

ANTIMICROBIAL RESISTANCE AND THE UNITED NATIONS SUSTAINABLE DEVELOPMENT COOPERATION FRAMEWORK

Guidance for United Nations country teams



Food and Agriculture
Organization of the
United Nations



World Health
Organization



KEY MESSAGES

- 1** Antimicrobial resistance (AMR) is currently one of the greatest global threats. It results in millions of deaths, long-lasting disabilities and increased health care costs. It also has severe impacts on livelihoods, threatens food security and results in loss of animal lives.
- 2** Rising levels of AMR will hinder progress towards many of the Sustainable Development Goals (SDGs), particularly those focusing on health and well-being, poverty reduction, food security, environment and economic growth.
- 3** Given the inter-relatedness of human and animal health, plant production, food safety and the environment in both the evolution of the AMR problem and solutions to that problem, tackling AMR effectively will require concerted action across all sectors, applying the so-called One Health approach. The United Nations (UN) system has a key role in supporting multisectoral responses to AMR.
- 4** To catalyse action, it is vital to include AMR in the Common Country Analysis and the UN Sustainable Development Cooperation Framework (Cooperation Framework), by meaningfully linking AMR to broader development issues of One Health, pandemic preparedness and response, universal health coverage, sustainable food systems and environmental issues. Doing so will underline the urgency of the situation and the importance of the UN in responding to this threat to global development.
- 5** The Cooperation Framework should support mainstreaming AMR into national development plans and enable better streamlining and integration of relevant AMR activities into the strengthening of overall systems.
- 6** Concrete AMR outputs for improved data, coordination, regulation or prevention could be added under the most relevant outcomes related to One Health, health, sustainable food systems and the environment.

ANTIMICROBIAL RESISTANCE AND THE UNITED NATIONS SUSTAINABLE DEVELOPMENT COOPERATION FRAMEWORK

Guidance for United Nations country teams



Food and Agriculture
Organization of the
United Nations



World Health
Organization



Antimicrobial resistance and the United Nations Sustainable Development Cooperation Framework: guidance for United Nations country teams

ISBN (WHO) 978-92-4-003602-4 (electronic version)

ISBN (WHO) 978-92-4-003603-1 (print version)

ISBN (FAO) 978-92-5-134936-6

ISBN (OIE) 978-92-95115-97-2

© **World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO) and World Organisation for Animal Health (OIE), 2021**

All rights reserved. WHO, FAO and OIE encourage the reproduction and dissemination of material in this information product. Any proposed reproduction or dissemination for non-commercial purposes will be authorized free of charge upon request, provided the source is fully acknowledged. Any proposed reproduction or dissemination for resale or other commercial purposes, including educational purposes, is prohibited without the prior written permission of the copyright holders, and may incur fees.

Requests for permission to reproduce or translate WHO publications – whether for sale or for non-commercial distribution – should be addressed to WHO Press through the WHO web site <https://www.who.int/copyright>.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO) or of the World Organisation for Animal Health (OIE) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these are or have been endorsed or recommended by WHO, FAO and OIE in preference to others of a similar nature that are not mentioned. The published material is being distributed without warranty of any kind either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall WHO, FAO and OIE be liable for damages arising from its use. The views expressed herein are those of the authors and do not necessarily represent those of WHO, FAO, OIE.

Publications of the World Health Organization are available on the WHO web site www.who.int or can be purchased from WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland. Tel.: +41 22 791 3264; fax: +41 22 791 4857; e-mail: bookorders@who.int.

FAO information products are available on the FAO website www.fao.org/publications and can be purchased through Publications-sales@fao.org

Publications of the World Organisation for Animal Health are available either on the OIE web site www.oie.int or can be purchased through the OIE online bookshop www.oie.int/en/ebookshop/.

CONTENTS

Acknowledgements	iv
Abbreviations and acronyms	v
1 What is AMR?	1
2 Why does AMR matter for sustainable development?	2
3 How does AMR impact the SDGs?	2
4 What action is the UN taking?	6
5 What action are countries taking?	7
6 What are the key challenges and barriers to tackling AMR effectively?	8
7 Why should AMR be included in the Cooperation Framework?	9
8 Indicators and monitoring	9
9 Moving forward: what needs to be done?	11
References	13
Annex: Selected priority resources	15

ACKNOWLEDGEMENTS

This document has been prepared with the active engagement of headquarters, regional and country staff of the Tripartite organizations – the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE), the World Health Organization (WHO) – and the United Nations Environment Programme (UNEP) under the coordination of the Tripartite Joint Secretariat on AMR.

The Tripartite and UNEP would also like to thank the UN Development Coordination Office for their input and support, and the following organizations for their valuable engagement and input:

- United Nations Development Programme (UNDP)
- United Nations Children’s Fund (UNICEF)
- World Intellectual Property Organization (WIPO)
- European Bank for Reconstruction and Development (EBRD)
- Organisation for Economic Co-operation and Development (OECD)
- The World Bank

ABBREVIATIONS AND ACRONYMS

AMR	antimicrobial resistance
CCA	Common Country Analysis
FAO	Food and Agriculture Organization of the United Nations
GLASS	Global Antimicrobial Resistance and Use Surveillance System
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
HIV	human immunodeficiency virus
IACG	Interagency Coordination Group on AMR
IPC	infection prevention and control
LMIC	low- and middle-income country
MARA	Ministry of Agriculture and Rural Affairs of the People's Republic of China
NAP	national action plan
OIE	World Organisation for Animal Health
SDG	Sustainable Development Goal
TrACSS	Tripartite AMR Country Self-Assessment Survey
UHC	universal health coverage
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
WASH	water, sanitation and hygiene
WHO	World Health Organization

1

WHAT IS AMR?

Antimicrobial resistance (AMR) occurs when bacteria, viruses, fungi and parasites no longer respond to medicines effectively (see Table 1). AMR makes infections harder to treat and increases the risk of disease spread, severe illness and death. **The emergence and spread of AMR have been accelerated by:**

- inappropriate use of antimicrobials in humans, animals and plants;
- inadequate sanitation, hygiene, biosecurity, and infection prevention and control (IPC) measures in health care settings, communities, farming and food production systems; and
- a lack of equitable access to affordable and quality-assured antimicrobials, vaccines and diagnostics.

AMR has been described as a silent pandemic. It will not only result in millions of excess deaths, greater suffering and increased health care costs, but also lead to the loss of animal lives, with severe effects on human livelihoods and food security. The World Bank estimated that if AMR is not addressed, by 2050 the global economy may have lost nearly 4% of annual gross domestic product (GDP) (1), with the losses being even greater in low- and middle-income countries (LMICs). This situation could push up to 28 million people, most of them in developing countries, into poverty by 2050, mainly through the effects of AMR on economic productivity, livestock production and health care costs.

TABLE 1. EXAMPLES OF MICROBES AND ANTIMICROBIALS

MICROBES	EXAMPLES	ANTIMICROBIALS	EXAMPLES
Bacteria	<i>Escherichia coli</i> , <i>Salmonella</i> , <i>Pneumococcus</i>	Antibiotics	Penicillin, Ciprofloxacin
Viruses	Influenza, HIV, COVID-19	Antivirals	AZT, Oseltamivir
Protozoa	Malaria	Antiprotozoal	Artemisinin
Fungi	<i>Aspergillus</i> , <i>Candida</i>	Antifungals (fungicides)	Fluconazole

AZT: azidothymidine; HIV: human immunodeficiency virus.



2

WHY DOES AMR MATTER FOR SUSTAINABLE DEVELOPMENT?

Rising levels of AMR are making infections in humans, animals and plants harder to treat. Thus, they are threatening recent gains in key areas of global health, food safety and security, economic growth, poverty alleviation and the environment.

The COVID-19 pandemic has shown the devastating impact of hard-to-treat infections, and the ease with which infections can spread and threaten global health security. The threat of AMR to global health security is just as serious. Alarming levels of resistance have been reported in countries of all income levels, with the result that common diseases are becoming untreatable and life-saving medical procedures riskier to perform. AMR threatens gains in maternal and neonatal health, tuberculosis, malaria, safe surgery, HIV prevention and control, and the management of noncommunicable diseases. No health system will be sustainable without access to affordable antimicrobial agents that work. The problem is aggravated because the pipeline for the development of new classes of antibiotics is almost empty. Untreatable infections and chronic diseases will mean that many people will be unable to work, and the burden of caring for the sick is likely to fall disproportionately on women.

AMR threatens animal health, food safety and security, livelihoods, economies and the environment. Antimicrobials play a critical role in treating diseases in animals (terrestrial and aquatic) and in plants. Additionally, some drug-resistant infections can be transmitted between animals and humans. AMR can develop in and spread through the environment (e.g. in contaminated drinking-water, recreational waters, effluent from agricultural production, and waste streams from pharmaceutical manufacturing and hospitals).

AMR will make the attainment of universal health coverage (UHC) more challenging because of increased health care costs. Medicines to treat drug-resistant infections cost more, and multiple treatments may be necessary and may take longer to be efficacious, with cures less certain. One estimate from a worst-case scenario from the World Bank (7) showed that **AMR would lead to an increase in health care costs of up to 25% in low-income countries and 8% globally.**

Strengthening laboratory capacity to combat antimicrobial resistance in Uzbekistan: a collaborative mentoring programme (22)

The programme “Better Labs for Better Health” (Better Labs) was launched in 2012 as an intersectoral approach aimed at providing sustainable improvements to the quality of all laboratories that deal with health. The AMR Centre, Uzbekistan’s national reference laboratory, joined the Better Labs programme in 2018. The AMR Centre diagnoses, identifies and monitors the emergence of drug-resistant bacteria. It plays a key role in training laboratories and maintaining the surveillance network in Uzbekistan.

UZBEKISTAN

3

HOW DOES AMR IMPACT THE SDGS?

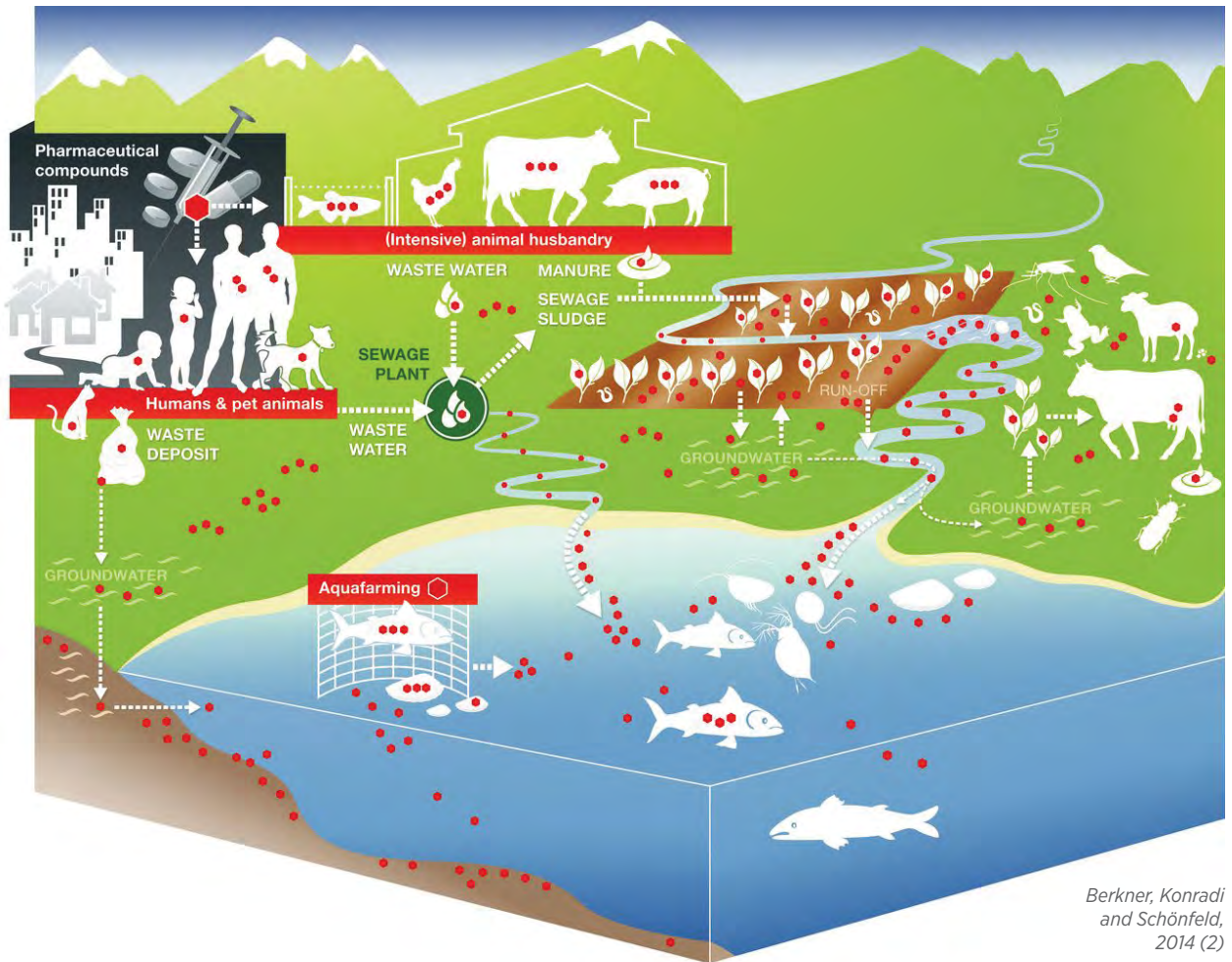
Addressing AMR is integral to achieving the Sustainable Development Goals (SDGs). Progress in many of the goals (e.g. improved access to clean water and sanitation, sustainable consumption and production such as more sustainable food production, and appropriate use of antimicrobials in humans and animals) will help to address AMR. However, at the same time, rising levels of AMR will make it more difficult to achieve the goals for health, poverty reduction, food security and economic growth.

There is increasing recognition of the relationships between human health, animal health, plant production, food safety and environmental sectors, in both the evolution of the AMR problem and solutions to that problem. To adequately address AMR, it is therefore necessary to take a “One Health” approach, with integrated actions across all sectors, as shown in Fig. 1.

WHAT IS A ONE HEALTH APPROACH TO AMR?

AMR is known to have multiple drivers and needs to be tackled on many fronts. Hence, a One Health approach is essential to ensure that all sectors and stakeholders communicate and work together effectively. One Health is a collaborative, multisectoral and transdisciplinary approach that recognizes the interconnections between people, animals, plants and their shared environment.

FIG. 1. A ONE HEALTH APPROACH TO AMR



There are two main SDG indicators for AMR:



- **SDG 3.d.2** *Percentage of bloodstream infections due to selected antimicrobial-resistant organisms.*
- **SDG 3.d.3** *Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis (where antibiotics will be disaggregated from the core set of data used in the metadata).*

Although these indicators relate to SDG 3, effectively tackling AMR will require concerted action across human health, animal health, plant production, food safety and the environmental sectors. It will be vital to engage other sectors, such as industry.







Table 2 shows how AMR is central to several SDGs and closely related to others.

TABLE 2. AMR AND THE SDGS

CORE SDGs	HOW AMR IMPEDES PROGRESS ON THE SDG	HOW PROGRESS ON THE SDG HELPS TO ADDRESS AMR
 <p>1 NO POVERTY</p>	<ul style="list-style-type: none"> ● People living in poverty are more prone to infectious diseases, and resistant infections are more likely to spread in poor living conditions. The poor are less able to access effective treatment. Substandard care and partial treatment can drive infection. ● High costs of treatment and chronic infections will impoverish millions. An additional 28.3 million people could be pushed into extreme poverty by 2050 because of AMR, most of them living in LMIC (1). 	<ul style="list-style-type: none"> ● Financial and social protection strategies will allow poor people to access quality services and decrease the impact of AMR.
 <p>2 ZERO HUNGER</p>	<ul style="list-style-type: none"> ● AMR in animals increases costs of animal health, infections become untreatable, production decreases and working animals cannot carry out their tasks, affecting the livelihood of farmers and food security. ● Livestock production in low-income countries would decline the most, with a possible 11% loss by 2050 in the high-AMR impact scenario (1). 	<ul style="list-style-type: none"> ● Developing sustainable food production systems with less reliance on antimicrobials and with the phasing out of antibiotic use in livestock for growth promotion will be essential for long-term AMR control. ● Increased professional advice and vaccination of food animals can reduce the emergence and spread of drug-resistant infections.
 <p>3 GOOD HEALTH AND WELL-BEING</p>	<ul style="list-style-type: none"> ● Globally, drug-resistant diseases currently cause at least 700 000 deaths a year (3). ● AMR will increase treatment costs, making effective care unaffordable for many, and UHC unattainable. ● Emerging and increasing resistance to drugs to treat HIV, TB and malaria is one of the key barriers to eliminating these diseases. Multi-drug resistant TB alone is estimated to cause 230 000 deaths annually (3). ● Reducing child and infant mortality relies on effective antibiotics. Currently, 200 000 neonates die each year from drug-resistant infections, such as pneumonia or resistant bloodstream infections (4). 	<ul style="list-style-type: none"> ● Strategies to reduce the risks of AMR must be linked to improving care and ensuring access to effective care when needed. ● Central to addressing AMR is ensuring that health systems are accessible and have a trained workforce providing evidence-based high-quality care in a hygienic setting (5). ● Increased vaccine coverage reduces the incidence of disease from resistant pathogens and limits the need for antibiotics; in turn, this prevents the development of AMR (6). ● Falsified and poor-quality antibiotics contribute to AMR. Hence, improving access to high-quality antimicrobials and preventing falsified and substandard medicines reaching the market will help to reduce AMR. ● Reliance on out-of-pocket payment for health care correlates with AMR in LMIC (7).
 <p>6 CLEAN WATER AND SANITATION</p>	<ul style="list-style-type: none"> ● Globally, 1 in 4 health care facilities have no access to basic water services, 1 in 10 have no sanitation services available, 1 in 3 do not have adequate facilities to clean hands at the point of care, and 1 in 3 do not segregate waste safely. Lack of the availability of basic WASH services is greatest in least developed countries, where 50% of health care facilities lack access to water services and 60% have no sanitation services at all (8). ● Lack of access to adequate WASH services is giving rise to the spread of infectious diseases; in turn, this increases antibiotic use and thus drives the emergence and spread of AMR. 	<ul style="list-style-type: none"> ● Each year, hundreds of millions of cases of diarrhoea in humans are treated with antimicrobials. Universal access to WASH could reduce such cases by 60% (9). ● Improved WASH services are critical to reducing the spread of infection.
 <p>8 DECENT WORK AND ECONOMIC GROWTH</p>	<ul style="list-style-type: none"> ● By 2030, increased mortality and morbidity due to AMR and thus reduced labour supply could cause a decrease in the global economic output of 1–3%, with estimated losses as high as US\$ 3.4 trillion (1). 	

CORE SDGs	HOW AMR IMPEDES PROGRESS ON THE SDG	HOW PROGRESS ON THE SDG HELPS TO ADDRESS AMR
	<ul style="list-style-type: none"> Antimicrobial compounds and their metabolites can be found in the wastewaters from manufacturing sites for medicines and APIs. In extreme cases, antimicrobial compounds have been found in water downstream from manufacturing sites in concentrations higher than those found in the blood of patients taking medicines (9). 	<ul style="list-style-type: none"> Effective pollution controls on pharmaceutical production, health facilities and agricultural production will substantially decrease the risk of AMR emergence and spread in the environment.
	<ul style="list-style-type: none"> To effectively tackle AMR, collaboration and partnerships are needed across all relevant sectors (human, animal, plants and the environment) and at all levels (national, regional and global). 	<ul style="list-style-type: none"> Working in partnership means taking up the One Health approach to addressing AMR.

RELATED SDGs

					
<ul style="list-style-type: none"> AMR can lead to increasing inequalities within societies; also, certain groups may be particularly vulnerable to drug-resistant infections. These groups include women, children, migrants, refugees, people employed in certain sectors (e.g. agriculture or health care) and people living in poverty. 	<ul style="list-style-type: none"> Quality-assured local production of antimicrobials, vaccines and diagnostics can improve access to medical technologies and this is an important part of the strategy for some countries. Investment in R&D is vital for the development of vaccines, new antibiotics and diagnostics. 	<ul style="list-style-type: none"> AMR can lead to increasing inequalities within societies; also, certain groups may be particularly vulnerable to drug-resistant infections. These groups include women, children, migrants, refugees, people employed in certain sectors (e.g. agriculture or health care) and people living in poverty. 	<ul style="list-style-type: none"> Addressing overcrowding, poor WASH provision and the lack of regulation of basic services will decrease the risks of infections and hence the emergence and spread of AMR in cities. 	<ul style="list-style-type: none"> Global warming is resulting in changing patterns of disease and increased reliance on antimicrobials in non-immune populations. Taking action on climate change will decrease the likelihood of extreme weather events and the associated spread of resistance. 	<ul style="list-style-type: none"> If countries develop aquaculture, it is vital that this is done with appropriate regulation to ensure access to quality antimicrobial agents and to minimize the overuse and misuse of antimicrobials.

API: active pharmaceutical ingredient; HIV: human immunodeficiency virus; LMIC: low- and middle-income country; R&D: research and development; SDG: Sustainable Development Goal; TB: tuberculosis; UHC: universal health coverage; WASH: water, sanitation and hygiene.

4

WHAT ACTION IS THE UN TAKING?

- The Global Action Plan on AMR was adopted by the World Health Assembly in 2015, and subsequently endorsed by the Food and Agriculture Organization of the United Nations (FAO) and World Organisation for Animal Health (OIE) (10). The plan calls for all countries to develop and implement multisectoral national action plans (NAPs) on AMR. World Health Organization (WHO) and FAO country offices and the OIE regional and subregional representations play a key role in helping countries to realize these commitments, but it is important to involve United Nations (UN) country teams (representing resident and non-resident UN development entities).
- At the 2016 UN High-level Meeting on AMR (11), global leaders committed to tackling AMR and called upon the Tripartite¹ (FAO, OIE and WHO) to scale up support through a One Health approach (12). The UN Secretary-General convened the ad hoc Interagency Coordination Group on AMR (IACG) in May 2017, in consultation with the Tripartite organizations.
- On receiving the IACG report in 2019 (3), the UN Secretary-General called upon Member States for urgent support and investment to scale up AMR responses at national, regional and global levels. He recommended that one component of this should be the **inclusion of AMR in the UN Sustainable Development Cooperation Framework (Cooperation Framework)**.
- The IACG report recommended the urgent establishment of three global governance structures to strengthen overall governance, accountability and cross-sector collaboration in efforts to tackle AMR. In response, the Global Leaders Group on AMR was established in 2020. The Independent Panel on Evidence for Action against AMR and a Partnership Platform, involving multilateral organizations, civil society, governments, academia and the private sector, will also be established.



© Jess Aston



© WHO / Ilyas Ahmed

- Actions to address AMR at country level will be strengthened by the Tripartite and the UN Environment Programme (UNEP), but other agencies and organizations also have a role to play, including the UN Development Programme (UNDP), the UN Children's Fund (UNICEF), the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund), the World Bank and other development banks, bilateral agencies and foundations.

¹ The UN Environment Programme (UNEP) is collaborating with the Tripartite to help address the environmental aspects of AMR.

5

WHAT ACTION ARE COUNTRIES TAKING?

Since the launch of the Global Action Plan on AMR in 2015, countries have substantially stepped up their response to AMR. **As of May 2021, 144 countries had a multisectoral NAP (13) in place and most of the remaining countries are in the process of developing such a NAP.** Since 2016, countries have also been reporting their progress in addressing AMR via the Tripartite AMR Country Self-Assessment Survey (TrACSS) (14). A total of 136 countries – representing over 90% of the world’s population – participated in the 2019–2020 TrACSS (15). Findings reveal increased national focus on AMR and growing recognition of the importance of a One Health approach in effectively tackling the issue: 76 countries reported having a functional multisectoral working group on AMR in place.

Overall, 92% of countries (125) reported having in place regulations on the prescription and sale of antimicrobials for human use. Likewise, 77% of countries (103) introduced regulations on prescriptions and sale of antimicrobials for animal use, although implementing these regulations can be difficult. In addition, 71.8% of countries reported having policies to optimize the use of antimicrobials in human health, such as guidelines for treatment and practices to assure appropriate antimicrobial use. Some 56% of countries reported having policies to optimize the use of antimicrobials in animal health, and 63% reported having laws prohibiting the use of antibiotics for growth promotion.

Overall, 60% of countries (81) reported the inclusion of the environment sector in their plans, including water, sanitation and hygiene (WASH). However, few countries reflect AMR issues and data in environmental plans or strategies.

As of April 2021, 107 countries or territories are also enrolled in the Global Antimicrobial Resistance and Use Surveillance System (GLASS). Set up in 2015, GLASS promotes and supports a standardized approach to the collection, analysis and sharing of AMR data at a global level. It encourages and supports countries to set up national AMR surveillance systems that can monitor AMR trends and produce reliable and comparable data.

In 2020, 160 countries reported the use of antimicrobials in animals to OIE’s Global Database on Antimicrobial Agents Intended for Use in Animals (76). The number of countries reporting information has grown over time, from 130 OIE members for the first report in 2016 to 160 in the fifth report in 2020.

Since 2019, nine countries have assessed the implementation of their national action plans on AMR in their food and agriculture sectors, using the FAO Progressive Management Pathway for AMR (FAO-PMP-AMR) (17). The aim of the FAO-PMP-AMR is to develop a road map that advances One Health responses to AMR at the country level. In addition, since 2016, more than 120 AMR laboratories in 28 countries have assessed AMR surveillance system with the support of the FAO Assessment Tool for Laboratories and AMR Surveillance Systems (FAO-ATLASS) (18). The FAO-ATLASS helps countries to generate quality data from their food and agriculture sectors.

The iAMResponsible campaign in the Philippines

The need to raise the awareness of the different stakeholders (especially in the animal health sector) in the Philippines has led to the development of a key message on AMR: *iAMResponsible*. The iAMResponsible campaign imparts a sense of accountability, ownership and responsibility among stakeholders in the fight against AMR. This message was developed in 2018 through the joint efforts of representatives of the Department of Agriculture Technical Working Group on AMR and different stakeholders. Since then, this communication has been used and adapted in information, education and communication (IEC) materials related to AMR in the Philippines.

PHILIPPINES

Tackling AMR in China

In 2015, Chinese scientists discovered the mobile resistance gene, *mcr-1*, in animals and patients in China (23). Bacteria carrying *mcr-1* can develop resistance to the antibiotic colistin. Within a year, this gene was found in other countries. In response to the research findings, in 2016, to reduce the emergence and the spread of AMR, the Ministry of Agriculture and Rural Affairs of China (MARA) issued Announcement No. 2428, to prohibit the use of colistin in animals to promote growth.

Since 30 April 2017, China has completely banned the use of colistin in animals as a growth promoter. In 2018, the FAO in China and MARA jointly organized a launch ceremony to raise awareness and promote the prudent use of antimicrobials. A video on AMR titled *Better animal health, use antimicrobials responsibly* was launched and attracted over 5 million viewers in 1 month.

In 2020, China made significant progress in implementing two plans: the National Action Plan for Antimicrobial Resistance (2016–2020) and the National Action Plan for Antibiotic Resistance of Microorganisms of Animal Origin (2017–2020). The MARA has issued announcements to stop the production, import, trade and use of growth-promoting antimicrobials. As of 31 December 2020, the use of antimicrobials for growth promotion has been prohibited completely in China.

CHINA

6

WHAT ARE THE KEY CHALLENGES AND BARRIERS TO TACKLING AMR EFFECTIVELY?

AMR is one of many challenges that countries face. Many people are unaware that they or their livestock might have a resistant infection, and often those who are treating them are also unaware. This means that the problem is largely unrecognized and undocumented. The lack of representative data on AMR, especially in LMICs, continues to be a challenge. Because the real scale of the problem and potential impact remain unclear, it is difficult to build a strong national AMR narrative to increase political engagement, financial commitments or public awareness.

Most countries have now developed AMR NAPs; however, there are major challenges in implementing, scaling up and sustaining programmatic and effective interventions. Coordinating ministries and involving other relevant stakeholders present logistical challenges, which are exacerbated by a lack of human and financial resources.

In general, systems to manage AMR are better established in high-income countries, which have been implementing AMR programmes and activities for a longer time. **Compared with countries with functional systems to address AMR, additional investment is required in countries that lack basic infrastructure; have weak human and animal health systems and food production systems; have a high burden of infectious diseases; lack or have deficient water treatment and waste management systems; or have weak environmental regulations.**

With the use of antimicrobials rapidly increasing in many middle-income countries, those that have large, unregulated private and informal sectors are particularly vulnerable to AMR. In many countries, substandard and falsified medicines and lack of access to essential health technologies (including diagnostics and vaccines) present a significant problem to human and animal health. This can contribute to rising levels of AMR.

Phasing out the use of antimicrobial agents for growth promotion in animals and introducing mechanisms to control pollution may require changes in agricultural practices, waste and wastewater management, and pharmaceutical production systems. Controlling ecosystem-based approaches to minimize the use of antimicrobials in plant production is fundamental for human health and the environment. These measures are a necessary investment to protect human, animal, plant and planetary health. Countries will therefore need a blend of incentives, education, training and regulation to make these changes happen.



© MD Duran

The groundbreaking Antibiotics Smart Use community approach in Thailand

THAILAND

The Thai Antibiotics Smart Use approach (19) has been one of the most successful approaches to lowering antibiotic use. The approach is bottom-up rather than top-down, and the campaign focuses on three common ailments for which antibiotics are not needed: upper respiratory tract infections, acute diarrhoea and simple wounds.

The programme has sought to improve the rational use of these medicines through a stepwise approach. It starts by improving education on antibiotic use locally and lowering barriers to behavioural change by offering alternative treatments for non-bacterial infections (20).

Thanks to its success, the Antibiotics Smart Use approach is now integrated into Thailand's rational drug use initiative under the national drug policy (21). The adoption into policy, coupled with campaigns by civil society organizations and local networks, sustain long-term actions in reducing unnecessary use of antibiotics in Thailand (20).

Data collected between 2014 and 2019 from about 680 hospitals showed that the prescribing rates of antibiotics decreased from 43.5% to 22.1% for upper respiratory infections, 45.7% to 19.3% for acute diarrhoea and 68.4% to 45.6% for uncomplicated wounds (21).

7

WHY SHOULD AMR BE INCLUDED IN THE COOPERATION FRAMEWORK?

Addressing AMR requires sustained coordination and action across sectors. Multisectoral work is challenging; hence, coordinated action of the UN country teams is essential to catalyse action and engage all relevant sectors:

- the Tripartite is supporting countries with the development and implementation of AMR NAPs:
 - WHO has a lead role with the health sector;
 - FAO leads on issues related to food production (livestock, fisheries and plants);
 - OIE has a lead role in the animal health and welfare sector through standard setting and strengthening of the national veterinary and animal health services;
- UNEP, as the leading organization on environment, is strengthening the environmental dimension of AMR, working in close collaboration with the Tripartite; and
- UNDP, UNICEF and organizations such as the Global Fund, Gavi (the Vaccine Alliance),² the World Bank and regional development banks have critical roles in supporting action in their relevant sectors.

Discussions at the UN General Assembly have resulted in commitments by heads of Member States to tackle AMR. However, in most LMICs, addressing AMR is still not a sufficiently high political or development priority because of low awareness about the issue, lack of sufficient funding and lack of data to quantify the extent of the situation. In addition, AMR is yet to be mainstreamed into national development plans, budgeting and monitoring systems.

There is an urgent need to stimulate interest and catalyse action on AMR, to support the implementation of the 2030 Agenda for Sustainable Development. An important step to achieve this is to include AMR as a risk in a Common Country Analysis (CCA)³ and in the Cooperation Framework, and encouraging the streamlining and integration of relevant AMR activities into overall systems strengthening. Although the Cooperation Framework must reflect the country's own development priorities, AMR is often overlooked. It is vital to meaningfully link AMR to broader development issues and not present it as a “stand-alone issue”.

8

INDICATORS AND MONITORING

Common Country Analysis

The first step in developing the Cooperation Framework is the CCA, in which the country gathers all the available national-level data on developmental issues. In a second step, data are prioritized based on the country's most pressing development needs.

As explained in Section 3 above, the two main SDG indicators for AMR are SDG 3.d.2 and SDG 3.b.3. Other relevant indicators that should be included in the socioeconomic section of the CCA and give an indication of the risks of AMR are given in Table 3.

Inclusion in the Cooperation Framework

The Cooperation Framework requires countries to identify areas with the greatest potential for transformative and inclusive development. Tackling AMR using a One Health approach has such potential.

AMR requires collaborative action across sectors; thus, multilateral agencies and intergovernmental organizations have a critical role in supporting countries in accelerating action. UN agencies, such as WHO, FAO, UNEP, UNICEF and UNDP, all have a contribution to make, working with other institutions such as OIE, the World Bank, and the Global Fund.

Integration of AMR into CCAs and then into the Cooperation Framework should be a priority, given the risk AMR poses to sustainable development in countries, and the capacity of the UN and other organizations to support collaborative and impactful actions to address the issue. AMR should be meaningfully linked to broader development issues such as One Health, pandemic preparedness and response, UHC, sustainable food systems and environmental issues.

² See <https://www.gavi.org/>

³ For information on CCAs, see Annex 2 of *United Nations Sustainable Development Cooperation Framework: internal guidance (24)*.

The Cooperation Framework adopts an integrated and multidimensional programming approach (24), in line with the “Five P” Framework of the 2030 Agenda (people, prosperity, planet, peace and partnerships) (25). The Cooperation Framework identifies how working on and advancing one SDG can maximize synergies and positive impacts and manages potential trade-offs. When developing the narrative of the Cooperation Framework and the Five P Framework, AMR fits best into the category “people”, but it is naturally also rooted in prosperity, planet and partnerships.

TABLE 3. RELEVANT INDICATORS FOR THE SOCIOECONOMIC SECTION OF THE CCA

MEASUREMENT	INDICATOR
Optimized antimicrobial use and regulation	Legislation or regulation that requires antimicrobials for human use to be dispensed only with a prescription from an authorized health worker
Use of antimicrobials in humans	Total human consumption of antibiotics for systemic use (ATC classification code J01) in defined daily doses per 1000 population (or inhabitants) per day Relative proportion of AWaRe antibiotics for paediatric formulation
Use of antimicrobials in growth promotion	Veterinary antimicrobials authorized or used for non-veterinary medical use (e.g. for growth promotion)
Levels and trends in sales/ imports/ use of antimicrobials in food-producing animals	i. Total volume of sales/ imports (or use), in mg/kg biomass, in food-producing animals ii. Percentage of totals sales or imports (or use) classified as WHO Highest Priority Critically Important Antimicrobial agents.
Access to safe water	Proportion of the population using safely managed drinking-water services
Access to safe sanitation	Proportion of the population with access to safe sanitation
Targeted awareness raising	Nationwide, government-supported AMR awareness campaign targeting priority stakeholder groups in: i. human health ii. animal health iii. plant health iv. food production v. food safety vi. the environment
Immunization coverage	i. Pneumococcal conjugate vaccine ii. Rotavirus vaccine iii. Measles-containing vaccine, either alone, or in a measles-rubella or measles-mumps-rubella combination iv. Hib type b containing vaccine
Patterns and trends in resistance in TB	Percentage of new bacteriologically confirmed pulmonary TB cases associated with RR-TB or MDR-TB

ATC: Anatomical Therapeutic Chemical; AWaRe: Access, Watch and Reserve; Hib: *Haemophilus influenzae*; MDR-TB: multidrug-resistant TB; RR-TB: rifampicin-resistant TB; TB: tuberculosis.

For most countries, the analysis of this data (or extrapolation from regional and global estimates) and the heightened awareness of the threat of untreatable infectious diseases (in the wake of COVID-19) **should result in the inclusion of AMR in the risk analysis section of the CCA.**

MOVING FORWARD: WHAT NEEDS TO BE DONE?

To effectively address AMR, countries need robust systems to prevent and manage infections in humans and animals, and support the prudent and responsible use of antimicrobials. Health facilities and food production need to be clean and safe. Sustainable procurement of antimicrobials needs to be promoted. Animal and human health workers need to be able to diagnose and treat infections properly; and access and use the right antimicrobial drugs of assured quality, for the right duration and dose, and only when indicated. Take-back systems, and solid and wastewater treatments need to be set up.

These are development priorities, particularly in the time of COVID-19, but AMR provides another urgent imperative to take these actions sustainably to scale.

Much of what needs to be done to tackle AMR is part of overall good human, animal and ecosystem health through a One Health approach. Various activities will have substantial benefits beyond tackling AMR; such activities include strengthening WASH provisions and pollution controls, biosecurity measures in animal production and along the food chain, sound chemicals and waste management and the supply of first-line medicines among others. In the wake of COVID-19, countries should be strengthening their integrated surveillance systems, pandemic preparedness plans and One Health collaboration to address international health threats, such as AMR. The Global Action Plan on AMR (10) and countries' own NAPs provide a comprehensive set of objectives and activities. Nevertheless, there is still much work to be done to see full and robust implementation of these plans.

There must be more awareness and greater capacity to decrease inappropriate use of antimicrobials in all sectors, while ensuring access to appropriate antimicrobial drugs of an acceptable quality where necessary. Many countries are scaling up domestic production of antibiotics; such production should be part of the sustainable consumption and production agenda, with associated actions to prevent the risks of environmental contamination and to ensure quality.

AMR-specific efforts, where focused action on AMR is required, include, but are not limited to, those shown in Box 1.

In many cases, AMR can offer an additional, compelling reason to enhance the quantity and quality of existing activities. Adapting basic projects and programmes to reinforce simple AMR-related messages can be cost effective and impactful.

Addressing AMR is an important component of UHC, primary health care, global health security, One Health and pandemic preparedness, and can be included within outcomes in these areas. In light of COVID-19, many countries will be strengthening laboratory and surveillance systems and IPC. Similarly, addressing AMR fits within the food security debate on how to sustainably feed 11 billion people by the end of the century.

It is essential that AMR responses are tailored to specific country contexts and capacities, including in environments that are resource constrained, conflict affected and challenging to operate in. People in such environments are still more likely to die because they cannot access antimicrobials when they need them, rather than because of a growing burden of AMR. The most important and pragmatic entry points may be strengthening systems to prevent and treat infections; for example, by expanding immunization coverage, applying integrated water resource management including WASH provision, promoting sustainable procurement and improving access to antibiotics for those in need.

In Uganda, a study urges actions to tackle AMR in livestock and fisheries

In Uganda, the loss of effective antimicrobials is a threat to economic activities. In addition, it undermines the country's ability to ensure food security and fight infectious and zoonotic diseases in the growing population.

A risk assessment conducted by FAO and Uganda's Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) provided information and reliable data to guide strategies to reduce and manage the risks associated with AMR. Public and private sectors can use these data to prioritize interventions and resources to address AMR in livestock and fisheries.



BOX 1. CONCRETE PROPOSALS ON AMR FOR INCLUSION IN THE COOPERATION FRAMEWORK: SUGGESTIONS FOR OUTPUTS

Listed here are suggested outputs in the areas of data, coordination, regulation and prevention under outcomes related to health, health security, One Health, sustainable food systems, or the environment.

Data:

- National capacity strengthened to ensure that systems are in place to generate information and understanding of the scale of the AMR problem, including data on the prevalence of resistance and the use of antimicrobials in human, animal and plant health.
- Integrated regular monitoring and tracking procedures and systems in place.
- Comprehensive multi-stakeholder mapping and situation analysis carried out that considers the risks of AMR developing across all sectors – human, animal (terrestrial and aquatic) and plant health, food systems, and the environment.
- Collection of better data and more consistent analyses for measuring the full economic burden attributable to AMR. This will enable a better understanding of the health and economic burden caused by AMR across human, animal and environmental sectors.

Coordination:

- Coordination mechanisms established and strengthened across sectors in government and involving the private sector, civil society, academia and research institutions, professional associations, consumer associations, media and communities and populations to raise awareness, review progress and challenges, and prioritize actions.

Regulation:

- Policies and systems approved, funded and implemented, to incentivize, regulate, enforce and manage the supply chain for quality-assured antimicrobials for human, animal and plant health; and environmental controls to prevent and tackle pollution by antimicrobials and limit the transmission of resistant organisms.
- Prudent and responsible use of antimicrobials ensured and promoted across all sectors, sustainable procurement, take-back programmes and sound management of unused antimicrobials.

Prevention:

- Strengthened safety measures and systems:
 - to prevent and control infections in communities, health facilities and farms, including immunization, WASH and biosecurity; and
 - for good animal husbandry, as an effective means of reducing susceptibility to infection in animals.
- Education programmes on AMR set up to improve awareness and understanding of antimicrobial resistance and promote behavioural change in the long term. Collaborative efforts with multilateral agencies (e.g. UNICEF and UNESCO) will be critical to support countries delivering on this output.

UNESCO: United Nations Educational, Scientific and Cultural Organization; UNICEF: United Nations Children's Fund; WASH: water, sanitation and hygiene.

REFERENCES

- 1 Drug-resistant infections: a threat to our economic future. Washington, DC: World Bank Group; 2017 (<https://www.worldbank.org/en/topic/health/publication/drug-resistant-infections-a-threat-to-our-economic-future>).
- 2 Berkner S, Konradi S, Schönfeld J. Antibiotic resistance and the environment—there and back again: Science & Society series on Science and Drugs. EMBO reports. 2014;15(7):740–4 (<https://www.embopress.org/doi/full/10.15252/embr.201438978>).
- 3 No time to wait: securing the future from drug-resistant infections: report to the Secretary-General of the United Nations. Geneva: United Nations Interagency Coordination Group on Antimicrobial Resistance; 2019 (https://www.who.int/docs/default-source/documents/no-time-to-wait-securing-the-future-from-drug-resistant-infections-en.pdf?sfvrsn=5b424d7_6).
- 4 Costello A, Petersen S. Birth in a time of antibiotic-resistant bacteria. 2016 (<https://www.project-syndicate.org/commentary/antibiotic-resistance-maternal-infant-mortality-by-anthony-costello-and-stefan-s-peterson-2016-08>).
- 5 Tayler E, Gregory R, Bloom G, Salama P, Balkhy H. Universal health coverage: an opportunity to address antimicrobial resistance? Lancet Glob Health. 2019;7(11):e1480–1 (<https://pubmed.ncbi.nlm.nih.gov/31548131/>).
- 6 Leveraging vaccines to reduce antibiotic use and prevent antimicrobial resistance. Geneva: World Health Organization; 2021 (<https://www.who.int/publications/m/item/leveraging-vaccines-to-reduce-antibiotic-use-and-prevent-antimicrobial-resistance>).
- 7 Alsan M, Schoemaker L, Eggleston K, Kammili N, Kolli P, Bhattacharya J. Out-of-pocket health expenditures and antimicrobial resistance in low-income and middle-income countries: an economic analysis. Lancet Infect Dis. 2015;15(10):1203–10 (<https://pubmed.ncbi.nlm.nih.gov/26164481/>).
- 8 Global progress report on water, sanitation and hygiene in health care facilities. Fundamentals first. Geneva: World Health Organization, United Nations Children's Fund; 2020 (<https://www.who.int/publications/i/item/9789240017542>).
- 9 World Health Organization / Food and Agriculture Organization of the United Nations / World Organization for Animal Health. Technical brief on water, sanitation, hygiene (WASH) and wastewater management to prevent infections and reduce the spread of antimicrobial resistance (AMR). Geneva: World Health Organization; 2020 (<https://www.who.int/publications/i/item/9789240006416>).
- 10 Global action plan on antimicrobial resistance. Geneva: World Health Organization; 2015 (<https://www.who.int/publications/i/item/9789241509763>).
- 11 High-level Meeting on Antimicrobial Resistance, 21 September 2016, UN Headquarters, New York. New York: United Nations; 2016 (<https://www.un.org/pga/71/event-latest/high-level-meeting-on-antimicrobial-resistance/>).
- 12 One Health [website]. Geneva: World Health Organization; 2017 (<https://www.who.int/news-room/q-a-detail/one-health>).
- 13 Supporting countries with national action plan implementation [website]. Geneva: World Health Organization; 2021 (<https://www.who.int/activities/supporting-countries-with-national-action-plan-implementation>).
- 14 Global database for the Tripartite Antimicrobial Resistance (AMR) Country Self-Assessment Survey (TrACSS) [website]. Geneva: World Health Organization, Food and Agriculture Organization of the United Nations, World Organisation for Animal Health; 2021 (<https://amrcountryprogress.org>).
- 15 Monitoring global progress on antimicrobial resistance: Tripartite AMR Country Self-Assessment Survey (TrACSS) 2019–2020. Geneva: World Health Organization; 2021 ([https://www.who.int/publications/i/item/monitoring-global-progress-on-antimicrobial-resistance-tripartite-amr-country-self-assessment-survey-\(tracss\)-2019-2020](https://www.who.int/publications/i/item/monitoring-global-progress-on-antimicrobial-resistance-tripartite-amr-country-self-assessment-survey-(tracss)-2019-2020)).

-
- 16 OIE 5th annual report on antimicrobial agents intended for use in animals. Paris: World Organisation for Animal Health (OIE); 2021 (<https://www.oie.int/en/document/fifth-oie-annual-report-on-antimicrobial-agents-intended-for-use-in-animals/>).
 - 17 FAO Progressive Management Pathway for Antimicrobial Resistance (FAO-PMP-AMR) [website]. Rome: Food and Agriculture Organization of the United Nations; 2021 (<http://www.fao.org/antimicrobial-resistance/resources/tools/fao-pmp-amr/en/>).
 - 18 FAO Assessment Tool for Laboratories and AMR Surveillance Systems (FAO-ATLASS) [website]. Rome: Food and Agriculture Organization of the United Nations; 2021 (<http://www.fao.org/antimicrobial-resistance/resources/tools/fao-atlass/en/>).
 - 19 Sumpradit N, Chongtrakul P, Anuwong K, Pumtong S, Kongsomboon K, Butdeemee P et al. Antibiotics smart use: a workable model for promoting the rational use of medicines in Thailand. Bull World Health Organ. 2012;90(12):905-13 (<https://pubmed.ncbi.nlm.nih.gov/23284196/>).
 - 20 Antibiotic smart use, Thailand: involving community to curb antibiotic resistance. ReAct; 2014 (<https://www.reactgroup.org/wp-content/uploads/2016/10/Antibiotic-Smart-Use-project-case-study.pdf>).
 - 21 Waleekhachonloet O, Rattanachotphanit T, Limwattananon C, Thammatacharee N, Limwattananon S. Effects of a national policy advocating rational drug use on decreases in outpatient antibiotic prescribing rates in Thailand. Pharm Pract (Granada). 2021;19(1):2201 (<https://pubmed.ncbi.nlm.nih.gov/33628347/>).
 - 22 Strengthening laboratory capacity to combat antimicrobial resistance in Uzbekistan: a collaborative mentoring programme. Geneva: World Health Organization; 2021 (<https://www.who.int/news/item/04-03-2021-strengthening-lab-capacity-to-combat-amr-in-uzbekistan-a-collaborative-mentoring-programme>).
 - 23 The Lancet Infectious Diseases: New gene that makes common bacteria resistant to last-line antibiotic found in animals and patients in China. London: Lancet; 2015 (https://www.eurekalert.org/pub_releases/2015-11/tl-tli111715.php).
 - 24 United Nations Sustainable Development Cooperation Framework: internal guidance. New York: United Nations; 2019 (https://unsdg.un.org/sites/default/files/2019-10/UN-Cooperation-Framework-Internal-Guidance-Final-June-2019_1.pdf).
 - 25 The Sustainable Development Goals in 2019: people, planet, prosperity in focus [website]. Washington, DC: United Nations Foundation; 2019 (<https://unfoundation.org/blog/post/the-sustainable-development-goals-in-2019-people-planet-prosperity-in-focus/>).

ANNEX: SELECTED PRIORITY RESOURCES

This annex lists, in date order, important resources not referenced in the main text.

World Organisation for Animal Health (OIE). The OIE Strategy on Antimicrobial Resistance and the Prudent Use of Antimicrobials. Paris: OIE; 2016 (<https://www.oie.int/app/uploads/2021/03/en-oie-amrstrategy.pdf>).

World Health Organization (WHO). Tackling antimicrobial resistance (AMR) together: working paper 1.0: multisectoral coordination. Geneva: WHO; 2018 (<https://apps.who.int/iris/handle/10665/336975>).

Magnusson U, Sternberg S, Eklund G, Rozstalnyy A. Prudent and efficient use of antimicrobials in pigs and poultry. Food and Agriculture Organization of the United Nations (FAO) Animal Production and Health Manual No. 23. Rome: FAO; 2019 (<http://www.fao.org/documents/card/en/c/ca6729en/>).

World Health Organization (WHO). Antimicrobial stewardship programmes in health-care facilities in low- and middle-income countries: a WHO practical toolkit. Geneva: WHO; 2019 (<https://apps.who.int/iris/handle/10665/329404>).

World Health Organization (WHO). Minimum requirements for infection prevention and control programmes. Geneva: WHO; 2019 (<https://apps.who.int/iris/handle/10665/330080>).

World Health Organization (WHO). Turning plans into action for antimicrobial resistance (AMR): working paper 2.0: implementation and coordination. Geneva: WHO; 2019 (<https://apps.who.int/iris/handle/10665/311386>).

World Health Organization (WHO). World Health Organization model list of essential medicines: 21st list 2019. Geneva: WHO; 2019 (<https://apps.who.int/iris/handle/10665/325771>).

World Health Organization (WHO), Food and Agriculture Organization of the United Nations & World Organisation for Animal Health. Monitoring and evaluation of the global action plan on antimicrobial resistance: framework and recommended indicators. Geneva: WHO; 2019 (<https://apps.who.int/iris/handle/10665/325006>).

Food and Agriculture Organization of the United Nations (FAO). Progress report on the implementation of FAO Action Plan on Antimicrobial Resistance (AMR) 2016–2020, and the proposal for a new FAO Action Plan on AMR 2021–2025. Rome: FAO; 2020 (<http://www.fao.org/3/nd393en/nd393en.pdf>).

World Health Organization (WHO). Selection of essential medicines at country level: using the WHO model list of essential medicines to update a national essential medicines list. Geneva: WHO; 2020 (<https://apps.who.int/iris/handle/10665/330898>).

World Health Organization (WHO), Food and Agriculture Organization of the United Nations & World Organisation for Animal Health. International instruments on the use of antimicrobials across the human, animal and plant sectors. Geneva: WHO; 2020 (<https://apps.who.int/iris/handle/10665/336379>).

World Organisation for Animal Health (OIE). OIE standards, guidelines and resolutions on antimicrobial resistance and the use of antimicrobial agents. Paris: OIE; 2020 (<https://www.oie.int/app/uploads/2021/03/book-amr-ang-fnl-lr.pdf>).

Food and Agriculture Organization of the United Nations (FAO). Resolution 4/2015 on AMR, adopted at FAO's Thirty-ninth Conference. Rome: Food and Agriculture Organization of the United Nations; 2021 (<http://www.fao.org/unfao/govbodies/gsbhome/conference/resolutions/2015/en/>).

World Health Organization (WHO). WHO policy guidance on integrated antimicrobial stewardship activities. Geneva: WHO; 2021 (<https://apps.who.int/iris/handle/10665/341432>).

World Organisation for Animal Health (OIE). OIE list of antimicrobial agents of veterinary importance. June 2021. Paris: OIE; 2021 (<https://www.oie.int/app/uploads/2021/06/a-oie-list-antimicrobials-june2021.pdf>).

World Health Organization & United Nations Children's Fund. Core questions and indicators for monitoring WASH in health care facilities in the Sustainable Development Goals. Geneva: WHO; 2018 (<https://apps.who.int/iris/handle/10665/275783>).

For more information contact:

World Health Organization

Antimicrobial Resistance Division
Avenue Appia 20
1211 Geneva 27
Switzerland

E-mail: amr-tjs@who.int

Website: www.who.int/health-topics/antimicrobial-resistance

