publications focusing on IPC competencies and outcomes in pre-service health care education.
- Educational frameworks and tools from national and regional authorities.
- Curricula and educational materials from Global Infection Prevention and Control (GIPC) Network.

In addition, an evidence inventory of existing IPC curricula in academic institutions was conducted to identify current IPC education and training material across universities. All gathered materials were appraised for relevance, and alignment with WHO's IPC Core Components framework, particularly Core Component 3: IPC Education and Training. Priority was given to content that supported competency-based education and demonstrated applicability to foundational pre-service learning.

Evidence was synthesized to:

- Define foundational IPC principles and competencies essential for all health and care workers at pre-service level.
- Select and justify inclusion of non-WHO materials based on resources provided by the Global Infection Prevention and Control (GIPC) Network.

Expert consultation and consensus

A consultative process was conducted with global and regional IPC experts and educators in adult learning. This involved:

- Strategic discussions within the WHO Global IPC Network's education and training sub-working group.
- External review by academic and IPC leaders across disciplines.
- Targeted feedback from national IPC programme representatives.

Normative statements, including learning aims and outcomes, were finalized through consensus agreement among subject matter experts. The consensus-building process ensured that each statement reflected expert judgment, and educational relevance, while maintaining adaptability to different local and national healthcare contexts. The final foundational curriculum structure, including content, learning aims and outcomes, assessment approaches, and targeted modules was mapped against:

- WHO's IPC core components and Global IPC Strategy (2022–2030).
- Competency-based education principles.
- Pedagogical best practices in health professional education.

The curriculum is designed to be adaptable, and scalable, supporting both national integration and institutional implementation across diverse educational environments.

## Target audience

The primary target audiences of this curriculum are **educators and curriculum developers** in health care educational institutions responsible for designing, delivering and evaluating IPC training for **pre-service** health science students across diverse health science disciplines. It is intended for learners in **medicine, nursing, midwifery, dentistry, public health, and allied health professions**, including paramedicine, physiotherapy, and other related fields. The availability of a WHO pre-service curriculum will also help policy makers to take action in the implementation of the WHO global action plan and monitoring framework, where this is indicated as a relevant action to strengthen IPC in their country.

## Proposed framework

The curriculum is structured in **two key components**:

- **Foundational content**. A core IPC framework applicable to all pre-service health science students covering essential principles, evidence-based practices and key competencies in IPC (Fig. 1.2).
- **Targeted modules** *(to be introduced progressively)*. These specialized modules will build on the foundational content, offering discipline-specific applications of IPC tailored to the unique clinical tasks and responsibilities of various health care professions. Teaching strategies will be adapted to align with the educational and practical requirements of each professional stream. For example, nursing students will engage with both foundational and nursing-focused targeted learning, delivered through pedagogical approaches relevant to their clinical practice.

This structure ensures flexibility and scalability, allowing institutions to adapt the curriculum to local training needs, regulatory frameworks and evolving IPC priorities in health care education.

**Fig. 1.2. Pre-service curriculum framework for health care education**


## Foundational content

The *foundational* content is designed for all pre-service health science students and applicable to every future health care professional. It outlines the basic principles of IPC practice that are essential to halt the spread of infectious agents and AMR, prevent infections, and promote safe environments within the health care systems (Table 1.3).

This curriculum is not intended to replace existing IPC content. Academic institutions should examine existing curricula against this pre-service curriculum to identify gaps so that they can be remediated.

**Table 1.3. Foundational IPC principles**

| |
|---|
| General concepts of microbiology |
| Introduction to HAI and AMR |
| Chain of transmission |
| What is IPC and why it matters |
| Standard precautions (risk assessment, hand hygiene, respiratory etiquette, personal protective equipment, environmental cleaning, waste management, management of reusable medical equipment/devices, linen management, prevention of needle-stick injury, aseptic technique, patient placements) |
| Transmission-based precautions |
| General concepts of AMR prevention |
| Prevention of infection in HCW, including the role of occupational health and safety, vaccinations, and post-exposure evaluations and follow-up |

HAI, health care-associated infection; AMR, antimicrobial resistance; IPC, infection prevention and control; HCW, health and care worker.

## Targeted modules

All pre-service health care education curricula should be incorporated into the foundational IPC content outlined in this framework. Targeted modules will serve as specialized additional modules, which are designed to equip future health care professionals with advanced IPC competencies relevant to their specific clinical roles and responsibilities.

Building on core IPC principles, these modules will provide discipline-specific learning outcomes, ensuring that students acquire the practical skills and contextual knowledge necessary to implement effective IPC measures within their respective clinical environments. The integration of these targeted modules will allow for progressive learning by adapting IPC education to the unique demands of different health care professions, while maintaining alignment with global and national IPC standards.

These modules will be delivered as separate documents from the foundational curriculum and will be available on a staggered timeline as the content is developed. Sample IPC content for some of these targeted professions are identified below in Table 1.4.

**Table 1.4. Examples of IPC content for targeted training of health science students**

| IPC content | Nursing | Medicine | Dentistry | Allied health professionals |
|---|---|---|---|---|
| Central catheter-associated bloodstream infection prevention | ✓ | ✓ | N/A | N/A |
| Ventilator-associated pneumonia prevention | ✓ | ✓ | N/A | N/A |
| Surgical site infection prevention | ✓ | ✓ | N/A | ✓ |
| Catheter-associated urinary tract infection prevention | ✓ | ✓ | N/A | ✓ |
| HAI prevention in specific populations | ✓ | ✓ | N/A | ✓ |
| Antimicrobial stewardship | ✓ | ✓ | ✓ | N/A |
| Medical device reprocessing | ✓ | ✓ | ✓ | N/A |
| Outbreak investigation and response | ✓ | ✓ | N/A | N/A |
| Health care facility built environment, infrastructure, and building requirements | ✓ | ✓ | ✓ | ✓ |
| Leadership and advocacy in IPC | ✓ | ✓ | ✓ | ✓ |

N/A, not applicable; HAI, health care-associated infection; IPC, infection prevention and control.

# 2.

# Foundational components and learning outcomes

# 2. Foundational components and learning outcomes

## 2.1 General concepts of microbiology

Microbes (or microorganisms) are living organisms that can be beneficial, neutral or harmful to humans. They can be divided into five categories—bacteria, viruses, fungi, parasites and prions. When pathogenic (able to cause disease), they are responsible for a variety of infectious diseases that can be transmitted from human to human (and sometimes also from animals to humans), both in the community and health care settings. They can also be resistant to many antimicrobials. AMR is covered in a separate chapter due to its increasing importance.

A basic understanding of microbiology will help learners to understand how they can prevent infections and break the cycle of transmission, with a specific focus on HAIs.

### Learning aims

On completion of this section, the learner will be able to explain general concepts of microbiology and develop the ability to apply this knowledge to implement strategies for preventing HAIs and AMR.

### Learning outcomes

#### Knowledge

The learner is able to:

1. identify the classifications of microorganisms, including bacteria, viruses, fungi, parasites and prions; gram-positive and gram-negative bacteria, etc.;
2. describe the normal microbial flora of the body;
3. discuss why these different categories of microorganisms are of concern in health care settings;
4. describe the concepts of contamination, colonization and infection;
5. explain how microbiology informs IPC measures, including isolation precautions and outbreak management.

#### Skills

The learner is able to:

1. apply microbiology knowledge to identify how to break the cycle of transmission and prevent HAIs.

#### Attitudes

The learner is able to:

1. discuss with colleagues appropriate IPC measures using microbiology knowledge as an important component of decision-making in the prevention and control of HAIs.

## Recommended tools and resources

Basic microbiology (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/coursewares/course-v1:WHOAcademy-Hosted+H0071EN+2025_Q1?from=discovery&source=edX, accessed 25 February 2025).

## Bibliography[1]

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/publication/infection-prevention-and-control-education-framework/).

Brown, M. (2014). Microbiology basics. APIC text of infection control and epidemiology (4th ed.). Association for Professionals in Infection Control and Epidemiology.

[1] All references were accessed on 25 February 2025.

## 2.2. Introduction to HAI and AMR

HAIs are infections acquired by a patient during the process of receiving health care (including preventive, diagnostic and treatment services) in a hospital or other health care facility, which were not present or incubating at the time of admission, including post-discharge. They can also be acquired by HCWs during health care delivery and visitors *(6)*.

HAIs affect millions of patients worldwide, leading to prolonged hospital stays, long-term disabilities, increased AMR, significant health care costs, emotional distress for patients and families, and preventable deaths.

AMR occurs when bacteria, viruses, fungi and parasites do not respond to antimicrobial medicines. It is a major threat to health and human development, affecting our ability to treat a range of infections. The scale of the AMR threat is such that no single country is free from its health and socioeconomic impact. Treatments for a growing number of HAIs have become less effective across the world due to the increasing incidence of infections becoming resistant to antimicrobials.

### Learning aims

On completion of this section, the learner will be able to explain the risks related to HAIs in health care settings, act to identify potential infections that may be encountered, and start to apply this knowledge to act to decrease transmission risks.

### Learning outcomes

#### Knowledge

The learner is able to:

1. define HAI and the most frequent types of HAI encountered in health care settings;
2. discuss the risk factors that contribute to the occurrence of HAIs, including those related to health systems, the provision of health care, and behavioural factors related to HCWs;
3. describe the consequences of infection to the person receiving care and the wider health system.

#### Skills

The learner is able to:

1. communicate about the consequences of HAIs and AMR on patient safety, health care costs, the health system and public health;
2. identify situations where individuals might be at higher risk of infection;
3. discuss with colleagues any signs and symptoms that indicate a potential HAI.

#### Attitudes

The learner is able to:

1. reflect on and identify any limitations in their personal knowledge about risk factors or indications related to HAI and AMR;

2. engage in learning activities that will reduce potential knowledge limitations.

## Recommended tools and resources[1]

Global report on infection prevention and control. Chapters 1 and 2. Geneva: World Health Organization; 2024 (https://iris.who.int/handle/10665/379632).

Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Geneva: World Health Organization; 2016 (https://iris.who.int/handle/10665/251730).

Healthcare-associated infections. Stockholm, Sweden: European Centre for Disease Prevention and Control; 2025 (https://www.ecdc.europa.eu/en/healthcare-associated-infections).

Health care-associated infection surveillance (WHO Academy). 2024 (https://web-staging.lxp.academy.who.int/).

Healthcare-associated infections (HAIs). Atlanta, GA: Centers for Disease Control and Prevention (https://www.cdc.gov/healthcare-associated-infections/).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Addressing the burden of infections and AMR associated with health care. Geneva: Organisation for Economic Co-operation and Development; World Health Organization; 2022 (https://www.oecd.org/content/dam/oecd/en/topics/policy-sub-issues/antimicrobial-resistance-and-pandemics/addressing-burden-of-infections-and-amr-associated-with-health-care.pdf).

Balasubramanian R, Van Boeckel TP, Carmeli Y, Cosgrove S, Laxminarayan R. Global incidence in hospital-associated infections resistant to antibiotics: an analysis of point prevalence surveys from 99 countries. PLoS Med. 2023; 20(6):e1004178 (https://doi.org/10.1371/journal.pmed.1004178).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

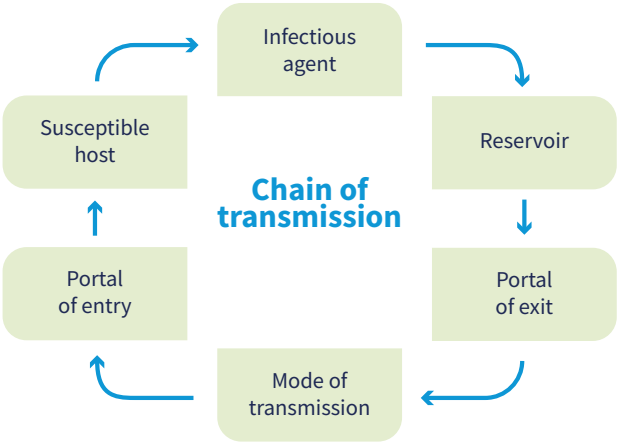
[1] All references were accessed on 25 February 2025.

## 2.3 Chain of transmission

To reduce the risk of HAIs, it is important to understand how different microorganisms spread. Microorganisms are found in the air, soil, water and on or in our bodies. Some microorganisms are helpful and constitute the human microbiome, whereas others can be harmful and cause infections.

Fig. 2.1 illustrates the chain of transmission. For an infection to develop and spread, all steps in the chain must occur. The key to stopping the spread of infection is to break at least one link in the chain. In a health care setting, the chain of transmission refers to numerous opportunities for pathogens to spread among patients, HCWs and the environment. Effective IPC interventions aim to break the chain.

**Fig. 2.1. Chain of transmission**




*Source*: WHO *(7)*.

### Learning aims

On completion of this section, the learner will be able to explain the chain of transmission of infections and start to apply this knowledge to effectively interrupt and prevent the spread of infection.

### Learning outcomes

#### Knowledge

The learner is able to:

1. describe each component in the chain of transmission (infectious agent, reservoir, portal of exit, mode of transmission, portal of entry, susceptible host);
2. describe how infections are spread and the contributing factors;
3. describe how IPC intervention can interrupt the chain and break its links.

### Skills

The learner is able to:

1. prevent the spread of infection by assessing the risk related to their clinical practice and acting to break the chain of transmission.

### Attitudes

The learner is able to:

1. act to interrupt the chain of transmission by applying IPC practices;
2. communicate the risks of transmission and how to reduce these to colleagues, patients and the public.

## Recommended tools and resource[1]

Chain of infection components. Atlanta, GA. National Institute for Occupational Safety and Health; Centers for Disease Control and Prevention; 2022. (https://www.cdc.gov/niosh/learning/safetyculturehc/module-2/3.html).

Introduction to IPC (WHO Academy). Geneva: World Health Organization, 2025 (https://web-staging.lxp.academy.who.int/coursewares/course-v1:WHOAcademy-Hosted+H0074EN+2025_Q1?source=edX).

Project Firstline. Introduction to reservoirs: where germs live training toolkit. Atlanta, GA: Centers for Disease Control and Prevention; 2023 (https://www.cdc.gov/project-firstline/hcp/training/).

Project Firstline. Learn where germs live in health care. Atlanta, GA: Centers for Disease Control and Prevention; 2022 (https://www.cdc.gov/project-firstline/about/?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/projectfirstline/healthcare/where-germs-live.html).

[1] All references were accessed on 25 February 2025.

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Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/publication/infection-prevention-and-control-education-framework/).

Jarvis WR, editor. Bennett & Brachman's Hospital Infections. Seventh edition. Lippincott Williams & Wilkins; 2023.

Siegel JD, Rhinehart E, Jackson M, Chiarello L. Management of multidrug-resistant organisms in health care settings, 2006. Am J Infect Control. 2007;35:S165-93 (https://doi.org/10.1016/j. ajic.2007.10.006).

[1] All references were accessed on 25 February 2025.

## 2.4 What is infection prevention and control and why it matters

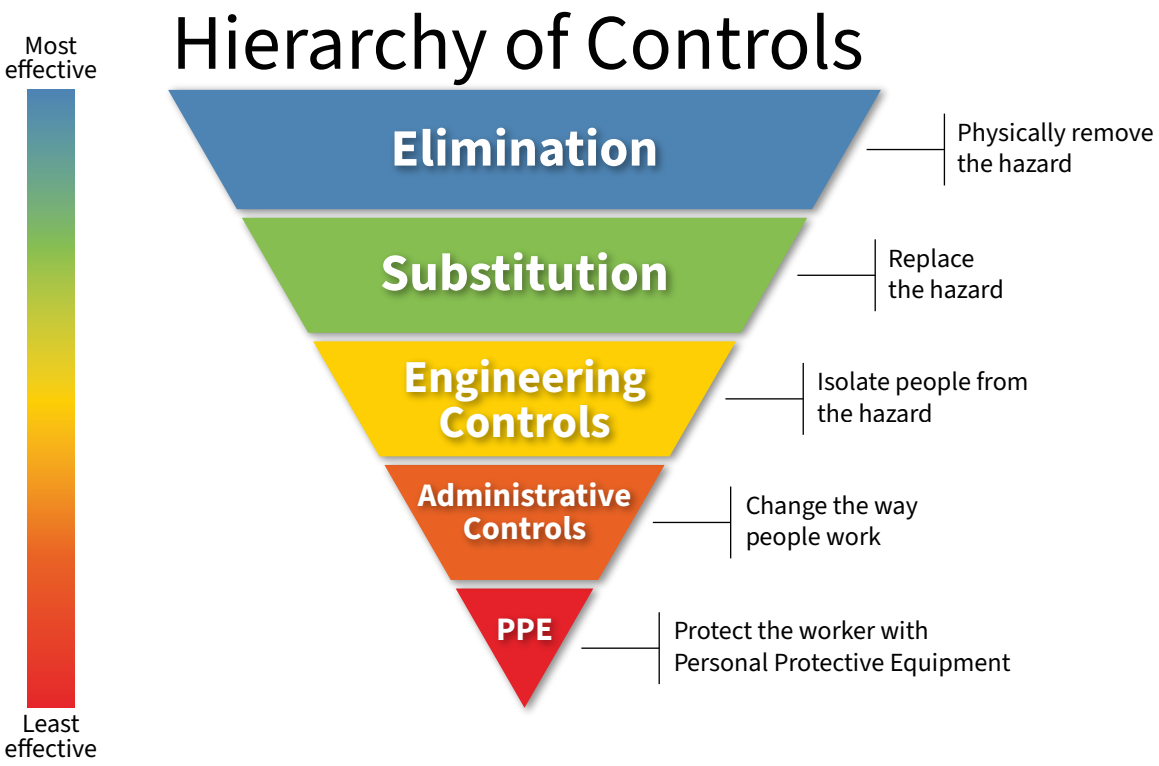
IPC is a clinical and public health specialty and a set of measures, based on a practical, evidence-based approach. The aim of IPC is to prevent patients, HCWs and visitors to health care facilities from being harmed by avoidable infections acquired during the provision of health care services, including those caused by antimicrobial-resistant pathogens and spread through outbreaks. IPC is based on a scientific approach grounded in infectious diseases, epidemiology, social and implementation science, engineering and health system strengthening. IPC is a proven and cost-effective approach to prevent the transmission of infectious hazards, but applying it requires programmatic, institutional, financial and knowledge support. The COVID-19 pandemic and other public health emergencies have underscored the critical role of IPC in not only protecting HCWs and patients, but also safeguarding health care environments. IPC is 'everyone's business', regardless of whether you are working as a hospital administrator, porter, housekeeper or providing direct clinical care to patients.

A foundational framework within IPC is the hierarchy of controls, which prioritizes strategies for infection prevention based on their effectiveness (Fig. 2.2). This hierarchy includes:

1. **Elimination:** removes the hazard (or infection risk) at the source, for example, excluding infectious patients from shared spaces.
2. **Substitution:** using a safer alternative at the source of the hazard, for example, replacing risky practices with safer alternatives, where applicable.
3. **Engineering controls:** reduce or prevent hazards from coming into contact with workers, for example, implementing physical barriers or systems to reduce exposure, such as effective ventilation systems.
4. **Administrative controls:** establish work practices that reduce the duration, frequency or intensity of exposure to hazards. This includes adopting policies and training programmes to promote safer practices, such as adherence to IPC guidelines.
5. **Personal protective equipment (PPE):** worn to minimize exposure to hazards, for example, using equipment such as gloves and masks to minimize risk when other measures cannot fully control exposure.

Understanding and applying this hierarchy ensures comprehensive infection prevention in health care settings, prioritizing safety for everyone involved.

**Fig. 2.2. National Institute for Occupational Safety and Health (NIOSH) model hierarchy of controls.**




*Source*: NIOSH *(8)*.

## Learning aims

On completion of this section, learners will be able to explain the principles of IPC and apply their knowledge of preventing HAIs to protect health and care workers, patients, and communities.

## Learning outcomes

### Knowledge

The learner is able to:

1. define IPC and its significance to prevent HAI, including its impact on delivering quality health care;
2. explain the role of IPC in protecting HCWs, patients, visitors and communities;
3. describe their role, as well as the role of other IPC team members, in the prevention and control of infection in other contexts;
4. summarize the hierarchy of controls and its application to IPC practices.

### Skills

The learner is able to:

1. apply evidence-based IPC measures to prevent infection transmission at the point of care;
2. effectively communicate IPC principles to patients, families and colleagues using an appropriate range of formats;
3. integrate the hierarchy of controls into decision-making for infection prevention strategies in health care settings.

### Attitudes

The learner is able to:

1. advocate and promote the importance of maintaining the principles of IPC with patients and families;
2. explain why using a different range of formats to communicate with others is important;
3. discuss with team members their role in the context of IPC.

## Recommended tools and resources[1]

About hierarchy of controls. Atlanta, GA: National Institute for Occupational Safety and Health. Centers for Disease Prevention and Control; 2024 (https://www.cdc.gov/niosh/hierarchy-of-controls/about/index.html).

Introduction to IPC (WHO Academy). Geneva: World Health Organization; 2025 (https://whoacademy.org/coursewares/course-v1:WHOAcademy-Hosted+H0074EN+2025_Q1?source=edX).

Who are infection preventionists? Arlington, VA: Association for Professionals in Infection Control and Epidemiology (https://apic.org/monthly_alerts/who-are-infection-preventionists/).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Geneva: World Health Organization; 2016 (https://apps.who.int/iris/handle/10665/251730).

Global report on infection prevention and control. Geneva: World Health Organization; 2024 (https://iris.who.int/bitstream/handle/10665/379863/B09195-eng.pdf?sequence=1).

[1] All references were accessed on 25 February 2025.

## 2.5 Standard precautions

Standard precautions aim to protect both HCWs and patients by reducing the risk of transmission of microorganisms from recognized and unrecognized sources. They are the minimum standard of IPC practices that should be used by all HCWs during the care of all patients at all times and in all settings. When applied consistently, standard precautions can prevent the transmission of microorganisms between patients, HCWs and the environment.

Key elements of standard precautions include:

- risk assessment
- hand hygiene
- respiratory hygiene and cough etiquette
- patient placement
- PPE
- aseptic technique
- safe injections and sharps injury prevention
- environmental cleaning
- handling of laundry and linen
- waste management
- decontamination and reprocessing of reusable patient care items and equipment.

### Learning aims

Upon completion of this section, learners will be able to explain the principles and elements of standard precautions and apply appropriate infection prevention measures to effectively reduce microbial transmission.

### Learning outcomes

#### Knowledge

The learner is able to:

1. explain the key standard precautions that should be used in health care settings;
2. explain how the use of standard precautions prevents HAIs.

#### Skills

The learner is able to:

1. practice the full range of skills to make standard precautions relevant to clinical settings and patient encounters (with a focus on risk assessment, hand hygiene, respiratory etiquette, PPE, environmental cleaning and waste management).

#### Attitudes

The learner is able to:

1. support colleagues to report any breach of using standard precautions without fear of consequences;
2. communicate with colleagues the appropriate use of standard precautions.

## Recommended tools and resources[1]

Infection prevention and control - basic IPC and primary care. Geneva: World Health Organization; 2025 (https://www.who.int/teams/integrated-health-services/infection-prevention-control/basic-ipc-and-primary-care).

Introduction to infection prevention and control (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/).

Standard precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/356855).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2007. (https://www.cdc.gov/infection-control/hcp/isolation-precautions/).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

[1] All references were accessed on 25 February 2025.

## 2.5.1 Risk assessment

Risk assessment is a critical component of implementing standard and TBP in health care. It involves evaluating each patient interaction to identify potential exposure risks to infectious agents, including blood, body fluids, secretions, excretions, non-intact skin, mucous membranes, contaminated surfaces or equipment, and visible symptoms of infection. This assessment guides the selection of appropriate PPE and other precautionary measures to mitigate risks effectively.

### Learning aims

On completion of this section, learners will be able to explain the principles of risk assessment and apply appropriate controls to reduce the transmission of infection, safeguarding both patients and other HCWs.

### Learning objectives

#### Knowledge

The learner is able to:

1. discuss risk assessment as a component of standard precautions and TBP;
2. assess the potential risk of exposure in different situations, as well as different signs and symptoms of infection, according to their role/context.

#### Skills

The learner is able to:

1. perform risk assessment and identify any risks that need to be addressed, during health care delivery;
2. select and use appropriate precautions based on this assessment.

#### Attitudes

The learner is able to:

1. promote the use and value of risk assessments as an appropriate approach to reducing infection for patients and colleagues.

### Recommended tools and resources[1]

Introduction to infection prevention and control (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/).

Standard precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/356855).

[1] All references were accessed on 25 February 2025.

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Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

[1] All references were accessed on 25 February 2025.

## 2.5.2 Hand hygiene

Hand hygiene is one of the simplest and most effective practices to prevent the spread of infections, including those caused by antibiotic-resistant microorganisms. HCWs play a vital role in reducing HAIs by practising hand hygiene at the right time and in the right way (for example, method and technique) during patient care. By performing hand hygiene when indicated, HCWs can significantly reduce the transmission of microorganisms, thus enhancing patient safety, improving outcomes and reducing costs.

### Learning aims

On completion of this section, learners will be able to explain the role of hand hygiene in preventing the spread of HAIs and AMR and demonstrate correct hand hygiene performance at the right time using the appropriate technique.

### Learning outcomes

#### Knowledge

The learner is able to:

1. describe the role of hand hygiene in preventing the transmission of microorganisms among HCWs, patients and visitors;
2. identify when to perform hand hygiene using the WHO 'My 5 moments for hand hygiene' concept;
3. identify the correct method for hand hygiene (using alcohol-based handrub or soap, water and clean/single-use towels or other appropriate drying methods) and when each method should be used.

#### Skills

The learner is able to:

1. select the correct method for hand hygiene and identify the rationale for this choice;
2. perform the correct steps of the WHO hand hygiene technique using an alcohol-based handrub or soap, water and clean/single-use towels or other appropriate drying methods;
3. perform hand hygiene when indicated according to the WHO "My 5 moments for hand hygiene" concept in a range of health care situations.

#### Attitudes

The learner is able to:

1. communicate the importance of ensuring that appropriate hand hygiene is undertaken at all times with HCWs, patients and families, using a different range of formats.

## Recommended tools and resources[1]

Glowicz JB, Landon E, Sickbert-Bennett EE, Aiello AE, deKay K, Hoffmann KK, et al. SHEA/IDSA/APIC Practice recommendation: strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update. Infect Control Hosp Epidemiol. 2023;44:355-376 (https://doi.org/10.1017/ice.2022.304).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

My 5 Moments for hand hygiene: the game. Geneva: World Health Organization; 2024 (https://web-staging.lxp.academy.who.int/coursewares/course-v1:WHOA+0018_MFM_EN+2022?source=edX).

APIC toolkit for patient hand hygiene. Arlington, VA: Association for Professionals in Infection Control and Epidemiology; 2023 (https://apic.org/patient-hand-hygiene-toolkit/).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Pittet D, Allegranzi B, Sax H, Dharan S, Pessoa-Silva CL, Donaldson L, et al. Evidence-based model for hand transmission during patient care and the role of improved practices. Lancet Infect Dis. 2006;6:641-52 (https://doi.org/10.1016/S1473-3099(06)70600-4).

Standard precautions: hand hygiene (WHO Academy). Geneva: World Health Organization; 2025 (https://whoacademy.org/coursewares/course-v1:WHOAcademy-Hosted+H0108EN+2025_Q1?source=edX).

Water and sanitation for health facility improvement tool (WASHFIT) training modules. Geneva: World Health Organization; United Nations Children's Fund; 2024 (https://www.washinhcf.org/wash-fit-training-modules/).

WHO guidelines on hand hygiene in health care. Geneva: World Health Organization; 2009 (https://iris.who.int/bitstream/handle/10665/44102/9789241597906_eng.pdf).

[1] All references were accessed on 25 February 2025.

## 2.5.3 Respiratory hygiene and cough etiquette

Respiratory hygiene and cough etiquette are infection prevention measures designed to limit the transmission of respiratory pathogens spread through the air. These measures should be practised by anyone with signs of respiratory illness, including cough, congestion, runny nose or increased production of respiratory secretions, particularly those accessing or working in the health care setting.

The elements of respiratory hygiene/cough etiquette include:

- source control: asking those with respiratory symptoms to wear a mask or use a tissue to cover their nose and mouth when sneezing, coughing, wiping and blowing their nose; where this is not possible, they should sneeze into their elbow/sleeve; and
- spatial separation: placing acute respiratory symptomatic patients at least 1 metre (3 feet) away from others in common waiting areas in health care settings.

### Learning aims

On completion of this section, learners will be able to explain the principles of respiratory hygiene and cough etiquette and apply them effectively to limit the transmission of respiratory pathogens through the air, particularly within health care settings.

### Learning outcomes

#### Knowledge

The learner is able to:

1. describe respiratory hygiene and cough etiquette;
2. explain the potential risk of transmission of infections through coughing and sneezing;
3. explain how to apply respiratory hygiene and cough etiquette to prevent the spread of infections.

#### Skills

The learner is able to:

1. demonstrate the correct application and removal of a medical mask;
2. demonstrate the practice of respiratory hygiene/cough etiquette.

#### Attitudes

The learner is able to:

1. communicate clearly to colleagues, patients and families why respiratory hygiene is important by using a range of communication tools, according to the targeted population.

## Recommended tools and resources[1]

Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2024 (https://www.cdc.gov/infection-control/media/pdfs/Guideline-Isolation-H.pdf).

Project Firstline. Infection control actions for respiratory viruses. Atlanta, GA: Centers for Disease Control and Prevention; 2023 (https://www.cdc.gov/project-firstline/hcp/infection-control/index.html).

Standard precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/356855).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Infection prevention and control: guidance to action tools. Aide-mémoire: respiratory and hand hygiene. Copenhagen: World Health Organization Regional Office for Europe; 2021 (https://iris.who.int/bitstream/handle/10665/341107/9789289055437-eng.pdf?sequence=3).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/publication/infection-prevention-and-control-education-framework/).

[1] All references were accessed on 25 February 2025.

## 2.5.4 Personal protective equipment

PPE is essential for all HCWs to safeguard themselves and others from exposure to infectious agents. PPE serve as a physical barrier, protecting the eyes, nose, mouth, skin, and clothing from potential contaminants. To maximize its effectiveness, proper use of PPE is critical, including correct donning and appropriate doffing and disposal. Inconsistent application or misuse of PPE significantly compromises its protective capacity, emphasizing the importance of comprehensive training and strict adherence to protocols. By understanding the broader context of PPE within the hierarchy of controls, HCWs can enhance their awareness of how to integrate multiple layers of protection for safer health care practices.

### Learning aims

Upon completion of this module, the learner will be able to identify the appropriate PPE for different situations and apply the correct procedures for donning, removing and safely disposing of PPE to ensure maximum protection for both HCWs and patients.

### Learning outcomes

#### Knowledge

The learner is able to:

1. describe the types of PPE commonly used in health care (for example, gowns, gloves, medical masks/respirators and eye protection);
2. discuss the principles, rationale and indication for the use of various PPE commonly used in health care delivery;
3. describe when a respirator (N95 or equivalent) is required, what is a fit test and seal check and why it must be performed.

#### Skills

The learner is able to:

1. choose the appropriate PPE based on a risk assessment;
2. correctly perform procedures for putting on, removing and disposing of PPE;
3. correctly perform a seal check (fit check) when a fit-tested respirator is used.

#### Attitudes

The learner is able to:

1. communicate the importance of wearing appropriate PPE to protect HCWs, patients and families by using a range of communication tools, according to the targeted population;
2. discuss how to ensure that cultural/religious dress is maintained or adjusted to be able to wear appropriate PPE.

## Recommended tools and resources[1]

How to put on and how to remove personal protective equipment (PPE). Geneva: World Health Organization; 2008 (https://iris.who.int/bitstream/handle/10665/70066/WHO_CDS_EPR_2007.8a_eng.pdf?sequence=1&isAllowed=y).

Standard precautions for all patient care. Atlanta, GA: Centers for Disease Prevention and Control; 2016 (https://www.cdc.gov/infection-control/hcp/basics/standard-precautions.html).

Standard precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/bitstream/handle/10665/356855/WHO-UHL-IHS-IPC-2022.1-eng.pdf?sequence=1&isAllowed=y).

Standard precautions: the role of personal protective equipment (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/coursewares/course-v1:WHOAcademy-Hosted+H0075EN+2025_Q1?source=edX).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

About hierarchy of controls. Atlanta, GA: National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention; 2024 (https://www.cdc.gov/niosh/hierarchy-of-controls/about/index.html).

Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2007. (https://www.cdc.gov/infection-control/hcp/isolation-precautions/?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html).

Infection prevention and control: guidance to action tools. Aide-mémoire: personal protective equipment. Copenhagen: World Health Organization Regional Office for Europe; 2021 (https://iris.who.int/bitstream/handle/10665/341107/9789289055437-eng.pdf?sequence=3&isAllowed=y).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/publication/infection-prevention-and-control-education-framework/).

[1] All references were accessed on 25 February 2025.

## 2.5.5 Environmental cleaning and disinfection

Health care environments host diverse microorganisms, including potential pathogens that may contribute to HAIs. Environmental cleaning and disinfection play a crucial role in preventing the spread of these microorganisms, especially those resistant to antimicrobials. Adhering to standards for routine cleaning and disinfection in patient care areas, as well as terminal cleaning after a patient leaves, is essential to reduce environmental contamination. Blood or body fluid spills need to be cleaned and disinfected immediately according to specific procedures. By understanding these procedures, learners can help to ensure a safer environment for patients and staff.

### Learning aims

Upon completion of this module, learners will be able to explain the guiding principles and appropriate steps for environmental cleaning and disinfection and apply this knowledge to select the appropriate products and procedures to effectively reduce the risk of microbial transmission through environmental cleaning and disinfection.

### Learning outcomes

#### Knowledge

The learner is able to:

1. define key terms related to high-touch surfaces, environmental cleaning and disinfection;
2. explain best practices in environmental cleaning and disinfection to prevent the spread of infections within health care settings;
3. explain the importance of maintaining a visibly clean and uncluttered work environment to facilitate effective cleaning and disinfection;
4. assess and discuss appropriate techniques and practices for cleaning and disinfection, such as working from clean to dirty areas and using the 'one wipe, one direction, one surface' method.

#### Skills

The learner is able to:

1. demonstrate the appropriate steps and principles for cleaning and disinfection;
2. use the correct products for environmental cleaning and the disinfection of surfaces and equipment in the health care environment;
3. select the appropriate PPE for environmental cleaning and disinfection.

#### Attitudes

The learner is able to:

1. communicate clearly to HCWs, patients, and families the importance of maintaining a clean, hygienic and uncluttered environment and what role they can play by using a range of communication tools, according to the targeted population.

## Recommended tools and resources[1]

Best practices for environmental cleaning in global healthcare facilities with limited resources. Atlanta, GA: Centers for Disease Control and Prevention; 2023 (https://www.cdc.gov/healthcare-associated-infections/hcp/cleaning-global/index.html).

Environmental cleaning and infection prevention and control in health care facilities in low- and middle-income countries. Modules and resources. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/366380).

Environmental cleaning and infection prevention and control in health care facilities in low- and middle-income countries. Trainer's guide. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/366379).

Learning to deliver training in IPC and environmental cleaning for health care facilities in low-and-middle-income countries (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/).

Standard precautions: environmental cleaning and disinfection (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/coursewares).

WASHFIT training modules: environment cleaning technical module. Geneva: World Health Organization; United Nations Children's Fund; 2024 (https://www.washinhcf.org/wash-fit-training-modules/).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Infection prevention and control: guidance to action tools. Aide-mémoire: environmental cleaning, waste and linen management. Copenhagen: World Health Organization Regional Office for Europe; 2021 (https://iris.who.int/bitstream/handle/10665/341107/9789289055437-eng.pdf?sequence=3&isAllowed=y).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

[1] All references were accessed on 25 February 2025.

## 2.5.6 Waste management

Safe disposal of health care waste is essential to protect patients, staff and the public. It is important to distinguish between different waste categories and understand the appropriate disposal methods according to local regulations, as well as the effective use of disposal equipment. Training in the safe disposal of all types of health care waste is crucial to prevent contamination and ensure compliance with regulatory standards. Health care waste should be managed through necessary steps ranging from the point of generation to its final disposal in order to ensure both environmental safety and regulatory compliance.

### Learning aims

On completion of this section, learners will be able to explain the key principles and best practices of health care waste management and apply them to ensure its safe handling and disposal.

### Learning outcomes

#### Knowledge

The learner is able to:

1. identify the different categories and sources of waste generated in a health care facility;
2. explain the risks associated with the improper management of health care waste in health care settings;
3. analyse and select the best practices for minimizing, segregating, collecting, transporting and storing health care waste.

#### Skills

The learner is able to:

1. apply waste management practices to prevent HAIs, from waste generation to final disposal;
2. demonstrate the safe disposal of waste into appropriate receptacles and designated waste streams;
3. demonstrate the safe disposal of items contaminated with blood, body fluids, secretions and excretions in compliance with local guidelines.

#### Attitudes

The learner is able to:

1. communicate to HCWs the need to be aware of the sources and types (hazardous versus non-hazardous) of health care waste;
2. discuss with colleagues the importance of safe disposal of waste in health care settings;
3. act to prevent any unsafe disposal of waste and report any such incidents.

## Recommended tools and resources[1]

Health-care waste: key facts. Geneva: World Health Organization; 2024 (https://www.who.int/news-room/fact-sheets/detail/health-care-waste).

Standard precautions: waste management (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/coursewares/course-v1:WHOAcademy-Hosted+H0109EN+2025_Q1?source=edX).

WASHFIT training modules: waste. Geneva: World Health Organization; United Nations Children's Fund; 2024 (https://www.washinhcf.org/wash-fit-training-modules/).

[1] All references were accessed on 25 February 2025.

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Infection prevention and control: guidance to action tools. Aide-mémoire: environmental cleaning, waste and linen management. Copenhagen: World Health Organization Regional Office for Europe; 2021 (https://iris.who.int/bitstream/handle/10665/341107/9789289055437-eng.pdf?sequence=3).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

Safe management of wastes from health-care activities. 2nd edition. Geneva: World Health Organization; 2014 (https://iris.who.int/bitstream/handle/10665/85349/9789241548564_eng.pdf).

Safe management of wastes from health care activities: a summary. Geneva: World Health Organization; 2017 (https://apps.who.int/iris/handle/10665/259491).

Overview of treatment technologies for infectious and sharp waste from health care facilities. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/handle/10665/328146).

[1] All references were accessed on 25 February 2025.

## 2.5.7 Aseptic technique

Aseptic technique refers to the method of handling, preparing and storing medication, injection equipment/supplies (for example, syringes, needles), catheters and other devices that enter body cavities to prevent microbial contamination and infection (9).

In particular, learners should understand the importance of using an aseptic technique for the insertion and maintenance of all invasive devices and aseptic/clean clinical procedures for surgical procedures to prevent infections, such as when changing or removing a wound dressing.

### Learning aims

Upon completion of this section, learners will be able to explain the principles of aseptic technique and apply them to prevent microbial transmission and infection during invasive procedures that are relevant to their clinical role and setting.

### Learning outcomes

#### Knowledge

The learner is able to:

1. define an aseptic technique;
2. review and outline the steps for performing an aseptic technique (for example, needle insertion or drawing blood);
3. provide examples when an aseptic technique is required for preventing HAIs.

#### Skills

The learner is able to:

1. apply an aseptic technique during invasive procedures, device use or wound care (for example, injections, insertion and maintenance of all invasive devices, and change of wound dressings).

#### Attitudes

The learner is able to:

1. communicate with colleagues appropriate practices to ensure a safe aseptic technique;
2. recognize, report and avoid the use of any invasive devices that do not appear to be appropriately cleaned.

### Recommended tools and resources[1]

Infection prevention and control: injection safety. Geneva: World Health Organization; 2025 (https://www.who.int/teams/integrated-health-services/infection-prevention-control/injection-safety).

Standard precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/356855).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2007 (https://www.cdc.gov/infection-control/hcp/isolation-precautions/?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html).

Guidelines for the prevention of bloodstream infections and other infections associated with the use of intravascular catheters. Part 1: peripheral catheters. Geneva: World Health Organization; 2024 (https://iris.who.int/handle/10665/376722).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

Preparing vaccines for administration. Atlanta, GA: Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/vaccines/hcp/admin/prepare-vaccines.html).

[1] All references were accessed on 25 February 2025.

## 2.5.8 Injection safety and needle-stick injury management

Use of safe injection practices is key to preventing infections during health care delivery. This section will cover the causes of unsafe injection practices, proper techniques for administering injections, safe disposal of needles and sharps, and the effective management of needle-stick injuries to protect HCWs and patients.

The content also emphasizes the risks associated with needle-stick injuries, including the potential for infection and the importance of a thorough training in sharps injury prevention to mitigate underreporting and ensure that safety practices are consistently applied.

### Learning aims

Upon completion of this section, learners will be able to discuss the principles of safe injection techniques and needle-stick injury management and apply these principles to the role of HCWs through guided practice and scenario-based exercises to build the necessary skills.

### Learning outcomes

#### Knowledge

The learner is able to:

1. identify factors that contribute to unsafe injection practices and the associated risks of infection;
2. describe the seven steps required for safe injection administration and the underlying principles;
3. explain the functionality and benefits of safety-engineered syringes in preventing needle-stick injuries;
4. discuss potential scenarios in which needle-stick injuries may occur and outline immediate response actions;
5. explain the procedures for exposure management related to hepatitis B, hepatitis C and HIV following a needle-stick injury.

#### Skills

The learner is able to:

1. demonstrate the correct handling, disposal and management of needles, sharps and items contaminated with blood and/or body fluids;
2. utilize safety-engineered devices, as appropriate, to reduce the risk of sharps injuries in the health care setting;
3. follow the procedures for exposure management related to hepatitis B, hepatitis C and HIV following a needle-stick injury.

#### Attitudes

The learner is able to:

1. communicate to colleagues how the prevention of unsafe injection practices can contribute to patient safety;
2. recognize and report any incident regarding blood and/or body fluid exposure through needle-stick injuries, and advise colleagues on the next steps to be followed;
3. support colleagues who may have experienced a blood and body fluid exposure.

## Recommended tools and resources[1]

WHO best practices for injections and related procedures toolkit. Geneva: World Health Organization; 2010 (https://iris.who.int/handle/10665/44298).

Infection prevention and control: injection safety. Geneva: World Health Organization; 2025 (https://www.who.int/teams/integrated-health-services/infection-prevention-control/injection-safety).

Standard precautions: injection safety and needle-stick injury management (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/coursewares/course-v1:WHOAcademy-Hosted+H0113EN+2025_Q1?source=edX).

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## Bibliography[1]

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Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

WHO guideline on the use of safety-engineered syringes for intramuscular, intradermal and subcutaneous injections in health-care settings. Geneva: World Health Organization; 2015 (https://iris.who.int/handle/10665/250144).

[1] All references were accessed on 25 February 2025.

## 2.5.9 Linen management

Infections can be transmitted through improper handling of hospital linen, which may harbour harmful microorganisms. The safe management of soiled linen is important to prevent HAIs. Staff exposure to pathogens often occurs when linen is handled inappropriately, leading to the aerosolization of microorganisms or direct contact without proper PPE. Effective linen management involves safely removing soiled materials, handling and transporting linen with minimal agitation, using appropriate PPE, and ensuring that cleaned linen is stored to prevent contamination. These practices are essential components of environmental cleaning and standard precautions in health care settings.

### Learning aims

Upon completion of this section, learners will be able to explain the principles of infection prevention related to the safe management of linen and apply them to ensure proper handling, transport and storage.

### Learning outcomes

#### Knowledge

The learner is able to:

1. identify how to categorize and segregate linen;
2. describe the process to safely handle, collect, label, store, transport, and wash and dry used and/or soiled linen.

#### Skills

The learner is able to:

1. apply the practices to safely label, store, transport and manage clean and soiled linen.

#### Attitudes

The learner is able to:

1. communicate to colleagues the principles of safely labelling, storing, transporting and managing clean and soiled linen.

### Recommended tools and resources[1]

Healthcare-associated infections. Appendix D – Linen and laundry management. Atlanta, GA: Centers for Disease Control and Prevention; 2023 (https://www.cdc.gov/healthcare-associated-infections/hcp/cleaning-global/appendix-d.html).

Standard precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/356855).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Environmental cleaning in global healthcare settings: best practices for global healthcare facilities with limited resources. Atlanta, GA: Centers for Disease Control and Prevention/Infection Control Africa Network (ICAN); 2023 (https://www.cdc.gov/healthcare-associated-infections/hcp/cleaning-global/?CDC_AAref_Val=https://www.cdc.gov/hai/prevent/resource-limited/index.html).

Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2007. (https://www.cdc.gov/infection-control/hcp/isolation-precautions/?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html).

Infection prevention and control: guidance to action tools. Aide-mémoire: environmental cleaning, waste and linen management. Copenhagen: World Health Organization Regional Office for Europe; 2021 (https://iris.who.int/ handle/10665/341107).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

[1] All references were accessed on 25 February 2025.

## 2.5.10 Management of reusable medical equipment/devices

Effective management of reusable medical equipment is essential for maintaining a safe health care environment and preventing infections caused by contaminated devices. This involves stringent cleaning, disinfection and sterilization practices to ensure that equipment is safe for patient use.

### Learning aims

Upon completion of this section, learners will be able to distinguish between single-use and reusable devices, explain the reprocessing requirements for reusable equipment, and apply essential principles for the cleaning, disinfection, sterilization and proper storage of reusable medical equipment to prevent cross-contamination and limit pathogen transmission.

### Learning outcomes

#### Knowledge

The learner is able to:

1. explain the importance of the cleaning, disinfection, and sterilization of equipment used in health care settings to ensure patient safety;
2. differentiate between single-use and reusable medical devices and describe the protocols for managing each type;
3. describe the classifications of health care equipment (critical, semi-critical, and non-critical), their reprocessing requirements and the rationale for each one;
4. explain the distinctions between cleaning, low- and high-level disinfection and sterilization, including the specific rationale for each process;
5. describe the principles for the proper storage, management and transportation of clean and sterile medical supplies, ensuring separation from contaminated items.

#### Skills

The learner will be able to:

1. identify and appropriately manage single-use versus reusable equipment in a health care setting;
2. perform correct cleaning, low-level disinfection and storage procedures for reusable equipment;
3. manage clean and sterile supplies in alignment with infection prevention standards, as relevant to their role;
4. identify where there has been an incident of the incorrect use of either a single-use or reusable medical device and ensure that it is reported.

#### Attitudes

The learner is able to:

1. discuss with colleagues about the safe management of medical devices to ensure their proper use in patient care;

2. ensure that colleagues are aware of the importance of reporting any incorrect use of medical devices and how to do this.

## Recommended tools and resources[1]

Decontamination and reprocessing of medical devices for health care facilities: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/364587).

Standard precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/356855).

APIC issue brief: Strategies to mitigate cross contamination of non-critical medical devices. Arlington, VA: Association for Professionals in Infection Control and Epidemiology; 2021 (https://apic.org/noncritical-is-critical/).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Decontamination and reprocessing of medical devices for health-care facilities. World Health Organization and Pan American Health Organization, 2016 (https://iris.who.int/handle/10665/250232).

Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2007. (https://www.cdc.gov/infection-control/hcp/isolation-precautions/?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html).

Standard precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/356855).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

[1] All references were accessed on 25 February 2025.

## 2.6 Transmission-based precautions

TBP are additional measures applied alongside standard precautions for patients who are known or suspected to be infected or colonized with pathogens that can spread within health care settings. TBP measures are determined by the transmission route of the microorganism—contact (direct and/or indirect) or through the air (airborne transmission/inhalation or direct deposition). For example, they include a specific uses of patient placement, PPE, dedicated equipment, environmental cleaning and ventilation requirements. In some cases, multiple types of TBP may be required simultaneously to effectively prevent the spread of infection (for example, chickenpox and contact/airborne precautions).

### Learning aims

Upon completion of this section, learners will be able to explain the principles of TBP and apply them effectively by selecting appropriate measures based on the transmission route of specific pathogens to prevent the spread of infections in health care settings.

### Learning outcomes

#### Knowledge

The learner is able to:

1. explain the purpose of TBP as additional measures beyond standard precautions to prevent the spread of specific pathogens;
2. explain the difference between contact, droplet and airborne precautions, based on transmission routes;
3. identify the elements of TBP, including the use of PPE, patient placement, signage, environmental cleaning and patient transport.

#### Skills

The learner is able to:

1. apply appropriate TBP in various clinical scenarios;
2. demonstrate the correct selection and application of PPE based on the required type of TBP;
3. implement patient placement and movement strategies to reduce the risk of pathogen transmission based on TBP.

#### Attitudes

The learner is able to:

1. discuss with colleagues, patients and the public about the importance of TBP and how to apply them effectively;
2. support colleagues in implementing TBP;
3. communicate any risk of transmission appropriately, supporting colleagues involved.

## Recommended tools and resources[1]

Transmission-based precautions for the prevention and control of infections: aide-memoire. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/356853).

Transmission-based precautions (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/coursewares/course-v1:WHOAcademy-Hosted+H0114EN+2025_Q1?source=edX).

[1] All references were accessed on 25 February 2025.

## Bibliography[1]

Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2007. (https://www.cdc.gov/infection-control/hcp/isolation-precautions/?CDC_AAref_Val=https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html).

Infection prevention and control core competencies for health care providers. Updated consensus document. Winnipeg: Infection Prevention and Control (IPAC) Canada; 2022 (https://ipac-canada.org/photos/custom/pdf/IPAC_CoreCompetencies_2022_web.pdf).

Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

[1] All references were accessed on 25 February 2025.

## 2.7 General concepts of antimicrobial resistance prevention

AMR threatens the effective prevention and treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses and fungi. AMR occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines, thus making infections harder to treat and increasing the risk of disease spread, severe illness and death. As a result, the medicines become ineffective and infections persist in the body, increasing the risk of spread to others.

There are several strategies and activities that can be implemented to reduce and prevent the occurrence of AMR. These strategies include IPC measures, such as appropriate hand hygiene and environmental cleaning, triaging and isolating/cohorting patients with infections that are antibiotic-resistant, antimicrobial stewardship, an improved access and use of diagnostics, and conducting surveillance.

### Learning aims

On completion of this section, the learner will be able to explain the concepts and principles of AMR and provide effective care using approaches that reduce and control the spread of AMR.

### Learning outcomes

#### Knowledge

The learner is able to:

1. explain how AMR is defined and develops and its main causes;
2. discuss the impact of resistance on the choice of antimicrobial therapy for treating infections;
3. explain the morbidity, mortality and economic threat of AMR to human health;
4. describe the importance of optimizing the use of antimicrobials in the human and animal sectors to prevent the development of resistance;
5. explain strategies relevant to their role in to prevent AMR, with a particular focus on IPC.

#### Skills

The learner is able to:

1. discuss AMR and appropriate antimicrobial use in a suitable format for the target audience, whether HCWs, patients or the general public;
2. apply IPC interventions to control HAI/AMR.

#### Attitudes

The learner is able to:

1. communicate to colleagues the need to share knowledge of antimicrobial stewardship strategies;
2. promote awareness of AMR and appropriate antimicrobial use among HCWs, patient communities and the general public;

3. act to protect the effectiveness of antimicrobials as an ethical imperative and a public good.

## Recommended tools and resources

Antimicrobial resistance and infection prevention and control (WHO Academy). Geneva: Switzerland; 2025 (https://web-staging.lxp.academy.who.int/coursewares, accessed 25 February 2025).

## Bibliography[1]

Health workers' education and training on antimicrobial resistance: curricula guide. Geneva: World Health Organization; 2019 (https://iris.who.int/handle/10665/329380, License: CC BY-NC-SA 3.0 IGO).

WHO competency framework for health workers' education and training on antimicrobial resistance. Geneva: World Health Organization; 2018 (https://iris.who.int/handle/10665/272766).

[1] All references were accessed on 25 February 2025.

## 2.8 Prevention of infection in health and care workers, including the role of occupational health and safety, vaccinations and post-exposure evaluations and follow-up

Adherence of HCWs to recommended occupational health policies and IPC practices will decrease the risk of getting an infection during the performance of their duties. This includes:

- knowing personal immunization status and recommended vaccinations to protect HCWs and prevent the acquisition of HAIs;
- following standard precautions and transmission-based precautions (including those for protecting themselves, such as an appropriate and correct use of PPE and hand hygiene);
- safe handling of sharps;
- reporting exposures and infections that put themselves and others at risk for transmission.

The effective management of staff exposures (for example, blood and/or body fluid exposure) requires the cooperation of both occupational health and IPC teams. Occupational health policies and procedures should address proof of immunity and required vaccinations, post-exposure follow-up (including blood and body fluid exposures) and prophylaxis when indicated.

### Learning aims

On completion of this section, the learner will be able to explain the importance of occupational health and safety policies and practices and effectively apply them to establish and maintain a safe work environment.

### Learning outcomes

#### Knowledge

The learner is able to:

1. identify the measures necessary to protect the health and safety of HCWs;
2. explain how infections in HCWs might pose a risk to the individuals they support or work with;
3. discuss all vaccinations recommended for HCWs to prevent the transmission of infections in health care settings, including seasonal vaccination, according to institutional and public health requirements;
4. discuss the risks associated with blood and body fluid exposures and how to manage them.

#### Skills

The learner is able to:

1. navigate relevant policies and standard operating procedures to make informed decisions about attending work when experiencing symptoms of an infectious condition;

2. apply IPC practices to minimize the risk for exposure to infectious agents;
3. demonstrate safe management of reusable items contaminated with blood and body fluids;
4. follow local protocols for blood and body fluid exposures;
5. maintain a history of personal vaccination records to ensure that all vaccines are up to date.

### Attitudes

The learner will be able to:

1. communicate to colleagues the need for appropriate vaccinations for their practice;
2. discuss without judgement any cultural or religious reasons for not wanting to have a vaccination;
3. support colleagues with post-exposure follow-up, as needed.

## Recommended tools and resources[1]

WHO best practices for injections and related procedures toolkit. Geneva: World Health Organization; 2010 (https://iris.who.int/handle/10665/44298).

Immunization in practice: a practical guide for health staff. Geneva: World Health Organization; 2015 (https://www.who.int/publications/i/item/immunization-in-practice-a-practical-guide-for-health-staff).

Infection prevention and control: injection safety. Geneva: World Health Organization (https://www.who.int/teams/integrated-health-services/infection-prevention-control/injection-safety).

Standard precautions: injection safety and needlestick injury management (WHO Academy). Geneva: World Health Organization; 2025 (https://web-staging.lxp.academy.who.int/coursewares/course-v1:WHOAcademy-Hosted+H0113EN+2025_Q1?source=edX).

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Occupational safety and health in public health emergencies: a manual for protecting health workers and responders. Geneva: World Health Organization & International Labour Organization; 2018 (https://iris.who.int/handle/10665/275385).

Occupational infections. Geneva: World Health Organization; 2025 (https://www.who.int/tools/occupational-hazards-in-health-sector/occupational-infections).

Advisory Committee on Immunization Practices; Centers for Disease Control and Prevention (CDC). Immunization of health-care personnel: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep. 2011;60 (RR-7):1-45 (www.cdc.gov/mmwr/pdf/rr/rr6007.pdf).

Kuhar DT, Henderson DK, Struble KA, Heneine W, Thomas Vasavi Cheever L et al. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HIV and recommendations for postexposure prophylaxis. Atlanta, GA: Division of Healthcare Quality Promotion, National Center for Emerging and Zoonotic Infectious Diseases. Centers for Disease Control and Prevention; Update, 23 May

2018 (http://stacks.cdc.gov/view/cdc/20711).

U.S. Public Health Service. Updated U.S. Public Health Service Guidelines for the Management of Occupational Exposures to HBV, HCV, and HIV and Recommendations for Postexposure Prophylaxis. MMWR Recomm Rep. 2001;50(RR-11):1-52 (www.cdc.gov/mmwr/PDF/rr/rr5011.pdf).

Schillie S, Murphy TV, Sawyer M, Ly K, Hughes E, Jiles R et al. CDC guidance for evaluating health-care personnel for hepatitis B virus protection and for administering postexposure management. MMWR Recomm Rep. 2013;62(RR-10):1-19 (www.cdc.gov/mmwr/PDF/rr/rr6210.pdf).

[1] All references were accessed on 25 February 2025.

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Infection prevention and control education framework. NHS England, 7 March 2023 (https://www.england.nhs.uk/long-read/infection-prevention-and-control-education-framework/).

WHO guideline on the use of safety-engineered syringes for intramuscular, intradermal and subcutaneous injections in health-care settings. Geneva: World Health Organization; 2015 (https://iris.who.int/handle/10665/250144).

[1] All references were accessed on 25 February 2025.

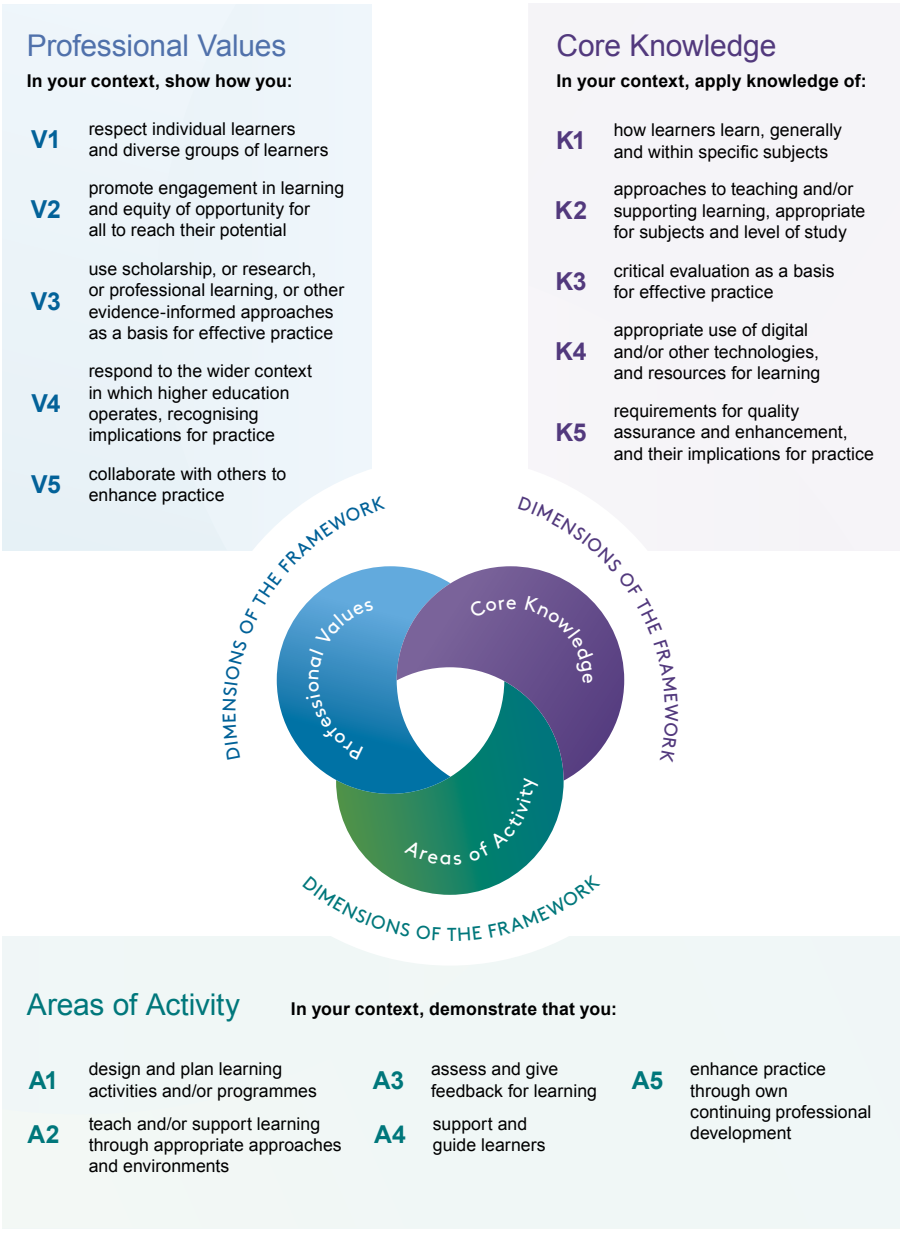
# 3.

# Developing teaching competence

# 3. Developing teaching competence

Those who provide education for others come from a range of backgrounds and not all have experience and training prior to teaching and so learn whilst in their role. It is useful to use a framework that provides an overview of the key aspects of practice that educators should be familiar with to promote high-quality teaching. There are a range of frameworks available, but one that is increasingly recognized globally to support learning and teaching in higher and professional education is the Professional Standards Framework (PSF) for teaching and supporting learning in higher education published in 2023 by Advance HE. This framework provides three dimensions that are the focus of teaching practice and focus on professional values, core knowledge and areas of activity (Fig. 3.1).

**Fig. 3.1. Advance HE Professional Standards Framework (PSF 2023)**




*Source:* Advance HE *(10)*.

Using a framework, such as the above-mentioned PSF, indicates the areas of activity that educators need to consider when designing and delivering teaching. This curriculum guide provides references to the design and content of pre-service education and training. Section 4 ('teaching strategies') links to the A2 and A4 areas of activity of the PSF and section 5 ('assessment methods') links to the PSF A3 area of activity. The professional values and core knowledge link to these areas of activity and underpin the PSF framework.

There are a range of approaches to developing teaching competence. This can include undertaking formal programmes of learning, teaching with more experienced colleagues, engaging in professional development opportunities (A5) and peer observation of teaching (K3).

Formal programmes to develop teaching skills provide units or modules of learning or qualifications and many institutions offer such teaching programmes.

Working with more experienced colleagues and learning their approaches to teaching through being mentored is another effective approach to gaining these skills.

There are a range of workshops and conferences offered online and in-person where specific teaching strategies and tools can be learnt and enhanced.

Peer observation of teaching enables two colleagues to engage in sharing practices. One colleague is observed by another and is given feedback after the teaching event, but the observer also reflects on their own practice (Cambridge Assessment International Education).

## Bibliography[1]

The Professional Standards Framework for teaching and supporting learning in higher education. York, UK: Advance HE; 2023 (https://advance-he.ac.uk/knowledge-hub/professional-standards-framework-teaching-and-supporting-learning-higher-education-0).

Getting started with peer observation. Cambridge, UK: Cambridge Assessment International Education (https://www.cambridge-community.org.uk/professional-development/gswpo/index.html).

[1] All references were accessed on 25 February 2025.

# 4.

# Teaching strategies

# 4. Teaching strategies

Each of the previous sections outline learning outcomes for learners that focus on the competence development of knowledge, skills and attitudes. Competence-based learning is focused on learners mastering these learning outcomes through active and experiential learning using specific activities and scenarios. Additionally, independent learning allows learners to engage with the material at times that suit their needs *(11)*.

Learners thrive when a variety of teaching and learning strategies are employed, including a blended learning format. They can engage in-person and/or through live online sessions, actively engaging with others at the same time, which is known as 'synchronous' learning. Additionally, there are independent study options, known as asynchronous learning, where learners can study at times that suit their needs, thus offering flexibility. Regardless of the approach used, it is crucial to embed assessment of learning within the teaching process. This involves using formative assessment activities and providing feedback, together with instructions enabling learners to assess their own progress.

The following principles should underpin the teaching strategies used.

**Inclusivity –** it is important that the teaching and learning strategies used support all, with the aim to engage and enable learning in a manner that most suits the individuals. This does mean using the full range of teaching strategies and resources that are available.

**Accessibility** – it is important that training and education is made available and accessible to all learners, including using a range of formats that can be used in a range of environments.

**Authenticity –** where possible, the teaching and learning strategies used should reflect the 'real-world' practice of those engaged in learning, taking into account their role and context.

**Collaboration –** where appropriate, approaches that support group work and collaboration should be used so that learners can share experiences and learn from each other, encounter new perspectives on problems, and practice working with new people and in teams.

**Engagement –** the approaches used should engage participants actively in learning and reflecting on their practice.

**Evidence-based –** the curriculum should provide the evidence to underpin the knowledge and skills needed by participants and give them the confidence to disseminate their learning with a variety of audiences, including colleagues, patients and the wider public.

**Constructive alignment –** the curriculum ensures that the teaching and learning strategies link to the assessment strategies and align with the learning outcomes.

The remainder of this section provides an overview of possible teaching strategies and formative assessment strategies that will support assessment for learning. Additional explanations for each strategy are included, with examples linking back to previous sections. It is important to remember that during in-person or live online teaching sessions, learners' attention can wane. Therefore, varying the activities helps maintain their engagement and focus. For independent learning activities, clear instructions are crucial as learners will be working on their own and cannot seek immediate clarification.

**Lectures** are useful for providing large amounts of information to a whole group, but they should

be limited to no more than 15 minutes at a time to ensure students can focus and the information is chunked together *(12)* . Integrating active learning at intervals helps keep participants engaged. These activities could include quizzes, polls and question-and-answer sessions to enable learners to reflect on their learning and assess their knowledge as they progress, depending on the mode of delivery.

Lectures can be delivered in person, online synchronously, or recorded for independent study.

This strategy is appropriate for delivering knowledge content that learners need to build on to develop further knowledge, skills and attitudes. For example, specific content about HAIs and the chain of transmission.

The advantage of synchronous delivery is that all learners are engaged simultaneously and can ask questions and clarifications in real-time. The challenge is that it requires all learners to be available at the same time. Independent learning offers flexibility, allowing learners to engage at their own pace and at times that suit them, but it lacks opportunities for immediate questions and clarifications. Therefore, providing appropriate scaffolding and guidance is important for this approach.

Resources will vary between synchronous and asynchronous delivery, but will typically include lecture materials (usually PowerPoint), use of technology if online (for example, Teams or Zoom), preparation of videos and setting up quizzes and polls.

**Flipped classroom** is a useful strategy for preparing learners to come to synchronous sessions ready to discuss knowledge and apply it to case studies, such as a patient admitted with an infection and how to reduce its spread to others. This approach requires preparing material and evidence for the learners to review before the synchronous session and providing guidance. Materials in various formats, such as videos, websites and articles, may be needed to support diverse learning needs, which can be time-consuming. Assessment of learning will then take place through the application of this knowledge to the case study.

**Whole class and small group discussions** are useful for brainstorming points, concepts and ideas. They enable the entire group to share information and learn from each other's experiences or debate different points of view. In synchronous teaching, students can work in pairs and small groups and then share with the whole class. Online, break-out rooms can be used. Group size should be considered to ensure all participants can engage actively. In asynchronous settings, discussion forums can be set up, but these are often less engaged with, thus alternative methods for sharing information may be needed. A careful preparation of discussion topics is essential.  For example, learners might be asked to consider the chain of transmission and which aspects of this they feel are easier to break or interrupt. These discussions help knowledge and identify any limitations in knowledge.

**Problem-based learning** uses group work to focus on real-world examples of issues that learners might encounter in their context and emphasize teamwork to develop possible solutions. This can be synchronous or asynchronous, but clear guidance on the purpose and expected output is necessary, such as a presentation or report. This approach is useful for patient case studies that include signs and symptoms and microbiology reports, requiring groups to interpret data and suggest a diagnosis and treatment/care plan.

**Presentations** as an individual or group provide an opportunity to summarize learning and present key points from viewed learning materials and sharing of experiences. These can be synchronous or asynchronous, but a clear brief on the purpose of the presentation, focus and length is important.

Feedback for each group is essential to highlight strengths and areas for improvement. Presentations can be useful for discussing the team's collective role in preventing infection in their context.

**Work-based learning** enables skills to be practised with safe supervision and feedback. It provides an opportunity to reflect on knowledge and its application to practices. Individuals can use the practice to reflect upon their skill development and also gain feedback from peers. This strategy is typically focused on in-person activities, usually with a patient, but simulated practice may also be used. It is appropriate when teaching and/or assessing specific skills such as hand hygiene, using PPE, or different approaches to communication with colleagues, patients and the public.

**Peer learning and teaching** is often referred to as collaborative learning. This enables students to work in small groups to learn and teach each other discussing any misunderstandings together. This is a helpful approach in learning as it also mirrors how colleagues work together in the real-world.

**Gamification** can be undertaken individually or in teams, with teams often coming together to use their shared knowledge to tackle a problem or review an existing practice to enhance it through collective experiences. It also provides an element of motivation. This strategy usually works well in synchronous sessions and may involve team exercises or role play. It can be useful for exploring the prevention of infection in HCWs, focusing on team communication and decision-making about individual roles.

The content of this curricula guide may delivered as a stand-alone unit or module, or as an integrated component of another programme. Therefore, the strategies used should be compatible with the learning philosophy of the programme.

### Recommended tools and resources[1]

Getting started with active learning techniques. Centre for Teaching Innovation, Cornell University, Ithaca, NY; 2025 (https://teaching.cornell.edu/getting-started-active-learning-techniques).

12 active learning strategies in the classroom. Promethean World, Seattle, WA; 2021 (https://www.prometheanworld.com/gb/resource-centre/blogs/12-active-learning-strategies-in-the-classroom/).

15 active learning strategies. Skillshub, Coventry, UK; 2023 (https://www.skillshub.com/blog/active-learning-strategies-examples/).

[1] All references were accessed on 25 February 2025.

## Bibliography

Cambridge Assessment International Education b – Assessment for Learning https://www.cambridgeinternational.org/Images/271179-assessment-for-learning.pdf (accessed 25 February 2025).

Collaborative learning Centre for Teaching Innovation – Cornell University https://teaching.cornell.edu/teaching-resources/active-collaborative-learning/collaborative-learning#:~:text=Collaborative%20learning%20can%20occur%20peer,addressing%20misunderstandings%20and%20clarifying%20misconceptions (accessed 22 April 2025).

# 5.

# Assessment methods

# 5. Assessment methods

As discussed in the previous chapter, in addition to providing education and training, it is crucial to incorporate assessment for learning to support learners' progress. This ensures that all HCWs develop the necessary knowledge, skills and attitudes to meet the learning outcomes. Formative assessment plays a key role in this process and should be integrated throughout curriculum delivery. It offers opportunities to assess learning, identify areas where further learning is needed, and gain feedback.

Formative assessments enhance learning by providing ongoing feedback to the learner and tutor to target additional learning needs. They motivate the students and provide indications of progress during a programme. Summative assessments can be used for a pass or fail decision, but also to grade or rank learners in relation to each other (for example, selection for a competitive activity or role). The purpose of the assessment, and how the assessment information will be used, influences the selection of assessment formats, and the effort required to ensure that the assessment decisions are defensible. The previous chapter on teaching strategies provides suggestions for formative assessment tools. The principles of inclusivity, accessibility, authenticity, collaboration, engaging, evidence- based and constructive alignment also apply to the assessment of learning tools used.

**Inclusivity and accessibility** in assessment - ensuring that instructions to are clear and can be followed by all. There may also be occasions where an alternative mode of assessment needs to be considered, for example, for a short answer examination questions can be asked in a "mini viva".

**Authenticity** – assessments need to be as closely related as possible to the real-world tasks that learners engage in; so for example skills being assessed either through simulation or with patients.

**Collaboration** – some activities require teamwork and thus, some assessment tasks may require group work.

**Engaging** – the assessment method used should be interesting and relevant to the learner to make it more meaningful to them.

**Evidence-Based** – where appropriate, assessments should require students to provide the evidence underpinning their actions, for example, policies or literature referenced.

It is essential to assess learning upon completion of the training to ensure that knowledge, skills and attitudes have been enhanced. Each section of the curriculum includes learning outcomes related to knowledge, skills, and attitudes, which can then be used to evaluate their achievement. Summative assessment involves making a final judgement about the learning achieved. Below are some assessment tools to consider for summatively assessing learning upon completion of sections.

## 5.1 Knowledge assessment

There are various methods and tools available to assess knowledge, depending on the focus of the assessment.

To assess the **breadth of knowledge,** such as the range of preventative measures, patient risk factors or the consequences of infection, the following methods and tools can be used:

- quizzes, multiple-choice questions and short answer examination questions: these provide limited information, but support recall of knowledge;
- written reports or verbal presentations: these allow for a broader assessment of knowledge and can include some links to relevant literature.

To assess the **depth of knowledge** gained on a specific topic by the learner and supported by the use of the published literature and research as an evidence base (for example, the chain of transmission or a specific practical activity such as hand hygiene), the following tools and methods can be used:

- long answer examination questions or essays;
- a critique of one or two articles;
- individual or group presentations.

To assess the **application of knowledge to practice,** such as a patient's signs and symptoms, laboratory test results, diagnosis and care, or when discussing specific aspects of risk and outlining preventative measures, the following tools can be used:

- case study examination questions and/or case study essays: provide some information about a patient, which allows the learner to apply their knowledge of clinical protocols or policies to prevent infection;
- individual or group presentations focused on case studies.

While there is a range of assessment methods and tools available, it is important to ensure that they test the intended learning outcomes. These methods and tools are effective when used correctly, but also take time to develop. A clear assessment brief is needed for the learner to understand what is required of them. Additionally, clear assessment criteria or a marking rubric should be provided for accurate evaluation.

## 5.2 Skills and attitudes

There are two main approaches to evaluating skills and attitudes, which can be assessed in practice or through simulation. Whilst here the focus may be on skills and attitudes the underpinning knowledge referred to above is important as well. It is the knowledge of the context and the rationale for specific skills and attitudes that support the demonstration of these.

Certain skills need to be practised multiple times to develop competence. The skills required for this curriculum include patient-focused skills, the use of equipment, and adherence to policies and processes.

Assessing skills and the use of equipment can be conducted through simulation in a practice or educational setting, without any patient contact. The focus is on the correct use of equipment and its disposal when necessary (for example, PPE). Various skills can be assessed within the same activity or using different stations in a simulated environment.

Simulation can be undertaken in clinical settings for simpler skills like hand hygiene, while more complex skills can be practised using high-fidelity simulation techniques in controlled environments. For example, advanced simulation scenarios can be designed to train students in managing infection

outbreaks in health care settings or using a case study in which students practise aseptic techniques for central line insertion and catheter care.

Simulations allow skills to be practised safely without risking patient safety. However, it is essential to carefully plan ahead and prepare simulation sessions. A limitation is the need for specific settings and specialized equipment, which can have resource implications, including the need for a dedicated space and funding for the equipment required.

The second approach is patient focused, where the skills being assessed actually involve patient contact. These skills can be evaluated either through simulation or actual patient interaction. If using direct patient contact, you can assess real-world practice and workbooks can be useful for participants to reflect on their skills. The advantages of this approach include the opportunity to apply knowledge in a real-world setting. However, limitations may arise if HCWs feel less confident about these skills. Additionally, there are resource implications, such as the need for an experienced practitioner to observe the skills and provide feedback.

Attitudes are assessed usually through observation of interactions with patients, colleagues and the public. These can also be assessed through the tools discussed above.

The selection of the most appropriate assessment formats for the learning outcome should reflect the following aspects: who (both learner and assessor)?; what (learning outcome, content)?; where (workplace-based, simulation, self-paced, examination hall)?; when (stage in the programme)?; why (purpose: formative or summative)?; and how (what format, standard or guideline for a decision)?

Factors involved in selecting the choice of assessment instruments include the validity (does the assessment measure what it is intended to measure?), reliability (is the assessment reproducible and consistent?), educational impact (does the assessment enhance learning and drive desirable behaviors?), cost–effectiveness (does the assessment provide value for its cost in terms of resources and time?) and feasibility (can the assessment be practically implemented given available resources and constraints?). In Table 5.1, utility considerations are depicted in relation to assessment formats to assess the different types of learning outcome.

**Table 5.1. Assessment formats and their relevance to learning objectives and programme outcomes**

| | | Utility considerations | | | Learning objectives | | | Programme outcomes | |
|---|---|---|---|---|---|---|---|---|---|
| **Stage in Miller's pyramid** *(84)* | **Example assessment formats** | **Reliability** | **Cost–effectiveness, feasibility** | **Validity, impact** | **Knowledge** | **Skills** | **Attitude** | **Behaviour** | **Practice activities** |
| Does | • Case-based discussion<br>• Checklists<br>• Direct observation of procedural skills<br>• Mini-clinical evaluation exercise<br>• Multi-source feedback<br>• Patient record review<br>• Portfolio | Subjective | Close supervision, unpredictable | Authentic, positive impact on learning, narrow breadth | (√) | (√) | (√) | √ | √ |
| Shows how | • Observed structured clinical examination<br>• Objective structured long examination record<br>• Oral case presentation<br>• Skills laboratory<br>• Simulation exercises<br>• Standardized patient encounter<br>• Virtual reality case management | | Resource intensive to run (controlled situations, predictable) | | (√) | √ | (√) | (√) | (√) |
| Knows how | • Chart-stimulated recall<br>• Development of individual learning plan<br>• Essay<br>• Oral questioning with longer answers<br>• Clinical problem solving | | | | √ | (√) | (√) | | |
| Knows | • Constructed response questions<br>• Multiple choice questions<br>• Short answer questions | Objective | Resource intensive to develop, predictable | Inauthentic, wide breadth | √ | | | | |

*Note:* (√) inferred, √ explicit.

*Source:* WHO *(13)*.

## 5.3 Evaluation of the education and training programme

Evaluation of the IPC pre-service education programme is aimed at enhancing the effectiveness and impact of the module/programme through an assessment of the teaching strategies/methods and learning resources.

**Purposes of evaluation:**

- to assess the delivery and content of the education/training programme including the knowledge and approach of the facilitator;
- to assess training effectiveness (learn about the strengths and weaknesses of the course design);
- to improve patient outcomes (learn about the long-term impact and effectiveness of IPC education and training).

The purpose of this evaluation is to assess the long-term impact of IPC education and training on pre-service health science students. Ultimately, the evaluation aims to understand how the training supports foundational knowledge and skills development in order to prepare students for future roles in health care. It also seeks to identify strengths and areas for improvement in the module design to enhance its effectiveness in fostering IPC competency, thereby contributing to the prevention of HAIs and AMR.

The Kirkpatrick Model is a globally recognized framework for assessing the effectiveness of training programmes and can be used to evaluate either formal or informal learning and can be used with any style of training. This model allows comprehensive evaluation of the education curriculum at four levels.

- **Reaction (level 1).** Immediate results by assessing learners' immediate reactions to the course and capturing learners' satisfaction and engagement. This phase involves surveys and feedback forms filled out by learners' post-training.
- **Learning (level 2).** Evaluating the extent to which learners have acquired the intended knowledge, skills and behaviours from the course. This is measured through pre- and post-tests, quizzes and practical assessments.
- **Behaviour (level 3)**. Behavioural changes, that is, observing the transfer of learned skills to the workplace, identifying changes in participants' attitudes and practices in their clinical professional settings. This involves follow-up surveys, interviews and direct observations over a period after course completion.
- **Results (level 4).** Positive change at organizational level resulting at least partly from IPC training. Examining the broader impact of the training on institutional practices and policies within participants' organizations. This level seeks to measure and capture significant changes attributed to the training, such as the impact of training on reducing HAIs and AMR, ultimately improving patient safety and outcomes.

The evaluation ensures a holistic understanding of the curriculum's effectiveness and areas for improvement, facilitating evidence-based decisions for future programme enhancements.

### Recommended tools and resources[1]

Writing and engaging students with assessment briefs, criteria and rubrics. Coventry Domains Academic Development toolkit series. Coventry: Coventry University; 2025 (https://acdev.orgdev.coventry.domains/application/files/8515/4117/4694/Assess_Brief_Criteria_Rubrics.pdf).

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The Kirkpatrick model. Kirkpatrick Partners; 2024 (https://www.kirkpatrickpartners.com/the-kirkpatrick-model/).

Pugh S. A compendium of assessment techniques in higher education: from students' perspectives. Leeds: Leeds Institute for Teaching Excellence; 2025 (https://teachingexcellence.leeds.ac.uk/wp-content/uploads/sites/89/2018/10/PUGHcompendiumcomplete.pdf).

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4. Tomczyk S, Twyman A, de Kraker MEA, Coutinho Rehse AP, Tartari E, Toledo JP et al. The first WHO global survey on infection prevention and control in health-care facilities. Lancet Infect Dis 2022; 22: 845-56.
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12. Bligh DA. What's the use of lectures? San Francisco, CA: Jossey Bass: 2000. ISBN 10 0787951625.
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[1] All references were accessed on 25 February 2025.

# Annexes

# Annex 1.
# Estimated duration of training for competencies

| # | Topic | Time |
|---|---|---|
| 1 | General concepts of microbiology | 120 min |
| 2 | The problem of health care-associated infection and antimicrobial resistance | 120 min |
| 3 | Chain of transmission | 15 min |
| 4 | What is infection prevention and control and why it matters | 60 min |
| 5 | General concepts of standard precautions:<br>Risk assessment<br>Hand hygiene<br>Respiratory etiquette<br>Personal protective equipment<br>Environmental cleaning<br>Waste management<br>Management of reusable medical equipment/devices<br>Linen management<br>Prevention of needle-stick injury<br>Aseptic technique | <br>30 min<br>60 min<br>15 min<br>60 min<br>30 min<br>30 min<br>60 min<br>30 min<br>60 min<br>30 min |
| 6 | Transmission-based precautions | 120 min |
| 7 | Prevention of infection in health and care workers, including the role of occupational health, vaccinations and post-exposure evaluations and follow-up | 45 min |
| **TOTAL** | | **8.45 academic hours** |

# Annex 2.
# Additional relevant curricula for pre-service health care education programmes[1]

Infection prevention and control curriculum framework. Australian Council of Deans of Health Sciences, & Australian Allied Health Leadership Forum. (2021). ACDHS. https://acdhs.edu.au/wp-content/uploads/2021/09/Infection-Prevention-Control-Curriculum-Framework-2021-FINAL-1.pdf.

Curriculum Standards and Guidelines for Certificate, Undergraduate, and Graduate Programs in Infection Prevention and Control. Arlington, VA: Association for Professionals in Infection Control and Epidemiology (APIC); 2024 (https://apic.org/ip-academic-pathway/).

Global competency and outcomes framework for universal health coverage. Geneva: World Health Organization; 2022 (https://iris.who.int/bitstream/handle/10665/352711/9789240034662-eng.pdf).

Health workers' education and training on antimicrobial resistance: curricula guide. Geneva: World Health Organization; 2019 (https://iris.who.int/handle/10665/329380). Licence: CC BY-NC-SA 3.0 IGO).

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Patient safety curriculum guide: multi-professional edition. Geneva: World Health Organization; WHO Patient Safety; 2011 (https://iris.who.int/handle/10665/44641).

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# Annex 3. Professional Societies delivering IPC education and training courses[1]

Association for Professionals in Infection Control and Epidemiology (APIC); https://apic.org/education-and-events/overview/

Asia Pacific Society of Infection Control (APSIC); https://apsic-apac.org/

Centers for Disease Control and Prevention (CDC); https://www.cdc.gov/infection-control/hcp/training/strive.html; https://www.cdc.gov/project-firstline/index.html

Australasian College for Infection Prevention and Control (ACIPC); https://www.acipc.org.au/

European Society of Clinical Microbiology and Infectious Diseases (ESCMID), The European Committee on Infection Prevention and Control (EUCIC); https://www.escmid.org/science-research/eucic/

The International Federation of Infection Control (IFIC); https://theific.org/

Infection Prevention and Control Canada (IPAC); https://ipac-canada.org/

Infection Control Africa Network (ICAN); https://icanetwork.co.za/training/

Infection Prevention Society (IPS); https://www.ips.uk.net/education-and-events

The Society for Healthcare Epidemiology of America (SHEA); https://shea-online.org/education-training/

[1] All references were accessed on 25 February 2025.

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