Advanced Infection Prevention and Control Training

Infection prevention and control (IPC) to combat antimicrobial resistance (AMR) in health care settings: trainer's guide

Outline of the module

The "IPC to combat AMR in health care settings" advanced training module is part of a broader IPC training package targeting individuals and teams in IPC who work or intend to work as IPC focal points. In particular, this module is designed to support implementation of the WHO guidelines on core components of infection prevention and control programmes at the national and acute health care facility level and guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in health care facilities.[1] It introduces recommended best practices and a multimodal approach for successful implementation and improvement.

Trainees are expected to possess at least basic experience and competence in IPC. They could include IPC professionals, IPC hospital teams, facility administrators, hospital epidemiologists, microbiologists and other relevant health care professionals, among others.

Learning objectives of the module

The module aims to equip the IPC focal point to:

- describe the principles of microbiology, mechanisms of antibiotic resistance and methods of laboratory detection and testing;
- list important antibiotic-resistant bacteria including Gram-positive and Gram-negative bacteria, and note key differences;
- explain why the spread of antibiotic resistance is a major threat in all health care facilities worldwide and why urgent action is needed;
- explain factors contributing to emergence and spread of antibiotic-resistant bacteria between health care facilities and communities;

[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/); 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/infection-prevention/publications/guidelines-cre/en/).

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- describe evidence-based IPC practices to prevent and control the spread of antibiotic resistance and a multimodal approach for stepwise implementation;
- describe key IPC implementation strategies, including considerations of behaviour change, and the application of multimodal strategies and campaigning.

Overview

This module is to be delivered as a one-day training package. It comprises a blend of PowerPoint slides, audiovisual material and a student handbook. The training is divided into three sessions:

Session 1: introduction to antibiotic-resistant bacteria in health care settings (60 minutes);

Session 2: overview of the threat caused by health care-associated infections and antibiotic resistance (90 minutes);

Session 3: evidence-based IPC strategies to combat antibiotic resistance (3 hours).

Materials needed

All materials should be collected and the publications listed should be reviewed prior to starting the training:

- PowerPoint slide deck;
- trainer's guide;
- student handbooks (these include handouts and group work instructions);
- laptop and data projector capable of playing video and audio;
- flipcharts and markers;
- paper and pens for students to use during group work;
- WHO guidelines on core components of IPC programmes at the national and acute health care facility level (including two-page summary) (available to download from: http://www.who.int/infection-prevention/tools/core-components/en/);
- WHO practical manuals to support implementation of the core components, (available to download from: http://www.who.int/infection-prevention/tools/core-components/en/);
- WHO tools to assess the level of progress in core component implementation at the national and facility level (available to download from: http://www.who.int/infection-prevention/tools/core-components/en/);
- Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in health care facilities (available to download from: http://www.who.int/infection-prevention/publications/guidelines-cre/en);

- Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level (available to download from: https://www.who.int/infection-prevention/tools/focus-amr/en/)
- WHO hand hygiene self-assessment framework (available to download from: http://www.who.int/infection-prevention/publications/hand-hygiene-2009/en/);
- Guide to local production: WHO-recommended handrub formulations (available to download from: http://www.who.int/gpsc/5may/Guide_to_Local_Production.pdf?ua=1);
- Centers for Disease Control and Prevention (CDC) 2007 guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings (available to download from: https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines.pdf);
- Best practices for environmental cleaning in healthcare facilities in resource-limited settings (available to download from: https://www.cdc.gov/hai/prevent/resource-limited/environmental-cleaning.html);
- Antimicrobial stewardship programmes in health care facilities in low- and middle-income countries. A WHO practical toolkit (available to download from: https://apps.who.int/iris/bitstream/handle/10665/329404/9789241515481-eng.pdf).

Evaluation

The same pre- and post-training test (Annex 1) will be distributed to attendees at the beginning and end of this module to help gauge their knowledge of AMR prevention.

Pre-test evaluation will develop a baseline score by measuring existing knowledge and knowledge gaps. Post-test evaluation will assess the knowledge gained through the module. A score of 85% or higher on the post-test evaluation indicates knowledge-based mastery of the training material. For students scoring less than 85%, the facilitator should review the results with the student individually and provide guidance accordingly. Successful completion of the course is based on mastery of both the content and IPC practice/skill components.

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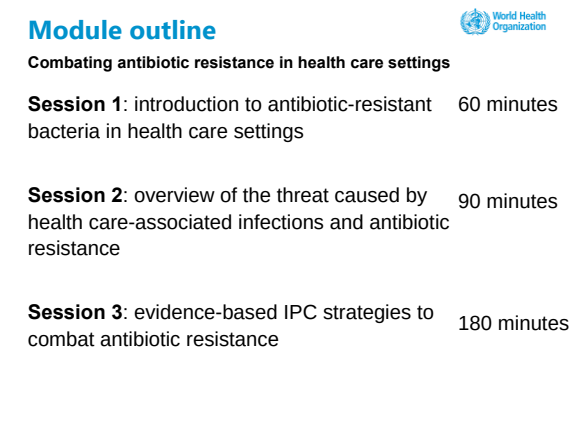
Details of presentation slides, with resources for the trainer

The table below sets out the module's sessions and lists the associated resources for the trainer. The last column in the table provides the trainer with preparatory pre-reading resources, information for further reading if needed at any point and/or key references to direct the students to do further reading offline.

Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
1		**Introduce** yourself and **welcome** the attendees to the module. If there are any safety/administrative announcements, **make** them now.	–
2		**Read** the slide. **Give** a 1–2-minute overview of the whole module.	–

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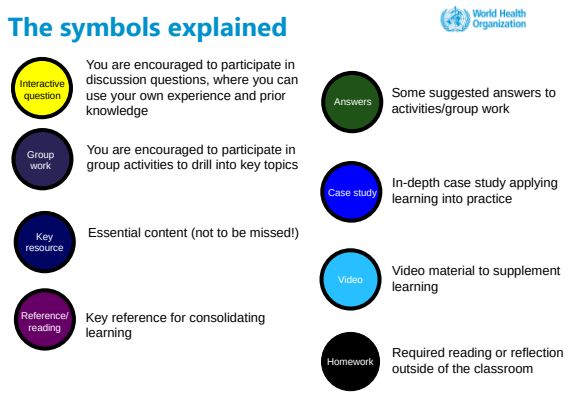
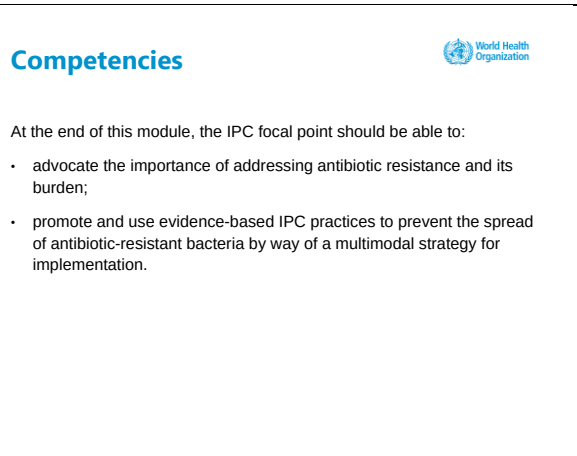
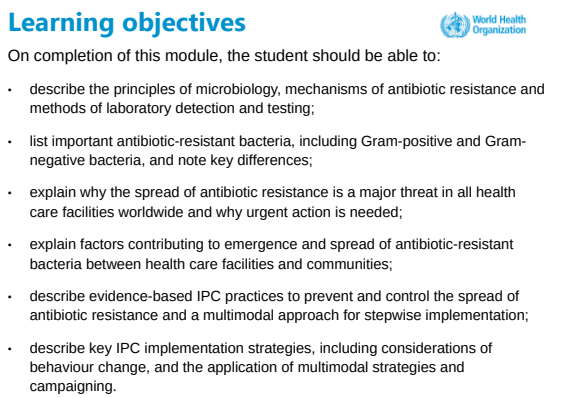
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
3		**Read** the explanations from the screen.	–
4		**Read** the slide. **Emphasize** that these are the learning outcomes that the attendees will attain through completion of this module.	–
5		**Read** the slide. **Emphasize** that these objectives are the knowledge and skills that the attendees will be able to demonstrate on completion of the module. **Ice breaker** • At this point **ask** the attendees to introduce themselves to the person next to them and share with them one fact about why they are interested in IPC. • **Allow** 2–3 minutes for the exchange of information. • Then **allow** 10 minutes for rapid sharing of information learned during the exercise. Go around the room, asking each person to tell us the name and the fact about their partner.	–

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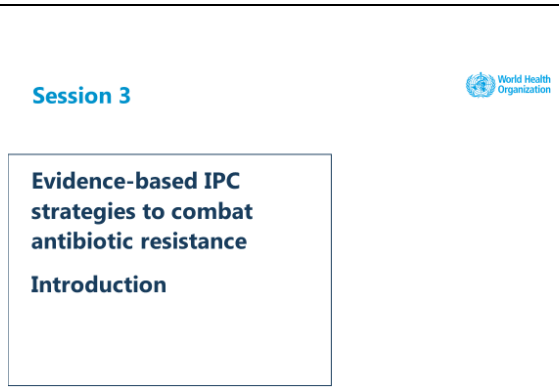
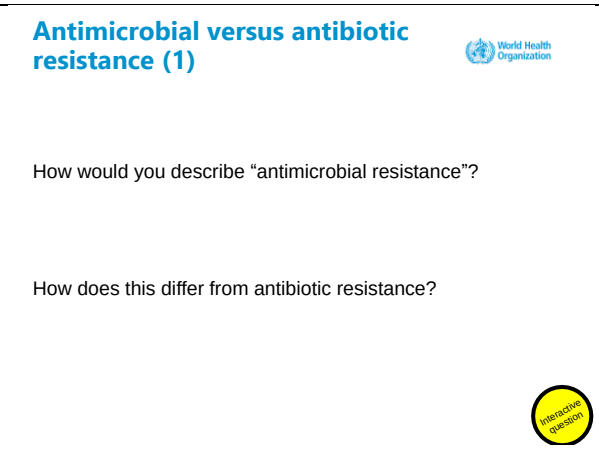
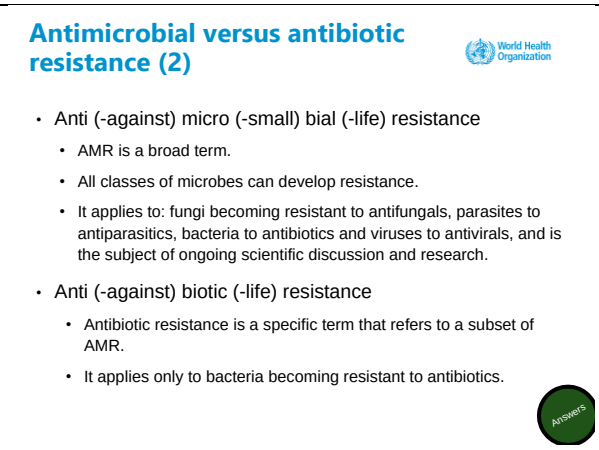
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
6		**State** that the first session is the introduction to antibiotic-resistant bacteria. **Explain** that it consists of two parts. **Say:** "We start with part A: basic principles of AMR, followed by part B: types of antibiotic resistance."	–
7		**Say:** "It's time to tackle the terminology to make sure we all understand the basics." **Pose** the slide questions, one at a time. **Moderate** the discussion as a group. **Allow** 5 minutes for this activity.	Flipchart and markers, in case notes are needed
8		**Read** the slide or **ask** a participant to read it. **Talk** through/**read** the bullet points.	–

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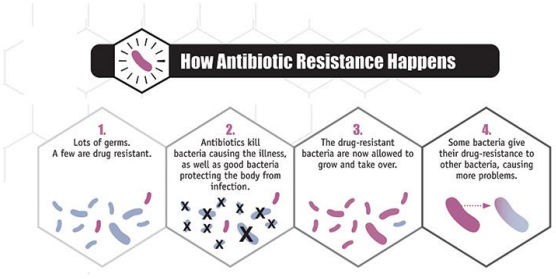
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
9	**Antimicrobial versus antibiotic resistance (3)** World Health Organization • In general, resistance develops when microorganisms adapt and grow in the presence of the substance used "against" them (= resist the effects). • This module covers antibiotic resistance in greatest detail. • Many actions are equally applicable to combat resistance in other microorganisms causing fungal, viral and parasitic diseases.	**Read** the slide or ask a participant to read it. **Highlight** that this module covers antibiotic resistance in the greatest detail, although many of the actions are equally applicable to combat resistance in other microorganisms causing fungal, viral and parasitic diseases.	–
10	**Mechanisms of antibiotic resistance (1)** World Health Organization How do organisms become resistant to antibiotics? Interactive question	**Say:** "Let's move on to the mechanisms of antibiotic resistance." **Ask** the attendees the question on the slide. **Moderate** the discussion. **Allow** a few minutes for this activity.	Flipchart and markers, in case notes are needed
11	**Mechanisms of antibiotic resistance (2)** World Health Organization  Source: https://www.cdc.gov/drugresistance/resources/digital_materials.html Answers	**Talk** through the sequence in the image, which explains how antibiotic resistance occurs (within the patient, but also in general).	Refer to handout 1 in the student handbook, p. 4: https://www.cdc.gov/drugresistance/about.html

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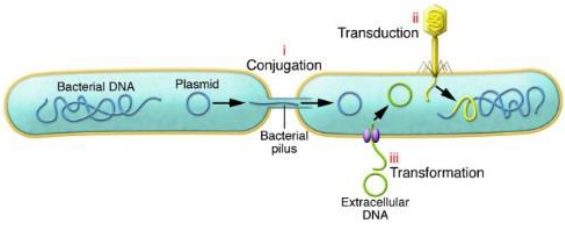
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
12	**Mechanisms of antibiotic resistance (3)** World Health Organization **Intrinsic resistance** • This relates to natural properties of bacteria and mechanisms of action; for example, Gram-negative bacteria are naturally resistant to vancomycin and enterococci to cephalosporins. **Acquired resistance** • This is acquired by transfer of mobile genetic material (such as plasmid) that can move easily between various bacterial species or by chromosomal mutation. • It is the most dangerous method for contributing to the spread of antibiotic resistance. Answers	**Read** the slide or **ask** a participant to read it. **Distinguish** the two principles of resistance. • **Read** the bullet point on intrinsic resistance (and explain that this might account for some microorganisms in step 1 in the image on the previous slide). • **Read** the bullet point on acquired resistance (and explain that this might account for some microorganisms in step 4 in the image on the previous slide). It might be helpful to **switch** back and forth to the previous slide when referring to it.	–
13	**Acquired resistance – transfer of mobile genetic material** World Health Organization  *Source:* Modi SR, Collins JJ, Relman DA. Antibiotics and the gut microbiota. J Clin Invest. 2014;124(10):4212-8.	**Say:** "This is a visual showing acquired resistance through transfer of mobile genetic material (such as plasmids), one mechanism by which resistance can be acquired." The following explanation is **for your reference only**. If attendees desire further information, it can be shared. • Bacteria exchange genetic information with one another using horizontal routes of conjugation, phage transduction and natural transformation. • In conjugation, donor and recipient cells are physically connected through the formation of a transient bridge (pilus), and DNA copied from one cell flows to the next. Cells can transfer plasmid DNA, integrative conjugative elements (chromosomally encoded gene clusters with autonomous conjugation machinery) or chromosomal DNA through high	–

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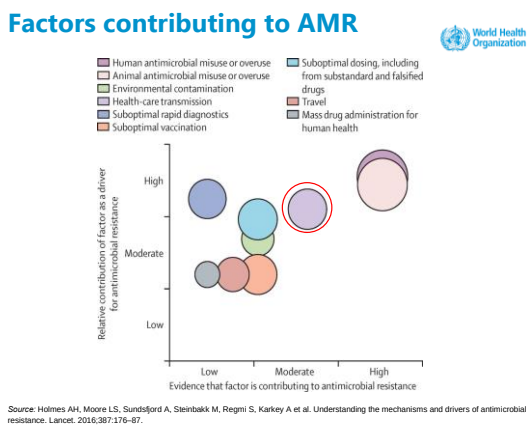
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
		frequency of recombination mediated by F plasmids. • Phages or bacterial viruses serve as vehicles for bacterial gene transfer by transducing DNA from one host cell to another. During lysis, phages can inadvertently package bacterial DNA, either randomly incorporating pieces of the bacterial genome into phage particles (generalized transduction) or taking up bacterial DNA positioned near the phage integration site (specialized transduction). Upon lysogenic infection of a new host, genetic material can be maintained in the genome by homologous recombination or site-specific integration. • In the process of natural transformation, certain bacterial species can take up free DNA from the environment using membrane protein complexes. While some species exhibit competence during phases of their life-cycle, others respond to extracellular cues to initiate DNA uptake.	
14	 *Source:* Holmes AH, Moore LS, Sundsfjord A, Steinbakk M, Regmi S, Karkey A et al. Understanding the mechanisms and drivers of antimicrobial resistance. Lancet. 2016;387:176–87.	**Say:** "There are many drivers of AMR. According to expert consensus, health care transmission is one of the most important contributing factors to AMR, supported by moderate to high evidence that IPC has an impact on AMR, not only on health care-associated infections."	–

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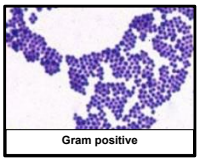
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
15	**Session 1** World Health Organization **Introduction to antibiotic-resistant bacteria** **Part B: types of antibiotic resistance**	**Congratulate** the attendees for accomplishing the first part of session 1. **Say:** "We will now move on to part B to examine the most relevant antibiotic-resistant bacteria."	–
16	**WHO priority pathogens list for new antibiotics** World Health Organization **Critical** • *Acinetobacter baumannii*, carbapenem-resistant • *Pseudomonas aeruginosa*, carbapenem-resistant • Enterobacteriaceae, carbapenem-resistant, extended spectrum beta-lactamase-producing **High** • *Enterococcus faecium*, vancomycin-resistant • *Staphylococcus aureus*, methicillin- and vancomycin-resistant • *Helicobacter pylori*, clarithromycin-resistant • *Campylobacter* species (spp.), fluoroquinolone-resistant • *Salmonella* spp., fluoroquinolone-resistant • *Neisseria gonorrhoeae*, cephalosporin- and fluoroquinolone-resistant **Medium** • *Streptococcus pneumoniae*, penicillin-non-susceptible • *Haemophilus influenzae*, ampicillin-resistant • *Shigella* spp., fluoroquinolone-resistant *Source*: http://www.who.int/mediacentre/news/releases/2017/bacteria-antibiotics-needed/en/ (February 2017)	**Say:** "Before going into detail, let's look at the pathogens list identified by WHO as priority for new antibiotics. In the following we will focus on the highlighted organisms from the critical and high-priority sections. These pathogens pose a highly relevant burden." **Highlight:** • all the critical pathogens; • two examples of high-priority pathogens; • one or two examples of medium-priority pathogens.	Refer to handout 2 in the student handbook, p. 6.
17	**Types of antibiotic-resistant Gram-positive organisms** World Health Organization • Methicillin-resistant *Staphylococcus aureus* (MRSA) is resistant to methicillin, oxacillin, flucloxacillin and cefoxitin. • Coagulase-negative staphylococci species are multi-resistant. • Vancomycin-resistant enterococci (VRE) are resistant to glycopeptide antibiotics (vancomycin or teicoplanin). • *Streptococcus pneumonia* is penicillin-resistant.  Gram positive	**Say:** "Gram-positive bacteria are so called because their cellular wall retains the violet stain in a test first used by bacteriologist Hans Christian Gram (1853 –1938)." **Read** the examples on the slide.	–

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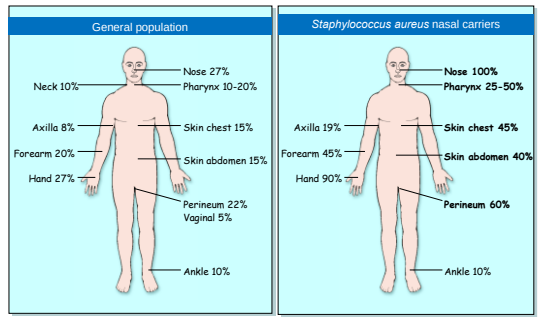
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
18	**MRSA** World Health Organization • MRSA first described in 1961, only two years after methicillin was introduced for penicillin-resistant *S. aureus*. • Pathogenic strains often promote infections by producing virulence factors. • If not controlled, it can achieve continuous presence or "endemic state" in a health care facility. • Routine screening of health care workers is not recommended but could be considered as part of outbreak control. 	**Say:** "Now let's focus on Methicillin-resistant *Staphylococcus aureus* (MRSA) in further detail." **Read** the slide or **ask** a participant to read it. The following explanation is **for your reference only**. If attendees desire further information, it can be shared. • Magnified 20 000 times, this colourized scanning electron micrograph image depicts a grouping of MRSA bacteria. • These are from one of the first isolates in the United States that showed increased resistance to vancomycin as well. Note the increase in cell wall material seen as clumps on the organisms' surface.	–
19	**Staphylococcus aureus carriage in various body sites of healthy adults** World Health Organization  *Source*: Wertheim HF, Melles DC, Vos MC, van Leeuwen W, van Belkum A, Verbrugh HA et al. The role of nasal carriage in *Staphylococcus aureus* infections. Lancet Infect Dis. 2005; 5(12):751–62.	**Say:** "This slide shows the average possibility of *Staphylococcus aureus* carriage in various body sites of healthy adults, per 100 people. **Note** that the percentages do not match those for MRSA, which are a lot lower, but the image shows the body sites where it is most commonly found, in both the general population and in nasal carriers of *S. aureus*."	Refer to handout 3 in the student handbook, p. 7.

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<table>
<tr><th>Slide no.</th><th>Slide image</th><th>Notes: descriptions and suggestions for the trainer to consider</th><th>Resources required</th></tr>
<tr><td>20</td><td>
VRE
World Health Organization
• Enterococci are opportunistic health care-associated microorganisms: they live in our intestines and skin, usually without causing problems, but they can become pathogenic in specific conditions.
• They occur not only in humans but also in a range of animals, insects and plants and in the environment.
• Enterococcus faecalis (90%) and Enterococcus faecium (5–10%) are the most prevalent species cultured from humans (>90% of clinical isolates).
• Resistance to glycopeptides (vancomycin or teicoplanin) is the most relevant pattern in enterococci.
(For this reason they may also be called GRE.)
• Vancomycin resistance is most common in E. faecium
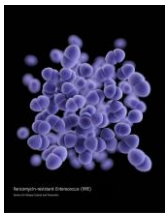
Photo credit: U.S. Centers for Disease Control and Prevention (CDC) - Medical Illustrator; Content Providers(s): CDC/James Archer
</td><td>Say:
“Now vancomycin-resistant enterococci (VRE) are described in further detail.”
Read the bullet points.
Highlight the fact that enterococci live in our intestines and skin, usually without causing problems.</td><td>–</td></tr>
<tr><td>21</td><td>
Summary: MRSA versus VRE (1)
World Health Organization
<table>
<tr><th>Factor</th><th>MRSA</th><th>VRE</th></tr>
<tr><td>Pathogenicity</td><td>High/moderate</td><td>Low</td></tr>
<tr><td>Human reservoirs</td><td>Nose, moist and hairy areas of body, such as groin and axillae</td><td>Gastrointestinal tract, anterior urethra, vagina, skin and oropharynx</td></tr>
<tr><td>Modes of transmission</td><td>Most frequently direct contact (via hands); also droplets</td><td>Most frequently direct and indirect contact (with contaminated objects/equipment, environmental surfaces)</td></tr>
<tr><td>Infections</td><td>• Skin and soft tissue infections
• Septic arthritis and osteomyelitis
• Sinusitis, pneumonias
• Bloodstream infections
• Infective endocarditis
• Food poisoning</td><td>• Urinary tract infection
• Infective endocarditis
• Bloodstream infections
• Surgical site infections
• Intra-abdominal infections
• Pelvic infections
• Meningitis and pleural space infections (rare)</td></tr>
</table>
Source: adapted with modification from: Damani N. Manual of infection prevention and control. Oxford: Oxford University Press; 2012.
</td><td>State that this slide and the next summarize the characteristics of MRSA versus those of VRE.
Highlight that despite both being Gram-positive, they have opposing and only a few common features.</td><td>Refer to handout 4 in the student handbook, p. 8.</td></tr>
<tr><td>22</td><td>
Summary: MRSA versus VRE (2)
World Health Organization
<table>
<tr><th>Factor</th><th>MRSA</th><th>VRE</th></tr>
<tr><td>Screening swabs</td><td>• Swab from nose, axilla and perianal/groin area
• Skin lesions, wounds, incisions, ulcers and exit sites of indwelling devices
• Newborn umbilicus swab</td><td>• Deep rectal swab, faeces or specimen from colostomy
• Swab from broken skin such as wounds, incisions, ulcers and exit sites of indwelling devices
• Newborn umbilicus swab</td></tr>
<tr><td>De-colonization therapy (to reduce carriage)</td><td>Yes: feasible in patients who are colonized with MRSA</td><td>No: reliable means for decolonization does not exist</td></tr>
</table>
Source: adapted with modification from: Damani N. Manual of infection prevention and control. Oxford: Oxford University Press; 2012.
</td><td>–</td><td>Refer to handout 4 in the student handbook, p. 8.
(See also Annex 4 for additional information available if requested by attendees.)</td></tr>
</table>

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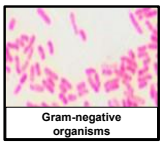
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
23	**Types of antibiotic-resistant Gram-negative organisms** World Health Organization • Extended-spectrum beta-lactamase-producing enterobacteriaceae: **ESBL-PE** • Carbapenem-resistant enterobacteriaceae: **CRE** • Carbapenem-resistant *Acinetobacter baumannii*: **CRAB** • Carbapenem-resistant *Pseudomonas* aeruginosa: **CRPsA** • These can cause serious nosocomial infections, which have been found to be associated with increased mortality, prolonged hospital stays and higher health care costs.  Gram-negative organisms *Source:* 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/infection-prevention/publications/guidelines-cre/en/).	**Say:** "Gram-negative bacteria, unlike Gram-positive, do not retain the violet stain in their cellular walls." **Read** through the examples.	–
24	**Outcomes associated with Gram-negative organisms** World Health Organization **Bloodstream infections** Especially in immunocompromised patients, indwelling devices **Skin colonization** **Gastrointestinal infections** Post-surgical infections, intra-abdominal sepsis ***Note:*** gut colonization can result in other various infections. Gram-negative organisms **Urinary tract infections** colonization/infection	**Say:** "This slide shows possible outcomes associated with Gram-negative organisms. It is important to note that once the gut is colonized with multiresistant Gram-negative organisms, it can result in various infections in patients, depending on the clinical condition."	–
25	**Enterobacteriaceae (family) (1)** World Health Organization • Enterobacteriaceae are a large family of Gram-negative "enteric" bacteria. • They include many harmless symbionts/organisms. • Disease-causing bacteria in this family include *Proteus*, *Enterobacter*, *Serratia*, *Salmonella, Shigella, Yersinia pestis, Escherichia coli, Klebsiella* and *Citrobacter* (among others) • They can produce enzymes – extended-spectrum beta-lactamases (ESBLs) – that provide multiresistance to beta-lactam antibiotics such as penicillins, cephalosporins, aztreonam and possibly some carbapenems (ertapenem). • These are mostly treated with intravenous carbapenems.	**Introduce** the Enterobacteriaceae, a large family of Gram-negative "enteric" bacteria. **Read** the bullet points.	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required

26	**Enterobacteriaceae (family) (2)**
	World Health Organization
	• Enterobacteriaceae can even be resistant to carbapenems. CRE are mostly *E. coli*, *Enterobacter* and *Klebsiella*.
	• Resistance can be acquired through several mechanisms, including:
	  • active transport of antibiotics out of the cell
	  • preventing antibiotics from entering the cell
	  • production of enzymes disabling the drug molecule: carbapenemases
	• **CRE can be treated with intravenous colistin (mostly in combination with others), which is an antibiotic of last resort.**
	2015: Discovery of first colistin resistance (plasmid-mediated mcr-1) in *E. coli* (animals/humans) in China
	2016: Bacteria found in United Kingdom and USA
		Read the bullet points.
		Talk through from top to bottom.
		Say:
		"Carbapenem-resistant Enterobacteriaceae (CRE) are treated with intravenous colistin (mostly in combination with others). Colistin is an antibiotic of last resort – the last therapeutic option for patients – however, and colistin resistance in animals and humans has already been identified."
			–

27	***Acinetobacter baumannii* (species)** **(*Acinetobacter* = genus)** World Health Organization • *Acinetobacter baumannii* is now recognized as significant nosocomial pathogen, especially in critically ill patients, for example those in intensive care units and with wound infections (trauma patients). • It is present in soil, water and sewage but is mostly isolated from hospital environments. • Transmission occurs through direct and indirect contact (such as with contaminated surfaces), through water or through medication (common vehicle). • It can rapidly acquire resistance to a wide range of antibiotics. Resistance to aminoglycosides and carbapenems is rapidly increasing. • According to EARS-Net, in 2018 carbapenem-resistant *A. baumannii* ranged from 1.7% to 95.5% of isolates tested in European countries • Once endemic, *A. baumannii* is difficult to eradicate because of its remarkable ability to survive and spread in the hospital environment. *Sources:* Alp E, Altun D, Cevahir F, Ersoy S, Cakir O, McLaws ML. Evaluation of the effectiveness of an infection control program in adult intensive care units: a report from a middle-income country. Am J Infect Control 2014;42(10):1056–61; Peleg AY, Seifert H, Paterson DL. *Acinetobacter baumannii*: emergence of a successful pathogen. Clin Microbiol Rev. 2008;21(3):538–82. Surveillance of antimicrobial resistance in Europe. European Centre for Disease Prevention and Control; 2018 (https://www.ecdc.europa.eu/en/antimicrobial-resistance/surveillance-and-disease-data/report)	**Say:** "Now *Acinetobacter baumannii* is described in further detail (which is not from the Enterobacteriaceae family)." **Read** the bullet points. **Highlight** *A. baumannii*'s remarkable ability to persist on artificial surfaces for extended periods and to spread in the hospital environment, making it a significant nosocomial pathogen.	–
28	***Pseudomonas aeruginosa* (species)** **(*Pseudomonas* = genus)** World Health Organization • *Pseudomonas aeruginosa* is found in soil, water and plants. • Transmission occurs through direct and indirect contact and through water (common vehicle). • This highlights the important role of potential environmental reservoirs, such as a handwash basin and hospital water supplies, especially in high-risk areas (such as intensive care, neonatal care and burns units). • It is responsible for causing a wide variety of infections, especially in patients with compromised host defence mechanisms, such as bloodstream, urinary tract, otitis externa and media, endocarditis, bacterial keratitis, endophthalmitis and skin infections. • It can rapidly acquire resistance to a wide range of antibiotics. Resistance to ceftazidime, aminoglycosides and carbapenems is rapidly increasing. • According to EARS-Net, in 2018 *P. aeruginosa* resistant to carbapenems varied across European countries from 0% to 55.1% in 2018. *Source:* Surveillance of antimicrobial resistance in Europe. European Centre for Disease Prevention and Control; 2018 (https://www.ecdc.europa.eu/en/antimicrobial-resistance/surveillance-and-disease-data/report)	**Say:** "Next, *Pseudomonas aeruginosa* is described in further detail (which is also not from the Enterobacteriaceae family)." **Read** the bullet points. **Highlight** its aqueous environmental reservoirs, such as handwash basins and hospital water supplies, and its association with serious infections (it has intrinsically advanced antibiotic resistance mechanisms).	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
29	**Antibiotic-resistant Gram-negative bacteria** 	Factor	CRE, CRAB and CRPsA
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Screening swabs	• Deep rectal swab, faeces or specimen from colostomy • Swab from broken skin such as wounds, incisions, ulcers and exit sites of indwelling devices • Newborn umbilicus swab
Decolonization therapy (to reduce carriage)	• Not effective | CRE: carbapenem-resistant Enterobacteriaceae CRAB: carbapenem-resistant *Acinetobacter baumanii* CRPsA: carbapenem-resistant *Pseudomonas aeruginosa* *Source*: adapted with modification from: Damani N. Manual of infection prevention and control. Oxford: Oxford University Press; 2012.	**State** that this slide shows the sites to use for screening swabs of CRE versus CRAB and CRPsA. **Highlight** the fact that decolonization therapy (to reduce carriage) is not effective.	Refer to handout 5 in the student handbook, p. 9.
30	**Session 2** **Overview of the threat caused by health care-associated infections (HAIs) and antibiotic resistance** **Part A: global patterns of AMR in hospitals**	**Welcome** students to the second session, which gives an overview of the threat caused by health care-associated infections (HAIs) and antibiotic resistance. **Explain** that this session consists of three parts to structure the content for attendees. **Say:** "We start with part A: the burden of AMR, followed by part B: the impact of AMR on people and health systems and part C: risk factors for AMR acquisition and spread."	–
31	**Burden of antibiotic resistance/AMR** • Do you know the frequency of antibiotic resistance/AMR and the most common health care-associated pathogens in your facility? And in your country? • Do you think there is a difference in rates between high-income and low-income countries? Interactive question	**Ask** the questions on the slide. **Put** the attendees in groups of 2–4 people to discuss their answers. **Allow** 3–5 minutes for the exchange of information. **Open** and **moderate** the discussion, then move on to the next slides to sum up.	Flipchart and markers, in case notes are needed

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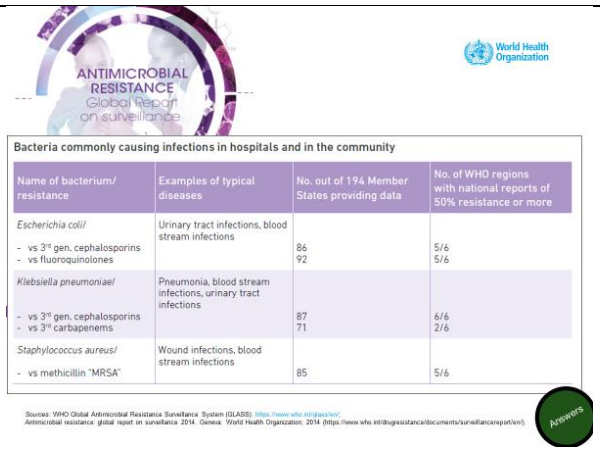
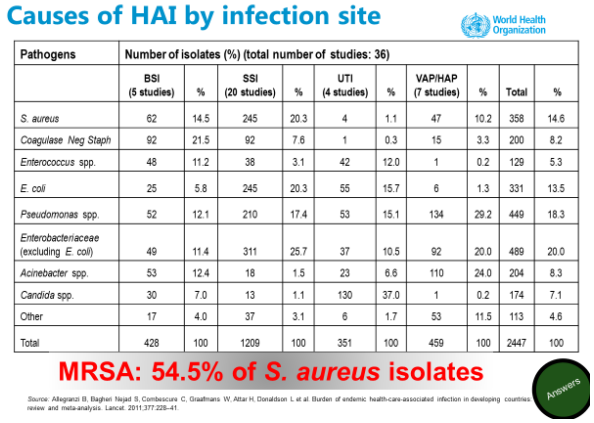
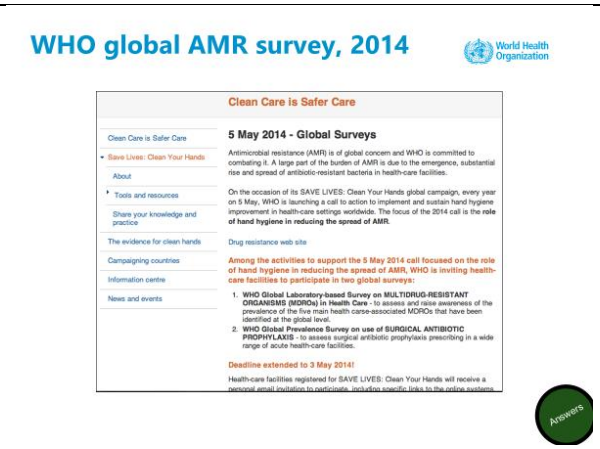
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
32		**Point** to the WHO antimicrobial resistance global report on surveillance data on the slide, which lists bacteria commonly causing infections in hospitals and in the community. **Highlight** the first (name + resistance) and last column (WHO regions with national reports of 50% resistance or more).	For additional information, check out the WHO Antimicrobial Resistance Surveillance System (GLASS) website: https://www.who.int/glass/en/
33		**State** that this table displays the causes of HAI by infection site, showing pathogens and the number of isolates in total, taken from 36 studies. **Draw** attention to *S. aureus* only: in terms of antibiotic resistance the data show that MRSA accounts for as much as 54.5% of *S. aureus* isolates. Abbreviations used are: BSI – bloodstream infections; SSI – surgical site infections; UTI – urinary tract infections; VAP/HAP – ventilator-associated pneumonia/hospital-acquired pneumonia.	–
34		**Tell** attendees that there are regular WHO global AMR surveys, usually sent out before World Hand Hygiene Day on 5 May, to support the activities around this event. In 2014 the survey was a WHO laboratory-based one on multidrug-resistant organisms in health care.	–

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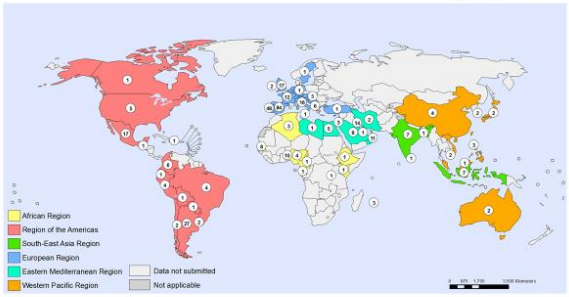
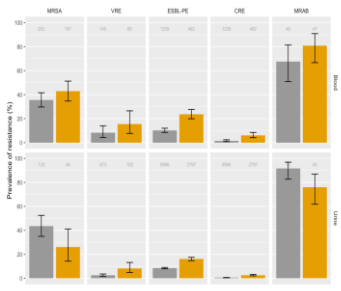
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required

35	**WHO laboratory-based global survey on multidrug-resistant organisms in health care**
	World Health Organization
	• **Objectives:**
	  • to have a snapshot of multidrug-resistant organism prevalence among inpatients in a wide range of health care facilities worldwide
	  • to collect information about the microbiological methods used for isolation and detection of resistance
	• **Design:** an online survey (1 March to 30 June 2014) based on routine collection of clinical blood and urine culture specimens (only the first isolate from inpatients during one week)
	• **Participants:** health-care settings registered for the WHO SAVE LIVES: Clean Your Hands global campaign and other WHO networks
	• **Main targeted resistance patterns:** MRSA, VRE, ESBL and carbapenem resistance in *E. coli* and *Klebsiella* spp., multidrug-resistance in *A. baumannii*
	Answers
		Read the bullet points, explaining the survey in more detail.	–

36	**Summary results** World Health Organization  African Region Region of the Americas South-East Asia Region European Region Eastern Mediterranean Region Western Pacific Region Data not submitted Not applicable **67 countries and 420 laboratories participated** Source: Allegranzi B, Damani N, Gayet-Ageron A, Stewardson A, Wallace S, Pittet D. World Health Organization period prevalence survey on multidrug-resistant microorganisms in healthcare. Vienna: European Congress of Clinical Microbiology and Infectious Diseases; 2017.	**State** that this visual aid shows the 67 countries (and 420 laboratories) that participated in the survey.	–
37	**Prevalence of multidrug resistance from inpatient clinical blood and urine specimens (2014)** World Health Organization  MRSA VRE ESBL-PE CRE MRAB Prevalence of resistance (%) Blood Urine High income Middle/low income **ESBL-PE** and **CRE** prevalence from blood cultures, and **VRE, ESBL-PE** and **CRE** prevalence from urine specimens **significantly higher in low- and middle-income countries.** Source: Allegranzi B, Damani N, Gayet-Ageron A, Stewardson A, Wallace S, Pittet D. World Health Organization period prevalence survey on multidrug-resistant microorganisms in healthcare. Vienna: European Congress of Clinical Microbiology and Infectious Diseases; 2017. Answers	**State** that this slide shows some results of the survey: the prevalence of multidrug resistance from inpatient clinical blood and urine specimens. **Note** that in low- and middle-income countries extended-spectrum beta-lactamase-producing Enterobacteriaceae (ESBL-PE) and CRE prevalence from blood cultures and VRE, ESBL-PE and CRE prevalence from urine specimens were significantly higher.	–

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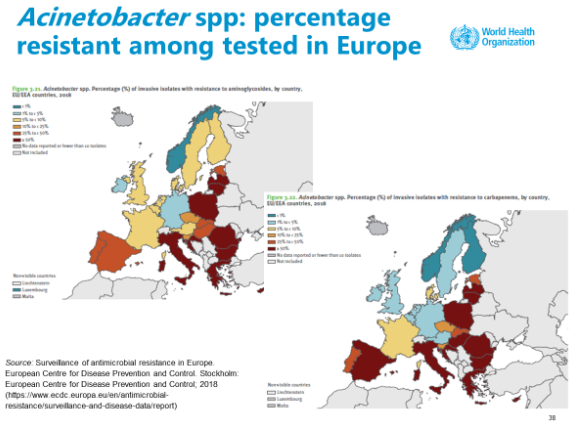
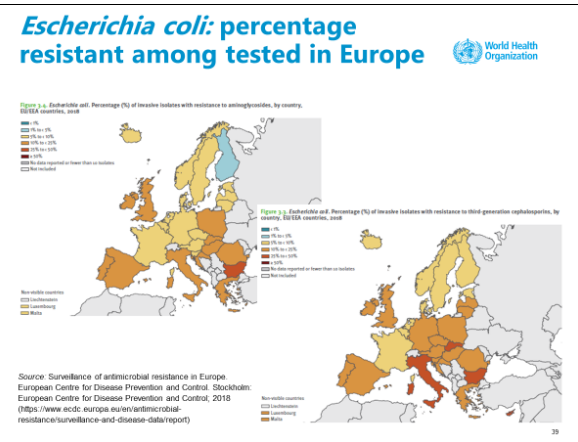
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
38		**Introduce** the European Antimicrobial Resistance Surveillance Network (EARS-Net), which is considered one of the most robust surveillance systems for AMR in the world. **Say:** "It is based on a number of 'sentinel' laboratories that report the number of resistant specimens over the total tested. Hence, it expresses resistance by giving the percentage of resistance. Today we will talk about the main pathogens spreading in health care facilities and their key resistance patterns, while recognising that the network also collects data on community acquired resistant pathogens. In this case, we can see that many countries have more than 50% of the tested isolates of *Acinetobacter* spp that were resistant to aminoglycosides and to carbapenems. Also to note, the geographical heterogeneity."	–
39		**Say:** "A similar geographical heterogeneity is noticed with *Escherichia coli*: in most countries resistance to aminoglycosides is between 5% and 25% and to third-generation cephalosporins between 5% and 50%."	–

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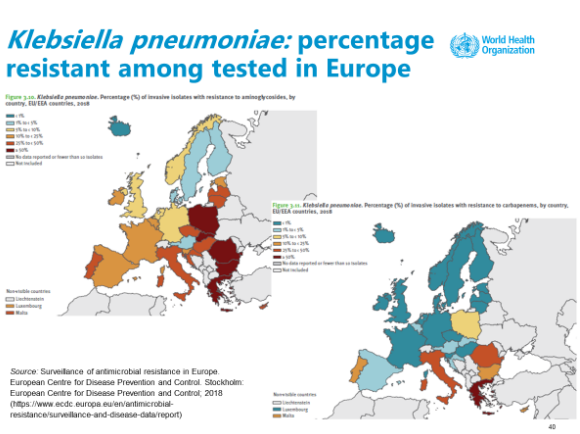
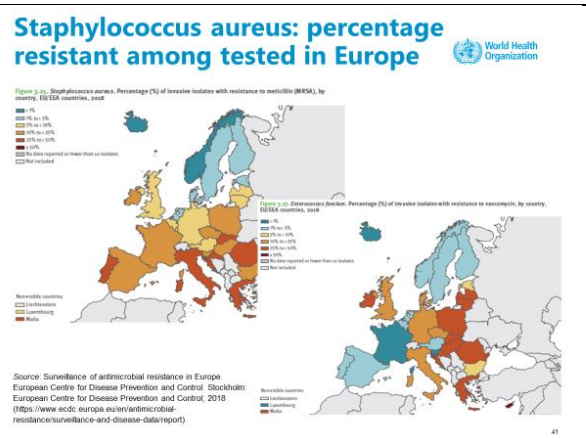
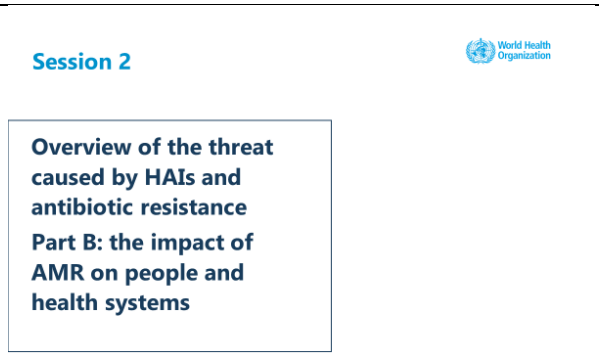
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
40		**Say:** "Similarly, the proportion of *Klebsiella pneumonia* isolates resistant to aminoglycosides and to carbapenems varies. The former is high in several countries and the latter seems to be an important problem in specific countries."	–
41		**Say:** "Finally, MRSA seems to be more evenly distributed across European countries. VRE is known to be a problem in health care facilities in a few countries across Europe."	–
42		**Say:** "Let's move on to part B of session 2 and have a closer look on the impact of AMR on people and health systems."	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
43	**Impact of antibiotic-resistant bacteria (1)** What would you say is the impact of antibiotic-resistant bacteria on the… • individual patient? • health care facility? • health care system in general? Interactive question	**Ask** the question on the slide. **Go through** each of the categories separately, asking for attendees' input. **Moderate** the discussion. **Record** answers using the flipchart and markers. **Allow** 3–5 minutes for the exchange of information.	Flipchart and markers

44	**Impact of antibiotic-resistant bacteria (2)**
	• **Increased morbidity and mortality** due to:
	  • failure to respond to the first or second-line of empirical antibiotics
	  • delayed treatment
	  • vulnerable patients at higher risk of exposure
	• **Limited choice in selection** of older "tried and tested" antibiotics, well known for their efficacy and side-effect profiles
	• **Restricted licensing conditions of newer agents** due to limited availability of clinical data on their efficacy and known side-effects
	• **Longer hospital stays** due to HAIs; some preparations only available in intravenous formulations
	Answers
		State that this slide and the next summarize the answers to the question.
		Talk through the bullet points.
		Point out which aspects were raised by attendees.
			–

45	**Impact of antibiotic-resistant bacteria (3)**
	• **Increased costs and use of limited resources to deliver care due to:**
	  • costs of newer expensive antibiotics and other drugs
	  • supplies needed for isolation/precautions
	  • costs of additional investigations or other complications
	  • increased lengths of stay, leading to lower numbers of available beds for other patients
	• **Collateral damage – increased use of antibiotics (including broad-spectrum) is associated with:**
	  • alterations of patients' flora (microbiomes), i.e. microbes essential for human functioning are being killed
	  • increased incidence of *Clostridium difficile* infections
	Answers
		Talk through the bullet points.
		Point out which aspects were raised by attendees.
			–

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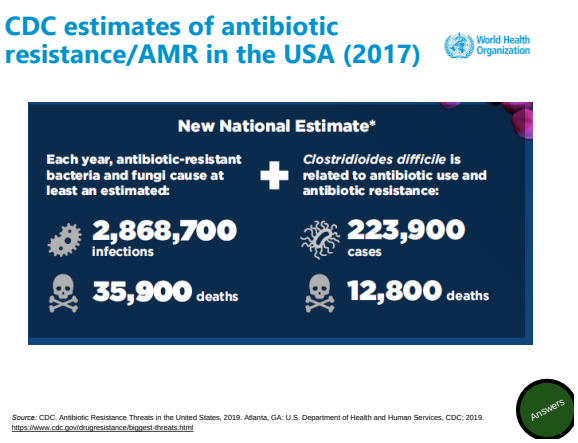
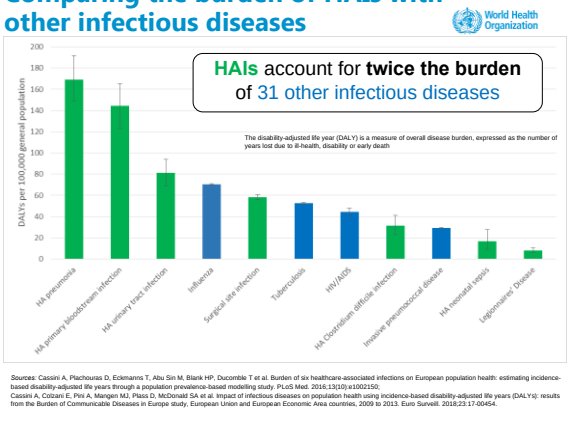
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
46		**State** that this slide has a visual aid showing the Centers for Disease Control and Prevention (CDC) annual estimates of the number of cases and deaths due to antibiotic resistance/AMR in the United States. **Read through** and pause to let attendees absorb the numbers.	–
47		Continue on the recent 2019 CDC report on AMR: the CDC identified urgent and serious threats for the health of US population. Say: “To note that 2 carbapenem-resistant organisms are now in the top threat priority list, including *Acinetobacter* spp for the first time. Considering Candida auris as well, it’s clear that there is an epidemiological shift towards infections that impact and kill mainly in hospitals. Hence, the growing importance of IPC to combat AMR.”	
48		**Say:** “Note that disability-adjusted life year (DALY) is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death A recent study estimating the burden of HAIs found that the six selected types of HAIs have a higher burden of disease than that of influenza, HIV/AIDS and tuberculosis, for example. In fact, these six HAIs have a higher burden than all the other infectious diseases under	–

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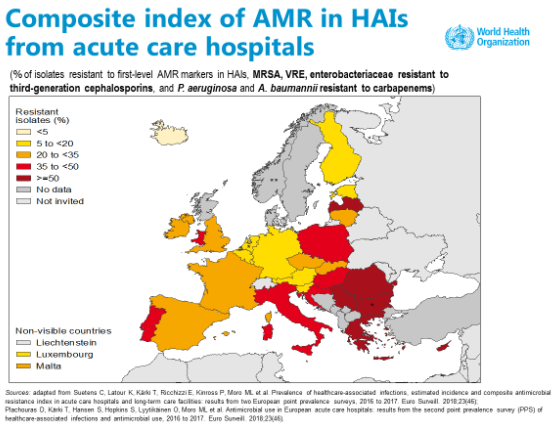
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
		surveillance in the European Union, combined. 2.6 million annual cases of HAIs are associated with more than 91 000 deaths (76 000–108 000), according to the Burden of Communicable Diseases in Europe project, 2015. 35–55% of HAIs are still preventable with multifaceted interventions, depending on the type. This is relevant because many infections with AMR bacteria, especially the more severe ones, are HAIs.”	
49		**Say:** “The European 2016–17 point prevalence survey of HAIs and antimicrobial use estimated an AMR index reflecting the number of infections with AMR bacteria. The study found a large variation of this index across Europe.” Additional notes for the trainer: These surveys were of European Union (EU) and European Economic Area (EEA) countries and Serbia, 2016–2017. Bulgaria and the Netherlands had poor national representativeness of acute care hospital sample; Norway has a national protocol; Norway and United Kingdom (Scotland) did not collect microbiological data.	–

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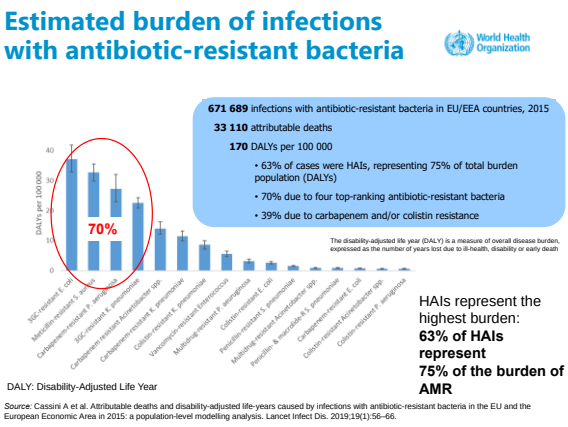
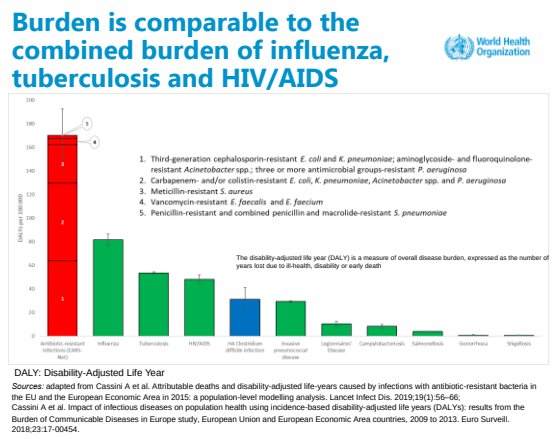
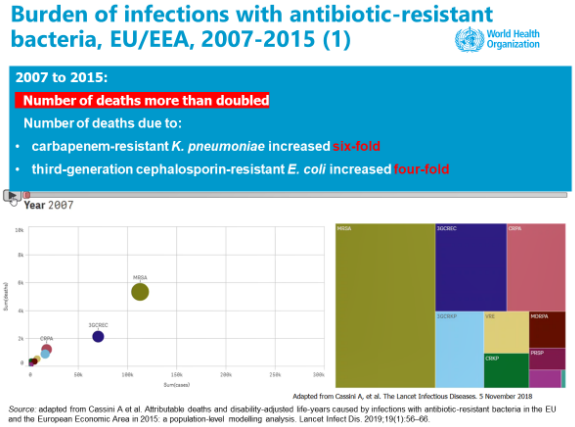
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
50		**Read** the slide and highlight the number of deaths due to AMR (33 000 every year in Europe) and the fact that 75% of the burden of AMR was found to be HAIs. **Note** that disability-adjusted life year (DALY) is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death. Also **point out** the fact that there is available estimations on AMR infections from high-income countries but extremely scarce data in LMICs.	–
51		**Read** the title and say: "The red bar includes the most relevant resistant microorganisms (which are predominantly transmitted in health care facilities). As you can see the burden of these in terms of disability-adjusted life year (DALY) (a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death) is comparable to or higher than other important infectious diseases combined. **Remind** that this is in European Union countries; it may not be the same in all other countries.	–
52		This slide and the next one should be read in conjunction; they show how the burden of infections due to antibiotic-resistant bacteria changed between 2007 and 2015. **Read** the text in the turquoise box that explains the changes.	–

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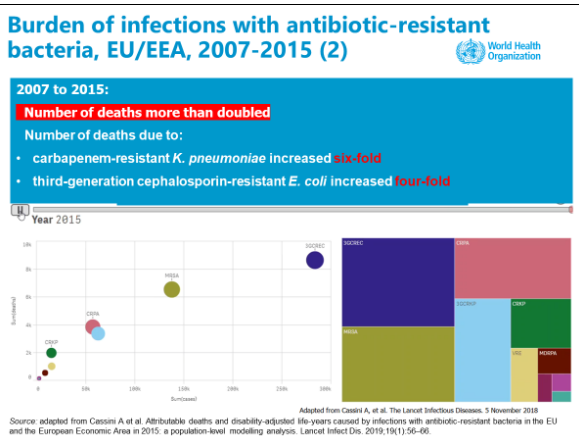
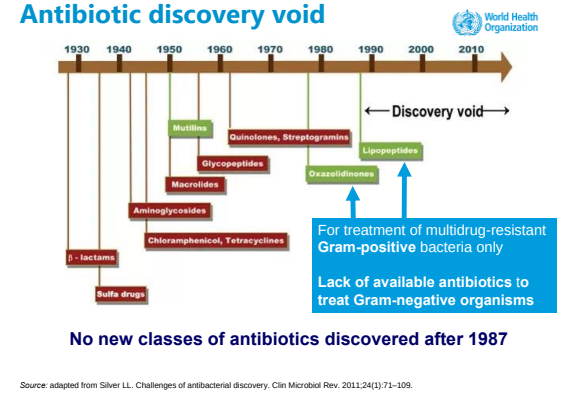
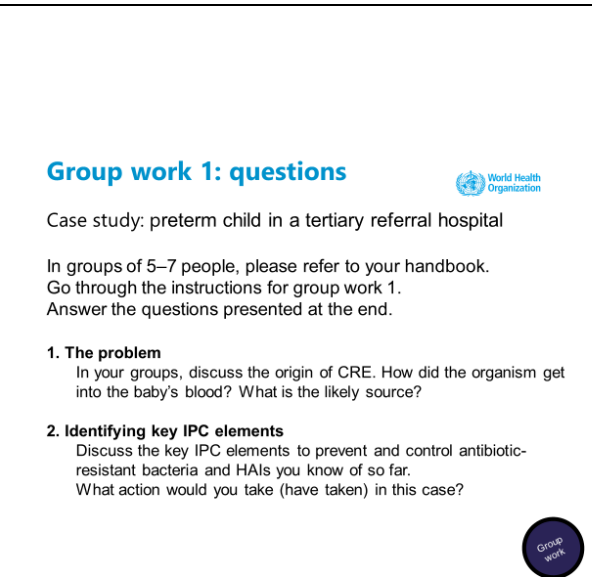
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
53		By switching between slides, **highlight** that the size of the MRSA box (olive green) decreased whereas the ones of third-generation cephalosporin-resistant *E. coli* (purple box) and carbapenem-resistant *K. pneumoniae* (green box) increased. **Say:** "The overall number of attributable deaths due to antibiotic resistant infections has more than doubled."	–
54		**Explain** that at the top of the slide is a timeline, along which new classes of antibiotics have been discovered and registered (pick out a few examples). **Highlight** the lack of new classes of antibiotics to treat Gram-negative organisms since the early 1960s. **Point out** that there is a discovery void for any new registered classes of antibiotics after 1987.	–
55		**Ask** the attendees to refer to their student handbooks and turn to group work 1. **Ensure** that attendees are in groups of no more than 5–7 people, if possible. **Go through** the instructions: attendees are to read the case study and answer the two questions presented at the end in their groups. **Allow** 15 minutes to read the case study and answer the questions. **Ask** a representative of each group to read/present their answers. **Moderate** the discussion. **Allow** 5 minutes for feedback from each group.	Refer to group work 1 in the student handbook, p. 10. (For facilitator notes and answers see Annex 2)

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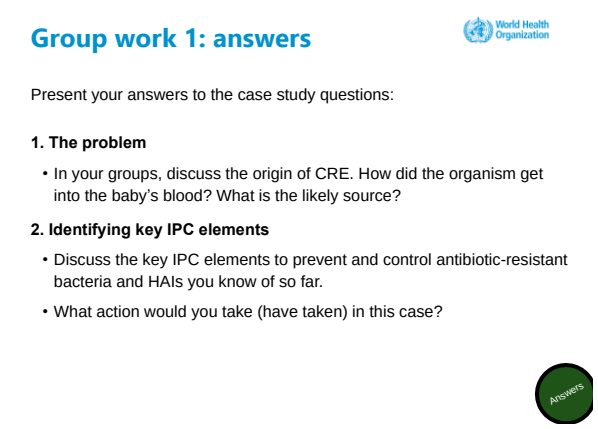
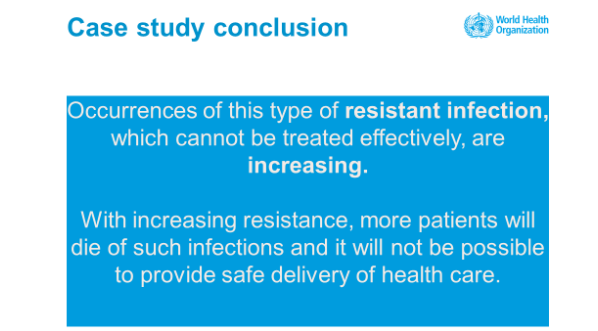
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
56		**Review** the answers in plenary. **Ask** the attendees if the answers are clear.	–
57		**Close** the case history with this final statement on the slide. **Say:** "In these conditions of increasing spread of AMR and infections that cannot be treated effectively, PREVENTION of transmission is key to saving lives. First of all, this means to rigorously apply standard precautions (that are infection prevention precautions for ALL patients), such as hand hygiene, sanitation, and environmental cleaning.	–
58		**Welcome** the attendees to the last part of session 2, which focuses on risk factors for AMR acquisition and spread in more detail.	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
59	**Risk factors for antibiotic-resistant bacteria in the health care setting (1)** World Health Organization What are the risk factors that contribute to the ***emergence*** of antibiotic-resistant bacteria? Interactive question	**Read** the question and **moderate** the discussion. **Allow** 3–5 minutes for this activity.	Flipchart and markers, in case notes are needed

60	**Risk factors for antibiotic-resistant bacteria in the health care setting (2)**
	World Health Organization
	• **Increased use/misuse of antibiotics for both prevention and treatment** (such as broad-spectrum antibiotics, cephalosporins, carbapenems, quinolones, glycopeptides)
	• **Patients with severe/chronic underlying disease** (past exposure to health care and antibiotic treatment)
	• **Critically ill patients with prolonged hospital stays:**
	  • patients undergoing intensive care/therapy or immunocompromised
	  • those in special care baby and neonatal units
	  • patients receiving oncology treatments
	  • transplant patients
	  • those on burns wards and in hemodialysis
	Answers
		This and the following slide summarize the answers to the question.
		Talk through the bullet points.
		Point out which aspects were raised by attendees.
			–

61	**Risk factors for antibiotic-resistant bacteria in the health care setting (3)**
	World Health Organization
	• **High-risk units** can have a high burden of antibiotic-resistant bacteria due to:
	  • increased use of antibiotics exerting selective pressure on bacteria
	  • Immunocompromised patients being more susceptible to infections
	  • increased patient contact, resulting in more cross-infection due to breaches in IPC practices
	  • presence of indwelling devices, such as intravenous lines, urinary catheters, endotracheal intubation, surgical drains, nasogastric and PEG (gastrostomy and jejunostomy) tubes
	Answers
		Talk through the bullet points.
		Point out which aspects were raised by attendees.
			–

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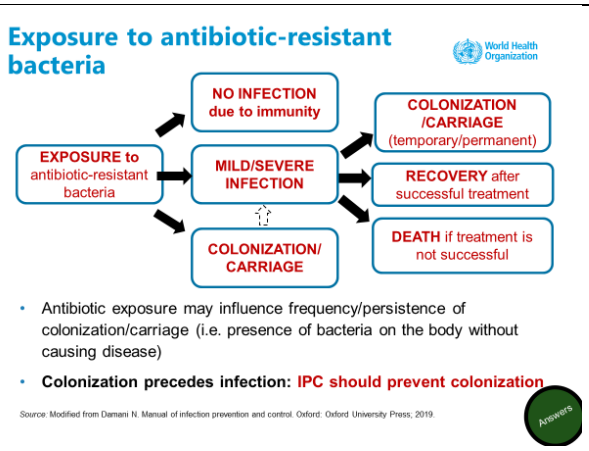
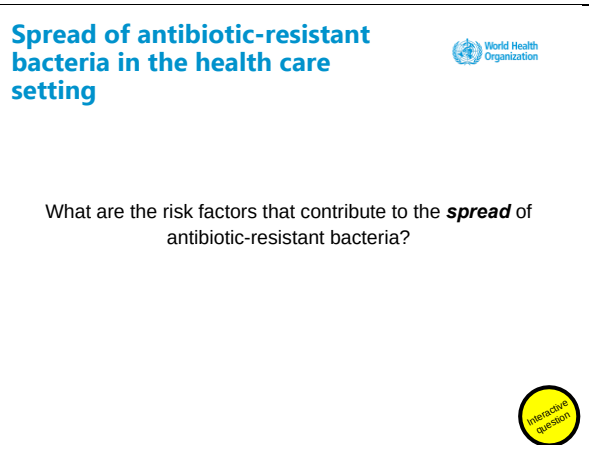
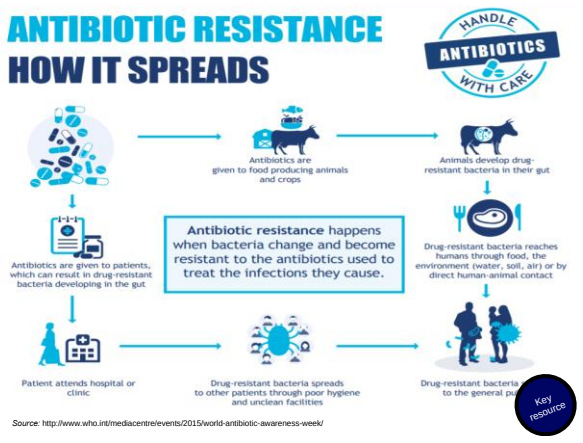
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
62		**Highlight** the fact that exposure of the patient to antibiotic-resistant bacteria is itself a risk factor. **Talk through** the flow from left to right. **Say:** "As colonization precedes infection (through exposure), IPC should prevent colonization *and* prevent infection. IPC also ultimately prevents exposure."	–
63		**Read** the question. **Allow** attendees to shout out answers.	–
64		**Talk through** the flow from the top left image (pills/antibiotics) to the bottom right corner image (family with germs). Be sure to **go both ways round** the diagram (patients/animals). **Read** out the statement in the middle. **Be very clear** that the more important route is the one on the left.	Refer to handout 6 in the student handbook, p. 12.

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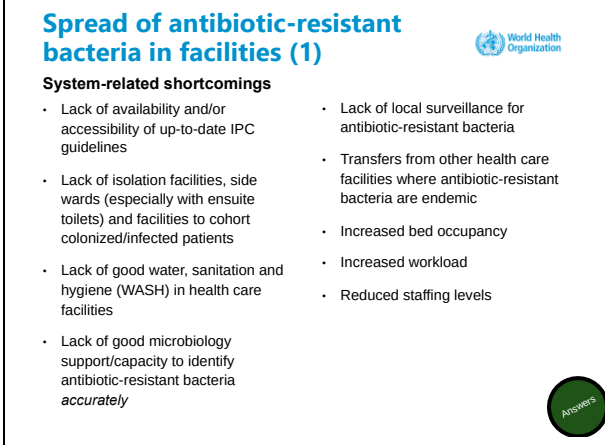
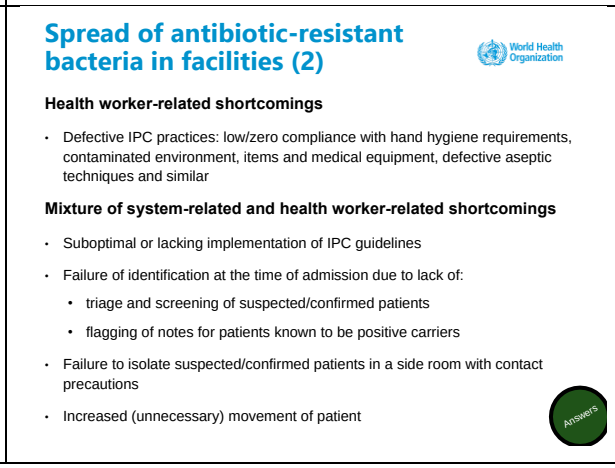
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
65		This and the following slide continue summarizing the answers to the initial question. **Say:** "Reasons for the spread of antibiotic-resistant bacteria can be divided into three categories: system-related shortcomings, health worker-related shortcomings and a mixture of the two." **Talk through** the bullet points. **Point out** which aspects were raised by attendees. **Highlight** the WHO vision "to substantially improve health through the safe management of water, sanitation and hygiene services in all settings". Further reading suggestions are provided at the end of the presentation and in the student handbook (handout 21).	Refer to handout 7 in the student handbook, p. 14.
66		**Talk through** the bullet points. **Point out** which aspects were raised by attendees.	–

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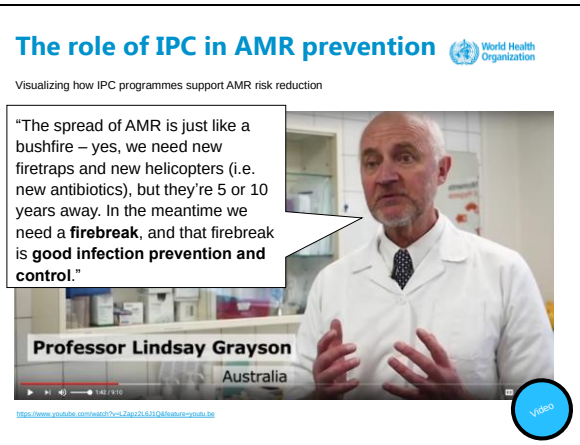
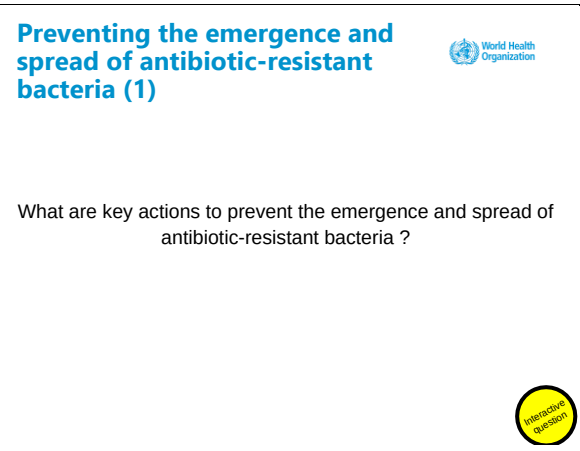
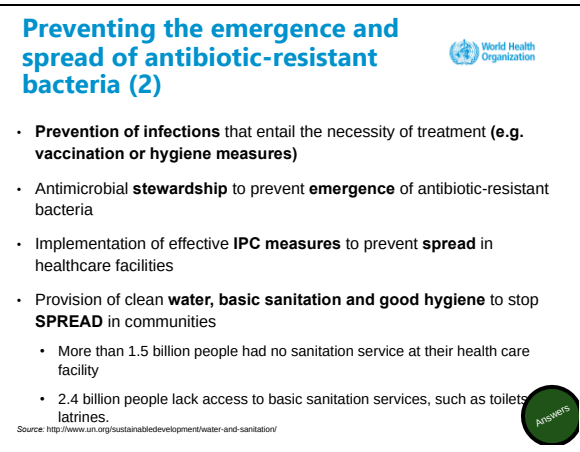
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
67		**Encourage** attendees to use different types of resources to gather information on the topic. **Point to** this YouTube video, accessible from the WHO core components for IPC: implementation tools and resources webpage. Professor Grayson uses a good analogy of a firebreak to describe the role of IPC in AMR prevention.	–
68		Moving on from factors to action, **read** the question and **moderate** the discussion. **Allow** a maximum of 3–5 minutes for this.	Flipchart and markers, in case notes are needed
69		This and the following slide summarize the answers to the question. **Talk through** the bullet points. **Point out** which aspects were raised by attendees. **Highlight** the most relevant action: preventing infections that entail the necessity of treatment.	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
70		**Ask** the following questions and **moderate** the discussion: "Are you familiar with the concept of the One Health approach? If so, do you have any experience of the One Health approach that you could share?" **Allow** a few minutes for this activity. In case no one is familiar, you can provide the following to attendees: "Many of the same microbes infect animals and humans, as they share the eco-systems they live in. Efforts by just one sector cannot prevent or eliminate the problem. To effectively detect, respond to, and prevent outbreaks of zoonoses and food safety problems, epidemiological data and laboratory information should be shared across sectors. Government officials, researchers and workers across sectors at the local, national, regional and global levels should implement joint responses to health threats"	Flipchart and markers, in case notes are needed
71		No need to read the slide – just **explain** that these are further reading materials on the topics addressed here. **Allow** a comfort break to refresh and stretch.	–

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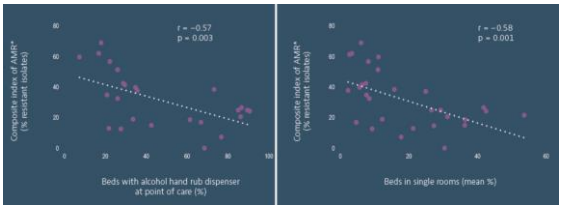
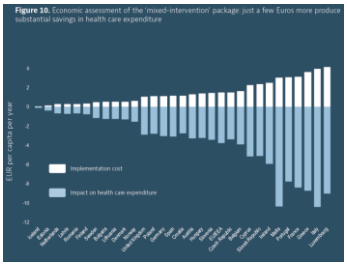
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
72	Session 3 World Health Organization **Evidence-based IPC strategies to combat antibiotic resistance**	**Welcome** the attendees back to the final of the module, which tackles evidence-based IPC strategies to combat antibiotic resistance. **State** that the session is composed of five parts and move on to the next slide.	–
73	**Correlations between IPC and composite index of AMR** World Health Organization  *Source*: OECD, ECDC. Antimicrobial resistance: tackling the burden in the European Union. Briefing note for EU/EEA countries. Paris: OECD Publications; 2019.	**Say:** "The AMR index we mentioned earlier was found to be inversely correlated with IPC indicators such as alcohol handrub use, percentage of beds with alcohol handrub dispensers at the point of care and the number of isolation rooms (isolation capacity). In other words, the AMR index decreases with increasing percentages of beds with alcohol handrub dispensers at the point of care and the number of isolation rooms. On top of these, the AMR index was found to be correlated with available full-time equivalent IPC nurses, antibiotic use in hospitals and evaluation/change of antimicrobial treatment."	–
74	**Economic assessment** World Health Organization **Investing €1.50 per capita per year** in three packages of public health interventions **would avoid about 27 000 deaths per year** in EU/EEA countries.  **Package 1,** for hospitals: hand hygiene, antibiotic stewardship programmes and enhanced environmental hygiene =⇩ 85% **Package 2,** for community settings: delayed antibiotic prescriptions, mass media campaigns and use of rapid diagnostic tests = ⇩ 23% **Package 3,** a mix of interventions = ⇩73% **Savings of €3.00 (package 1), €0.70 (package 2) and €2.00 (package 3) per capita per year** *Source*: OECD, ECDC. Antimicrobial resistance: tackling the burden in the European Union. Briefing note for EU/EEA countries. Paris: OECD Publications; 2019.	**Say:** "The Organisation for Economic Co-operation and Development (OECD) published a report on the cost–effectiveness of interventions to prevent AMR. It found that all interventions were cost-effective, and most combined interventions (packages) were cost-saving.	–

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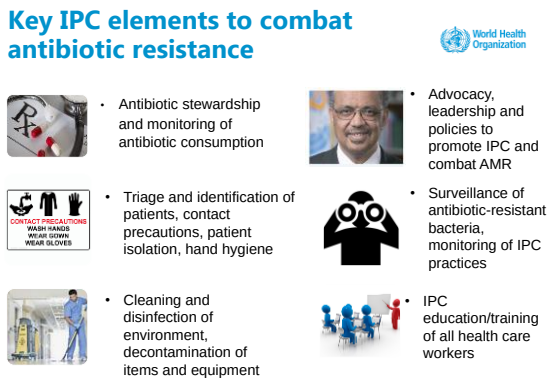
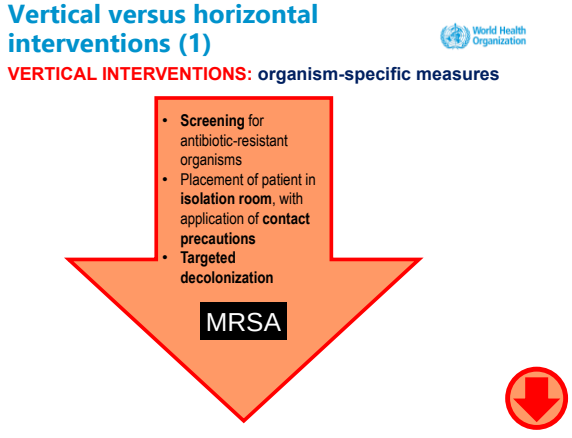
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
		The most cost-saving interventions were those in hospitals with a large IPC component."	
75		This slide lists the key IPC elements to combat antibiotic resistance. **Read** the bullet points and **explain** that each aspect is dealt with in detail in this session: Part A: antibiotic stewardship and monitoring of antibiotic consumption Part B: triage and identification of patients, contact precautions, patient isolation and hand hygiene Part C: cleaning and disinfection of environment, decontamination of items and equipment Part D: surveillance of antibiotic-resistant bacteria and monitoring of IPC practices. **Say:** "IPC education/training of all health care workers is what is being done here right now, but it's not covered specifically in the session as content. There is, however, a fifth session addressing the multimodal modal strategy for effective implementation, which includes an educational component for health workers."	Refer to handout 8 in the student handbook, p. 15.
76		**Explain** that one can differentiate between two principles of intervention: vertical and horizontal interventions. **Talk through** the flow from top to bottom. **Highlight** the importance of organism-specific measures with the example of MRSA. **Say**: "For example, patients who are known positive carriers for MRSA	Refer to handout 9 in the student handbook, p. 16.

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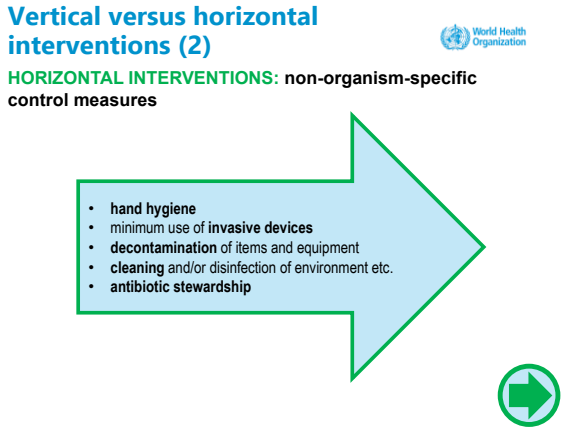
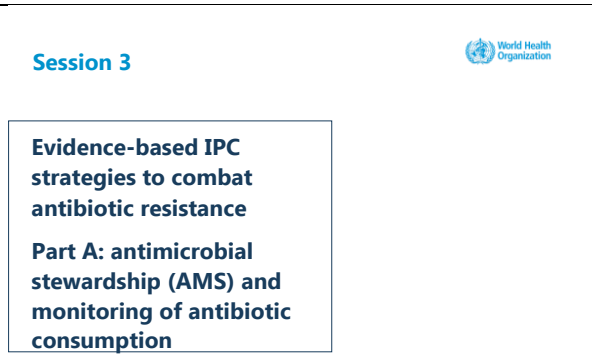
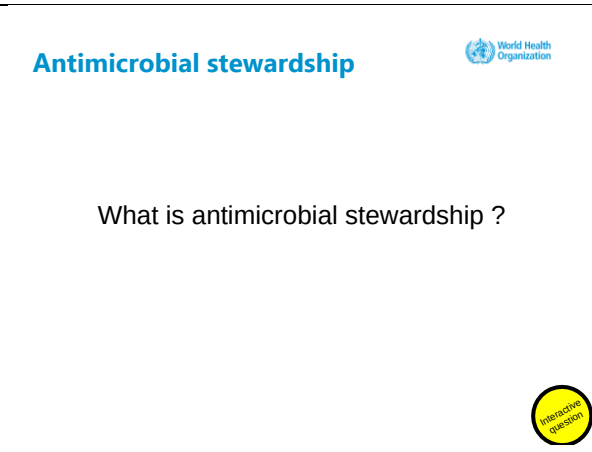
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
		are often isolated under contact precautions or targeted for decolonization prior to surgery, in an effort to reduce potential postoperative complications. These types of intervention are specific to MRSA, making them vertical interventions."	
77		**Talk through** the bullet points on horizontal interventions. **Highlight** that this is "to control all health care-associated microorganisms".	Refer to handout 9 in the student handbook, p. 16.
78		**Say:** "After this very general clarification let's move on to Part A of the session on antibiotic stewardship and monitoring of antibiotic consumption."	–
79		**Read** the question and **moderate** the discussion. **Allow** a few minutes for this activity.	Flipchart and markers, in case notes are needed

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required

80	**Antimicrobial stewardship is**
	World Health Organization
	• The optimal selection, dosage and duration of antimicrobial treatment that results in:
	  • the **best clinical outcome** for the treatment or prevention of infection;
	  • **minimal toxicity** to the patient;
	  • **minimal impact** on subsequent resistance.
	Source: Adapted from: Dellit TH, Owens RC, McGowan JE Jr, Gerding DN, Weinstein RA, Burke JP, et al. Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. Clin Infect Dis. 2007;44(2):159–77.
	Answers
		This slide summarizes the answers to the question.
		Talk through the bullet points.
		Point out which aspects were raised by attendees.
			–

81	**Goals of antibiotic stewardship (1)** World Health Organization What are the goals of antimicrobial stewardship? Interactive question	**Read** the question and **moderate** the discussion. **Allow** a few minutes for this activity.	Flipchart and markers, in case notes are needed

82	**Goals of antimicrobial stewardship (2)**
	World Health Organization
	• A coherent set of actions which promote responsible use of antimicrobials.
	• The main goal is the responsible use of antimicrobials/ antibiotics.
	• Objectives are:
	  • behavior change in physicians' antibiotic prescribing practices;
	  • behavior change in how patients use antibiotics;
	  • improving patient outcomes;
	  • slowing down the development of AMR;
	  • prolonging the lifespan of existing antibiotics; and
	  • reducing health care costs.
	Source: Antimicrobial stewardship programmes in health care facilities in low- and middle-income countries. A WHO practical toolkit. Geneva: World Health Organisation; 2019 (https://apps.who.int/iris/bitstream/handle/10665/329404/9789241515481-eng.pdf)
	Answers
		This slide summarizes the answers to the question.
		Talk through the bullet points.
		Point out which aspects were raised by attendees.
			–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
83	**Actors in antimicrobial stewardship (1)** Who is engaged in antimicrobial stewardship? Interactive question	**Read** the question and **moderate** the discussion. **Allow** a few minutes for this activity.	Flipchart and markers, in case notes are needed

84	**Actors in antimicrobial stewardship (2)**
	
	• It requires **multidisciplinary teamwork**: creating an effective team within the facility's resources.
	• Most AMS stewardship teams include an infectious disease physician and/or a pharmacist and/or nurse.
	• They also include, either as active members or working in close collaboration with the team:
	  • a microbiologist or microbiology laboratory;
	  • an infection prevention specialist (or focal IPC person);
	  • a hospital epidemiologist;
	  • the hospital administration;
	  • the clinician/prescriber.
	
	Answers
		This slide summarizes the answers to the question.
		
		Talk through the bullet points.
		
		Point out which aspects were raised by attendees.
		
		Highlight that it requires teamwork and that the administration has to collaborate and support it.
			–

85	**Monitoring antibiotic consumption (1)** • Surveillance of antibiotic consumption is an essential step in the antibiotic stewardship strategy • In some countries surveillance of antimicrobial consumption is already mandatory  Sources: • Methodology for a Global Programme on Surveillance of Antimicrobial Consumption. Geneva: World Health Organization; 2018 (https://www.who.int/medicines/areas/rational_use/AMU_Surveillance/en/) • WHO Methodology for Point Prevalence Survey on Antibiotic Use in Hospitals. Geneva: World Health Organization; 2018 (https://www.who.int/medicines/areas/rational_use/AMU_Surveillance/en/) • WHO report on surveillance of antibiotic consumption: 2016–2018 early implementation. Geneva: World Health Organization; 2018 (https://www.who.int/medicines/areas/rational_use/oms-amr-amc-report-2016-2018/en/).	**Emphasize** that surveillance of antibiotic consumption is an essential step in the antibiotic stewardship strategy. **Point** to the WHO report without going into detail.	WHO report on surveillance of antibiotic consumption: https://www.who.int/medicines/areas/rational_use/who-amr-amc-report-20181109.pdf?ua=1

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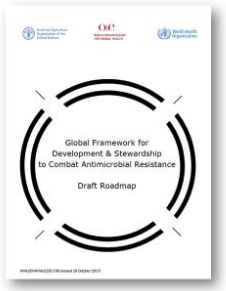
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
86	**Monitoring antibiotic consumption (2)** World Health Organization Countries and areas submitting national data on antimicrobial consumption to WHO based on the WHO methodology or a comparable methodology WHO Region / Countries and areas in the region / Countries and areas submitting data / Countries and areas included in the report No. / No. / No. / % African Region 47 6 4 9 Region of the Americas 35 6 6 17 South-East Asia Region 11 0 0 0 European Region 54 46 46 85 Eastern Mediterranean Region 21 3 3 14 Western Pacific Region 27 7 6 22 *Source:* WHO report on surveillance of antibiotic consumption: 2016–2018 early implementation. Geneva: World Health Organization; 2018 (https://www.who.int/medicines/areas/rational_use/oms-amr-amc-report-2016-2018/en/).	Here refer to the WHO report on surveillance of antibiotic consumption in more detail. **Say:** "This WHO report presents data on antimicrobial consumption from 65 countries. The table shows that the proportion of countries included in the report by WHO region ranges from 0% to 85%."	WHO report on surveillance of antibiotic consumption: https://www.who.int/medicines/areas/rational_use/who-amr-amc-report-20181109.pdf?ua=1
87	**Antimicrobial stewardship and monitoring antibiotic consumption** World Health Organization   *Sources:* Global framework for development and stewardship to combat antimicrobial resistance, draft. Geneva: World Health Organization; 2018 (http://apps.who.int/medicinedocs/documents/s23198en/s23198en.pdf) 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/bitstream/handle/10665/329404/9789241515481-eng.pdf) Key resource	**Point** to efforts undertaken by WHO and stakeholders on this topic, such as the Global Framework for Development & Stewardship to Combat Antimicrobial Resistance and the 2019 practical toolkit, without going into detail. **Encourage** further reading.	Global Framework for Development & Stewardship to Combat Antimicrobial Resistance: http://www.who.int/antimicrobial-resistance/global-action-plan/UpdatedRoadmap-Global-Framework-for-Development-Stewardship-to-combatAMR_2017_11_03.pdf Antimicrobial stewardship programmes in health care facilities in low- and middle-income countries. A WHO practical toolkit. https://apps.who.int/iris/bitstream/handle/10665/329404/9789241515481-eng.pdf

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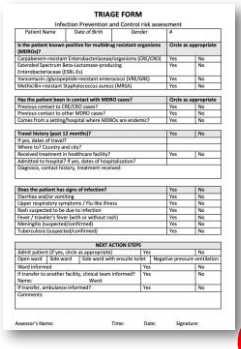
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
88	**Session 3** World Health Organization **Evidence-based IPC strategies to combat antibiotic resistance** **Part B: triage and identification of patients, contact precautions, patient isolation and hand hygiene**	**Say:** "Part B of session 3 covers triage and identification of patients, contact precautions, patient isolation and hand hygiene."	–

89	**Triage and identification of patients**
	World Health Organization
	• Triage of a patient is very important
	  • Identify on admission previously known positive patients with antibiotic-resistant bacteria
	  • Identify "high-risk" patients using a triage risk assessment form
	  • Flag the information in the patient's notes (manually and/or via electronic record)
	 
		Point out that triage of patients is very important – even more so for those with clinical symptoms of infection.
		Say:
		"To save resources and be effective, identify 'high-risk' patients (for example, using a triage risk assessment form or other means/workflows)."
			Refer to handout 10 in the student handbook, p. 17.

90	**Flag notes/records of patients with antibiotic-resistant bacteria** World Health Organization **ALERT** Put alert sticker on the front of patient's notes **MRSA** --- • Isolate patient • Implement contact IPC precautions • Inform IPC nurse Put name of microorganisms inside the patient's notes to prevent breach of confidentiality	**Say:** "By flagging notes and records of patients with antibiotic-resistant bacteria this information is carried on to the relevant care takers." **Highlight** the need for a system everybody is familiar with (so that everybody knows where to look for the information). It is important to **highlight** the need to safeguard confidentiality.	–

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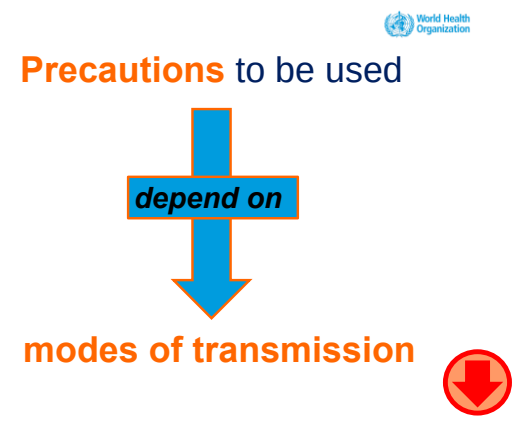
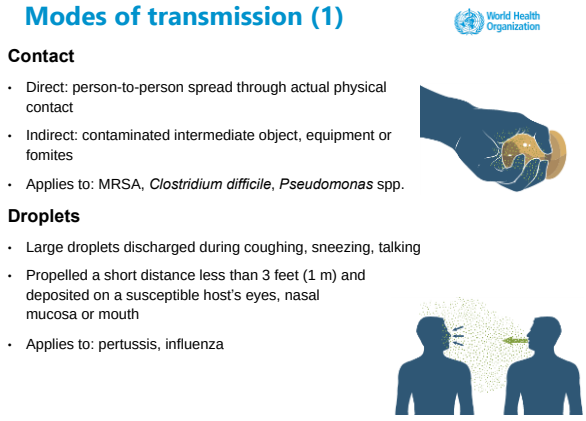
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
91		**Read** the message from top to bottom. **Highlight** the importance of being aware of the mode of transmission. **Ask** attendees to think of common modes of transmission (answers on the following slides).	–
92		**Talk through** the bullet points. **Point out** which aspects were raised by attendees. **Say:** "Contact transmission is the most important and frequent mode of HAI transmission. It is divided into three subgroups: direct contact, indirect contact and droplet transmission. Direct-contact transmission involves direct body surface to body surface contact and physical transfer of microorganisms between a susceptible host and an infected or colonized person. For instance, it can occur when a nurse turns a patient, gives a patient a bath or performs other patient-care activities that require direct personal contact. Direct-contact transmission also can occur between two patients. Indirect-contact transmission involves contact of a susceptible host with an intermediate object, usually inanimate, such as contaminated instruments, needles or dressings, or contaminated gloves that are not changed between patients."	Refer to handout 11 in the student handbook, p. 18.

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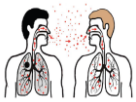
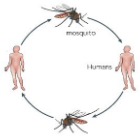
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
93	**Modes of transmission (2)** **Airborne** • Tiny droplet nuclei <5 microns discharged and suspended in air on dust particles, respiratory or water droplets • Aerosolized during procedures (such as suctioning or bronchoscopy) and travelling further • Applies to: tuberculosis, measles, chickenpox  **Common vehicle** • Contaminated inanimate vehicle (food, water or medication) • Applies to: *Salmonella* spp., *Pseudomonas aeruginosa* **Vector** (uncommon in hospitals) • Transfer of microorganisms through insects, mosquitos, flies rats, fleas • Applies to: malaria, yellow fever via mosquitos 	**Talk through** the bullet points. **Point out** which aspects were raised by attendees.	Refer to handout 11 in the student handbook, p. 18.
94	**Modes of transmission (3)** What is the mode of transmission for each of the pathogens below? • *Clostridium difficile* • Influenza virus • Norovirus • *Pseudomonas aeruginosa* • Chickenpox • Measles • Ebola virus disease • Middle East respiratory syndrome coronavirus (MERS-CoV) • Malaria 	**Ask** the attendees to answer the questions. **Encourage** them discuss with the neighbour and to write them down. **Allow** about 3–5 minutes to find the answers.	Flipchart and markers, in case notes are needed
95	**Modes of transmission (4)** • *Clostridium difficile* (contact) • Influenza virus (droplet) • Norovirus (contact and droplet possible) • *Pseudomonas aeruginosa* (contact & common vehicle) • Chickenpox (airborne) • Measles (airborne) • Ebola virus disease (contact) • MERS-CoV (droplet) • Malaria (vector) 	**Talk through** the bullet points. **Point out** which aspects were raised by attendees. **Moderate** the discussion.	Flipchart and markers, in case notes are needed

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required

96	**After identification of patients during triage**
	World Health Organization
	• After identification of patients during triage:
	  • Isolate patients **known** for being infected or colonised with resistant microorganisms
	  • Isolate **suspected** patients, take appropriate screening swabs and keep under isolation until microbiological culture results are available
	  • Isolate patients and implement **contact precautions** with dedicated toilet (if available)
	Interactive question
	What can you do if no single isolation rooms are available?
		Read through the bullet points.
		Ask the question.
			–

97	**Cohorting (1)** World Health Organization • The practice of grouping together patients (a cohort) who are **colonized or infected with the same organism** to confine their care to one area and prevent contact with other susceptible patients (for example, all patients infected or colonized with a carbapenem-resistant Enterobacteriaceae in a specific cohort and all patients colonized with methicillin-resistant Staphylococcus aureus in a different cohort). • Cohorts are created based on clinical diagnosis, microbiologic confirmation when available, epidemiology and mode of transmission of the infection agent. *Source*: Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee. 2007 guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html). WHO. Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, Acinetobacter baumannii and Pseudomonas aeruginosa in health care facilities. 2017 (https://www.who.int/infection-prevention/publications/guidelines-cre/en/). Answers	**Talk through** the bullet points. **Point out** which aspects were raised by attendees. **Highlight** the CDC 2007 guideline for isolation precautions: preventing transmission of infectious agents in health care settings as a very comprehensive source for further reading.	CDC 2007 guideline for isolation precautions: preventing transmission of infectious agents in health care settings: https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines-H.pdf
98	**Cohorting (2)** World Health Organization • Dedicated area • Dedicated staff • Restrictions on number of visitors • Use of single-use items and disposable items, if possible • Dedicated patient items: thermometer, stethoscope, sphygmomanometer etc. • Increased frequency of cleaning and/or disinfection • Decontamination of items/equipment between uses *Source*: Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee. 2007 guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html). Answers	**Talk through** the bullet points. **Point out** which aspects were raised by attendees.	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
99	**Contact precautions** World Health Organization Measures intended to prevent transmission of infectious agents, which are spread by direct or indirect contact with the patient or the patient's environment: • ensuring appropriate patient placement • use of personal protective equipment (PPE), including gloves and gowns • limiting transport and movement of patients • use of disposable or dedicated patient-care equipment • if not single-use items, decontamination of items/equipment between uses • prioritizing cleaning and disinfection of rooms *Source:* Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee. 2007 guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html).	**Explain** that out of all transmission-based precautions (contact, droplet, airborne) the contact precautions are examined in closer detail, because contact is the most important and frequent mode of HAI transmission and the most common mode of transmission of antibiotic-resistant organisms such as MRSA, ESBL-PE, VRE, CRE, CRAB and CRPsA. **Talk through** the bullet points.	–
100	**Standard versus contact precautions (1)** World Health Organization *Source:* Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee. 2007 guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html).	**Explain** the activities for standard versus contact precautions. **Highlight** the fact that most are also crucial in standard care.	Refer to handout 12 in the student handbook, p. 19.
101	**Standard versus contact precautions (2)** World Health Organization *Source:* Siegel JD, Rhinehart E, Jackson M, Chiarello L, Healthcare Infection Control Practices Advisory Committee. 2007 guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention; 2019 (https://www.cdc.gov/infectioncontrol/guidelines/isolation/index.html).	**Explain** the activities for standard versus contact precautions. In contact precautions personal protective equipment (PPE) is meant to be an additional barrier, whereas in standard care PPE is worn according to specific indications.	Refer to handout 12 in the student handbook, p. 19.

Standard versus contact precautions (1)

ACTIVITY	STANDARD	CONTACT
Hand hygiene	YES	YES
Aseptic technique	YES	YES
Decontamination of patient-care items and equipment	YES	YES
Environment cleaning and disinfection	YES	YES
Waste disposal	YES	YES
Safe handle and transport of linens	YES	YES
Patient isolation	NO	YES

Standard versus contact precautions (2)

ACTIVITY	STANDARD	CONTACT
PERSONAL PROTECTIVE EQUIPMENT (PPE)		
Gloves	*Only* when likely to touch blood/body fluids and contaminated equipment and surfaces	Yes – upon entering room to provide patient care, when likely to touch blood/body fluids and contaminated equipment and surfaces
Apron/gown	*Only* during procedures likely to generate contamination from blood and body fluids (soiling)	Yes – upon entering room if clothing will have substantial contact with patient, surfaces or other items in room
Face protection (Surgical face mask)	*Only* during procedures likely to generate aerosols[a]	During procedures likely to generate aerosols[a]
Eye protection/ face-shields	*Only* during procedures likely to generate contamination with blood/body fluids	During procedures likely to generate contamination with blood and body fluids

[a] Only for situations that may provoke contamination of mucous membrane (mouth and nose), and procedures that are likely to create significant aerosols; suctioning, dentistry, intubation, chest physiotherapy and similar.

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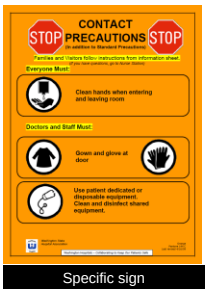
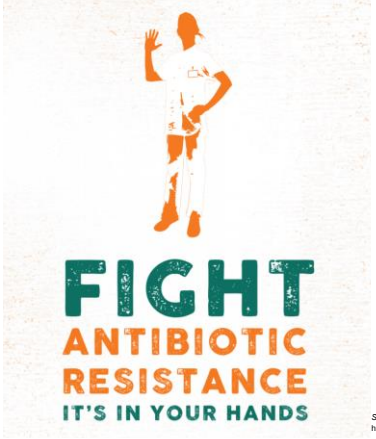
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
102	**Examples of signage on doors of isolation rooms** World Health Organization  Non-specific sign  Specific sign Photo credit (non-specific): Nizam Damani	**Mention** the different examples of signage on door of isolation rooms. **Ask** what attendees prefer and how it is handled in different facilities. **Moderate** the discussion. **Allow** a few minutes for this activity.	Refer to handout 13 in the student handbook, p. 20. Flipchart and markers, in case notes are needed
103	**Patient transfer** World Health Organization • Limit movement and transfer of the patient from the ward/room to essential purposes only • If the patient is transported out of room/ward, ensure that IPC precautions are maintained to minimize risk of transmission of antibiotic-resistant bacteria: inform staff about IPC precautions • If patient is transferred to another health care facility, inform the nurse in change	**Explain** the aspects to ensure proper patient transfer. **Read through** the bullet points.	–
104	 World Health Organization Why is hand hygiene important for preventing antibiotic resistance? *Source:* https://www.who.int/gpsc/5may/2017/en/ Interactive question	**Link** to the previous slide by saying that when transporting a patient, it is of the greatest importance to perform hand hygiene before and after touching the patient, and even after touching the patient's bed. **Ask** the attendees why hand hygiene is important for preventing antibiotic resistance.	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
105		**Highlight** again the fact that contact is the most important and frequent mode of HAI transmission and the most common mode of transmission of antibiotic-resistant organisms such as MRSA, ESBL-PE, VRE, CRE, CRAB and CRPsA. **Use** the opportunity to re-emphasize the WHO 5 moments model by going through the five indications. **Tell** students that they can undertake the "Standard Precautions: Hand Hygiene" course at https://ipc.ghelearning.org/course/123 and access additional educational resources on hand hygiene at https://www.who.int/infection-prevention/tools/hand-hygiene/training_education/en/	–
106	What are good practices with sinks and handwashing basins? World Health Organization  Photo credit: Nizam Damani Interactive question	**Ask** the question on the slide. **Discuss** the photos. **Moderate** the discussion. **Allow** a few minutes for this activity.	Flipchart and markers, in case notes are needed

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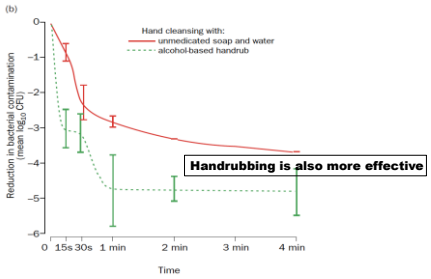
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
107	**Best practices for handwash stations to minimize risk of multidrug-resistant Gram-negative contamination** World Health Organization • Use handwash stations for washing hands **only** • **Do not** dispose of body fluids, beverages or foods at handwash basins – use dedicated (e.g. dirty utility) areas • **Do not** wash any patient equipment in handwash basins or use basins to store equipment awaiting decontamination • Ensure cleaning staff have been trained in correct cleaning procedures for taps and sinks, paying particular attention to limescale deposits • Identify any problems or concerns related to safety, maintenance and cleanliness of handwash stations to the IPC team and facilities department Answers	This slide summarizes the answers to the question **Talk through** the bullet points. **Point out** which aspects were raised by attendees.	–

108	**Hand hygiene in health care settings in low- and middle-income countries**
	World Health Organization
	• Issues with availability of:
	  • running water, 24 hours a day
	  • clean water
	  • soap and antiseptic handwash for sterile procedures
	  • drying materials, such as single-use paper towels or single-use cloth towels
	How do you overcome this problem?
	Interactive question
		Point out that handwashing is not easily achieved even in health care settings owing to a lack of availability of water and other materials.
		Talk through the bullet points.
		Open the discussion by asking the question on the slide.
		Allow a few minutes for this activity.
			Flipchart and markers, in case notes are needed

109	**Application time for hand hygiene and reducing bacterial contamination (soap and water versus alcohol-based handrub)** World Health Organization  *Source*: Pittet D, Boyce J. Hand hygiene and patient care: pursuing the Semmelweis legacy. Lancet Infect Dis. 2001; April: 9–20.	**Say:** "The only way to overcome this issue is to promote the use of alcoholic handrub, which is not only more effective but also faster and better tolerated. This graph shows the application time for hand hygiene (horizontal X-axis) and reduction of bacterial contamination (vertical Y-axis). The green dotted line represents alcohol-based handrub; the red line represents unmedicated soap and water. After only 15–30 seconds, handrubbing (dotted green line) is significantly more efficient than handwashing with plain soap and water to reduce hand bacterial contamination."	–

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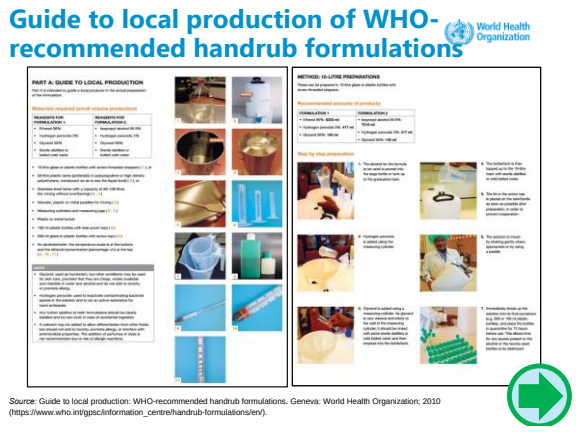
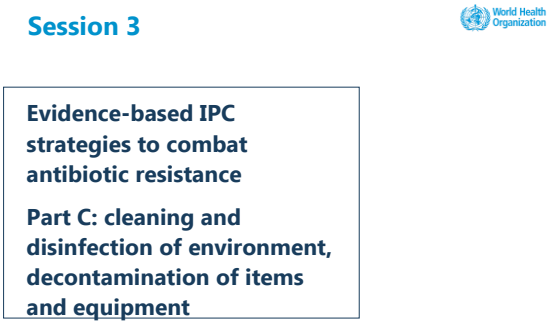
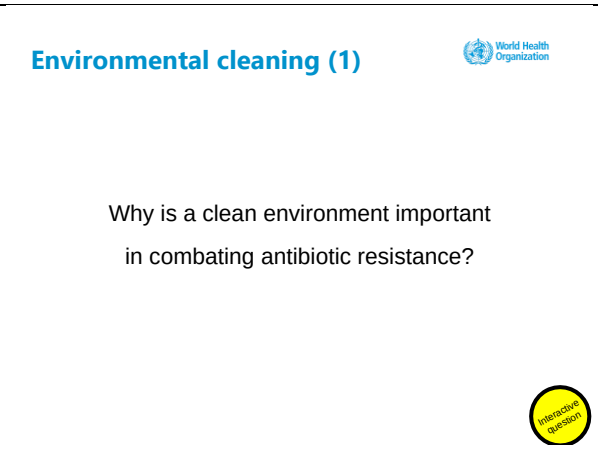
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
110		**Say:** "To support the availability and use of handrub, especially in low-resource settings, WHO has produced and tested a guide to local production of WHO-recommended handrub formulations. This is a practical guide for use at the pharmacy bench during preparation of the formulation, and provides essential background information." **Encourage** further reading.	Guide to local production of WHO-recommended handrub formulations: http://www.who.int/gpsc/5may/Guide_to_Local_Production.pdf?ua=1
111		**Say:** "We now move on to part C of session 3, which covers cleaning and disinfection of environment and decontamination of items and equipment." practices for environmental cleaning in healthcare facilities in resource-limited settings	–
112		Begin by **asking** the question on the slide. **Moderate** the discussion. **Allow** a few minutes for this activity.	Flipchart and markers, in case notes are needed

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
113		This slide summarizes the key answer to the question. **Talk through** it. **Point out** which aspects were raised by attendees. **Ask** the attendees if they know the basic principles of environmental cleaning.	–
114		**Say**: "This is a new publication issued by CDC and the Infection Control Africa Network. It is a best practices document to help guide environmental cleaning in resource-limited settings."	–
115		This and the following slide summarize the answers to the question. **Talk through** the points.	–
116		**Talk through** the bullet points. **Point out** which aspects were raised by attendees.	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
	Basic principles of environmental cleaning (2) World Health Organization • Provide education and practical training to cleaning staff • Appropriate PPE must be worn • Clean and disinfect all environmental surfaces with special emphasis on "hand-touch" surfaces • Use detergent only for cleaning floors; use of disinfectant is not necessary		
117	**Survival time, infectious dose and prior occupancy risk by pathogen** World Health Organization Microorganism / Survival time MRSA — 7 days to >12 months VRE — 5 days to >46 months *Clostridium difficile* — >5 months *A. baumannii* — 3 days to 5 months *E. coli* — 2 hours to 16 months *Klebsiella* spp. — 2 hours to 30 months Norovirus — 8 hours to 7 days Source: Dancer SJ. Controlling hospital-acquired infection: focus on the role of the environment and new technologies for decontamination. Clin Microbiol Rev. 2014;27(4):665–90.	**Say:** "This slide shows different pathogens/microorganisms and their possible survival time in the environment. The article describes these as: 'survival times and infectious doses of a range of pathogens according to, or extrapolated from, original studies, some of which involved animal-based research'. However, it remains somewhat unclear here what media, environment and type of surface this depends on."	Refer to handout 14 in the student handbook, p. 21.
118	**Low- and high-touch surfaces** World Health Organization What is the difference between low- and high-touch surfaces? Interactive question	**Ask** the question on the slide. **Moderate** the discussion. **Allow** a few minutes for this activity.	Flipchart and markers, in case notes are needed

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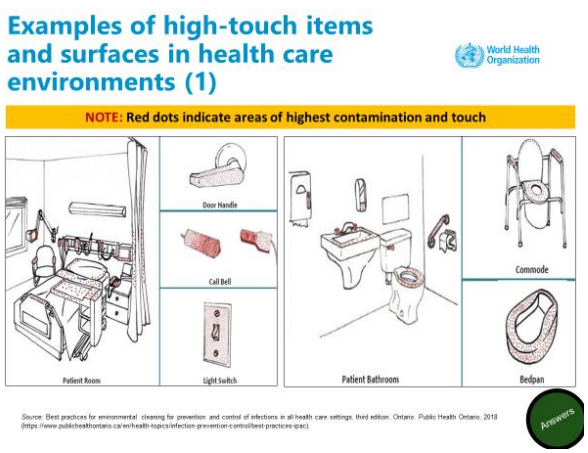
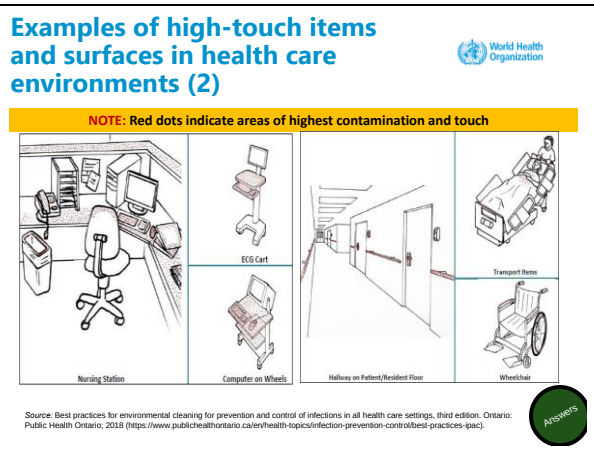
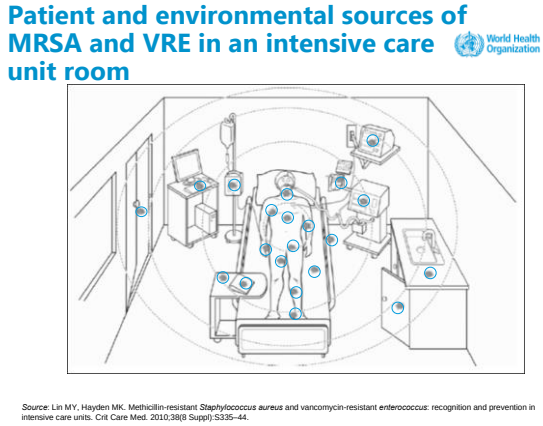
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
119		This and the following slides summarize the answers to the question. **Talk through** the image. **Note**: red dots indicate areas of highest contamination and touch As the red dots might be difficult to see in the images, you might want to walk to the slide and **point them out** by hand or with a laser pointer and name them out loud. **Point out** which surfaces were named by attendees.	Refer to handout 15 in the student handbook, p. 22. https://www.publichealthontario.ca/-/media/documents/bp-environmental-cleaning.pdf?la=en
120		**Talk through** the image. **Note**: red dots indicate areas of highest contamination and touch As the red dots might be difficult to see in the images, you might want to walk to the slide and **point them out** by hand or with a laser pointer and name them out loud. **Point out** which surfaces were named by attendees.	Refer to handout 15 in the student handbook, p. 22. https://www.publichealthontario.ca/-/media/documents/bp-environmental-cleaning.pdf?la=en
121		This slide also displays the “real-life” patient and environmental sources of MRSA and VRE in an intensive care unit room. **Talk through** the image and **refer** to the examples of high-touch items and surfaces seen in earlier slides.	–
122		**Say:** “This table summarizes what high-touch surfaces and their corresponding cleaning requirements are.”	Refer to handout 16 in the student handbook, p. 25.

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
	Cleaning and disinfection World Health Organization <table><tr><th>Type of surface</th><th>Definition</th><th>Cleaning needs</th></tr><tr><td>High-touch surfaces</td><td>• Surfaces that have frequent contact with hands • Surfaces at high risk of touch as near the patient, e.g. bedrail, bed surface, supply cart, overbed table, intravenous pump, call bell, telephone, computer keyboard, light switch, doorknob.</td><td>• Require more frequent cleaning and decontamination with appropriate disinfectants • Require cleaning at least daily and more frequently if risk of environmental contamination is higher, e.g. in intensive care units, during outbreaks</td></tr><tr><td>Low-touch surfaces</td><td>• Surfaces that have minimal contact with hands • Items not in close contact with the patient or immediate surroundings, e.g. floor, wall, ceiling, window sill</td><td>• Require cleaning on a regular basis (but not necessarily daily) • Require cleaning when soiling or spills occur, and when patient/resident is discharged from health care setting</td></tr></table> Answers	**Talk through** the top row in the table. **Contrast** it to low-touch surfaces: **talk through** the second row.	
123	**Medical equipment cleaning** World Health Organization • Depends on type of equipment: clean according to the manufacturer's instructions and written protocols (e.g. after each patient use, daily or weekly) • Refer to the manufacturer's instructions to ensure that the item will not be damaged by use of disinfectants • Schedules and procedures should be consistent and updated on a regular basis • Education and practical training must be provided to all cleaning staff • Assign clear responsibility: who is going to clean/disinfect which items and equipment (cleaning staff or nurses)? • Refer to the WHO decontamination module for further reading	**Say:** "Cleaning of medical equipment is of utmost importance here, especially when dealing with high-touch items and surfaces." **Talk through** the bullet points. **Point out** the requirement to refer to the manufacturer's instructions to ensure that an item will not be damaged by use of disinfectants. **Ask** the attendees whether responsibility for cleaning and disinfecting items and equipment is clearly assigned (to cleaning staff or nurses, for instance) at their facility. **Point out** that it is usually possible to find "grey zones" to which cleaning responsibility is not clearly assigned.	–
124	**Session 3** World Health Organization **Evidence-based IPC strategies to combat antibiotic resistance** **Part D: surveillance of antibiotic-resistant bacteria and monitoring of IPC practices**	**Welcome** the attendees to part D of the session on surveillance of antibiotic-resistant bacteria and monitoring of IPC practices.	–

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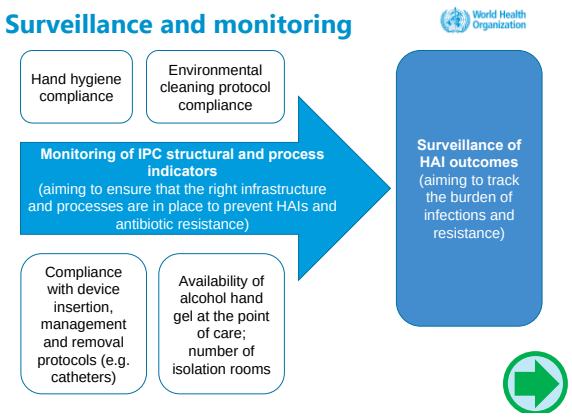
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
125		**Highlight** that there are different approaches to improving and maintaining quality of care. **Say:** "You can monitor **processes**, with the aim of ensuring that they are in place to prevent HAIs and antibiotic resistance." **Talk through** the examples of IPC processes on the slide around the arrow on the left. **Say:** "You can also look at **outcomes**, with the aim of tracking the burden of infections and resistance. After analysis this could be used to focus on and improve processes and other aspects of care. It should be clear that these are complementary forms of surveillance (of processes and of HAIs) and should be implemented simultaneously."	–
126		This and the following slides go into more detail on monitoring compliance. **Say:** "When you want to record whether hand hygiene is happening reliably, use an observational tool to monitor and provide feedback to health care workers. The WHO hand hygiene self-assessment framework is a tool with which to obtain a situation analysis of hand hygiene promotion and practices within an individual health care facility, according to a set of indicators. It also acts as a diagnostic tool and a baseline assessment tool, identifying key issues requiring attention and improvement. Health care facilities can track their	WHO hand hygiene self-assessment framework: https://www.who.int/gpsc/5may/hhsa_framework/en/

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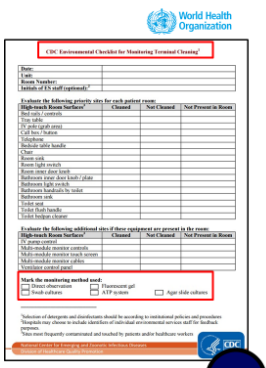
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
		progress in hand hygiene resources, promotion and activities, plan their actions and aim for improvement and sustainability through the framework. Repeated use of the framework will allow documentation of progress over time."	

127	**Monitoring methods of cleaning**
	• Direct observation
	  • Visual assessment
	  • Observation of performance
	• Measurements of cleanliness
	  • Environmental markers to measure residual bioburden
	  • Adenosine triphosphate (ATP) bioluminescence
	  • Environmental cultures
	  • Do not perform routine environmental swabbing
	Source: https://www.cdc.gov/hai/pdfs/toolkits/environmental-cleaning-checklist-10-6-2010.pdf
	 
	Key resource
		Say:
		
		"There are several types of audit. Direct observation can be a visual assessment, such as an inspection after cleaning, or observing a staff member while they are cleaning.
		
		Patient/resident satisfaction surveys are an example of indirect observation. You are getting them to be your eyes and tell you what they see in terms of cleanliness.
		
		Direct and indirect observation answer the question 'Does it look clean?'
		
		Other measurements of cleanliness – such as environmental cultures, adenosine triphosphate and the use of environmental markers – measure the residual bioburden, which means the germs that may have been left behind after cleaning. This type of audit answers the question 'Are germs still present?'"
		
		Point to the CDC website as the source of this checklist.
			Refer to handout 17 in the student handbook, p. 26.
			
			https://www.cdc.gov/hai/toolkits/environmental-cleaning-checklist-10-6-2010.pdf

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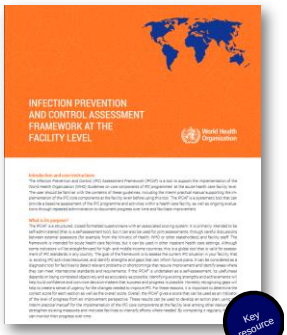
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
128	**Facility-level assessment tool** World Health Organization • Supports facility-level implementation of the WHO guidelines on core components of IPC programmes • Assesses existing IPC activities/resources and identify strengths and gaps • Assigns hospitals a score and position on a continuum of improvement from "inadequate" to "advanced"  *Source:* 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/IPCAF-facility.PDF). Key resource	**Say:** "WHO has developed an assessment tool to assess existing IPC activities/resources and identify strengths and gaps. At the facility level this tool supports implementation of the WHO guidelines on core components of IPC programmes." **Highlight** that a core component of these guidelines is surveillance of HAIs. **Ask** the attendees what "surveillance" means and what it is used for – **allow** 3–5 minutes for discussion.	IPC assessment framework: https://www.who.int/infection-prevention/tools/core-components/IPCAF-facility.PDF Flipchart and markers, in case notes are needed
129	**Surveillance of HAIs/antibiotic resistance** World Health Organization Definition: ongoing, systematic collection, analysis, interpretation and dissemination of data about HAIs and resistance to help guide clinical and public health decision-making and action Surveillance is used to: • provide baseline information on infection occurrence • develop benchmarks of infections in health care settings • describe the microbiological profile of pathogens causing HAIs • detect changes in endemicity of an HAI over time • detect hospital outbreaks • provide data for decision-making, policy and research • set priorities and target activities based on findings • evaluate the impact of IPC measures • reinforce appropriate IPC and patient management practices	This slide summarizes the answers to the question about surveillance. **Read** the definition. **Talk through** the bullet points. **Point out** which aspects were raised by attendees.	–
130	**WHO Global Antimicrobial Resistance Surveillance System (GLASS)** World Health Organization  *Source:* 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/). Key resource	**Say:** "As mentioned earlier in the module, WHO has set up and is running a Global Antimicrobial Resistance Surveillance System (GLASS)."	WHO Global Antimicrobial Resistance Surveillance System (GLASS): http://www.who.int/antimicrobial-resistance/publications/surveillance-system-manual/en/

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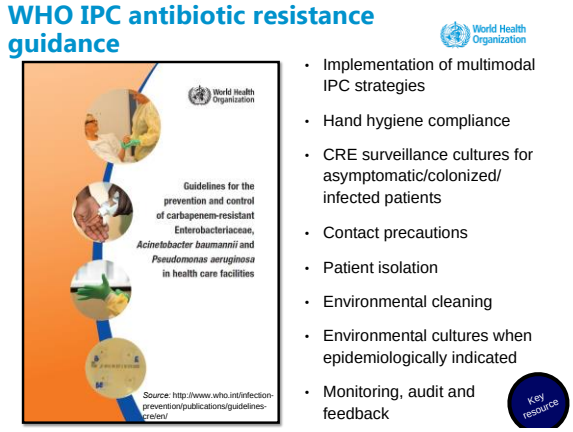
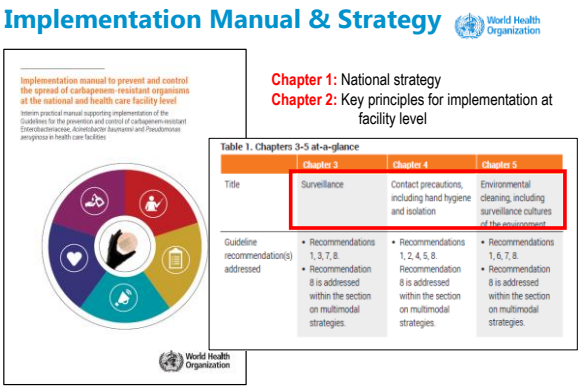
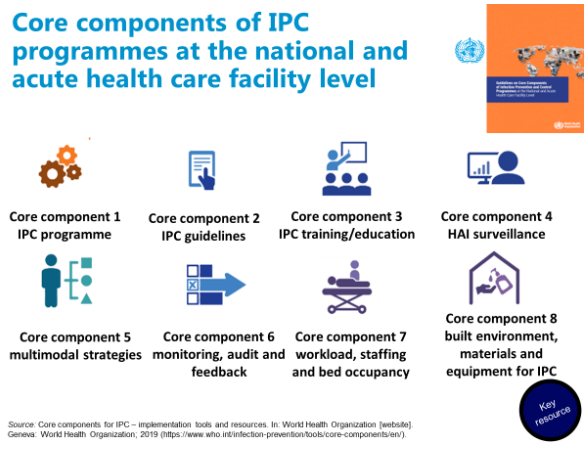
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
131		**Highlight** the recently published WHO guidelines. **Say:** "These are the first ever global guidelines for the prevention and control of CRE, CRAB and CRPsA in health care facilities. They include eight recommendations distilled by experts from a review of the latest evidence. They are intended to support IPC improvement at the health care facility and national level, in both public services and the private sector, and include the component of monitoring, audit and feedback."	WHO guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in health care facilities: http://www.who.int/infection-prevention/publications/guidelines-cre/en/
132	 Source: 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)	**Say:** "Additionally, there is an interim practical manual to support the implementation of the antibiotic resistance guidelines." **Point out** that specific chapters detail the exact recommendations and provide directions on how to approach their implementation by using the WHO multimodal improvement strategy.	Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level: https://apps.who.int/iris/bitstream/handle/10665/312226/WHO-UHC-SDS-2019.6-eng.pdf?ua=1
133		**Say:** "The WHO guidelines on core components of IPC programmes cover eight areas of IPC and comprise 14 recommendations and best practice statements. They describe the evidence-based core elements of an IPC programme. As noted before, one core component is surveillance of HAIs, but an entire core component section is dedicated to monitoring and evaluation and feedback."	Guidelines on core components of IPC programmes at the national and acute health care facility level: https://www.who.int/infection-prevention/publications/core-components/en/

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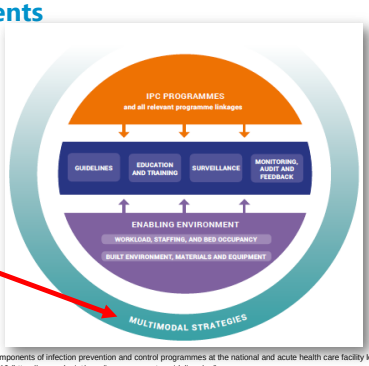
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
134	**National-level key points to support CRO prevention and control** World Health Organization Implementation Manual Chapter 1 1. Having a National IPC programme 2. Awareness-raising/advocacy about the problem 3. Legislation/regulation and accreditation 4. Governance/coordination 5. Laboratory capacity 6. Surveillance 7. System change 8. Education 9. Endemic versus outbreak contexts	This slide summarizes the key elements that need to be taken into consideration at the national level for CRO prevention and control **Read** through the bullet points and encourage attendees to read Chapter 1 of the Implementation manual.	Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level: https://apps.who.int/iris/bitstream/handle/10665/312226/WHO-UHC-SDS-2019.6-eng.pdf?ua=1
135	**Session 3** World Health Organization **Evidence-based IPC strategies to combat antibiotic resistance** **Part E: multimodal strategies for implementing IPC activities**	**Welcome** the attendees to the last part of the last session of the day: part E on multimodal strategies for implementing IPC activities.	–
136	**Combating antibiotic resistance in the context of WHO IPC core components** World Health Organization  *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/). Key resource	**Explain** that the visual “burger” diagram summarizes all the core components. **Point out** that combating antibiotic resistance in the context of WHO IPC core components in a sustained way is only possible with a multimodal strategy: the core component embracing/circling all the others. The next slides take a closer look at the idea of the multimodal strategy.	Refer to handout 18 in the student handbook, p. 28.

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required

137	**Multimodal strategies for combating antibiotic resistance**
	World Health Organization
	• Targeting only **one** area (i.e. unimodal) for AMR prevention – such as offering one training session – is highly likely to be less effective
	• Instead, **a multimodal strategy** is highly recommended, which:
	  • consists of several elements (three or more; usually five)
	  • is implemented in an integrated way in the local context
	  • aims to improve outcomes and change behaviour
	• Multimodal strategies include **bundles** (an implementation tool to improve the care process and patient outcomes in a structured manner)
	• WHO identifies **five elements for IPC multimodal strategies** in the health care context
		Read through the bullet points.
		Highlight the fact that a multimodal strategy usually consists of 3–5 elements.
		Highlight the fact that a multimodal strategy can include bundles, but a bundle is something very specific: a tool to improve the care process and patient outcomes in a structured manner.
			–

138	**Bundle examples: reduction of catheter-related bloodstream infections** World Health Organization  The NEW ENGLAND JOURNAL of MEDICINE An Intervention to Decrease Catheter-Related Bloodstream Infections in the ICU  BMJ RESEARCH Sustaining reductions in catheter related bloodstream infections in Michigan intensive care units: observational study *Sources:* Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S et al. An intervention to decrease catheter-related bloodstream infections in the ICU. N Engl J Med. 2006;355(26):2725–32.; Pronovost P, Goeschel CA, Colantuoni E, Watson S, Lubomski LH, Berenholtz SM et al. Sustaining reductions in catheter related bloodstream infections in Michigan intensive care units: observational study. BMJ 2010;340:c309. Reference/ reading	Don't go into detail, just **point out** the examples of bundles and checklists for reduction of catheter-related bloodstream infections in the USA and United Kingdom.	–
139	**Taking it a step further: multimodal strategies for combating antibiotic resistance** World Health Organization **1. Build it** (system change) — What infrastructure, equipment and supplies are needed? **2. Teach it** (training & education) — Who needs training? What type? How frequently? **3. Check it** (monitoring & feedback) — How can you identify gaps to prioritize actions, track progress and feed back to drive change? **4. Sell it** (reminders & communications) — How do you promote and reinforce the appropriate messages? **5. Live it** (culture change) — Do senior managers support the intervention? Are others willing to be champions? *Source:* 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/).	**Talk through** the five elements of IPC multimodal strategies in a health care context. **Say:** "Scientific evidence and global experience show that each component of the WHO strategy is crucial, and in general no component can be considered optional if the objective is to achieve an effective and sustainable impact. However, the implementation strategy itself is designed to be adaptable without jeopardizing its fidelity and intended outcome. Therefore, depending on the local situation and available resources, some components might be given more emphasis than others, or in	Refer to handout 19 in the student handbook, p. 30.

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
		practice might be implemented in different ways. Regular assessment allows health facilities to direct efforts to all, some or one of the components at any given time. In summary, what is required for success? A focus on all five components as appropriate in the local context; a focus on the local context, with recipients and key multidisciplinary team identified; some innovation; an understanding of the social, cultural and organizational factors; and a clearly understood process of implementation at the local level.”	
140	**Campaigns as good opportunities to invigorate multimodal strategies: WHO Hand Hygiene campaign** World Health Organization SAVE LIVES: Clean Your Hands WHO's global annual call to action for health workers SAVE LIVES: Clean Your Hands 5 May 2017 - Fight antibiotic resistance - it's in your hands Our calls to action are: • Health workers: "Clean your hands at the right times and stop the spread of antibiotic resistance." • Hospital Chief Executive Officers and Administrators: "Lead a year-round infection prevention and control programme to protect your patients from resistant infections." • Policy makers: "Stop antibiotic resistance spread by making infection prevention and hand hygiene a national policy priority." • IPC leaders: "Implement WHO's Core Components for infection prevention, including hand hygiene, to combat antibiotic resistance." Read more about 5 May 2017 here JOIN the Campaign! Take Action! Tools & Resources for Cleaner Care FIGHT ANTIBIOTIC RESISTANCE IT'S IN YOUR HANDS *Source*: http://www.who.int/campaigns/world-antibiotic-awareness-week/en/	**Note** that campaigns are good opportunities to invigorate multimodal strategies, as in this example of the WHO hand hygiene campaign…	–
141	**Campaigns as good opportunities to invigorate multimodal strategies: WHO antibiotic awareness week** World Health Organization World Antibiotic Awareness Week Save the date: World Antibiotic Awareness Week 2017 *Source*: http://www.who.int/campaigns/world-antibiotic-awareness-week/en/	…or the WHO antibiotic awareness week.	–

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
142	 *Source*: based on Guide to the implementation of the WHO multimodal hand hygiene strategy. Geneva: World Health Organization; 2009 (https://apps.who.int/iris/handle/10665/70030). *Source*: 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/en/).	**Say:** "WHO has developed a five-step approach to support implementation of IPC interventions in health facilities. It is important to note that within each of these five steps implementers should consider that success and sustainability of the intervention will only be possible if different competencies are involved from the beginning of the process: multidisciplinarity and co-development." Starting from step 1 walk through the steps **saying:** "The preparatory phase is when you start to think about the context, the intervention or innovation that you want to change and the recipients of that intervention. In step 2 you use available tools to perform a baseline assessment that provides rich and vital information on the current situation. It will reinforce your initial thinking on the context for change, provide insights on the challenges and barriers to implementation and provide some information on recipients. Baseline assessment is a critical step in how you will design and execute your intervention plans. As you move to step 3 and develop your plan, informed by all the intelligence gathered so far, this is where you drill down and consider each of the elements of the multimodal strategy. That is, what you need to put in place to build the best supportive system for change, use of the most appropriate teaching approaches, how you will check whether a change has taken place and practice has improved, the methods you might use to sell the change, and how you will	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

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
		secure the necessary institutional support towards a culture that values the change in practice. Step 4 involves repeating an assessment of the overall impact of the intervention, then reviewing your approach and plans to determine how to sustain the change. This manual focuses on the facility level, but the five-step approach can also be used to support implementation of IPC interventions at the national level (for which WHO has produced a separate manual): the steps are the same."	
143	**Objectives of implementation steps** World Health Organization **STEP** / **OBJECTIVE** 1. Prepare for action — Ensure all the prerequisites that need to be in place for success (planning and coordination of activities) are addressed, including: • necessary human and financial resources; • identification of roles and responsibilities, including key leaders and "champions", an overall coordinator and deputy; • infrastructures in place. 2. Conduct baseline assessment — Conduct an exploratory baseline evaluation of the current situation, including identification of existing strengths and weaknesses. 3. Develop and execute action plan — Use the results of the baseline assessment to develop and execute an action plan based around a multimodal improvement strategy. 4. Evaluate impact — Conduct a follow-up evaluation to assess the effectiveness of the plan, with a focus on its impact, acceptability and cost–effectiveness. 5. Sustain programme over the long term — Develop an ongoing action plan and review cycle to support the long-term impact and benefits of the programme and the extent to which it is embedded across the health system and country, thus contributing to its overall impact and sustainability. *Source*: 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).	For recapitulation **ask** an attendee to read the steps.	Refer to handout 20 in the student handbook, p. 32.
144	**Multimodal strategies to combat antibiotic resistance (1)** World Health Organization Who can give an example of a multimodal approach to reduce HAIs and improve infection control? Interactive question	Move on to further interaction by **asking** the question on the slide. **Moderate** the discussion. **Allow** a few minutes for this activity.	Flipchart and markers, in case notes are needed

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
145	**Multimodal strategies to combat antibiotic resistance (2)** World Health Organization • In 2007 the National Children's Hospital in Costa Rica started working with WHO on a pilot study to reduce HAIs, including antibiotic-resistant bacteria. • The Ministry of Health provided initial support and a local private company donated alcohol-based handrub for first year. • Using a multimodal approach, this is what happened in Costa Rica…  *Source*: 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/).	**Ask** an attendee to read the introduction to the group work 2 case study on the slide. **Move on** to the next slide and pause that one during the group work.	–
146	**Multimodal strategies to combat antibiotic resistance (3)** World Health Organization • Below you see the five crucial elements of the multimodal approach. • In groups of 5–7 people, please refer to your handbook. Go through the instructions for group work 2. • Building the right system • Selling the right messages • Teaching the right things • Living IPC throughout the health system • Checking the right things Case study	**Ask** attendees to refer to their student handbooks and turn to group work 2. **Ensure** that attendees are in groups of no more than 5–7 people, if possible. **Go through** the instructions: attendees are to read the case study and answer the questions presented at the end in their groups. **Allow** 15 minutes to read the case study and answer the questions. **Ask** a representative of each group to read/present their answers. **Moderate** the discussion. **Allow** 5 minutes for feedback from each group.	Refer to group work 2 in the student handbook, p. 33. (For facilitator notes and answers see Annex 3)
147	**Applying the multimodal strategy to preventing carbapenem resistance spread** World Health Organization **Focus on 3 recommendations: Contact Precautions, Including Hand Hygiene and Isolation** • Recommendation 2: importance of hand hygiene compliance for the control of CRE-CRAB-CRPsA: Hand hygiene best practices according to the WHO guidelines on hand hygiene in health care should be implemented. *(Strong recommendation)* • Recommendation 4: contact precautions: Contact precautions should be implemented when providing care for patients colonized or infected with CRE-CRAB-CRPsA. *(Strong recommendation)* • Recommendation 5: patient isolation: Patients colonized or infected with CRE-CRAB-CRPsA should be physically separated from non-colonized or noninfected patients using (a) single room isolation or (b) by cohorting patients with the same resistant pathogen. *(Strong recommendation)* *Source*: http://www.who.int/infection-prevention/publications/guidelines-cre/en/	After the discussion on the case study, **remind** the students about the recommendations to prevent carbapenem resistance spread and in particular, recommendations 2, 4 and 5. **Read** the slide. **Tell** the attendees that the next slides will explain the application of the multimodal strategy for the implementation of these recommendations.	WHO guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae, *Acinetobacter baumannii* and *Pseudomonas aeruginosa* in health care facilities: http://www.who.int/infection-prevention/publicat

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
			ions/guidelines-cre/en/
148	**Build it** World Health Organization *The infrastructure, equipment, supplies, and other resources (including human) required to implement the intervention.* • Put in place/improve a sustainable system to reliably procure and deliver necessary supplies needed to enable: (a) compliance with hand hygiene at the 'Five Moments', that is, alcohol-based handrub at the point of care, water, soap and hand drying materials; (b) compliance with recommended contact precautions, that is, PPE, with a focus on the need for a range of sizes. • In settings where water access/quality are not readily available, develop a plan for improving water access and quality. • In settings where bar soaps are used for handwashing, they should be kept dry; hand drying materials should be single use. • For special considerations relating to clinical handwash basins/sinks, including location and design, see the system change section in chapter 5 (environmental cleaning). • Develop/adapt enforceable protocols/standard operating protocols available at the point of care on: (a) who decides about patient isolation (that is, designate nurses as decision-makers on isolation as they are 24/7 on the wards and it can be done in a more timely manner; (b) which organisms require the implementation of contact precautions and isolation; (c) criteria for ward closure, for example, outbreaks; (d) when is it acceptable to care for patients with different CROs in the same cohort and how the geographical separation should be done (that is, where there is no availability of separate rooms and influenced by local epidemiology); (e) what supplies need to be procured and distributed regularly. • Define and agree on roles and responsibilities for effective procurement systems with strong IPC involvement. • In settings where single rooms are in short supply/unavailable, consider using coloured tape on the floor to reinforce contact precautions and the geographical separation of cohorted patients. *Source:* 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)	**Ask** a participant to read the slide and the group if they have any comments or anything to add.	Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level: https://www.who.int/infection-prevention/tools/focus-amr/en/
149	**Teach it** World Health Organization *Training the appropriate health staff to ensure that interventions are implemented in line with evidence-based policies.* • Assess local training needs. • Put in place/improve a reliable mechanism for producing/using updated training resources and information for staff on these recommendations with a focus on: (a) the use of risk assessment; (b) practical hands-on/real-life demonstrations (for example, PPE use); (c) training materials in the local language. • Reinforce application of the 'Five Moments' for hand hygiene for patients with invasive devices (see hand hygiene Tools and Resources). • Ensure that senior management and hospital administrators fully understand all aspects of CROs, including the importance of the moments for hand hygiene, the use of PPE, and the indications for contact precautions and isolation. • Secure sign-off of training plans by senior managers (for example, by the IPC committee or equivalent) • Train staff on a regular schedule on all aspects of these recommendations (focus on pre-employment/orientation and periodic updates) and enable staff to train others. • Develop information/educational resources using a range of media for patients and carers with a focus on the implications of infection/colonization and psychological support. Those performing training should be competent in the subject matter. *Source:* 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)	**Ask** a participant to read the slide and the group if they have any comments or anything to add.	Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level: https://www.who.int/infection-prevention/tools/focus-amr/en/

150	**Check it**
	World Health Organization
	Identifying gaps in IPC practices or other indicators to prioritize interventions and tracking practices to ensure that they are being done appropriately. Giving feedback to target audience and managers.
	• Put in place/improve a monitoring, reporting and feedback mechanism (including roles and responsibilities) regarding:
	  ○ reliable availability of hand hygiene infrastructures and products, for example, clinical handwash basins, soap, water, hand drying products, alcohol-based handrub;
	  ○ percentage of staff compliant with standard operating procedures/protocols, for example, hand hygiene compliance according to the 'Five Moments'; (b) use of contact precautions, including a mechanism for reporting shortages, stockouts and failure of PPE;
	  ○ reliable availability of isolation and cohorting facilities;
	  ○ appropriate use of isolation and cohorting facilities;
	  ○ availability and use of patient and visitor information materials;
	  ○ correct and timely implementation of contact precautions and isolation or cohort (that is, isolation of all patients with positive results for CRO in the last 24 hours).
	• Ensure that monitoring, reporting and feedback mechanism address decision makers in addition to health care workers.
	• Consider the development/use of daily/weekly checklists.
	Source: 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)
		Ask a participant to read the slide and the group if they have any comments or anything to add.	Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level: https://www.who.int/infection-prevention/tools/focus-amr/en/

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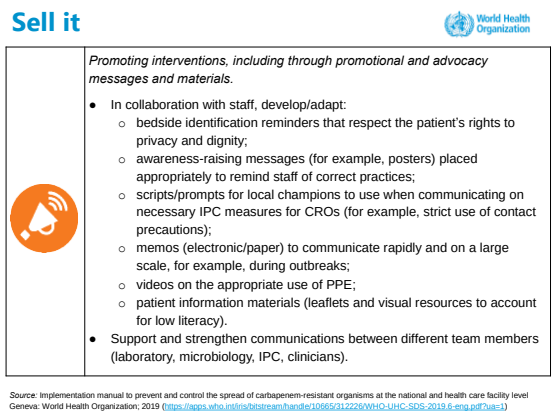
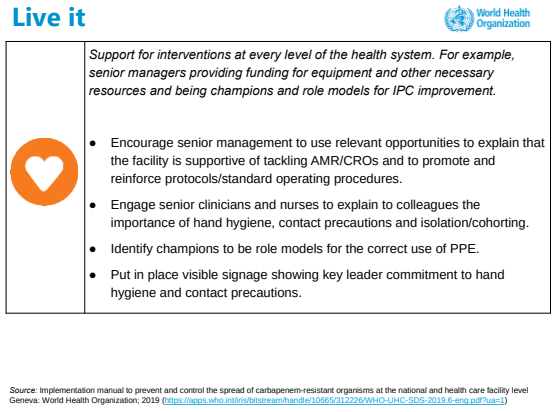
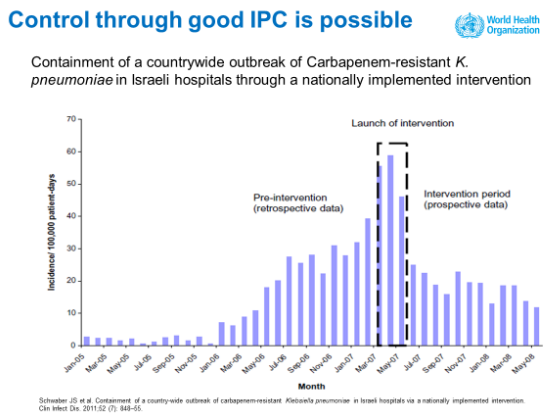
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
151		**Ask** a participant to read the slide and the group if they have any comments or anything to add.	Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level: https://www.who.int/infection-prevention/tools/focus-amr/en/
152		**Ask** a participant to read the slide and the group if they have any comments or anything to add.	Implementation manual to prevent and control the spread of carbapenem-resistant organisms at the national and health care facility level: https://www.who.int/infection-prevention/tools/focus-amr/en/
153		**Conclude** that control through good IPC is possible, giving an example. **Say:** "During 2006, Israeli hospitals faced a clonal outbreak of carbapenem-resistant *Klebsiella pneumoniae* that was not controlled by local measures. A nationwide intervention was launched to contain the outbreak and to introduce a strategy to control future dissemination of antibiotic-resistant bacteria in hospitals. By 31 March 2007, 1275 patients were affected in 27 hospitals (175 cases per 1 million population). Prior to the intervention, the monthly incidence of nosocomial CRE was 55.5 cases per 100 000 patient-days. With the intervention, the continuous increase in the incidence of CRE acquisition was	–

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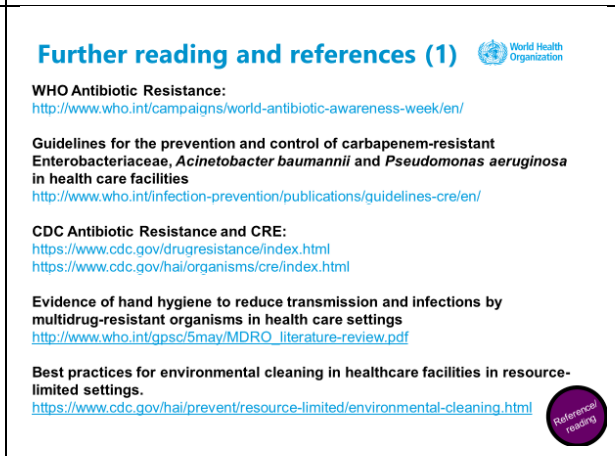
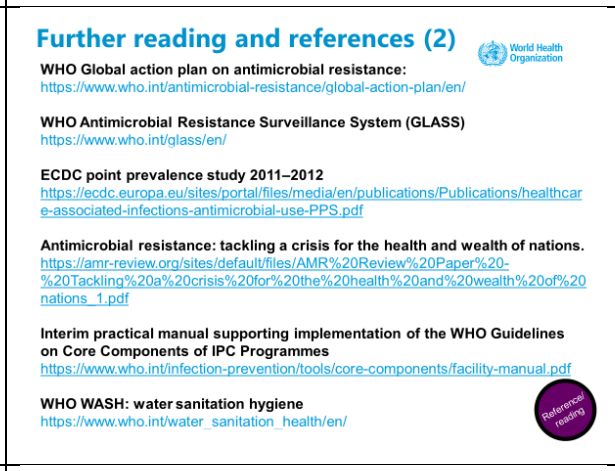
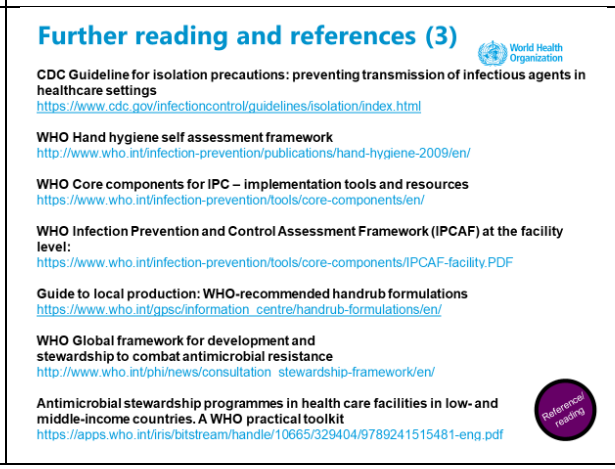
Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
		halted, and by May 2008 the number of new monthly cases was reduced to 11.7 cases per 100 000 patient-days (P <.001)."	
154		No need to read the slide – just **explain** that there are further reading materials on all of the topics addressed here. Attendees will find the list at the end of their handbooks.	Refer to handout 21 in the student handbook, p. 36.
155		No need to read the slide – just **explain** that there are further reading materials on all of the topics addressed here. Attendees will find the list at the end of their handbooks.	Refer to handout 21 in the student handbook, p. 36.
156		No need to read the slide – just **explain** that there are further reading materials on all of the topics addressed here. Attendees will find the list at the end of their handbooks.	Refer to handout 21 in the student handbook, p. 36.

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Slide no.	Slide image	Notes: descriptions and suggestions for the trainer to consider	Resources required
157	**Acknowledgemnts** World Health Organization • Benedetta Allegranzi (Department of Integrated Health Services, WHO) coordinated the development of this module and contributed to its writing. • Sara Tomczyk (Robert Koch Institute, Germany) and Peter Bischoff (Institute of Hygiene and Environmental Medicine,Charité-University Medicine Berlin, Germany) led the writing of the module. • Alessandro Cassini and Anthony Twyman (Department of Integrated Health Services, WHO) contributed to the writing of the module.	No need to read the slide.	–
158	World Health Organization **WHO Infection Prevention and Control Technical and Clinical Hub** HEALTH CARE WITHOUT AVOIDABLE INFECTIONS	**Thank** everyone for attending.	–

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Annex 1. Pre- and post-training test

The same pre- and post-training test (p. 60 below) should be distributed to attendees at the beginning and end of this module to gauge their knowledge of AMR. The pre-training test will develop a baseline, measuring existing knowledge, and identify knowledge gaps. The post-training test will assess the knowledge gained through the module.

This page contains the answers to the test; please ensure two copies of the master form on p. 60 are printed for each student. Hand one out at the start of the session to collect initial data from attendees and the other at the end to assess progress.

FORM WITH ANSWERS – for trainer

Advanced IPC knowledge exam: combating AMR

All questions are multiple choice. Please circle one answer or all that apply as per each question's instructions.

Combating AMR

1. What are the key IPC elements used to prevent and control antibiotic-resistant bacteria? (Please circle all that apply.)
    a. **Triage and identification of patients, contact precautions, patient isolation, hand hygiene**
    b. Taking microbiological samples of the environment to detect contamination and enhancing disinfection when positive
    c. **Cleaning and disinfection of environment, decontamination of items and equipment**
    d. **Surveillance of antibiotic-resistant bacteria and monitoring of IPC practices**
    e. **IPC education/training of all health care workers**

2. Please mark the horizontal interventions (i.e. measures to control **all** health care-associated infections (HAIs)) with an "H" and the vertical interventions (i.e. **organism-specific** measures) with a "V".

- **H** – Cleaning and/or disinfection of environment
- **H** – Waste management
- **V** – Screening for antibiotic-resistant organisms
- **V** – Placement of patient in isolation room
- **H** – Application of contact precautions
- **H** – Hand hygiene
- **H** – Minimum use of invasive devices, decontamination of items and equipment

3. Which of the following statements are true about antibiotic-resistant bacteria? (Please circle all that apply.)

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a. **Some bacteria can pass genetic material to other bacteria to become antibiotic-resistant, contributing to the spread of antibiotic resistance.**
b. Bacteria that are antibiotic-resistant are also resistant to most disinfectants.
c. **Antibiotic-resistant Gram-negative bacteria can cause serious nosocomial infections.**
d. **Some bacteria are difficult to eradicate because of their remarkable ability to survive and spread in the hospital environment.**

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Master form – for use in session

Advanced IPC knowledge exam: combating AMR

All questions are multiple choice. Please circle one answer or all that apply as per each question's instructions.

Combating AMR

1. What are the key IPC elements used to prevent and control antibiotic-resistant bacteria? (Please circle all that apply.)

    a. Triage and identification of patients, contact precautions, patient isolation, hand hygiene
    b. Taking microbiological samples of the environment to detect contamination and enhancing disinfection when positive
    c. Cleaning and disinfection of environment, decontamination of items and equipment
    d. Surveillance of antibiotic-resistant bacteria and monitoring of IPC practices
    e. IPC education/training of all health care workers

2. Please mark the horizontal interventions (i.e. measures to control **all** health care-associated infections (HAIs)) with an "H" and the vertical interventions (i.e. **organism-specific** measures) with a "V".

- Cleaning and/or disinfection of environment
- Waste management
- Screening for antibiotic-resistant organisms
- Placement of patient in isolation room
- Application of contact precautions
- Hand hygiene
- Minimum use of invasive devices, decontamination of items and equipment

3. Which of the following statements are true about antibiotic-resistant bacteria? (Please circle all that apply.)

    a. Some bacteria can pass genetic material to other bacteria to become antibiotic-resistant, contributing to the spread of antibiotic resistance.
    b. Bacteria that are antibiotic-resistant are also resistant to most disinfectants.
    c. Antibiotic-resistant Gram-negative bacteria can cause serious nosocomial infections.
    d. Some bacteria are difficult to eradicate because of their remarkable ability to survive and spread in the hospital environment.

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Annex 2. Group work 1: facilitator notes

Case study: preterm child in a tertiary referral hospital

Instructions

- Divide attendees into groups of 5–7 people.
- If possible, assign a facilitator from the training team to each group.
- Instruct all attendees to read the case study, which is listed in their student handbooks.
- Ask each group to answer the two questions presented at the end.
- Allow a total of 15 minutes for this discussion.
- Gather the groups together and discuss their conclusions (5 minutes per group).

Setting

Preterm child in a tertiary referral hospital

Background information

- extremely preterm (<28 weeks)
- very preterm (28 to <32 weeks)
- moderate to late preterm (32 to <37 weeks).

Case history

- **Day 1**. A preterm (32 weeks) baby was delivered in the labour ward of a tertiary referral hospital and transferred to the neonatal intensive care unit (NICU).

- **Day 2.** The baby developed signs and symptoms of acute respiratory distress syndrome. Blood culture and umbilical swab were taken and she was started on ceftazidime and vancomycin.

- **Day 3.** The baby's condition deteriorated. A lab technician phoned to say that they had isolated multidrug-resistant Gram-negative bacteria from blood culture and umbilical swab: CRE.
    - The antibiotic was changed to meropenem.

- **Day 4.** The baby's condition deteriorated further, so the antibiotic was changed to colistin (a last-resort drug). The microbiology lab report confirmed *Klebsiella pneumoniae*, resistant to all antibiotics including colistin.

- **Day 5.** The baby's condition deteriorated even further. She developed septic shock with multi-organ failure. The baby died the next day.

The NICU had had other cases of CRE in the past year but no outbreaks. This was the first case of colistin-resistant bacteria in the NICU.

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Questions

1. **The problem**
   In your groups, discuss the origin of CRE. How did the organism get into the baby's blood? What is the likely source?

   Summarize in writing what you think was the main problem that needed to be addressed.

2. **Identifying key IPC elements**
   a. Discuss the key IPC elements to prevent and control antibiotic-resistant bacteria and health care-associated infections (HAIs) you know of so far.
   b. What action would you take (have taken) in this case?

   Summarize in writing what you think are the key IPC elements and apply the action steps to this case.

Facilitator notes: sample answers

Question 1

- The baby could have acquired the multidrug-resistant antibiotic infection through:
  - staff in the labour/NICU ward (for example, through a lack of hand hygiene)
  - contaminated items, equipment or environment
  - parents

- Such bacteria could also be imported into the hospital by:
  - patients who acquired them in the community but were unaware until admitted
  - visitors to the hospital
  - those who have travelled abroad and/or sought care in foreign countries

Question 2

Key IPC elements include:

- triage and identification of patients, contact precautions, patient isolation, hand hygiene
- cleaning and disinfection of environment, decontamination of items and equipment
- surveillance of antibiotic-resistant bacteria and monitoring of IPC practices
- IPC education/training of all health care workers
- antibiotic stewardship

Possible actions in this case include:

- placement of patient in isolation room
- application of contact precautions
- high-frequency cleaning and/or disinfection of environment, 2–3 times per day

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- taking microbiological samples of the environment to detect contamination and enhancing disinfection when positive
- personalized use of items and equipment, with frequent decontamination
- screening patients on the ward for antibiotic-resistant organisms
- hand hygiene
- specific IPC education/training of health care workers involved
- specific IPC education/training of visitors/parents (especially in hand hygiene)
- monitoring of IPC practices (hand hygiene, management of invasive devices/lines, decontamination of items and equipment)

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Annex 3. Group work 2: facilitator notes

Case study: multimodal strategies to combat antibiotic resistance

Instructions

- Divide attendees into groups of 5–7 people.
- If possible, assign a facilitator from the training team to each group.
- Instruct all attendees to read the case study, which is listed in their student handbooks.
- Ask each group to work through the five questions on the multimodal approach elements and the supplementary questions presented at the end.
- Allow a total of 15 minutes for this discussion.
- Gather the groups together and discuss their conclusions (5 minutes per group).

Setting

- In 2007 the National Children's Hospital in Costa Rica started working with WHO on a pilot study to reduce HAIs, including antibiotic-resistant bacteria.
- The Ministry of Health provided initial support and a local private company donated alcohol-based handrub for the first year.

Multimodal strategies for combating antibiotic resistance

Since targeting only one area (i.e. unimodal) for AMR prevention – such as offering one training session – is highly likely to be less effective, a multimodal strategy was developed and implemented. It consisted of five elements implemented in an integrated way in the local context.

Case history

The five crucial elements of the multimodal approach in Costa Rica were as follows.

Building the right system

- Health care workers historically used soap, water and towels to clean hands when providing care, but water shortages were an issue during the dry season.
- Following WHO recommendations to ensure safe, clean hands at the right times, the critical need to make alcohol-based handrub available at the bedside was discussed with managers.
- Since 2007 a major part of the National Children's Hospital's improvement success has been the commitment to having alcohol-based handrub at bedsides.

Teaching the right things

- Every health care worker starting work at the hospital received training on hand hygiene, HAIs and antibiotic resistance, including students.

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Checking the right things

- Early reports showed average hand hygiene compliance to be low (40%) – this was a big driver for improvement.
- Once the multimodal approach was implemented, hand hygiene compliance rates increased from 40% to 70%, with HAIs falling from 7% to 4% (leading to fewer infections and deaths).
- The hospital started collecting data on antibiotic-resistant bacteria and introduced standardized monitoring methods.

Selling the right messages

- All the hand hygiene improvement tools and the advocacy and promotional materials were translated into Spanish.
- Awareness-raising events were held to promote the value of clean hands.

Living IPC throughout the health system

- Strong leadership support at the hospital and nationally were critical to changing the culture.
- When there was a shortage of alcohol-based handrub, a survey showed that staff missed using the product and found it more difficult to clean their hands.
- The improvement approach then spread to other facilities.

Questions

Each of the elements of the multimodal approach is prompted by specific questions.

1. Build it – What infrastructure, equipment and supplies are needed?
2. Teach it – Who needs training? What type? How frequently?
3. Check it – How can you identify gaps to prioritize actions, track progress and feed back to drive change?
4. Sell it – How do you promote and reinforce the appropriate messages?
5. Live it – Do senior managers support the intervention? Are others willing to be champions?

- Read through the questions.
- In your group, discuss and write down the key aspects to answer them from the case study.
- Would you have taken different action? How?
- What are possible challenges that need to be overcome?
- As a group, for each element, choose one of the challenges identified above that you/members of your group have faced and write down what action was taken to address these challenges in your own place of work.

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Facilitator notes: sample answers

Implementation and behavioural change strategies are important for successful IPC.

- Quality improvement interventions in IPC require individual, team and organizational behaviour change.
- Understanding cultural, behavioural, organizational and clinical factors influencing behaviour change is essential for the successful implementation of guidelines and interventions.
- Several psychological frameworks have been used to understand how the different factors interplay.

Possible challenges that need to be overcome include the following.

Internal context

- Organizational leaders don’t believe there is a problem.
- Leaders don’t prioritize the topic.

Local and organizational context

- A negative culture (of fear or similar) is present.
- Equipment/resources are lacking.

External context

- No national guidelines or mandates are in place on the topic.
- No national campaigns are run to reduce X or enforce X.

Recipients may lack:

- motivation
- values/beliefs
- goals
- skills
- knowledge
- time
- resources
- support
- opinion leaders
- power
- authority

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Multimodal strategies aim to improve outcomes and change behaviour. To learn more about the multimodal improvement strategy, use Handout 15 of the Student's Handbook or the related document at https://www.who.int/infection-prevention/publications/ipc-cc-mis.pdf?ua=1.

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Annex 4. Additional information

Provide these further details if asked by attendees.

Decolonization therapy for control of antibiotic-resistant bacteria

For MRSA, decolonization therapy can be effective in the short term, helping to reduce the bioburden and cross-infection in select populations. It can take the form of:

- body wash – use of an antiseptic solution, for example, such as chlorhexidine gluconate (4%) daily for five days;
- nasal ointment – use of mupirocin (2%) nasal ointment, for example, twice daily for five days.

Note: mupirocin resistance has been associated with widespread, prolonged use and should initially be limited to two consecutive decolonization treatments.

For VRE, ESBL-PE, CRE, CRAB and CRPsA, decolonizing therapy may not be effective, although it has been used as part of interventions to control outbreaks of VRE or CRE.

Source: Septimus EJ, Schweizer ML. Decolonization in prevention of health care-associated infections. Clin Microbiol Rev. 2016;29(2);201–22.