White Paper

National Ownership of Antibiotic Access and Use: Driving Policy Decision-Making Based on Population Needs

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Acronyms

AMR	Antimicrobial resistance
ATC	Anatomical therapeutic chemical classification
AWaRe	Access, Watch and Reserve antibiotic classification
CARB	Combating Antibiotic-Resistant Bacteria
CARB-X	Combating Antibiotic-Resistant Bacteria Biopharmaceutical Accelerator
DHS SPA	Demographic and Health Survey’s Service Provision Assessment
DID	Defined daily doses per 1,000 inhabitants per day
EML	Essential medicines list
GARDP	Global Antibiotic Research and Development Partnership
GLASS	Global Antimicrobial Resistance Surveillance System
GLASS-AMC	GLASS antimicrobial consumption program
GLASS-AMR	GLASS microbiology data program
GLASS-AMU	GLASS antimicrobial use program
Global-PPS	Global Point Prevalence Survey of Antimicrobial Consumption and Resistance
GRAM	Global Research on Antimicrobial Resistance
IHME	Institute for Health Metrics and Evaluation
IMI	Innovative Medicines Initiative
MIDAS	Multinational Integrated Data Analysis System
NAP	National action plan
NAAR	National antibiotic assessment reports
NHS	National Health Service
PPP	Public-private partnership
PPS-AMU	Point Prevalence Survey on Antibiotic Use in Hospitals
SARA	Service Availability and Readiness Assessment
SDG	Sustainable Development Goals
UHC	Universal health coverage
WHO	World Health Organization

Introduction

Antimicrobial resistance (AMR) is one of the world's most urgent threats to global public health. AMR occurs when microorganisms no longer respond to available treatments, limiting options for managing and preventing severe infections and increasing the risk of complications, hospital admissions, and death. Antibiotic resistance in bacteria is threatening advances in medical care and can undermine efforts to achieve global public health ambitions. Recent outbreaks and pandemics have further highlighted the far-reaching consequences of infectious diseases without effective treatment, raising questions about preparedness and global coordinated action.

Understanding the magnitude and curbing the impact of AMR requires the convergence of domestic and international efforts, in which comprehensive data collection and appropriate antibiotic use practices come to the center of the equation. The World Health Organization (WHO) has systematically provided guidance and tools to support countries in addressing the threat of AMR, including global targets, stewardship protocols, and the parameters of national action plans (NAPs). However, current trends in antibiotic use and the rising deaths associated with bacterial resistance, in the order of 4.95 million in 2019,[1] suggest the need for improved approaches.

To respond to these challenges, this paper discusses the development of national antibiotic assessment reports (NAARs) as foundations for the design of national antibiotic policies. Using a single standard method to combine multiple antibiotic use datasets within these reports would help to make information comparable within and across countries. As a central hypothesis, the paper proposes that more robust global and national data on antibiotic use can support equitable access and steer sound procurement and financial decision-making. Therefore, creating a more comprehensive assessment of antibiotic use can increase national ownership and improve the AMR response.

This paper is divided into three parts. The first section discusses global trends in antibiotic use over the last decade, reflects on current efforts and challenges to develop new anti-infectives, and highlights the barriers to collecting and processing the right data on AMR. The second section delves into the need for standardized NAARs, including metrics to better inform national antibiotic policies and monitor progress, and presents an analysis of gaps in current NAPs. The third and final section elaborates on the partnership frameworks required to enable NAARs and national antibiotic policies and integrate multi-disciplinary technical capabilities to better monitor antibiotic use and the trajectory of AMR.

This paper is the result of a collaboration between IQVIA, City St. George's University of London and the University of Oxford, and builds on the insights and analysis of a wide body of research and publications conducted separately and jointly by the authors.

Section I. Understanding antibiotic use in humans

Current trends in antibiotic use

An analysis of IQVIA data covering pharmacy sales in 87 countries from 2013 to 2023 describes the use of antibiotics based on defined daily doses per 1,000 inhabitants per day (DID), showing an increase worldwide with noticeable variations across regions.[2] Antibiotics selected for review are representative of the Access, Watch and Reserve (AWaRe) groups, a WHO classification set in 2017 to support surveillance; cluster antibiotics according to their spectrum of activity, clinical effectiveness and potential to develop resistance; and ensure appropriate use and long-term stewardship. The 2022 AWaRe Antibiotic Book provides detailed guidance on the optimal use of antibiotics in adults and children, with recommendations on the choice of antibiotic, dose, and treatment duration for 35 common infections managed in primary and secondary care.[3]

Based on this categorization, Access antibiotics are characterized by oral extended-spectrum penicillins. This group is recommended for around 80% of common primary care infections and is known for its good safety profile and affordability.[3,4] The Watch group covers broader spectrum antibiotics normally used for specific clinical indications with higher potential for resistance. In this case, given the growing concern over their inappropriate use, the analysis focused on oral third-generation cephalosporins. Lastly, Reserve antibiotics are used as a last-resort measure to manage severe multidrug-resistant infections. Use trends examined for this group selected parenteral polymyxins as a representative class. Table 1 summarizes these definitions and antibiotic selection using a broad policy and public health approach.

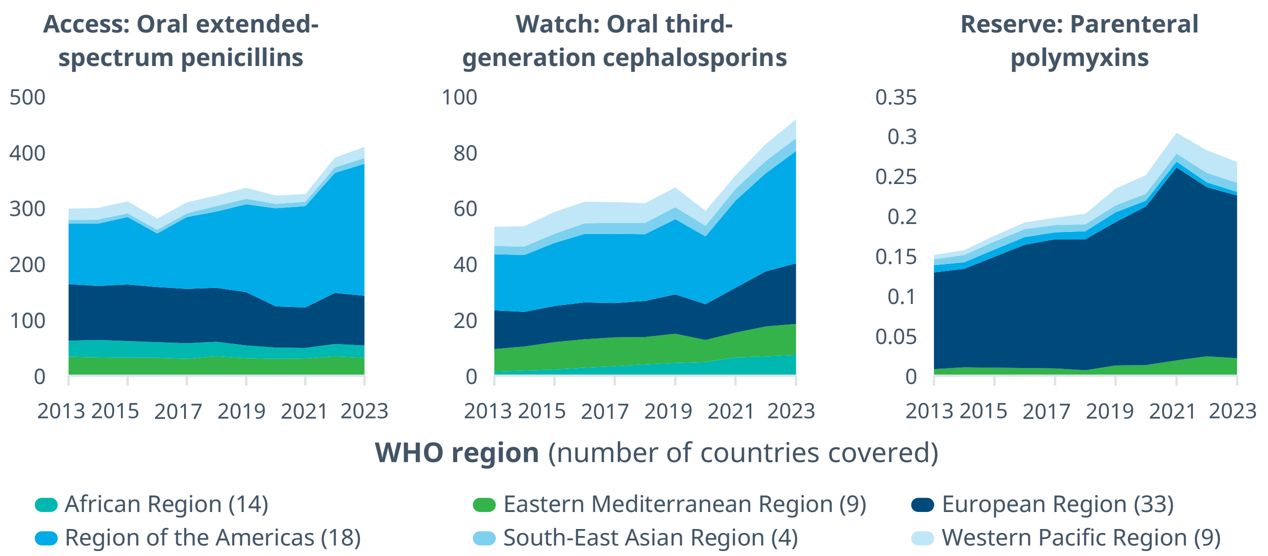
Table 1. Definition of antibiotic groups and formulations selected for analysis, including WHO's anatomical therapeutic chemical (ATC) classification

ANTIBIOTIC AWARE CLASSIFICATION	GENERAL USE	CLASSES SELECTED FOR ANALYSIS	ATC CODE
Access	Common drug-susceptible infections	Oral extended-spectrum penicillins	J01CA
Watch	Limited number of severe and drug-resistant infections	Oral third-generation cephalosporins	J01DD
Reserve	Multidrug-resistant infections	Parenteral polymyxins	J01XB

Source: World Health Organization[5]

Figure 1 shows an overall increase in the use of antibiotics in all three AWaRe categories. While the use of Access oral extended-spectrum penicillins decreased in some WHO regions, it increased in others, most notably in the Americas and South-East Asia. Concurrently, the use of Watch oral third-generation cephalosporins and Reserve parenteral polymyxins grew globally.

Figure 1. Regional antibiotic use across three AWaRe representative drug classes from 2013 to 2023[6]



Note: Antibiotic use is quantified in DID to provide a standardized approach.[6] Y axis is different due to proportions measured.
Sources: IQVIA EMEA Thought Leadership based on analysis of IQVIA MIDAS data and World Bank World development indicators[7]

The examination of population-adjusted volume data covered in figure 1 is helpful to understand use trends, but it provides limited insights as a stand-alone resource. To accurately interpret changes in antibiotic use at the national level, analyses should incorporate other relevant sources, particularly contextual data on the current burden of infection, prevalence of resistance, and other drivers of population health needs. Relying solely on antibiotic use data for policy development could reduce access to essential medicines needed for effective and efficient infection treatment. Finally, while it is crucial to minimize unnecessary exposure to antibiotics to slow the development and spread of AMR, a balance must be struck between maintaining access to effective, affordable, and safe antibiotics and preventing their overuse when not clinically required.[8]

A decreasing pipeline of new antibiotics

In addition to the rising threat of antibacterial resistance, the shrinking pipeline of novel therapies reduces the number of effective treatment options. The waning commercial interest in developing new therapeutic tools is a consequence of (1) inadequate incentives and policy support; (2) the high cost of antibiotic discovery; (3) the complexity of clinical trials for investigational and last-line drugs; and (4) the rapid emergence and spread of resistance, often within a few years of a new antibiotic entering the market.[9]

As commercial incentives are insufficient, estimates indicate that supporting antibiotic innovation requires an average of US$1.2 billion in public funding every year, through either direct donor contributions or the deployment of innovative financing mechanisms.[10] With the drying pipeline of new antibiotics, where only 12 new antibiotics were introduced to the market between 2017 and 2021, it is more critical than ever to ensure the optimal use and close monitoring of existing effective therapies.[11]

Consequently, the redevelopment of older generic antibiotics, such as polymyxins first approved in the 1950s, is also important. Despite their potential nephrotoxic and neurotoxic properties, polymyxins remain effective against some multidrug-resistant organisms, reinforcing their renewed clinical relevance, albeit in restricted clinical cases as Reserve group antibiotics.[12]

The need for more robust and representative datasets

Significant efforts have been undertaken to gather data electronically on antibiotic use (especially by measuring aggregate facility-level volumes through procurement and dispensing statistics) and the circulation volumes of these medicines across global markets (usually captured through imports, manufacturing and wholesale insights). Despite the existence of these multiple sources, ranging from the individual to the global level, antibiotic use data is still fragmented and incomplete. More importantly, it is not properly standardized or integrated across interoperable systems.

To collect individual-level data, hospital point prevalence surveys (PPS) or household surveys, facility exit interviews, and prescription reviews are commonly utilized. Countries with electronic medical records may also have large-scale patient-level data available. These resources favor institutional monitoring of antibiotic use over time, but individual databases are difficult to consolidate as studies are conducted at various points in time and employ diverse methods. Without a robust sampling strategy, it cannot be assumed that institutions participating in these exercises represent antibiotic use nationally.

WHO's Point Prevalence Survey on Antibiotic Use in Hospitals (PPS-AMU) offers serial cross-sectional antibiotic prescribing information collected at the patient level from participating hospitals.[13] Similarly, the Global Point Prevalence Survey of Antimicrobial Consumption and Resistance (Global-PPS) conducts surveys among participating hospitals across 95 countries, which can assist as local quality improvement and global surveillance tools.[14] These surveys provide benchmarks for other institutions in the context of local and regional audits, although they are not necessarily representative of national antibiotic use.

WHO's Global Antimicrobial Resistance and Use Surveillance System (GLASS) represents one of the most important resources available to monitor and share national data on AMR and AMU through a standardized approach.[15] Launched in 2015, GLASS features two programs: GLASS-AMR, to collect microbiology and some patient-level data, and GLASS-AMU (formerly, GLASS AMC), to estimate medicine-level antibiotic use volume from routinely collected data across the antibiotic value chain.[16,17] This platform allows countries to generate local, reliable and comparable data on AMR and antibiotic use through a voluntary and inclusive process. GLASS also encourages and supports evidence-based policymaking and the development of NAPs to combat AMR. The GLASS methodology is flexible, allowing the use of data from different sources to facilitate country participation and improve the coverage and representativeness of surveillance data.[18] GLASS-AMU is rapidly increasing the number of countries reporting to WHO and improving data completeness, but there is a need to enhance the overall assessment of population exposure to antibiotics in both primary and hospital settings.

IQVIA's Multinational Integrated Data Analysis System (MIDAS) is a platform for assessing worldwide healthcare markets. It integrates IQVIA's national audits into a globally consistent view of the pharmaceutical market, tracking products in hundreds of therapeutic classes, and offers estimated product volumes, trends and market share through retail and non-retail channels. Using public and private sector sources, MIDAS provides comprehensive country coverage in 94 countries, allowing cross-country comparisons and access to relevant country-level data. The platform delivers solutions to stakeholders across emerging and established companies, international and non-governmental organizations, and healthcare authorities. Figure 1 represents data from 87 countries with a median market coverage of 97%. Despite the wealth of information within MIDAS, this database focuses on one element of antibiotic use and variability in coverage may restrict comparisons across regions.

Section II. National antibiotic policies as vehicles to optimize antibiotic use and access

Developing national antibiotic policies as a core component of national action plans

NAPs are a core component of country-level commitments to preventing and addressing the risk of AMR and WHO has promoted their use since the mid-2000s.[19] From a public health perspective, NAPs represent domestic strategies to manage the use of antibiotics, strengthen surveillance and monitoring systems, improve infection prevention and control, and enhance public awareness and education. NAPs recommend multi-stakeholder coordination at the local level to ensure that health authorities, life science companies, healthcare providers, and other relevant actors engage in the prevention or impact reduction of AMR. Ideally, NAPs should also provide roadmaps for the design and implementation of national policies that reduce the emergence and spread of drug-resistant infections and optimize the use of antimicrobials. However, NAPs have mainly focused on antibiotic stewardship at the individual patient level and only a few of them have resulted in comprehensive national antibiotic policies.

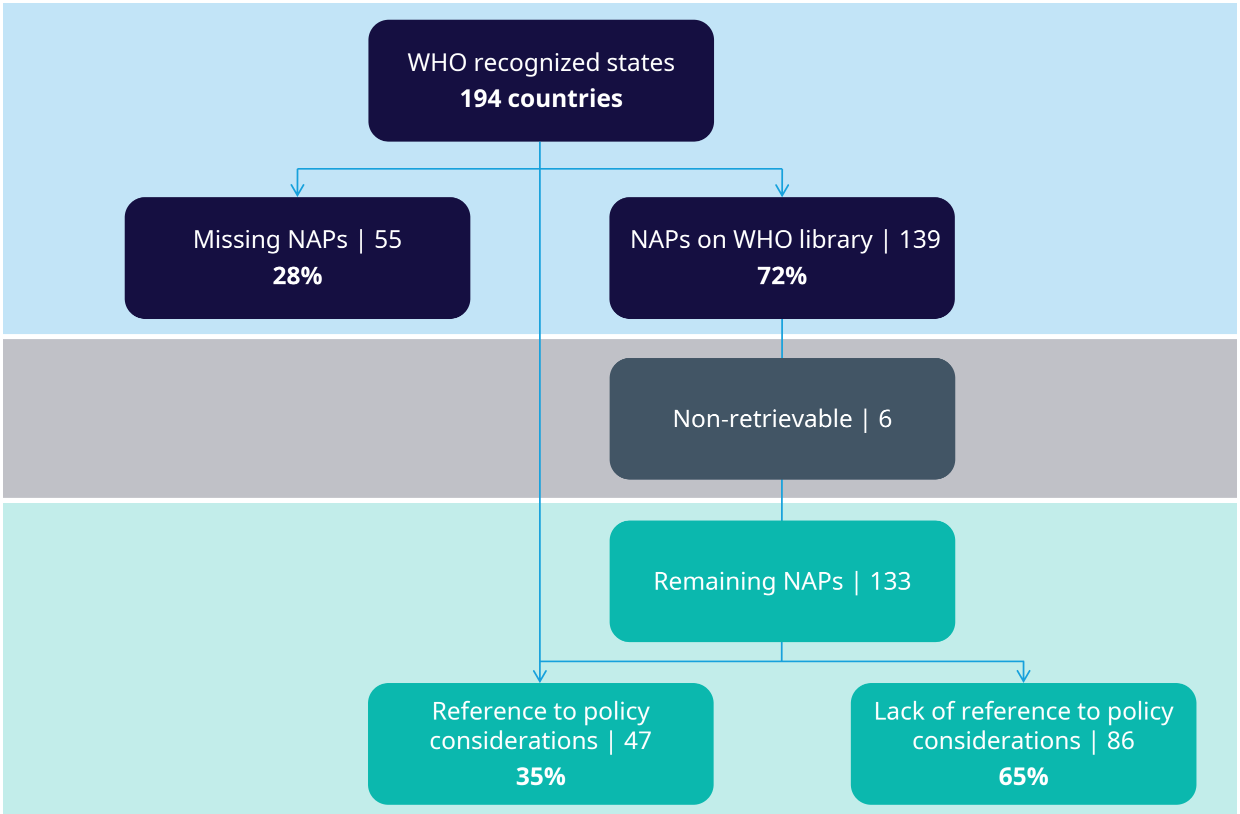
NATIONAL ACTION PLANS IN PERSPECTIVE

Out of 164 available NAPs, 139 correspond to unique entries by countries and 25 are updated versions of pre-existing documents. The analysis covered all documents available at the WHO library of AMR NAPs, including original and updated versions. Six files were not retrievable and could not be reviewed, only allowing for the assessment of 133 NAPs in total. Overall, 55 countries have not yet submitted their NAPs. This represents 28% of the 194 states in WHO regions. Regarding national antibiotic policies, only 35% of NAPs had a comprehensive and targeted strategy towards antibiotic use.

A systematic review of 133 available NAPs involved identifying terms that suggested the existence or need for national antibiotic policies through language referencing procurement, responsible or rational use, consumption, supply chains, and quality control. The analysis explored the presence of these provisions within normative or operational statements under the assumption that accompanying antibiotic use policies or similar regulatory frameworks could be in place. Based on these parameters, only 35% of NAPs had a comprehensive and targeted strategy on antibiotic use or mentioned arrangements for the fulfillment of policies with timelines, funding, and risk mitigation considerations, in line with the conclusions of previous studies.[20] In many cases, when countries decided to go beyond WHO templates and pre-set objectives within NAPs, the need for establishing or developing antibiotic policies rarely included supporting evidence or implementation details. Figure 2 presents a summary of these findings.

NAPs are not all the same and gaps and variability exist in their development and operationalization. Some NAPs can cover a variety of complex issues that would be more fitting for the policy definition that this review sets forth. For example, the National Action Plan for Combating Antibiotic-Resistant Bacteria (CARB) in the United States outlines a comprehensive strategy for improving antibiotic stewardship, enhancing surveillance, and promoting the discovery of new antibiotics and diagnostic tools.[21] Similarly, the United Kingdom's Five-Year Action Plan for Antimicrobial Resistance 2019-2024 focuses on reducing the need for antibiotics, including clear targets for national optimal use and supporting innovation in antimicrobial research and development.[22] At the regional level, the European Union's Action Plan on Antimicrobial Resistance suggests measures to improve the prudent use of antimicrobials, enhance infection prevention and control, and stimulate research and innovation.[23]

Figure 2. References to national antibiotic policies in available NAPs as of August 2024



Source: IQVIA EMEA Thought Leadership analysis based on WHO's library of AMR NAPs

Although NAPs are failing to recommend the formulation of national antibiotic policies, the data to support the latter is often lacking. In this context, establishing comprehensive NAARs based on data collected through a single standard method can help countries define national antibiotic policies that meet their population's health needs. Greater clarity on disease burden and antibiotic use can inform decisions on access, procurement, and financing, and facilitate the sharing of knowledge domestically, regionally, and globally.

Population health factors informing national antibiotic policies

There is no standard method to set global or regional antibiotic targets or to account for the varying population health needs of individual countries. Previous targets focused on proportions, with one global target recommending that 60% of national antibiotic use should be restricted to the Access group by 2023.[24,25] In the case of a specific region, the European Council recently invited member states to ensure that the total consumption of antibiotic use in humans across the primary care and hospital sectors is reduced by 20% by 2030 compared to the 2019 baseline. It has also recommended that at least 65% of the total use in countries should be of Access group antibiotics as defined by the WHO AWaRe system.[26] A recent Lancet series on AMR indicates that several countries are not achieving this target, flagging a wide variation in the levels of absolute total antibiotic use.[27]

Population health factors with the potential of influencing national antibiotic policies and targets can be grouped into several categories, including healthcare structures (e.g., gross national income, universal health coverage [UHC], and access to healthcare facilities); population demographics (e.g., age structure, sex, and rural population); burden of infections; key antibiotic resistance patterns; burden of comorbidities (or conditions that impact the severity of infection outcomes); and uptake of potential prevention measures (e.g., vaccination coverage, and water, sanitation, and hygiene). Population-level estimates are available for most countries from various data sources such as the World Bank, Global Burden of Disease from the Institute for Health Metrics and Evaluation (IHME), the Global Research on Antimicrobial Resistance (GRAM) project, WHO's GLASS, and the WHO data observatory. In some cases, countries have national sources to help inform the levels of AWaRe antibiotic use needed at a population level.

Combining guidance from the WHO AWaRe Antibiotic Book with burden of disease and population factors as key components of NAARs can help in the estimation of risk-adjusted levels of Access, Watch and Reserve antibiotics needed at the national level. This calls for greater investment into the collection of more accurate local data through, among other measures, the definition of precise NAAR-embedded indicators and metrics. Countries with available or developing electronic health records (i.e., demographic, clinical and microbiological data) can start to fill this gap with patient data. In cases where healthcare systems are more fragmented or patients seek care in diverse settings, such as pharmacies and the informal sector, utilizing available national data could be beneficial for evaluating population antibiotic needs.

Connections between national policies and sustainable antibiotic access

Access to effective essential antibiotics is critical for achieving UHC, which is consistent with the aspiration of Sustainable Development Goal (SDG) 3.8.[28] By deriving population health needs for AWaRe antibiotics, national antibiotic policies and global and national access targets can be more robustly developed to ensure sustainable access to these treatments.

While GLASS provides a flexible method for measuring antibiotic use, many member states report from a single data type that may differ between countries and over time. Therefore, national assessments of overall antibiotic use at the population level are a practical solution with great potential to fill this gap. NAARs can act as a central data compendium that makes population-level antibiotic use and disease burden considerations visible and comparable. This effort would entail the creation of a standard framework and models for combining numerous antibiotic use datasets within a country, maximizing the information already available on the ground. In instances where this information is incomplete, additional analysis and the imputation of missing data to inform population estimates will be necessary. This is particularly true for health systems relying heavily on paper-based records.[29]

Developing future NAARs should consider total and relative patterns of AWaRe antibiotic use in DID as critical indicators, with the possibility of further disaggregating data by antibiotic class. Other metrics could cover quality indicators for antibiotic use at a healthcare facility or aggregate level. Alongside current use, the assessment of availability of antibiotics at healthcare facilities could serve as an additional measurement. The Demographic and Health Survey's Service Provision Assessment (DHS SPA) and WHO's Service Availability and Readiness Assessment (SARA) surveys are clear examples of this process, which also factor pricing in their structure.

By having more accurate information on antibiotic use and population health data, countries can anticipate the volume of antibiotics necessary to satisfy local demand and gauge the impact of existing treatments. Based on these parameters, national governments can adjust national essential medicines lists (EML), allocate resources, recalibrate health system practices, address capacity and infrastructure gaps, and streamline procurement to ensure that the right antibiotics are available, accessible, and affordable.

Section III. The value of cross-sectoral collaboration in national antibiotic policymaking

Establishing a fruitful national policy dialogue and steering it with the right data and reporting requires the participation and engagement of a variety of stakeholders. No single dataset can offer the level of detail to entirely measure antibiotic use nationally, regionally or globally, unless they are properly articulated. The development of NAARs could bring together public and private actors to effectively leverage multi-sectoral capabilities and flesh out the solutions this paper proposes, especially the need for partnerships to facilitate additional sharing of antibiotic use data in support of national and global surveillance efforts.

The role of public-private partnerships in addressing antibiotic use

Public-private partnerships (PPPs) offer many advantages in the response to AMR, including enhancing research and development efforts by pooling resources from governments, international organizations, and private sector entities. For this reason, PPPs are a foundational component of national antibiotic policy formulation and execution.

The role of existing PPPs has been pivotal in moving the AMR agenda forward in terms of clinical research, innovation, data-sharing, access, funding, policy incentives, and advocacy activities. The examples captured in figure 3 summarize the contributions of four organizations leveraging PPPs to accelerate the development of new drugs, facilitate their access, and raise awareness around AMR and responsible antibiotic use.

Assessing national antibiotic use and informing antibiotic policies also calls for a partnership approach. At the country level, engaging national AMR committees and medicines and procurement agencies, involving actors responsible for EMLs, could bring forward more coordinated action. Stakeholders partaking in the creation and updating of NAPs are also central to this conversation. Integrating the national AMR committees and medicines access and procurement government agencies would also be beneficial for advancing UHC and antibiotic policies more efficiently. Medicines procurement agencies in both the public and private sectors have had a limited role in AMR discussions thus far, but their participation is critical to better understand the barriers and enablers of national antibiotic policy development.

Figure 3. Examples of successful PPPs in addressing AMR-related challenges

AMR Action Fund	Global Antibiotic Research and Development Partnership (GARDP)	Combating Antibiotic-Resistant Bacteria Biopharmaceutical Accelerator (CARB-X)	Innovative Medicines Initiative (IMI)
• Drives innovation in antimicrobial development by investing in companies working on urgently needed treatments for priority pathogens. • Advocates for market reforms to ensure society appropriately values antibiotics. • Aims to bring two to four new antimicrobials to market within the next decade while fostering a sustainable ecosystem for investment and innovation. • Seeks to secure a future where effective treatments for resistant infections remain available by addressing one of the most significant global health challenges.	• Supports the development of treatments for drug-resistant bacterial infections through the de-risking of research and manufacturing. • Addresses the urgent global health threat of AMR by driving innovative research to bring new and effective antibiotics to market in collaboration with public, private, and non-profit partners. • Seeks to make treatments accessible to all, regardless of geographic or economic barriers. • Aims to preserve the effectiveness of antibiotics for future generations and make a lasting impact on global health.	• Seeks to accelerate the development of antibacterial products to tackle drug-resistant bacteria. • Provides non-dilutive funding as well as scientific, regulatory and business support to product developers • Integrates solutions for the prevention, diagnosis, and treatment of life-threatening bacterial infections, moving innovations from basic research to clinical trials. • Aims to bring lifesaving innovations to market, focusing on bacteria identified as top priorities by WHO and the U.S. Centers for Disease Control and Prevention.	• Invests in developing new antibacterial strategies through PPPs. • Incentivizes drug development in areas of unmet medical need by sharing the financial burden between the private and public sectors. • Funds public partners, including academia, subject matter experts, patient groups, and regulators. • Designs and executes public education campaigns and training programs to raise awareness about the dangers of antibiotic resistance and the importance of responsible antibiotic use.

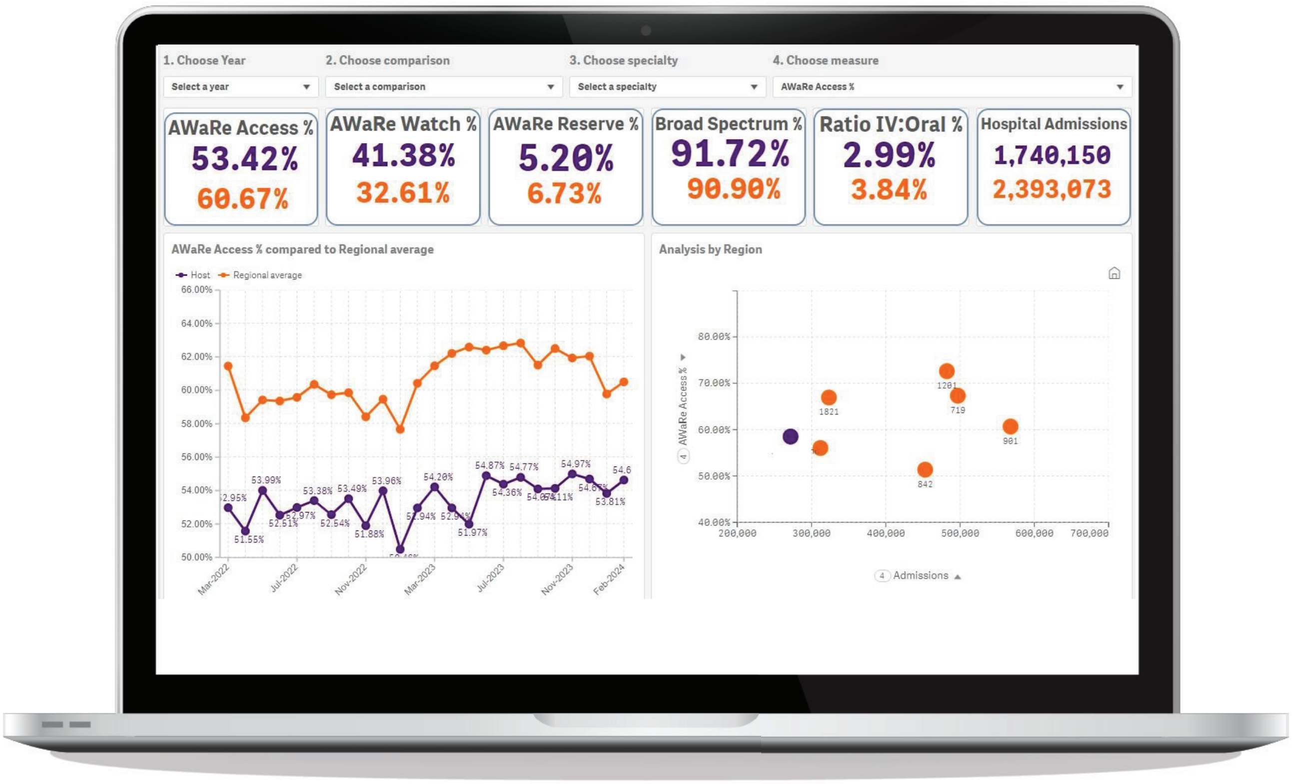
Sources: AMR Action Fund,[30] GARDP,[31] CARB-X[32] and IMI (2024)[33]

Integration of real-world data tools to guide national efforts to optimize antibiotic use: A case study from the United Kingdom

IQVIA has been involved in public-private collaborations that demonstrate the value of data-driven actionable insights in creating innovative solutions. The IQVIA AMR program in the United Kingdom was designed in collaboration with government organizations, academic institutes, and front-line clinicians, and proposes the design and implementation of tools to optimize antibiotic prescribing. IQVIA solutions stemming from this initiative range from the generation of insights on antibiotic use in hospitals across England to the integration of real-time electronic health record data into systems that enable precision antibiotic prescribing.

IQVIA has worked closely with NHS England, the national body responsible for the National Health Service (NHS) in England, to create IQVIA Antimicrobial Dashboards. This solution employs IQVIA's Hospital Pharmacy Audit, a data source that captures over 99% of hospital dispensing data across inpatient, out-patient and homecare settings. This data is standardized by clinical specialty, allowing antibiotic use to be associated with hospital activity as a means of benchmarking. There are several dynamic dashboards available, including a summary of antibiotic dispensing by AWaRe category (figure 4), antibiotic dispensing by clinical specialty mapped to hospital activity data, and a report builder that enables users to create bespoke data extracts for analysis. Insights generated through the dashboards can empower those responsible for optimizing antimicrobial prescribing at the local, regional, and national levels to identify unusual patterns and target the implementation of stewardship interventions.

Figure 4. Antimicrobial Dashboard AWaRe tracking and benchmarking page



Source: IQVIA Antimicrobial Dashboard (2024) (solution under development)

These solutions could be replicated in countries where granular data on antibiotic prescribing and/or dispensing are available, supporting country efforts to implement and monitor antibiotic policies. Whenever such systems are not present, partnerships could also create strategies on the best route to build them and strengthen overall national data collection capacity, informing the development of NAARs.

Enhancing national antibiotic policymaking through the combination of data sources

WHO's surveillance data of antibiotic use in GLASS is important but has limitations in terms of global coverage and variability of reporting. Some countries already use IQVIA's MIDAS or other market research data to estimate use trends keeping in mind comparability issues. Incomplete and non-standardized information hampers governments and international health bodies from fully understanding antibiotic use and making informed recommendations on access and use targets.

For WHO to form a more comprehensive picture of antibiotic use at the national, regional and global levels, GLASS datasets could incorporate additional inputs that capture volume data on AWaRe medicines. Therefore, explorations are underway that could lead to a broader use and sharing of IQVIA MIDAS data to support antibiotic use surveillance efforts by global health stakeholders such as WHO. Against the backdrop of AMR's growing threat, partnerships of this nature would pursue the efficient integration of existing IQVIA antibiotic data into global surveillance systems. Though combining existing data sources can provide a more comprehensive view of antibiotic use, the proactive engagement of key national stakeholders should address remaining gaps, thereby supporting NAAR formulation and, in turn, the establishment of strong national antibiotic policies.

Conclusions

Effectively managing antibiotic use is a central measure to prevent and curb the impact of AMR. To achieve this goal, international health actors and governments should consider the possibility of establishing global and national policies that inform the optimal use and access to antibiotics. The first step is the development of a standard method for countries to evaluate their current patterns of antibiotic use based on all available data sources. The formulation of standard NAARs that compare current levels of AWaRe antibiotic use with population health needs would be a significant step forward. Overall, strengthening national data ownership can help governments create more tailored solutions and take greater control of the AMR response, which can also improve national health systems and help countries achieve UHC.

At the global level, WHO continues to evolve its monitoring of antibiotic use by embedding more robust, locally generated, and standardized data in GLASS, while simultaneously incorporating real-world data that illustrates the total volume of antibiotics circulating across national and global markets. Bringing together multiple datasets under a single system and a common methodology could support the international community to make strides in addressing AMR. As the paper also recommends, cross-sectoral collaboration through PPPs continues to be the preferred avenue for multi-stakeholder engagement, both for national and international policy-making processes and beyond.

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Rachel Freeman is an infectious disease epidemiologist by training with over 15 years of experience working in the field of antimicrobial resistance (AMR). She has held positions across several sectors including healthcare, academia, public health, and industry. Rachel has spent the majority of her career implementing surveillance systems and optimizing data collection. Rachel is leading on IQVIA's AMR Strategy, including the development of innovative solutions and offerings that integrate real-world data into decision making. She is an advocate for the need for cross-sectoral and transdisciplinary working in addressing the threat posed by AMR and is leading engagements with national bodies and the life sciences industry in support of generating valuable data assets that may be used to provide powerful insights. Rachel holds a Ph.D. from Imperial College London, with her thesis exploring the application of statistical models for the automated detection of outbreaks in hospital settings using routinely collected national and local data.

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Mike Sharland is a leading global expert in antibiotic use and policy. He is an advisor to the WHO on optimal antibiotic use including as a member of the Expert Committee on the Selection and Use of Essential Medicines. Mike was the Chair of the Antibiotic Working Group of the Essential Medicines Lists, which developed the Access, Watch and Reserve (AWaRe) system for antibiotics and the WHO AWaRe Book. He leads the Wellcome Trust-funded Antimicrobial Resistance, Prescribing, and Consumption Data to Inform Country Antibiotic Guidance and Local Action (ADILA) project, developing novel risk-adjusted models of optimal AWaRe antibiotic use. Mike chaired the Department of Health's Expert Advisory Committee on AMR from 2011 to 2018. Alongside his antibiotic policy work, Mike is a leading expert in optimal antibiotic use in children and neonates. He has a long-standing interest in developing the evidence base for the use of all paediatric antimicrobials and has developed a research strategy using both cohort studies and clinical trials to improve the evidence base for antimicrobial prescribing.

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Natasha Pillai is a medical doctor and epidemiologist with expertise in real-world patient-level data and applying advanced analytics, including predictive analytics and artificial intelligence and machine learning to derive insights on optimal health outcomes. As Chief of Staff for IQVIA's Global Public Health Unit and a South African national, Natasha is passionate about contributing to improving healthcare equity and access. She has worked clinically as a medical doctor treating patients in primary and tertiary referral centers in the United Kingdom's National Health Service (NHS), Durban, South Africa and Addis Ababa, Ethiopia. Prior to joining IQVIA, she contributed to clinical guidelines for the National Institute for Health and Care Excellence (NICE). Natasha holds a medical degree from the University of Manchester and an M.Sc. in Public Health and Health Economics from the London School of Hygiene and Tropical Medicine.

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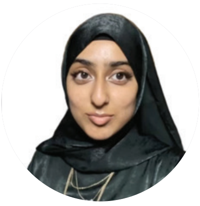

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Mike Sharland and Aislinn Cook from City St. George's University of London, and Koen Pouwels from University of Oxford, have collaborated independently and on a non-remunerated basis with IQVIA in the production of this paper.

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