

Assessment tool for joint 'One-Health' country visits in relation to antimicrobial resistance

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Introduction

ECDC has been conducting country visits to discuss antimicrobial resistance (AMR) issues since 2006. The objectives of these visits are to provide assistance with the development; review and implementation of national strategies and actions plans on AMR; exchange experience and knowledge on initiatives taken by European Union/European Economic Area (EU/EEA) countries, and document the AMR situation and control efforts being made in the country visited. During the period 2006–2019, AMR country visits were conducted in 27 EU Member States and one EEA country. The reports of recent visits as well as the terms of reference for these visits are available on ECDC's website [1].

In 2006, to standardise evaluation and reporting, an assessment tool was developed, covering ten areas having an impact on the control of AMR, as outlined in the Council Recommendation on the prudent use of antimicrobial agents in human medicine [2]. The tentative indicators proposed in this assessment tool proved useful for many subsequent country visits. However, after more than ten years, an update was required to incorporate newly-published evidence and guidance, as well as experience gained during the visits. In addition, the assessment tool also needed to take into account the fact that the AMR country visits are now mainly follow-up visits, rather than initial assessments. Finally, the assessment tool needed to be adapted to reflect the needs of a 'One-Health' approach to tackling AMR. Since 2016, ECDC's AMR country visits, which previously only focused on human health, have been replaced by joint 'One-Health' country visits, conducted together with the European Commission (EC), which also cover the veterinary and environmental sectors.

This updated assessment tool, which outlines the indicators for human health and the joint parts of the country visits, should therefore be used in conjunction with respective EC assessment tools for the veterinary and environmental sectors. The updated assessment tool was drafted after an expert consultation meeting in Stockholm on 5–6 February 2020 and finalised after review by the participating experts.

1. Proposed areas for evaluation and related indicators

1.1 Inter-sectoral coordinating mechanism

The importance of adopting a 'One-Health' approach to tackling AMR has been recognised in the European One Health Action Plan against AMR and globally by the World Health Organization's Health Assembly which has endorsed a Global Action Plan on AMR. Due to the involvement of many sectors and actors in AMR prevention and control, the development and implementation of the plan and related activities will have to be coordinated at national level. Different government institutions, healthcare providers and relevant organisations should be included in the inter-sectoral coordinating mechanism (ICM). There is also a need for close cooperation among professionals from various fields within human and animal health and food production including epidemiology, microbiology, clinical medicine, infection prevention and control (IPC), pharmacology and behavioural sciences. It is also important to consider the environmental aspects, including wastewater and manure management and the disposal of expired drugs and to involve the relevant partners. Although EU/EEA countries have different administrative structures, the coordination group should always be located at the highest administrative level and include representatives from regulatory bodies and professionals from the different sectors, including the human and animal health environmental sectors.

Proposed indicators for 1.1

Area	Indicators
Composition of ICM	Intersectoral composition (human health, animal health and environmental sectors). High-level chairpersons from the above sectors. Inclusion of relevant stakeholders (government, industry, professional societies, patient representatives, relevant organisations). Inclusion of relevant expertise (infectious diseases), epidemiology, IPC, microbiology, pharmacology, surveillance, communications).
Terms of Reference (ToR)	Description of governmental mandate/authority. Clearly-defined roles, responsibility, and accountability. Responsibility for national action plan (see 1.2).
Regular meetings of ICM	Frequency of meetings. Regular attendance of participants. Minutes with defined action items.
Budget of ICM	Established national funding. Adequate size and sustainability of funding.
Provision of support to regional/local working groups	Examples of supported activities. Type of assistance provided (technical, coordination, financial).

1.2 National action plan

WHO's World Health Assembly urged all its country members, including EU Member States, to develop and have in place by 2017 national action plans on AMR that are aligned with the objectives of the Global Action Plan on AMR, adopted at the 68th World Health Assembly in May 2015. The Global Action Plan has five overarching strategic objectives: 1. Communication, education and training; 2. Surveillance and research; 3. Sanitation, hygiene and infection prevention measures; 4. Optimisation of use of antimicrobial medicines in human and animal health; 5. Investment in new medicines, diagnostic tools, vaccines and other interventions [3]. The European Council also called on Member States to have in place before mid-2017 a national action plan against AMR, based on the 'One-Health' approach and in line with the objectives of WHO's Global Action Plan [4].

Proposed indicators for 1.2

Area	Indicators
Development of national action plan	Existence of national action plan and latest update. Based on thorough situational analysis. Plan written from a 'One-Health' perspective. Alignment with the overarching objectives of WHO's Global Action Plan on AMR. Working groups with involvement of all relevant sectors and stakeholders for the development and implementation of the national action plan. High-level endorsement. Comprehensive country coverage with participation of all regions (also autonomous regions) or separate regional plans.
Strategic plan	Clearly-outlined goals, objectives, priorities and interventions.
Operational plan	Clearly-outlined activities and interventions, implementation arrangements, timetable, responsible entities, detailed budget and costing.
Monitoring and evaluation plan	Clearly-outlined performance indicators, targets and timelines, data collection and reporting methods.
Periodic reviews of progress and impact	Regular and publicly-available progress reports. Assessment of effectiveness and impact of measures.
Budget	Availability of appropriate budget for outlined activities
Integration into other action plans/regulatory efforts	Links to other national action plans on related topics (e.g. healthcare-associated infections/IPC, EU-harmonised AMR monitoring in certain animals and foodstuffs) or specific disease areas (e.g. tuberculosis, HIV).
Preparedness/response planning for AMR	Preparedness and response planning for outbreaks of highly-resistant pathogens in humans and animals, and detection of novel AMR mechanisms in isolates of human, animal and environmental origin. Strategy for use and to ensure availability of new and old antimicrobial agents.

2. Organised multidisciplinary collaboration at local level

To prevent and control AMR, national strategies must be translated into local AMR control activities with local ownership, adaptation to individual settings, daily oversight and on-the-job training. An example of local activity is the regular discussion by practising physicians of local data on antimicrobial consumption and AMR patterns, supported by epidemiologists, pharmacists and infection prevention and control (IPC) specialists. This provides an opportunity to revise local antimicrobial use patterns, develop local guidelines (based on national guidelines) and organise local meetings with prescribers to promote rational use of antimicrobial agents.

Proposed indicators for 2

Area	Indicators
General structure	<ul style="list-style-type: none"> Organised local activities. Funding or incentives for these activities (for example recognition as a form of continuing education). Inclusion of hospital as well as primary care level. Extent of regional/national coverage. Support from hospital/local leadership and at national level. Established link between activities in primary and hospital care and surrounding long-term care facilities.
Local activities in hospital and primary health care - structure	<ul style="list-style-type: none"> Multidisciplinary team (pharmacist, microbiologist, ID physician, IPC specialist, nurses), participation of private providers where necessary. Evidence of direct involvement of senior management. Access to local AMR surveillance and antimicrobial consumption data. Administrative level to which the group reports. Public (non-commercial) funding. Regular meetings. Availability of data/IT tools (for benchmarking or self-evaluation).
Local activities in hospital and primary health care - coverage of areas of work	<ul style="list-style-type: none"> IPC, antimicrobial stewardship, educational activities. Analysis of local antimicrobial consumption and AMR data. Feedback of data to prescribers – at the hospital level and in primary care. Development of local guidelines based on/supported by local data. Coordination of interventions, including local hospitals/primary care providers. Implementation of local guidelines. Feedback to and meetings with local prescribers.

3. Clinical diagnostic and reference laboratory services

Public health microbiology services consist of three components: 1. Clinical laboratories performing diagnostic testing, antimicrobial susceptibility testing (AST) and screening with a focus on patient management, 2. Reference laboratories at national or regional level and 3. Laboratory networks working on harmonisation of methods and quality assessment and contributing to surveillance [5]. These services are essential to enable prescribers to make informed treatment choices based on timely feedback, to follow trends in antimicrobial resistance and to detect newly-emerging resistant strains. All laboratory work should be subject to regular internal and external quality assessment. For specific pathogens and types of resistance, a system should be established for referral to specialised laboratories.

Proposed indicators for 3

Area	Indicators
Access to clinical diagnostic services	<p>Access for acute care hospitals, specialist care hospitals and community healthcare - residential care, ambulatory care and primary care.</p> <p>Independence of access irrespective of the type of healthcare provider (private or public).</p> <p>Adequate funding of microbiological testing in patient care (hospital and primary care) – e.g. by defining reimbursement rules or including microbiological diagnostics in treatment pathways for the health insurance system.</p> <p>Use of services by healthcare providers – e.g. blood culture rate.</p>
Quality of sampling and clinical diagnostic testing	<p>Provision of guidelines for sampling and transport to providers.</p> <p>Operation under a nationally-approved quality management system.</p> <p>Participation in external quality assurance (EQA) schemes.</p> <p>Accreditation of laboratories.</p>
Timeliness of reporting and communication of results	<p>Time to reporting for critical results (positive cultures from blood, cerebrospinal fluid or other samples from invasive infections).</p> <p>Regular reporting of preliminary results (species identification).</p> <p>Time to reporting of culture and AST results for primary and hospital care.</p> <p>Use of selective reporting of AST results.</p> <p>Reliable communication of results (oral, paper, electronic).</p> <p>Availability of microbiological consultation for clinicians.</p> <p>Availability of out-of-hours microbiology services for the processing and reporting of results (weekday nights, weekends).</p>
Point-of-care testing (POCT)	<p>Access to POCT.</p> <p>Governance of POCT.</p> <p>Interface with laboratory information system.</p> <p>Reporting format.</p>
National standardisation and guidelines	<p>Established national AST Committee.</p> <p>Use of the European Committee on AST (EUCAST) breakpoints and methods in clinical laboratories.</p> <p>Availability of national guidelines for diagnostic testing and screening.</p>
Availability, access to and funding of reference laboratory services	<p>Access to national/international reference laboratory services for relevant AMR pathogens.</p> <p>Official nomination of national reference laboratories by national authorities.</p> <p>Capacity of reference laboratory services for pathogen identification and AST.</p> <p>Capacity of reference laboratory services for identification of (newly emerging) AMR mechanisms.</p> <p>Capacity of reference laboratory services for typing/whole genome sequencing of pathogens with AMR.</p> <p>Capacity of reference laboratory services to support local, regional and national outbreak investigations.</p> <p>Provision of individual support/quality assessment/reference materials to laboratories.</p> <p>Timeliness and user-friendly format of feedback to local laboratories.</p> <p>Regular analysis of trends and publication of reports on submitted isolates.</p> <p>Integration into national AMR surveillance systems.</p> <p>Adequate and sustainable public funding of reference laboratory services.</p>

4. Monitoring of AMR

AMR patterns should be monitored regularly using standardised methodology. Data should be collected and analysed nationally, regionally and locally, to follow long-term trends. To be able to guide prescribers in the empiric choice and prudent usage of antibiotics requires data related to specific clinical conditions in order to determine the most frequently-associated pathogens and their susceptibility profiles. The AMR patterns may vary from region to region and hospital to hospital, thus necessitating detailed local monitoring. Molecular surveillance data can complement phenotypic AST data and improve the understanding of transmission pathways. New approaches to the monitoring of AMR, such as monitoring of the resistome in urban sewage, might be worth exploring [6].

Proposed indicators for 4

Area	Indicators
National surveillance systems for key AMR bacteria	<p>National surveillance system for key bacteria with AMR, including methicillin-resistant <i>Staphylococcus aureus</i>, <i>Streptococcus pneumoniae</i> resistant to penicillin or macrolides, <i>Escherichia coli</i> resistant to 3rd-generation cephalosporins, <i>Klebsiella pneumoniae</i> resistant to aminoglycosides, fluoroquinolones and 3rd-generation cephalosporins, and <i>K. pneumoniae</i> resistant to carbapenems in accordance with the list in the joint opinion by ECDC, the European Food Safety Authority (EFSA) and the European Medicines Agency (EMA) [7].</p> <p>Additional national surveillance for <i>Acinetobacter baumannii</i> resistant to carbapenems, multidrug-resistant <i>Pseudomonas aeruginosa</i>, and <i>Enterococcus faecium</i> resistant to vancomycin.</p> <p>Sub-national analysis of data for rates, trends and distribution of AMR.</p>
National surveillance of resistance patterns linked to healthcare-associated infections	<p>AMR patterns collected from surveillance systems of healthcare-associated infections (HAIs), including HAIs in intensive care units, surgical site infections and <i>Clostridoides difficile</i> infections.</p>
National/local surveillance of AMR patterns in the community	<p>Sentinel AMR surveillance of urine isolates from general practices to avoid bias by only analysing specimens from cases of treatment failure.</p> <p>AMR surveillance for <i>S. pneumoniae</i> blood culture isolates as an indicator for community levels of AMR.</p>
National surveillance data on other AMR pathogens	<p>Surveillance of AMR associated with food-and waterborne pathogens including <i>Campylobacter</i> spp., <i>Salmonella</i> spp. and <i>Shigella</i> spp.</p> <p>Surveillance of AMR in <i>Neisseria gonorrhoeae</i> and <i>Mycobacterium tuberculosis</i>.</p>
National surveillance of emerging healthcare-associated pathogens/AMR genes	<p>Provision of data on specific emerging healthcare-associated pathogens/AMR genes – e.g. carbapenemase genes, <i>Candida auris</i>.</p> <p>Subnational analysis and trending of data.</p>
Participation in European-level surveillance of AMR pathogens	<p>Coverage, quality and representativeness of data submitted to the European Antimicrobial Resistance Surveillance System (EARS-Net).</p> <p>Participation in the European Antimicrobial Resistance Genes Surveillance Network (EURGen-Net).</p> <p>Participation in AMR surveillance of <i>Salmonella</i> spp. and <i>Campylobacter</i> spp. isolates related to the Food- and Waterborne Diseases and Zoonoses Network (FWD-Net).</p> <p>Participation in the European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP).</p> <p>Participation in the European Reference Laboratory Network for Tuberculosis (ERLTB-Net).</p>
Public and comprehensive reporting of AMR data	<p>Integrated analysis of data from different AMR surveillance systems and antimicrobial consumption surveillance data.</p> <p>Timely provision of data to the ICM for the planning of future interventions.</p> <p>Publication of AMR surveillance data in regular 'One-Health' reports.</p>
Integration of local routine clinical laboratory data into surveillance	<p>Integration of data from routine AST of diagnostic laboratories into local, regional, national AMR surveillance systems.</p> <p>Participation of private laboratories in AMR surveillance.</p> <p>Procedure for notification of notifiable pathogens with AMR.</p> <p>Provision of timely feedback and reports to participating laboratories.</p> <p>Rapid feedback in outbreak situations.</p> <p>Provision of an interface/platform where data providers can compare their data to the national AMR surveillance data.</p> <p>Provision of AMR statistics to local clinicians and care providers.</p>

5. Monitoring of antimicrobial consumption

It is important to monitor antimicrobial consumption as a driving force for emerging AMR. Therefore, reliable antimicrobial consumption surveillance systems are essential to complement AMR data and develop instruments for assessing effective strategies to foster appropriate antimicrobial use in all EU/EEA countries. Current antimicrobial consumption surveillance systems mainly monitor trends and shifts in usage patterns. However, to improve understanding of antimicrobial prescription, more detailed information on the indication for each antimicrobial treatment and on prescribers would enable better targeting of interventions. Prescriber data can be used for self-assessment as well as the benchmarking of antimicrobial consumption patterns and trends.

Proposed indicators for 5

Area	Indicators
Availability of valid national data on antibiotic consumption in all sectors	Data source (e.g. reimbursement, sales, prescriptions). Legal framework for data collection. Responsibility for collection/analysis/interpretation/dissemination the data. Level (granularity) of the data. Calculation of the denominator. Frequency of data collection. Public availability of data.
National electronic prescription system (mainly ambulatory care)	Existence of national electronic prescription system. Use of data for feedback on prescription patterns. Applicability for private and public sector.
Benchmarking of antimicrobial consumption	Data available by sector (primary care, hospitals, long-term care). Date available by level of administration (local, regional, national). Data available by type of provider (private/public). Data available by prescriber. Prescription data linked to indication (and pathogen, if available).
Financial support for data collection	Public funding for data collection. Adequate size and sustainability of the budget.
Public dissemination of data on antimicrobial consumption	Publicly-available report. Publicly-available raw data. Level of disaggregation for the analysis. Regular update. Link of antimicrobial consumption data to AMR data.
Primary indicator (ECDC/EFSA/EMA) of antimicrobial consumption	Consumption of antibacterials for systemic use (ATC group J01, in Daily Defined Doses (DDD) per 1 000 inhabitants per day) compared to other EU/EEA countries.

6. Antimicrobial stewardship and treatment guidelines

Antimicrobial stewardship refers to a coherent set of actions which promote using antimicrobials responsibly [8]. The primary goal of antimicrobial stewardship is to optimise clinical outcomes while minimising unintended consequences of antimicrobial use, including toxicity, the selection of pathogenic organisms, and the emergence of AMR [9]. The largest volume of antimicrobial agents is prescribed in the community (i.e. outside of hospitals) while the highest antimicrobial prescription rates are seen in hospitals (particularly in intensive care units and onco-haematology units). Both are recognised as providing selective pressure which drives AMR in these settings. In addition, unnecessary use of antimicrobials requires more resources, motivates patients to re-consult and exposes them to the additional risk of side-effects. On the other hand, under-prescribing could be associated with a higher risk of complications from untreated infections. Most guidelines define treatment based on specific diagnosis, requiring an accurate diagnosis to be established before the guidelines can be applied.

Proposed indicators for 6

Area	Indicators
Structure of antimicrobial stewardship programmes (ASPs) at different levels (local, regional, national)	<p>ASPs implemented at all levels (local, regional national).</p> <p>Overarching national plan/strategy/guidelines for ASPs with reference to international standards/professional societies.</p> <p>Monitoring and reporting of ASP indicators.</p> <p>Legal framework.</p> <p>Appropriate human resources with a multidisciplinary approach (antibiotic stewardship committees/teams – ID, microbiology and pharmacy specialists, nurses).</p> <p>Allocation of budget.</p> <p>Inclusion of restrictive and persuasive policies into the national strategy.</p> <p>Indicators for monitoring ASPs in acute and long-term care facilities.</p> <p>Integration with IPC and other quality improvement activities.</p> <p>Institutional support (tools, incentives).</p>
National and locally-adapted treatment guidelines	<p>Diseases/topics covered (surgical prophylaxis, urinary tract and respiratory tract infections in ambulatory care, healthcare-associated infections).</p> <p>Standardised criteria for diagnosis.</p> <p>Consultation process/involvement of relevant stakeholders in guideline development.</p> <p>Dissemination strategy.</p> <p>Monitoring of uptake and compliance.</p> <p>Frequency of updates.</p> <p>Up-to-date recommendations for duration of treatment.</p>
Availability of antimicrobials and disposal of expired medication	<p>National strategy to ensure the availability of narrow-spectrum antibiotics (penicillin V, flucloxacillin, amoxicillin).</p> <p>Restriction of over-the-counter dispensation of antimicrobials.</p> <p>Inspections related to/sanctioning of over-the-counter dispensation of antimicrobials.</p> <p>Possibility of per-unit dispensing (ambulatory care).</p> <p>Frequency of shortages/disruption of supply of key antimicrobials.</p> <p>National scheme for collection of expired antimicrobials and monitoring of their disposal.</p>
Use of rapid diagnostic tests (RDTs)	<p>Use of RDTs in ambulatory care to inform prescription decisions.</p> <p>Public funding for reimbursement of RDTs.</p>
Decision-making tools	<p>Availability of IT tools to improve data collection and decision-making.</p>
Assessment of the appropriateness of antimicrobial prescriptions	<p>Use of indicators for compliance with guidelines, de-escalation, switch from intravenous to oral treatment, duration of treatment.</p> <p>Frequency of collection and analysis.</p> <p>Regular feedback of prescription patterns to prescribers.</p>
Targets for antimicrobial prescribing	<p>Use of qualitative and quantitative targets.</p> <p>Level of target setting.</p> <p>Incentives/sanctions.</p>

7. Infection prevention and control (IPC)

Healthcare facilities have traditionally been an important hub for the transmission of various pathogens during historic epidemics and they continue to act as such for the spread of multidrug-resistant organisms today [10-12]. All hospitals therefore need an IPC programme and sufficient well-trained staff to monitor healthcare-associated infections and carry out preventive activities. A national system for surveillance of healthcare-associated infections (HAIs) facilitates the benchmarking of hospitals and the setting of priorities for infection prevention and control (IPC) programmes at national and local level. It can also be used to evaluate the effectiveness of interventions. IPC programmes should follow minimum requirements at national and hospital level [13]. IPC activities should also be extended to long-term care facilities (LTCFs) and ambulatory care facilities. Typical activities of hospital IPC programmes include development of hospital-specific IPC guidelines, implementation of multimodal prevention programmes, adherence monitoring and audits. Preconditions for successful IPC activities are having sufficient and adequately trained human resources, institutional support and an adequate hospital infrastructure. To help with this, both ECDC and WHO have developed a set of core competencies for IPC staff [14,15].

Proposed indicators for 7

Area	Indicators
IPC programmes – national level	<p>National IPC programme with clearly-defined objectives, functions and activities for the prevention of HAIs.</p> <p>National up-to-date IPC guidelines.</p> <p>National curriculum for IPC training and evaluation of its performance.</p> <p>Technical group for national HAI surveillance and IPC monitoring.</p> <p>Use of multimodal strategies.</p> <p>National monitoring and auditing of IPC programmes.</p> <p>National standards for staffing levels – healthcare and IPC staff.</p> <p>National standards for construction/equipment of healthcare facilities.</p>
IPC programmes – hospital level	<p>Presence of an IPC coordinating entity/committee with involvement of all relevant departments (IPC, clinical, microbiology) and direct, routine involvement of senior management.</p> <p>Existence of an IPC plan approved by the hospital's Chief Executive Officer.</p> <p>Sufficient human resources (i.e. one full-time IPC nurse for ≤250 beds), dedicated physician trained in IPC, epidemiology and microbiology and data management support.</p> <p>Specific tasks outlined.</p> <p>IPC programme linked to quality-of-care and patient safety activities.</p>
IPC guidelines at hospital level	<p>Guidelines and checklists on prevention of HAIs.</p> <p>Guidelines on standard and enhanced precautions.</p> <p>Guidelines on prevention of transmission of multidrug-resistant organisms</p> <p>Training of staff on guidelines</p>
Education and training for IPC professionals	<p>Titles, diplomas, certifications (nurses, physicians)</p> <p>Career paths for IPC (nurses, physicians, academia)</p> <p>Participation of IPC staff in continuous medical education/professional development.</p> <p>Use of core competencies (ECDC, WHO).</p>
Surveillance of HAI	<p>Prospective surveillance of HAIs in place (infections acquired in ICUs, bloodstream infections, surgical site infections, <i>Clostridoides difficile</i> infection).</p> <p>National network for HAI surveillance and its national coverage.</p> <p>Voluntary or mandatory participation in HAI surveillance networks.</p> <p>Regular feedback of HAI rates to healthcare personnel.</p> <p>Public availability of reference data on HAIs (aggregated or hospital-specific).</p> <p>Inclusion of HAI data in quality-of-care hospital key performance indicators.</p> <p>Regular discussion of HAIs on hospital management board.</p>
Prevention programmes/multimodal strategies	<p>Combined interventions including guidelines, bundles, checklists, training, audit, surveillance and feedback for the prevention of HAIs.</p> <p>Awareness of the institution's organisational culture in relation to IPC prevention.</p>
Monitoring and audits of IPC practices	<p>Hand hygiene compliance observations.</p> <p>Surveillance of alcohol-based hand rub consumption.</p> <p>Audits of device management (e.g. for intravenous cannulas, urinary catheters).</p> <p>Monitoring of adherence to guidelines.</p>
Workload and staffing	<p>Bed occupancy.</p> <p>Full-time equivalents of registered nurses, hospital-wide and in ICUs.</p> <p>Challenges, brain-drain.</p>
Infrastructure, environment, equipment	<p>Number of patients per room.</p> <p>Number of single rooms.</p> <p>Number of airborne isolation rooms.</p> <p>Alcohol-based hand rub dispensers at point-of-care.</p>
LTCFs and community care	<p>National IPC programmes and indicators established for LTCFs.</p> <p>IPC audits of LTCFs.</p> <p>IPC staff and/or consultations available for LTCFs.</p> <p>Established link between LTCFs and surrounding acute care facilities.</p> <p>Availability of alcohol-based hand rub and personal protective equipment.</p> <p>Appropriate management of patients with multidrug-resistant organisms.</p> <p>Monitoring of IPC in outpatient facilities and homecare.</p>

8. AMR and IPC education

Knowledge of AMR is the basis for interventions to improve antimicrobial prescribing and adherence to IPC measures for healthcare workers. All professionals working in the healthcare sector should receive education on AMR suitable for their respective roles as prescribers, non-prescribers, healthcare workers in supportive roles and health services or public health managers. A curricula guide for the education and training of healthcare workers in the area of AMR has been developed by WHO [16].

Proposed indicators for 8*

Area	
Pre-graduate education	Inclusion of basic IPC training and education on AMR in the curriculum for professions in the healthcare sector. AMR teaching to include the 'One-Health' approach. Curricula and allocated time.
Post-graduate education	Inclusion of IPC and antimicrobial stewardship training in the post-graduate education of physicians, clinical microbiologists, pharmacists, and nurses. Incentives, career paths, credits, diplomas and certifications for this type of training course. Availability of online training.
Recognised positions	Qualifications and training needed. Job description. Performance incentives/awards given to dedicated persons, key personnel, ambassadors.
In-service training	Targeting specialists, physicians, nurses, nurse assistants and pharmacists. Training at start of employment, regular refresher courses. Mandatory versus voluntary.

* for training of IPC professionals, please see Section 7 IPC above.

9. Public information and behavioural change interventions for AMR ('One-Health' – all sectors)

Public awareness of AMR and antimicrobials is an important component of any effort designed to bring about prudent antimicrobial use in the community and in healthcare settings. Public campaigns may be an effective way of improving the use of antimicrobials in outpatient settings [17]. Examples of international campaigns in this area include the European Antibiotic Awareness Day and the World Antimicrobial Awareness Week [18-20]. Behavioural determinants and social norms have an impact on antimicrobial prescribing and should be taken into account in the design of related interventions [21].

Proposed indicators for 9

Area	Indicators
Planned approach to campaign development	Needs assessment/situation analysis to identify AMR communication needs. Awareness of possible cultural drivers of antimicrobial consumption. Goals, targets and objectives of communication plan outlined. Specific target groups and related activities identified, including tools and channels. Frequency and duration of the campaign. Campaign branding and materials. Incorporation of social marketing and behaviour change strategies. Monitoring of misinformation.
Resources	Appropriate and sustainable funding for communication/behaviour change campaigns. Appropriate human resources.
Examples of collaborative communication activities	Activities related to European Antibiotic Awareness Day. Activities conducted together with WHO (e.g. World Antimicrobial Awareness Week) or other international/national-level communication initiatives. Activities conducted at various levels (national, regional, local, facility level). Activities conducted in collaboration with different institutions/organisations (including professional associations). Activities conducted with a 'One-Health' approach.
Type of campaign media	Use of traditional and social media.
Evaluation	Evaluation of campaigns, including campaigns related to behaviour change. Influence of campaigns on national results in the Eurobarometer on AMR [22].

10. Marketing-related issues

The sources of information on antimicrobials used by physicians have been shown to influence their prescribing patterns. Use of information received from the pharmaceutical industry is associated with a higher prescribing frequency, increased costs and incorrect indications (overprescribing) [23,24]. Doctors in training are especially vulnerable to the influence of the pharmaceutical industry [25]. This highlights the importance of the availability of independent drug information and the need for appropriate regulation of interactions between pharmaceutical companies and physicians.

Proposed indicators for 10

Area	Indicators
Drug information	Availability of independent (not industry-supported) drug information for prescribers, professional organisations and professionals involved in ASPs. Access to independent (not sponsored by the pharmaceutical industry) educational seminars for physicians, especially for doctors in training, and nurses.
Inter-relation between doctors and industry	Policy/legal framework for mandatory disclosure of doctors' conflicts of interest, including grants, sponsorship, speaker fees. Website with publicly-accessible information on the disclosure of doctors' conflicts of interest. Financial incentives to prescribers. Regulations regarding gifts from pharmaceutical industry to physicians. Regulations regarding sponsorship of educational activities. Access of pharmaceutical representatives to doctors in training. Monitoring of adherence to regulations.
Generic prescription	Permission for pharmacists to dispense generic medication.

Use of the assessment tool for follow-up visits

Twenty-eight EU/EEA countries have already received a country visit. For these countries, the first step with the follow-up visits should therefore be to review previous visit reports for information already collected on the respective indicators. However, some indicators have changed in this update of the assessment tool. In addition, for those indicators described in the previous version of the tool, the information was not always documented in detail in the country visit reports. However, where information is available, there is no need for repetition of the description of the indicators. Rather the evaluation should focus on new developments since the initial visit. In this respect, it will also be important to evaluate which of the recommendations from previous country visits have been implemented, which have not been addressed and reasons for this.

Consulted experts

ECDC experts: John Kinsman, Anke Kohlenberg, Dominique Monnet, Diamantis Plachouras, Carl Suetens, Svetla Tsoleva, Andrea Würz.

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All external experts have submitted declarations of interest, and a review of these did not reveal any conflict of interest.

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