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SOUTH CENTRE

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ABSTRACT

The United Nations General Assembly has taken up Antimicrobial Resistance (AMR) twice in the past decade, but the follow-through on commitments and financing of both Global and National Action Plans on AMR have lagged considerably behind the policymaker pronouncements. The need to update the intersectoral approach to the Global Action Plan on Antimicrobial Resistance requires urgent attention if measurable progress is to be made in tackling this One Health challenge. This paper identifies where progress must pick up and outlines how intersectoral action might catalyze needed next steps.

L'Assemblée générale des Nations unies a abordé la question de la résistance aux antimicrobiens (RAM) à deux reprises au cours de la dernière décennie, mais le suivi des engagements et du financement des plans d'action mondiaux et nationaux sur la RAM a pris un important retard par rapport aux déclarations des décideurs politiques. La nécessité de réexaminer l'approche intersectorielle du plan d'action mondial sur la résistance aux antimicrobiens requiert une attention urgente si l'on veut réaliser des progrès mesurables dans la lutte contre ce défi dans le cadre « d'une seule santé ». Ce document identifie les domaines dans lesquels le progrès doit être accéléré et décrit comment l'action intersectorielle pourrait catalyser les prochaines étapes nécessaires.

La Asamblea General de las Naciones Unidas ha abordado el tema de la resistencia a los antimicrobianos en dos ocasiones en la última década, pero la implementación de los compromisos y la financiación de los planes de acción mundiales y nacionales sobre la resistencia a los antimicrobianos sigue rezagada con respecto a las declaraciones de los responsables políticos. Actualizar el enfoque intersectorial del Plan de Acción Mundial sobre la Resistencia a los Antimicrobianos requiere una atención urgente si se quiere avanzar de forma mensurable en la lucha contra este reto con un enfoque de Una Sola Salud. En este documento se identifican los puntos en los que se debe avanzar y se esboza cómo la acción intersectorial podría catalizar los próximos pasos necesarios.

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I. EXECUTIVE SUMMARY: THE CHALLENGE AND OPPORTUNITY AHEAD TO ADRESS ANTIMICROBIAL RESISTANCE

Twice in the past decade, the United Nations (UN) General Assembly will have taken up the global health challenge of antimicrobial resistance (AMR). Building on the adoption of the Global Action Plan on AMR at the World Health Organization in 2015, concerted action at the UN Food and Agriculture Organization and World Organization for Animal Health followed. In 2019 the UN Inter-agency Coordination Group on AMR shared its recommendations to the UN Secretary-General. A global AMR governance structure has taken shape, and the Tripartite agencies have become a Quadripartite with the addition of the UN Environment Program. Anticipating the need for One Health action that addressed the interconnections of human health, food systems and the environment, an intersectoral alliance of civil society groups and the South Centre have worked as part of the Antibiotic Resistance Coalition to give greater voice to public interest concerns on how to address AMR.

Importantly, attention has focused on the drafting of the 2024 UN General Assembly's High-Level Political Declaration on AMR; however, the global community will need to move from principles to policies and from an inventory of agreed upon positions to actions. Unless there is significantly greater commitment in financing to tackle AMR, one should not place undue expectations on the impact of the UN High Level Political Declaration on AMR.

In addition to mobilizing financing, the critical work will be in broadening the engagement of international agencies and civil society, increasing responsibility of the private sector, strengthening Quadripartite agency capacities and coordination, and setting shared goals under an updated Global Plan of Action on AMR, replacing the GAP with a measurable GPA.

These goals may include adopting:

- A concrete policy framework that prioritizes interventions by local context and responsibility proportionate to inappropriate antimicrobial use in human and animal health;
- Measurable and actionable targets, feasibly implementable and supported with commensurate resources to track progress and contribute to an AMR Watch;
- End-to-end approach to ensure innovation and sustainable, affordable access to health technologies to tackle AMR— not just drugs, but diagnostics and vaccines, and not just in healthcare delivery, but also in the agri-food system;
- Support for initiatives to bolster government regulation and enforcement, align incentives to reduce the use of antimicrobials in food production, and repurpose food subsidies to enable practices less reliant on antimicrobial use;
- One Health approach to tackling AMR that enlists and integrates interventions from WASH to wastewater management and surveillance;
- A comprehensive package of interventions, primarily preventative, that at core might be comprised of near-term cost-saving measures and longer-term investments to turn the tide of AMR; and
- A strategy for mobilizing finances, both domestic and global, by framing the AMR intervention package like a social vaccine adaptable to local context.

II. TAKING STOCK OF THE GLOBAL ACTION PLAN ON ANTIMICROBIAL RESISTANCE (AMR)

Ten years ago, the World Health Assembly called for the development of a Global Action Plan on Antimicrobial Resistance (AMR). Just ahead of these developments, the Antibiotic Resistance Coalition took shape as an intersectoral alliance of civil society groups and the South Centre, united around a shared commitment to tackle AMR.[1]

Not since 2016 has the UN General Assembly focused such attention on the global challenge of antimicrobial resistance. This came on the heels of the adoption of the Global Action Plan on AMR by the Tripartite agencies (WHO, FAO and WOAH) in 2015.[2] At that time, the High-Level Political Declaration deepened commitments to address AMR.[3] It linked AMR to the 2030 Agenda for Sustainable Development, and in the interval, two AMR-specific indicators to monitor progress towards the Sustainable Developments have been added. The Declaration recognized the need for both technical and financial assistance but specified no concrete plans—and little resource mobilization has followed. The Declaration acknowledged "the importance of delinking the cost of investment in research and development on antimicrobial resistance from the price and volume of sales so as to facilitate equitable and affordable access to new medicines, diagnostic tools, vaccines, and other results to be gained through research and development."[4] On both sides of the Atlantic, proposals like transferrable extended exclusivity in the European Union[5] and the PASTEUR Act in the United States fall short of fully delinked incentives. Much of the follow-on guidance rested in the creation of an Inter-Agency Coordination Group on AMR.

In 2019, the UN Secretary General welcomed the recommendations from the Interagency Coordination Group on AMR (IACG) on AMR calling for urgency to scale up the resourcing, implementation and monitoring of national action plans and to take the global measures necessary to address antimicrobial resistance.[6] The IACG report lays out its recommendations in five areas:

- Accelerate progress in countries, with a focus on access and stewardship in NAPs;
- Innovate to secure the future, with a focus on R&D for new antibiotics and technologies to tackle AMR;
- Collaborate for more effective action, both with civil society and the private sector
- Invest for a sustainable response, with both existing and new funding; and
- Strengthen accountability and global response, with recommendations for global governance.

The IACG's recommendations spanned across sectors, but their adoption has been uneven, with notable shortfalls in mobilizing financing to address AMR and to support civil society's engagement.

The recommendations for global governance led, in turn, to the creation of the Global Leaders Group on AMR in 2020 and the convening of the Multi-Stakeholder Partnership Platform in 2023. In 2022, the UN Environment Program joined the Tripartite agencies of WHO, FAO and WOAH to form a Quadripartite. A Joint Secretariat supporting the Quadripartite agencies works to improve coordination and facilitate joint work on AMR.

Still the unfinished challenge of addressing AMR is immense. Only one out of ten countries (11%, or 20 out of 177) reported having "financial provision for the National AMR action plan implementation is included in the national plans and budgets."[7] While trillions of dollars were expended to respond to the COVID-19 pandemic, the Antimicrobial Resistance Multi-Partner Trust Fund has recruited around US$30 million in commitments since 2019.[8]

In September 2024, the UN General Assembly (UNGA) will revisit AMR in a dedicated High-Level Meeting. For the upcoming UNGA High-Level Meeting, the bar should be set higher—a refrain of prior set principles will not pave the road forward. In the lead up to the UN General Assembly High-level Meeting on AMR in September 2024, many actors have sought to steer the direction that the Political Declaration might take. In the negotiations towards a consensus, the focus has been on areas of prior agreement, and this has been reflected in inputs, from some members of the Multi-Stakeholder Partnership Platform (MSPP)[9] to the Global Leaders Group on AMR.[10] From several quarters, proposed global targets have been put forward, several building on those adopted in the Muscat Ministerial Manifesto on AMR. The Quadripartite Secretariat has also shared an economic analysis suggesting that a comprehensive package of AMR interventions might be adopted globally for $46 billion a year. Importantly though, we must prepare for the day after the UNGA High-Level Meeting, and central to that, the updating of the Global Action Plan on AMR.

III. THE GLOBAL CHALLENGE OF AMR

The progress in giving shape to AMR global governance has received greater impetus from an improved understanding of the disease burden behind AMR. The global burden of drug-resistant infections exacts both a toll in human lives and livelihoods, but how should the epidemiology and economics of AMR shape our approach to tackling AMR? The now often-cited Lancet GRAM study estimates the mortality attributable to bacterial antimicrobial resistance (AMR) coming to 1.27 million lives in 2019, a toll that exceeds the lives lost to HIV/AIDS, malaria or breast cancer in that year.[11] While those suffering from infections associated with bacterial AMR came to 4.95 million deaths associated with bacterial AMR, unpacking what is behind these numbers is key.

The geographical disparity in the burden of AMR warrants a strategy based on local or regional context. The burden of bacterial AMR disproportionately falls on those in Sub-Saharan Africa and South Asia. Looking deeper, the Lancet GRAM study found sub-Saharan Africa to have the lowest percentage of deaths attributable to bacterial drug-resistant infections. However, the rate of deaths from such infectious diseases, notwithstanding drug resistance, in this region was so much higher, that it lifted the toll to top all others in the world. This also suggests that this geographical disparity warrants a distinctively different approach as well. The approaches taken to address AMR might differ between regions, where the local drivers of this disease burden trace to underuse or lack of available antimicrobials, where healthcare delivery systems are less resilient to dealing with the impact of infectious diseases, or where other interventions to reduce the overall burden of infectious diseases— not just drug-resistant ones—warrant priority. At the same time, the study of trends in 76 countries from 2000 to 2015 suggested that the antibiotic consumption rate rose by nearly 40%, primarily driven by low- and middle-income countries.[12] However, much of sub-Saharan Africa fell outside of the available data used in this study. Inadequate diagnostics such as for febrile children also allow only a partial capture of whether patients presenting for treatment failed to receive appropriate prescribing and dispensing of antimicrobials.[13]

Underuse of antimicrobials in human medicine demands interventions at different points than just innovation of novel antibiotics or stewarding existing ones. The challenge of antimicrobial resistance faces the paradox that the focus on stewarding better the use of antibiotics belies the underlying problem of lack of access to these life-saving medicines, especially in some low- and middle-income countries. The true magnitude of underuse of antimicrobials is hard to assess given gaps in surveillance and diagnostics. Using global burden of disease figures, however, one study estimated that 5.7 million people die of treatable infectious diseases each year, including lower respiratory infections, tuberculosis and malaria, a figure much larger than the projected number of those dying from drug-resistant infections.[14] Were there effective access to antimicrobials available, their deaths might have been averted. Understandably, underuse even more so than overuse of antimicrobials might be the focus of LMIC policymakers. Countries can hardly be expected to steward what they cannot access.

Such was the policy tension when only one AMR-specific indicator for tracking the progress of the Sustainable Development Goals was put forward in 2019. As originally proposed and adopted, the indicator tracked drug resistance in two priority pathogens found in bloodstream infections of hospitalized patients. This would have taken measure of antimicrobial stewardship, but not of access to the antimicrobials that might have caused such drug resistance.[15] Eventually though, the Quadripartite agencies did create a companion measure out of an existing indicator, one capturing the availability and affordability of antimicrobials within a basket of essential medicines.[16]

AMR-sensitive, not just AMR-specific, interventions could play a critical role in tackling AMR. AMR-specific interventions such as infection prevention and control measures speak to the

need for effective stewardship of available antibiotics. Such measures most directly relate and can be readily counted towards AMR efforts. AMR-sensitive interventions, though more indirect, might reduce the selective pressure on the use of antimicrobials and arguably could make as significant a difference in tackling AMR. As complementary technologies, diagnostics can better target antimicrobial treatment, and vaccines can prevent the infections—bacterial or viral--that might present for antimicrobial treatment.[17] As case in point, water, sanitation and hygiene (WASH) interventions offer a cost-effective, AMR-sensitive intervention. Adequate WASH could have averted 1.9 million deaths, over 40% of which trace to diarrheal disease.[18] At current levels of coverage, vaccinations from pneumococcal conjugate vaccines and live attenuated rotavirus vaccines could help avert, respectively, 23.8 million and 13.6 million clinical encounters requiring antibiotic treatment, particularly among children under five, and have the potential of preventing 40 million such episodes if universal vaccination goals were achieved.[19] Others have also noted the need to prioritize efforts that reduce the burden of infection rather than "costly new antibiotics that can be accessed only by a minority of people attending private or tertiary level academic teaching hospitals."[20]

The intersectoral challenge of AMR involves not just parallel efforts in sectors beyond healthcare, but also work across sectors. Taken as an intersectoral challenge, AMR spans across the healthcare delivery and agri-food systems as well as the environment. The UN Environment Program's global spotlight report, *Bracing for Superbugs*, observes how AMR results when value chains in key economic sectors are overloaded, when the production or consumption of antimicrobials exceeds the carrying capacity in pharmaceutical manufacturing, healthcare delivery system or the agri-food system.[21] SDG 12 (Responsible consumption and production) captures this ecosystem perspective. Such a framing requires understanding 1) the drivers of production and consumption; 2) the patterns of production and consumption; and 3) prioritizing where in the lifecycle production and consumption impact society and environment the most.[22] Integrated surveillance efforts must find strategic, cost-effective tools and actionable measures that track what is important, particularly for human health and agri-food livelihoods. Annually, 600 million cases of foodborne diseases, with 420,000 deaths, occur, providing a clear path for bacterial and drug-resistant infections to move from the food to healthcare delivery system.[23] The globalization of trade, growing urbanization, and the food system's integral connection to health of populations require that intersectoral responses be done in tandem, not just in parallel.

Despite the urgent need and the multiple, clear pathways for addressing AMR, the financing of a global response to this challenge has not kept pace. Unlike other infectious disease control efforts from HIV/AIDS to polio, there is no Global Fund to Fight AIDS, Tuberculosis and Malaria nor a Global Polio Eradication Initiative. Though the UN IACG on AMR called for "additional and increased investment in the global response to antimicrobial resistance, including from domestic financing in all countries," few countries have matched National Action Plans on AMR with comparable funding commitments. In the interval, the response to COVID- 19 had overtaken healthcare delivery systems, leaving them economically strapped, and regrettably, little has ensued to piggyback concerns to address AMR on efforts to ensure future pandemic preparedness and response.

IV. Building Beyond the Foundation of the 2015 Global Action Plan on AMR

IV.A. From one UN agency to a One Health, Quadripartite approach

A decade ago, the World Health Assembly started down the road of drafting a Global Action Plan on Antimicrobial Resistance. Member States supported its drafting, with principles and priorities to act on and "key targets and quantifiable objectives" to take measure of progress.[24] The rationale laid out very much focused on HIV/AIDS, malaria and tuberculosis, with only a nod to drug-resistant bacterial infections. As it took shape, the WHO organized its Global Action Plan of Action around five strategic objectives in 2015 with greater attention to One Health:

1. Improve awareness and understanding of antimicrobial resistance through effective communication, education and training;
2. Strengthen the knowledge and evidence base through surveillance and research;
3. Reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures;
4. Optimize the use of antimicrobial medicines in human and animal health; and
5. 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.[25]

The Food and Agriculture Organization of the United Nations and World Organization for Animal Health would follow with their Global Action Plans on AMR. However, it would take until 2022 before the UN Environment Program would join the Tripartite agencies to form a Quadripartite.

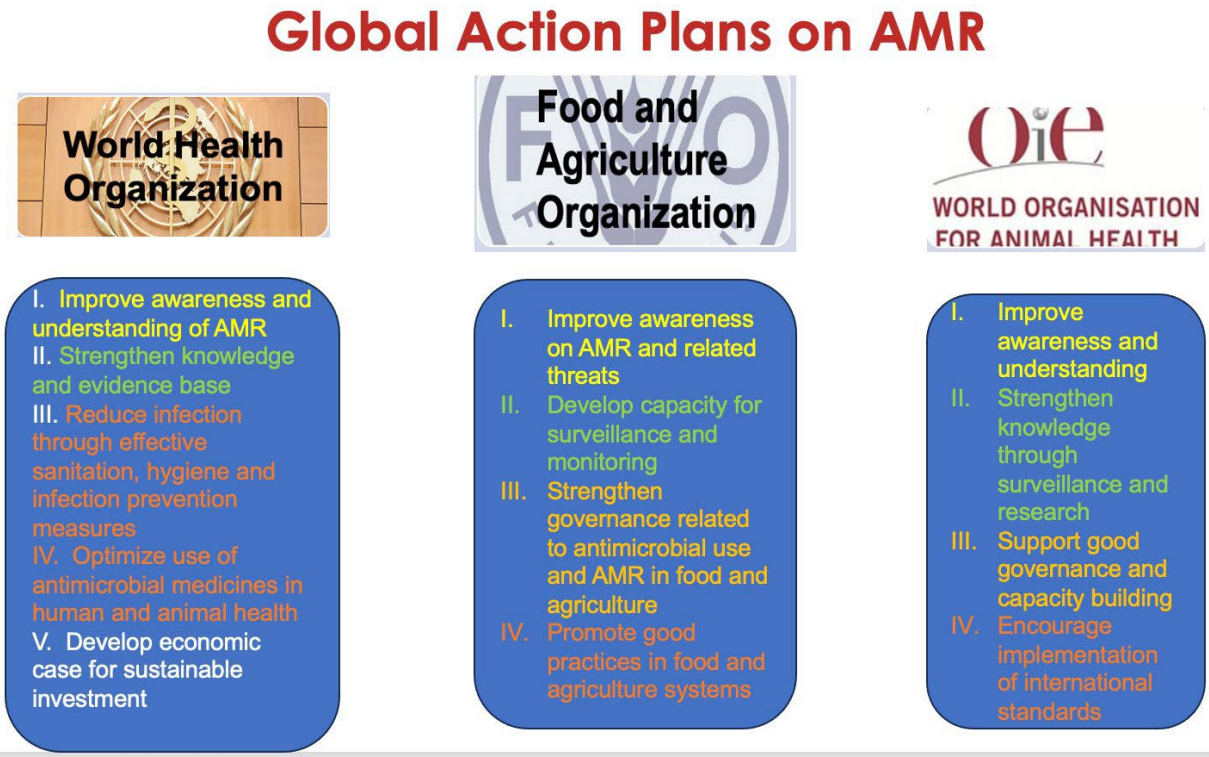

Figure 1: The Global Action Plans across the WHO, FAO and WOAH have similar elements, as the color-coded text suggests, but also important differences in their sector-specific strategies.

While the implementation of Global Action Plan on AMR has undergone independent evaluation, at least at WHO and FAO, each has required mid-course adjustments. The FAO added a fifth, separate objective focused on "promoting responsible use of antimicrobials" as it charted activities for 2021-2025. While not revising its Global Action Plan, the WHO's Division of AMR received a highly critical, mid-term evaluation and has undertaken a number of revisions in how it frames its strategic and operational priorities,[26] most recently at the Executive Board meeting in January 2024. Responding to a public consultation, the Antibiotic Resistance Coalition (ARC) highlighted that the then draft *People-Centred Framework to Addressing AMR in Human Health Sector*[27] could do more to follow the WHO's own *Framework on integrated, people-centred health services*: 1) empowering and engaging people and communities; 2) strengthening governance and accountability; 3) reorienting the model of care; 4) coordinating services within and across sectors; and 5) creating an enabling environment.[28] Drawing from ARC members, examples from the Antibiotic Smart Communities project in India and the "Sumak Kawsay" approach embracing the Andean indigenous vision of life in Latin America to the Innovate4Health global student design competition represented varied ways of engaging and empowering communities and civil society in efforts to address AMR. While few of these inputs appear to be reflected in the final People-Centred Framework or the Strategic and Operational Priorities that follow from it, the WHO Division of AMR began at least to tap into the power of the stories of individuals, if not communities, through the Task Force of AMR Survivors.

The WHO had undertaken a range of important activities, mostly predating the IACG recommendations but continuing today, from the Tracking Antimicrobial Resistance Country Self-Assessment Survey (TrACSS, beginning in 2017), the Tricycle ESBL surveillance project (beginning in 2019), and the WHO Guidelines on Use of Medically Important Antimicrobials in Food-Producing Animals (beginning in 2017) to the AWaRe classification of antibiotics (beginning in 2017), the WHO bacterial priority pathogens list (beginning in 2017), and WHO's antibacterial pipeline analysis (2019).

In 2021, the World Health Organization released its independent evaluation of the WHO Division of AMR's work.[29] The comprehensive evaluation covered the significant challenges of the Division's track record, from the relative inattention to antimicrobial access concerns as opposed to stewardship and the inadequate engagement of civil society and other international agencies to the need to benchmark progress better and work on financing National Action Plans. The COVID-19 pandemic provided WHO an "unprecedented opportunity to find synergy and support for emerging diseases, including drug-resistant infections."[30] However, both this connection and the opportunity to secure greater financing for AMR seemed largely to have been missed.

Recently, the Food and Agriculture Organization has organized its campaign efforts through the RENOFARM Initiative to "Reduce the Need for Antimicrobials on Farms for Sustainable Agrifood Systems Transformation." Over a ten-year period, the RENOFARM Initiative seeks to improve production practices, across the entire value chain from farm to fork, that reduce the need for antimicrobials and promote prudent and responsible use of antimicrobials where needed. At the country level, FAO has piloted efforts to improve biosecurity practices and reduce antimicrobial use among farmers in Indonesia. Through the Indonesian government's NKV certification program, those farms adopting the three-zone biosecurity protocol gain advantage in selling their poultry products on the market.[31] In Zambia, the Global Farmer Field School has sought to train farmers in better animal husbandry practices and thereby reduce their antimicrobial use under a Fleming Fund initiative.[32] FAO has also created Reference Centers for AMR, responsible for engaging stakeholders, bolstering surveillance and supporting the adoption of good practices, as well as Reference Centers specifically for AMR and Aquaculture Biosecurity. Contributing to Quadripartite efforts at integrated AMR surveillance, FAO has established the International FAO Antimicrobial Resistance Monitoring

(InFARM) system. FAO has also played a lead role in supporting the organizing of the Multi-Stakeholder Partnership Platform and developing the Quadripartite One Health Legislative Assessment Tool for Antimicrobial Resistance as well as maintaining AMR-LEX that documents regulations, laws and policies relating to AMR in the agri-food system.

The World Organization for Animal Health (WOAH) provides veterinary guidance on the use of antimicrobials in food animal production. WOAH also maintains the ANIMUSE (ANImal antiMicrobial USE) database, building upon its annual survey of antimicrobial consumption in food animal production. This complements the FAO tracking of antimicrobial resistance data in food animals and plant crops.

Joining the Quadripartite in 2022, the UN Environment Program released a global spotlight report on environmental dimensions of AMR in 2023. With UNEP stepping up its work on AMR, the environmental dimensions of AMR now have begun to appear, from questionnaire items in the Tracking AMR Country Self-assessment Survey and the Global Leaders Group's position statement on climate change and AMR to the Muscat Ministerial Manifesto on AMR, recommendations forwarded from the Multi-Stakeholder Partnership Platform as inputs to the UNGA High-Level Political Declaration, and Zero Draft of the UNGA High-Level Political Declaration. The Global Leaders Group on AMR recognized the need to update the 2015 Global Action Plan on AMR to include environmental dimensions of AMR.[33]

IV.B. Global AMR governance

Two of the three entities, proposed by the IACG, for AMR global governance have taken shape since 2019. The Global Leaders Group (GLG) on AMR comprised of political leaders and experts drawn from across sectors "performs an independent global advisory and advocacy role and works to maintain urgency, public support, political momentum and visibility of the AMR challenge on the global health and development agenda."[34] Its terms of reference flow directly from the IACG Recommendation E2.[35] The GLG, chaired by government leaders from Barbados and Malta, is comprised of twenty members, including one academic, one civil society representative, and two representatives from industry (one from the global pharmaceutical industry and the other from the International Dairy Federation, both from the United States).

The GLG AMR has organized convenings on AMR, often piggybacked on other meetings, from COP28 to the ECCMID; issued a handful of information notes; and put forward recommendations to the UNGA HLM AMR process. Its own meetings have not been open to civil society, and unsurprisingly, its deliberations have gone largely unnoticed. Though it has logically made "Increased mobilization of internal and external financial resources, with a focus on low- and middle-income countries" as a priority area of work, little progress has been made. Instead the Global Leaders Group on AMR has recommended that UNGA HLM "Request the Secretary-General to urgently establish, in consultation with relevant stakeholders, an ad hoc group composed of governments, development banks, multilateral organizations, civil society and the private sector including philanthropy representatives, to define approaches and concrete measures needed for adequate, dedicated, predictable, and sustainable financing from domestic and external sources to address AMR, including research and development."[36] To the GLG's credit, their recommendations to Member States in lead up to UNGA HLM called for targets, building on the precedent set by the Muscat Ministerial Manifesto on AMR—a step over which the Multi-Stakeholder Partnership Platform could not achieve consensus.

The second entity proposed by the IACG, the Multi-Stakeholder Partnership Platform (MSPP), took longer to establish. While launched during World Antimicrobial Awareness Week in 2022, members were not signed up until mid-2023, and its first Plenary Assembly took place in November 2023 in Rome, Italy. With FAO staffing its Secretariat and Steering Committee,

activities have ramped up quickly. Those at the Plenary Assembly noted the need for greater participation from the health and environment sectors. The MSPP is organized into five Stakeholder Clusters, and its over 200 members may participate in over a dozen Action Groups. The limitations of the MSPP structure were raised in advance by the Antibiotic Resistance Coalition both in public consultation and an intergovernmental policy dialogue. These include the disparity in resources to participate in such a Platform between industry trade associations and civil society, the need to ensure representation and voice from LMICs, the challenges in addressing financial conflict of interest in policy deliberations, and the difficulties in advancing catalytic change as opposed to consensus. This critique has proven foresighted as the MSPP continues to grapple with these limitations.

In the lead up to the UNGA High-Level Meeting on AMR in September 2024, several proposed changes in global AMR governance have been put forward. Some have called for the creation of an Independent Panel. In 2019, the IACG had proposed an Independent Panel on Evidence for Action against Antimicrobial Resistance "in a One Health context to monitor and provide Member States with regular reports on the science and evidence related to antimicrobial resistance, its impact and future risks, and recommend options for adaptation and mitigation."[37] As envisioned, the Global Leadership Group on AMR would advise and provide guidance on the Independent Panel's reports. Though purportedly independent, it would be reliant on the Secretariat of the Global Leadership Group and partnership platform, which rests with the Quadripartite agencies, and its funding requirement for convening and commissioning expert analysis was anticipated to be modest. While some imagine that this Independent Panel might draw lessons from the Intergovernmental Panel on Climate Change, such expectations may be misplaced without significantly greater resources, staffing, and expert engagement as well as independence from the Quadripartite agencies. Evidence-based expert guidance already comes from the Quadripartite agencies, which would also be called upon to support the Independent Panel. How could the Independent Panel surmount the gaps in data collection and deficits in country-level capacity to report, assess risks and set priorities suited to the local context? Would additional financial resources be used to support efforts to seal these gaps and to build this capacity? It will be necessary to ensure that the process of establishing and supporting the Independent Panel does not further drain the thinly resourced AMR units in the Quadripartite agencies or NAPs that have garnered meager support from donor funding.

Others have suggested either that a One Health approach to AMR might be embedded within the Pandemic Accord negotiations or be covered in a separately negotiated treaty. *Médecins sans Frontières* wrote of the potential synergy in governance and financing, improved surveillance and laboratory capacity, infection prevention and control, access to medical tools through pooled procurement, diversification of manufacturing, and an open science approach conditioned to ensure greater access.[38] A vision for an international binding agreement, like the International Health Regulations or the WHO's Framework Agreement on Tobacco Control, has long been considered,[39] but the complexity of an intersectoral instrument taking a One Health approach to AMR compounds the difficulties of negotiating such a binding agreement.

In the Pandemic Accord, a proposed "One Health instrument" advanced by the European Union with backing from other high-income countries has run into strong opposition from developing countries and civil society organizations.[40] Unsurprisingly, opponents have raised questions over inequities over access to technologies for surveillance and zoonotic risk technologies,[41] the benefit-sharing that would result, and the disparate impact from the economic repercussions on livelihoods and trade. The source of their objections may prove instructive in understanding how to address similar concerns in tackling AMR. A framework for global coordination might work to recognize flexible approaches to attaining targets, given the differing stages of country development and context; the need to ensure financial and technical support, particularly those not sufficiently resourced to meet targets, as a shared responsibility across countries; and transition periods and milestones set to minimize the impact on livelihoods and trade.[42]

V. UPDATING THE GLOBAL ACTION PLAN ON AMR

The Global Action Plan on AMR serves as a guiding framework for the work of the Quadripartite agencies and for National Action Plans on AMR. The Global Leaders Group on AMR has also recognized the need to update the Global Action Plan on AMR and called for this in its urgent call to Member States in lead up to the UNGA HLM AMR.

V.A. Strengthening Quadripartite agency coordination

A Joint Secretariat serves to connect the units working on AMR within WHO, FAO, WOAH and UNEP. Some challenges have arisen from facilitating collaboration across the Quadripartite agencies themselves. Each Quadripartite agency serves different Ministries even among the same Member States governments. Since 2017, FAO and WOAH have assiduously avoided mention of WHO's *Guidelines on Use of Medically Important Antimicrobials in Food-Producing Animals* though now targets advanced by the Muscat Ministerial Global Leaders Group on AMR have embraced several of the key take-aways from the WHO guidelines (see Table 1).

Table 1: Normative Positions on Antimicrobial Use in Food Production

WHO *Guidelines on Use of Medically Important Antimicrobials in Food-Producing Animals* (2017)[43]	**Muscat Ministerial Manifesto on AMR (2022)[44]**	**Global Leaders Group on AMR Report: Towards Specific Commitments and Action in the Response to Antimicrobial Resistance (2024)[45]**
We recommend an overall reduction in use of all classes of medically important antimicrobials in food-producing animals.	Reducing the total amount of antimicrobials used in the agri-food system by at least 30-50% from the current level by 2030	By 2030, reduce the quantity of antimicrobials used in the agri-food system globally by at least 30-50% from the current level
We recommend complete restriction of use of all classes of medically important antimicrobials in food-producing animals for growth promotion. We recommend complete restriction of use of all classes of medically important antimicrobials in food-producing animals for prevention of infectious diseases that have not yet been clinically diagnosed.	Zero use of medically important antimicrobials for human medicine in animals for nonveterinary medical purposes or in crop production and agri-food systems for nonphytosanitary purposes	By 2030, eliminate the use of medically important antimicrobials for human medicine in animals for non-veterinary medical purposes, or in crop production and agri-food systems for nonphytosanitary purposes
We suggest that antimicrobials classified as critically important for human medicine should not be used for control of the dissemination of a clinically diagnosed infectious disease identified within a group of food-producing animals. We suggest that antimicrobials classified as highest priority	Not addressed directly	Not addressed directly

critically important for human medicine should not be used for treatment of food-producing animals with a clinically diagnosed infectious disease.		

Today the logos of these agencies more commonly appear together on jointly issued documents, and that is an important sign of progress. Understandably though, one agency among the Quadripartite might take lead, and this division of duties is both strategic and necessarily more efficient. For example, the Quadripartite One Health Legislative Assessment Tool for Antimicrobial Resistance could build upon the work of FAO's *Methodology to Analyse AMR-Relevant Legislation in the Food and Agriculture Sector*,[46] or an expert meeting on foodborne AMR, examining the role of environment, crop and biocides, involved FAO and WHO in collaboration with WOAH.[47] However, there is potential to go further, if sufficient resources are made available. Could the work on "WHO Guidance on waste and wastewater management in pharmaceutical manufacturing with emphasis on antibiotic production" take greater advantage of UN Environment Program's work on pollution and health? Could the Quadripartite work on integrated AMR surveillance piggyback off the Global Polio Laboratory Network that involves over 140 laboratories in 92 countries much like COVID-19 surveillance did?[48]

V.B. Broadening engagement of international agencies and civil society

The paradox is that the paucity of resources available to these international agencies makes recruitment and engagement of other key actors critical to their success, but the lack of sufficient resources does hamper their ability to enlist such participation or to prioritize such activities over other core programmatic efforts. Fortunately, some of these partners already work closely with Quadripartite agencies, and AMR is just another lens on the importance of these preexisting collaborations. UNICEF's and WHO's respective roles in WASH efforts, WHO's prequalification of products in UNICEF's tenders for pooled procurement, and commitment to maternal and child health all interrelate with AMR efforts. Gavi, the Vaccine Alliance, works closely with UNICEF and WHO in mounting childhood vaccination campaigns. The World Bank has carried out important economic analysis on the impact of AMR, and the Quadripartite agencies are finally working to extend the costing of a comprehensive AMR intervention package behind the 2018 OECD report, *Stemming the Superbug Tide: Just a Few Dollars More* to non-OECD countries.

In other cases, key actors have contributed to global efforts to address AMR, even if these efforts have neither been tapped nor coordinated closely with the Quadripartite agencies. To curb antimicrobial use in the food supply chain, civil society groups from the US-based Keep Antibiotics Working Coalition[49] to the Alliance to Save Our Antibiotics[50] have applied consumer scorecards on how restaurant franchises and grocery store chains sourced their food animal products without the routine use of antibiotics. Others like Healthcare without Harm Europe have worked to address AMR in hospitals, both through guiding their procurement of food[51] and reducing antibiotic pollution discharges.[52] Similarly, the Sustainable Shrimp Partnership works with Ecuadorian shrimp farms to adopt sustainability practices, including zero-antibiotic use, documents their success in doing so with random checks and lab testing, and applies block-chain certification to food buyers interested in the premium product.[53] Given the limited resources to address AMR globally, Quadripartite agencies would benefit from prioritizing efforts to enlist, coordinate and leverage the collaboration of international partner agencies and civil society.

VI. Setting Shared Goals Under an Updated Global Plan of Action: From GAP to a Measurable GPA

Many challenges to addressing AMR remain. In framing ways in which the Global Action Plan on AMR with a One Health approach might be updated across the Quadripartite agencies and other key international partners, there clearly may be one or more agencies taking lead, but it would be valuable to put into place a shared goal that serves as a unifying operating principle for the collective action of all, with alignment across sectors.

It is less about redefining what are the buckets of action within the Global Action Plan of each Quadripartite or partner organization, but how those areas are operationalized towards a shared goal. “Improving awareness” and “strengthening governance” are fairly meaningless in the abstract but provide useful direction when made concrete. Centering an updated Global Action Plan around shared goals might strategically align and build needed collaboration, both among Quadripartite agencies and with other potential partners, in addressing AMR. Setting specific targets, but allowing the flexibility for different paths to attaining these shared goals would be a critically important update to the post-2015 GAP.

Similarly, while a Monitoring and Evaluation Framework for supporting the implementation of the GAP had been developed and released in 2019,[54] few of the proposed indicators had been successfully operationalized and monitored. The 22 outcome indicators and 26 output indicators were selected not only because they captured an important dimension of the response to AMR, but also because of their sensitivity to note change, measurability by most countries within five years, and ease and cost of implementing. The Monitoring and Evaluation Framework at that time did not set targets given the absence of baseline data or trends. While the Quadripartite’s follow-up on implementing this Framework is unclear, WHO’s independent evaluation of its Division of AMR provided a more telling analysis in 2021:[55]

> While recognizing the importance of understanding progress towards the GAP AMR’s expected outcomes, objectives and goals, the review notes that this is currently difficult because there is a lack of a shared understanding as to what the expected outcomes of the GAP AMR are and what would constitute success. Although the GAP AMR’s M&E framework seeks to address this by identifying a number of outcome indicators, progress toward these is not yet being systematically tracked and reported by the WHO Secretariat. It may be difficult to do this, not least because of the number of outcome indicators identified. While the framework identifies 18 outcome indicators, the review counted these as 34 once compound indicators were separated out. Of these, the review found that three (9%) were incompletely defined, more than half (19, 55%) appeared to lack any data and a further seven (21%) had insufficient data for the purposes of outcome monitoring.”

That would leave five outcome indicators remaining, and clearly work to be done.

To ensure sustainable financing, measurable milestones to track progress in tackling AMR must be in place. The Global Action Plan (GAP) must be succeeded by a Global Plan of Action (GPA) where progress towards shared targets can be tracked, making the GAP into making the grade, a measurable GPA (to wit, Grade Point Average).

VI.A. Develop a concrete policy framework that prioritizes interventions by local context, recognizes the proportionate responsibility that comes with greater use of antimicrobials in human healthcare delivery and food animal production, and considers the opportunity costs for such investments across sectors and countries.

The local context for each country to address and respond to the challenge of AMR varies. This is not an excuse for not working towards common ends, or targets, but a recognition that the means for doing so may differ. Countries may have significant livestock or aquaculture industries, but insufficient veterinarian services; low childhood vaccination rates but high mortality among children under age 5 presenting with pneumonia where there are stockouts of antibiotics; or populations concentrated in urban informal settlements, but inadequate or non-existent municipal sewerage systems. These present targets of opportunity—AMR hotspots that may be geographic or not—for priority setting in National Action Plans.

Tools like the "WHO Costing and Budgeting Tool for National Action Plans on Antimicrobial Resistance" need to be complemented by priority setting tools and modelling that enables a country-level, intersectoral dialogue on the relative, cost-effective yield of different investments in tackling AMR. Building on the OECD's Strategic Public Health Planning (SPHeP) modelling for AMR,[56] the Quadripartite has adapted this work to 14 regions, classifying countries by WHO region and World Bank income group.[57] In lead up to UNGA HLM AMR, this microsimulation model has looked at loss in life expectancy and yearly financial losses in making the global investment case for AMR. By looking at 18 bug-drug combinations and the cost distribution and estimated returns on investment for a range of potential interventions,[58] these efforts might feed into developing a prioritization tool for country-level decision making.

The analysis paints a business-as-usual scenario whereby healthcare systems globally would suffer AMR-attributable economic losses of US$412 billion per year from 2015-2035. Beyond the healthcare sector, productivity losses would mount to 68 million full-time equivalents per year, or monetized based on average national wages, an economic loss of US$443 billion annually. The analysis calls for an investment of US$1.4 trillion between 2020 and 2050, or US$46 billion a year.

However, the top-line findings from this analysis shared in an Annex to the GLG Meeting report raise important questions that ought to be addressed before policy implications are drawn from this work. The model projected the total costs for 13 intervention components, distilled down from 52 priority interventions considered, from 2020-2050 (see Figure 2). Key questions that clearly arise from this analysis are:

- If this $1.4 trillion investment to be overseen is largely dedicated to new antimicrobials (23.3%), WASH (22.5%), and financial incentives (15.6%), is the analysis suggesting that other agencies ought to be running the Global Action Plan on AMR, as all of these areas fall largely outside of the expertise and ambit of the AMR units in the Quadripartite agencies?
- Did the analysis adequately take into account a systems approach when considering complementary technologies to antimicrobials (new antimicrobials, 23.3%, diagnostics 8.1%, and vaccine 0.2%)? If the allocation to vaccines is so small alongside new antimicrobials, has the WHO's previous policy work on vaccines and AMR overstated the value of vaccines, or did this analysis not adequately take this into consideration?
- What assumptions were made on the fair returns on public investment in new antimicrobials, accounting for nearly a quarter of this proposed US$1.4 trillion investment? Were these costs based on the traditional industry R&D model, on a reasonable yield of effective antibiotics, and on affordable access to those patients in need globally?
- To what key actors are the financial incentives directed? What will be the anticipated returns, multiplier effects, and opportunity costs of applying such financial incentives?

- Despite the use of antimicrobials in the agri-food system is three times the volume used in the healthcare delivery system, the investments in food hygiene (1.2%), biosecurity (1.2%) and environmental hygiene (7.4%) suggest modest needs for investment. Is that because they are being funded outside of AMR, or was the model not able to capture fully the returns on these One Health dimensions of AMR?
- How does the model take into account prevention of infections as opposed to prevention of AMR, and how does it weigh the opportunity costs of acting on the former rather than dealing with the consequences of the latter?

These questions and others suggest the need for independent review and analysis of the underlying model, data and assumptions in this work.

Figure 2. Total investment required for the period of analysis 2020-2050 expressed in billion US$, 2020

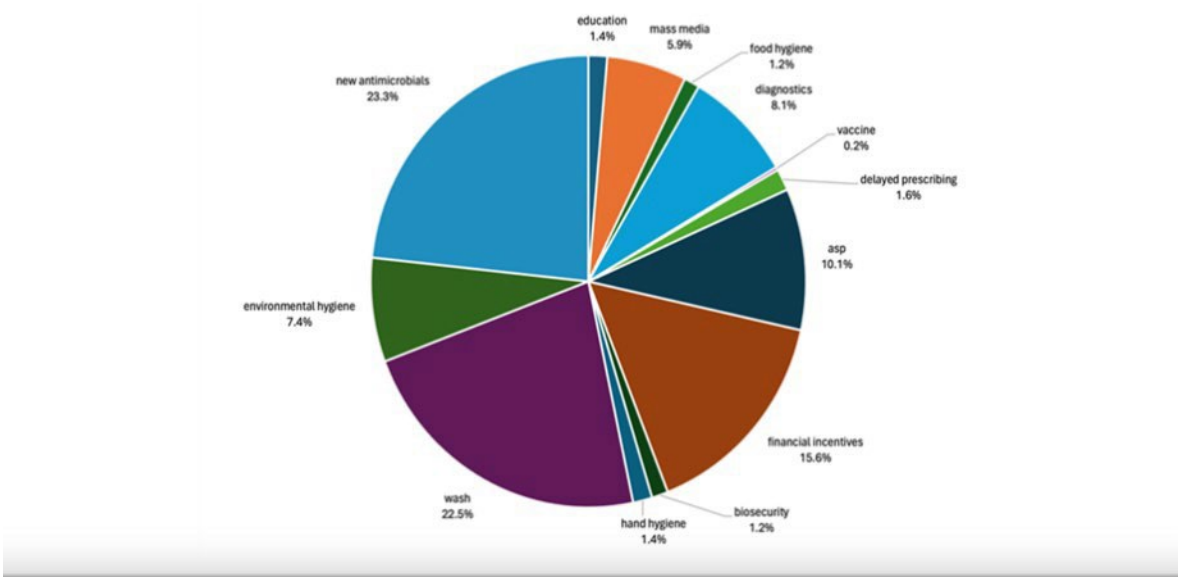

Figure 2: Projected investment for scaling AMR intervention package, 2020-2050
Source: Annex to the GLG Report: Towards specific commitments and action in the response to antimicrobial resistance. Meeting report, April 4, 2024. Available at: https://www.amrleaders.org/resources/m/item/annex-to-the-glg-report

Such a priority-setting framework also would require considering the opportunity costs for various investments to address AMR. While various Quadripartite agencies have separately described priority interventions, this framework should be, to the degree possible, intersectoral, not compartmentalized by sectoral agencies or Ministries. That is, given limited financial resources, which investments would make the most difference in saving lives or reducing economic losses, now and into the future, in tackling AMR? Should the focus be on developing and introducing new antimicrobial drugs or lowering the prevalence of infectious diseases overall through WASH interventions and childhood vaccinations? Equipping both country-level policymakers and development aid agencies and funders with such perspective is core to making the case for investment as well as mobilizing and sustaining such support.

At the country level, prioritizing program activities at the country level will require making tough decisions between AMR-specific and AMR-sensitive interventions and across different economic sector value chains and sectors. The distinction between AMR-specific and AMR-sensitive refers to the primary purpose of the described interventions. AMR-specific interventions focus on reducing AMR spread and transmission, whereas AMR-sensitive interventions have another primary purpose but nonetheless do contribute indirectly to this aim.[59] This is why a National Action Plan (NAP) on AMR is an intersectoral, One Health

undertaking guided by shared goals, such as lowering the toll in human lives and economic losses in healthcare delivery, averting losses in productivity in agri-food systems, and so on. Undoubtedly, data gaps, synergy with existing successful programs, and amplifying results from concentrating efforts on particular points of intervention can all make differences not fully captured in microsimulation modeling of the investment case. However, building the evidence base, providing the scaffolding for decision making, and making explicit the trade-offs and opportunity costs can help better direct and eventually hold accountable NAPs on AMR.

At the global level, the use of antimicrobials in the human health sector, by country, rises with larger populations and with greater burden of infectious diseases. Even adjusting for such differences, significant variability exists across country settings. One study illustrates clearly the need to allow context-specific pathways, exploring a proposed target that antibiotic consumption not exceed a median global level (as measured in defined daily doses per capita per year).[60] Of the seventy-five countries for which data were available, the top five countries ranked highest by per capita consumption (Spain, Algeria, Turkey, Tunisia and Greece) differ from those that topped the list in overall sales (India, China, United States, Brazil, Pakistan).

Strategic considerations in setting priorities require that the underlying causes for the use of antibiotics, the burden of disease and the level of inappropriate use, the challenge of underuse as well as overuse, and the infrastructure in place allow for responding equitably to this challenge. In the study of antibiotic use in healthcare delivery across 75 countries, India and the United States both had per capita antibiotic sales above the global median and, as seen in Figure 3, also among the highest levels of total antibiotic sales. However, the picture of access vs. excess use of antibiotics may differ considerably between these two countries, and so would the approach to rectifying inappropriate use or overuse in these vastly different country contexts.

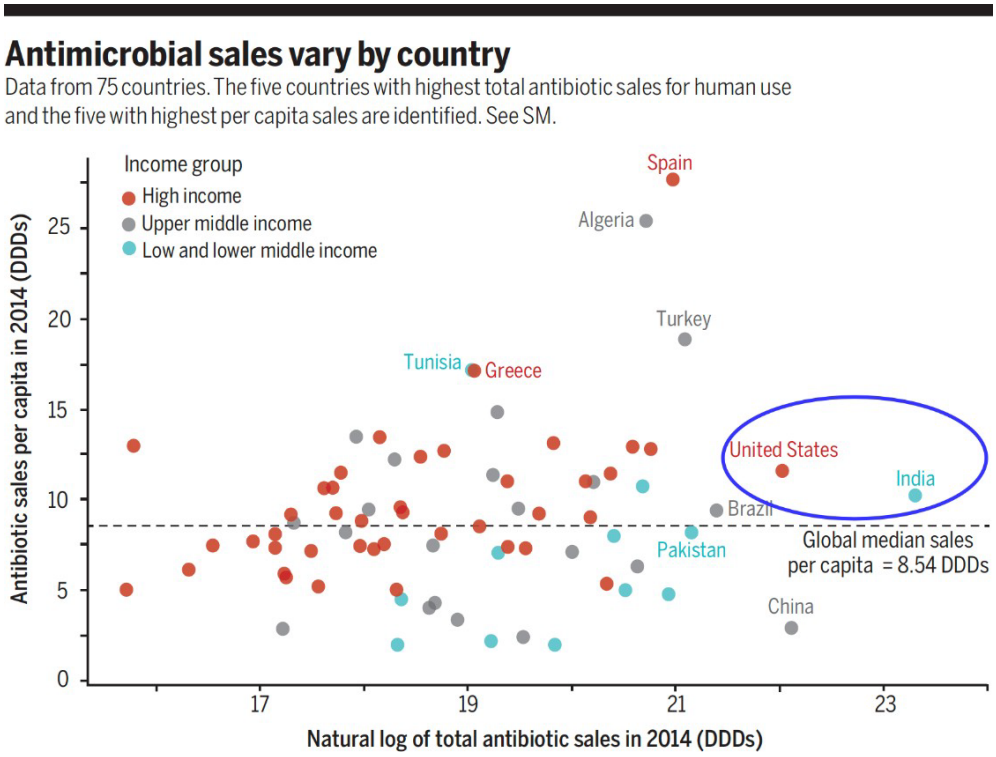

Figure 3: Across 75 countries, this graph depicts country-level antibiotic sales data, both as the natural log of total antibiotic sales in 2014 along the x-axis and as antibiotic sales per capita in 2014 along the y-axis. The volumes of antibiotics were converted by the route-specific defined daily doses (DDD) factor. A global median of 8.54 DDDs per capita was calculated based on available data for the countries in this study, and the plots were color coded by World Bank classification of countries as high, upper

middle, or low and lower middle income. Those countries with antibiotic consumption levels above the dashed line represent those consuming more than the global median level.

GRAPHIC: N. CARY/*SCIENCE*. From Ramanan Laxminarayan et al. Achieving global targets for antimicrobial resistance. *Science* 353,874-875(2016). DOI:10.1126/science.aaf9286. Modified with permission from AAAS.

In the agri-food system, antimicrobial use is heavily concentrated in a handful of countries. One study has estimated that in 2020, China, Brazil, the United States, India, and Australia topped the list of countries using the most antimicrobials for food animal production (cattle, sheep, poultry and swine), and all were projected to see further increases by 2030.[61] Together, these five countries would comprise over half of the antimicrobial use (58%) in these four livestock species across the globe. One could adjust for the size of the domestic livestock industry, but regardless, the effective stewardship of antimicrobials in food animal production relies on compliance by these countries, in particular. Their export of food animal products also can globalize the consequences of shortcomings in their production practices to curb AMR. Of note, only one of these five countries—India--was a signatory to the Muscat Ministerial Manifesto on AMR that committed to targeted reductions in antimicrobial use in the agri-food system. Should these countries bear some measure of proportionate responsibility for acting on this issue?

How can the global community support the transition of these economies, particularly in this group of middle-income countries? To move to food production systems less reliant on antimicrobial use, there will be need for regulation, enforcement, and incentives for alternative practices that improve biosecurity and livestock growing conditions; a ban on the use of antibiotics as growth promoters and for group disease prevention for medically important antimicrobials; and efforts to provide veterinary or para-veterinary oversight on the use of antimicrobials in food-producing animals. Greater transparency of the use, sale and trade of antimicrobials, by class and species, also is needed to ensure better accountability. There is greater urgency for countries exporting food animal products to Europe to undertake these measures. European Union regulation Article 118 will come into effect in September 2026, and when implemented fully, food animal products that involve the use of antibiotic growth promoters or antimicrobials on a restricted list will no longer be allowed as imports to countries in the European Union.[62]

VI.B. Develop measurable and actionable targets, designed to be feasibly implementable in differently resourced settings and supported with commensurate resources, that can be used to track progress and contribute to an AMR Watch.

Setting priorities is closely tied to taking baseline measures and tracking target goals over time. Monitoring such measures is key to ensuring accountability by key actors and by country governments. Meaningful implementation, however, requires both technical and financial support for putting into place surveillance efforts. Public transparency of such measures is critical, particularly if technical assistance for AMR is to be directed to where it is most needed, and if civil society is to engage.

Just as in the Pandemic Accord negotiations, measures and mandates must be accompanied by commensurate resources. Such an understanding may explain, in part, the success of the Montreal Protocol. Absent an AMR treaty, examining its framework could still provide useful insights into what might be required analogously for supporting NAP implementation. Adopted in 1987, the Montreal Protocol has phased out 98% of the ozone-depleting substances compared to the 1990 baseline. The Montreal Protocol divides countries into Article 5 countries and non-Article 5 countries. Article 5 countries are developing countries with annual per capita consumption of controlled substances less than 300 grams. The non-Article 5 and Article 5

countries committed to different, stepwise timetables, Article 5 countries have longer to phase out production and consumption of ozone-depleting substances.[63] By tiering implementation, the Montreal Protocol recognizes country contexts that differ at baseline and by resource levels. Importantly, these commitments were coupled to funding and monitoring under the Protocol. Non-Article 5 countries contribute to a Multilateral Fund based on the UN assessment scale. By 2013, three-quarters of the parties to the Protocol (147 of the 196) had benefited from financial assistance from this Fund, and impressively, all developing countries were reportedly in compliance. Since 1991, the Fund has moved over $3.9 billion towards more than 8600 projects, from industry conversion and technical assistance to training and capacity building efforts. The Multilateral Fund also supports the operation of national ozone units in 145 Article 5 countries. As part of this arrangement, each party commits to delivering to the Secretariat statistical data on the production, import and export of each of the controlled substances, and the Multilateral Fund also undertakes monitoring and evaluation of its projects. The treaty's measures also resulted in co-benefits for climate change—reducing greenhouse gas emissions by 11 gigatons a year.[64]

While an integrated AMR surveillance system is taking shape, the findings from part of this Quadripartite effort remain shrouded. Most notably, the World Organization for Animal Health has conducted an annual survey of antimicrobial consumption in food animal production since 2016. To WOAH's credit, 152 of its 182 members submitted data to varying degrees for the eighth report and the ANIMUSE database.[65] Only 129 of those reporting submitted quantitative data for at least one year from 2020 to 2022, but only 39 out of 129 (30%) allowed their reported data to be made public. Nearly 80% of those countries were from Europe (31 out of 39), and this figure has not budged in years. The list of countries making their data publicly available reveals that not one of the top five countries comprising over half of the world's consumption of antimicrobials in food animal production make their data available.[66] This includes the United States, which actually makes public data on antimicrobials sold or distributed in food-producing animals each year,[67] but has not indicated its willingness to make data publicly available in WOAH's reporting system. Of the 47 countries pledging commitments to the targets lowering antimicrobial use in food production in the Muscat Ministerial Manifesto on AMR, only nine have volunteered to share their data publicly in WOAH's ANIMUSE system.

Several reasons have been advanced to justify non-transparency. Some have argued that country participation in WOAH's voluntary reporting system is paramount, and that participation is contingent on making such country-level data confidential. Consequently, the data collected are much less useful for the community of nations and civil society to hold these countries accountable. However, were this the case, there would still be ways to support WOAH's efforts to encourage countries to report voluntarily their data. For example, most countries do not have domestic pharmaceutical manufacturing capacity. If UN COMTRADE were to code the trade data for pharmaceutical products, destined for veterinary or human medicine use, the export-import data tracking antimicrobial products across borders could pinpoint which countries export colistin—a last-line antibiotic for human medicine—for veterinary use. Pulling away the curtain on this non-transparency would make it harder for those countries not making public their voluntarily reported data to WOAH to justify continuing to do so.

Concerns over how targets might be implemented ought to be systematically addressed rather than just an easy path to rejecting their use out of hand. For example, global targets are not meaningful unless it is clear how they are translated into actionable targets by countries or industry sectors. Principles like proportionate responsibility, roadmaps that offer measures and interventions tailored to differently resourced settings, and targets that reflect varying baseline starting points can all be applied. For example, targets based on a percentage reduction of remaining inappropriate use anticipates the fact that some countries have already made progress on reducing antimicrobials. After all, the percentage of a shrinking denominator of inappropriate use is proportionately smaller. Targets also should be considered not only a goal

to be attained, but also as a way of justifying requests for external technical and financial support. By offering a set of targets that all feed into a larger overarching goal, one might also offer country-level flexibility to prioritize the modalities best suited to achieving these gains in the local context. Operationalizing this may require more technical work to model how such interventions might contribute differentially towards a larger goal. However, by their current allocation of resources to interventions, country-level NAPs already implicitly do just that. A concrete policy framework should try to provide useful guidance to optimize a country's priority setting.

A Global Action Plan should invest in non-governmental mechanisms for monitoring that spur greater accountability. There are many areas where data gaps are a consequence of governmental or intergovernmental inaction. Antibiotic pollution discharges from manufacturing plants are not widely monitored. Data on the use of antimicrobials by food producers and by animal species in the value chain are not readily available. Even bacterial contamination of foods passing through ports of entry and on grocery store shelves undergo spotty inspections, and by and large, remain latent problems to policymakers. Trade in antimicrobial products, destined for use in human medicine as opposed to veterinary use, is not sufficiently nor clearly coded and tracked.

Efforts by civil society can serve as policy triggers for follow-on action. The IACG recommendations clearly called for greater engagement of civil society, including through "strengthening their roles in accountability…and provision of political, financial and technical support,"[68] but not much action has followed. A Global Action Plan might call for an AMR Watch that actively works to empower civil society and communities, together with governments and international agencies, to monitor for accountability. Such an AMR Watch must be free of prior or ongoing financial conflict of interest and vested in institutions and civil society groups that have a track record of effective engagement and independent voice willing to speak truth to power.

VI.C. Enable effective innovation of health technologies to tackle AMR and create an alternative, end-to-end approach to align incentives to ensure sustainable, affordable access to these technologies.

Innovation to tackle AMR can focus on the technology or on practices. Policymaker attention has largely focused on innovation of technologies, notably to address the dearth of novel classes of antibiotics. The traditional business model, however, has failed to produce reliably these advances. The blame for this dearth, going back several decades, has been placed on inadequate returns on investment or insufficient profits to be made. However, that is a significantly incomplete picture of the root problems with the traditional business model under which large pharmaceutical companies operate.

Unpacking the hurdles, one might consider three dimensions to access—therapeutic, financial and structural access. Therapeutic access refers to whether candidate treatments for the disease or condition are in the R&D pipeline. Financial access describes whether the health technologies that come to market are affordable, while structural access considers whether the health technologies are delivered the last-mile to those in need. For a new health technology to make it from bench to bedside, all three hurdles must be surmounted.

The challenges facing antibiotic innovation stem from underlying failings of the pharmaceutical R&D system, but also are compounded by the fact that the biology of drug-resistant infections and the economics of treating these infections are at odds. Selling more antimicrobials drives greater drug resistance. In structuring financial incentives to bring these medicines to market, a core principle has been delinkage, or divorcing the return on investment in R&D from volume-based sales (price x quantity). While some have suggested subscription programs

provide a delinkage incentive, too often this represents just a topping up of payout incentives, an advance market commitment or payment. However, any approach must be balanced by the need to ensure affordability of these products by patients in need, sustainable access over time, and stewardship of these products upon use in the healthcare delivery system. None of these aims are adequately addressed by proposed pull incentives backed by industry.

The industry has called for hiking pull incentives—from transferrable extended exclusivity in the European Union to the Pasteur Act in the United States--that pay for the outputs from R&D. Such approaches fall short of achieving the broader innovation aims required. The bottleneck is upstream in the R&D pipeline: small companies and biotech firms are responsible for the vast majority of innovation, both in the preclinical pipeline (86.7%) and the clinical pipeline (93%).[69] The continuing dearth of truly innovative antibacterials and of oral antibiotics suggest upstream R&D investment must be bolstered further. By contrast, GARDP's cumulative commitments as of its 2023 financial report came to less than US$200M,[70] and CARB-X expended less than half a billion dollars over the first five years of its existence. By contrast, the proposed PASTEUR Act had been budgeted for billions of dollars, and the estimated size of global pull incentives needed for antibacterial medicines is also projected to be between $1.6 billion (best estimate for a partially delinked award for acquisition of a Phase II-ready antibacterial asset) to $3.1 billion (best estimate for a fully delinked subscription), with global peak year sales to ensure profitability coming to $1.9 billion.[71] Not only have such levels of return for bringing novel antibiotics to market seldom been achieved (except in the case of two first-in- class antibiotics, linezolid and daptomycin), the traditional pharmaceutical business model provides no assurances of sustainable access, let alone affordability for those in need globally.

Worse yet, the industry track record has repeatedly brought forward antibacterial medicines of little clinical value added—a raft of me-too drugs without novel mechanisms of action. A succession of incentives--from the U.S. GAIN Act to exempting these drugs from requirements for demonstrating substantial clinical improvement to qualify for new technology add-on payments under Medicare--has continued to lower the bar for receiving incentives, without producing commensurate returns on delivering truly innovative antibiotics. By so doing, perhaps unwittingly, it has become very clear that the traditional pharmaceutical business model will not be able to deliver novel antibiotics sustainably or affordably for the global market. Alternative end-to-end models will have to be considered, and fortunately, two such approaches are near at hand—product development partnerships like GARDP or public sector or non-profit pharmaceutical firms like CivicaRx.

The high projected costs of antibiotic R&D also have prompted the need to consider the opportunity costs of investing in one technology to tackle AMR. Complementary technologies could play key roles in addressing AMR. Enhanced diagnostic innovation in human medicine could not only reduce the selection pressure on antibiotics by better targeting the use of these medicines, but also could reduce the costs of clinical trial recruitment in testing new antibacterial medicines.[72] Diagnostic technology platforms might be adapted for food system and environmental sampling, both contributing to surveillance and monitoring beyond the healthcare delivery system.

Vaccines also could help reduce the selection pressure on antibiotics by lowering the number of patients presenting with infections that might otherwise prompt antibiotic use. Vaccines reducing both viral as well as bacterial diseases can assist with this. WHO has also recognized the role that vaccines might play in addressing AMR.[73] The value of vaccines also extends to food animal production. By ensuring product and market development of interventions to address small-scale livestock diseases, GALVmed has reported to be on track in attaining the ambitious targets of its PREVENT (Promoting and Enabling Vaccination Efficiently, Now and Tomorrow) initiative. Fielding over 200 technicians to bridge the work at hatcheries with local producers, the PREVENT initiative has distributed over 50 million hatchery-vaccinated, day-old chicks across eight African countries in Africa.[74]

So an updated Global Action Plan on AMR must not only consider an alternative end-to-end approach to bringing novel antibiotics to market, but also the opportunity costs, both of investing in complementary technologies like diagnostics and vaccines and of non-technology interventions to tackle AMR. Access to existing, effective antimicrobials would also go a long way in reducing the burden of infectious diseases. Some treatments like benzathine penicillin G may require innovative reformulation, for delivery without a cold chain and perhaps in a depot formulation that would diminish the requirement of intramuscular injections every 3-4 weeks.

VI.D. Reduce the use of antimicrobials in food production by implementing more effective government regulation and enforcement, aligning market incentives, and repurposing food subsidies, without compromising food security, safety or livelihoods of smallholder farmers and food producers.

In many countries, the volume of antimicrobials used in agri-food systems exceeds that used in human medicine. Globally, there may be a three-fold difference. The use of antimicrobials is also projected to grow with intensification of agricultural production and increased demand for meat consumption.[75] Insofar as the classes of antibiotics overlap between human medicine and food animal production, even countries meeting the goals of the WHO's AWaRe classification for managing antibiotics in healthcare delivery must beware of how the use of antibiotics in the agrifood system might undermine the objectives of improved stewardship.

Governments can take effective action to curb the inappropriate and unnecessary use of antimicrobials in food production. Controlling their use in agri-food systems, governments can issue and enforce regulations over the sale, prescribing and dispensing of antimicrobials through veterinary feed directives or in medicated feeds, the removal of antibiotics as growth promoters or in routine preventative or metaphylactic use, or the allowable duration of treatment and testing of antimicrobial residues, drug-resistant pathogens, or antimicrobial resistance genes. Other measures can help realign incentives in the agri-food system through labeling and certification, transparency of antimicrobial use, sales and consumption in the food system, and surveillance as well as technical assistance efforts. By repurposing food subsidies, incentives to implement production practices that promote biosecurity and that are less reliant on antimicrobials would support the transition of the livelihoods of food producers.

The feasibility of ambitious targets is documented in the success that various countries have reported in reducing antimicrobial use in food production. Several examples were highlighted in the Annex to the Muscat Ministerial Manifesto on AMR as the Manifesto laid out the rationale behind quantitative targets for curbing antimicrobial use in food production.[76] Between 2008 and 2012, the Netherlands saw a 50% reduction, and between 2014 and 2021, the UK reduced its antimicrobial use in food animals by 55%. In the five years between 2014 and 2018, China's antimicrobial consumption in the agriculture sector dropped by 57%, and Thailand similarly cut its antibiotic consumption in animals by 49% between 2017 and 2019.

Within the agri-food system, however, progress on the regulatory front has been slow. The European Union banned the use of antibiotics as growth promoters in 2006, and in 2022, extended the ban to group preventative use of antibiotics and some metaphylactic use.[77] The United States found it more expeditious to seek voluntary withdrawal of the indications for antimicrobial use for growth promotion by its 26 veterinary antimicrobial manufacturers.[78] Yet the most recent WOAH survey of antimicrobial consumption in food animal production showed that a quarter of its members continue to use antibiotics for growth promotion, a figure that has stubbornly not changed in recent years.[79] International standards require that a preliminary risk analysis be conducted to justify continued use of antibiotic growth promoters, yet 76% of these WOAH members had not provided such justification. Down the road,

governmental actions may exert greater influence over the use of antimicrobials in producing food animal products in trade. For example, effective on September 3, 2026, food animal products imported into the European Union will be required to be produced without the use of antibiotics as growth promoters.[80]

Till that day, an important complement and spur to more effective government regulation and enforcement will be the work of consumer groups in pressuring food buyers to adopt voluntarily practices that curb the sourcing of food animal products raised with the routine use of antimicrobials. Several members of the Keep Antibiotics Working coalition came together to produce the *Chain Reaction* report that scored the top twenty-five U.S. restaurant chains on their efforts to curb antibiotic use in their supply chains. By selecting these public-facing brands, the *Chain Reaction* report put pressure on food buyers that, in turn, could influence upstream suppliers of food animal products. Over the first three annual reports, five, then nine and eventually fourteen of these restaurant chains –comprising two-thirds of the country's fast food industry revenues—took steps in this direction, primarily for poultry.[81] While consumer groups called for a halt to the routine use of antibiotics in supply chains sourcing food animal products, food producers sometimes went further, with the catchier marketing label, "No Antibiotics Ever." The Centre for Science and Environment drew attention to the double standards of multinational restaurant franchises that made such commitments in the United States, but not in India.[82]

The UK-based Alliance to Save Our Antibiotics has focused on grocery store chains.[83] A study with Cambridge University scientists revealed that a quarter of the poultry sampled from seven major supermarkets carried drug-resistant bacteria, notably ESBL *E. coli*. The Alliance undertook the development of a scorecard. At the outset, only five of nine supermarkets had policies banning the prophylactic use of antibiotics in food animal products sourced, and none reported antibiotic-use data. By 2021, the third scorecard registered that all ten supermarkets had such policies in place, and some had made progress in reporting antibiotic-use data. This work may have contributed, in part, to the decline in antibiotic sales by over half since 2014, and sales of highest priority critically important antimicrobials, by 82%. In May 2024, the UK government enacted a policy banning routine use of antibiotics in farm animals and limited prophylactic use to "exceptional circumstances."

These efforts to make markets work to reduce the use of antimicrobials in the agri-food systems are increasingly being found on the supply side of the food value chain as well. From organic certification to labeling food products as "antibiotic-free," food producers like the Sustainable Shrimp Partnership and the Global Salmon Initiative have undertaken efforts to make their agri-food production value chains more sustainable and, at the same time, reduce or eliminate antimicrobial use. The co-benefits of these sustainability measures warrant further analysis as would be the ways to support a market that might be more willing to pay a premium for food brought to their tables in a more sustainable way.

These voluntary efforts, however, cannot substitute for governmental action. With Tyson, a major poultry producer in the United States walking back its "no antibiotics ever" pledge in 2023, only one of the top four U.S. poultry producers—Perdue—remains committed to this pledge.[84] The repercussions in the supply chain can also be seen, as Chick-a-Fil, a major fast food restaurant franchise, did the same over concerns where it would source antibiotic-free chicken. Voluntary efforts can create the Overton window to take government action and to help transform market incentives in a more lasting way. Along the way, there are many steps that governments can take to support and shape the way markets work to reduce the use of antimicrobials in the agri-food system. Buying through government procurement for schools, public hospitals and the military can help create the demand that sustains the move by food producers to change their practices.

To bolster such efforts, governments might repurpose existing funding sources as a more strategic starting point for policy change. A UN report documented that 87**%** of the $540 billion in global farm subsidies each year were harmful to the environment and price-distorting.[85] Finding a way to adopt more responsible practices on antimicrobial use in the food production system, alongside other sustainability measures, might give greater impetus to transforming the agri-food system and redirecting food subsidies to align with these changes while realizing co-benefits for a more sustainable food system.

VI.E. Enlist and integrate a One Health approach that embraces interventions, from WASH to wastewater surveillance, across sectors and both Quadripartite agencies and non-Quadripartite partners.

Undertaking a One Health approach to tackling AMR can pay dividends in tracking zoonotic disease transmission, monitoring wastewater for emerging infectious diseases, and accelerating water, sanitation and hygiene (WASH) efforts. Justifiably important concerns have been raised over the "One Health instrument" in Pandemic Accord negotiations, and resources commensurate to the measures and mandates sought must be addressed. However, there is ample room to begin where wide agreement exists.

Unlike the more modest reach of the Quadripartite Joint Secretariat on AMR or the proposed Independent Panel, over 30 UN organizations currently operate under the umbrella of UN Water to coordinate efforts on water and sanitation issues. Still the work ahead leaves much to be done:[86]

- 2.2 billion people lack access to safely managed drinking water, and 3.5 billion without safely managed sanitation.
- 2 billion lack basic hygiene services, and unsafe water, sanitation and hygiene account for the deaths of 1000 children under 5 each day.
- Diseases related to poor water and sanitation contribute to losses of productivity amounting up to 5% of GDP.
- Cost savings from averted medical costs and economic returns from increased productivity have been projected:
    - Urban basic drinking water: $3 return for every $1 invested
    - Urban basic sanitation: $2.5 to $1
    - Rural basic drinking water: $7 to $1
    - Rural basic sanitation: $5 to $1

The ISS African Futures project has put together forecasting of scenarios and projections for each country in Africa. Their analysis highlights the potential opportunity in WASH interventions:[87]

- While 70% of those outside Africa have piped water, only 43% of Africans do.
- By boosting WASH infrastructure spending by US$64 billion between 2023 to 2043, the return on investment might yield US$150 billion in reduced healthcare expenditures.

WASH interventions, like other strategic areas of AMR, offer the potential for longer term returns that would repay near-term investments. Designing a financial instrument that could advance this scale of funding today for a pay-off tomorrow has remained elusive.

Wastewater surveillance and treatment efforts could complement WASH interventions. Building on surveillance networks where community trust has been cultivated over years, the Global Polio Laboratory Network might be a starting point before the infrastructure is phased

out with last-mile efforts for polio eradication. While the monitoring protocols and technology involved might well be different than that used for poliovirus surveillance, the sampling of wastewater, the connections with local health authorities, and the communication of results with local communities provide a foundation upon which to build. Similarly, there may be useful experience from a project on global sewage surveillance system for AMR, based out of the Technical University of Denmark, that has recently sought to transition its work to WHO.[88] The opportunity and challenges of carrying this out have been considered by various academic groups.[89,90]

Treating wastewater might take precedence over surveillance and return co-benefits beyond AMR. A core challenge, however, is prioritizing how centralized or decentralized such wastewater treatment facilities might be located. The country context for siting such efforts may depend on existing municipal sewerage infrastructure, the prevalence of open defecation practices, and strategic points for intervention with respect to peri-urban agricultural irrigation with recycled wastewater, contamination of potable drinking water sources, and other factors. The cost of wastewater treatment technology ranges substantially from expensive advanced technologies to more affordable options. While these contextual factors vary across LMICs, a case study of Southeast Asia offers useful insights into how to prioritize these interventions.[91]

Taking a One Health approach to tackling AMR requires considering the opportunity costs of prioritizing interventions with greater returns across sectors. This must be reflected in the prioritization framework, economic cost modeling, and most importantly, the intersectoral policymaking approach undertaken to implement these efforts.

VI.F. Support a comprehensive package of interventions, primarily preventative, that at core might be comprised of near-term cost-saving measures and longer-term investments to turn the tide of AMR.

Clearly the trajectory of AMR's burden of disease will not be reversed by just adding novel antibiotics to the pharmaceutical armamentarium. Prevention would have to be integral to any Global Action Plan (GAP), but does not presently feature prominently in the One Health strategy of the WHO, FAO and WOAH GAPs. An updated Global Action Plan on AMR could give shape to what interventions are effective, cost-saving, and feasible in differently resourced settings as well as offer a policy framework that allows countries to gauge whether they are likely on track or not to making targeted commitments.

Looking at the OECD modelling of comprehensive intervention packages, a mix of infection and prevention control measures, better antimicrobial stewardship and environmental hygiene measures are included.[92] Rapid diagnostic tests also figure as part of the OECD package. Just for US$2 per capita per year, their model suggested that one could avert 47,000 deaths per year in OECD countries. The public health package could pay for itself in under a year and save $4.8 billion per year in these countries.

The bundling of an intervention package serves several useful purposes. Spelling out its potential components can provide a clearer picture of what interventions have been proven to be effective, cost-saving, equity-enhancing, or appropriate to differently resourced contexts. As a bundled package, it could strategically advance the goal of universal health care and lead with what might prove cost-saving as well. Many of the potential interventions—from diagnostics and vaccines to infection and prevention control measures—can bolster the infrastructure of healthcare delivery systems. The integration of One Health interventions across sectors can also be more clearly laid out. Where there are gaps in evidence, it also helps to set meaningful priorities on the research agenda, and it implicitly lays out a theory of change – a hypothesis that if one implements A, then B would result – that can be projected by policy modelling and verified by measurable targets. While there is no certainty that such actions will necessarily generate projected results, this does provide a transparent framework based on the available evidence to make commitments towards shared targets.

Customization of the comprehensive package must take into account the local context. This should reflect context-specific priority setting, identifying interventions that might best move a country towards a common set of targets. However, these would be inevitably different depending on a country's situational context. For example, the size of a country's local food animal industry would influence its strategy—decisions over whether it must move more quickly to respond to export requirements or whether it must rely on para-veterinary workers, livestock or aquaculture vaccines, or other means to ensure greater biosecurity and lower AMR risks. Or the structure of the healthcare delivery system might shape where to position new diagnostic capacity in the pyramid of care, how to manage over-the-counter dispensing or inappropriate prescribing, whether to bundle the use of antibiotics with diagnostic verification of drug-resistant infections, or whether priority should be given to vaccinate or address WASH interventions. This might require extending the work begun under the Quadripartite's building out of the OECD's Strategic Public Health Planning (SPHeP) for antimicrobial resistance modeling.

Only then, building upon this enriched understanding of the local context, can the necessary interplay between priorities, feasible interventions and available resources be worked out. The AMR package might take different forms across countries, some perhaps with a greater linkage to WASH interventions and improved vaccinations or targeting of AMR hotspots in the environment. Putting together a compelling, cost-effective and even cost-saving package would make a huge contribution to country-level efforts to address AMR.

VI.G. Mobilize external and domestic financing that would sustainably address AMR through a comprehensive AMR package, tailored to the local context and financed like a social vaccine.

Even before the pandemic, the World Bank projected that, If AMR went unchecked, up to 24 million more people could be forced into extreme poverty by 2030.[93] Under the high AMR-impact scenario, this could amount to a 3.8% loss of annual GDP by 2050, with an annual shortfall of $3.4 trillion by 2030. The Bank had concluded that "putting resources into AMR containment now is one of the highest-yield investments countries can make."

By investing just $9 billion a year in low- and middle-income countries, one could avert trillions of dollars of potential economic losses. A clear finding from the World Bank's analysis is that one can either pay now or pay much more later. Of note, significant returns on this investment would accrue to LMICs, but over 80% of these returns—as illustrated in Figure 4—would benefit upper middle and high-income countries, the very countries that would be best positioned to make this global investment.

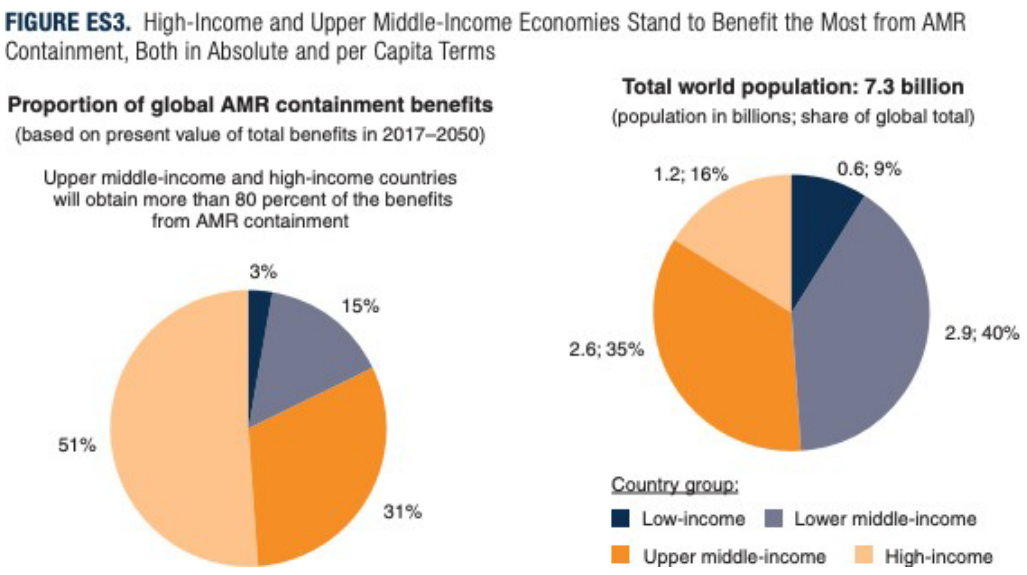

Figure 4: Proportion of global AMR containment benefits
Source: World Bank, *Drug-Resistant Infections: A Threat to Our Economic Future*. Washington, DC: World Bank, March 2017, Figure ES3, page xxi.

Extending the OECD analysis globally, a Quadripartite working group has proposed a comprehensive package to address AMR for US$46 billion each year. Though a welcomed step, it might be challenging to mobilize the needed finances with a price tag of US$46 billion. Despite the magnitude of the AMR challenge, the UN Multi-Partner Trust Fund has only raised around $30 million dollars over 5 years to support the work of the Quadripartite agencies. Taking a lesson from OECD's *Stemming the Superbug Tide* report, the recommendation might be reframed as a specific commitment to a per capita package amount, like $2 per capita, that would cover the hoped-for package by every country.

Several potential sources of funding might be identified to make the overall investment. While it would be magnificent if the community of nations would rally behind a mechanism like the Montreal Protocol to finance the response to this challenge, other approaches might be worth considering in the near term. These might be divided into what financing might be readily available and repurposed (e.g., food subsidies otherwise harmful to health, environment or climate change); what might be easily fungible to allied purposes (e.g., WASH interventions, vaccination campaigns, regional pooled procurement efforts); what might be cost-saving and measurably so (e.g., infection prevention and control measures); and what new funding might be mobilized (e.g., an assessment like the Montreal Protocol).

The prioritization of particular package components could be locally customized. As such, it could be marketed as a social vaccine to address AMR, much as one would buy polio vaccine doses for an immunization campaign. The interventions comprising a social vaccine can act not just as a technological fix, but through social, behavioral, and economic determinants of health. A social vaccine might have key components in common, but different formulations in the country context—proven interventions or technologies like diagnostics and tested practices that make their application effective in the local context. A social vaccine confers benefits both at individual and community level, but the targeting of the intervention may be less focused or reliant on making the case for individual benefit from preventing one specific disease. Like childhood vaccines, a well designed and implemented social vaccine tackling AMR has the potential to save many lives. Evidence of cost savings might motivate investments in campaigns that deliver the social vaccine at scale. Unlike a traditional vaccine, the herd immunity does not result from the biological immunity of

those vaccinated, but from how the impact of interventions in the social vaccine spill over to amplify and reinforce the broader collective actions of others to tackle AMR. Just as any vaccine is partially effective or requires local adaptation for delivery, its impact must be evaluated, so that the return on this investment is measurable. A social vaccine strategically packages a set of interventions for both domestic and global financing efforts, and its composite evaluation can provide the justification for sustaining that support.

VII. CONCLUDING TAKEAWAYS

When WHO originally sought to announce its Global Strategy for Containment of Antimicrobial Resistance on September 11, 2001 in the Washington, DC Press Club, the press conference got cancelled as a result of the ill-fated timing with the terrorist attacks on that dark day. Two decades after that inauspicious start, there is broad recognition that antimicrobial resistance is a One Health challenge that will require more than any one UN agency, any region or country, or any single sector going it alone.

This call to action begins with strengthening the system for global AMR governance. Taking a systems approach, this will require strategically setting priorities, recognizing the opportunity costs of making investments in these priorities, and coordinating effective government action as well as aligning economic incentives to curb AMR. Mobilizing the needed financing to support both a Global Plan of Action (GPA) and National Action Plans must be commensurate to meeting this challenge. Countries that disproportionately consume antimicrobials in human health and in agri-food systems should be asked to step up to their responsibilities. Where resources are lacking, the global community must recognize the shared commitment that we must undertake. As the World Bank has noted, the returns on a $9 billion investment in LMIC efforts to address AMR would disproportionately pay back benefits to upper-middle and high-income countries, those most capable of mounting such a global investment.

Measurable targets to hold key actors accountable are critical to tracking progress, not one more resolution voicing our shared concerns without real commitments. Measures cannot become mandates without the resources to follow through and implement. Supporting both demand and supply side efforts to curb antimicrobial use in food production requires backing civil society where governments have not yet acted and creating markets for food producers that have set the pace for more sustainable practices. Import restrictions on the trade in food products across borders will step up the urgency of supporting the transition of livelihoods to agri-food system practices less reliant on the use of antimicrobials.

This also means rethinking the opportunity costs of where and how we invest in tackling AMR. If the Quadripartite analysis that $46 billion could avert nearly ten times that in economic losses a year holds, would a systems approach to saving lives focus nearly a quarter of that investment on new antimicrobials and 0.2% on vaccines? Would investing in a public sector-led system of innovation, manufacture and pooled procurement help bring drugs, diagnostics and vaccines to market affordably and sustainably, much as the non-profit CivicaRx in the United States or the parastatal Farmaguinhos is doing in Brazil? Taking a page from the OECD's proposed $2 per capita AMR package, could an investment in tackling AMR be better framed as a cost-effective, even cost-saving package, tailored to national context like a social vaccine that both donors and domestic financing might back? Of course, a more perfect world would ensure that novel antibiotics were affordable and available to all in need, ensure WASH interventions and wastewater treatment reduced the underlying burden of infections, and vaccinations were delivered for children and adults that might otherwise present and receive antimicrobials in the healthcare delivery system. However, we live in a world where the UN Multi-Partner Trust Fund has garnered a scant $30 million dollars over five years, while co-benefits go unrealized from redirecting hundreds of billions of dollars of harmful global farm subsidies each year towards more sustainable production practices, including reducing the use of antimicrobials.

Taking these strategic actions will require collective action across sectors, each doing their part, around key shared priority goals that will help to bring unity of purpose, coordination, and synergy to these efforts. While the COVID-19 pandemic was like a tsunami, antimicrobial

resistance is like a rising tide. Before that high tide comes in, we must seize this policy window of opportunity to act before it is too late.

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