EBRD engagement in global efforts to curb antimicrobial resistance (AMR)

January 2025

European Bank
for Reconstruction and Development

EBRD engagement in global efforts to curb antimicrobial resistance (AMR)

January 2025

Acknowledgements and disclaimer: This report was written by Nobuko Ichikawa and Adonai Herrera-Martinez. The findings, interpretations and conclusions expressed in this work are those of the authors alone and do not necessarily reflect the views of the European Bank for Reconstruction and Development. Figures will need to be updated over time, as research work on antimicrobial resistance is progressing at a rapid pace. The report does not cover issues such as diagnostics and surveillance due to time limitations. The report benefited from reviews by Matthias Loening, Noriko Kitamura, David Jenkins, Debbie Cousins, Alexander Plekhanov, Stanislav Suprunenko, Martin McKee, Michael Corley and David Tyler. The EBRD's AMR engagement is a result of the combined efforts of different teams and departments, including the Environment and Sustainability Department, Manufacturing and Services, Agribusiness, Infrastructure, Transition Impact, Global Economics, Project Preparation and Implementation, Corporate Debt Banking Portfolio, Procurement Operations and Delivery, and the Communications Department. The report is a result of the Bank's close collaboration with clients, industry, investors, medical professionals, academia, research institutions, the World Health Organization, the World Bank, the International Finance Corporation, the Asian Development Bank, the Asian Infrastructure Investment Bank, Germany's KfW Development Bank, the Organisation for Economic Co-operation and Development, the UK Department of Health and Social Care, and civil society organisations.

Contents

EBRD engagement in global efforts to curb antimicrobial resistance (AMR)

Foreword

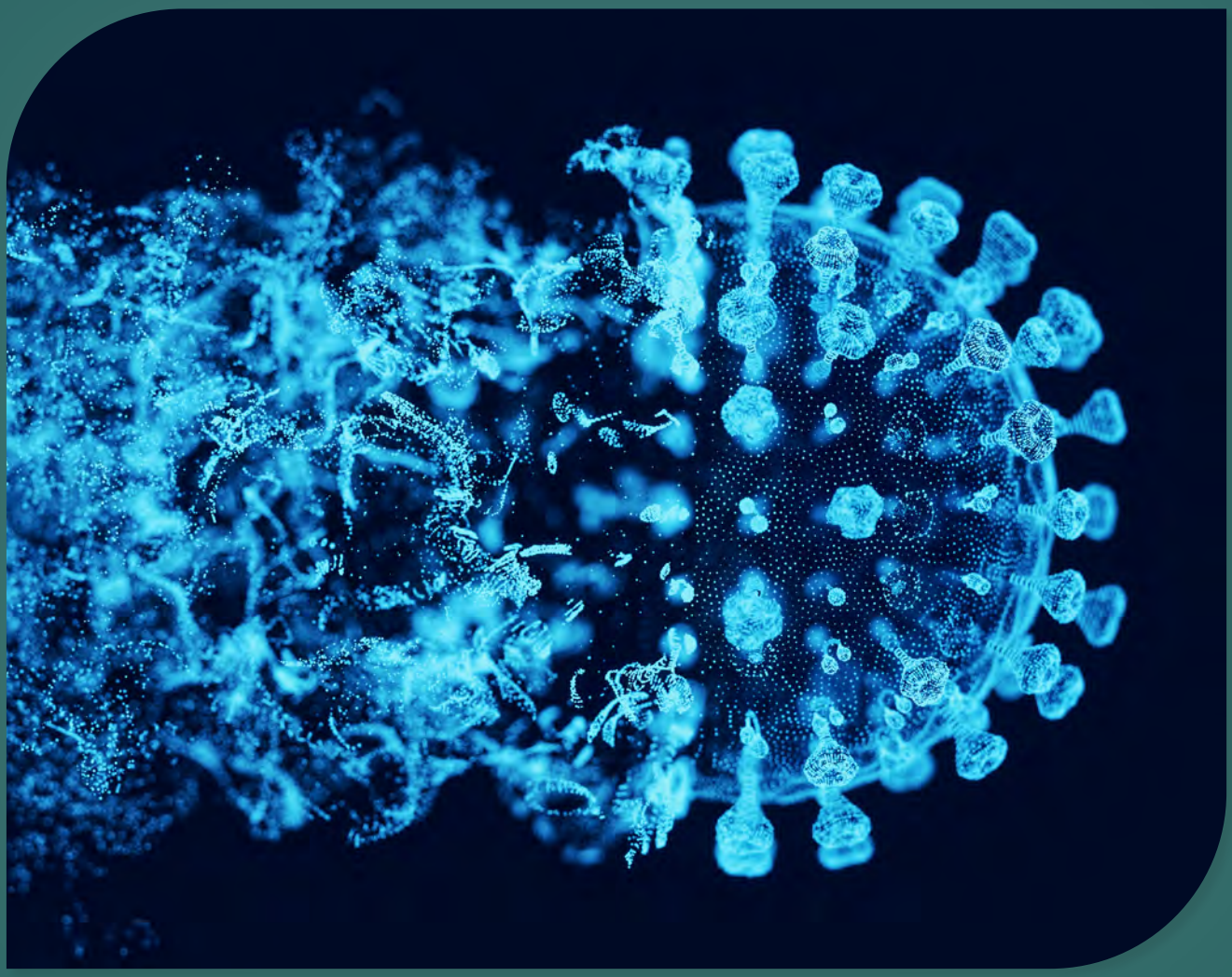
At the High-Level Meeting (HLM) on Antimicrobial Resistance (AMR) that took place in the context of the 79th United Nations General Assembly (UNGA) in September 2024, global leaders issued a declaration, committing to a clear set of targets and actions to curb AMR, including a 10 per cent reduction by 2030 in the estimated 5 million human deaths annually associated with bacterial AMR. The World Health Organization (WHO) considers AMR to be a key global health issue.[1] Since 2016, the European Bank for Reconstruction and Development (EBRD) has driven AMR engagement by fostering cooperation between different Bank teams and working closely with external stakeholders, from clients and industry to investors, governments, other international organisations and civil society, to generate synergies and produce effective outcomes.

The Bank has undertaken AMR risk management capacity-building technical cooperation programmes for healthcare service, public-private partnership (PPP) hospital, national Covid-19 response, pharmaceutical and agribusiness projects in Egypt, Georgia, Kazakhstan, Türkiye and Ukraine and across the EBRD regions. It has hosted five international AMR symposiums, with keynote speakers including Professor Dame Sally Davies, the United Kingdom's Special Envoy on AMR. Furthermore, the EBRD has posted 23 AMR articles on its intranet and held 20 internal workshops on AMR. Various outside speakers were invited to participate in the workshops, from academia, research organisations, industry, philanthropic organisations, civil society, the WHO and the World Bank. World AMR Awareness Week (WAAW) is marked every November by a staff campaign to increase AMR awareness in the EBRD community.

The Bank will continue to engage on AMR at this critical global political juncture to address the urgency of the AMR challenge and to implement effective interventions based on a cross-sectoral and cross-discipline One Health approach.[2] It is time to pool our efforts to prevent the proliferation of AMR and to safeguard our families and communities.

Henrik Linders
Managing Director
EBRD Environment and Sustainability Department

[1] See WHO (2023).
[2] The WHO defines One Health as "an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent". See WHO (n.d.).



EBRD engagement in global efforts
to curb antimicrobial resistance (AMR)

Executive summary

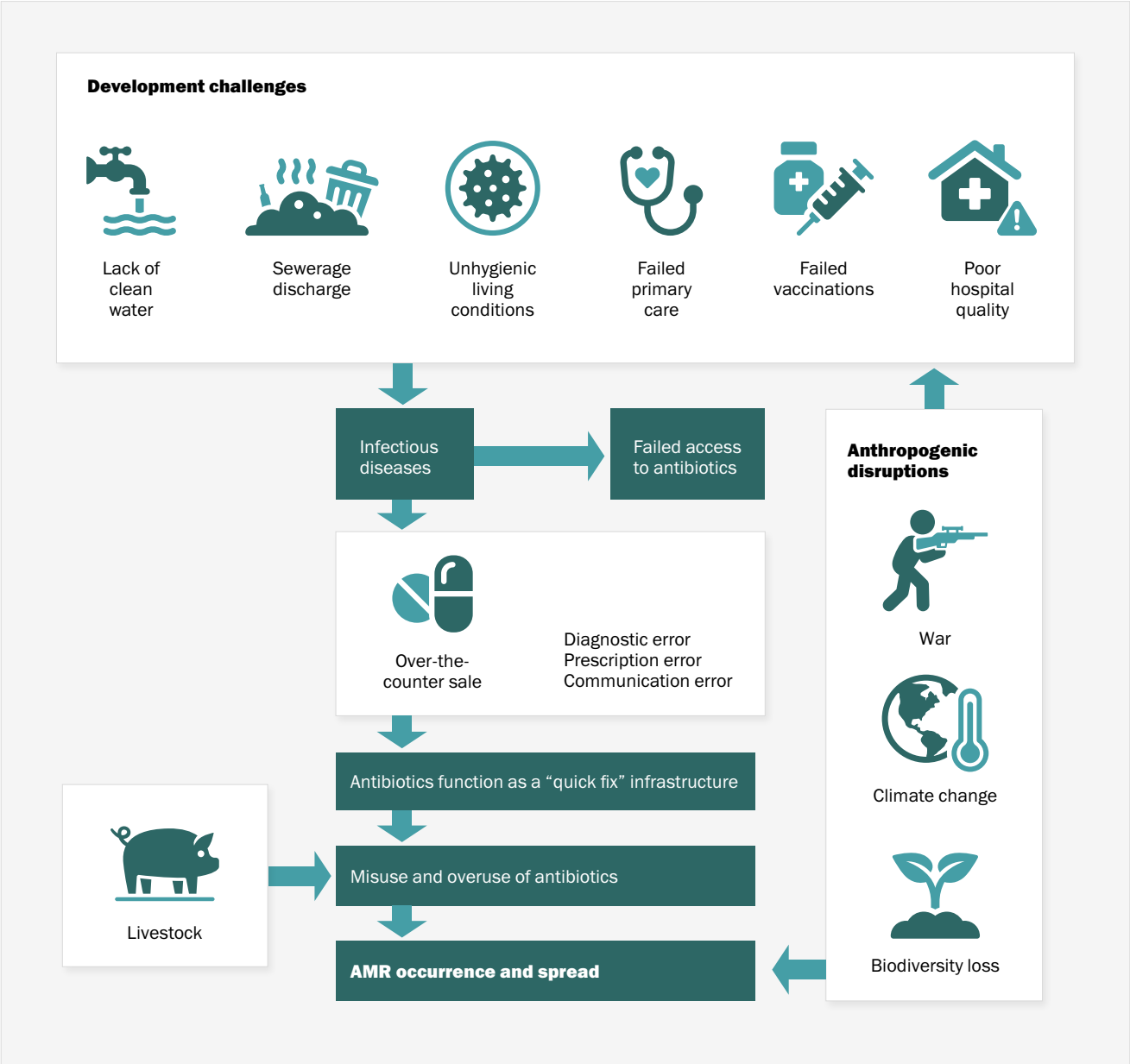
Executive summary

This report takes stock of what the EBRD, as a multilateral development bank (MDB), has done to address AMR. It also outlines proposals to scale up the Bank's AMR engagement with stakeholders and the regions in which the EBRD operates and invests. The occurrence and spread of AMR are primarily accelerated by the misuse and overuse of antimicrobials, as well as by development challenges and anthropological disruptions. AMR is already having a significant impact on human, animal, plant and ecosystem health. It is incurring economic costs in the form of increased healthcare spending, lost productivity and a deterioration in food safety and security. In the same way that Covid-19 spread rapidly around the globe, the global connectivity of travel and trade exposes the whole world to the risk of AMR. Furthermore, the impact of AMR is disproportionately borne by low- and middle-income countries (LMICs) and war-torn territories. AMR was directly responsible for killing 1.3 million people in 2019,[3] and it is estimated that almost 38 million people could die from drug-resistant bacterial infections between now and 2050.[4] AMR is an existential threat to humanity, together with climate change, biodiversity loss and environmental pollution.

The Bank recognises AMR as a significant challenge for the regions in which it operates, both in terms of addressing the Sustainable Development Goals (SDGs) and countering environmental and sustainability risks to its investments. In accordance with its Environmental and Social Policy, which includes AMR risk management provisions, the Bank has been working to tackle AMR. It has also explored related opportunities in sectors such as healthcare, PPP hospital infrastructure, agribusiness and water. International and national efforts are under way to prevent AMR and its proliferation. MDBs, such as the EBRD, can play a key role in this sphere by using their investment capacity, as well as their experience, knowledge and networks with industry, governments and civil society, to respond to the urgency of the AMR challenge. To this end, the Bank is keen to further facilitate cooperation and collaboration with stakeholders for a systematic One Health approach to mitigating AMR risk and building resilient sustainable economies.

[3] See Antimicrobial Resistance Collaborators (2022).
[4] See GBD 2021 Antimicrobial Resistance Collaborators (2024).

Figure 1. The AMR burden is disproportionately heavy in LMICs



Source: Alina Almakky, University of Bath.

1. What is AMR?

Antimicrobials are used to protect human, animal and plant health from pathogenic microbes. AMR occurs when bacteria, viruses, fungi and parasites no longer respond to antimicrobial medicines. As a result, antibiotics and other antimicrobial medicines become less effective or completely ineffective in treating infections, increasing the risk of disease spread, severe illness, disability and death. AMR is a natural process that happens over time through genetic changes in pathogens. Its emergence and spread are accelerated by human activity, mainly the misuse and overuse of antimicrobials to treat, prevent or control infections in humans, animals and plants.[5]

2. Antimicrobials as critical social infrastructure

Antimicrobials, particularly antibiotics, save lives from infectious diseases and are estimated to add an average 20 years to life expectancy around the globe.[6] Antimicrobials are a foundation of modern medicine and have become a critical part of the infrastructure of modern society, as well as a global public good.[7] It is estimated that a total of 5 million global deaths were associated with AMR in 2019, including some 1.3 million deaths that were directly attributable to bacterial AMR, exceeding the number of people who died from HIV/AIDS or malaria.[8] This is a stark reminder of the efficacy of current antibiotics. In the 2019 Global Burden of Disease (GBD) study, AMR was the third-highest underlying cause of death behind ischaemic heart disease and stroke.[9] According to the study, between now and 2050, almost 38 million people could die from drug resistance. By 2050, the annual numbers of deaths attributable to and associated with AMR could rise to 1.9 million and 8.2 million, respectively. The number of deaths directly attributable to AMR bacterial infection is expected to increase by 70 per cent between 2021 and 2046.[10] AMR could reduce life expectancy globally by 1.8 years over the next decade without proper action.[11] The "Grand Pandemic" is here.[12]

Meanwhile, no new classes of antibiotic have been discovered since the 1980s. Discovering and developing new antibiotics is challenging. It can take 10-15 years and cost more than US$ 1 billion to bring a new antibiotic to market. Many major manufacturers have pulled out of antibiotic development, while some

[5] See WHO (2023).
[6] See Hutchings, Truman and Wilkinson (2019).
[7] See World Bank (2024).
[8] See Antimicrobial Resistance Collaborators (2022).
[9] See World Bank (2024).
[10] See GBD 2021 Antimicrobial Resistance Collaborators (2024).
[11] See Global Leaders Group on Antimicrobial Resistance (2024).
[12] Ibid.

have even gone bankrupt. In the 1980s, there were 18 multinational companies committed to antibiotic research; today, there are only a handful.[13] This is because a volume-based model that supplies a large quantity at a lower price does not preserve the efficacy of precious new antibiotics, while a value-based model that provides a small quantity at a higher price does not ensure equitable and secure access to drugs for patients when they need them. The market-based system does not function for manufacturers of new antibiotics.

Global health officials are concerned that the lack of new antibiotics will exacerbate the rise in AMR.[14] To tackle this market failure, organisations such as the Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator (CARB-X) and the Global Antibiotic Research & Development Partnership (GARDP) are offering "push" incentives to support innovation and development from the early stages by lowering developers' costs and risks with financial support. Meanwhile, the United Kingdom has adopted a new "pull" payment model to reward makers of new antibiotics that have successfully proven their drugs' scientific value, viability and market relevance by awarding them government procurement contracts. Similar efforts are ongoing in Sweden, Germany and the United States of America. These programmes aim to incentivise research and innovation in the antibiotic sector by providing a guaranteed financial return and de-linking price from volume.

While global efforts to bring new antibiotics to market are crucial, preventing infectious diseases in the first place and preserving the efficacy of existing antimicrobial medicines are urgent tasks. People die from a lack of timely access to antibiotics. Globally, the 5.7 million deaths per year from treatable bacterial infections exceed those from AMR infection.[15] The majority of treatable bacterial infectious deaths occur in LMICs, so interventions to ensure timely access to quality antibiotics backed by supporting microbiology laboratory infrastructure to ensure appropriate antibacterial choice are essential in these countries (see Section 12).

[13] See Wellcome (2023).
[14] See Janković (2024).
[15] See CDDEP (2019).

3. AMR and One Health

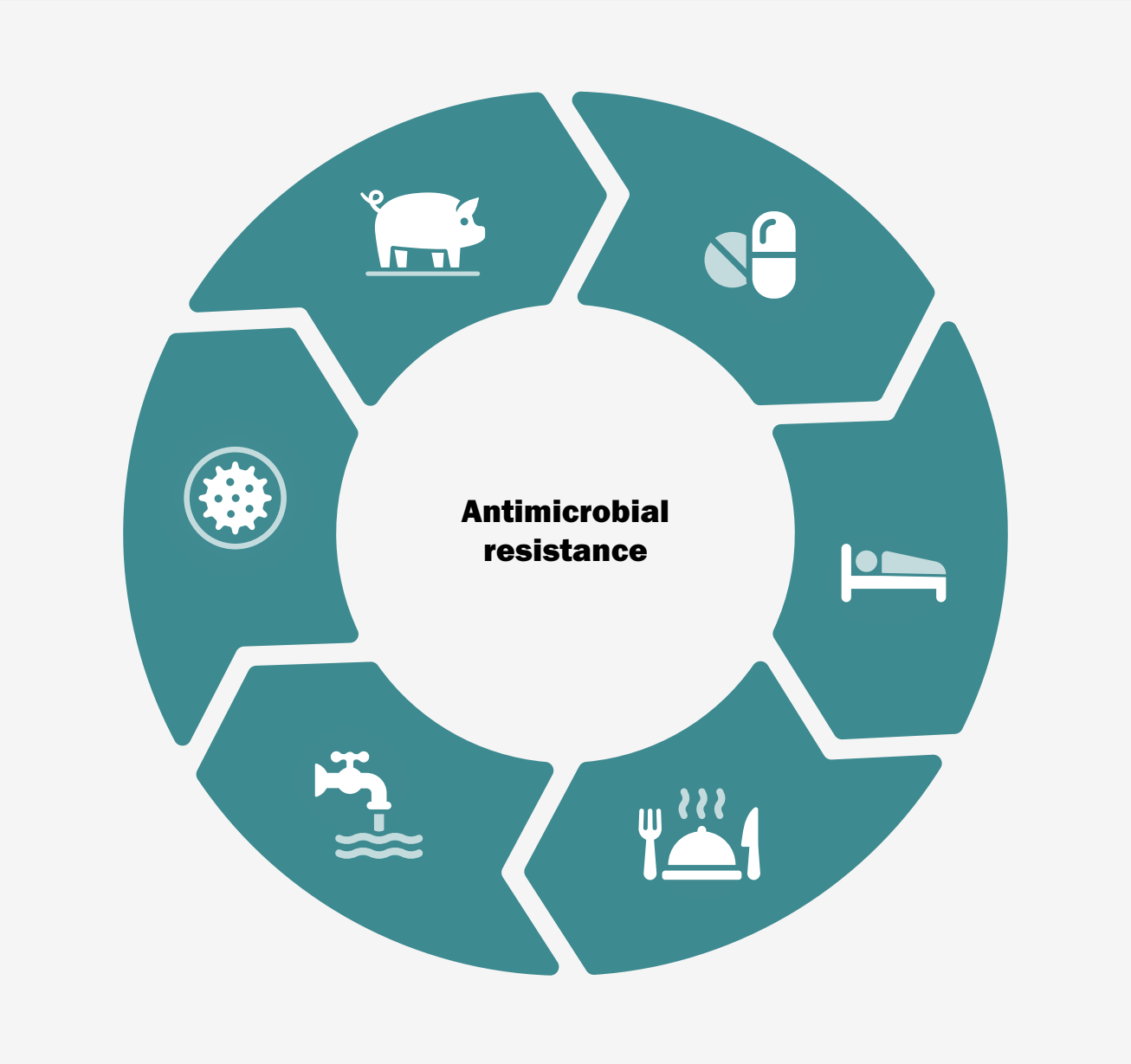
More than half of global antibiotic use is for animal protein production, largely as a growth-promotion agent, but also for the prophylaxis and metaphylaxis of infection, often as a less costly alternative in the absence of biosecurity and biosafety, animal welfare and nutrition management to safeguard animal health.[16] The use of antibiotics is expected to grow rapidly in LMICs in tandem with increasing income and demand for animal protein.[17] Intensive use of antibiotics in food animals increases the risk of AMR occurrence in the animals in question (see Section 4). Moreover, antibiotics used in humans and animals are reaching the environment through urine and excreta. Between 40 per cent and 90 per cent of a given antibiotic dose is excreted as metabolites that retain antimicrobial activity, eventually reaching the environment, contaminating soil, water and vegetation.[18] Wastewater treatment plants, hospitals and livestock farms can be sources of contamination in the form of active antibiotic ingredients, AMR bacteria and genes, inducing AMR (see Section 9 for more on pharmaceutical manufacturing waste standards and Section 10 for the European Union [EU] approach to wastewater treatment plant monitoring of AMR).[19]

In addition, on a worldwide scale, up to 39 countries have been found to use antibiotics to treat or prevent infections caused by plant pathogenic bacteria,[20] which are responsible for various plant diseases.[21] While data are limited, antibiotics are reportedly recommended far more frequently and for a much greater variety of crops than previously thought. Relative to human and animal use, the quantities of antibiotics used for crops globally are comparatively small, but this does create some unique avenues through which resistance can develop in human pathogens.[22] The agricultural use of antifungal compounds that have high human medicine value is another concern.[23]

The environment is considered a reservoir of AMR bacteria and a pathway for AMR genes to transfer horizontally to other bacteria. Other contaminants, such as biocides and heavy metals in the environment, can act as a stressor for AMR occurrence.[24] The use of antimicrobials, such as antibiotics, in humans, animals and plants and their contamination of the environment need to be understood in the context of a One Health integrated and multidisciplinary approach, which aims to sustainably balance and optimise the health of people, animals, plants and ecosystems (see footnote 2).

[16] See Ritchie (2017).
[17] See Mulchandani et al. (2023).
[18] See Polianciuc et al. (2020).
[19] See Han et al. (2023).
[20] See European Food Safety Authority (2024).
[21] See Gautam and Kumar (2020).
[22] See Taylor and Reeder (2020).
[23] See Fisher et al. (2022).
[24] See Samreen, Malak and Abulreesh (2021).

Figure 2. One Health



Source: Kensuke Matsueda, UN-HABITAT Afghanistan office.

4. The cost of AMR

In 2017, a World Bank report estimated that global annual gross domestic product (GDP) could fall by 1.1 per cent by 2050 relative to a base-case scenario with no AMR effects, while in a high-impact AMR scenario, the loss could be as much as 3.8 per cent. Under that high-impact scenario, an additional 24 million people would be forced into extreme poverty by 2030, mostly in low-income countries. This would make SDG 1, to eliminate poverty by 2030, harder to reach.[25] According to the most recent research funded by the United Kingdom (2024), conducted by the World Organisation for Animal Health (WOAH) and the World Bank, in a scenario of failing to contain drug resistance, there could be a staggering US$ 1.7 trillion annual reduction in global economic output by 2050, amounting to a 0.9 per cent decrease in GDP due to the economic impacts of AMR in humans.[26]

A 2024 United Nations report said countries were "severely off track" to meet the SDGs, with only 15 per cent of SDGs currently likely to be achieved.[27] Globally, the extreme poverty rate increased in 2020 for the first time in decades, setting back progress by three years. Since then, the recovery has been uneven, with low-income countries lagging. The prolonged impact of Covid-19, compounded by conflict, climate change and economic turmoil, continues to pose interrelated challenges when it comes to achieving the SDGs. AMR is an additional burden.[28]

The World Bank's 2017 report also estimated that global livestock production could decline by 2.6-7.5 per cent per year – and by 11 per cent in LMICs – by 2050 due to AMR.[29] The aforementioned 2024 research by the WOAH and the World Bank estimates that annual livestock production losses due to AMR will equal the consumption needs of 746 million people by 2050 and, under a more pessimistic assumption, as many as 2 billion people globally.[30]

According to a recent report by the Global Leaders Group (GLG) on AMR,[31] the larger AMR impact on LMIC livestock production is due to the heavier burden of animal disease and limited access to preventative measures such as vaccines, leading to an overdependency on increasingly ineffective antimicrobials to control animal diseases.[32] With more than 1.3 billion people relying on livestock for their livelihoods and over 20 million people depending on aquaculture,[33] there is an urgent need to prioritise actions and policies targeting AMR in animals, such as herd and health management (for example, biosecurity, biosafety, animal welfare, feed management and so on).

The same GLG report warns that: (i) AMR's human and economic impacts are already staggering and will grow exponentially, particularly in LMICs, without a much more robust global response; (ii) AMR could reduce life expectancy globally by 1.8 years over the next decade (as mentioned in Section 2); (iii) AMR is expected to lead to far greater healthcare expenditures, with total expenses to treat resistant bacterial infections alone reaching US$ 412 billion annually by 2035; and (iv) increased morbidity and mortality from these infections will lead to lower workforce participation and productivity losses of US$ 443 billion per year.

[25] See Jonas et al. (2017).
[26] See WOAH and World Bank (2024).
[27] See United Nations Statistics Division (2024).
[28] Ibid.
[29] See Jonas et al. (2017).
[30] See WOAH and World Bank (2024).
[31] See Global Leaders Group on Antimicrobial Resistance (n.d.).
[32] See Global Leaders Group on Antimicrobial Resistance (2024).
[33] See FAO (2022).

The cost of AMR is also sizeable in high-income countries, where more data are available. A 2023 Organisation for Economic Co-operation and Development (OECD) report shows that the cost of treating complications due to AMR infections is close to US$ 30 billion annually, adjusting for purchasing power parity, across 34 OECD and EU/European Economic Area (EEA) countries.[34] For comparison, across 17 countries where data are available, the total health expenditure incurred each year due to AMR is almost 20 per cent of all health expenditure for treating Covid-19 patients in 2020. This means that the cost of treating AMR patients for five years is roughly equivalent to that of treating all Covid-19 patients in 2020 alone.[35]

The OECD report also suggested that scaling up investments in One Health packages of actions against AMR – human health interventions in relation to antimicrobial stewardship (AMS), better environmental and hand hygiene in healthcare settings and better food safety practices and biosecurity on farms – in the EU/EEA and OECD countries could generate a significantly greater return than the cost of implementation. Every US$ 1 generates the equivalent of US$ 5 in economic benefits through reductions in health expenditure and increased productivity at work.[36]

The GLG report, meanwhile, states that if a package of AMR interventions it recommends were implemented globally, it would be likely to cost an average of US$ 46 billion per year and yield a return of US$ 7-13 for every US$ 1 spent by 2050. This makes a compelling global economic case for sustainable investment in AMR response.

[34] See OECD (2023).
[35] Ibid.
[36] Ibid.

5. Why does the EBRD engage on AMR?

The Bank supports the economies in which it operates in attaining the SDGs through investment projects, technical cooperation and policy dialogue. The Bank identifies AMR as an obstacle to national achievement of the SDGs, as well as an environmental and sustainability risk to its investments. Where appropriate, it also explores proactive opportunities to prevent AMR and its proliferation. The EBRD's transition impact, a key principle governing its operations, incorporates AMR risk management as an important part of its impact mandate under the "well governed" quality of a sustainable market economy in healthcare and livestock production (see Section 6 for more on the transition impact of AMR).

Furthermore, the Bank is investing in the healthcare services, hospital infrastructure, pharmaceutical, agribusiness and water sectors. Projects in these sectors come up against AMR risks and opportunities where effective entry points can be identified under a One Health approach. All of the EBRD's investee economies have developed national action plans (NAPs) on AMR. However, they face the common challenges of insufficient institutional capacity, funding and prioritisation. The Bank, therefore, has a unique opportunity to make a difference on AMR through a private sector-focused approach, complementing the approach of other international organisations, who mainly have a mandate to work with governments and grants.

Many of the economies in which the EBRD works are significantly affected by AMR. While data are scarce in low-income countries, with microbiology laboratory capacity limited or entirely lacking, sub-Saharan Africa, into which the Bank is expanding, is estimated to be one of the regions most severely affected by AMR (see Figure 3). The number of children under five dying from drug-resistant infections is on the decline globally, including in sub-Saharan Africa.[37] Children in sub-Saharan Africa, however, are still 58 times more likely to die from AMR than children in high-income countries.[38]

It is estimated that 133,000 deaths were directly attributable to bacterial AMR in the WHO European region in 2019, with a further 541,000 deaths associated with AMR. (This is one of the seven Global Burden of Disease regions and includes all of the EBRD's central and eastern European, Central Asian and Baltic economies, Georgia, Azerbaijan, Armenia, Türkiye, Cyprus and Greece.)[39] The high levels of resistance of several significant bacterial pathogens, together with the high mortality rates associated with infections due to these pathogens, demonstrate that AMR is a serious threat to public health in the WHO European region.[40] Here, a notable resistance gradient emerges, with a clear pattern from north to south and west to east. The northern and western regions predominantly show lower resistance rates, while the eastern and southern regions tend to show higher rates.[41] This indicates that the regions in which the EBRD operates have a higher burden of AMR.

[37] See GBD 2021 Antimicrobial Resistance Collaborators (2024).
[38] See McDonnell and Klemperer (2022).
[39] See European Antimicrobial Resistance Collaborators (2022).
[40] See McDonnell and Klemperer (2022).
[41] See ECDC and WHO European Region (2023).

Case study: the impact of conflict

Conflicts and wars in the regions where the EBRD operates deprive people of access to clean water, nutrition, hygiene, energy, housing and medical services, such as child vaccination and maternity care, among other things. Attacks on healthcare workers in conflict areas worsen conditions even further.[42] The provision of healthcare services, with access to essential medicines such as antibiotics, a good standard of infection prevention and control (IPC), and robust AMS, has become difficult. Serious war-related injuries and diseases exacerbate the situation. While reliable data on infections following war wounds in the current conflict in Ukraine are unavailable, the prevalence of war wounds and AMR have been studied over the past two decades (together with conflict-driven environmental contamination by heavy metals from expended munitions, which may co-select for both metal and antibiotic resistance).[43] Since March 2022, the European Centre for Disease Prevention and Control (ECDC) has advised that the treatment of traumatic wounds in Ukraine may be made more challenging by multidrug-resistant bacteria.[44]

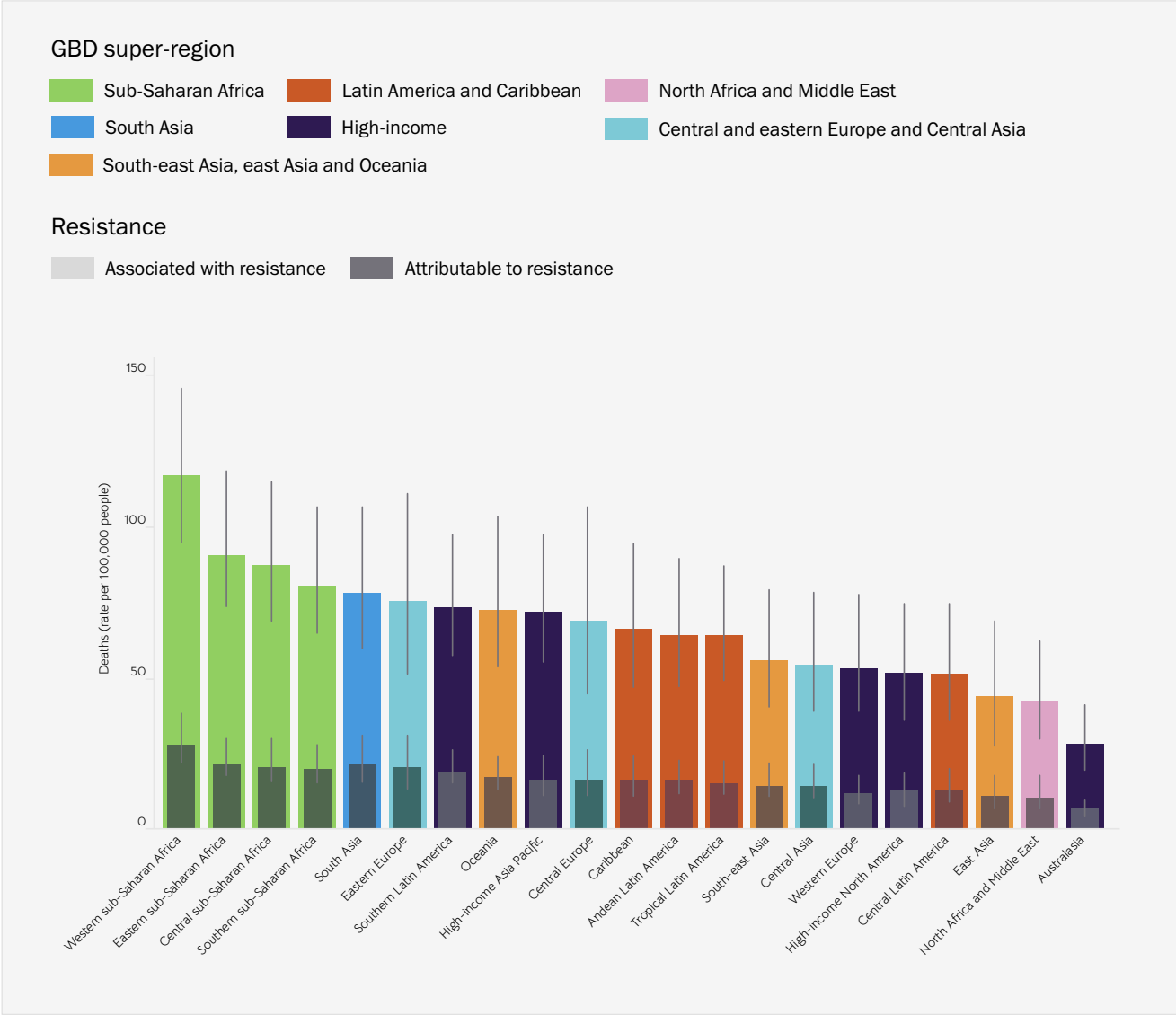
In June 2022, screening for multidrug-resistant, Gram-negative bacteria – the world's most significant public health problem due to their high resistance to antibiotics[45] – was carried out in 103 Ukrainian patients admitted to University Hospital Frankfurt, Germany. It found 34 multidrug-resistant, Gram-negative isolates in 17 (17 per cent) of the 103 patients.

Ukraine's devastated infrastructure and disrupted essential services, compounded by war injuries, are creating the conditions for increased incidence of AMR.[46] A recent molecular analysis of Gram-negative bacterial isolates from injured Ukrainian service members identified multiple resistance genes, including genes capable of conferring resistance to cefiderocol, a recently licensed antibiotic for use on carbapenem-resistant bacteria, which is not officially available in Ukraine.[47] War-related infections and AMR could have a drastic impact on the health of people inside and outside the country, creating a vast reservoir of multidrug-resistant, Gram-negative infections in Ukraine and Russia, with the potential for further spread.[48] A similarly devastating situation in Gaza is creating a high risk of AMR occurrence among the population and beyond.[49]

Experts recommend the following in Ukraine: strong IPC and AMS leadership, strict adherence to basic precautions and the development of standardised, context-specific guidelines along the entire patient care pathway; adequate diagnostics; and robust cooperation between emergency medical care providers, such as host-country workers, the United Nations, the WHO, allied military personnel and people from conflict areas on hospital admissions in other countries, with adequate explanation to patients.[50]

[42] See Safeguarding Health in Conflict (2024).
[43] See Fayad et al. (2023).
[44] See Petrosillo, Petersen and Antoniak (2023).
[45] See Olivera and Reygaert (2024).
[46] See Schultze et al. (2023).
[47] See Stepanskyi et al. (2024).
[48] See Loban et al. (2023).
[49] See Moussally et al. (2023).
[50] See Pallett et al. (2023).

Figure 3. Rates of death attributable to and associated with bacterial AMR by Global Burden of Disease region (2019)



Source: Antimicrobial Resistance Collaborators (2022).

6. The EBRD's approach

Following the political declaration of the first UNGA-HLM on AMR in 2016, the EBRD has engaged holistically on AMR and formally integrated AMR into its environmental and sustainability risk management. It has incorporated AMR risk management into its environmental and social due diligence and AMR actions into environmental and social action plans. It has adapted its transition impact on AMR and undertaken technical cooperation programmes with hospital, pharmaceutical and agribusiness clients. It has explored wastewater-based epidemiological surveillance, undertaken internal capacity building through information dissemination and workshops for EBRD staff, and embarked on collaborations and engagement with stakeholders.

The Bank is committed to promoting strong safeguards and high standards in its projects, as well as supporting the attainment of the SDGs in the regions where it operates. The EBRD recognises the public health, economic and sustainability implications of AMR in its regions. It learns lessons and draws on experience from its climate change and biodiversity strategies. The Bank consistently addresses AMR from the policy level to the project level with a view to creating an impact: identifying and managing AMR risks and opportunities for improvement through sector-specific entry points in the healthcare, pharmaceutical, agribusiness and water sectors. It identifies AMR risks and opportunities during environmental and social due diligence and proposes corresponding actions to be agreed by clients. Such actions are incorporated into environmental and social action plans as part of legal agreements and monitored for progress.

Transition impact on AMR

Transition impact is one of the key principles governing the Bank's operations. The measurement of transition impact is the Bank's assessment mechanism, with its projects incorporating "competitive", "well governed", "green", "inclusive", "resilient" and "integrated" elements to promote open-market economies and entrepreneurship in the regions where it operates. The EBRD recently adopted transition impact AMR scoring for projects in the healthcare and livestock sectors. Transition impact scoring of AMR can be conducted in the "well governed" category if the project aims to go beyond national standards or practices and move towards good international practice (GIP) on AMR. This encourages the project to factor GIP mitigation measures into project-specific environmental and social action plans.

The EBRD's Environmental and Social Policy

The Bank's Environmental and Social Policy recognises the sustainability challenges imposed by AMR and provides a solid base from which clients can improve the sustainability of their business operations in the economies where the Bank operates. The G20 ministerial declaration of 2019[51] praised the EBRD's leadership as the first MDB to incorporate specific references to AMR into its Environmental and Social Policy. The new Environmental and Social Policy for 2024-29[52] addresses the environmental dimension of AMR in Environmental and Social Requirement (ESR) 3, the prevention and mitigation of AMR in human health in ESR 4, and the accountable use of antibiotics in livestock production in ESR 6:

[51] See G20 (2019).
[52] See EBRD (2024a).

ESR 3: Resource efficiency and pollution prevention and control

Safe use and management of hazardous substances and materials

To prevent and minimise environmental impacts and contamination with microorganisms and chemicals with antimicrobial properties, the client will apply GIP wastewater treatment and livestock faecal waste treatment.

ESR 4: Health, safety and security

Health and safety risks in community services

Where the project involves the provision of health services and/or the production, distribution and use of antimicrobials, the client will incorporate antimicrobial stewardship to minimise antimicrobial resistance.

ESR 6: Biodiversity conservation and sustainable management of living natural resources

Sustainable management of living natural resources

To avoid and minimise antimicrobial resistance (AMR), the client will only use antimicrobials on food-producing animals, in accordance with EU substantive environmental standards.

7. EBRD achievements

EBRD institutional capacity building

AMR can be perceived as complex and is unfamiliar to some. Addressing AMR requires a cross-sectoral and cross-disciplinary One Health approach. Questions about AMR raised by colleagues are valuable entry points from which to start conversations on AMR, and this has been one of the approaches adopted by the Bank to raise awareness. As of September 2024, 23 AMR articles had been posted on the Bank's intranet, while 20 internal workshops had taken place. For the workshops, various outside speakers were invited from academia, research organisations, industry, philanthropic organisations, civil society, the WHO and the World Bank. World AMR Awareness Week is marked every November by a staff campaign to increase AMR awareness in the EBRD community. The Bank's Communications Department also used social media to indicate the Bank's support for WAAW to external audiences. The Japanese government supported medical consultants who provided scientific assurances for the EBRD's AMR work for three years.

Technical cooperation for clients and beyond

The Bank has carried out AMR risk management capacity-building technical cooperation programmes for healthcare service, PPP hospital, national Covid-19 response, pharmaceutical and agribusiness projects in Egypt, Georgia, Kazakhstan, Türkiye and Ukraine and across the EBRD regions. The programmes support institutional capacity building, identified as a priority in the NAPs on AMR in the economies where the Bank operates. Lifelong professional training schemes in the medical field are lacking in many countries where AMS is in its infancy. Participating medical professionals welcomed the technical cooperation training.

For healthcare services and hospital clients, the AMR technical cooperation programmes focused on (i) IPC, (ii) microbiology laboratory capacity building, (iii) AMS and (iv) surveillance. Experts from the British Society for Antimicrobial Chemotherapy (BSAC) assessed client capacity and existing risk management systems at facility level, provided advisory services for actions and held training events. AMR-related guidance from the WHO, the US Centers for Disease Control and Prevention (CDC), the BSAC, the ECDC, ministries of health and NAPs has been applied to the Bank's technical cooperation work. Technical cooperation programmes aim to bring sectoral GIP to clients through step-by-step actions in the specific country context.

In Türkiye, the Bank played an instrumental role in organising Turkish experts to conduct a live YouTube AMR workshop (June 2022). More than 280 Turkish medical professionals joined the live session, while more than 2,500 have since watched the recording.[53] Where appropriate, wider healthcare professional communities and regulators have been invited to such training sessions.

The BSAC has developed an online AMR tutorial scheme and an AMS accreditation scheme.[54] The latter was highlighted by the Egyptian delegate at the UNGA-HLM on 26 September 2024 as part of the country's response to AMR and has been part of EBRD projects in Georgia. The BSAC-Pfizer-EBRD Tripartite Alliance for AMR was announced in 2021 to raise awareness of AMR and used the BSAC's open-access e-learning resources for the Bank's healthcare clients following a memorandum of understanding with the BSAC in 2020.

[53] See Turkish Ministry of Health (2022).
[54] See BSAC (2021).

In the pharmaceutical sector, an AMR capacity-building technical cooperation programme in Kazakhstan in 2024 was the first such programme in Central Asia focused on sectoral AMS, based on the Common Antibiotic Manufacturing Framework of the AMR Industry Alliance (see Section 9)[55] and good manufacturing practice (GMP). Pharmaceutical companies in the economies where the EBRD operates are helping to secure timely patient access to critical medicines, such as antibiotics, while their role in promoting responsible antibiotic use is valued in the context of NAPs. The BSAC's pharmaceutical industrial experts have provided insights into the business and AMR nexus. Kazakhstan remains in the early stages of AMS implementation. However, Bank client and leading Kazakh pharmaceutical company VIVA Pharm's focus on product quality, the consistent implementation of standard operating procedures and an initiative on the rational use of antiseptics to prevent environmental bacterial resistance in plants are a basis for forward-looking actions to address AMR. The technical cooperation in Kazakhstan demonstrated the firm's leadership commitment to AMS and the Bank's additionality in supporting it. It also underscored the importance that AMS in the sector reflect interactions between drug manufacturers, governments, medical professionals, pharmacy retailers, suppliers and patients.

In the agribusiness sector, in 2020, under a long-term collaboration agreement between the Food and Agriculture Organization of the United Nations (FAO) and the EBRD,[56] the Bank embarked on capacity-building technical cooperation on animal health and food safety in Ukraine. The initiative aimed to improve the sustainability of animal production by reducing risks associated with transboundary animal diseases and AMR. The technical cooperation programme supported responsible antibiotic use in chicken meat production through systematic actions across the entire supply chain: the adoption of voluntary standards on antibiotic use in poultry production and certified and labelled chicken meat on the shelves of Ukrainian supermarkets, with the cooperation of industrial associations and regulators. This was the first such labelling scheme in the region to create new market incentives for the responsible use of antibiotics through the supply chain by raising awareness among producers and consumers.

[55] See AMR Industry Alliance (n.d.).
[56] See FAO Investment Centre (2024).

In 2021, this technical cooperation effort with the FAO was extended to pig production in Ukraine. On the AMR side, it included a veterinary educational curriculum review against WOAH (formally OIE) recommendations, and EU guideline-aligned labelling and monitoring for voluntary certification schemes for agricultural products and foodstuffs.[57] The FAO's technical expertise and the EBRD's investment capacity are mutually enhancing.[58]

A team of experts from the Institute of Infection, Veterinary and Ecological Sciences at the University of Liverpool was involved in a technical cooperation programme on cross-regional AMR risk management in the livestock sector from 2021 to 2024. The programme was developed to assist the economies in which the EBRD operates in preparing for the EU's revised regulations on antibiotic use in food-producing animals, enforced in January 2022,[59, 60] as well as the bloc's Green Deal (farm-to-fork) objective to reduce the sale of antimicrobials for farmed animals and aquaculture by 50 per cent by 2030.[61] The team focused on practical guidance for animal food production in EBRD investee economies by integrating biosafety and biosecurity, animal welfare and AMR components. The guidance aims for the most effective use of antibiotics in livestock by avoiding unnecessary, inadequate or abusive use of antibiotics, based on veterinary diagnostics, as well as to preserve WHO medically important antimicrobials for human medicine.[62] Two online training sessions have been provided for Bank staff.

In the wastewater sector, in 2023, the Dutch KWR Water Research Institute conducted a pilot study on wastewater epidemiological surveillance for tracking Covid-19 and other concerns such as AMR. The study found that this surveillance method was a cost-effective early-warning and monitoring tool for Covid-19 occurrence and spread, complementing diagnostic tests. Effective sharing of data with the public and stakeholders can help shape public health policy interventions. The Royal Society of Chemistry's May 2024 position statement on AMR called on governments to "further capitalise on wastewater surveillance technology established during the Covid-19 pandemic to expand our capability to detect biological concerns".[63]

[57] See European Commission (2010).
[58] See EBRD (2021).
[59] See European Union (2018).
[60] See European Union (2019).
[61] See European Commission (n.d.a).
[62] See WHO (2017).
[63] See Royal Society of Chemistry (2024).

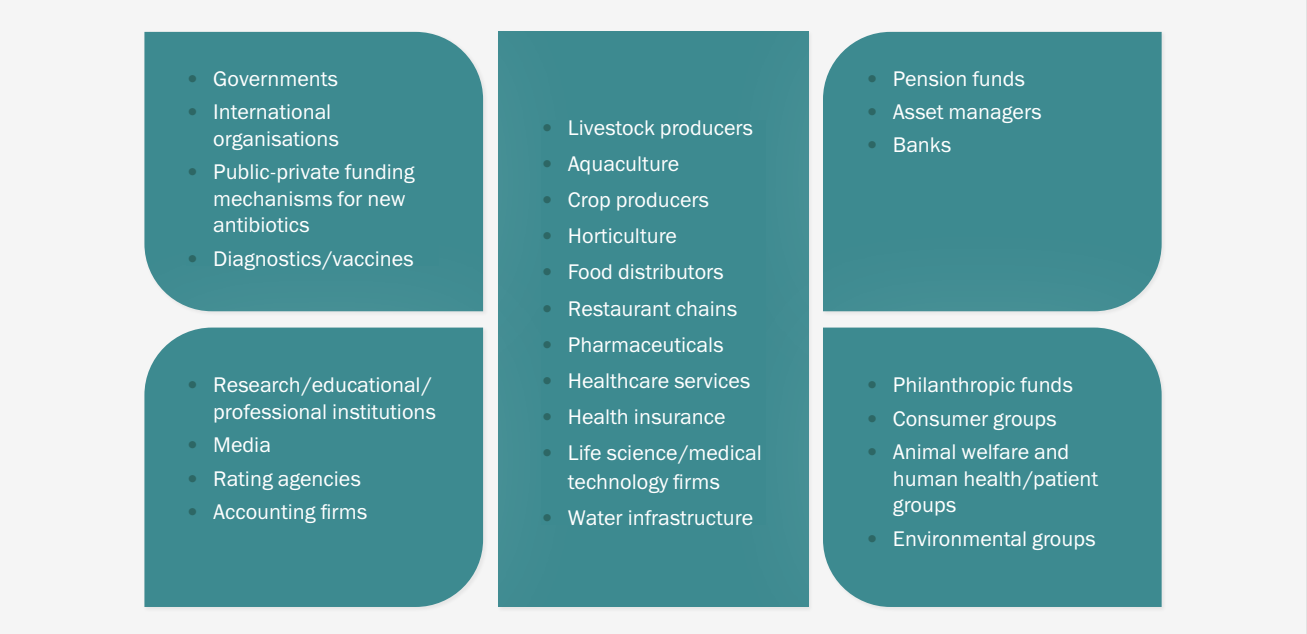
8. Stakeholder engagement

The EBRD has been collaborating with key AMR stakeholders such as clients, industry, investors, governments, civil society, and professional and academic bodies (see Figure 4). Under the One Health approach, such collaboration is required to raise awareness, tap into expertise and resources, and bring about the most effective outcomes.

The Bank has hosted five international AMR symposiums, with keynote speakers including Professor Dame Sally Davies (the United Kingdom's Special Envoy on AMR). At the most recent symposium on Public-Private Cooperation on Global Resilience Against AMR (16 April 2024), Professor Davies warned of the seismic impact of AMR on human, animal and environmental health, food security and economic sustainability, suggesting a roadmap for global governance to address AMR. A wide range of AMR experts made up the lineup of speakers from industry, the investment community, academia, civil society, Bank clients and MDBs. The Bank also informed the symposium about the updated AMR sections of the 2024 ESP, which would replace the 2019 ESP, in order to seek the experts' feedback. The symposium, highlighting the urgency of tackling AMR, voiced solidarity in taking action and continuing the fight against AMR.

The Bank highlighted its AMR engagement at conferences hosted by the WHO, the OECD, the Economist, the Wellcome Trust, the Health and Global Policy Institute, the Asia-Europe Foundation and Tsinghua University. For accountability and transparency, the Bank has reported on its AMR engagement in the EBRD's *Sustainability Report* since 2020.[64] Together with the World Bank, the EBRD has organised four MDB AMR network meetings with the Asian Development Bank, the Asian Infrastructure Investment Bank, the International Finance Corporation and Germany's KfW Development Bank to share mutual experience of raising awareness in the MDB community and to find common approaches to addressing AMR.

Figure 4. AMR stakeholders



[64] See EBRD (2024b).

9. Private-sector initiatives

Important private-sector initiatives have emerged to tackle global AMR. In 2020, Investor Action on AMR (IAAMR) was launched as a collaboration between the Access to Medicine Foundation, the Farm Animal Investment Risk and Return (FAIRR) Initiative and the UK Department of Health and Social Care to galvanise investor efforts to tackle drug-resistant infections. Supported by 22 investors and representing more than US$ 14 trillion in combined assets, IAAMR aims to cut the excess use of antibiotics in the food supply chain and in healthcare. To safeguard society, economies and the long-term value of investment portfolios, IAAMR encourages investors to formally assess and integrate AMR risks, opportunities and impacts using the holistic and multisectoral One Health approach. It explicitly discusses the adverse impact AMR will have on global financial markets, economic stability and long-term value generation, as well as the need for global cooperation, sustained funding and innovative solutions.[65]

Ahead of the UNGA-HLM on AMR in September 2024, IAAMR issued a public investor statement, endorsed by 80 investors, calling on global leaders to take decisive and coordinated action to curb AMR to safeguard global health, economic stability and financial markets.[66] IAAMR, together with the MSCI Sustainability Institute and FAIRR, published *Health and Wealth: The Investors' Guide to Antimicrobial Resistance (AMR), A Growing Global Health Crisis* in August 2024.[67] This guide provides an introduction to the investment risks and opportunities associated with AMR. It focuses on the livestock, food, pharmaceutical, biotechnology, life science and managed healthcare sectors. It sets out a view on AMR risk and the necessary robust response by the environmental, social and governance (ESG) community.

The pharmaceutical industry has launched its own AMR initiatives. The AMR Industry Alliance (AMRIA) is one of the largest private-sector coalitions aimed at providing sustainable solutions to AMR, with more than 100 biotech, diagnostic, generic and research-based pharmaceutical companies and associations joining forces. It spans the commercial manufacturing of antibiotic pharmaceutical active ingredients and drug products, representing around 30 per cent of human antibiotic production.

In 2018, the AMRIA launched the Common Antibiotic Manufacturing Framework, which proposes a risk-based approach to assessing and controlling antibiotic manufacturing waste streams. In 2022, to formalise the framework, the AMRIA published its Antibiotic Manufacturing Standard, comprising numerical emissions standards at the point of production. These aim to reduce the risk of antibiotic resistance and aquatic ecotoxicity developing in the environment as a result of the manufacture of specifically human antibiotics. In 2023, the British Standards Institution (BSI) developed a certification scheme to verify that antibiotics are manufactured in conformance with AMRIA standards. This provides guidance to manufacturers in the global antibiotic supply chain to ensure that their antibiotics are made responsibly to minimise the risk of AMR in the environment.[68] This is a voluntary scheme for the sector, though the certification is required to meet various national healthcare-system antibiotic-tendering environmental compliance requirements and will ultimately prepare firms for the national regulations that may come into force several years down the road.

[65] See Investor Action on AMR (n.d.).
[66] See Investor Action on AMR (2024).
[67] See FAIRR (2024).
[68] See AMR Industry Alliance (2022).

The US Food and Drug Administration, the European Medicines Agency (EMA) and national legislation currently have no formal regulations governing antibiotic concentration limits in pharmaceutical wastewater, for example.[69] India attempted to draft such regulations, but withdrew them, while Sweden is currently contemplating their introduction. In September 2024, the WHO published its first ever guidance on antibiotic pollution from manufacturing. The new guidance on wastewater and solid waste management for antibiotic manufacturing provides human health-based targets to reduce the risk of the emergence and spread of AMR and to address the risks to aquatic life caused by all antibiotics intended for human, animal or plant use. It covers all steps from the manufacturing of active pharmaceutical ingredients and formulations to finished products, including primary packaging.[70] WHO member countries may develop national standards based on the guidance in the coming years.

The UK NAP on AMR (2024-29) refers to the environmental impact of antibiotic manufacturing and the need for standards such as the AMRIA Antibiotic Manufacturing Standard and the BSI Minimised Risk of AMR certification.[71] The UK National Health Service (NHS) announced in August 2024 that pharmaceutical companies applying for a contract through its antibiotic subscription model would have to prove they were meeting responsible antibiotic manufacturing standards through BSI Minimised Risk of AMR certification against the AMRIA Antibiotic Manufacturing Standard.[72]

[69] See Wellcome and Boston Consulting Group (2022).
[70] See WHO (2024).
[71] See Government of the United Kingdom (2024).
[72] See Dall (2024).

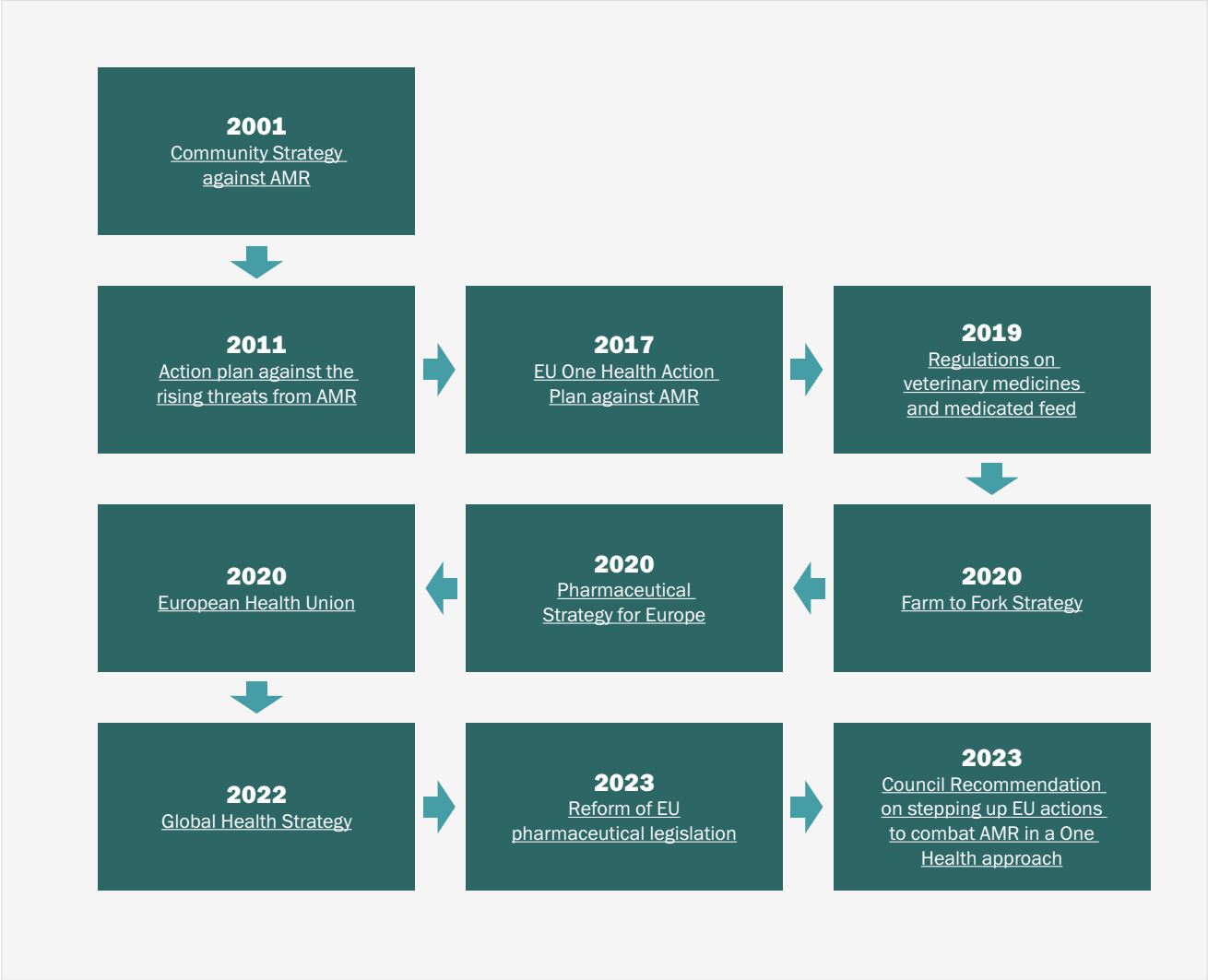
10. EU framework on AMR

Back in 2001, the EU identified the importance of tackling AMR with the adoption of the 2001 Community Strategy against AMR. The bloc's AMR policy was subsequently reinforced with the 2011 European Commission Action plan against the rising threats from AMR. In 2017, the Commission adopted the EU One Health Action Plan against AMR, which aims to make the EU a best-practice region, boost research, development and innovation, and shape the global agenda. Though varying from region to region, overall consumption of antibiotics in humans in the EU/EEA decreased by 23 per cent between 2011 and 2020. Total antimicrobial consumption by food-producing animals decreased by 44 per cent between 2014 and 2021.[73]

In 2023, the Council of the European Union adopted a recommendation on stepping up EU actions to curb AMR in a One Heath approach.[74] This complements the 2017 EU One Health Action Plan against AMR. The recommendation aims to: (i) strengthen One Health NAPs against AMR; (ii) reinforce surveillance and monitoring of AMR and antimicrobial consumption; (iii) strengthen IPC; (iv) strengthen AMS and the prudent use of antimicrobials; (v) set recommended targets for AMR and antimicrobial consumption in human health (for example, a targeted 20 per cent reduction in total antibiotic consumption by 2030); (vi) improve awareness, education and training; (vii) foster research and development (R&D) and incentives for innovation, as well as access to antimicrobials and other AMR medical countermeasures; (viii) increase cooperation; and (ix) enhance global action.[75] The European Commission and its agencies – the EMA, the European Food Safety Authority (EFSA) and the ECDC – cooperate closely on the One Health concept. The EU4Health and Horizon Europe programmes provide funding for actions against AMR.[76]

[73] See ECDC (2022).
[74] See European Commission (2023).
[75] See European Union (2021).
[76] See European Commission (n.d.b).

Figure 5. Chronology of EU AMR policy



Source: European Commission presentation at an EBRD AMR conference, 16 April 2024.

In terms of legislation on the use of antibiotics in food-producing animals, EU Regulation 2019/61 on Veterinary Medicines and EU Regulation 2019/4 on Medicated Feed have been in force since January 2022, aimed at stringently restricting the prophylactic and metaphylactic use of antibiotics to exceptional circumstances. These are the most important regulations in the area since the 2006 ban on the use of antibiotics as growth promoters.

Where the environmental monitoring of AMR is concerned, the European Commission has been working on a water framework directive, an environmental quality standards directive and a groundwater directive (including antimicrobial properties monitoring, for example). The EEA-European Topic Centre (Biodiversity and Ecosystems) and the European Environment Information and Observation Network (Eionet, a network of 38 European countries) have been running a project since 2023 to monitor AMR in surface water (which will end in 2025). Investigations are under way in relation to the Urban Wastewater Treatment Directive (UWWTD) to upgrade selected urban wastewater treatment plants (UWWTPs) to more advanced treatment technologies. There is also a proposal to revise the UWWTD's frequency and methodology for monitoring AMR at the inlets and outlets of UWWTPs to at least twice a year to inform further actions. The integration of AMR into the Sewage Sludge Directive and the Industrial Emissions Directive is also being considered. The EU has also adopted a proposal for a directive on soil monitoring and resilience that includes AMR.[77]

In 2023, the European Commission adopted a proposal for a new directive and regulation to revise and replace the bloc's current general pharmaceutical legislation. To encourage the development of innovative antimicrobials, the Commission has proposed a "transferable data exclusivity voucher", which will give developers of new antimicrobials an extra year of regulatory data protection. This aims to address difficulties in bringing much-needed new antibiotics to patients across the EU. The system will make it more attractive for businesses to develop innovative antimicrobials without direct financial contributions from EU member states. The vouchers will be granted and used under strict conditions.[78]

[77] See European Commission (2024).
[78] See Blaney et al. (2023).

11. Global governance

The political declaration on AMR[79] by the second UNGA-HLM on 26 September 2024[80] and the Jeddah Commitments to Accelerate Actions on AMR (16 November 2024)[81] by the fourth global High-Level Ministerial Conference (HLMC) on AMR galvanised global political commitment to address AMR. The WHO has long recognised the need for a concerted global effort to contain AMR; to this end, it convened scientific working groups back in 1994 to address the issue.[82] The WHO published the first global strategy on AMR in 2001.[83] Global uptake was slow and, 15 years later, it issued the Global Action Plan (GAP) on AMR together with the FAO and the WOAH.[84]

The GAP promotes five strategic objectives to: (i) improve awareness and understanding of AMR through effective communication, education and training; (ii) strengthen the knowledge and evidence base through surveillance and research; (iii) reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures; (iv) optimise the use of antimicrobial medicines in human and animal health; and (v) 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. To enforce the GAP, the 194 member states of the WHO committed to integrating the above five GAP objectives into their NAPs on AMR.[85]

The political declaration of the 2016 UNGA-HLM on AMR represented a landmark in the world's commitment to tackling AMR, calling for greater urgency and action in response to the challenge.

In 2019, based on the recommendations of the ad hoc Interagency Coordination Group (IACG) on AMR, the Tripartite of the FAO, the WHO and the WOAH formed the Joint Secretariat on AMR. In 2022, the United Nations Environment Programme joined the group and the Secretariat was renamed the Quadripartite Joint Secretariat (QJS) on AMR.

The QJS on AMR facilitates interagency coordination among the Quadripartite. The Quadripartite Strategic Framework on AMR, coordinated by the QJS, supports efforts to scale up national responses to AMR, as well as to mobilise resources in the multilateral system, including United Nations member nations, the G7 and the G20. The QJS supports the operations of global governance structures, including the GLG on AMR and the AMR Multi-Stakeholder Partnership Platform, as well as the United Nations Multi-Partner Trust Fund.

The GLG on AMR was established in 2020 by the Quadripartite organisations to accelerate political action on AMR. The GLG is composed of heads of state, serving or former ministers and/or senior government officials acting in their individual capacities. The mission of the GLG is to collaborate globally with governments, agencies, civil society and the private sector through a One Health approach, advising on and advocating for prioritised political actions for the mitigation of drug-resistant infections through responsible and sustainable access to and use of antimicrobials.[86]

[79] See UNGA-HLM (2024a).
[80] See UNGA-HLM (2024b).
[81] See United Nations (2024).
[82] See Prestinaci, Pezzotti and Pantosti (2015).
[83] See WHO (2001).
[84] See ReAct (n.d.).
[85] See WHO (2016).
[86] See Dogan (2024).

The presidencies and members of the G7 and G20 also advocate for an end to AMR. The G7 has explicitly mentioned AMR in outcome documents from the presidencies of the United Kingdom (2021), Germany (2022), Japan (2023) and Italy (2024), while AMR has featured in G20 Leaders' Declarations in Saudi Arabia (2020), Italy (2021), Indonesia (2022), India (2023) and Brazil (2024).[87, 88, 89] The third global HLMC on AMR was held in Muscat, Oman, on 24-25 November 2022 (the first having been in 2014). The Muscat Manifesto,[90] endorsed by about 50 countries since 2022, includes, for the first time, targets on antimicrobials in agrifood systems, animal health and human health. The UNGA-HLM on AMR of 26 September 2024 was the second opportunity to discuss AMR since 2016, followed by the fourth HLMC on AMR in Jeddah, Saudi Arabia. Global high-level political commitment is a prerequisite for effective local, national and global-level action to tackle AMR, particularly with regard to funding, policy development and multi-sectoral collaboration. In a political declaration, United Nations members have committed to new targets and practical steps to address this global threat to humans, animals, plants and the environment.

Future ministerial conferences and parallel processes, such as G7 and G20 discussions, will be well placed to capitalise on the focus the UNGA-HLM provides. Targets set by the UNGA-HLM on AMR, as well as the coordinating structure of the QJS and the anticipated Independent Panel for Evidence on Action Against AMR (to be established in 2025) espoused by the Jeddah Commitments, are a solid structural basis for furthering global efforts to tackle AMR. The fifth HLMC on AMR will be held in Nigeria in 2026 and the next UNGA-HLM on AMR will be held in 2030. Together, these fora should provide an opportunity to lay the foundations for stronger global AMR governance and consolidate political support accordingly. Funding implementation, particularly in low-income countries, requires continuous effort.

[87] See Wellcome (2024).
[88] See Global AMR R&D Hub (2024).
[89] See G20 Brazil (2024).
[90] See Third Global High-Level Ministerial Conference on Antimicrobial Resistance (2022).

12. Next steps

A concerted effort is required to minimise AMR risks, address the misuse and overuse of antibiotics, and ensure access to quality antibiotics in LMICs. There are, however, science-based and proven interventions to prevent and control AMR. These have been reflected in the Bank's current AMR capacity-building exercises: (i) IPC; (ii) AMS, laboratory and surveillance capacity building in healthcare settings; (iii) an e-learning and voluntary accreditation scheme on AMS; (iv) AMS in the pharmaceutical value chain and adherence to GIP; (v) regulation of over-the-counter sales of antibiotics; (vi) rational use of antimicrobials and the improvement of biosafety and biosecurity in food animals; (vii) a new labelling scheme to create a new market for rational antibiotic use in food animals; and (viii) awareness raising. The Bank's investments in the water sector have contributed to better access to clean water, sanitation and hygiene (WASH) services. The Bank also supports local businesses that tackle AMR, as seen in the example of phage production with GMP certification in Georgia (see case study in Annex 1).

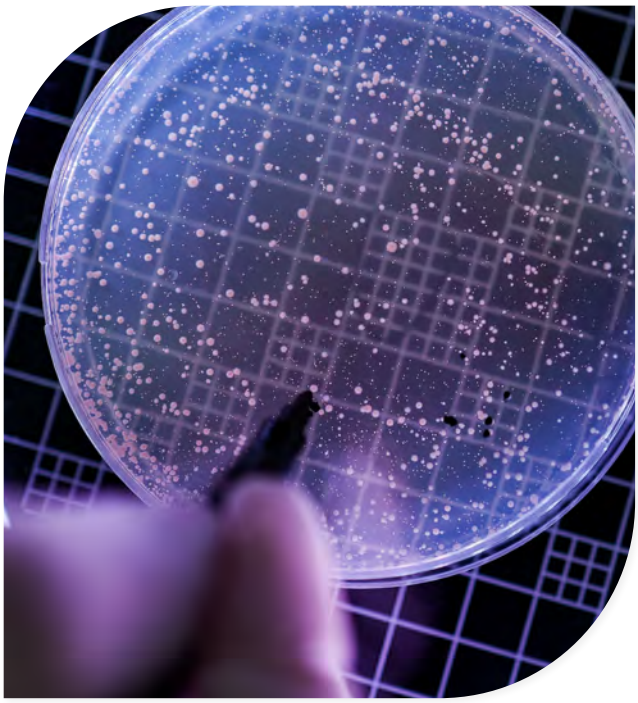
The Lancet AMR series suggests that existing interventions can have a significant impact on AMR in LMICs.[91] It indicates that reducing global AMR-associated deaths by 10 per cent by 2030 (the target set by the 2024 UNGA-HLM political declaration on AMR) is achievable with existing interventions. It estimates, for example, that aligning IPC standards in LMIC healthcare settings with those of high-income countries could prevent up to 337,000 AMR-associated deaths annually. Securing universal access to WASH services could prevent up to 247,800 AMR-associated deaths annually. Achieving universal coverage for high-priority paediatric vaccines – such as vaccines against rotavirus, pneumococci and respiratory syncytial virus (RSV) – could prevent up to 181,500 AMR-associated deaths a year in LMICs, as vaccine-based prevention of infections obviates the need to use antibiotics to treat viral infections. Improved access to existing and new antibiotics, vaccines and diagnostics is also needed. Innovation should focus on LMICs, where the burden of AMR is greatest.[92]

The local production of critical medicines (such as antibiotics) and medical devices in LMICs is underscored as a response to the supply-chain disruptions seen during the pandemic, as well as to ensure resilient health systems. The EBRD may consider supporting such initiatives from an investment perspective. WHO member states in Africa import between 70 per cent and 100 per cent of finished pharmaceutical products (FPPs), 99 per cent of vaccines and between 90 per cent and 100 per cent of medical devices and active pharmaceutical ingredients, and have little or no domestic capacity to manufacture pharmaceutical-quality excipients, vaccines, medical devices or other health technologies. Furthermore, counterfeit and substandard antimicrobial drugs are a prevailing problem in the region.[93]

African leaders have committed to boosting local production, strengthening regulatory systems and implementing pooled procurement mechanisms under the 2024 Framework for Medicines, Vaccines and Other Health Technologies in the WHO African Region (2025-35).[94] Strengthening local production will require investment and PPPs, in which the Bank could play a role. Furthermore, only 52 per cent of healthcare facilities in sub-Saharan Africa had a basic water service in 2021.[95] The Bank may examine its role in WASH in new investee economies in the region.

[91] See The Lancet (2024).
[92] Ibid.
[93] See Tegegne et al. (2024).
[94] See WHO African Region (2024).
[95] See Ren et al. (2022).

The Bank will continue its AMR engagement based on the global agreement formed by the UNGA-HLM on AMR, the fourth HLMC on AMR (November 2024) and the G7 and G20 AMR work streams. The Bank will embark on this journey alongside stakeholders by using its investment, technical cooperation and policy dialogue in accordance with its sustainability mandate, the Environmental and Social Policy, and the One Health approach. The Bank's continuous work on AMR with stakeholders in the economies where it operates will increase awareness of how acute the AMR challenge is and help to scale up their AMR engagement. Furthermore, MDBs such as the EBRD could explore the links between climate change, biodiversity, pollution, waste and AMR, rather than working in silos, as these issues are interactive and intertwined and critical to national attainment of the SDGs (see Annex 2).



EBRD engagement in global efforts
to curb antimicrobial resistance (AMR)

Annex 1

Case study: Georgian engagement on AMR and phage

In 2023, the Bank's long-term client Vian Caraps Medline (formerly Georgia Healthcare Group) received an EBRD Gold Award for environmental and social best practice for its engagement on AMR. Vian is the largest healthcare services provider in Georgia, operating hospitals, clinics, pharmacies, medical insurance and laboratory services. It accounts for 20 per cent of the healthcare services sector in Georgia by number of beds and has over 15,000 full-time employees. Because of its leading position in the country's health sector, its AMR engagement is critical.

Vian is the Bank's first client to address AMR, participating in a pilot programme facilitated by the EBRD and the BSAC. Improvements to practices for the prevention and mitigation of AMR will support the objectives of Georgia's NAP on AMR.

In a further show of the EBRD's engagement in tackling AMR, the Bank participated in a US$ 6.4 million loan to Georgia's BioChimPharm under the flagship EU4Busness-EBRD Credit Line.[96] The package supported the modernisation of the company's bacteriophage manufacturing facility, enabling it to attain GMP accreditation.

Bacteriophages,[97] also known as phages, are viruses that specifically target bacteria. Phage therapy[98] involves using phages to treat bacterial infections. In contrast to many antibiotics, each phage targets bacterial strains or species more narrowly, making phage therapy an attractive alternative for managing infections. Modernising BioChimPharm's manufacturing plant in line with GMP will enable it to scale up production and export phage products.

Faced with ever-growing AMR, phage therapy is of increasing global interest to researchers and doctors, with Georgia in a position to contribute to further clinical trials and research.[99]

[96] See EU4Business-EBRD Credit Line (n.d.).
[97] See Kasman and Porter (2022).
[98] See Gordillo Altamirano and Barr (2019).
[99] See American Society for Microbiology (2022).

EBRD engagement in global efforts
to curb antimicrobial resistance (AMR)

Annex 2

The AMR-climate change-biodiversity loss nexus

The WHO considers AMR to be a key global health issue.[100] Climate change and biodiversity loss are existential threats to planetary and human health. The following is a summary prepared by William Gaze, Abigail Herron and Nobuko Ichikawa, describing how these three global anthropogenic crises combine to create catastrophic risks for humans.[101]

Climate change, biodiversity loss and AMR are vast and complex subjects. Holistic analysis of the interface between them, which goes beyond current work on each subject, is needed to understand their cumulative impacts and synergistic interactions, and to devise mutually beneficial mitigation and adaptation measures, guided by further scientific findings, to inform global policy dialogue.

AMR is impacted by and intertwined with climate change through complex and multidirectional relationships and feedback loops within the biosphere.[102] Biodiversity is adversely affected by anthropogenic impacts and climate change.[103] The links between AMR and biodiversity loss may manifest in soil microbial diversity, which is an essential shield against the spread of AMR,[104] as well as a main source of pharmaceutical discoveries, such as antimicrobial drugs.[105] Ancient evidence reveals that current warming is occurring at roughly 10 times the average rate of warming since the last ice age.[106] One million animal and plant species are now threatened with extinction, many within decades, more than ever before in human history.[107] While AMR is a natural process in the evolution of microbes, the acceleration of its occurrence and spread is driven by anthropogenic impacts – mainly the misuse and overuse of antimicrobials to treat, prevent or control infections in humans, animals and plants in modern times.[108]

Higher temperatures have been identified as an independent variable associated with increased AMR infection. Temperature is a key variable influencing bacterial processes – including horizontal gene transfer, a major mechanism for the acquisition of antibiotic resistance.[109] Storms and floods, the frequency and severity of which are intensified by

[100] See WHO (2023).
[101] See Herron (2022).
[102] See Fleming Fund (2023).
[103] See Jaureguiberry et al. (2022).
[104] See Klümper et al. (2024).
[105] See Thiele-Bruhn (2021).
[106] See NASA (n.d.).
[107] See United Nations (2019).
[108] See WHO (2023).
[109] See San Lio et al. (2023).

climate change, are already displacing populations, damaging healthcare services and disrupting wastewater management, leading to more cases of water-borne disease in affected areas. In Pakistan, for example, unprecedented flooding led to a surge in skin and eye infections, diarrhoea, malaria, typhoid and dengue fever in 2022.[110] It is also likely to be associated with the significant spread of AMR bacteria and the transferable genes that confer resistance, as animal and human faeces have contaminated potable water in numerous communities.[111]

Rising global temperatures are changing ecoregions and impacting the resident range of species: this is changing the way different organisms and animals, including vectors such as ticks, fleas, mosquitos, birds and bats, enable pathogens to spread.[112] Research indicates that biodiversity has a protective buffer effect on infectious diseases, as competition controls the population of pathogen hosts and that of microorganisms themselves.[113]

When biodiversity is reduced, there are greater opportunities for zoonoses (whether viral, bacterial, parasitic or fungal), where pathogens emerge from hosts and jump from one species to another. Around 60 per cent of emerging human infections are zoonotic in nature, and of the 30 new human pathogens discovered in the last three decades, 75 per cent have originated in animals.[114] This type of cross-species disease transmission is thought to have triggered the Covid-19 pandemic.[115]

Deforestation by mining, logging, ranchers, intensive monocrop agriculture and road construction destroys not only carbon sequestration capacity, but also

nutrient cycling, which leads to the disturbance of the extraordinary diversity of microorganisms in soil.[116] Melting permafrost due to rising temperatures can unlock gases, such as carbon dioxide and methane, as well as ancient viruses and bacteria.[117] Scientists report that melting Arctic glaciers produce conditions for algae to bloom, turning sun-reflecting glaciers into sun-absorbing hotspots.[118] These, in turn, have ecosystem and geo-planetary impacts, worsening their remaining natural carbon sink function, as well as potentially increasing methane production.[119]

[110] See Manzoor and Adesola (2022).
[111] See Larsson and Flach (2021).
[112] See Environmental Resilience Institute (n.d.).
[113] See Keesing et al. (2010).
[114] See WHO Eastern Mediterranean Regional Office (n.d.).
[115] See WHO (2020).
[116] See Timmis (2021).
[117] See Denchak (2018).
[118] See McDougall (2019).
[119] See Topp and Pattey (1997).

Intensive use of antibiotics in livestock production (which accounts for approximately 70 per cent of global sales),[120, 121] as well as biocides and heavy metals, which can remain in the environment, may reduce microbial biodiversity and induce AMR in bacteria.[122]

The complexity of the AMR-climate change-biodiversity loss nexus requires further scientific research. Meanwhile, if inaction prevails, all three global issues will help bring the world to a point of no return in terms of the unrecoverable depletion of common resources. According to the most recent research (2024), as a result of AMR alone, in a scenario in which countries fail to contain drug resistance, the world could face a staggering US$ 1.7 trillion annual reduction in global economic output in 2050, amounting to a decline of almost 0.9 per cent in GDP, due to the economic impacts of AMR in humans.[123] Greater public awareness; surveillance and laboratory capacity; comprehensively financed NAPs with civil society engagement; access to WASH; IPC; secure access to essential medicines of assured quality and immunisation; the regulated, rational use of medicines, including in animal husbandry; proper patient care; effective diagnostics; and R&D for new antibiotics can all play a part.[124]

Global governing bodies on climate change and biodiversity are already in place. A similar architecture to address AMR needs to be developed urgently based on the landmark political declaration by the second UNGA-HLM on 26 September 2024,[125] the Jeddah Commitments to Accelerate Actions on AMR of 16 November 2024[126] and the QJS and the Global Leaders Group on AMR. An expert body similar to the Intergovernmental Panel on Climate Change (IPCC), the Independent Panel for Evidence on Action Against AMR, will be formed in 2025. As seen in Section 11 on global governance, the political declaration on AMR of 26 September 2024 and the Jeddah Commitments to Accelerate Actions on AMR of 16 November 2024 are critical landmarks in laying the foundations for global architecture to tackle AMR. To convert the political declaration on AMR into concrete action, a ministerial conference and parallel processes, such as the G7 and G20, would be well placed to capitalise on the focus the UNGA-HLM has provided. Cooperation and collaboration by policymakers, industry, investors, academia, international organisations and civil society are required for effective outcomes to address AMR.

[120] See Jonas et al. (2017).
[121] See Tiseo et al. (2020).
[122] See Larsson and Flach (2021).
[123] See WOAH and World Bank (2024).
[124] See WHO (2016).
[125] See UNGA-HLM (2024a).
[126] See United Nations (2024).

EBRD engagement in global efforts
to curb antimicrobial resistance (AMR)

Abbreviations, acronyms and references

Abbreviations and acronyms

AMR	antimicrobial resistance
AMS	antimicrobial stewardship
API	active pharmaceutical ingredient
BSAC	British Society for Antimicrobial Chemotherapy
CDC	US Centers for Disease Control and Prevention
EBRD	European Bank for Reconstruction and Development
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FPP	finished pharmaceutical product
G7	Group of Seven
G20	Group of 20
GDP	gross domestic product
GIP	good international practice
GLG on AMR	Global Leaders Group on AMR
GMP	good manufacturing practice
IAAMR	Investor Action on Antimicrobial Resistance
IACG	Interagency Coordination Group
IPC	infection prevention and control
LMICs	low- and middle-income countries
MDB	multilateral development bank
NAP	national action plan
OECD	Organisation for Economic Co-operation and Development
PPP	public-private partnership
QJS	Quadripartite Joint Secretariat on AMR
SDG	Sustainable Development Goal
UNGA-HLM	United Nations General Assembly High-Level Meeting
UWWTD	Urban Wastewater Treatment Directive
WAAW	World AMR Awareness Week
WHO	World Health Organization
WOAH	World Organisation for Animal Health

References

American Society for Microbiology (2022), "Phage Therapy: Past, Present and Future", 31 August 2022. Available at: https://asm.org/articles/2022/august/phage-therapy-past,-present-and-future

AMR Industry Alliance (n.d.), "AMR Industry Alliance", Geneva, Switzerland. Available at: https://www.amrindustryalliance.org/

AMR Industry Alliance (2022), *Antibiotic manufacturing standard: Minimizing risk of developing antibiotic resistance and aquatic ecotoxicity in the environment resulting from the manufacturing of human antibiotics*, Geneva, Switzerland. Available at: https://www.amrindustryalliance.org/wp-content/uploads/2022/06/AMRIA_Antibiotic-Manufacturing-Standard_June2022.pdf

Antimicrobial Resistance Collaborators (2022), "Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis", *The Lancet*, 399(10325): 629-655. Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)02724-0/fulltext

R. Blaney, E. Handy, A. Wawrzyniak and R. Dirkzwager (2023), "EU Pharma Legislation Review Series: Regulatory Data Protection", *Inside EU Life Sciences*, Covington, London. Available at: https://www.insideeulifesciences.com/2023/04/26/eu-pharma-legislation-review-series-regulatory-data-protection/

BSAC (2021), "Global Antimicrobial Stewardship Accreditation Scheme", Birmingham, United Kingdom. Available at: https://bsac.org.uk/global-antimicrobial-stewardship-accreditation-scheme/

CDDEP (2019), *Access Barriers to Antibiotics*, Washington, DC. Available at: https://onehealthtrust.org/wp-content/uploads/2019/04/AccessBarrierstoAntibiotics_CDDEP_FINAL.pdf

C. Dall (2024), "UK's NHS to require companies to meet responsible antibiotic manufacturing standard", CIDRAP, University of Minnesota, 13 August 2024. Available at: https://www.cidrap.umn.edu/antimicrobial-stewardship/uks-nhs-require-companies-meet-responsible-antibiotic-manufacturing

M. Denchak (2018), "Permafrost: Everything You Need to Know", Natural Resources Defense Council, New York. Available at: https://www.nrdc.org/stories/permafrost-everything-you-need-know

S.E. Dogan (2024), "Explained: the history of progress in tackling antimicrobial resistance", Wellcome, 3 September 2024. Available at: https://wellcome.org/news/explained-history-progress-tackling-antimicrobial-resistance

EBRD (2021), "EBRD-FAO Framework (2019 extension)", London. Available at: https://www.ebrd.com/work-with-us/projects/tcpsd/12330.html

EBRD (2024a), *Environmental and Social Policy*, London. Available at: https://www.ebrd.com/environmental-and-social-policy-esp-2024

EBRD (2024b), *Sustainability Report 2023*, London. Available at: https://www.ebrd.com/sustainability-report-2023.html

ECDC (2022), *Antimicrobial Resistance in the EU/EEA – A One Health response*, Solna, Sweden. Available at: https://www.ecdc.europa.eu/en/publications-data/antimicrobial-resistance-eueea-one-health-response

ECDC and WHO European Region (2023), *Surveillance of antimicrobial resistance in Europe, 2022 data: executive summary*, Solna, Sweden, and Copenhagen. Available at: https://www.ecdc.europa.eu/sites/default/files/documents/Nov2023-ECDC-WHO-Executive-Summary.pdf

Environmental Resilience Institute (n.d.), "Climate Implications – Mosquitoes, Ticks, and Other Vectors", Indiana University, Bloomington, IN. Available at: https://eri.iu.edu/erit/implications/mosquitoes-ticks-and-other-vectors.html

EU4Business-EBRD Credit Line (n.d.), "EU4Business-EBRD Credit Line", Chisinau. Available at: https://www.eu4business-ebrdcreditline.md/

European Antimicrobial Resistance Collaborators (2022), "The burden of bacterial antimicrobial resistance in the WHO European region in 2019: a cross-country systematic analysis", *The Lancet*, 7(11): e897-e913. Available at: https://www.research.ed.ac.uk/en/publications/the-burden-of-bacterial-antimicrobial-resistance-in-the-who-europ

European Commission (n.d.a), "Farm to Fork Strategy", Brussels. Available at: https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en

European Commission (n.d.b), "Antimicrobial Resistance: Research, Projects & Studies", Brussels. Available at: https://health.ec.europa.eu/antimicrobial-resistance/research-projects-studies_en

European Commission (2010), "Commission Communication – EU best practice guidelines for voluntary certification schemes for agricultural products and foodstuffs (2010/C 341/04)", *Official Journal of the European Union,* 16 December 2010. Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:341:0005:0011:en:PDF

European Commission (2023), *Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach,* Brussels. Available at: https://health.ec.europa.eu/publications/council-recommendation-stepping-eu-actions-combat-antimicrobial-resistance-one-health-approach_en

European Commission (2024), "Update on AMR-related issues in several environmental policy contexts", Brussels. Available at: https://ec.europa.eu/assets/sante/health/amr/docs/amr_20240229_co04_en.pdf

European Food Safety Authority (2024), *Data collection on antibiotics for control of plant pathogenic bacteria,* Parma, Italy. Available at: https://www.efsa.europa.eu/en/supporting/pub/en-8522

European Union (2018), *Regulation (EU) 2019/6 of the European Parliament and of the Council of 11 December 2018 on veterinary medicinal products and repealing Directive 2001/82/EC,* Brussels. Available at: https://eur-lex.europa.eu/eli/reg/2019/6/oj

European Union (2019), *Regulation (EU) 2019/4 of the European Parliament and of the Council of 11 December 2018 on the manufacture, placing on the market and use of medicated feed, amending Regulation (EC) No 183/2005 of the European Parliament and of the Council and repealing Council Directive 90/167/EEC,* Brussels. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019R0004

European Union (2021), *Community strategy against antimicrobial resistance,* Brussels. Available at: https://eur-lex.europa.eu/EN/legal-content/summary/community-strategy-against-antimicrobial-resistance.html#:~:text=This%20recommendation%20is%20a%20follow,the%20effectiveness%20of%20these%20agents

FAIRR (2024), *Health and Wealth: The Investors' Guide to Antimicrobial Resistance (AMR), A Growing Global Health Crisis,* London. Available at: https://www.fairr.org/resources/reports/health-and-wealth-the-investors-guide-to-antimicrobial-resistance

FAO (2022), "Antimicrobial resistance: Now is the time for collective action", Rome. Available at: https://www.fao.org/newsroom/detail/antimicrobial-resistance-now-is-the-time-for-collective-action/en

FAO Investment Centre (2024), "Helping minimize the misuse of antibiotics in farmed poultry in Ukraine", Rome. Available at: https://www.fao.org/support-to-investment/news/detail/en/c/1677564/

A.A. Fayad, A. Rizk, S. El Sayed, M. Kaddoura, N.K. Jawad, A. Al-Attar, O. Dewachi, V.K. Nguyen and Z.A. Sater (2023), "Antimicrobial resistance and the Iraq wars: armed conflict as an underinvestigated pathway with growing significance", *BMJ Global Health*, 7(Suppl 8): e010863. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC9933488/

M.C. Fisher, A. Alastruey-Izquierdo, J. Berman, T. Bicanic, E.M. Bignell, P. Bowyer et al. (2022), "Tackling the emerging threat of antifungal resistance to human health", *Nature Reviews Microbiology,* 20(9): 557-571. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC8962932/

Fleming Fund (2023), "First line of defence for AMR One Health must address the climate crisis", 4 July 2023. Available at: https://www.flemingfund.org/publications/the-first-line-of-defence-for-amr-one-health-must-address-the-climate-crisis/#:~:text=Although%20AMR%20is%20an%20existing,adapt%2C%20spreading%20to%20new%20locations

G20 (2019), *Okayama Declaration of the G20 Health Ministers,* Okayama, Japan. Available at: https://www.mhlw.go.jp/seisakunitsuite/bunya/hokabunya/kokusai/g20/health/jp/img/G20Okayama_HM_EN.pdf

G20 Brazil (2024), "Sherpa Track: Health", Brasilia. Available at: https://g20.gov.br/en/documents/sherpa-track

A.K. Gautam and S. Kumar (2020), "Techniques for the Detection, Identification, and Diagnosis of Agricultural Pathogens and Diseases", in C. Egbuna and B. Sawicka (eds.) (2020), *Natural Remedies for Pest, Disease and Weed Control,* Elsevier Inc. Available at: https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/plant-pathogenic-bacteria#:~:text=The%20most%20commonly%20found%20pathogenic,such%20as%20soft%20rot%20Agrobacterium

GBD 2021 Antimicrobial Resistance Collaborators (2024), "Global burden of bacterial antimicrobial resistance 1990-2021: a systematic analysis with forecasts to 2050", *The Lancet,* 404(10459): 1199-1226. Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)01867-1/fulltext

Global AMR R&D Hub (2024), "Hub-WHO Joint G7 Progress Report Published", 18 October 2024. Available at: https://globalamrhub.org/news/hub-who-joint-g7-progress-report-published/

Global Leaders Group on Antimicrobial Resistance (n.d.), "Global Leaders Group on Antimicrobial Resistance". Available at: https://www.amrleaders.org/#tab=tab_1

Global Leaders Group on Antimicrobial Resistance (2024), *Towards Specific Commitments and Action in Response to AMR: Recommendations for consideration by UN Member States in the outcome document of the High-level Meeting on AMR in September 2024*. Available at: https://www.amrleaders.org/resources

F.L. Gordillo Altamirano and J.J. Barr (2019), "Phage Therapy in the Postantibiotic Era", *Clinical Microbiology Reviews,* 32(2). Available at: https://journals.asm.org/doi/10.1128/cmr.00066-18#:~:text=The%20therapeutic%20use%20of%20bacteriophages,the%20successful%20introduction%20of%20antibiotics

Government of the United Kingdom (2024), *UK 5-year action plan for antimicrobial resistance 2024 to 2029,* London. Available at: https://www.gov.uk/government/publications/uk-5-year-action-plan-for-antimicrobial-resistance-2024-to-2029

Z. Han, H. Feng, C. Wang, X. Wang, M. Yang and Y. Zhang (2023), "Mitigating Antibiotic Resistance Emissions in the Pharmaceutical Industry: Global Governance and Available Techniques", *China CDC Weekly,* 5(46): 1038-1044. Available at: https://pubmed.ncbi.nlm.nih.gov/38046642/

A. Herron (2022), "Confronting a permacrisis? The intersection between antimicrobial resistance, climate change and biodiversity loss", Aviva Investors, 23 November 2022. Available at: https://www.avivainvestors.com/en-gb/views/aiq-investment-thinking/2022/11/antimicrobial-resistance/

M. Hutchings, A.W. Truman and B. Wilkinson (2019), "Antibiotics: past, present and future", *Current Opinion in Microbiology,* 51: 72-80. Available at: https://pubmed.ncbi.nlm.nih.gov/31733401/

Investor Action on AMR (n.d.), "Investor Action on Antimicrobial Resistance". Available at: https://amrinvestoraction.org/

Investor Action on AMR (2024), "US $13 Trillion Investors Call on Global Leaders To Tackle Antimicrobial Resistance Crisis", 3 September 2024. Available at: https://amrinvestoraction.org/article/usd13-trillion-investors-call-on-global-leaders-to-tackle-antimicrobial-resistance-crisis

S. Janković (2024), "Subscription model for antimicrobials could be expanded in new UK five-year AMR plan", *The Pharmaceutical Journal,* 9 May 2024. Available at: https://pharmaceutical-journal.com/article/news/subscription-model-for-antimicrobials-could-be-expanded-in-new-uk-five-year-amr-plan

P. Jaureguiberry, N. Titeux, M. Wiemers, D.E. Bowler, L. Coscieme, A.S. Golden et al. (2022), "The direct drivers of recent global anthropogenic biodiversity loss", *Science Advances,* 8(45). Available at: https://www.science.org/doi/10.1126/sciadv.abm9982

O.B. Jonas, A. Irwin, F.C.J. Berthe, F.G. Le Gall and P.V. Marquez (2017), *Drug-resistant infections: a threat to our economic future (Vol. 2): final report,* World Bank, Washington, DC. Available at: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/323311493396993758/final-report

L.M. Kasman and L.D. Porter (2022), *Bacteriophages*, StatPearls Publishing, Treasure Island, FL. Available at: https://www.ncbi.nlm.nih.gov/books/NBK493185/

F. Keesing, L.K. Belden, P. Daszak, A. Dobson, C.D. Harvell, R.D. Holt et al. (2010), "Impacts of biodiversity on the emergence and transmission of infectious diseases", *Nature,* 468: 647-652. Available at: https://www.nature.com/articles/nature09575

U. Klümper, G. Gionchetta, E. Catão, X. Bellanger, I. Dielacher, A.X. Elena et al. (2024), "Environmental microbiome diversity and stability is a barrier to antimicrobial resistance gene accumulation", *Communications Biology,* 7(706). Available at: https://www.nature.com/articles/s42003-024-06338-8#:~:text=Diversity%20as%20a%20limiting%20factor,being%20invaded%20by%20ARBs29

D.G.J. Larsson and C.-F. Flach (2021), "Antibiotic resistance in the environment", *Nature Reviews Microbiology*, 20: 257-269. Available at: https://www.nature.com/articles/s41579-021-00649-x

G. Loban, M. Faustova, O. Dobrovolska and P. Tkachenko (2023), "War in Ukraine: incursion of antimicrobial resistance", *Irish Journal of Medical Science,* 192(6): 2905-2907. Available at: https://pubmed.ncbi.nlm.nih.gov/37178279/

A. Manzoor and R.O. Adesola (2022), "Disaster in public health due to flood in Pakistan in 2022", *Health Science Reports,* 5(6): e903. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC9584091/

A. McDonnell and K. Klemperer (2022), *Drug-Resistant Infections Are One of the World's Biggest Killers, Especially for Children in Poorer Countries. We Need to Act Now,* Center for Global Development, Washington, DC and London. Available at: https://www.cgdev.org/blog/drug-resistant-infections-are-one-worlds-biggest-killers-especially-children-poorer-countries

D. McDougall (2019), "The tiny algae at ground zero of Greenland's melting glaciers", *The Guardian*, 18 September 2019. Available at: https://www.theguardian.com/environment/2019/sep/18/tiny-algae-ground-zero-greenland-melting-glaciers

K. Moussally, G. Abu-Sittah, F. Gordillo Gomez, A.A. Fayad and A. Farra (2023), "Antimicrobial resistance in the ongoing Gaza war: a silent threat", *The Lancet*, 402(10416): P1972-1973. Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(23)02508-4/fulltext

R. Mulchandani, Y. Wang, M. Gilbert and T.P. Van Boeckel (2023), "Global trends in antimicrobial use in food-producing animals: 2020 to 2030", *PLOS Global Public Health*, 3(2): e0001305. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC10021213/#:~:text=Globally%2C%20antimicrobial%20usage%20was%20estimated,%3C1%25%20were%20in%20Africa

NASA (n.d.), "Evidence", Washington, DC. Available at: https://science.nasa.gov/climate-change/evidence/

OECD (2023), *Embracing a One Health Framework to Fight Antimicrobial Resistance*, Paris. Available at: https://www.oecd.org/en/publications/embracing-a-one-health-framework-to-fight-antimicrobial-resistance_ce44c755-en.html

J. Olivera and W.C. Reygaert (2024), *Gram-Negative Bacteria,* StatPearls Publishing, Treasure Island, FL. Available at: https://www.ncbi.nlm.nih.gov/books/NBK538213/

S.J.C. Pallett, S.E. Boyd, M.K. O'Shea, J. Martin, D.R. Jenkins and E.J. Hutley (2023), "The contribution of human conflict to the development of antimicrobial resistance", *Communications Medicine (London)*, 3(1): 153. Available at: https://pubmed.ncbi.nlm.nih.gov/37880348/

N. Petrosillo, E. Petersen and S. Antoniak (2023), "Ukraine war and antimicrobial resistance", *The Lancet Infectious Diseases*, 24(6): P653-654. Available at: https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(23)00264-5/fulltext

S.I. Polianciuc, A.E. Gurzău, B. Kiss, M.G. Stefan and F. Loghin (2020), "Antibiotics in the environment: causes and consequences", *Medicine and Pharmacy Reports,* 93(3): 231-240. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7418837/#:~:text=Once%20in%20the%20environment%2C%20antibiotic,causes%20the%20development%20and%2For

F. Prestinaci, P. Pezzotti and A. Pantosti (2015), "Antimicrobial resistance: a global multifaceted phenomenon", *Pathogens and Global Health,* 109(7): 309-318. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC4768623/

ReAct (n.d.), "Global Policy", Uppsala, Sweden. Available at: https://www.reactgroup.org/toolbox/policy/global-policy/

M. Ren, A.D. So, S.J. Chandy, M. Mpundu, A.O. Peralta, K. Åkerfeldt, A.K. Sjöblom and O. Cars (2022), "Equitable Access to Antibiotics: A Core Element and Shared Global Responsibility for Pandemic Preparedness and Response", *Journal of Law, Medicine and Ethics*, 50(S2): 34-39. Available at: https://pubmed.ncbi.nlm.nih.gov/36889350/

H. Ritchie (2017), "Three-quarters of antibiotics are used on animals. Here's why that's a major problem", World Economic Forum, Geneva, Switzerland. Available at: https://www.weforum.org/stories/2017/11/three-quarters-of-antibiotics-are-used-on-animals-heres-why-thats-a-major-problem/

Royal Society of Chemistry (2024), *Position Statement: Antimicrobial Resistance*, London. Available at: https://www.rsc.org/globalassets/22-new-perspectives/health/our-policy-position-antimicrobial-resistance.pdf

Safeguarding Health in Conflict (2024), "2023 Attacks on Health Care in War Zones Most Ever Documented", 22 May 2024, Geneva, Switzerland. Available at: https://insecurityinsight.org/wp-content/uploads/2024/05/2023-SHCC-Press-Release-Critical-Conditions.pdf

A.I. Samreen, H.A. Malak and H.H. Abulreesh (2021), "Environmental antimicrobial resistance and its drivers: a potential threat to public health", *Journal of Global Antimicrobial Resistance,* 27: 101-111. Available at: https://www.sciencedirect.com/science/article/pii/S2213716521001910

R.M. San Lio, G. Favara, A. Maugeri, M. Barchitta and A. Agodi (2023), "How Antimicrobial Resistance Is Linked to Climate Change: An Overview of Two Intertwined Global Challenges", *International Journal of Environmental Research and Public Health*, 20(3): 1681. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC9914631/

T. Schultze, M. Hogardt, E.S. Velázquez, D. Hack, S. Besier, T.A. Wichelhaus, U. Rochwalsky, V.A.J. Kempf and C. Reinheimer (2023), "Molecular surveillance of multidrug-resistant Gram-negative bacteria in Ukrainian patients, Germany, March to June 2022", *Euro Surveillance*, 28(1): 2200850. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC9817211/

D. Stepanskyi, O. Ishchenko, T. Luo, F. Lebreton, J.W. Bennett, I. Kovalenko and P. McGann (2024), "Phenotypic and genomic analysis of bacteria from war wounds in Dnipro, Ukraine", *JAC-Antimicrobial Resistance*, 6(3): dlae090. Available at: https://pubmed.ncbi.nlm.nih.gov/38872715/

P. Taylor and R. Reeder (2020), "Antibiotic use on crops in low and middle-income countries based on recommendations made by agricultural advisors", *CABI Agriculture and Bioscience*, 1(1). Available at: https://cabiagbio.biomedcentral.com/articles/10.1186/s43170-020-00001-y#Sec2

A.A. Tegegne, A.B. Feissa, G.H. Godena, Y. Tefera, H.K. Hassen, Y. Ozalp and S. Suleman (2024), "Substandard and falsified antimicrobials in selected east African countries: A systematic review", *PLoS One*, 19(1): e0295956. Available at: https://pubmed.ncbi.nlm.nih.gov/38277385/

The Lancet (2024), "Infographics: Antimicrobial resistance: an enormous, growing, and unevenly distributed threat to global health", AMR series, 23 May 2024. Available at: https://www.thelancet.com/infographics-do/antibiotic-resistance-series-2024

S. Thiele-Bruhn (2021), "The role of soils in provision of genetic, medicinal and biochemical resources", *Philosophical Transactions of the Royal Society B: Biological Sciences*, 376: 20200183. Available at: https://royalsocietypublishing.org/doi/10.1098/rstb.2020.0183

Third Global High-Level Ministerial Conference on Antimicrobial Resistance (2022), "The Muscat Ministerial Manifesto on AMR", Muscat, Oman. Available at: http://amrconference2022.om/assets/images/Final%20Version%20Muscat%20Manifesto%20AMR%20with%20Annex.pdf

K. Timmis (2021), "The soil crisis: the need to treat as a global health problem and the pivotal role of microbes in prophylaxis and therapy", *Microbial Biology*, 14(3): 769-797. Available at: https://enviromicro-journals.onlinelibrary.wiley.com/doi/full/10.1111/1751-7915.13771

K. Tiseo, L. Huber, M. Gilbert, T.P. Robinson and T.P. Van Boeckel (2020), "Global Trends in Antimicrobial Use in Food Animals from 2017 to 2030", *Antibiotics*, 9(12): 918. Available at: https://www.mdpi.com/2079-6382/9/12/918#:~:text=Global%20Trends%20in%20Antimicrobial%20Use%20in%20Food%20Animals,of%2011.5%25%20by%202030%20to%20104%2C079%20tonnes.%20

E. Topp and E. Pattey (1997), *Soils as sources and sinks for atmospheric methane,* Centre for Land and Biological Resources Research, Agriculture and Agri-Food Canada, Ottawa. Available at: https://cdnsciencepub.com/doi/pdf/10.4141/S96-107#:~:text=Methane%20is%20produced%20in%20soils,carbon%20dioxide%20by%20methanotrophic%20bacteria

Turkish Ministry of Health (2022), "Sağlık Bakanlığı Antimikrobiyal Direnç Önleme Eğitimi" (Ministry of Health Antimicrobial Resistance Prevention Training), *YouTube,* 23 June 2022. Available at: https://www.youtube.com/watch?v=Nihmr5Gqg5Y

UN Environment Programme (n.d.), "About Montreal Protocol", Nairobi. Available at: https://www.unep.org/ozonaction/who-we-are/about-montreal-protocol

UNGA-HLM (2024a), *Political Declaration of the High-Level Meeting on Antimicrobial Resistance*, New York. Available at: https://www.un.org/pga/wp-content/uploads/sites/108/2024/09/FINAL-Text-AMR-to-PGA.pdf

UNGA-HLM (2024b), "UN General Assembly High-Level Meeting on antimicrobial resistance 2024", 26 September 2024, New York. Available at: https://www.who.int/news-room/events/detail/2024/09/26/default-calendar/un-general-assembly-high-level-meeting-on-antimicrobial-resistance-2024

United Nations (2019), "UN Report: Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating'", New York. Available at: https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/

United Nations (2024), "Jeddah conference closes with adoption of global pledges to tackle antimicrobial resistance", 16 November 2024, Jeddah. Available at: https://news.un.org/en/story/2024/11/1157091

United Nations Statistics Division (2024), *The Sustainable Development Goals Report 2024*, New York. Available at: https://unstats.un.org/sdgs/report/2024/

Wellcome (2023), "Why is it so hard to develop new antibiotics?", London. Available at: https://wellcome.org/news/why-is-it-so-hard-develop-new-antibiotics

Wellcome (2024), *Driving action on antimicrobial resistance (AMR) in 2024: Policy briefing*, London. Available at: https://cms.wellcome.org/sites/default/files/2024-05/driving-action-on-antimicrobial-resistance-in-2024.pdf

Wellcome and Boston Consulting Group (2022), *Understanding the antibiotic manufacturing ecosystem*, London. Available at: https://cms.wellcome.org/sites/default/files/2022-04/understanding-the-antibiotic-manufacturing-ecosystem-2022.pdf

WHO (n.d.), "One Health", Geneva, Switzerland. Available at: https://www.who.int/health-topics/one-health#tab=tab_1

WHO (2001), *WHO Global Strategy for Containment of Antimicrobial Resistance*, Geneva, Switzerland. Available at: https://iris.who.int/bitstream/handle/10665/66860/WHO_CDS_CSR_DRS_2001.2.pdf

WHO (2016), *Global action plan on antimicrobial resistance,* Geneva, Switzerland. Available at: https://www.who.int/publications/i/item/9789241509763

WHO (2017), *WHO guidelines on use of medically important antimicrobials in food-producing animals,* Geneva, Switzerland. Available at: https://www.who.int/publications/i/item/9789241550130

WHO (2020), *Origin of SARS-CoV-2,* Geneva, Switzerland. Available at: https://iris.who.int/bitstream/handle/10665/332197/WHO-2019-nCoV-FAQ-Virus_origin-2020.1-eng.pdf

WHO (2023), "Antimicrobial resistance", Geneva, Switzerland. Available at: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance

WHO (2024), "New global guidance aims to curb antibiotic pollution from manufacturing", Geneva, Switzerland. Available at: https://www.who.int/news/item/03-09-2024-new-global-guidance-aims-to-curb-antibiotic-pollution-from-manufacturing

WHO African Region (2024), *Framework for strengthening local production of medicines, vaccines, and other health technologies in the WHO African Region 2025-2035: Report of the Secretariat*, Brazzaville, Republic of the Congo. Available at: https://www.afro.who.int/sites/default/files/2024-07/AFR-RC74-6%20Framework%20for%20strengthening%20local%20production%20of%20medicines,%20vaccines%20and%20other%20health%20technologies%20in%20the%20WHO%20African%20Region.pdf

WHO Eastern Mediterranean Regional Office (n.d.), "Zoonotic disease: emerging public health threats in the Region", Cairo. Available at: https://www.emro.who.int/fr/about-who/rc61/zoonotic-diseases.html

WOAH (2024), *Forecasting the Fallout from AMR: Economic Impacts of Antimicrobial Resistance in Food-Producing Animals,* Paris. Available at: https://www.woah.org/app/uploads/2024/09/ecoamr-woah-animal-sector-web-reduced-23924.pdf

WOAH and World Bank (2024), *Forecasting the Fallout from AMR: Economic Impacts of Antimicrobial Resistance in Humans,* Paris and Washington, DC. Available at: https://www.woah.org/app/uploads/2024/09/forecasting-fallout-amr-economic-impacts-antimicrobial-resistance-humans-27924-compressed.pdf

World Bank (2024), *Stopping the Grand Pandemic: A Framework for Action Addressing Antimicrobial Resistance through World Bank Operations – Summary Report,* Washington, DC. Available at: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099050724083015872/p17446410f60aa01d1b9d3185a333f20bef

EBRD engagement in global efforts
to curb antimicrobial resistance (AMR)

European Bank
for Reconstruction and Development