NATIONAL ACTION PLANS ON ANTIMICROBIAL RESISTANCE: NEED FOR GREATER FOCUS ON ENVIRONMENTAL SPREAD

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NATIONAL ACTION PLANS ON AMR

Antimicrobial resistance (AMR) arises when micro-organisms such as bacteria survive exposure to a drug that would normally kill them or stop their growth. AMR is globally recognized as an emerging public-health threat as antibiotics are becoming increasingly ineffective against disease-causing bacteria. AMR is linked with greater spread of infectious diseases, difficulty in treating common infections, uncertainty in success of high-end therapeutic procedures, longer hospital stays, and more expensive treatments. If not contained, AMR is believed to cause significant impact to the health of humans, animals and the environment.

Besides misuse of antibiotics in humans, AMR (antibiotic resistance in particular) is known to accelerate and spread by misuse and overuse of antibiotics in rearing both terrestrial and aquatic animals for food. Antibiotics are routinely used for non-therapeutic purpose such as growth promotion and disease prevention, specifically in intensive food production systems. Other then food and direct contact, environment is a key route for spread of AMR. Waste from livestock and aquaculture farms is considered an important route for spread of antibiotics and resistant bacteria into the larger environment. Other routes for environmental spread include waste from pharmaceutical industry and healthcare settings.

Global Action Plan on AMR

There has been an increase in the momentum across the world to address the threat from rising AMR. In 2015, the World Health Organization (WHO) adopted the **"Global Action Plan on Antimicrobial Resistance"**.[1] The Plan (also known as GAP) laid out several measures under five strategic objectives and underscores the need to limit emergence and spread of AMR through antibiotic use in humans, animals, and the agriculture sector. GAP emphasizes the need for an effective 'One Health' approach through cross-sectoral coordination among multiple stakeholders. Recognizing the variability in national resources, GAP calls for member states to develop a National Action Plan by mid–2017. WHO is engaged in a tripartite with the Food and Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health (OIE) to support implementation of the WHO-led GAP. The five strategic objectives outlined in GAP are:

- Improve awareness and understanding of antimicrobial resistance through effective communication, education and training
- Strengthen the knowledge and evidence base through surveillance and research
- Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures
- Optimize the use of antimicrobial medicines in human and animal health
- Develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.

Additionally, in September 2016, the FAO released its **"Action Plan on Antimicrobial Resistance 2016–2020"**,[2] aimed at supporting the food and agricultural sectors in implementing GAP. The Plan identifies four focus areas, namely, awareness, evidence, governance and practice. It supports WHO-led GAP in highlighting the necessity of adopting a 'One

Need for greater global guidance in containing the environmental spread of AMR

AMR has been recognized as a 'One Health' issue encompassing humans, animals, agriculture and the environment. While the tripartite has reflected on the importance of containing AMR spread, the environmental aspect deserves much greater attention and articulation in terms of how countries are to move ahead specifically in view of growing evidence of environmental spread. Also, the nature and gravity of the issue deserves an active involvement of a global environmental organization, preferably of the United Nations.

1. http://www.wpro.who.int/entity/drug_resistance/resources/global_action_plan_eng.pdf
2. http://www.fao.org/3/a-i5996e.pdf

2016

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Health' approach, with the involvement of public health and veterinary authorities, the food and agriculture sectors, financial planners, environmental specialists, and consumers. The OIE, in its latest resolution of 2016,[3] also calls for combating AMR in line with the 'One Health' approach.

increased bio-security, infection prevention and control (IPC), responsible use of antimicrobials, and increased oversight and regulatory control over antibiotic use. Surveillance of antimicrobial use, antibiotic residues and antimicrobial resistance is also reflected in most NAPs.

Table 1: National Action Plans on AMR

WHO regions	Countries with NAPs listed
Africa	Ethiopia, South Africa
Americas	Canada, USA
South-east Asia	#
Europe	Austria, Cyprus, Czech Republic, Denmark, France, Germany, Greece, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK, Macedonia
Western Pacific	Australia, Cambodia, Fiji, Japan, Philippines, Vietnam
Eastern Mediterranean	#

Source: Library of National Action Plans, WHO, http://who.int/antimicrobial-resistance/national-action-plans/library/en/

No Action Plans or Strategy Frameworks available for any country in this region

National Action Plans on AMR

As on 5 November 2016, WHO library has listed the National Action Plans (NAPs) of 25 countries.[4] Most of these NAPs (or strategic frameworks in some cases) are from developed countries (see *Table 1: National Action Plans on AMR*). There are no NAPs from countries of South-east Asia and Eastern Mediterranean.

Summary of NAPS: limited focus on environmental spread of AMR

A review of the country-level NAPs was carried out to understand how different countries plan to address environmental spread of AMR, specifically from animal farms in view of research, monitoring, waste management and environmental standards (and not only infection prevention and bio-security approaches). Out of the 25 National Action Plans available with WHO NAP library, the 17 available in English were considered. In addition, the NAP of China, released in August 2016, but not yet reflected in the WHO library, is also reviewed. The analysis can be summarized as follows:

- Most countries have outlined necessary strategies/ goals/ activities related to antimicrobial stewardship and surveillance. The efforts mentioned include
- With reference to addressing the environmental aspects of spread from farms, most countries highlight the role of inspection, prevention and control, and bio-security in reducing the need for antimicrobials and subsequent burden of AMR on the environment. However, mention of specific measures to tackle waste from food animal production settings is not common. Moreover, it is largely limited to NAPs of developed countries.
- Only a few countries mention specific efforts to address waste from one or more of healthcare settings (hospitals, veterinary clinics etc.), pharmaceutical industry (research and manufacturing) and food animal processing settings (slaughter houses, meat, dairy and sea-food processing units). This is despite a broad recognition and acceptance of the 'One Health' approach.
- Clearly, the environmental dimension gets greater mention in NAPs of developed countries. In most cases it is about initiating or intensifying research, while in few cases it's about moving ahead with surveillance and monitoring of resistance. For example, Canada, US and UK refer to the need for research-based data to understand the mechanism

3. http://www.oie.int/fileadmin/Home/eng/Our_scientific_expertise/docs/pdf/AMR/A_RESO_AMR_2016.pdf
4. http://www.who.int/antimicrobial-resistance/national-action-plans/library/en/

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and routes of environmental dissemination of AMR. On the other hand, the NAPs of Switzerland, Netherlands, Japan, Australia and Norway consider environmental monitoring. Setting environmental standards does not seem to be a priority.

- In particular, Switzerland underscores the need for monitoring antibiotics in farmyard manure, soil and water. Netherlands stresses on monitoring manure and waste water from health facilities, treatment plants and residential areas. Japan emphasizes on researching surveillance or monitoring mechanisms of resistant bacteria as well as residues in aquatic and terrestrial environment. Sweden talks about controlling pharmaceutical waste.

While most NAPs are from developed countries and developing countries seem to be working towards their NAPs, it is important that containing environment spread of AMR gets adequate focus. Considering that the environment is a major issue, developing countries may consider aggressive initiatives and adopt best practices from certain developed countries who have taken a lead on this.

More detail about countrywise NAPs is given in *Table 2: Summary of National Action Plans—limited focus on environmental spread of AMR*.

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Table 2: Summary of National Action Plans—limited focus on environmental spread of AMR*

Key points	Extent of environment focus
Australia: Responding to the threat of Antimicrobial Resistance: Australia's First National Antimicrobial Resistance Strategy 2015–19	
Objectives • Increase awareness and understanding of AMR, its implications and actions to combat it through better communication, education and training • Implement effective antimicrobial stewardship practices across human health and animal care settings to ensure appropriate and judicious prescribing, dispensing and administering of antimicrobials • *Develop nationally coordinated 'One Health' approach surveillance of antimicrobial use and antimicrobial resistance* • Improve infection prevention and control measures across human health and animal care settings to help prevent infections and the spread of AMR • *Agree on a national research agenda and promote investment in the discovery and development of new products and approaches to prevent, detect and contain AMR* • Strengthen international partnerships and collaboration on regional and global efforts to respond to AMR • Establish and support clear governance arrangements at the local, jurisdictional, national and international levels to ensure leadership, engagement and accountability for actions to combat AMR	• Integration of surveillance of antimicrobial use and resistance across sectors under a 'One Health' approach • Increased research to garner a better understanding of how resistance develops and transfers between species and settings, between animals and their care takers, in food processing and the environment, for better targeting of intervention strategies
Cambodia: National Strategy to Combat Antimicrobial Resistance (2015–17)	
Components • Commit to a master plan to combat AMR • Strengthen laboratory capacity • Strengthen AMR surveillance • Ensure uninterrupted access of essential medicines of assured quality • Regulate and promote rational use of medicines • Enhance infection prevention and control • Foster innovation and research and development of new tools	—_
Canada: Federal Action Plan on Antimicrobial Resistance and Use in Canada: Building on The Federal Framework for Action	
• *Surveillance — Detecting and monitoring trends and threats in order to inform strategies to reduce the risks and impacts of AMR* • Stewardship—Conserving the effectiveness of existing treatments through infection prevention and control guidelines, education and awareness, regulations, and oversight • Innovation—Creating new solutions to counteract loss in antimicrobial effectiveness through research and development	• Supporting the development of an integrated and global package of activities to combat AMR that spans human, animal, agricultural, food, and environmental sectors • Supporting R&D on mode of transmission of resistance between organisms and transmission of resistant bacteria among different reservoirs, namely animal, environment and humans • Support research at the interface between human and animal health and the environment

Note: Text in italics in the table refer to the topic under which environment issues have been considered
'—' No specifics mentioned towards environmental research, surveillance and standards

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Key points	Extent of environment focus
China: National Action Plan to Contain Antimicrobial Resistance (2016–20)*	
Major Strategies and Actions • To exploit the advantages of joint prevention and control, and fulfill the department responsibility • To increase investment in the research and development of antimicrobials • *To strengthen the management of antibacterial agents supply security* • To strengthen the construction of antibacterial agent application and antimicrobial resistance control system • To optimize antimicrobial consumption and resistance surveillance system • To improve the capacity of professional personnel in antimicrobial resistance prevention and control • *To strengthen the prevention and management of environmental pollution of antimicrobials* • To strengthen publicity and education of AMR • To conduct extensive international change and cooperation	• Setting up of evaluation of environmental hazards caused by antimicrobials and conduct their evaluation for registration of medicines and veterinary drugs • Formulating the evaluation system for indicators of antimicrobial pollution • Strengthen environmental law enforcement on antimicrobials contamination • Improve the capacity building of surveillance techniques and regulations about antimicrobials environmental pollution in water, soil, and solid waste • Research on the ecological impact of antibacterial agent contamination, develop the prevention and management strategies of antimicrobials environmental pollution, and promote the emission reduction of antibacterial agents waste
Ethiopia: National Strategic Framework for Prevention and Containment of Antimicrobial Resistance	
Objectives • To establish a national alliance for the prevention and containment of AMR • To institute a surveillance system that captures the emergence of resistance, trends in its spread and utilization of antimicrobial agents in different settings • To promote and strengthen infection prevention and control measures to minimize the emergence and spread of AMR • To promote rational use of antimicrobial medicines in human health, animal health, and animal production • To promote research and education in the area of antimicrobial resistance	—_
Fiji: Fiji National Antimicrobial Resistance Action Plan 2015	
Strategic Objectives • Improving awareness and understanding of AMR through communication, education and training • Strengthen nationally coordinated surveillance systems • *Reduce the incidence of antimicrobial resistance events through improved infection prevention and control, sanitation and hygiene, measures and implementation of wellness* • Optimize the use of antimicrobial medicines in human and animal health • Establish and ensure governance, sustainable investment and actions to combat AMR	• Establish an effective waste management system, specifically addressing water sewage and landfills (solid waste) involving agricultural and medical waste • Establish Risk Management Unit and develop risk assessment system for antimicrobial resistance in all sectors.
Germany: DART 2020-Fighting antibiotic resistance for the good of both humans and animals	
Goals • Strengthen the 'One-Health' approach nationally and internationally • Recognizing changes in resistance at an early stage • Retaining and improving therapy options • *Breaking chains of infection early and avoiding infections* • Raising awareness and strengthening skills • Supporting research and development	• Studying the effects of measures to reduce emissions in livestock operations on the exposure of the population to resistant bacteria from livestock farming via the environment • Analyze the ecology of resistant pathogens and of the resistance characteristics in the sectors of humans, animals, the environment and at their points of interaction

*Not updated in the WHO Library of National Action Plans

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Key points	Extent of environment focus
Japan: National Action Plan on Antimicrobial Resistance (2016-20)	
Goals • Improve public awareness and understanding, and promote education and training of professionals • *Continuously monitor antimicrobial resistance and use of antimicrobials, and appropriately understand the signs of change and spread of antimicrobial resistance* • Prevent the spread of antimicrobial-resistant organisms by implementing appropriate infection prevention and control • Promote appropriate use of antimicrobials in the fields of healthcare, livestock production and aquaculture • Promote research on antimicrobial resistance and foster research and development to secure the means to prevent, diagnose and treat the antimicrobial-resistant infections • Enhance global multidisciplinary counter measures against AMR	• Researching surveillance and monitoring mechanisms of antimicrobial resistant organisms and antimicrobial residues in aquatic and terrestrial environment
Netherlands*	
Overall goals • International efforts—focus on international cooperation • Healthcare—focus on developing better policies and embedding them more fully in institutional procedures • Animals—reduction and prudent use of antibiotics in animal farming in order to limit the development of resistance where possible • Food safety—focus on continued monitoring and research • *Environment—focus on development of knowledge outline and policy recommendations* • Innovation—development of new antibiotics, improvements in infection prevention, prevention of spread of resistant bacteria, improved application and much faster diagnoses, alternative treatments focused on reducing the use of antibiotics • Communication—Multi-annual communication strategy	• Measurements in waste water from health facilities, residential areas, wastewater treatment plants, as well as in manure
Norway: National Strategy against Antibiotic Resistance 2015–20	
Focus Areas • *Strengthen scientific understanding* • Improve the level of understanding and competence regarding the use of antibiotics, among the general population as well as among prescribers • Improve prescribing practices in all sectors • Improved infection control • *Treat and eradicate infections caused by resistant bacteria* • *Strengthen normative international collaboration* • Contribute internationally to the development of vaccines, new antibiotics and diagnostic tools • Follow-up and organization of the strategy work	• Increased scientific understanding of how AMR spreads in the environment • Regular mapping of resistant bacteria and development/spread of ABR, in representative environments and organisms in animal, water and soil • Implementation of measures to cleanse environments of resistant bacteria

* Letter to the Dutch House of Representatives from Ministry of Health, Welfare and Sports, Netherlands

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Key points	Extent of environment focus
Philippines: The Philippine Action Plan to Combat Antimicrobial Resistance: One-Health Approach (2014)	
Key Strategies • Commit to a comprehensive, financed national plan with accountability and civic society engagement • Strengthen surveillance and laboratory capacity • Ensure uninterrupted access to essential medicines of assured quality • Regulate and promote rational use of medicines, including in animal husbandry and ensure proper patient care • *Enhance infection prevention and control across all settings* • Foster innovations, research, and development • Development of a Risk Communication Plan to combat AMR	• Instilling standard practices in agricultural sector to minimize inputs
South Africa: Antimicrobial Resistance National Strategy Framework (2014–24)	
Strategic Objectives • Strengthen, coordinate and institutionalize interdisciplinary efforts • Optimize surveillance and early detection of AMR • Enhance infection prevention and control • Promote appropriate use of antimicrobials in human and animal health	• Research to understand environmental cleaning practices*
Spain: Strategic Action Plan to reduce the risk of selection and dissemination of antibiotic resistance (2014–18)	
Strategic Lines • Surveillance of antibiotic consumption and AMR • *Control of bacterial resistance* • *Identification and spearheading of alternative and/or complementary measures of prevention and treatment* • Defining research priorities • Training and information for healthcare professionals • Communication and raising awareness in the population as a whole and in population subgroups	• Reducing transmission of resistant organisms and related infections in primary and health care settings
Sweden: Swedish strategy to combat antibiotic resistance (2016–20)	
Objectives • Increased knowledge through enhanced surveillance • *Continuous strong preventive measures* • *Responsible use of antibiotics* • Increased knowledge for preventing and managing bacterial infections and antibiotic resistance with new methods • Improved awareness and understanding in society about ABR and counter measures • Supporting structures and systems • Leadership within the EU and in international cooperation	• Technology development for cleaning of pharmaceutical residues from waste water plants • Development of good manufacturing practices to reduce release of antibiotics into environment during pharmaceutical production • Generation of environmental data for environmental risk assessment • Dealing with discarded antibiotics in an environmentally sound way

*Not part of Strategic Objectives, component of strategy enabler on research

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Key points	Extent of environment focus
Switzerland: Strategy on Antibiotic Resistance StAR (2015)	

Strategic Objectives
• *A cross-sector system for monitoring humans, animals, agriculture and the environment*
• Rules on the appropriate use of antibiotics to be defined in accordance with current understanding
• Minimize transmission and spread of resistant organisms will in order to reduce antibiotic resistance
• Interdisciplinary R&D on the emergence, transmission, spread and control of resistant bacteria
• Cooperation among the various stakeholders at political, scientific and economic levels (national/global)
• Improve dissemination of knowledge of ABR among experts/ general public for responsible decision making
• General conditions and incentives, to be created for so that effective antibiotic availability and sensible use
	• Environmental monitoring
	  • Tracking amount of antibiotics entering farmyard manure and soil, their persistence and activity
	  • Building upon previously existing monitoring systems (for other chemicals/substances)
	  • Reduce volume of antibiotics entering environment from research and production facility
	  • Reduce ABR through implementation of measures aimed at eliminating substance traces in waste water treatment plants
	  • Focus on research to help set basic principles concerning entry of antibiotics into farmyard manure, soil, water and their persistence and activity

United Kingdom of Great Britain and Northern Ireland: UK Five Year Antimicrobial Resistance Strategy (2013–18)	
Key Areas • Improving infection prevention and control practices • Optimising prescribing practice • Improving professional education, training and public engagement • Developing new drugs, treatments and diagnostics • Better access to and use of surveillance data • *Better identification and prioritization of AMR research needs* • Strengthened international collaboration	• Prioritization of research needs to understand different transmission pathways between the environment, humans, animals
USA: National Action Plan For Combating Antibiotic-Resistant Bacteria	
Goals • *Slow the emergence of resistant bacteria and prevent the spread of resistant infections* • Strengthen National One-Health Surveillance efforts to combat resistance • Advance development and use of rapid and innovative diagnostic tests for identification/characterization of resistant bacteria • Accelerate basic and applied research and development for new antibiotics, therapeutics, vaccines • Improve international collaboration and capacities for antibiotic-resistance prevention, surveillance, control, and antibiotic R&D	• Research to understand environmental factors that facilitate development of ABR and spread of resistant genes
Vietnam: National Action Plan on Combating Drug Resistance (2013–20)	
Specific Objectives • Raise awareness of community and health workers on drug resistance • Strengthen, improve national surveillance system on the use of antibiotics and drug resistance • Ensure adequate supply of quality medicines to meet the needs of people • Promote proper safe use of drugs • Promote infection control • Promote proper safe antibiotic use in livestock, poultry, aquaculture and cultivation	—

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