Task Force 6
Accelerating SDGs: Exploring New Pathways to the 2030 Agenda

TOWARDS POLICIES TO PREVENT ANTIMICROBIAL RESISTANCE

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Abstract

Antimicrobial resistance (AMR) is an emerging public health crisis, particularly in low- and middle-income countries, where knowledge gaps are more dominant. The pandemic has further enhanced AMR with long-term repercussions, exacerbating social vulnerabilities. A 'one health' (OH) approach with cross-sectoral collaboration is, therefore, essential to ensure sustained action across the human-animal-environmental interface. Under the OH approach, the G20 nations should formalise a collaborative governance structure, with representatives from health, agriculture, animal husbandry, water and sanitation, and climate sectors. The G20 must also foster research and development efforts on this front. Stringent regulatory frameworks must be developed across the value chain of antimicrobials, and national action plans must formulate surveillance strategies (comprehensive and sentinel) to inform policies and infection prevention and control responses. Social scientists and communication specialists must be engaged to identify key factors hampering behavioural change while mobilising communities towards the development of stewardship interventions.

The Challenge

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Antimicrobial resistance (AMR) is a natural evolutionary response where microorganisms develop robust protective mechanisms to evade antimicrobial substances becoming resistant and thereby rendering these substances ineffective in treating infections.[1] AMR continues to rise across the globe, especially in low-and-middle income nations (LMICs).[2] The emergence of AMR is complex and may be attributed to high rates of prescription and overuse of antibiotics in human medicine, food production and animal husbandry, limited vaccine uptake, prevailing water, sanitation, and hygiene (WASH) practices, and inadequate disease surveillance.

AMR presents catastrophic implications for human health, vastly threatening the achievements made towards meeting the Sustainable Development Goals (SDGs) with the progress already made at risk of loss. Various SDGs are linked to AMR particularly health, food security, biodiversity (life on land and below water), responsible consumption and production, and poverty reduction.

For instance, in 2019, multidrug-resistant tuberculosis led to 465,000 incident cases, accounting for 180,000 deaths.[3] This is further exacerbated due to limited surveillance, inadequate knowledge sharing, and paucity of estimates on widespread societal effects of AMR.

Patterns of antimicrobial consumption may be dictated by self-diagnosis and local prescribing practices wherein the consumption may be unnecessary, and dosage and duration of treatment may be sub-optimal, leading to the emergence of resistant strains. This is partly due to lack of adequate drug dosage guidelines as well as limited public awareness communication, contributing to poor public understanding of judicious antimicrobial use, easy availability of over-the-counter antibiotics, and patients discontinuing use before the end of treatment course.[4] Further, counterfeit, and sub-standard antimicrobials which are less effective in treating infections may also contribute to the emergence of resistant strains, while poverty and poor access to antimicrobials might also play a role in inadequate utilisation.[5] Greater demand for animal protein is resulting in increasing utilisation of intensive farming and animal husbandry practices, which may grossly overuse antibiotics to

prevent and treat infections in livestock and boost production. Determinants of AMR may also include prevailing WASH practices within communities, as well as at healthcare facilities as resistant Enterobacteriaceae may be spread through the faecal-oral route and methicillin-resistant *Staphylococcus aureus* may be transmitted from hospital-associated infections.[6] Environmental pollution, inadequate sewage, and waste management also play a crucial role in AMR as untreated antimicrobials and metabolites may lead to the emergence of resistant strains. Untreated hospital wastewater and sewage often leads to the selection of resistant strains of *Escherichia coli*.[7]

The Tripartite AMR Country Self-assessment Survey (TrACSS)[a] is a global survey to monitor progress on the implementation of the national action plan (NAP) on AMR. In 2022, 166 countries responded to this self-assessment survey, including the G20 nations.

According to the findings from TrACSS 2022, various member countries of the G20 responded positively towards utilising the 'One Health' (OH) approach[b] in the formulation of strategies aimed at addressing AMR.[8] However, 40 percent of these members do not have multisectoral coordination mechanisms for food production and 25 percent do not consider environmental aspects in the development of their NAP. Furthermore, developed nations such as Australia responded 'No' to the integration of AMR mitigation strategies

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a Envisaged under the Global Action Plan on AMR, since 2016, this survey is jointly administered by the Food and Agricultural Organization of the United Nations (FAO), Governing Conference and the World Assembly of World Organisation for Animal Health (OIE) and the World Health Organization (WHO). It aims to monitor the progress in the formulation and implementation of policy decisions and national action plans towards the prevention, control and monitoring of AMR. The self-assessment questionnaire includes aspects under the OH approach such as human health, animal health, food and agriculture as well as environment. The survey follows a five-point rating scale, from A to E (A - no capacity, B - limited, C- developed, D - demonstrated, and E- sustained capacity) on understanding national progress and functionality.

b The One Health approach is a framework underpinned in the principles of collaborative effort across multiple disciplines of human health, animal and plant health and environment to address health threats. For more, see: Food and Agriculture Organization, United Nations Environment Programme, World Health Organization, and World Organization for Animal Health. 2022. "One Health Joint Plan of Action (2022-2026)." Rome.

with the OH approach, WASH, Climate Change and Environmental Planning, and National Food Security. 80 percent of the nations do not include climate change and environmental planning, while 75 percent do not include WASH in their NAPs. Moreover, several nations have developed NAPs, but the plan is yet to be approved and implemented, such as in Canada, Mexico, and Turkey. For 55 percent of the nations, the action plan does not have financial provisions or any monitoring mechanisms. While most nations have initiated or implemented surveillance systems, Australia, Brazil, and Turkey have so far not initiated any steps on the establishment of an integrated multisectoral surveillance system including AMR and antimicrobial consumption/use. An overview of the TrACSS shows that there is substantial progress towards the development and implementation of AMR mitigation strategies, however, this progress is fragmented as certain focus areas and measures have received more emphasis, while others remain stagnated and have received little to no attention. It is, therefore, essential to stress the integration of AMR national planning with existing national budgets and programmes, enhancing surveillance and data quality, and improving monitoring mechanisms. Further, evidence suggests that policies around AMR prevention have predominantly focused on human health and agriculture sectors, but the environmental dimension of pollution due to discharges from hospital and community wastewater, from drug manufacturing units into the soil, which helps microorganisms like bacteria to modulate its genomic expression, thereby acquiring resistance and affecting the entire ecosystem (as the run-off from the plants and animal agriculture are often neglected).

The implementation of AMR National Action Plans has been challenging to achieve due to its complex nature with interlinkages across human, animal, and plant health, food and feed production, and the environment, requiring multi-stakeholder engagement and collaboration. Further, the lack of financing mechanisms and infrastructure to address AMR contribute significantly towards impeding the implementation of NAPs and effectuating stringent regulatory policies.[9, 10] Hence, it is essential to place emphasis on interventions and strategies aimed at holistic multi-stakeholder engagement and sustainable financing mechanisms.

Australia has implemented measures to improve budgetary allocations for AMR prevention and is investing in surveillance, research and development (R&D) and monitoring and evaluation (M&E), through the Australian Antimicrobial Resistance Network. These impactful interventions, strategised through multi-stakeholder engagements and collaborations, aim to invest in novel antimicrobials, diagnostics, surveillance, as well as financing mechanisms. Nations such as Germany have undertaken strategies and interventions targeted at reducing the use of antibiotics in environmental circulation, animal agriculture, and food production by banning the use of antibiotics in animal feed. Further, since 2018, Canada has mandated the reporting of the annual sales of medically important antimicrobials intended for use in animals via the Veterinary Antimicrobial Sales Reporting system. In 2021, its fourth year of implementation, overall sales of antimicrobials had reduced by 2 percent as compared to 2020. Such interventions are essential to bolster efforts towards antimicrobial stewardship.[11,12,13]

The G20's Role

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As AMR is an all-encompassing challenge across the interface of human-animal-environmental health, a comprehensive and collaborative approach must be adopted. All G20 member nations should formalise a steering committee (SC) that consists of representatives from various ministries and departments, listed in 'Table 1'. The major objective of the SC should be to foster well-being and address the threats of AMR by initiating inter-sectoral coordination and mobilising communities through the OH approach.[14]

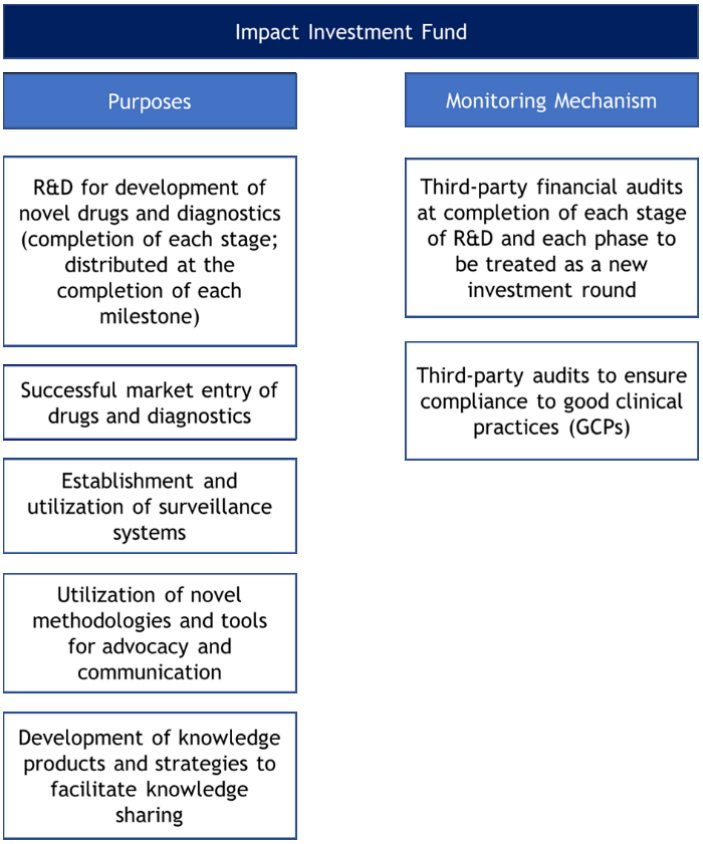
Since investment in R&D is pivotal to the development of robust scientific methods for novel drugs, surveillance, digital tools, and communication strategies, the G20 nations must formulate an impact investment fund. Additionally, member nations should also engage with multi-lateral agencies, international financial institutions, and private sector lenders (see Figure 1). Further details are included in Figure 1.

The nature of the threat of AMR demands

Table 1: Representative members of the SC on AMR

Steering Committee Number	Description
SC-1	WASH and environmental health and safety
SC-2	Human health- epidemiology, microbiology, drug control
SC-3	Environmental regulation
SC-4	Agriculture and food production
SC-5	Animal husbandry
SC-6	Infrastructure, technology, and telecommunications
SC-7	Human resource and development
SC-8	Industry associations- chemicals, fertilisers, and pharmaceuticals
SC-9	Science and technology- statistics and (R&D)

Figure 1: Functions of the proposed fund- Combat AMR: Impact Investment Fund



a global concerted effort. Therefore, the G20 nations must support R&D and surveillance efforts among non-member nations, developing a joint plan of action. This can be initiated among nations which have existing bilateral relations with the G20 member countries.

Recommendations to the G20

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We recommend that the overarching responsibilities of the SC include formulation of strategies for data collection and disease surveillance mechanisms in alignment with the extant global collaborations like Interagency Coordination Group on AMR and the Global AMR Surveillance System. Traditional clinical surveillance combined with metagenomics will help in identifying the emergence of various resistant strains of microbes through both phenotypic and genotypic data.

Further, the committee needs to lay down frameworks to strengthen environmental discharge regulations from voluntary industry initiatives to mandatory disclosures across the value chain of antimicrobial drugs, disinfectants, sterilants, and biocides.[15]Since improving community WASH, safe-sex, and antimicrobial consumption practices is essential, the SC must encourage development of strategies that engage communities, thereby improving behavioral practices through efficient communication and digital penetration strategies.[16] Further, these strategies must aim to enhance stewardship amongst communities, especially by empowering stakeholders from disadvantaged and vulnerable groups. The SC must also promote and enhance research in alignment with the objectives of the Global Antibiotic Research and Development Partnership, while ensuring that national interests are also addressed. Research needs to emphasise transmission dynamics and aim to understand the spread of resistant strains of microbes between human-human and animal-human interfaces. The SC should channel funds from various ministries to ensure that the national budget on AMR research meets the World Health Organization (WHO) recommended value of 2percent.[17] Academia and research institutions of national importance must conduct solution-oriented research into the development, transmission, and spread of AMR. Some pertinent factors that contribute to AMR, recommendations against these factors, drivers for said recommendations, and relevant SC representatives for each recommendation are illustrated in Table 2. Having strong regulatory and legal frameworks is critical to contain the spread of AMR. Further, the SC should align NAPs AMR with other national and global strategies (for example, those tackling WASH and the environment) as

all the contributing factors mentioned in Table 2 help the microorganism modulate its genome and express AMR affecting the entire ecosystem. More importantly, the SC should mandate a monitoring framework which would help in evaluating emerging strains, their incidence, and frequency of emergence to revisit existing policies for tackling the problem of AMR.

Table 2: Factors contributing to the growth of AMR and corresponding recommendations

Factors contributing to AMR	Recommendations	Drivers	SC Representative
Value chain stage: Manufacturing			
Discharge of chemical residue and resistant microorganisms into water bodies, effluent waste from industries-pharmaceutical, chemical and fertilizer	Develop and enforce stringent environmental discharge standards to cover chemical residue and resistant microorganisms of existing and upcoming antibiotic drugs for all environmental media	**Regulation:** Revised standards for effluent and hazardous waste discharge	SC-3
	Capacity building for environmental and drug manufacturing regulators on monitoring of chemical residue to detect microbial contamination in the discharge from pharmaceutical manufacturing units	**Capacity building**: Upskill regulators, strengthen monitoring framework	SC-1 SC-2 SC-3
	Strengthen capacity of testing laboratories for detecting chemicals used in antibiotics that are resistant to waste treatment strategies	**Technology**: Upgrade laboratories **Capacity building**: Upskill laboratory staff	SC-2 SC-9
	Improve transparency in data sharing across the supply chain	**Technology:** Build infrastructure for secure data collection and reporting aligned with existing national reporting architecture. Consider provisions for data capturing in remote locations **Regulation:** Structured and frequent third-party audits and assurance	SC-2 SC-3 SC-6

Factors contributing to AMR	Recommendations	Drivers	SC Representative
Poor WASH practices by the staff in manufacturing plants resulting in emergence of infections and resistant strains	Incorporate waste management and leading WASH practices into standard operating procedures for the workers	**Regulation:** Mandatory third-party audits on environmental health and safety of workers **Regulation:** Mandatory vaccination of workers **Capacity building:** Regular training of workers on the merits of proper hygiene as a preventive strategy against AMR	SC-1 SC-2 SC-3 SC-7
Inappropriate data labelling for consumers	Enforce appropriate labelling on correct use, dosage, expiry dates, health and environmental impacts of long-term use, and proper disposal of unused antimicrobials	**Regulation:** Mandatory labelling on antimicrobials analogous to labelling on food products	SC-1 SC-8
Lack of innovation in development of new antimicrobials	Incentivise design and development of degradable antimicrobials	**Financial support:** Enhance funding for research and innovation of new antimicrobials to achieve national target of at least 2 percent of the budget	SC-2 SC-8 SC-9
Value chain stage: Distribution			
Inappropriate storage and warehousing conditions	Improve cold storage facilities across the value chain and enhance resilience of warehouses to climate change to avoid spillage during extreme weather events	**Regulation:** Mandatory third-party audit of environmental performance standards and climate resilience of physical assets in the value chain of antimicrobial drug distribution	SC-3 SC-8
Influx of counterfeit antimicrobials at warehouses and pharmacies	Enhance transparency in reporting of antimicrobials inventory and strengthen market surveillance. Through this surveillance, identify hotspots of counterfeit drugs distribution and take action accordingly	**Regulation:** Drug controllers should enhance reporting and regulatory norms on the maintenance of drug inventory **Technology:** Centralised infrastructure for secure data collection, data quality checks, and reporting of drug inventory throughout the value chain	SC-2 SC-6 SC-8 SC-9

Factors contributing to AMR	Recommendations	Drivers	SC Representative
Availability of over-the-counter drugs	Allow sale of antimicrobials only on prescription basis. Pharmacies must log data on the antimicrobial drug sold and details of the certified health professional (including unique identity number) prescribing the drugs. Create a national database of health professionals for improved monitoring and compliance	**Regulation:** Drug controllers must implement norms on selling antimicrobials and regularly inspect the database of medicines sold at sub-national and national levels **Technology:** Centralised infrastructure for secure data entry on sale of antimicrobials	SC-2 SC-6
Value chain Stage: Healthcare facilities (HCFs)			
Sub-optimal prescription of antimicrobials	Improve understanding and prescription patterns of doctors through stewardship programmes at healthcare facilities, including veterinary hospitals, while remaining aligned with the latest WHO guidelines	**Capacity building:** Regular training of medical practitioners for the optimum prescription of drugs, especially newly approved antimicrobials **Capacity building:** Train practitioners for effective communication with patients about the optimum use of antimicrobials	SC-1 SC-2 SC-7
Poor WASH practices by the healthcare staff	Sensitise and train healthcare staff on practices around hygiene, sanitation, safe medicine disposal, and treatment of hazardous waste from HCFs	**Capacity building:** Train healthcare staff on good practices and AMR-targeted on-site wastewater treatment	SC-1 SC-7
Inadequate communication channels for reporting antimicrobial-resistant infections	Strengthen reporting on antibiotic-resistant infections to surveillance teams	**Technology:** Centralised infrastructure for communication with surveillance team	SC-6 SC-9

Factors contributing to AMR	Recommendations	Drivers	SC Representative
Value-chain Stage: Animal and crop production			
Sub-optimal use of antimicrobials in terrestrial breeding, aquaculture, and crop production	Reduce antimicrobial use, boosting animal health through biosafety, immunisation, and good animal husbandry practices	**Capacity building:** Regular training of farmers on good practices **Regulation:** Stringent standards on administration of drugs in the sector	SC-2 SC-4 SC-5
	Avoid administration of antimicrobial drugs in open system (natural water bodies, such as oceans, lakes, rivers) for aquatic animals		
	Promote nature-based solutions to minimise the use of antimicrobials		
	Administer antimicrobials to animals only under veterinary supervision		
Inadequate M&E systems in crop production	Optimise the M&E framework for antimicrobials used in plant protection at sub-national and national levels	**Capacity building:** Regular training of farmers on good practices **Technology:** Centralised infrastructure for monitoring and reporting	SC-4 SC-6
Poor WASH practices by farmers and livestock handlers	Sensitise and train farmers on good practices associated with WASH and the disposal of antimicrobial drug waste	**Capacity building:** Train farmers on good practices	SC-4 SC-7
Runoff from the fields adds to the environmental impact of AMR	Enforce stringent environmental discharge standards	**Regulation:** Revise standards for agricultural runoff	SC-3
	Arrest agricultural runoff and channelise it to wastewater treatment plants	**Financial support:** Support farm owners and wastewater treatment facilities to build sufficient infrastructure to arrest agricultural runoff	SC-4 SC-6

Factors contributing to AMR	Recommendations	Drivers	SC Representative
Value chain stage: Patient and community practices			
Poor communication between patients and healthcare providers	Strengthen communication between doctors and patients through digital platforms (telephonic communication and SMS). Doctors can upload prescriptions and the duration of consumption of antimicrobials on a centralised digital platform through which patients can get daily reminders (in national and regional languages) to take prescribed medicines on time. Similar systems were utilised and were successful during the COVID-19 pandemic and for remotely monitoring TB patients.	**Technology:** Centralised communication system to send reminders to patients to use prescribed antimicrobials for the recommended duration **Capacity building:** Strengthen adoption of digital medical technologies by healthcare practitioners	SC-2 SC-6 SC-7 SC-9
Poor awareness of AMR in communities	Facilitate training for individuals and communities on WASH, safe sex practices, optimum usage and proper disposal of antimicrobial drugs	**Capacity building:** Civil society organisations must utilise a gender-responsive approach, including women and vulnerable and disadvantaged communities as stakeholders, to educate communities on AMR	SC-1 SC-7
	Design public awareness messages using design techniques like pictograms and Otto and Marie Neurath Isotype	**Capacity building:** Use effective and region-specific AMR communication strategies to bridge any language/cultural barriers	SC-1 SC-2 SC-7
	Strengthen education curriculum to include AMR in school	**Capacity building:** Incorporate AMR as a subject at school and university levels, as previously implemented for environmental education	SC-7

Attribution: Dhrubaa Ghosh, Pranav Bhardwaj, and Pankhuri Jain, "Towards Policies to Prevent Antimicrobial Resistance," *T20 Policy Brief*, July 2023.

Endnotes

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