# Infection prevention and control to reduce the risk and burden of AMR

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Prevention and control of infections in healthcare settings can reduce the risk of resistant microorganisms, minimise their spread and reduce the overall need for antimicrobials. Consequences of poor infection prevention and control (IPC) include inadequate quality and safety of care, high healthcare costs and increased severity and number of deaths. However, to understand how IPC has an impact on antimicrobial resistance (AMR), which interventions are more effective and how to implement these, we first need to take a step back and look at why AMR is a healthcare issue.

## Why is AMR a healthcare issue

Organisms unceasingly evolve to adapt and survive in nature. Microorganisms causing infections are not different and may develop resistance to antimicrobials which threaten to kill them. Antimicrobials such as antibiotics exist in nature, and so does resistance to these. However, since synthesized antimicrobials have started to be used to treat infections saving millions of lives, increased exposure has amplified the number of infections with antimicrobial resistance. This phenomenon is based on mechanisms of selective pressure from the antimicrobials: 1) microorganisms have the incentive to evolve and 2) those surviving will occupy the space (ecology) of those that were killed by the antimicrobial.

Hospitals and other healthcare settings are closed environments containing a large sick population, often in contact, and where antimicrobials are used in high numbers. This time/place/person combination represents the perfect epidemiological storm for infectious diseases. It's no surprise, therefore, that an ecology with such a selective pressure is a source and reservoir for infections with antimicrobial-resistant bacteria. Basically, hospitals are places where it's easier to be infected by infections (healthcare-associated infections, HAIs), particularly those that are resistant to antimicrobials.

Moreover, hospitals are places populated with patients, sometimes elderly or very young, who might be suffering from several diseases at the same time (co-morbidities), such as immunodepression, that tamper their ability to respond to infections. These vulnerable people are more exposed to HAIs, will carry the infections for more time and might succumb to them. The risk of a severe infection and of death due to these infections is higher for AMR because some antimicrobials are ineffective, it takes more time to identify the correct treatment and AMR is more difficult to treat.

The burden of AMR is considered biggest in healthcare facilities, leading the World Health Organization (WHO) Global Action Plan on Antimicrobial Resistance *(1)*, to identify Objective 3 as key in addressing AMR: "Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures". A large part of these interventions aims at preventing and controlling AMR in healthcare facilities and are essential if quality of care is to be guaranteed. In fact, up to 50% of HAIs, including those with AMR, are preventable through the implementation of appropriate IPC measures.

With the objective to assist countries in implementing IPC of AMR in healthcare settings, WHO recently published the "Guidelines for the prevention and control of carbapenem-resistant Enterobacteriaceae (CRE), *Acinetobacter baumannii* (CRAB) and *Pseudomonas aeruginosa* (CRPsA) in health care facilities" *(2)*. The guidelines tackle the issue of preventing and controlling infections with antibiotic-resistant bacteria that pose a significant threat to national and international public health because they are associated with high mortality and have the potential for widespread transmission. The document complements the 2016 WHO "Guidelines on core components of infection prevention and control programmes at the national and acute healthcare facility level" *(3)*, and addresses specific intervention and implementation strategies for these emerging causes of HAIs.

## IPC for reducing AMR

IPC interventions to control the occurrence, identification and spread of AMR in healthcare settings can be grouped vertically and horizontally depending on whether they apply to specific microorganisms or to all infections, respectively. Horizontal interventions constitute the building blocks for preventing the spread of any pathogen, including those carrying AMR features. To lay the foundations for safe health systems able to protect populations and patients from infection harm, WHO identified

and provided recommendations on the core components of IPC (3). Based on these horizontal interventions, additional tailored measures are needed for preventing AMR and are referred to as vertical interventions.

For example, surveillance of HAIs is a horizontal component throughout the healthcare facility: the infrastructure needs to be in place (e.g., laboratory capacity, reporting tools) and healthcare workers need specific expertise to recognize and diagnose a HAI. To the same extent, screening and surveillance of specific microorganisms with an antimicrobial threat (a vertical IPC intervention), such as carbapenem-resistant ones, need to be in place and follow specific guidelines and workflows. Inpatients with clear symptoms are at risk of spreading a HAI, in addition to hospitalized patients without any clear sign of an infection (asymptomatic) and who can still carry AMR microorganisms (colonization) that can spread in the healthcare facility. Therefore, monitoring of signs and symptoms of infected inpatients, as well as identifying and swabbing those at risk of carrying CRE, are key IPC interventions particularly in outbreak situations. Decision-making flowcharts for triage are available for implementation of screening *(4)* and identification of an infected or carrier inpatient should trigger a number of IPC measures, besides those normally recommended.

Once patients with a suspected infection or positive cultures are identified, they should must be isolated in single rooms or, if unavailable, it's also possible to group them according to affecting organisms and transmission pathways (cohorting). Healthcare facilities should have a dedicated area for isolating or cohorting patients with the same pathogen; in these areas, dedicated staff and equipment should be assigned with preference to single-use, disposable items and particular attention to decontamination of reusable equipment and environment cleaning and disinfection, and the number of visits should be restricted.

Precautions do not stop at isolating or cohorting the inpatients: anyone entering the room should be aware and able to apply contact precautions, and signage reminding about tailored contact precautions should be applied on the doors of these rooms (no names to ensure confidentiality). Usually, standard precautions should be in place (horizontal interventions): these include proper hand hygiene; using gloves, aprons, face and eye protection only when at risk of touching body fluids and airborne infections. During contact precautions (vertical interventions), this personal protective equipment must always be worn.

Compliance with appropriate hand hygiene has consistently been shown to be a major effective IPC intervention. The way hand hygiene is performed (procedure) and when (practicing the 5 moments of hand hygiene) are as important as where the alcohol handrub is placed and available (at the bedside, within arms-length). Compliance also improves when healthcare workers receive refreshed and practical training in hand hygiene, when it is regularly monitored and feedback is provided in a timely manner.

Availability of alcohol-based handrubs for hand hygiene at the point-of-care is key to creating an enabling environment for IPC, also considering that they are better tolerated than soap and water and have higher antimicrobial efficacy against most pathogens. Regular cleaning of the surrounding "patient zone" area must be ensured through institutional policies, structured education and monitoring compliance with cleaning protocols. At times, closing the ward might be useful to ensure enhanced cleaning. For some microorganisms (CRAB and CRPsA, for example) and when resources are available, environmental surveillance (e.g., sinks and taps) could be useful to target enhanced cleaning.

As mentioned above, a fundamental component of compliance to appropriate IPC measures, from hand hygiene to environmental cleaning, is represented by the capacity to monitor, audit and feedback their implementation and execution in a non-punitive spirit of improvement. This activity, and in particular the feedback of data to critical audiences at all levels and their use for planning improvement actions, is often neglected. Coupled with the surveillance of HAIs and AMR, this increases adherence and ownership of the safety culture in the facility. In fact, it enables and increases awareness of the problem, of the effect of everyday actions on the well-being of patients (learning from experience) and of the sustainability of IPC in the long-term. Education and training of staff should be embedded in the professional requirements, should be regular and adapted to the local context. For example, local IPC leads could involve frontline staff in the development of training materials, ensuring that different competencies are involved (multidisciplinary); co-development of the material is another way of increasing ownership in a spirit of quality of care and patient safety.

In a similar way, the availability of updated and relevant clinical guidelines for reducing HAIs and AMR are part of the enabling factors. Guidelines should be evidence-based and should reference international and national standards. However, as discussed above, adaptation increases adoption and local conditions and preferences need to be considered.

## Implementation of IPC: The multimodal approach

"Adapt to Adopt" is not only a slogan and brings us to the innovative approach recommended by WHO for the implementation of IPC interventions: multimodal strategies *(5)*. This approach provides the "how to" organize and successfully achieve the goals of IPC interventions: the change

of the system, climate and behaviour that support IPC progress and, ultimately, lead to measurable impact that benefits patients and healthcare workers. The principle underpinning multimodal strategies is that implementing a single action, for example, training, is less effective to achieve improvement.

To be effective, IPC practitioners are required to focus on a range of strategies that target different influencers of human behaviour (e.g., procurement, monitoring and feedback, infrastructures or organizational culture). The five elements of the WHO multimodal strategy to implement IPC interventions are easily summarized: 1) "Build it" or system change (what infrastructure, equipment and supplies are needed to change the system?); 2) "Teach it", i.e., training and education (who needs training and education? what type? how frequently?); 3) "Check it", i.e., monitoring and feedback (how to identify gaps to prioritize actions, track progress and feedback to drive change?); 4) "Sell it", i.e., reminders and communications (how to you promote and reinforce the appropriate messages through communication and reminders?); and 5) "Live it", i.e., culture change (do senior managers support the intervention? are others willing to be champions? ultimately, has the safety culture changed?). Patient participation and education are a critical part of this element of the WHO multimodal strategies, to achieve the culture change of the healthcare environment to a climate that is supportive of people centeredness and patient safety.

Thus, implementing several elements (3 to 5, see below) that bring different complementary effects (such as increasing knowledge, but also providing appropriate equipment to enable best practices) in an integrated way and adapted to the local context, has proven to be more effective at improving behaviours and especially outcomes (less HAIs, less AMR spread, less deaths). If appropriately and creatively refreshed, these strategies also ensure long-term sustainability.

To catalyse behavioural change the elements of the multimodal strategy require local adaptation, which can be achieved by producing practical tools at the local level. Recent experiences have shown that integrated training packages (e.g., slide decks, trainer and student manuals, videos, e-learning modules), adapted locally (e.g., videos of local IPC lead and other colleagues) and developed with input from all interested parties (from hospital director to cleaning staff), are more effective in creating a safety culture and people-centred service delivery. The multimodal approach has an effect on intangible components of care delivery, such as healthcare workers' attitudes, beliefs and values, so that they consistently perform tasks the way they know and believe they should.

Based on multimodal strategies, successful IPC interventions require dedicated multidisciplinary teams and step-wise action plans, adapting recommendations and guidelines to local context, empowering frontline staff and allowing them to lead the adaptation, engaging leadership, catalysing collective and individual ownership, using data to create awareness and awarding teams.

Curbing the AMR tide will require all these steps to support IPC progress, which in turn achieves system change, climate and behaviour, ultimately creating a culture of safety and the quality of care patients are entitled to. ■

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