CORE COMPETENCIES FOR INFECTION PREVENTION AND CONTROL PROFESSIONALS

World Health Organization

Core competencies for infection prevention and control professionals

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Abbreviations and acronyms

AMR	antimicrobial resistance
APIC	Association for Professionals in Infection Control and Epidemiology
ARHAI	antimicrobial resistance and health care-associated infections
ECDC	European Centre for Disease Prevention and Control
GIPCN	Global Infection Prevention and Control Network
HAI	health care-associated infection
HAP	health care-associated pneumonia
HW	health worker
ICAN	Infection Control Africa Network
IPAC	Infection Prevention and Control (Canada)
IPC	infection prevention and control
IPCAF	infection prevention and control assessment framework
IPCP	infection prevention and control professional
IPSE	Improving Patient Safety in Europe (project)
MDRO	multidrug-resistant organisms
SOP	standard operating procedures
VAP	ventilator-associated pneumonia
WASH	water, sanitation and hygiene
WHO	World Health Organization

Glossary of key terms and definitions

Competency: **Proven ability** to use knowledge, skills and personal, social and/or methodological abilities in work or study situations and in professional and personal development – in other words, what a professional should be able to do.
Source: Core competencies for infection control and hospital hygiene professionals in the European Union. Stockholm: European Centre for Disease Prevention and Control; 2013 (https://www.ecdc.europa.eu/en/publications-data/core-competencies-infection-control-and-hospital-hygiene-professionals-european, accessed 24 April 2020).

Core competencies: Refer to the **knowledge, skills and attitudes** required for an infection prevention and control (IPC) professional to practice with an in-depth understanding of situations, using reasoning, critical thinking, reflection and analysis to inform assessment and decision-making in the prevention and control of health care-associated infection and antimicrobial resistance.

Health worker: all people primarily engaged in actions with the primary intent of enhancing health. Examples are: Nursing and midwifery professionals, doctors, cleaners, other staff who work in health facilities, social workers, and community health workers, etc.
Source: The World Health Report 2006 - working together for health. Geneva: World Health Organization; 2006 (https://www.who.int/whr/2006/en/, accessed 10 September 2020).

Infection prevention and control professional (IPCP): 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**.
Source: adapted from 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://www.who.int/gpsc/ipc-components-guidelines/en/, accessed 10 September 2020); and 2) Minimum requirements for infection prevention and control programmes Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/core-components/en/, accessed 10 September 2020).

Infection prevention and control professional I (IPCP I - junior): IPC professional with **up to 3 years** of IPC practical experience.

Infection prevention and control professional II (IPCP II - senior): IPC professional with **more than 3 years** of IPC practical experience and more senior roles and responsibilities.

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.
Source: Minimum requirements for infection prevention and control programmes Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/core-components/en/, accessed 10 September 2020).

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

Source: adapted from 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://www.who.int/gpsc/ipc-components-guidelines/en/, accessed 10 September 2020); and 2) Minimum requirements for infection prevention and control programmes Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/core-components/en/ accessed 10 September 2020).

Point of care: The place where three elements come together: the patient, the health care worker, and the care or treatment involving contact with the patient.
Source: 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://www.who.int/gpsc/ipc-components-guidelines/en/, accessed 10 September 2020).

Skills: An ability and capacity acquired through deliberate, systematic, and sustained effort to smoothly and adaptively carryout complex activities or job functions involving ideas (cognitive skills), things (technical skills), and/or people (interpersonal skills).
Source: http://www.businessdictionary.com/definition/skill.html, accessed 10 September 2020.

1 Part 1. Introduction

Preventing harm to patients, health workers (HWs) and visitors due to health care-associated infections (HAIs) is fundamental to achieve safe quality care and reduce antimicrobial resistance (AMR) *(1-5)*. Similarly, preventing and reducing the transmission of infectious diseases that may pose global threats, such as pandemic influenza or influenza-like infection, coronaviruses, Ebola virus disease and other emerging epidemic-prone pathogens, is paramount. Supported by many stakeholders in the field of infection prevention and control (IPC), the World Health Organization (WHO) has issued recommendations and specifications for effective IPC programmes, identified as core components of IPC programmes *(1)* and the approach for their implementation is presented in associated manuals for both the national and facility levels *(6, 7)*.

IPC is a practical, evidence-based approach that prevents patients and HWs from being harmed by avoidable and preventable infections.

Preventing HAIs and AMR avoids this unnecessary harm and, at times, even death, and saves money *(8-10)*.

No country or health system, even the most developed or sophisticated, can claim to be free of HAIs. Preventing HAIs has never been more important.

WHO identified eight core components (for the facility level, six of which for the national level) that are necessary to be established in countries to ensure effective IPC programmes *(1)*. In the context of these core components, WHO also identified minimum requirements *(2)*.

Core component one constitutes the foundation for all other components, that is, the need to have functional IPC programmes both at the national and facility level to prevent HAI, promote patient safety, and combat AMR *(1, 2, 6, 7)*.

The IPC programme should be led by a trained, dedicated IPC focal point who ideally leads a trained and multidisciplinary team, and reports to the highest level in the health care organization. Availability of the proposed level of expertise and reporting hierarchy is to ensure the proper support to implement and execute an IPC programme that will not only monitor and mitigate the ongoing risk of HAIs and AMR but will be able to protect HWs and the organization at the time of a large-scale outbreak or even a pandemic. The IPC programme should also be linked closely with the national, sub-national and facility structures for quality to ensure that IPC is adequately considered throughout the quality planning, assurance and improvement interventions implemented by the country.

IPC capacity and expertise at the country level depends on the level of implementation of IPC core component three (IPC education and training). According to WHO recommendations, each country should have a national IPC curriculum and training programme developed in collaboration with academic institutions and aligned with national guidelines.

A policy to support implementation and monitoring of the training programme should be in place, with the requirement that at least all frontline HWs and cleaning staff should have basic IPC training *(2)*. A system assessing the programme effectiveness should also be in place. In addition, IPC training should be provided to administrative and managerial staff, and auxiliary service personnel. Training programmes should include pre- and postgraduate training, new employee orientation, in-service training, as well as continuous educational opportunities. Ideally, IPC training should be mandatory. Based on the understanding that capacities and resources for implementation vary widely from one country to another, a stepwise approach is recommended to achieve this core component, according to the WHO minimum requirements for IPC *(2)*.

Core component three also recommends that there should be support at national level for IPC professionals to receive education and training to achieve an expert level of knowledge covering all areas relevant to IPC *(1, 2, 6, 7)*. In the curricula development process, it is advisable to refer to international curricula and networks endorsed by local academic institutions and investigate the process for establishing IPC certificates, diplomas and postgraduate degrees (or their equivalent) and discuss how the various possible scenarios related to IPC specialization can be reflected in future career paths.

It is essential that all persons responsible for and working in the IPC programme at the national, sub-national and facility level be competent. This includes knowledge, skills and attitudes to be able to practice safely and ethically as an IPC professional.

This group of professionals should be trained to achieve a high level of knowledge covering all areas relevant to IPC, including patient and HW safety and quality improvement.

To maintain high-level expertise, it is important that all IPC professionals pursue continuing education to achieve a higher level of knowledge, develop new skills and keep up-to-date with current IPC practices.

In addition, IPC professionals should reengage with techniques and theories previously learned to ensure that they stay fresh in the mind. This will give the opportunity for IPC professionals to regularly update their competencies.

Currently, education and training packages on relevant IPC topics, including general resources, hand hygiene, assessment tools, etc., are available on the WHO website *(11)*. IPC professionals can access and use these in the interim to gain knowledge and skills.

Furthermore, IPC focal points and teams have the responsibility for the development and implementation of IPC training curricula and/or programmes, while integrating them at the same time with other complementary domains, such as water, sanitation and hygiene (WASH) or quality improvement. Therefore, it is critical that these professionals have the necessary expertise and experience to undertake this critical role, among other responsibilities.

With reference to the focus of this document, that is, the specific expertise and competencies of IPC professionals, both the minimum requirements and, progressively, the full requirements of core components one (Table 1) and three (Table 2) should be achieved at the country and facility levels *(1, 2)*.

TABLE 1. Minimum and full requirements for implementation of IPC core component one

CORE COMPONENT 1: IPC PROGRAMMES

WHAT (*minimum requirements*)

NATIONAL LEVEL

A functional IPC programme should be in place, including at least:

- one full-time focal point trained in IPC;
- a dedicated budget for implementing IPC strategies/plans.

FACILITY LEVEL

PRIMARY CARE

IPC-trained link person and health care officer

- Trained IPC link person, with dedicated (part-) time in each primary health care facility.
- One IPC-trained health care officer at the next administrative level (for example, district) to supervise the IPC link professionals in primary health care facilities.

SECONDARY CARE

Functional IPC programme

- Trained IPC focal point (one full-time trained IPC Officer [nurse or doctor]) as per the recommended ratio of 1:250 beds with dedicated time to carry out IPC activities in all facilities (for example, if the facility has 120 beds, one 50% full-time equivalent dedicated officer).
- Dedicated budget for IPC implementation.

TERTIARY CARE

Functional IPC programme

- At least one full-time trained IPC focal point (nurse or doctor) with dedicated time per 250 beds.
- IPC programme aligned with the national programme and with a dedicated budget.
- Multidisciplinary committee/team.
- Access to microbiology laboratory.

WHO (is responsible for action)

NATIONAL LEVEL

- Minister of health or other assigned senior authority within the ministry of health (for example, Director General of Health Services) at national and/or state level.
- Minister of finances may also have an important role in allocating a dedicated budget for IPC.
- Leads of other programmes where links can be useful for synergistic action (for example, HAI, AMR, WASH).
- National IPC committee or technical working group, depending on the country situation as in some countries the committee exists, but there is no national IPC focal point or team to take action. Thus, the IPC committee can have a critical role in advocating for establishing a national IPC focal point.
- IPC technical partners have an important role in advocating for and supporting (also financially in some cases) the establishment of an IPC focal point (for example, WHO country office, WHO Regional Office, UNICEF, United States Centers for Disease Control and Prevention [CDC], and other organizations with competence and activities in the field of IPC).

FACILITY LEVEL

- All key players mentioned at the national level can influence and/or mandate the establishment of IPC link persons, IPC focal points and IPC committees at the health care facility level and of IPC officers at the next administrative level.
- Directors of health or health management teams (or other decision-making role) at the district or province or state level (or other administrative level depending on the country).
- At secondary and tertiary health care facility level, hospital director, medical director, chief nurse and finance office director have a critical role in the decision to establish the minimum requirements for core component 1.
- Existing IPC committee (or similar) at the facility or next administrative level.
- Local partners have an important role in advocating for and supporting (also financially in some cases) the establishment of IPC *minimum requirements* at the facility level.

TABLE 2. Minimum and full requirements for implementation of IPC core component three

CORE COMPONENT 3: IPC EDUCATION AND TRAINING

WHAT (*minimum requirements*)

NATIONAL LEVEL

National training policy and curriculum

- National policy that all HCWs are trained in IPC (in-service training).
- An approved IPC national curriculum aligned with national guidelines and endorsed by the appropriate body.
- National system and schedule of monitoring and evaluation to check on the effectiveness of IPC training and education (at least annually).

FACILITY LEVEL

PRIMARY CARE

IPC training for all frontline clinical staff and cleaners upon hire

- All front-line clinical staff and cleaners must receive education and training on the facility IPC guidelines/SOPs upon employment.
- 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.

SECONDARY CARE

IPC training for all front-line clinical staff and cleaners upon hire:

- All front-line clinical staff and cleaners must receive education and training on their IPC guidelines/SOPs upon employment.
- All IPC staff need to receive specific IPC training.

TERTIARY CARE

IPC training for all front-line clinical staff and cleaners upon hire *and annually*

- All front-line clinical staff and cleaners must receive education and training on the facility IPC guidelines/SOPs upon hire **and annually.**
- All IPC staff need to receive specific IPC training either on-line or participate in courses.

WHO (is responsible for action)

NATIONAL LEVEL

- IPC focal point (and IPC team or committee if they exist) at the ministry of health or other national responsible body as IPC education and training are key activities in their mandate.
- Senior leads in key positions at the ministry level, including ministries of health and education.
- Local academic institutions, including universities and others with a mandate on health workforce education, have a key role in curricula development and endorsement, and in training delivery.
- It is important to include all other relevant programmes and national actors and identify key joint areas of work across education and training efforts.
- In a country where the IPC focal point/team is newly established and has limited experience/expertise, consider external IPC technical support as needed for initial IPC curriculum development and implementation.

FACILITY LEVEL

PRIMARY CARE

- Trained IPC officer at the next administrative level (for example, district) is responsible for training IPC link persons, front-line HCWs and cleaners in primary care facilities, according to a plan and strategy developed at the national level.
- IPC officers at the next administrative level (for example, district) should be trained by the national or sub-national level.
- IPC expertise is required to lead IPC training.
- If the expertise at the next administrative level is limited, external support should be sought.
- IPC link persons should provide on-the-job supervision/ mentorship to HCWs and cleaners in their facility.

SECONDARY AND TERTIARY CARE

- The IPC focal point (or IPC team if it exists) is responsible for training front-line HCWs and cleaners.
- IPC expertise is required to lead IPC training.
- If the expertise of the IPC focal point is limited, external support should be sought, for example, at the regional or national level.
- In addition, non-IPC personnel with adequate skills (for example, link nurses/practitioners or champions and opinion leaders) could play a role of mentorship to refresh IPC principles and champion IPC practices at the ward level.

In this context, standardized core competencies for IPC professionals are needed as a guide and a reference for national authorities, academic institutions and professional associations, as well as for individual IPC professionals to acquire the required knowledge, skills, attitudes and practices required to be competent in the fight against HAI and AMR.

2 Part 2. Purpose and target audience of the document, development methodology, definition and role of the infection prevention and control professional

2.1 Purpose of the document

The purpose of this document is to define who is the IPC professional and identify what core competencies are needed to be qualified in this discipline and at what level, that is, junior versus senior.

The ultimate goal of this document is to support the achievement of the specific expertise and competencies of IPC professionals needed at country and facility level.

This document can be used as a guide for identifying the needs of health care organizations with regards to IPC professional staff. It can also be used for assessing the training needs of IPC professionals and developing institutional curricula for IPC postgraduate courses/certificates/diplomas in combination with education and training curricula and evaluation tools that may be already in place locally. Furthermore, it can be useful for self-evaluation, performance appraisal, development of tools for knowledge evaluation, and related professional development activities. Finally, it may be used to develop a career path by identifying the needed skills for a junior versus a senior IPC professional.

2.2 Target audience

The **main target audience** of this document are **those in charge of (or participating in) IPC programmes** at the national, sub-national or facility level, such as IPC and AMR focal points, IPC officers, link persons and diverse professionals participating in IPC programme activities. IPC professionals and others mentioned above should seek to achieve an expertise in all core areas/domains of IPC. This document will also be useful as an orientation for **persons who wish to become IPC professionals** and work in this field.

Critical target audiences are also those in charge of IPC postgraduate education and training at the national, sub-national and facility levels, and those in charge of human resources for health care. In addition, policy-makers, senior managers, and professionals with the mandate of (or involved in) developing or strengthening IPC programmes at the national and facility level may be interested in this document.

The document could also be of help to **other stakeholders**, such as those responsible for training and education programmes of HWs involved in direct or indirect patient care, or responsible for health care quality, patient safety, public health, infectious disease control and surveillance, WASH, occupational health, antimicrobial stewardship programmes, clinical microbiology and environmental health interventions, including other professional bodies where IPC knowledge can be incorporated into their programmes.

2.3 Document development

The development of this document included a three-pronged approach: 1) an inventory of existing or publicly-available documents on IPC competencies was performed; 2) the inventory was then broadened by sending a questionnaire on existing documents on IPC competencies to the members of the WHO Global IPC Network (GIPCN)[1]; and 3) key published WHO IPC documents, including guidelines, implementation manuals and IPC training packages, were considered for inclusion in the content of this document in order to build upon evidence- and consensus-based principles and ensure consistency across WHO resources *(1, 2, 5-7, 11, 12)*.

The inventory work and review of all documents led to the identification of five main documents with a similar structure regarding IPC principles, competency statements (knowledge, skills and attitudes), intended users, and indications for use (Annex); these were selected as key references for this document.

In an effort to make this document comprehensive and beneficial, several expert discussions were undertaken, involving national and international organizations, and professional societies included in the GIPCN, and WHO regional IPC focal points, in order to ensure that this document could benefit from country experiences and adequately respond to country needs.

A second review of the first draft of this document was undertaken with expert contributors and reviewers' input for the development of the final version.

2.4 Role of the infection prevention and control professional and introduction to the core competencies

IPC is an evidence-based discipline and thus IPC practices should be understood and implemented by referring to standardized and validated principles that are rooted in evidence. Similar to other specialties, it requires the acquisition of specific knowledge and practical skills. For IPC professionals, these skills and knowledge are essential, given their role in influencing changes in practice and outcomes associated with patients, families, and HWs' safety and quality of care.

> **The IPC professional is defined by WHO as a "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" (see glossary).**

A list of existing training courses and certificates organized by GIPCN participating organizations is available on the WHO website *(13)*. Those persons who are motivated to become IPC professionals should have minimum educational qualifications in one or more of the following fields: nursing; clinical laboratory science; medical laboratory technology; microbiology; medicine; epidemiology; public health; or a related field.

[1] GIPCN includes institutions, organizations, agencies, professional societies and selected WHO Collaborating Centres with demonstrated influence and experience in international IPC capacity-building representing all WHO regions (https://www.who.int/infection-prevention/about/GIPC_Network/en/).

Core competencies refer to the knowledge, skills and attitudes required for an IPC professional to practice with an in-depth understanding of situations, using reasoning, critical thinking, reflection and analysis to inform assessment and decision-making in the prevention and control of HAIs and AMR (see glossary).

For the purpose of this document, two levels of competency are defined to enable IPC professionals to take a stepwise approach to achieving progressive IPC competences from junior to senior level, regardless of their educational background, related experience or resource setting.

Definitions of two levels of IPC professionals

I

Level I IPC professional (IPCP I-junior) is defined as a newly-appointed IPC professional with up 3 years of practical IPC experience *(14)*.

The expectation of an IPCP I-junior is to demonstrate listening and learning skills and acquire understanding about each department and team which he/she is meant to interact with in order to support them. The IPCP I-junior should be able to contribute to the development of the IPC annual plan based on national or international recommendations. He/she should be able to understand the link between IPC risk assessment and the reduction strategies selected, and to implement the national and local IPC directives or standards to reduce HAIs. The IPCP I-junior should also be able to contribute to IPC training and begin to identify and use nationally or locally recognized surveillance and/or outbreak definitions relevant to the practice setting. With ongoing guidance, he/she will become more independent in collaborating with key stakeholders.

II

Level II IPCP (IPCP II-senior) is defined as a professional with more than 3 years' practical IPC experience, including higher levels of education in critical fields such as epidemiology, infectious diseases, public health and quality improvement, and demonstration of the capacity to take on senior leadership roles and responsibilities.

In addition to the expectations listed above for the junior IPCP, a IPCP II-senior is expected to actively suggest and seek ideas to improve the quality, efficiency and effectiveness of IPC activities and programmes *(14)*. He/she is able to describe, compare and contrast how various equipment, product and/or service options, and cost align with IPC best practices. An IPCP II-senior conducts and develops a comprehensive risk assessment and prioritizes findings; develops an overall prevention plan, including goals and objectives, using local data on HAIs and AMR and nationally and internationally recognized guidelines; proactively identifies key potential risks and adjusts prevention measures. The IPCP II-senior is able to critically assess and interpret scientific evidence, including surveillance data, and translate it into risk reduction strategies and innovative implementation approaches to develop targeted quality improvement interventions, involving also the use of solutions proposed by a multidisciplinary team, where appropriate. He/she actively pursues collaboration and discussion by facilitating and leading diverse groups, participating in networks or professional organizations, welcoming opinions, respectfully challenging perspectives, and demonstrating effective listening skills. The IPCP II-senior contributes to or leads research activities and has writing skills to describe research objectives, methods and findings, including their interpretation in reports and scientific publications. The IPCP II-senior also has a critical mentorship role for other IPC professionals and for clinical staff.

The **ultimate goals** for the work and mission of a competent IPC professional are to:

> **establish and/or support an organizational structure to effectively prevent HAI, reduce AMR, and improve the safety of patients, HWs and visitors in order to achieve health care without avoidable infections.**

Practical IPC experience is fundamental for the role of any IPC professional and should be demonstrated through:

> **working in clinical care by integrating IPC principles in service delivery and collaborating with nursing and medical staff, microbiology, epidemiology and occupational health staff, including those involved in patient safety, quality of care, surveillance and WASH, together with other key stakeholders or teams.**

In addition to working to promote basic IPC throughout the whole facility, some examples of critical clinical areas where the IPC professional should actively contribute to embed IPC principles and best practices are intensive care units, surgery departments, maternal and neonatal services, dialysis and transplant units.

The **attributes (skills and attitudes)** that are useful to becoming an effective IPCP are (but not limited to):

> **acting as a role model and visible advocate for IPC, quality of care and patient and HW safety; encouraging individuals and teams to learn and develop IPC best practices; appropriately communicating about risks and recommended IPC practices while explaining the evidence basis; and supporting individuals and teams with audit/ surveillance and feedback *(15)*.**

Core behaviours that are considered essential for an IPC professional are:

> **to be passionate, advocative and persuasive about IPC; being accountable for his/her own actions; approachable; communicative; thorough; and perceptive *(15)*.**

IPC professionals may also play a consulting role in specific circumstances regarding IPC needs at the community and public settings where health care is dispensed.

Since IPC professionals perform their activities in a variety of health care settings, it is expected that they have knowledge and skills in all the competency areas, although not all the core competencies listed in this document would necessarily need to be applied in all work settings *(16)*.

Table 3 presents the areas and domains of the IPC core competencies described in Part 3 this document.

TABLE 3. Areas and domains of infection prevention and control core competencies detailed in this document.

Areas	Domains
Leadership and infection prevention and control programme management	Infection prevention and control programme management and leadership
	Built environment in health care facilities
Microbiology and surveillance	Basic microbiology
	Antimicrobial resistance prevention
	Health care-associated infection surveillance
Infection prevention and control in clinical practice	Standard precautions
	Transmission-based precautions
	Decontamination and reprocessing of medical devices and equipment
	Catheter-associated bloodstream infection prevention
	Catheter-associated urinary tract infection prevention
	Surgical site infection prevention
	Prevention of health care-associated pneumonia
	Health care-associated outbreak prevention and management
Education	Infection prevention and control education and training
Quality, patient safety and occupational health	Quality and patient safety
	Occupational health

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11. Infection prevention and control: core components for IPC - implementation tools and resources. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/core-components/en, accessed 24 April 2020).
12. Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, Acinetobacter baumannii and Pseudomonas aeruginosa in health care facilities. Geneva: World Health Organization; 2017 (http://www.who.int/iris/handle/10665/259462, accessed 24 April 2020).
13. Training courses organized by GIPCN participating organizations. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/about/GIPCN_Training-Courses/en/, accessed 24 April 2020).
14. Bubb TN, Billings C, Berriel-Cass D, Bridges W, Caffery L, Cox J, et al. APIC professional and practice standards. Am J Infect Control 2016; 44:745-49.
15. Manley K, Gallagher, R. The role of the link nurse in infection prevention and control (IPC): developing a link nurse framework. London (UK): Royal College of Nursing; 2012; pp 17.
16. Infection Prevention and Control Canada. IPAC Canada core competencies for infection control professionals. 2016 (https://ipac-canada.org/photos/custom/pdf/2016_IPAC_Canada_CoreCompetenciesforICPs.pdf, accessed 24 April 2020).

3 Part 3. Core competencies for IPC professionals

3.1 Infection prevention and control programme management and leadership

Area: Leadership and infection prevention and control programme management

Competence summary: Use management strategies and leadership for planning and operationalizing an infection and prevention control (IPC) programme and/or a team, including cost-benefit and feasibility considerations to achieve planned objectives. Develop or adapt and implement evidence-based IPC guidelines, standard operating protocols (SOPs), training resources and monitoring/audit tools; organize and provide training and education for health workers (HWs); and undertake monitoring and feedback activities of adherence with guideline recommendations. Use data and evidence for decision making about IPC interventions to be implemented. Use leadership and communication skills to interact with teams, senior management, HWs, patients and families, and other audiences. Support the achievement of adequate water, sanitation and hygiene (WASH) and IPC infrastructures and supplies procurement.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

IPC programme, policy and guidance

1. The benefits of an active IPC programme at the national and facility levels with clearly defined objectives, functions and activities for preventing health care-associated infection (HAI) and combating antimicrobial resistance (AMR).
2. The role, responsibilities and way of functioning of the multidisciplinary IPC team and committee.
3. Approaches to develop IPC policies and procedures, strategic plans, SOPs, and monitoring/feedback and evaluation strategies.
4. Elements of an infectious diseases epidemic plan and its functions: preparedness and response planning for emerging infectious disease emergencies at facility, national and regional levels, including community epidemics that can be affected or amplified in the health care setting.

Leadership and implementation

5. The importance of leadership and coordination as a key role of the IPC focal person.

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

IPC programme, policy and guidance

a. Develop a written and measurable IPC action plan (national or local) with clear objectives, time frame, responsibilities and budget and update annually by using a multimodal strategy based on needs and risk assessment and the available resources of the IPC programme.
b. Develop a written and measurable infectious diseases epidemic plan with clear objectives, time frame, responsibilities and budget and update annually.
c. Develop evidence-based, national or facility-adapted IPC policies and SOPs to provide guidance on recommended practices for HAI and AMR prevention.

Leadership and implementation

d. Use leadership skills to direct IPC programme initiatives (for example, evaluation processes, monitoring of results, planning, coaching, training, capacity building, etc.).
e. Demonstrate problem solving and critical thinking skills when presented with situations involving infectious threats.
f. Implement a hand hygiene multimodal improvement strategy and campaign in the local context.
g. Implement IPC interventions working with multidisciplinary teams and using multimodal

6. Management strategies for planning and operationalizing a programme and/or a team to achieve objectives, including project management, cost-benefit analysis and fostering teamwork.
7. Key principles of implementation science, including behavioural change approaches and the three factors of successful implementation (context, innovation and recipients) to design a framework for improving IPC activities.
8. The elements of multimodal improvement strategies and their application to IPC interventions.
9. The WHO five-step cycle of implementation to support any IPC improvement intervention or programme: preparing for action; baseline assessment; developing and executing an action plan; evaluating the impact; and sustaining the programme over the long term.
10. Equipment and supply chains, product evaluation process for standardization, appropriate utilization and price considerations.

Communications and advocacy

11. The components of communication and how they are used to communicate effectively in IPC.
12. Key messages and principles for effectively advocating the importance of IPC programmes and practices with different audiences.

Education and training

13. Key methods for adult education and learning, including mentorship.
14. Key areas to be included in IPC curricula for pre-graduate, in-service and postgraduate IPC training using evidence-based and practical approaches and adult learning methods.

Monitoring

15. Risk assessment to identify hazards and related risks regarding the geographical location and population health and safety, the care environment, emergency management, and behavioural factors. Use of risk prioritization of probability of occurrence, consequence of occurrence, and level of preparedness for each risk.
16. Evaluation approaches to assess the effectiveness of IPC strategies and campaigning when indicated.

h. Link the local IPC team to regional health authorities to help coordinate the outbreak response (community or multi-hospital/facility outbreaks), promote an exchange of information, and generate regular reports. Contribute to or lead research activities and innovative implementation approaches as appropriate, depending on the local context.
i. Identify gaps and challenges of the existing national and/or facility-based IPC initiatives and needs for improvement based on local resources, epidemiology and risk-based priorities.
j. Coordinate with the microbiology department to identify the infectious agent and establish an appropriate IPC strategy.

Communications and advocacy

k. Communicate a vision of IPC that aligns organizational and workforce priorities and in parallel with the existing quality of care and patient safety vision.
l. Advocate for and facilitate synergy between IPC and other national and local programmes including (but not limited to) patient safety, quality improvement, antimicrobial stewardship and WASH, by participating in meetings, forums, and taking the opportunity to propose sound IPC recommendations where applicable.
m. Advocate for the involvement of the IPC team in local project development, the built environment and budget planning, particularly in recommending specific equipment, personnel and resources for the IPC programme.
n. Advocate for the use of effective communication approaches to facilitate multidisciplinary interactions with key stakeholders.

Education and training

o. Develop or adapt IPC training resource strategies and plans targeting different audiences.
p. Conduct HWs training in IPC using both evidence-based and practical approaches, while supporting continuous education, including a mentorship role for other IPC professionals and clinical staff.

Monitoring

q. Develop and implement feasible monitoring systems for key IPC indicators (both process and outcome) at the national and facility level, based on the WHO IPC core components and their minimum requirements.
r. Conduct product evaluation for IPC equipment and supplies based upon appropriate

interventions and identify which activities of the IPC programme are successful and which need to be changed to improve outcomes, based on the WHO IPC core components and their minimum requirements.

assessment criteria with the objective of selecting the most clinically and cost-effective products.

s. Implement a process to monitor the quality and quantity of IPC equipment, signage, supplies (including medical devices, chemical disinfectants and antiseptics, etc.) and information, including education and communication materials to allow HWs to practice IPC effectively according to the policies of the IPC programme.

t. Disseminate/present IPC audit and surveillance findings, IPC recommendations, annual reports, and policies and procedures to relevant stakeholders (for example, individuals, committees, departments, units, academia, etc.).

u. Collaborate with risk management and quality improvement teams and other stakeholders to identify and review adverse and sentinel events and other risks.

v. Monitor potential epidemics or influx of infectious disease through routine surveillance of admissions provided by the emergency department, syndromic surveillance and microbiological surveillance, including emerging and re-emerging pathogens.

Key resources

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://www.who.int/infection-prevention/publications/ipc-components-guidelines/en/, accessed 20 April 2020).
2. Minimum requirements for infection prevention and control (IPC) programmes. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/, accessed 20 April 2020).
3. Interim practical manual supporting facility implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
4. Interim practical manual supporting national implementation of the WHO guidelines on core components of infection prevention and control Programmes. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
5. Core components for infection prevention and control programmes national level assessment tool (IPCAT2). Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
6. Infection prevention and control assessment framework (IPCAF) at the facility level. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
7. IPC training: leadership and programme management in infection prevention and control module. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 2 September 2020).
8. Infection prevention and control core components and multimodal strategies. Geneva: World Health Organization; 2020 (https://openwho.org/channels/ipc, accessed 2 September 2020).
9. Infection prevention and control training package. Application of IPC: leadership and programme management. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
10. Disease outbreak toolboxes. Geneva: World Health Organization; 2020 (https://www.who.int/emergencies/outbreak-toolkit/disease-outbreak-toolboxes#cletter, accessed 20 April 2020).

11. WHO multimodal improvement strategy. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1, accessed 2 September 2020).
12. Handbook for national quality policy and strategy: a practical approach for developing policy and strategy to improve quality of care. Geneva: World Health Organization; 2018 (https://www.who.int/servicedeliverysafety/areas/qhc/nqps_handbook/en/, accessed 2 September 2020).
13. Infection and prevention control assessment framework results report. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/IPCAF-template.pdf?ua=1, accessed 4 September 2020).
14. State Party self-assessment annual reporting tool. International Health Regulations (2005). Geneva: World Health Organization; 2018 (https://www.who.int/ihr/publications/WHO-WHE-CPI-2018.16/en/, accessed 4 September 2020).
15. Joint External Evaluation tool (JEE tool) second edition, Geneva: World Health Organization; 2018 (https://www.who.int/ihr/procedures/joint-external-evaluations/en/, accessed 4 September 2020).
16. Food and Agriculture Organization of the United Nations; Organisation for Animal Health; WHO. Global monitoring of country progress on antimicrobial resistance (AMR): Tripartite AMR country self-assessment survey (TrACSS), version 3.0. 2018 (https://www.who.int/antimicrobial-resistance/global-action-plan/Tripartite-antimicrobial-resistance-country-self-assessment-questionnaire-2018-EN.pdf?ua=1, accessed 4 September 2020).
17. Association for Professionals in Infection Control and Epidemiology (APIC). Cost calculators (https://apic.org/resources/cost-calculators/, accessed 4 September 2020).

3.2 Built environment in health care facilities

Area: Leadership and infection prevention and control programme management

Competence summary: Develop or adapt and implement evidence-based strategies and guidelines/standard operating procedures to improve the health care environment and prevent the transmission of health care-associated infection (HAI) and antimicrobial resistance, according to the WHO recommendations for core component eight. In particular, use a risk-based approach for appropriate water, sanitation and hygiene (WASH) and health care waste management infrastructure and services. Assess the infection risks related to building design, construction and renovation and provide guidance based on infection prevention and control (IPC) and WASH principles. Assess IPC and WASH equipment and environmental cleaning and waste management needs and monitor WASH indicators; support WASH training activities.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. The health care environment as an infection source, including the most frequent pathogens and the health-related impact due to inadequate WASH (for example, lack of waste water management as a source of disease causing the spread of antibiotic-resistant pathogens) in health care facilities.
2. IPC core component eight related to how the built environment contributes to effective IPC.
3. The principles of environmental cleaning and disinfection, including:
   a. actual survival times of microorganisms on environmental surfaces in health care settings, based on factors such as temperature, humidity and surface type;
   b. cleaning products and disinfectants; types, composition, constituents, modes of action, spectrum, resistance, effects on different surfaces, human toxicity;
   c. strategies and techniques for conducting environmental cleaning and disinfection based on risk assessment and best practices;
   d. appropriate methods used to monitor and provide feedback on the efficacy of environmental cleaning;
   e. WASH services and requirements needed for environmental cleaning programmes.
4. The principles and operational aspects related to an appropriate water supply, including the safe collection, management (including drainage), transportation and elimination of health care waste and

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop or adapt evidence-based/informed and facility-adapted policies and standard operating procedures related to a safe built environment, in particular environmental cleaning and disinfection, an appropriate water supply and health care waste management.

Leadership and implementation

b. Optimize facility design and layout using IPC principles to help reduce and eliminate the transmission of infection as it relates to the built environment (that is, material finishes, sink placement, storage of sterile equipment, dirty utility room, etc.).

c. If cleaning services are contracted out, provide guidance on cleaning standards and training requirements (cleaning techniques, types and dilution of disinfectants, proper use of personal protective equipment, etc.) and request their enforcement.

Education and training

d. Develop or contribute to developing training resources, strategies and plans specifically for cleaning and laundry staff and environmental workers on appropriate cleaning and disinfection procedures, including the safe collection, transport, sorting and washing of soiled linen, and appropriate waste management.

e. Conduct or support training roll-out adapted to different audiences.

f. Provide supplemental training according to the needs identified by facility staff (for example, cleaning programme manager).

associated environmental health issues in health care facilities.

5. The IPC risk assessment criteria and key principles for pre-, during, and post-construction of a new building or for any demolitions or renovations, taking into consideration human factors and ergonomics supporting IPC, as well as current building guidance and legislation. In particular:
   a. principles of hospital design related to layout, ventilation and other aspects of general wards and specialized units, such as isolation rooms/facilities, (including negative and positive pressure systems), operating rooms (and immediate pre- and postoperative areas), hemodialysis units, burns unit, sterile services department, or endoscopy unit, dietary and pharmacy services, etc.;
   b. outcomes/indicators relating to IPC and WASH during the design, construction, and modification of the built environment;
   c. patient, health workers and waste flow at the ward and hospital level;
   d. surface and material characteristics that are important for IPC.
6. IPC standards and practices for the hospital laundry to protect health workers from exposure to potentially infectious materials during the collection, handling and sorting of soiled linen, which may be contaminated with blood and body fluids or other infectious material.

Communications and advocacy

g. Develop appropriate communication messages and tools (for example, reminders) tailored to different audiences about the importance of the safe built environment, in particular environmental cleaning and disinfection, the basic drinking water supply, hand hygiene and menstrual hygiene facilities, and appropriate health care waste management.
h. Engage with stakeholders and identify and work with champions among WASH leads, cleaners and other related staff to advocate for a safe built environment.

Monitoring

i. Develop and implement standardized monitoring programmes to ensure that environmental cleaning is conducted according to best practices, apply it on a routine basis, and provide timely feedback to cleaning staff and programme leadership.
j. Recognize and monitor elements important for a safe care environment (for example, adequate ventilation in specialized areas, air conditioning, water quality, and other factors relating to the built environment).
k. Assess the infection risks of design, construction and renovation that may impact on patient care settings and provide recommendations to reduce the risk of infection.
l. Monitor WASH implementation using the indicators for basic WASH, heath care waste management and environmental cleaning services, provide feedback to relevant staff, and adapt/refine strategies for improvement.

Key resources

1. Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Core component 8. Geneva: World Health Organization; 2016 (https://www.who.int/infection-prevention/publications/ipc-components-guidelines/en/, accessed 20 April 2020).
2. Minimum requirements for infection prevention and control (IPC) programmes. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/, accessed 20 April 2020).
3. Interim practical manual supporting facility implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
4. Interim practical manual supporting national implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
5. Essential environmental health standards in health care. Geneva: World Health Organization 2008 (https://www.who.int/water_sanitation_health/publications/ehs_hc/en/, accessed 24 April 2020)
6. Guidelines on sanitation and health. Geneva: World Health Organization; 2018 (https://www.who.int/water_sanitation_health/publications/guidelines-on-sanitation-and-health/en/, accessed 20 April 2020).

7. Water and sanitation for health facility improvement tool (WASH FIT). Geneva: World Health Organization; 2018 (https://www.who.int/water_sanitation_health/publications/water-and-sanitation-for-health-facility-improvement-tool/en/, accessed 2 September 2020).
8. WASH FIT training package – revised 2020. World Health Organization and New York: United Nations Children's Fund (UNICEF); 2020 (https://www.washinhcf.org/resource/wash-fit-training-package-revised-2020/, accessed 6 September 2020).
9. Best practices for environmental cleaning in healthcare facilities: in resource-limited settings. Version 2. Atlanta, GA: United States Department of Health and Human Services, Centers for Disease Control and Prevention; Cape Town, South Africa: Infection Control Africa Network; 2019 (https://www.cdc.gov/hai/prevent/resource-limited/index.html, accessed 2 September 2020).
10. Tools for healthcare settings. CDC Environmental checklist for monitoring terminal cleaning. United States Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/hai/pdfs/toolkits/environmental-cleaning-checklist-10-6-2010.pdf, accessed 6 September 2020).
11. Standard precautions: environmental cleaning and disinfection module. Geneva: World Health Organization; 2020 (https://openwho.org/channels/ipc, accessed 2 September 2020).
12. Natural ventilation for infection control in health-care settings. Geneva: World Health Organization; 2009 (https://www.who.int/water_sanitation_health/publications/natural_ventilation/en/, accessed 2 September 2020).
13. Overview of technologies for the treatment of infectious and sharp waste from health care facilities. Geneva: World Health Organization; 2019 (https://www.who.int/water_sanitation_health/publications/technologies-for-the-treatment-of-infectious-and-sharp-waste/en/, accessed 2 September 2020).
14. WASH in health care facilities: practical steps to achieve universal access to quality care. Geneva: World Health Organization; 2019 (https://www.who.int/water_sanitation_health/publications/wash-in-health-care-facilities/en/, accessed 2 September 2020).
15. Core questions and indicators for monitoring WASH in health care facilities in the Sustainable Development Goals. Geneva: World Health Organization; 2018 (https://www.who.int/water_sanitation_health/publications/core-questions-and-indicators-for-monitoring-wash/en/, accessed 2 September 2020).
16. Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum. Geneva: World Health Organization; 2017 (https://www.who.int/water_sanitation_health/publications/drinking-water-quality-guidelines-4-including-1st-addendum/en/, accessed 2 September 2020).
17. WHO/UNICEF joint monitoring programme for water supply, sanitation and hygiene. Joint monitoring programme definitions of improved water/sanitation. New York: United Nations Children's Fund (UNICEF) and World Health Organization; 2019 (https://www.unwater.org/publication_categories/whounicef-joint-monitoring-programme-for-water-supply-sanitation-hygiene-jmp/, accessed 6 September 2020).
18. Guidelines on tuberculosis infection prevention and control. 2019 update. Geneva: World Health Organization; 2019 (https://www.who.int/tb/publications/2019/guidelines-tuberculosis-infection-prevention-2019/en/, accessed 6 September 2020).

3.3 Basic microbiology

Area: Microbiology and surveillance

Competence summary: Correctly identify the microorganisms that cause infections in humans, in particular in health care settings and in the context of the global, national and local epidemiology; understand their modes of transmission and antimicrobial resistance (AMR) patterns.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

General principles

1. General classification and taxonomy of microorganisms (including bacteria, virus, fungus, prions, etc., in particular, those of epidemiological significance in the health care and community settings, those commonly found in the environment, and outbreak-prone microorganisms) and their key characteristics, including mode of transmission, pathogenicity and virulence, reservoirs or sources, chain of infection, incubation period and period of communicability, survival rate in various environments, most common clinical presentations of the infection, and appropriate diagnostic/screening test(s) for specific microorganisms.
2. Different host-microorganism interactions (for example, colonization versus infection, normal flora versus transient carriage, latency, commensal versus pathogens) and general concepts about AMR mechanisms.
3. Human microbiome and its role in the transmission and prevention of disease.
4. General principles of appropriate IPC measures to reduce or prevent transmission of microorganisms and infections, including immunization.

Leadership and implementation

5. Standard operating procedures for the proper collection (that is, correct microbiological samples at the correct time from the correct site and correct amount), handling, packaging, labelling and transport of specimens and biohazardous material.
6. General methods for the detection and identification of

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Contribute to develop evidence-based, national or facility-adapted guidance and/or standard operating protocols on recommended microbiological investigations needed for health care-associated infections and AMR, both on a regular basis and in the event of an outbreak.

Leadership and implementation

b. Support national and facility-based efforts to minimize antibiotic resistance, including diagnostic and antimicrobial stewardship initiatives and reporting of multidrug-resistant microorganisms, according to local and national requirements.

c. Coordinate with the microbiology department to identify the infectious agent and to establish an appropriate IPC strategy.

d. Advise or participate in discussions on the microbiological specimens to be taken in specific infection cases and/or outbreaks and make hypotheses about microorganisms potentially involved based on laboratory results, clinical presentation, epidemiological information, and modes of transmission.

e. Interpret common laboratory results, for example:
   - gram stain for bacterial morphology and Ziehl-Neilsen stain for acid-fast bacilli;
   - antibiotic susceptibility tests;
   - unusual AMR resistance patterns for specific pathogens;
   - distinction between microorganisms that normally cause colonization versus infection in humans;
   - recognition of possible contamination of cultures;
   - limitations of tests used (sensitivity and specificity);
   - genome typing and sequencing of microorganisms used during outbreak investigation.

f. Take appropriate actions to provide directions to health workers caring for patients infected or colonized by epidemiologically-relevant microorganisms, depending on the

microorganisms in the laboratory and when each is appropriate (for example, direct detection methods, culture, serology, molecular techniques).

7. The role of the IPC programme, including specific interventions and antimicrobial stewardship and their integration in AMR containment strategies.

modes of transmission and virulence patterns identified through microbiological tests (if available).

Communication and advocacy

g. Communicate in a timely and effective manner with stakeholders (for example, laboratory, local public health units, operations, health workers, medical leaders) and target audiences (for example, patients and families) about modes of transmission and risks of specific pathogens and necessary microbiological investigations.

h. Advocate for the diagnostic and antimicrobial stewardship programmes through influence, such as sharing of expertise.

Education and training

i. Identify relevant clinical microbiology topics and practical activities to be included in IPC training programmes and develop related training resources.

Monitoring

j. Review and interpret laboratory reports of epidemiology and antibiotic resistance relevant to locally common microorganisms.

k. Review the processes used to conduct diagnostic/laboratory tests for investigating health care-associated infections (active or passive surveillance).

Key resources

1. Basic microbiology module. Geneva: World Health Organization; 2020 (https://openwho.org/channels/ipc, accessed 2 September 2020).
2. Infection prevention and control training package: IPC basic modules. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
3. Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/focus-amr/en/, accessed 2 September 2020).
4. Advocacy document on infection prevention and control (IPC) to reduce the burden of AMR. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/focus-amr/en/, accessed 2 September 2020).
5. Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in health care facilities. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/guidelines-cre/en/, accessed 2 September 2020).

3.4 Antimicrobial resistance prevention

Area: Microbiology and surveillance

Competence summary: Understand antimicrobial resistance (AMR) mechanisms and methods for the detection and interpretation of results; understand basic concepts of AMR surveillance. Contribute to develop or to improve/sustain AMR surveillance protocols and systems including rapid alert/detection systems, as well as evidence-based infection prevention and control (IPC) strategies and policies for AMR, at the national and/or the facility level. Implement AMR prevention activities at the national and/or health care facility level. Conduct or support training activities on AMR detection in health care.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

General principles

1. Definition of AMR; concept of intrinsic and acquired resistance.
2. Factors contributing to the emergence and spread of antibiotic-resistant bacteria in health care facilities and communities, including the overuse/misuse of antimicrobials, and lack of IPC and water, sanitation and hygiene (WASH) infrastructures.
3. Main AMR mechanisms of the most common microorganisms causing health care-associated infections (HAIs).
4. Global, national and local epidemiology of AMR and its implications on the burden of endemic HAIs and in outbreaks.
5. Impact of AMR in terms of morbidity, mortality, complications and costs.
6. Common classes of antimicrobials and their mechanisms of action to prevent and control infections, including the role of antimicrobial prophylaxis.
7. Key principles of standard and transmission precautions and their effectiveness to reduce the spread of AMR.
8. Principles of the rational use of antibiotics, including key elements of effective antibiotic stewardship programmes and their linkages to IPC.

Leadership and implementation

9. Components of the AMR global and national action plans and the role of IPC as a key intervention to combat AMR.
10. Evidence-based antibiotic management principles for prophylaxis and treatment.

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

- **a.** Contribute to develop or to improve/sustain AMR surveillance protocols and systems including rapid alert/detection systems.
- **b.** Contribute to develop or to improve/sustain evidence-based AMR prevention strategies and policies, at the national and/or the facility level.

Leadership and implementation

- **c.** Identify factors contributing to the emergence and spread of antibiotic-resistant microorganisms in the health care facility.
- **d.** Support the implementation of appropriate IPC measures for preventing the spread of AMR and specific transmission-based precautions for caring for patients colonized or infected with resistant microorganisms.
- **e.** Use multimodal strategies to implement IPC measures to curb AMR spread and reduce HAI.
- **f.** Participate in or coordinate the activities of the antimicrobial stewardship and IPC committees to develop and update plans to reduce AMR in health care, based on findings related to local AMR determinants and data including the consumption of antimicrobial agents.

Communication and advocacy

- **g.** Advocate continuous and strong support (including financial) to enable effective implementation of IPC and antimicrobial stewardship strategies to combat AMR at the national and/or facility level.
- **h.** Effectively and timely communicate about the burden of AMR and the effectiveness and cost-effectiveness of IPC and antimicrobial stewardship measures using messages tailored to different audiences and stakeholders (for example, laboratory and local public health staff, health workers, medical leaders, IPC committee, patients and the public).

11. Evidence-based IPC practices to prevent and control the spread of AMR, particularly in health care settings, and a multimodal approach for stepwise implementation.

12. The synergy effect of IPC and antimicrobial stewardship at the health care facility and national level to curb AMR.

Communication and advocacy

13. Behavioural change and communication approaches to support IPC and stewardship programmes to reduce AMR.

Education and training

i. Develop or contribute to developing training resources on the importance of AMR and IPC and antimicrobial stewardship strategies to combat AMR.

j. Conduct or support training roll-out on AMR as part of IPC training, adapted to different audiences.

Monitoring

k. Work closely with the microbiology laboratory for the collection, validation and interpretation of AMR data.

l. Contribute to the set-up or improvement of a functioning system for ongoing surveillance and rapid alert/detection of AMR at the health care facility level.

m. Contribute to the set-up or improvement of a functioning system for monitoring the consumption of antimicrobial agents.

Key resources

1. Antimicrobial stewardship programmes in health-care facilities in low- and middle-income countries: a WHO practical toolkit. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/handle/10665/329404, accessed 20 April 2020).
2. Global action plan on Antimicrobial resistance. Geneva: World Health Organization; 2015 (https://apps.who.int/iris/bitstream/handle/10665/193736/9789241509763_eng.pdf?sequence=1, accessed 20 April 2020).
3. Therapeutic guidelines. American Society of Health-system Pharmacists (ASHP); 2013 (https://www.ashp.org/pharmacy-practice/policy-positions-and-guidelines/browse-by-document-type/therapeutic-guidelines, accessed 20 April 2020).
4. The Johns Hopkins Hospital Antimicrobial Stewardship Program. Antibiotic guidelines 2015-2016: Treatment recommendations for adult inpatients. 2015 (https://medicinainternaaldia.files.wordpress.com/2016/03/antibiotic-guidelines-2015-2016-johns-hopkins.pdf, accessed 20 April 2020).
5. Antimicrobial stewardship: A competency-based approach; (https://openwho.org/courses/AMR-competency, accessed 20 April 2020).
6. Basic microbiology module. Geneva: World Health Organization (https://openwho.org/channels/ipc, accessed 2 September 2020).
7. Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/focus-amr/en/, accessed 2 September 2020).
8. Advocacy document on infection prevention and control (IPC) to reduce the burden of AMR. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/focus-amr/en/, accessed 2 September 2020).
9. Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, Acinetobacter baumannii and Pseudomonas aeruginosa in health care facilities. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/guidelines-cre/en/, accessed 2 September 2020).
10. Infection prevention and control training package. Application of IPC: antimicrobial resistance. Geneva: World Health Organization (https://ipc.ghelearning.org/courses, accessed 3 September 2020).
11. Infection prevention and control training: IPC to combat antimicrobial resistance in health care settings. Geneva: World Health Organization (https://www.who.int/infection-prevention/tools/focus-amr/en/, accessed 3 September 2020).
12. 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://www.who.int/infection-prevention/publications/ipc-components-guidelines/en/, accessed 20 April 2020).

13. Minimum requirements for infection prevention and control (IPC) programmes. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/, accessed 20 April 2020).
14. Interim practical manual supporting facility implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
15. Interim practical manual supporting national implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
16. Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings (2007). United States Centers for Disease Control and Prevention; 2007 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html, accessed 20 April 2020).
17. Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings (2007). Type and duration of precautions recommended for selected infections and conditions. United States Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/appendix/type-duration-precautions.html, accessed 20 April 2020).
18. Infection prevention and control training package. Transmission-based precautions. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
19. Infection prevention and control. Posters to use in your health-care settings highlighting the role of the WHO 5 moments for hand hygiene in preventing the spread of MDROs through clinical procedures. Geneva: World Health Organization; 2014 (https://www.who.int/infection-prevention/tools/hand-hygiene/5moments-posters/en/, accessed 3 September 2020).

3.5 Health care-associated infection surveillance

Area: Microbiology and surveillance

Competence summary: Understand basic concepts of epidemiology, biostatistics, and surveillance. Contribute to develop or to improve/sustain health care-associated infection (HAI) surveillance protocols and systems at the national and/or the facility level. Implement HAI surveillance, including antimicrobial resistance (AMR), considering the local context and other infection prevention and control (IPC) processes. Use surveillance data to identify adequate IPC interventions to reduce the risk of HAIs among patients and providers. Conduct or support training activities.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Basic principles

1. Epidemiological concept of person, place and time in descriptive epidemiology.
2. Types of surveillance to target HAIs and AMR microorganisms and other processes, and the use of surveillance data to implement interventions to reduce the risk of HAIs among patients and care providers and improve compliance to IPC and reduce AMR.
3. Basic epidemiological and biostatistical principles and methods (for example, descriptive statistics, exploratory data analysis, summary measures, adjustment or risk stratification of rates, appropriate numerator and denominator data).
4. Differences between HAI surveillance definitions and clinical definitions for infectious syndromes.
5. The basic principles, advantages and disadvantages of different surveillance methodologies: incidence versus prevalence; passive versus active; prospective versus retrospective; hospital-wide versus targeted; laboratory versus patient-based; adjusted versus crude.
6. The role of surveillance and feedback (prospective, benchmarking, identifying trends and patterns) and reporting to inform appropriate interventions and clinical practice.
7. Existing surveillance systems (local, regional, and national) and the most appropriate informatics support tools.
8. Best methods for targeted surveillance of common HAIs, such as: central line-associated bloodstream infection; surgical site

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop protocols for a surveillance programme, including clearly defined objectives and goals that are relevant for the target areas, procedure, population or event of interest.

Leadership and implementation

b. Support a surveillance system, including relevant linkages with clinical/laboratory services.
c. Implement facility and/or IPC surveillance and a notification system.
d. Determine organizational priorities for surveillance, based on available evidence and resources and regulatory or other relevant contextual factors.
e. Develop a plan to collect data: choose surveillance protocol, create or adapt practical data collection forms, identify a data collection system, train dedicated surveillance staff, emphasize data quality.
f. Develop recommendations for action based on the data and literature.

Education and training

g. Develop or contribute to developing training resources, strategies and plans to teach basic principles of HAI and AMR surveillance, as well as special training for surveillance staff.
h. Conduct or support training roll out adapting to different audiences.

Communications and advocacy

i. Advocate the value of HAI surveillance and the choice of methods.
j. Communicate the surveillance data to different stakeholders periodically to raise awareness of HAI and motivate health workers to change their behaviour and improve

infection; catheter-associated urinary tract infection; ventilator-associated pneumonia; multidrug-resistant organism; outbreak-prone microorganisms.

9. Methods of validation of HAI surveillance data.
10. Methods for the comparison of surveillance data across institutions/settings and against population-based data sets or benchmarking.
11. Best approaches (both descriptive and visual) to present surveillance data.

IPC practices.

Monitoring

k. Incorporate information technology systems and applications into the analysis and dissemination of data.
l. Contribute to data management, analysis and reporting by advising on descriptive statistics (means, rates, odds ratios), best visual data representation (graphs and tables), and user-friendly surveillance reporting.
m. Critically evaluate and interpret the HAI surveillance results in the context of trends over time, comparison with internal/external data sources and/or benchmarks, and the achievements of the surveillance programme and any other relevant context.
n. Monitor the indicators of outcomes, process and structure following IPC interventions targeted at HAI.
o. Establish data quality control mechanisms and protocols to assess the surveillance system.

Key resources

1. Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level. Core component 4. Geneva: World Health Organization; 2016 (https://www.who.int/infection-prevention/publications/ipc-components-guidelines/en/, accessed 20 April 2020).
2. Minimum requirements for infection prevention and control (IPC) programmes. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/, accessed 20 April 2020).
3. Interim practical manual supporting facility implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
4. Interim practical manual supporting national implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
5. Infection prevention and control training package. Health-care associated infection (HAI) surveillance. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/html/modules/surveillance, accessed 7 September 2020).
6. Protocol for surgical site infection surveillance with a focus on settings with limited resources. Geneva: World Health Organization; 2018 (http://www.who.int/infection-prevention/tools/surgical/evaluation_feedback/en/, accessed 3 September 2020).
7. Epidemiological surveillance of HAI. Washington, DC: Pan American Health Organization; 2011 (http://new.paho.org/hq/dmdocuments/2011/ENG_Modulo_I_final.pdf, accessed 3 September 2020)
8. Provincial Infectious Diseases Advisory Committee (PIDAC). Best practices for surveillance of health care-associated infections in patient and resident populations, 3rd ed. Toronto, ONT: Public Health Ontario; 2014 (https://www.publichealthontario.ca/-/media/documents/b/2014/bp-hai-surveillance.pdf?la=en, accessed 3 September 2020).
9. Global antimicrobial resistance surveillance system (GLASS). Geneva: World Health Organization (https://www.who.int/glass/en/, accessed 3 September 2020).
10. Global antimicrobial resistance surveillance system manual for early implementation. Geneva: World Health Organization; 2015 (https://www.who.int/antimicrobial-resistance/publications/surveillance-system-manual/en/, accessed 3 September 2020).

11. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals – protocol version 5.3. Stockholm: European Centre for Disease Prevention and Control; 2016 (https://www.ecdc.europa.eu/en/publications-data/point-prevalence-survey-healthcare-associated-infections-and-antimicrobial-use-3, accessed 7 September 2020).
12. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. PPS validation protocol version 3.1.2. Stockholm: European Centre for Disease Control and Prevention; 2019 (https://www.ecdc.europa.eu/en/publications-data/point-prevalence-survey-healthcare-associated-infections-and-antimicrobial-use-4, accessed 7 September 2020).
13. Point prevalence survey database. Stockholm: European Centre for Disease Control and Prevention (https://www.ecdc.europa.eu/en/healthcare-associated-infections-acute-care-hospitals/surveillance-disease-data/database, accessed 3 September 2020).
14. Surveillance of surgical site infections and prevention indicators in European hospitals. Stockholm: European Centre for Disease Control and Prevention; 2017 (https://www.ecdc.europa.eu/sites/default/files/documents/HAI-Net-SSI-protocol-v2.2.pdf, accessed 3 September 2020).
15. National healthcare safety network (NHSN) patient safety component manual. United States Centers for Disease Control and Prevention; 2020 (https://www.cdc.gov/nhsn/PDFs/pscManual/pcsManual_current.pdf, accessed 3 September 2020).
16. Centers for Disease Control and Prevention/National Healthcare Safety Network. Surveillance definition of healthcare-associated infection and criteria for specific types of infections in the acute care setting. United States Centers for Disease Control and Prevention; 2019 (http://www.cdc.gov/nhsn/PDFs/pscManual/17pscNosInfDef_current.pdf, accessed 7 September 2020).

3.6 Standard precautions

Area: Infection prevention and control in clinical practice

Competence summary: Correctly and consistently implement standard precautions according to risk assessment for all patients in clinical services through working with the infection prevention and control (IPC) team, unit heads and facility staff. Develop or adapt evidence-based policies and/or standard operating protocols (SOPs), training resources and monitoring/audit tools on standard precautions; organize and provide training and education for health workers (HWs) on standard precautions; undertake monitoring and feedback activities to assess compliance with standard precautions.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. Measures to break the chain of disease transmission.
2. The hierarchy of controls (replacement or removal of hazards, engineering and administrative controls, and personal protective equipment) to prevent and control the transmission of microorganisms in health care settings.
3. Standard precautions as the basic IPC practices that apply to all patients in any setting where health care is delivered. These can include, but are not limited to:
   a. hand hygiene;
   b. risk assessment at the point of care;
   c. appropriate placement of patients (segregation/isolation/cohort to limit transmission);
   d. appropriate use of personal protective equipment based on risk assessment;
   e. respiratory hygiene/cough etiquette;
   f. aseptic technique;
   g. sharps and injection safety and prevention of transmission of bloodborne pathogens;
   h. safe handling and/or disposal of contaminated patient care items and equipment (waste management);
   i. environmental cleaning;
   j. linen (safe handling, transporting and processing);
   k. cleaning and disinfection of non-critical patient care equipment;
   l. decontamination and sterilization of reusable equipment.

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop or adapt evidence-based/informed policies and SOPs related to standard precautions.

Leadership and implementation

b. Identify the existing gaps and apply multimodal strategies to implement standard precautions.
c. Use standard precautions appropriately according to risk assessment.
d. Collaborate with HWs and other relevant departments to address issues related to the consistent application of standard precautions.
e. Identify the appropriate technical specifications for personal protective equipment (gloves, masks, gowns, etc.) and other products (for example, disinfectants) that may be used for implementing standard precautions and support their timely procurement.

Education and training

f. Develop training resources, strategies and plans for standard precautions in the context of broader IPC training and targeting different audiences.
g. Conduct or support HW training on standard precautions using both evidence-based and practical approaches.
h. Inform and/or educate patients, families and visitors on standard precautions.

Communications and advocacy

i. Develop appropriate communication messages and tools (for example, reminders) about the importance of standard precautions to be applied for all patients, regardless of their infectious status.
j. Act as a role model and champion for the implementation of standard precautions to

4. The equipment, supplies and products needed for the implementation of standard precautions and their technical specifications as appropriate.

Leadership and implementation

5. The roles and responsibilities of the organization and all HWs to minimize the risk of exposure to, and transmission of infectious diseases in health care settings through the implementation of standard precautions.

ensure quality of care and safety for both patients and HWs.

Monitoring

k. Develop and implement monitoring and evaluation strategies for assessing compliance with standard precautions.

Key resources

1. Standard precautions in health care. Geneva: World Health Organization; 2007 (https://www.who.int/docs/default-source/documents/health-topics/standard-precautions-in-health-care.pdf?sfvrsn=7c453df0_2, accessed 20 April 2020).
2. Infection prevention and control. Hand hygiene tools and resources. Geneva: World Health Organization (https://www.who.int/infection-prevention/tools/hand-hygiene/en/, accessed 20 April 2020).
3. Infection prevention and control. Injection safety tools and resources. Geneva: World Health Organization (https://www.who.int/infection-prevention/tools/injections/en/, accessed 20 April 2020).
4. Infection prevention and control training package. Standard precautions: hand hygiene. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://openwho.org/channels/ipc, accessed 09 September 2020).
5. Infection prevention and control training package. Standard precautions: personal protective equipment. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
6. Infection prevention and control training package. Standard precautions: waste management. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://openwho.org/channels/ipc, accessed 20 April 2020).
7. Infection prevention and control training package. Standard precautions: environmental cleaning. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://openwho.org/channels/ipc, accessed 20 April 2020).
8. Infection prevention and control training package. Application of IPC: decontamination and sterilization. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://openwho.org/channels/ipc, accessed 20 April 2020).
9. Interim practical manual supporting national implementation of the WHO guidelines on core components of infection prevention and control Programmes. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
10. Minimum requirements for infection prevention and control. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/, accessed 20 April 2020).
11. Infection prevention and control training package. Standard precautions: injection safety. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
12. Interim practical manual supporting facility implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
13. WHO multimodal improvement strategy. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1,

accessed 2 September 2020).

14. Guide to implementation: a guide to the implementation of the WHO multimodal hand hygiene improvement strategy. Geneva: World Health Organization; 2009 (https://www.who.int/gpsc/5may/Guide_to_Implementation.pdf?ua=1, accessed 2 September 2020).
15. Infection prevention and control assessment framework (IPCAF) at the facility level. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
16. Infection and prevention control assessment framework results report. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/IPCAF-template.pdf?ua=1, accessed 4 September 2020).
17. Best practices for environmental cleaning in healthcare facilities: in resource-limited settings. Version 2. Atlanta, GA: United States Department of Health and Human Services, Centers for Disease Control and Prevention; Cape Town, South Africa: Infection Control Africa Network; 2019 (https://www.cdc.gov/hai/prevent/resource-limited/index.html, accessed 2 September 2020).
18. Essential environmental health standards in health care. Geneva: World Health Organization; 2008 (https://www.who.int/water_sanitation_health/publications/ehs_hc/en/, accessed 24 April 2020)
19. Guidelines on sanitation and health. Geneva: World Health Organization; 2018 (https://www.who.int/water_sanitation_health/publications/guidelines-on-sanitation-and-health/en/, accessed 20 April 2020).

3.7 Transmission-based precautions

Area: Infection prevention and control in clinical practice

Competence summary: Correctly and consistently implement transmission-based precautions according to risk assessment and in relation to the suspected or confirmed microorganism(s) through working with the infection prevention and control (IPC) team, unit heads and other facility staff. Develop or adapt evidence-based policies and/or standard operating procedures, training resources and monitoring/audit tools on transmission-based precautions; organize and provide training and education for health workers on transmission-based precautions in the context of broader IPC training; undertake monitoring and feedback activities to assess compliance with transmission-based precautions.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. Definitions and empiric use of transmission-based precautions.
2. National and international guidelines regarding:
    a. isolation, including airborne, droplet or contact precautions, or a combination of the three precautions and required duration, based on the confirmed or suspected microorganism or conditions (for example, Ebola, Middle-East Respiratory Syndrome, coronavirus disease 2019, multidrug-resistant Candida species, measles, tuberculosis, carbapenem-resistant organisms, and other antibiotic-resistant bacteria), including personal protective equipment, patient preparation, and route of patient transit (ambulance, corridors, etc.);
    b. safe transport of patients on isolation precautions;
    c. criteria for placing and removing patients on isolation (suspected, confirmed, or high-risk cases);
    d. criteria for cohorting patients with infectious diseases (same organism or disease);
    e. engineering and environmental controls supporting the application of transmission-based precautions.
3. The equipment, supplies and products needed for the implementation of transmission-based precautions and their technical specifications as appropriate.

Leadership and implementation

4. The roles and responsibilities of the organization and health care

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

- **a.** Develop or adapt evidence-based/informed policies and standard operating procedures for transmission-based precautions.
- **b.** Develop signage based on transmission-based precautions (required personal protective equipment, engineering, environmental controls, etc.).

Leadership and implementation

- **c.** Identify gaps and the need for additional precautions according to the modes of transmission of the confirmed or suspected microorganism.
- **d.** Implement the correct transmission-based precautions consistently throughout the facility by working together with the IPC team, unit heads and facility staff (including the initiation and discontinuation of transmission-based precautions, patient transport, items/equipment cleaning, waste management, visitor management, etc.).
- **e.** Assess the risk of transmission related to the clinical presentation, patient placement, required clinical procedures, etc.

Education and training

- **f.** Educate health workers on the principles of transmission-based precautions, including types of precautions, transmission routes, implementation, duration and discontinuation of transmission-based precautions, correct and rational use of personal protective equipment and processes related to donning (putting on) and doffing (taking off) personal protective equipment, and specific waste disposal and management systems.
- **g.** Inform and/or educate patients, families and visitors on IPC measures to prevent and control the transmission of infection in health care settings, including the specific features of transmission-based precautions.

workers to minimize the risk of exposure to, and transmission of infectious diseases in health care settings through implementation of transmission-based precautions.

Communications and advocacy

h. Develop appropriate communication messages and tools (for example, reminders) about the importance of transmission-based precautions to be applied for specific patients.

i. Act as a role model and champion in implementing transmission-based precautions to ensure quality of care and patient and health care worker safety.

Monitoring

j. Develop and implement monitoring and evaluation strategies for assessing compliance with transmission-based precautions.

Key resources

1. Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings (2007). United States Centers for Disease Control and Prevention; 2007 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html, accessed 20 April 2020).
2. Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings (2007). Type and duration of precautions recommended for selected infections and conditions. United States Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/appendix/type-duration-precautions.html, accessed 20 April 2020).
3. Minimum requirements for infection prevention and control. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/, accessed 20 April 2020).
4. Interim practical manual supporting national implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
5. Interim practical manual supporting facility implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
6. Infection prevention and control training package. Transmission-based precautions. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
7. Infection prevention and control training package. Standard precautions: personal protective equipment. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
8. Infection prevention and control of epidemic-and pandemic-prone acute respiratory infections in health care. Geneva: World Health Organization; 2014 (https://apps.who.int/iris/bitstream/handle/10665/112656/9789241507134_eng.pdf;jsessionid=BE25F8EAA4F631126E78390906050313?sequence=1, accessed 20 April 2020).
9. Guidelines on tuberculosis infection prevention and control. 2019 update. Geneva: World Health Organization; 2019 (https://www.who.int/tb/publications/2019/guidelines-tuberculosis-infection-prevention-2019/en/, accessed 2 September 2020).
10. Natural ventilation for infection control in health-care settings. Geneva: World Health Organization; 2009 (https://www.who.int/water_sanitation_health/publications/natural_ventilation/en/, accessed 2 September 2020).
11. Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, Acinetobacter baumannii and Pseudomonas aeruginosa in health care facilities. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/guidelines-cre/en/, accessed 2 September 2020).
12. Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/focus-amr/en/, accessed 2 September 2020).

3.8 Decontamination and reprocessing of medical devices and equipment

Area: Infection prevention and control (IPC) in clinical practice

Competence summary: Develop or adapt and implement evidence-based strategies guidelines/standard operating procedures and training resources on appropriate cleaning, disinfection and sterilization processes and quality control for medical devices and equipment. Conduct or support training and education for staff on processes and methods for reprocessing medical devices and equipment. Undertake monitoring and feedback activities to assess the cleaning, disinfection and sterilization processes and their quality, including the appropriate maintenance and functioning of the sterile services department (SSD) machines.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. International, national, and local evidence-based recommendations for cleaning, disinfection and sterilization processes for medical devices and equipment, including restrictions and risks for reprocessing single-use items.
2. Concepts of cleaning, disinfection and sterilization,
3. Spaulding classification for noncritical, semi-critical and critical medical equipment:
    a. biofilm formation in medical devices and how to prevent it;
    b. advantages and disadvantages of chemical agents used as chemical sterilant or as high-level disinfectants;
    c. preparation and packaging for reprocessing;
    d. decontamination of endoscopes;
    e. decontamination of reusable medical devices.
4. Infection prevent and control risk related to specific high-risk pathogens (for example, Creutzfeldt-Jakob disease, Clostridium difficile) and the appropriate handling and reprocessing of medical devices/equipment used on patients identified with these pathogens.
5. Standard methods for achieving effective sterilization:
    a. quality assurance: documentation and monitoring for cleaning, disinfection (including high-level disinfection) and sterilization processes;
    b. advantages and disadvantages of chemical agents used as chemical sterilants or high-level disinfectants, including level of action of chemical germicides (low, intermediate and high);
    c. Components of sterilization validation:

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop or adapt evidence-based/informed policies and standard operating procedures related to cleaning, disinfection and sterilization processes for medical devices and equipment.

b. Advise on actions that are required to improve quality and safety when reprocessing medical devices/equipment.

Leadership and implementation

c. Support and encourage the centralization of decontamination/SSD for the sterilization of medical devices.

d. Establish a system for the proper receipt, storage and safe transportation of sterile medical devices.

e. Review SSD written procedures to ensure that the national guidelines and standards for reprocessing reusable instruments and devices are met.

Education and training

f. Develop or adapt training resources, strategies and plans on cleaning, disinfection and sterilization processes and quality control for medical devices and equipment.

g. Assess staff competencies and performance and identify knowledge gaps, and provide the necessary training (in all areas where reprocessing is carried out and for all staff involved).

Monitoring

h. Collaborate with others to assess medical equipment and devices under product evaluation (for purchase) for their ability to be safely reprocessed.

i. Monitor the physical layout and flow, ventilation, temperature and humidity of the

i. types of sterilizers and methods of validation (for example, testing and monitoring of physical, chemical and biological indicators for the monitoring of sterilizers);
ii. recommended quality indicators to monitor the sterilization process and their interpretation.

d. Risk management in decontamination and sterilization: processes to identify, manage and mitigate breaches in processes.

6. Essential requirements for the SSD design:
   a. staffing, education and training, workflow and work environment;
   b. how to monitor and evaluate practice, and monitor patient outcomes in order to identify failures in process and practice;
   c. structure of an SSD (design layout, utilities, surfaces, etc.);
   d. required air changes, negative pressure for decontamination, storage room and racks, temperature and humidity ranges for each working area, etc.

7. Preparation and holding of used medical devices at the point of use.

8. Storage, handling and transportation of contaminated, clean and/or sterile supplies and medical devices to SSD (internally or externally), including factors that affect the shelf life of sterile items.

SSD areas (cleaning, disinfection and sterilization) and provide recommendations for improvement based on findings.

j. Establish a system to monitor the documentation and reporting of practices to ensure full traceability of sterilized medical devices to the patient on whom it was used.

k. Initiate action/investigation if breaches in processes have been identified including equipment tracking, callback of sets, any harmed patient-recalls.

l. Interpret relevant surveillance data and consider the implications of decontamination activities as part of an improvement strategy for the reduction in spread of both health care-associated infection and antimicrobial resistance.

Key resources

1. Decontamination and reprocessing of medical devices for health care facilities. Geneva: Switzerland; 2016 (https://www.who.int/infection-prevention/publications/decontamination/en/, accessed 20 April 2020).
2. Decontamination and sterilization of medical devices module. Geneva: World Health Organization (https://openwho.org/channels/ipc, accessed 2 September 2020).
3. Infection prevention and control training: decontamination and sterilization of medical devices. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://openwho.org/channels/ipc, accessed 3 September 2020).
4. Guideline for disinfection and sterilization in healthcare facilities, 2008.Update May 2019. United States Centers for Disease Control and Prevention (https://www.cdc.gov/infectioncontrol/pdf/guidelines/disinfection-guidelines-H.pdf, accessed 2 September 2020).
5. Decontamination of surgical instruments (HTM 01-01). Department of Health and Social Care. National Health Service. London: UK Government; 2016 (https://www.gov.uk/government/publications/management-and-decontamination-of-surgical-instruments-used-in-acute-care, accessed 2 September 2020).

3.9 Catheter-associated bloodstream infection prevention

Area: Infection prevention and control (IPC) in clinical practice

Competence summary: Understand the epidemiology, risk factors and burden of bloodstream infections associated with intravascular catheters. Develop or adapt and implement evidence-based strategies and guidelines/standard operating procedures for their prevention. Develop or improve a surveillance/monitoring system to detect bloodstream infections associated with intravascular catheters and monitor compliance with preventive measures; review, interpret and use local data to inform preventive measures and provide regular and timely feedback on infection rates and compliance with best practices to all relevant audiences and stakeholders. Conduct or support training activities and develop and/or use effective communications to advocate for the prevention of harm due to bloodstream infections.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. Definitions and classification of central and peripheral catheter-associated bloodstream infections.
2. Epidemiology, risk factors, burden, clinical presentation and complications of bloodstream infections associated with intravascular catheters (central venous catheter, peripherally-inserted central catheter, and peripheral venous catheter) worldwide, nationally and locally, if data are available.
3. Causative microorganisms of intravascular catheter-associated bloodstream infections, as well as commonly-used types of catheters and their potential associated risks.
4. Multimodal strategies* (including care "bundles"**, checklists and multidisciplinary collaboration) for the prevention of the risk of bloodstream infection related to the insertion, maintenance and removal of both peripheral and central lines, with a particular focus on the following:
    a. hand hygiene performance, according to the WHO "5 moments" with adaptation to catheter care;
    b. designated trained and competent staff to perform insertion, maintenance and removal;
    c. catheter selection based on the type of patient (adult versus paediatric patients), intended purpose and duration of use;
    d. insertion with aseptic technique using the appropriate skin disinfection preparation (for example, an alcohol-based

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop or adapt evidence-based/informed (including international guidelines) national and/or facility policies and standard operating procedures related to the prevention of bloodstream infections associated with intravascular catheters.

Leadership and implementation

b. Identify the existing gaps in practices and apply multimodal strategies for the prevention of bloodstream infections associated with intravascular catheters.

Education and training

c. Develop or contribute to developing training resources, strategies and plans on the prevention of bloodstream infections associated with intravascular catheters, with a focus on indications for intravascular catheter use, aseptic and appropriate procedures for their insertion, and the maintenance and removal of intravascular catheters.

d. Conduct or support training roll-out adapted to different audiences, including continuous education and the use of bedside training simulations and other practical approaches.

Communications and advocacy

e. Develop appropriate communication messages and tools (for example, reminders) tailored to different audiences about the importance of preventing bloodstream infections associated with intravascular catheters.

f. Engage with key stakeholders and identify and work with champions to advocate for the prevention of harm due to bloodstream infections.

preparation containing >0.5% chlorhexidine for central lines);

e. maintenance:
   i. appropriate site inspection and catheter site dressing;
   ii. daily review of line necessity, with prompt removal of unnecessary lines;
   iii. scrub the hub with disinfectant before accessing the port.

Monitoring

5. Monitoring and evaluation methods for the surveillance of catheter-associated bloodstream infections and for assessing compliance with measures to prevent them, including other indicators.

Communications and advocacy

6. Approaches to appropriate and effective communication about the problem of bloodstream infections and related preventive strategies, including targeting different audiences across all levels (national, facility, unit).

Monitoring

g. Evaluate the local risk factors, epidemiology and burden of catheter-related bloodstream infections, including at the unit level.

h. Collect, critically review, interpret and use local data on bloodstream infections to inform preventive measures. Develop audit protocols for the regular monitoring of compliance with best practices for insertion maintenance, and removal of vascular catheters.

i. Identify barriers to compliance with recommended procedures.

j. Provide regular and timely feedback on infection rates and compliance with best practices to all relevant audiences and stakeholders, including user-friendly methods (for example, displaying data on the unit board or providing results on smartphones).

***Multimodal implementation strategy:** A strategy consisting of several elements or components (three or more; usually five) implemented in an integrated way with the aim of improving an outcome and changing behaviour. It includes tools, such as bundles and checklists, developed by multidisciplinary teams that take into account local conditions. The five most common components include: (i) system change (that is, availability of the appropriate infrastructure and supplies to enable IPC best practices); (ii) education and training of health care workers and key players (for example, managers); (iii) monitoring infrastructures, practices, processes, outcomes and providing data feedback; (iv) reminders in the workplace/communications; and (v) culture change with the establishment or strengthening of a safety climate.

****Bundle:** An implementation tool aiming to improve the care process and patient outcomes in a structured manner. It comprises a small, straightforward set of evidence-based practices (generally three to five) that have been proven to improve patient outcomes when performed collectively and reliably.

Key resources

1. Infection prevention and control training package. Bloodstream infections. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program; 2019 (https://ipc.ghelearning.org/html/modules/bsi_prevention.html, accessed 20 April 2020).
2. Infection prevention and control. Injection safety tools and resources. Geneva: World Health Organization (https://www.who.int/infection-prevention/tools/injections/en/, accessed 20 April 2020).
3. My 5 moments for hand hygiene: focus on caring for a patient with a central venous catheter. Geneva: World Health Organization; 2015 (https://www.who.int/gpsc/5may/HH15_CentralCatheter_A3_EN.pdf?ua=1, accessed 3 September 2020).
4. My 5 moments for hand hygiene: focus on caring for a patient with a peripheral venous catheter. Geneva: World Health Organization; 2015 (https://www.who.int/gpsc/5may/HH15_PeripheralCatheter_A3_EN.pdf?ua=1, accessed 3 September 2020).

5. WHO multimodal improvement strategy. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1, accessed 2 September 2020).
6. Guidelines for the prevention of intravascular catheter-related infections. United States Centers for Disease Control and Prevention; 2002 (https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5110a1.htm, accessed 3 September 2020).
7. DeVries C. Prevention of intravascular device-associated infections. In: Friedman C, Newsom SWB, editors. IFIC basic concepts of infection control, 3rd edition. Craigavon (United Kingdom): International Federation of Infection Control; 2016: 1-9 (https://www.theific.org/wp-content/uploads/2016/04/17-IV_2016.pdf, accessed 3 September 2020).
8. How to prevent sepsis - the role you can play in health care and communities. Infographic. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/campaigns/clean-hands/5may2018/en/, accessed 9 September 2020).

3.10 Catheter-associated urinary tract infection prevention

Area: Infection prevention and control (IPC) in clinical practice

Competence summary: Understand the epidemiology, risk factors, burden, clinical presentation and complications of urinary tract infections associated with urinary catheters. Develop or adapt and implement evidence-based strategies and guidelines/standard operating procedures for their prevention. Develop or improve a surveillance/monitoring system to detect urinary tract infections associated with urinary catheters and monitor compliance with preventive measures; review, interpret and use local data to inform preventive measures and provide regular and timely feedback on infection rates and compliance with best practices to all relevant audiences and stakeholders. Conduct or support training activities and develop and/or use effective communications to advocate for the prevention of harm due to urinary tract infections.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. Definitions and classification of catheter-associated urinary tract infections.
2. Epidemiology, risk factors, burden, clinical presentation and complications of urinary tract infections associated with urinary catheters worldwide, nationally and locally, if data are available.
3. Causative microorganisms of catheter-associated urinary tract infections, as well as commonly-used types of catheters and their potential associated risks.
4. Multimodal strategies* (including care "bundles" ** and checklists) for the prevention of the risk of urinary tract infections related to the insertion, maintenance and removal of urinary catheter, with a particular focus on the following:
    a. hand hygiene performance, according to the WHO "5 moments" with adaptation to urinary catheter care;
    b. designated trained and competent staff to perform insertion maintenance and removal;
    c. use of catheters of appropriate size and closed drainage systems;
    d. insertion with an aseptic technique and using the appropriate skin preparation (for example, using single-use sterile water/saline antiseptic solution);
    e. avoiding unnecessary catheterization;
    f. appropriate maintenance by:
        i. using an aseptic technique for accessing the port and

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop or adapt evidence-based/informed (including international guidelines) national and/or facility policies and standard operating procedures related to the prevention of urinary tract infections associated with urinary catheters.

Leadership and implementation

b. Identify the existing gaps in practices and apply multimodal strategies for the prevention of urinary tract infections associated with urinary catheters.

Education and training

c. Develop or contribute to developing training resources, strategies and plans on the prevention of urinary tract infections associated with urinary catheters, with a focus on indications for catheter use, and aseptic and appropriate procedures for their insertion, maintenance and removal.

d. Conduct or support training roll-out adapted to different audiences, including continuous education and the use of bedside training simulations and other practical approaches.

Communications and advocacy

e. Develop appropriate communication messages and tools (for example, reminders) tailored to different audiences about the importance of preventing urinary tract infections associated with urinary catheters.

f. Engage with stakeholders and identify and work with champions to advocate for the prevention of harm due to urinary tract infections.

emptying the bag daily;
ii. securing the catheter;
iii. keeping the drainage bag below the level of the bladder and off the floor;
iv. performing meatal hygiene at least once daily;

g. no routine changes of the urinary catheters and daily review of catheter necessity, with prompt removal when not needed.

5. Urinary tract infection surveillance methods including the collection, collation and analysis of data for the purpose of quality improvement.

Communications and advocacy

6. Approaches to appropriate and effective communication about the problem of urinary tract infections and related preventive strategies targeting different audiences across all levels (national, facility, unit).

Monitoring

g. Evaluate local risk factors and the epidemiology and burden of catheter-associated urinary tract infections, including at the unit level.

h. Critically review, interpret and use local data on urinary infections to inform preventive measures.

i. Develop audit protocols for the regular monitoring of compliance with best practices for insertion, maintenance and removal of urinary catheters.

j. Identify barriers to compliance with recommended insertion and maintenance procedures.

k. Provide regular and timely feedback on infection rates and compliance with best practices to all relevant audiences and stakeholders.

***Multimodal implementation strategy:** A strategy consisting of several elements or components (three or more; usually five) implemented in an integrated way with the aim of improving an outcome and changing behaviour. It includes tools, such as bundles and checklists, developed by multidisciplinary teams that take into account local conditions. The five most common components include: (i) system change (that is, availability of the appropriate infrastructure and supplies to enable IPC best practices); (ii) education and training of health care workers and key players (for example, managers); (iii) monitoring infrastructures, practices, processes, outcomes and providing data feedback; (iv) reminders in the workplace/communications; and (v) culture change with the establishment or strengthening of a safety climate.

****Bundle:** An implementation tool aiming to improve the care process and patient outcomes in a structured manner. It comprises a small, straightforward set of evidence-based practices (generally three to five) that have been proven to improve patient outcomes when performed collectively and reliably.

Key resources

1. Improving infection prevention and control at the health facility: Interim practical manual supporting implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/279788, accessed 21 April 2020).
2. Infection prevention and control training package. Catheter-associated urinary tract infection prevention. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program; 2019 (https://ipc.ghelearning.org/html/modules/pm_training.html, accessed 20 April 2020).
3. My 5 moments for hand hygiene: focus on caring for a patient with a urinary catheter. Geneva: World Health Organization; 2015 (https://www.who.int/infection-prevention/tools/hand-hygiene/workplace_reminders/en/, accessed 3 September 2020).
4. Infection prevention and control. Implementation tools and resources - other interventions. Geneva: World Health Organization (https://www.who.int/infection-prevention/tools/other/training-education/en/, accessed 3 September 2020).
5. Damani N. Prevention of catheter-associated urinary tract infections. In: Friedman C, Newsom SWB, editors. IFIC basic concepts of infection control, 3rd edition.

Craigavon (United Kingdom): International Federation of Infection Control; 2016 (https://www.theific.org/wp-content/uploads/2016/04/18-UTI_2016.pdf, accessed 7 September 2020).

6. Guideline for prevention of catheter-associated urinary tract infections (2009). United States Centers for Disease Control and Prevention; 2009 (https://www.cdc.gov/infectioncontrol/guidelines/cauti/index.html, accessed 7 September 2020).
7. Meddings J, Saint S, Fowler KE, Gaies E, Hickner A, Krein SL et al. The Ann Arbor criteria for appropriate urinary catheter use in hospitalized medical patients: results obtained by using the RAND/UCLA appropriateness method. Ann Intern Med. 2015;162(9 Suppl):S1–S34.
8. WHO multimodal improvement strategy. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1, accessed 2 September 2020).

3.11 Surgical site infection prevention

Area: Infection prevention and control (IPC) in clinical practice

Competence summary: Understand the epidemiology, risk factors, and burden of surgical site infection (SSI). Develop or adapt and implement evidence-based strategies and guidelines/standard operating procedures for their prevention. Develop or improve a surveillance/monitoring system to detect procedure-associated infections and monitor compliance with preventive measures; review, interpret and use local data to inform preventive measures and provide regular and timely feedback on infection rates and compliance with best practices to all relevant audiences and stakeholders. Conduct or support training activities and develop and/or use effective communications to advocate for the prevention of harm due to SSI.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. Definitions and classification of SSI.
2. Epidemiology, risk factors (depending on the patient [endogenous] and the procedure [exogenous]), burden, clinical presentation and complications of SSI, worldwide, nationally, and locally, if data are available.
3. Causative microorganisms of SSI, including type of surgery and their antimicrobial resistance patterns.
4. SSI prevention recommendations as they relate to the surgical patient journey and the stages of operations (pre-, intra- and postoperative periods), for example:
    a. pre-operative nasal decolonization for known Staphylococcus aureus carriers in cardiac and orthopaedic surgery; hair removal with a clipper only if necessary, no shaving; optimal timing for preoperative surgical antibiotic prophylaxis within the 120 minutes when indicated; and mechanical bowel preparation, surgical hand preparation, etc.;
    b. intra-operative: use of an alcohol-based solution containing chlorhexidine gluconate for skin preparation; use of either disposable sterile non-woven or reusable sterile woven drapes and surgical gowns; no antimicrobial sealants after surgical site skin preparation, etc.;
    c. postoperative: no prolongation of surgical antibiotic prophylaxis in the postoperative period; no continuation of surgical antibiotic prophylaxis due to the presence of a drain; appropriate wound

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop or adapt evidence-based/informed (including international guidelines) national and/or facility policies and standard operating procedures related to the prevention of SSI.

Leadership and implementation

b. Identify the existing gaps in practices and apply multimodal strategies for the prevention of SSI.

c. Establish or facilitate a multidisciplinary team (including, for example, IPC and quality improvement teams, surgical staff, anaesthetists and pharmacy staff) responsible for tackling SSI prevention in the local context.

d. Work with the multidisciplinary team to develop and implement a SSI prevention programme based on evidence-based recommendations and a multimodal approach.

e. Integrate adaptive and technical improvement approaches for SSI prevention in the context of quality improvement projects.

Education and training

f. Develop or contribute to developing training resources, including strategies and plans for the prevention of SSI as they relate to the surgical patient journey and the various stages of the operations (pre-, intra- and postoperative periods).

g. Conduct or support training roll-out adapted to different audiences, including continuous education and the use of bedside training simulations and other practical approaches.

evaluation and management, including cleaning, dressing and care, hand hygiene performance according to the WHO "5 moments" with adaptations to wound care, etc.

5. Multimodal strategies* (including care "bundles"** and checklists) for the implementation of the WHO recommendations for SSI prevention, as well as their rationale, evidence basis and considerations related to the pre-, intra- and postoperative periods.
6. Approaches to maintain an aseptic environment in the operating room.
7. SSI surveillance methods, including the approach to collection, collation and analysis of SSI data for the purpose of quality improvement, and the related surveillance systems and informatics support tools required.
8. Methods for the decontamination and sterilization of surgical instruments and medical devices.

Leadership and implementation

9. The approach to a multidisciplinary collaboration to support SSI prevention involving the IPC and surgical teams, as well as wider hospital teams.

Communications and advocacy

10. Approaches to appropriate and effective communication about the problem of SSI and related surveillance and prevention strategies targeting different audiences across all levels (national, facility, unit).

Communications and advocacy

h. Develop and convey communication messages for all relevant staff, patients and their family on the importance of SSI, local data and prevention measures.
i. Collaborate with key stakeholders (for example, IPC and quality improvement teams, surgical staff, anesthesiologists, the sterile services department and pharmacy staff) via regular and open communications to advocate for practice improvements to reduce SSI and prevent patient harm, including identifying and working with champions.

Monitoring

j. Evaluate local risk factors, the epidemiology and burden of SSI.
k. Collect, understand and interpret SSI surveillance data in the context of overall health care-associated surveillance.
l. Adopt or develop and implement monitoring tools for compliance with recommended SSI prevention measures during the pre-, intra- and postoperative periods.
m. Identify barriers to compliance with recommended procedures.
n. Provide regular and timely feedback on infection rates and compliance with best practices to all relevant audiences and stakeholders, including user-friendly methods (for example, displaying data on the unit board).

***Multimodal implementation strategy:** A strategy consisting of several elements or components (three or more; usually five) implemented in an integrated way with the aim of improving an outcome and changing behaviour. It includes tools, such as bundles and checklists, developed by multidisciplinary teams that take into account local conditions. The five most common components include: (i) system change (that is, availability of the appropriate infrastructure and supplies to enable IPC best practices); (ii) education and training of health care workers and key players (for example, managers); (iii) monitoring infrastructures, practices, processes, outcomes and providing data feedback; (iv) reminders in the workplace/communications; and (v) culture change with the establishment or strengthening of a safety climate.

****Bundle:** An implementation tool aiming to improve the care process and patient outcomes in a structured manner. It comprises a small, straightforward set of evidence-based practices (generally three to five) that have been proven to improve patient outcomes when performed collectively and reliably.

Key resources

1. Improving infection prevention and control at the health facility: interim practical manual supporting implementation of the WHO guidelines on core components of

infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/279788, accessed 21 April 2020).
2. Infection prevention and control training package. Surgical site infection prevention. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020.)
3. Infection prevention and control training package. Standard precautions: decontamination and sterilization. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020.)
4. Global guidelines on the prevention of surgical site infection. Geneva: World Health Organization; 2016 (https://www.who.int/gpsc/ssi-prevention-guidelines/en/, accessed 21 April 2020).
5. Preventing surgical site infections: implementation approaches for evidence-based recommendations. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/bitstream/handle/10665/273154/9789241514385-eng.pdf?ua=1, accessed 21 April 2020).
6. Implementation manual to support the prevention of surgical site infections at the facility level – turning recommendations into practice. (Interim version). Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/publications/implementation-manual-prevention-surgical-site-infections.pdf?ua=1, accessed 21 April 2020).
7. Surgical site infection tools and resources. Geneva: World Health Organization (https://www.who.int/infection-prevention/tools/surgical/en/, accessed 21 April, 2020).
8. My 5 moments for hand hygiene: focus on caring for a patient with a postoperative wound. Geneva: World Health Organization; 2016 (https://www.who.int/gpsc/5may/5moments-EducationalPoster.pdf?ua=1, accessed 3 September 2020).
9. WHO multimodal improvement strategy. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1, accessed 2 September 2020).
10. Protocol for surgical site infection surveillance with a focus on settings with limited resources. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/surgical/evaluation_feedback/en/, accessed 9 September 2020).
11. Training video: preoperative surgical site skin preparation. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/surgical/training_education/en/, accessed 7 September 2020).
12. Training video: Surgical wound evaluation and dressing. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/surgical/training_education/en/, accessed 7 September 2020).

3.12 Prevention of health care-associated pneumonia

Area: Infection prevention and control (IPC) in clinical practice

Competence summary: Understand the epidemiology, risk factors and burden of health care-associated pneumonia (HAP), both not associated and associated with mechanical ventilation (ventilator-associated pneumonia [VAP]). Develop or adapt and implement evidence-based strategies and guidelines/standard operating procedures for HAP prevention. Develop or improve a surveillance/monitoring system to detect HAP and monitor compliance with preventive measures; review, interpret and use local data to inform preventive measures and provide regular and timely feedback on infection rates and compliance with best practices to all relevant audiences and stakeholders. Conduct or support training activities and develop and/or use effective communications to advocate for the prevention of HAP.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. Definitions and classification of VAP and HAP.
2. Epidemiology, risk factors, burden, clinical presentation and complications of HAP and VAP, worldwide, nationally, and locally, if data is available.
3. Causative microorganisms of VAP and HAP, as well as the risks associated with mechanical ventilation.
4. Decontamination techniques and the challenges of respiratory equipment such as ventilators, bronchoscopes and laryngoscopes.
5. Multimodal strategies* (including care "bundles"**, checklists and multidisciplinary collaboration) for the prevention of HAP, including the risks related to mechanical ventilation, with particular a focus on the following:
    a. hand hygiene performance, according to the WHO "5 moments" with adaptation to HAP and VAP prevention;
    b. appropriate oral care;
    c. patient early mobilization interventions (for example, post-surgical patients);
    d. elevation of the head of the bed to between 30 and 45 degrees;
    e. daily "sedation interruption" and daily assessment of readiness to extubate;
    f. peptic ulcer disease prophylaxis (unless contraindicated);
    g. deep venous thrombosis prophylaxis (unless contraindicated);
    h. appropriate procedures for cleaning and maintenance of ventilators and other respiratory patient care equipment and filter

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop or adapt evidence-based/informed (including international guidelines) national and/or facility policies and standard operating procedures related to the prevention of HAP and VAP.

Leadership and implementation

b. Identify existing gaps in practices and apply multimodal strategies for the prevention of HAP and VAP.

c. Establish or facilitate a multidisciplinary team (including, for example, IPC and quality improvement teams, intensivists, pulmonologists, anaesthetists and other teams) to develop plans for prevention in the local context.

Education and training

d. Develop or contribute to developing training resources, strategies and plans on measures and strategies for the prevention of HAP and VAP.

e. Conduct or support training rollout adapted to different audiences, including continuous education and the use of bedside training simulations and other practical approaches.

Communication and advocacy

f. Develop and convey communication messages for all relevant staff, patients and their family related to the importance of pneumonia, local data and prevention measures.

g. Collaborate with key stakeholders (IPC and quality improvement teams, intensive care and medical ward staff, anaesthetists and other teams) via regular and open

changes;

i. programmes for the prevention of nosocomial influenza and other viral acute respiratory infections;

j. minimize pooling of secretions above the endotracheal tube cuff.

Communications and advocacy

6. Approaches to appropriate and effective communication about the problem of pneumonia, including HAP and VAP data evidence, and related preventive strategies targeting different audiences across all levels (national, facility, unit).

Monitoring

7. Monitoring and evaluation methods for HAP and VAP surveillance and for assessing compliance with HAP and VAP prevention measures and other indicators.

communications to advocate for practice improvements to reduce HAP and VAP and prevent patient harm.

h. Work with the multidisciplinary team to develop and implement a prevention programme based on evidence-based recommendations and a multimodal approach.

Monitoring

i. Evaluate local risk factors, the epidemiology and burden of pneumonia.

j. Adopt or develop and implement monitoring tools for compliance with HAP and VAP prevention measures.

k. Collect, understand and interpret HAP and VAP surveillance data in the context of overall health care-infection surveillance.

l. Identify barriers to compliance with recommended procedures.

m. Provide regular and timely feedback on HAP and VAP rates and compliance with recommended preventive measures to all relevant audiences and stakeholders, including user-friendly methods (for example, displaying data on the unit board or providing results on smartphones).

***Multimodal implementation strategy:** A strategy consisting of several elements or components (three or more; usually five) implemented in an integrated way with the aim of improving an outcome and changing behaviour. It includes tools, such as bundles and checklists, developed by multidisciplinary teams that take into account local conditions. The five most common components include: (i) system change (that is, availability of the appropriate infrastructure and supplies to enable IPC best practices); (ii) education and training of health care workers and key players (for example, managers); (iii) monitoring infrastructures, practices, processes, outcomes and providing data feedback; (iv) reminders in the workplace/communications; and (v) culture change with the establishment or strengthening of a safety climate.

****Bundle:** An implementation tool aiming to improve the care process and patient outcomes in a structured manner. It comprises a small, straightforward set of evidence-based practices (generally three to five) that have been proven to improve patient outcomes when performed collectively and reliably.

Key resources

1. Infection prevention and control training package. Standard precautions: hand hygiene. Geneva: World Health Organization (https://openwho.org/courses/IPC-HH-en, accessed 7 September 2020.)
2. Infection prevention and control training package. Standard precautions: personal protective equipment. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
3. Infection prevention and control. Health-care associated infection surveillance. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
4. Klompas M, Branson R, Eichenwald EC, Greene LR, Howell MD, Lee G, et al. Strategies to prevent ventilator-associated pneumonia in acute care hospitals: 2014 update. Infect Control Hosp Epidemiol 2014;35(8): 915-36 (https://www.jstor.org/stable/10.1086/677144, accessed 4 September 2020).

5. WHO multimodal improvement strategy. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1, accessed 2 September 2020).
6. Improving infection prevention and control at the health facility: interim practical manual supporting implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/279788, accessed 21 April 2020).
7. Natural ventilation for infection control in health-care settings. Geneva: World Health Organization; 2009 (https://www.who.int/water_sanitation_health/publications/natural_ventilation/en/, accessed 2 September 2020).
8. Guidelines on tuberculosis infection prevention and control. 2019 update. Geneva: World Health Organization; 2019 (https://www.who.int/tb/publications/2019/guidelines-tuberculosis-infection-prevention-2019/en/, accessed 7 September 2020).
9. Szilagyi E. Prevention of lower respiratory tract infections. In: Friedman C, Newsom SWB, editors. IFIC basic concepts of infection control, 3rd edition. Craigavon (United Kingdom): International Federation of Infection Control; 2016 (https://www.theific.org/wp-content/uploads/2016/04/18-UTI_2016.pdf, accessed 7 September 2020).
10. Guideline for preventing healthcare-associated pneumonia. United States Centers for Disease Control and Prevention; 2003 (https://www.cdc.gov/infectioncontrol/guidelines/pneumonia/index.html, accessed 4 September 2020).
11. Infection prevention and control of epidemic-and pandemic prone acute respiratory infections in health care. Geneva: World Health Organization; 2014 (https://www.who.int/csr/bioriskreduction/infection_control/publication/en/, accessed 4 September 2020).
12. Decontamination and sterilization of medical devices module. Geneva: World Health Organization; 2020 (https://openwho.org/channels/ipc, accessed 2 September 2020).

3.13 Health care-associated outbreak prevention and management

Area: Infection prevention and control in clinical practice

Competence summary: Prevent, detect, manage and control health care-associated outbreaks. Conduct or support infection prevention and control (IPC) training activities and develop and/or use effective communications during outbreaks in health care facilities.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. Definitions and basic principles: levels of disease occurrence, definition of an outbreak, cluster and pseudo-outbreak; types of outbreaks, including health care-associated outbreaks and their possible sources.
2. International Health Regulations.
3. Concepts of preparedness and readiness to respond to outbreaks and the role of IPC programmes in reducing the risk of health care-associated outbreaks, including those due to antimicrobial resistance.

Leadership and implementation

4. Key steps for outbreak investigation and management in health care settings, including production of line lists and Gantt charts to correlate events.
5. Effective IPC measures to control transmission during a health care-associated outbreak.
6. The approach to a multidisciplinary collaboration between the IPC team and other stakeholders for preparedness and response to outbreaks.
7. Approaches to identify lessons learned from outbreak investigations to inform long-term IPC and quality improvement measures.

Communications and advocacy

8. Approaches to appropriate and effective communications during an outbreak, targeting different audiences, including the media.

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Develop or adapt evidence-based/informed (including international guidelines) national and/or facility policies and standard operating procedures related to the prevention, preparedness, response and control of health care-associated outbreaks, including those due to antimicrobial resistance.

Leadership and implementation

b. Collaborate with key stakeholders (for example, disaster management, local public health units) to ensure that the health care facility has the minimum requirements in place so as to be prepared to effectively recognize and respond to an infectious disease threat (for example, pandemics, emerging infections and bioterrorism), including planning and preparation, implementation, evaluation, communication, and keeping up-to-date with new recommendations and directives.

c. Investigate outbreaks using appropriate methods and interpretation of outbreak findings, in particular by:

- establishing the case definition;
- identifying the parameters of the investigation and the case-finding methodology;
- making hypotheses and identifying the source and mode of transmission;
- preparing and maintaining a line list and epidemic curve, and calculating the attack rate and case fatality ratio.

d. Effectively manage health care-associated outbreaks by identifying, implementing, evaluating and updating outbreak management strategies with a focus on IPC measures.

e. Work closely with relevant departments (for example, microbiology laboratory, occupational health and safety, laboratory, patient care units) to identify outbreaks affecting patients and/or staff and ensure a timely and effective exchange of information.

Education and training

f. Develop or contribute to developing training resources, strategies and plans related to

9. Key messages to advocate for IPC as a pillar of outbreak preparedness, response and control.

IPC measures and minimum requirements to prevent, detect, manage and control outbreaks in health care facilities.

g. Conduct or support training roll-out adapted to different audiences, including practical approaches and case studies, and ensuring continuous education.

Communications and advocacy

h. Communicate in a timely and effective manner with internal and external stakeholders (for example, laboratory, local public health units, operations, health care workers, medical leaders, as well as the media) regarding the existence and characteristics of the outbreak as well as actions for contact tracing and IPC measures.

Monitoring

i. Contribute to analyzing the outbreak data in order to understand the modes of transmission and the possible source and to assess the impact of the control measures implemented, including future measures for improvement and prevention.

j. Organize and lead outbreak data and debrief sessions with different stakeholders and the broader scientific community to summarize the main findings of the outbreak, measures implemented, and lessons learned (for example, ward rounds, internal reports, conference abstracts; publications in scientific journals).

Key resources

1. Improving infection prevention and control at the health facility: interim practical manual supporting implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/facility-manual.pdf?ua=1, accessed 22 April 2020).
2. Minimum requirements for infection prevention and control (IPC) programmes. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/, accessed 22 April 2020).
3. Disease outbreak toolboxes. Geneva: World Health Organization; 2020 (https://www.who.int/emergencies/outbreak-toolkit/disease-outbreak-toolboxes#cletter, accessed 22 April 2020).
4. Infection prevention and control training package - outbreak Investigation. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/course/247, accessed 7 September 2020).
5. WHO multimodal improvement strategy. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1, accessed 2 September 2020).
6. Infection prevention and control of epidemic-and pandemic prone acute respiratory infections in health care. Geneva: World Health Organization; 2014 (https://www.who.int/csr/bioriskreduction/infection_control/publication/en/, accessed 4 September 2020).
7. Prevention strategies for seasonal influenza in healthcare settings. United States Centers for Disease Control and Prevention; 2018 (https://www.cdc.gov/flu/professionals/infectioncontrol/healthcaresettings.htm, accessed 4 September 2020).

8. Influenza. Pandemic preparedness. Geneva: World Health Organization (https://www.who.int/influenza/preparedness/pandemic/en/, accessed 4 September 2020).
9. Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, Acinetobacter baumannii and Pseudomonas aeruginosa in health care facilities. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/guidelines-cre/en/, accessed 4 September 2020).
10. Implementation manual of the WHO recommendations on prevention and control of carbapenem-resistant organisms. Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/bitstream/handle/10665/312226/WHO-UHC-SDS-2019.6-eng.pdf?ua=1, accessed 22 April 2020).
11. Emergencies, preparedness, response. Infection prevention and control in health care for preparedness and response to outbreaks. Geneva: World Health Organization; 2020 (https://www.who.int/csr/bioriskreduction/infection_control/publications/en/, accessed 4 September 2020).
12. Rasslan O. Outbreak management. In: Friedman C, Newsom SWB, editors. IFIC basic concepts of infection control, 3rd edition. Craigavon (United Kingdom): International Federation of Infection Control; 2016 (https://www.theific.org/wp-content/uploads/2016/04/5-Outbreak_2016.pdf, accessed 3 September 2020).
13. Healthcare-associated infections. Outbreak investigations in healthcare settings. United States Centers for Disease Control and Prevention (https://www.cdc.gov/hai/outbreaks/index.html, accessed 4 September 2020).

3.14 Infection prevention and control education and training

Area: Education

Competence summary: Develop infection prevention and control (IPC) education and training resources based on the priority topics identified in the WHO guidelines on core components of IPC programmes at the national and acute health care facility levels (see core component three, in particular). Develop strategies and plans for IPC pre- and postgraduate and in-service training at the national, sub-national and facility level, as appropriate, including strategies and tools for evaluation of the effectiveness of training programmes. Implement training for the different levels of trainees or health workers, as well as for patients and their families and visitors, using adult learning principles and different educational methods.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

General principles

1. Principles and methods of adult education and learning including team- and task-based strategies that are participatory, including bedside and simulation training.
2. Principles of instructional design (for example, education programmes/lesson planning, analysis of learning needs, teaching strategies, evaluation of learning).
3. Roles and processes related to coaching, mentoring, consulting and preceptorship.
4. The role of education in translating evidence into practice and promoting behavioural change.
5. Means of identifying training needs and evaluating knowledge transfer.
6. The role of training and education in multimodal IPC strategies.
7. Priority IPC domains/topics to be included in training and education programmes according to the target audience and context.
8. Best informatics resources/tools available to support effective delivery of IPC training.
9. Methods to evaluate the effectiveness and impact of training programmes.

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and programmes

- **a.** Develop or adapt IPC training programmes including pre- and postgraduate and in-service training, depending on local needs, with curricula for all relevant target audiences, including at least (but not limited to) all health care workers involved in service delivery and patient care, other personnel that supports health service delivery (for example, cleaners), and IPC professionals.
- **b.** Design a comprehensive strategy to provide appropriate IPC education to patients, family members, visitors and others included in the caregiving network.

Leadership and implementation

- **c.** Identify different learners' needs; develop objectives that align with intended learning outcomes to meet identified needs and organizational objectives.
- **d.** Effectively implement planned training activities in a flexible and creative approach to meet learner needs and planned objectives in a variety of learning contexts (for example, group or individual, classroom or unit, online) using different methods (for example, participatory team- and task-based approaches and bedside and simulation training).
- **e.** Support continuous education, including for health worker orientation/new hires.
- **f.** Deliver rapid training refresher courses in the case of change of policies and/or in special situations, such as during the response to outbreaks and emergencies.
- **g.** Collaborate with other departments and stakeholders to coordinate and provide IPC training and promotional messages (and signage).
- **h.** Use facilitation and mentorship skills to promote learning, problem-solving and behavioural change.

Communications and advocacy

i. Develop workplace reminders associated with IPC training and communications and key messages to advocate for support for educational activities.

Monitoring

j. Assess the implementation of the WHO recommendations and minimum requirements for IPC training and education at the national and/or facility level (ideally by using WHO standardized tools).

k. Evaluate the effectiveness of teaching processes and learning outcomes and use results for planning new or revised education modules to improve the knowledge, skills and competence of the workforce.

l. Effectively report on education provided, including relevant outcomes and recommendations for follow-up; describe the steps for updating training resources and providing continuing education and training over the short-, medium- and long-term.

m. Self-reflect and use methods to be assessed on strengths and limitations as an educator, and develop strategies for strengthening own knowledge, skills and practices.

Key resources

1. Core components for IPC. Implementation tools and resources. IPC training. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 22 April 2020).
2. Infection prevention and control training package. E-learning modules. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 22 April 2020).
3. Infection prevention and control training package. OpenWHO. Geneva: World Health Organization (https://openwho.org/channels/ipc, accessed 22 April 2020).
4. Focus on AMR - tools and resources. IPC training: IPC to combat AMR in health care settings. Geneva: World Health Organization (https://www.who.int/infection-prevention/tools/focus-amr/en/, accessed 22 April 2020).
5. Injection safety tools and resources. Tools for training and education. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/tools/injections/training-education/en/, accessed 22 April 2020).
6. Hand hygiene. Tools for training and education. Geneva: World Health Organization (https://www.who.int/infection-prevention/tools/hand-hygiene/training_education/en/, accessed 22 April 2020).
7. Implementation manual to support the prevention of surgical site infections at the facility level – turning recommendations into practice. (Interim version). Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/surgical/en/, accessed 22 April 2020).
8. Disease outbreak toolboxes. Geneva: World Health Organization; 2020 (https://www.who.int/emergencies/outbreak-toolkit/disease-outbreak-toolboxes#cletter, accessed 22 April 2020).
9. Interim practical manual supporting national implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva:

World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/facility-manual.pdf?ua=1, accessed 22 April 2020).

10. 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://www.who.int/infection-prevention/publications/ipc-components-guidelines/en/, accessed 20 April 2020).
11. Minimum requirements for infection prevention and control (IPC) programmes. Geneva: World Health Organization; 2019 (https://www.who.int/infection-prevention/publications/min-req-IPC-manual/en/, accessed 20 April 2020).
12. Improving infection prevention and control at the health facility: interim practical manual supporting implementation of the WHO guidelines on core components of infection prevention and control programmes. Geneva: World Health Organization; 2018 (https://apps.who.int/iris/handle/10665/279788, accessed 21 April 2020).
13. WHO multimodal improvement strategy. Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1, accessed 2 September 2020).
14. Infection prevention and control assessment framework (IPCAF) at the facility level. Geneva: World Health Organization; 2018 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
15. Core components for infection prevention and control programmes national level assessment tool (IPCAT2). Geneva: World Health Organization; 2017 (https://www.who.int/infection-prevention/tools/core-components/en/, accessed 20 April 2020).
16. Guide to implementation: A guide to the Implementation of the WHO Multimodal Hand Hygiene Improvement Strategy. Geneva: World Health Organization; 2009 (https://www.who.int/gpsc/5may/Guide_to_Implementation.pdf?ua=1, accessed 2 September 2020).

3.15 Quality and patient safety

Area: Quality, patient safety and occupational health

Competence summary: Contribute to designing, developing, implementing and evaluating quality improvement and patient safety programmes. Use multimodal strategies in the context of quality improvement and patient safety programmes to create structured change and translate infection prevention and control (IPC) standards into practice. Contribute to training and education in the fields of quality of care and patient safety. Contribute to linkages between IPC and national strategic direction on quality.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

General principles

1. Definitions of quality and patient safety as defined by WHO, according to expert consensus and scientific evidence.
2. Epidemiology, risk factors and burden and causes of adverse events, near-misses, accidents, and dangerous incidents in health care.
3. Concepts of health systems' organization and complexity of care delivery, organizational and safety culture, behavioural change, human factors, quality improvement and patient safety, and how these relate to each other and to IPC.
4. Key concepts and processes for identifying, investigating and managing sentinel and adverse events and other safety risks to patients and staff.
5. Key concepts related to national strategic direction on quality and the role of IPC within this context.

Implementation

6. Quality assurance and improvement programmes, including commonly-used methods (for example, 'Plan-Do-Study-Act', 'Failure mode and effects analysis', root cause analysis) to promote the collection of IPC indicators and use of data to drive improvement.
7. National, sub-national and organizational quality and patient safety standards and initiatives, including interventions to shape the system environment, reduce harm, improve clinical care, and engage patients, families and communities.

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

General principles

a. Demonstrate an understanding of the key principles of quality and patient safety and of the epidemiology, risk factors' burden and causes of adverse events, near-misses, accidents and dangerous incidents in health care.
b. Develop or adapt evidence-based/informed resources and tools to improve the institutional safety climate and quality of care in the context of IPC multimodal strategies.

Leadership and implementation

c. Contribute to design quality improvement projects according to gaps identified in IPC.
d. Implement interventions to improve the institutional safety climate and quality of care in the context of IPC multimodal strategies.
e. Provide expertise to other departments on quality improvement issues related to IPC (for example, environmental monitoring and system changes).
f. Engage and liaise with facility leadership to shape service planning that prioritizes IPC and quality (noting that these require system change and not just individual actions).
g. Collaborate with stakeholders, including communities, to identify, prevent or mitigate potential patient safety risks related to IPC.
h. Include antimicrobial resistance, water, sanitation and hygiene and patient safety as integral parts of IPC quality improvement.
i. Contribute to the integration of IPC activities within the health care organization's quality and patient safety programmes.

Education and training

j. Contribute to develop resources for and deliver training on quality of care and patient safety.
k. Demonstrate and share learning from practical efforts on quality improvement related to IPC to enhance sustained practice-based learning.

8. Most effective quality improvement approaches to support the implementation of IPC and water, sanitation and hygiene practices contributing to improving quality of care.
9. Concepts and systems related to the engagement of patients, families and communities in health care.

Monitoring

10. Approaches to adverse events documentation and reporting, data analysis and interpretation, and feedback and learning, including integration with health care-associated infection surveillance and IPC indicator monitoring systems.
11. Methods and systems for internal or external evaluation of the implementation of quality and patient safety standards, including accreditation of health care facilities and licensing of health care personnel.

Communications and advocacy

l. Effectively communicate, manage and escalate appropriately any risks that are identified.
m. Engage with patients, families and communities to understand their needs and ensure their active participation in IPC programmes to gain compliance with hand hygiene, standard and transmission-based precautions, and other measures as needed.
n. Advocate and enable integration of risk management concepts (such as rapid reporting of adverse events or errors without sanctions) and methods (such as systemic analysis, for example, root causes of adverse events) in IPC activities within the health care organization.

Monitoring

o. Advise on IPC indicators to be included in quality and patient safety assessment tools and systems.
p. Contribute to conducting an assessment of services using quality and patient safety standards to identify and learn from gaps to enhance performance.
q. Contribute to provide clinical audit and feedback in the context of quality improvement projects, including the dissemination and spread of successful interventions.
r. Understand how to select and interpret quality indicators and use them to drive improvements in IPC and quality of care.
s. Actively participate in external evaluations, including accreditation, certification and normalization processes, and develop action plans to meet standards and required organizational practices for IPC.

Key resources

1. A compendium of tools and resources for improving the quality of health services. Geneva: World Health Organization; 2019 (https://www.who.int/servicedeliverysafety/compendium-tools-resources/en/, accessed 22 April 2020).
2. Cleghorn GD, Headrick L. The PDSA cycle at the core of learning in health profession education. Jt Comm J Qual Improv. 1996; 22(3):206–12 (https://www.ncbi.nlm.nih.gov/pubmed/8664953, accessed 22 April 2020).
3. McDermott RE, Mikulak RJ, Beauregard MR. The basics of FMEA, 3rd ed. New York: CRC Press; 2009 (https://psnet.ahrq.gov/issue/failure-mode-and-effects-analysis-health-care-proactive-risk-reduction-third-edition, accessed 22 April 2020).
4. Root cause analysis. Washington, DC; United States Department of Veterans Affairs National Center for Patient Safety; 2010 (https://www.patientsafety.va.gov/professionals/onthejob/rca.asp, accessed 22 April 2020).
5. WHO patient safety curriculum guide: multi-professional edition. Geneva: World Health Organization; 2011 (https://apps.who.int/iris/handle/10665/44641 accessed 22 April 2020).
6. Prevention and control of infections (PCI). In: Joint Commission International Accreditation Standards for Hospitals. 6th edition. 2017;191-206 (http://www.tsrt.or.th/a/wp-content/uploads/2019/05/1-Chamaree-EXT-STD-JCI-10-1-July-2017-1.pdf, accessed 8 September 2020).

3.16 Occupational health

Area: Quality, patient safety and occupational health

Competence summary: Understand the infectious risks related to employment and support the implementation of appropriate preventive measures; monitor and investigate infectious diseases; assist in the provision of a safe working environment for staff to provide a safe environment and healthy work force.

To achieve this competence, an IPC professional needs to demonstrate updated and evidence-based *knowledge* of the following:

Policy and guidance

1. Transmission, preventive measures and management of health workers (HW) exposure to infectious agents in the health care setting:
   a. bloodborne pathogens such as human immunodeficiency virus/acquired immunodeficiency syndrome, hepatitis B, hepatitis C, viral hemorrhagic fevers (Ebola, Lassa fever, etc.);
   b. influenza: seasonal, pandemic, avian, swine, and Influenza-like diseases;
   c. multidrug-resistant organisms (for example, methicillin-resistant Staphylococcus aureus);
   d. tuberculosis, meningitis, norovirus/rotavirus;
   e. coronaviruses (severe acute respiratory syndrome coronavirus 1, Middle East respiratory syndrome coronavirus, and severe acute respiratory syndrome coronavirus 2);
   f. vaccine-preventable diseases: measles, rubella, mumps, tetanus.
2. Occupational health measures that ensure staff protection such as:
   a. barrier protection--personal protective equipment, respiratory protection;
   b. injection safety best practices and sharps injury prevention;
   c. immunization as the first and crucial step to protect staff against influenza, hepatitis, and other vaccine-preventable diseases, its potentially serious complications, and the prevention of nosocomial spread to patients;
   d. work restriction for HWs exposed to or infected with an infectious disease of importance in health care settings;

To achieve this competence, an IPC professional needs to demonstrate the *ability* to successfully undertake or contribute to the following:

Policy and guidance

a. Contribute to develop or adapt evidence-based/informed policies and standard operating procedures related to occupational health measures and practices that protect HWs from acquiring infection and prevent HWs from transmitting an infection to a patient.

Leadership and implementation

b. Collaborate with occupational health professionals regarding counselling, follow-up, and work restriction recommendations related to communicable diseases and/or exposures.

c. Support the implementation of HW protection measures in the context of standard and transmission-based precautions using multimodal strategies (in particular, hand hygiene and injection safety).

d. Provide the steps for occupational exposure management, in particular, sharps injury and blood or body fluid exposure incidents.

Communications and advocacy

e. Advocate for all HWs to take part in institutional immunization programmes (for example, seasonal flu vaccine) to prevent the spread of infections among them and to patients, according to national and international recommendations.

Training and education

f. Contribute to develop training resources, strategies and plans for training and education of HWs regarding occupational health measures and practices that protect HWs (for example, post- exposure prophylaxis) and nosocomial transmission to patients (for example, immunization programmes).

Monitoring

g. Contribute to the development or the improvement of a system for assessing and managing the risk of occupational exposure to infectious diseases.

e. engineering controls (for example, ventilation and environmental cleaning.

3. Roles and responsibilities with respect to occupational health and safety in the organization.
4. Key steps for the management and follow-up of HWs infected with different infectious agents,including work absence, restrictions and return policies and guidelines.

h. Collaborate with occupational health professionals to evaluate local data on infections in HWs and provide recommendations on tailored surveillance, feedback and prevention strategies.
i. Collaborate with occupational health and safety staff to investigate and recommend appropriate actions if a HW has been exposed or potentially exposed to an infectious agent (for example, from another HW or a patient) or is ill with a communicable disease or infection, including steps for prevention of a repeat occurrence.

Key resources

1. Workplace safety and health for healthcare workers. United States Centers for Disease Control and Prevention. The National Institute of Occupational Safety and Health (NIOSH); 2017 (https://www.cdc.gov/niosh/topics/healthcare/infectious.html, accessed 20 April 2020).
2. Immunization of healthcare workers: Recommendation of the Advisory Committee on Immunization Practices (ACIP). Advisory Committee on Immunization Practices. United States Centers for Disease Control and Prevention; 2011 (https://www.cdc.gov/vaccines/hcp/acip-recs/index.html, accessed 6 September 2020).
3. Occupational safety and health in public health emergencies: a manual for protecting health workers and responders. Geneva: World Health Organization; 2018 (https://www.who.int/publications-detail/occupational-safety-and-health-in-public-health-emergencies-a-manual-for-protecting-health-workers-and-responders, accessed 25 August 2020).
4. Workload indicators of staffing need (WISN). Geneva: World Health Organization; 2015 (https://www.who.int/hrh/resources/wisn_user_manual/en/, accessed 2 September 2020).
5. Infection prevention and control. Injection safety tools and resources. Geneva: World Health Organization; 2020 (https://openwho.org/channels/ipc, accessed 20 April 2020).
6. Infection prevention and control training package. Standard precautions: Injection safety. World Health Organization; United States Centers for Disease Control and Prevention; University of Washington Global Health E-Learning Program (https://ipc.ghelearning.org/courses, accessed 20 April 2020).
7. Occupational health. Health workers. Geneva: World Health Organization (https://www.who.int/occupational_health/topics/hcworkers/en/, accessed 2 September 2020).

Annex

Inventory of existing documents on infection prevention and control competencies

To inform the development of the WHO "Core competencies for infection prevention and control (IPC) professionals", an inventory of existing or publicly-available documents on IPC competencies was performed through a desk search and a survey targeting the members of the WHO Global IPC Network (GIPCN). Of the 14 responses from GIPCN members, nine IPC competence framework documents and competency-based education programmes were received and represented input from all six WHO regions *(1-9)*. Three duplicated competency frameworks and one short course were not retained and the remaining documents were further reviewed. A review of the five documents revealed similar structure, such as in areas of IPC principles, competency statements (knowledge, skills, and attitudes), intended users and indications for use and these were selected as references for this document *(1-5)*.
The five frameworks described in the Table below are from Infection Prevention and Control Canada (IPAC), Massaroli A. et al (Brazil), European Centers for Disease Prevention and Control (ECDC), Association for Professionals in Infection Control and Epidemiology (APIC; United States of America), and the Infection Control African Network (ICAN).
Each competency area/domain includes a set of competency statements related to knowledge (of) and ability (to).

ORGANIZATIONS	AREAS	DOMAINS (Competencies)	COMPETENCY LEVELS	TARGET AUDIENCE/ INDICATION FOR USE
IPAC Canada *(1)* Numbers in brackets represent the number of knowledge and ability competency statements per domain.	Foundational core competencies	1. Education (5/12) 2. Microbiology (8/3) 3. Routine practices and additional precautions (8/7) 4. Surveillance and epidemiology (2/13) 5. Research utilization (2/10)	None	IPC professionals and their managers to guide performance appraisal and related professional development activities, as well as training programmes and educational offerings.
	Applied core competencies	1. Health care facility design, construction, renovation and maintenance (2/6) 2. Occupational health and safety (3/5) 3. Outbreaks and infectious disease threats (3/9) 4. Quality improvement and patient safety (3/8) 5. Reprocessing of medical devices (9/6)		

ORGANIZATIONS	AREAS	DOMAINS (Competencies)	COMPETENCY LEVELS	TARGET AUDIENCE/ INDICATION FOR USE
	Supporting core competencies	1. Communication (4/8) 2. Leadership (2/8) 3. Management (3/7) 4. Professionalism (2/6)		
Massaroli A, et al, Brazil *(2)* Numbers in brackets represent the number of knowledge and ability competency statements per domain.	None	1. Core competencies for both levels (4/9) 2. Generic competencies (13/50) 3. Specific competencies (17/51)	Two: 1. generalist 2. specialist	Skills for generalist and specialist nurses working in the domain of IPC
ECDC *(3)* Numbers in brackets represent the number of competency statements for junior and senior levels, respectively.	Programme management	1. Elaborating and advocating an infection control programme (7/7) 2. Management of an infection control programme, work plan and projects (18/20)	Two: 1. junior 2. senior	1. Competencies for a junior specialist – introductory level • Newly appointed IPC professional with little or no previous experience 2. Competencies for a senior specialist – expert level • IPC professional who is confident and experienced; who reasoning, critical thinking, reflection and analysis to inform his/her assessment and decision-making; and is able to develop and implement new solutions to problems
	Quality improvement	1. Contributing to quality management (4/4) 2. Contributing to risk management (2/2) 3. Performing audits of professional practices and evaluating performance (9/9)		

ORGANIZATIONS	AREAS	DOMAINS (Competencies)	COMPETENCY LEVELS	TARGET AUDIENCE/ INDICATION FOR USE
		4. Infection control training of employees (5/5) 5. Contributing to research (2/2)		
	Surveillance and investigation of health care-associated infections	1. Designing a surveillance system (8/8) 2. Managing (implementation, follow-up, evaluation) a surveillance system (9/9) 3. Identifying, investigating and managing outbreaks (7/7)		
	Infection control activities	1. Elaborating infection control interventions (12/12) 2. Implementing infection control health care procedures (5/5) 3. Contributing to reducing antimicrobial resistance (8/8) 4. Advising appropriate laboratory testing and use of laboratory data (3/3) 5. Decontamination and sterilization of medical devices (4/4) 6. Controlling environmental sources of infections (2/2)		
APIC (APIC Competency Model for the Infection Preventionist includes the United States Certification Board for Infection Control core competencies and the APIC Professional and Practice Standards. These foundation documents and elements reside on the outermost circle of the updated	None	Identification of infectious disease processes (5) Surveillance and epidemiological investigation (30) Preventing/controlling the transmission of infectious agents (17) Employee/occupational health (5) Management and communication (16)	Five levels: 1. novice knowledge/skills 2. approaching proficiency 3. fully proficient 4. approaching advanced 5. advanced/expert	Competency self-assessment and professional development plan for proficient and advanced infection preventionists.

ORGANIZATIONS	AREAS	DOMAINS (Competencies)	COMPETENCY LEVELS	TARGET AUDIENCE/ INDICATION FOR USE
model, indicating how they support IPC professional development.) *(4)* Numbers in brackets represent the number of knowledge and ability competency statements per domain.		Education and research (9) Care environment (5) Cleaning, sterilization, disinfection, asepsis (3)		
ICAN *(5)* Numbers in brackets represent the number of knowledge and ability competency statements per domain.	None	Basic microbiology and introduction to antimicrobial resistance (9/23) Attitude: Promote IPC practices that reduce transmission and antimicrobial resistance, awareness of health care-associated infections, transmission relating to antimicrobial resistance and appropriate antimicrobial use among all health care workers, patient communities and the public. Act to protect the effectiveness of antimicrobials as an ethical imperative and a public good. Preventative strategies (4/10) Surveillance (2/14) Attitude: Link with other teams, know dissemination, act on feedback. Research methodology (2/2) Leadership and engaging management (3/11) Attitude: Support production of guidelines relevant to IPC.	None	Newly-appointed IPC practitioners or any health care worker or scientist interested in the field of IPC.

ORGANIZATIONS	AREAS	DOMAINS (Competencies)	COMPETENCY LEVELS	TARGET AUDIENCE/ INDICATION FOR USE
		Sterile supply services/ department (2/10) Built environment (2/5)		

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2. Martini JG, Medina Moya JL, Pereira MS, Ferreira Veiga Tipple A, Maestri E. Skills for generalist and specialist nurses working in the prevention and control of infections in Brazil. Rev. Latino-Am. Enfermagem. 2019; 27 e3134. DOI: 10.1590/1518-8345.2620.3134.
3. Core competencies for infection control and hospital hygiene professionals in the European Union. Stockholm: European Centre for Disease Prevention and Control; 2013 (https://www.ecdc.europa.eu/en/publications-data/core-competencies-infection-control-and-hospital-hygiene-professionals-european, accessed 24 April 2020).
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5. Infection Control African Network (ICAN). Fundamentals in Infection Prevention and Control. Certificate of Competence; 2020 (http://www.icanetwork.co.za/fundamentals-in-infection-prevention-and-control/, accessed 24 April 2020).
6. The European Committee on Infection Control (EUCIC) Infection Prevention and Control Certificate 2020-2022. European Training Programme. European Society of Clinical Microbioloy and Infectious Diseases; 2020 (https://www.escmid.org/eucic/eucictraining_programme/, accessed 24 April 2020).
7. European Network to Promote Infection Prevention for Patient Safety. UK Competences for Practitioners in Infection Prevention and Control; 2018 (http://www.eunetips.eu/fileadmin/pdf/2018_IFIC/IFIC-O-CONNOR.pdf, accessed 24 April 2020).
8. Société française d'Hygiène Hospitalière (SF2H). Referentiel metier et competences. Les spécialistes en hygiène, prévention et contrôle de l'infection en milieu de soins. Edition 2018 (https://www.sf2h.net/wp-content/uploads/2018/03/Référentiel_Métier_DEF_05.04_2018.pdf, accessed 24 April 2020).
9. Columbia University Mailman School of Public Health. Sierra Leone: National IPC certification course project; 2020 (https://icap.columbia.edu/where-we-work/sierra-leone/, accessed 24 April 2020).


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