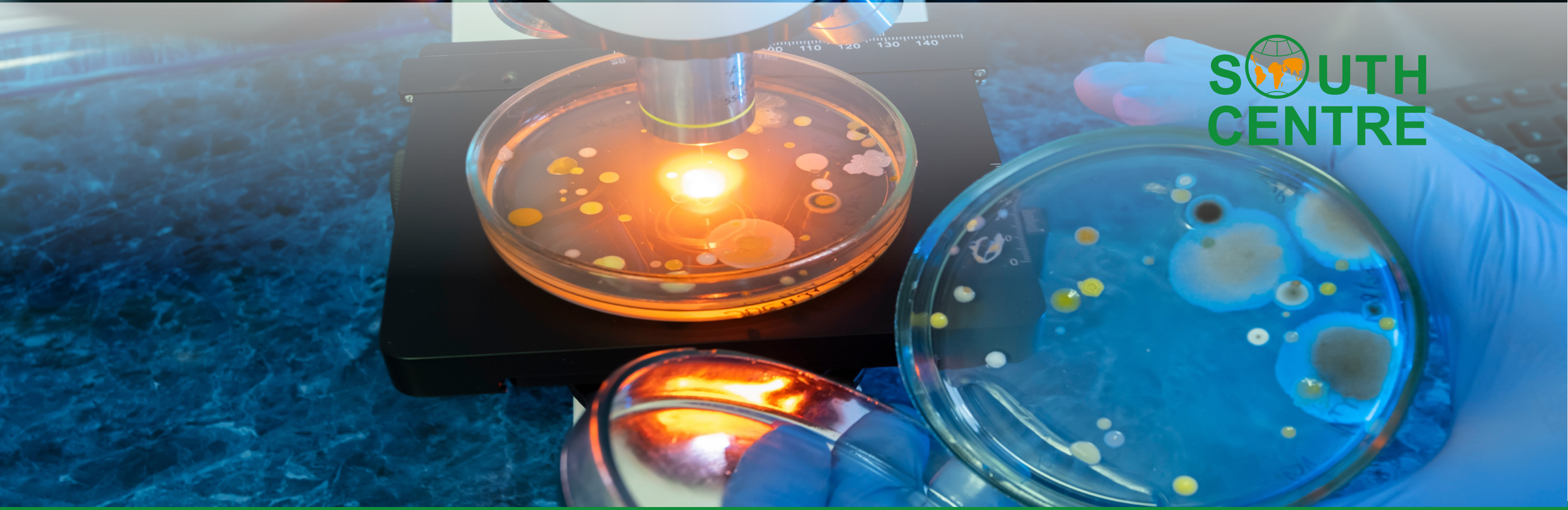

POLICY BRIEF

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Meeting the 2030 Target on Reducing the Global Burden of AMR: Pathways for Strengthening and Leveraging Surveillance in Developing Countries

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ABSTRACT

Antimicrobial Resistance (AMR) poses a major and growing threat to global health, yet low- and middle-income countries (LMICs) face significant challenges in implementing AMR surveillance –collection and analysis of data on AMR. Global AMR targets, including the United Nations' goal of reducing AMR-associated deaths by 10 percent by 2030 and achieving diagnostic capacity in 80 percent of countries, rely on surveillance data that are often incomplete, hospital-centered, and unrepresentative of community infections in LMICs. While the Global Antimicrobial Resistance and Use Surveillance System (GLASS) of the World Health Organization (WHO) provides a standardized framework, in LMICs limited access to diagnostics, high laboratory costs, and reliance on data from specialized hospitals constrain participation and data comparability. Modeling studies have helped quantify the global burden of AMR, yet their reliance on sparse LMIC data underscores the need for improved primary surveillance. Achieving the United Nations' 2030 target—where 80 per cent of countries can test resistance in all GLASS pathogens—will require substantial investment, technical support, and sustained political commitment. Embedding AMR surveillance within health systems and strengthening pandemic prevention and preparedness can help unlock external funding for eligible LMICs through the Pandemic Fund and the Global Fund.

KEYWORDS: Antimicrobial Resistance (AMR), AMR Surveillance, Global Burden of AMR, Diagnostic Capacity, Low- and Middle-Income Countries (LMICs), Global Antimicrobial Resistance and Use Surveillance System (GLASS), World Health Organization (WHO), Pandemic Prevention and Preparedness, Pandemic Fund, Global Fund

KEY MESSAGES

- Achieving a 10% Reduction in AMR Deaths Requires Measuring the Problem Accurately—Current Surveillance Systematically Underrepresents LMICs.
- Reaching 80% Diagnostic Capacity Requires Community Surveillance—But Two-Thirds of LMIC Sites Are Hospitals.
- Closing LMIC Surveillance and Diagnostic Gaps Requires Sustained International Investment and National Commitment—Only 48 Countries Have All WHO-Recommended Surveillance Components.

La résistance aux antimicrobiens (RAM) constitue une menace majeure et croissante pour la santé mondiale ; pourtant, les pays à revenu faible et intermédiaire sont confrontés à des défis considérables pour mettre en place une surveillance de la RAM, notamment la collecte et l'analyse des données relatives à ce phénomène. Les objectifs mondiaux en matière de RAM, notamment celui des Nations Unies visant à réduire de 10 % les décès liés à la RAM d'ici 2030 et à doter 80 % des pays de capacités de diagnostic, reposent sur des données de surveillance souvent incomplètes, centrées sur les hôpitaux et non représentatives des infections communautaires dans les pays à revenu faible ou intermédiaire. Si le Système mondial de surveillance de la résistance aux antimicrobiens et de leur utilisation (GLASS) de l'Organisation mondiale de la santé (OMS) fournit un cadre normalisé, dans les pays à revenu faible et intermédiaire, l'accès limité aux diagnostics, les coûts élevés des analyses en laboratoire et la dépendance vis-à-vis des données provenant d'hôpitaux spécialisés limitent la participation et la comparabilité des données. Des études de modélisation ont permis de quantifier la charge mondiale de la RAM, mais leur dépendance vis-à-vis de données clairsemées provenant des pays à revenu faible et intermédiaire souligne la nécessité d'améliorer la surveillance primaire. Atteindre l'objectif des Nations Unies pour 2030 — selon lequel 80 % des pays devraient être en mesure de tester la résistance de tous les agents pathogènes couverts par le GLASS — nécessitera des investissements substantiels, un soutien technique et un engagement politique soutenu. L'intégration de la surveillance de la RAM au sein des systèmes de santé et le renforcement de la prévention et de la préparation aux pandémies peuvent contribuer à débloquer des financements externes pour les pays à revenu faible et intermédiaire éligibles par le biais du Fonds pour les pandémies et du Fonds mondial.

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MOTS-CLÉS: *Résistance aux antimicrobiens (RAM), surveillance de la RAM, charge mondiale de la RAM, capacités de diagnostic, pays à revenu faible ou intermédiaire, Système mondial de surveillance de la résistance aux antimicrobiens et de leur utilisation (GLASS), Organisation mondiale de la Santé (OMS), prévention et préparation aux pandémies, Fonds pour les pandémies, Fonds mondial*

La resistencia a los antimicrobianos (RAM) supone una amenaza grave y creciente para la salud mundial; sin embargo, los países de ingresos bajos y medios (PIBM) se enfrentan a importantes retos a la hora de poner en marcha la vigilancia de la RAM —es decir, la recopilación y el análisis de datos sobre la RAM—. Los objetivos mundiales en materia de RAM, incluido el de las Naciones Unidas de reducir en un 10 % las muertes asociadas a la RAM para 2030 y lograr la capacidad de diagnóstico en el 80 % de los países, se basan en datos de vigilancia que a menudo son incompletos, se centran en los hospitales y no son representativos de las infecciones comunitarias en los PIRM. Si bien el Sistema Mundial de Vigilancia de la Resistencia a los Antimicrobianos y su Uso (GLASS) de la Organización Mundial de la Salud (OMS) proporciona un marco estandarizado, en los PIRM el acceso limitado a los diagnósticos, los elevados costes de laboratorio y la dependencia de datos de hospitales especializados limitan la participación y la comparabilidad de los datos. Los estudios de modelización han ayudado a cuantificar la carga mundial de la RAM, pero su dependencia de los escasos datos de los PIRM subraya la necesidad de mejorar la vigilancia primaria. Alcanzar el objetivo de las Naciones Unidas para 2030 —según el cual el 80 % de los países podrán realizar pruebas de resistencia en todos los patógenos del GLASS— requerirá una inversión sustancial, apoyo técnico y un compromiso político sostenido. La integración de la vigilancia de la RAM en los sistemas de salud y el fortalecimiento de la prevención y la preparación ante pandemias pueden ayudar a desbloquear financiación externa para los países de ingresos bajos y medios que cumplan los requisitos a través del Fondo para Pandemias y el Fondo Mundial.

PALABRAS CLAVES: *Resistencia a los antimicrobianos (RAM), vigilancia de la RAM, carga mundial de la RAM, capacidad de diagnóstico, países de ingresos bajos y medios (PIBM), Sistema Mundial de Vigilancia de la Resistencia a los Antimicrobianos y su Uso (GLASS), Organización Mundial de la Salud (OMS), prevención y preparación ante pandemias, Fondo para Pandemias, Fondo Mundial*

抗微生物药物耐药性（AMR）对全球健康构成日益严重的重大威胁，然而中低收入国家（LMICs）在实施抗微生物药物耐药性监测——即收集和分析抗微生物药物耐药性相关数据方面——面临巨大挑战。全球抗微生物药物耐药性目标——包括联合国提出的到2030年将抗微生物药物耐药性相关死亡人数减少10%以及80%的国家具备诊断能力的目标——依赖于监测数据，而这些数据往往不完整、以医院为中心，且无法代表中低收入国家中的社区感染情况。尽管世界卫生组织（WHO）的全球抗微生物药物耐药性和使用监测系统 （GLASS）提供了一个标准化框架，但在中低收入国家，诊断手段有限、实验室成本高昂以及对专科医院数据的依赖，限制了参与度并影响了数据的可比性。建模研究虽有助于量化全球抗微生物药物耐药性的负担，但其对中低收入国家稀缺数据的依赖，凸显了改进基层监测的必要性。要实现联合国2030年目标——即80%的国家能够对所有抗微生物药物耐药性和使用监测系统包括的病原体进行耐药性检测——将需要大量投资、技术支持以及持续的政治承诺。将抗微生物药物耐药性监测纳入卫生系统，并加强大流行病预防和应对准备，有助于为符合条件的低收入和中等收入国家通过大流行病基金和全球基金争取外部资金。

关键词: 抗微生物药物耐药性（AMR）、抗微生物药物耐药性监测、抗微生物药物耐药性的全球负担、诊断能力、中低收入国家（LMICs）、全球抗微生物药物耐药性和使用监测系统（GLASS）、世界卫生组织（WHO）、大流行预防与准备、大流行病基金、全球基金

I. The Policy Context

By 2025, more than 39 million people around the world could die from antibiotic-resistant infections,[1] with economic loss from AMR estimated at US $1.7 trillion of global Gross Domestic Product and an additional US $175 billion required for healthcare spending by 2050.[2] The 2024 United Nations Political Declaration on AMR announced an "aim of reducing the global deaths associated with bacterial antimicrobial resistance by 10 percent by 2030 against the 2019 baseline".[3] Furthermore, there is an additional goal that at least 80 percent of countries achieve diagnostic capacity for bacterial and fungal infections by 2030.

To understand how these goals might be accomplished means understanding how surveillance data are produced. This Policy Brief reviews the present landscape of surveillance of global AMR,[4] focusing on public health AMR surveillance,[5] while highlighting issues of particular concern for LMICs. Section 2 maps the current landscape of AMR surveillance data relevant to LMICs and efforts to estimate AMR mortality through statistical modeling. The section shows how three sources of AMR surveillance data are constrained in coverage and highlights the problem that most surveillance sites in LMICs are tertiary hospitals, which overrepresent severe drug-resistant infections and underrepresent the community settings where most infections and treatments occur. Section 3 discusses pathways for improving AMR surveillance in LMICs, focusing on expanding diagnostic capacity, reducing costs, integrating surveillance into primary health care, and fostering the sustained investment and political commitment needed to reach the UN 2030 targets.

II. Evidence Gaps: Understanding the True Burden

There are several regional and global programs for antimicrobial resistance, where low- and middle-income country data can be found. [6,7]

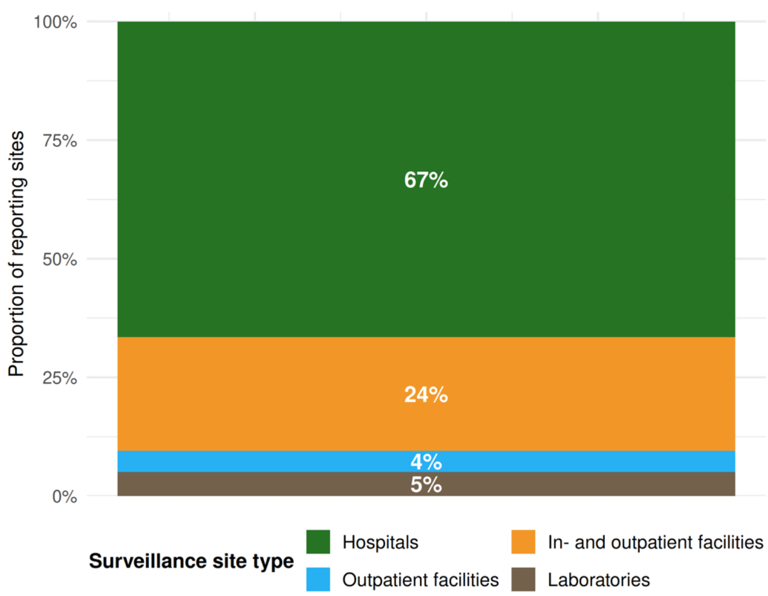
Governmental

The WHO GLASS system is a standardized methodology for collecting, analyzing and sharing surveillance data.[8] A key feature of GLASS is that it is based on clinical samples sent routinely to laboratories for diagnosing infections, both in the community and hospital settings.[9] Another important aspect of GLASS is that it builds on national surveillance data collected by Member States themselves. It works collaboratively with regional AMR surveillance networks such as CAESAR (Central Asian and Europe), EARS-Net (European Union), ReLAVRA (Latin America and the Caribbean), and WPRAMRSS (Western Pacific).

The GLASS passive-surveillance design can work well to create nationally-representative information when there are low barriers to routine diagnostics. Without adequate diagnostic capacity, countries cannot produce representative, reliable data on resistance. Large parts of sub-Saharan Africa, Central Asia and Latin America still report limited or no data to GLASS.[10] One hundred and four (104) Member States shared AMR data from 2023 (of 194 Member States) but the overall global score for national data completeness was only 53.8 percent. A study by Abdelsalam has found that for South Centre Member States only 60 percent report AMR surveillance to GLASS, and just 38 percent report antimicrobial use (AMU) data to GLASS.[11] Furthermore, the Lancet Commission on diagnostics highlighted that 47 percent of the global population had little to no access to diagnostics.[12] For these reasons, the data available is incomplete and data comparisons between countries are not always appropriate as data comes from countries with differing volume and quality.

GLASS focuses on certain pathogens that cause bloodstream, gastrointestinal, urinary tract, and urogenital (gonorrhea) infections. While for certain infections (e.g., bloodstream) and treatment-resistant infections, samples would most likely originate from hospitals where best practice would be treatment in a hospital setting. However, community treatment of gastrointestinal and urinary tract infections is feasible and appropriate. A limitation of GLASS data from developing countries is that this data most often comes from tertiary care facilities (e.g., specialized hospitals). In 2019, around two-thirds of surveillance sites were hospitals (Figure 1). Outpatient facilities (i.e., community settings) only represented 4 per cent of surveillance sites. However, the majority of treatment happens in community settings. Patients who are failing treatment at general/district hospitals can be transferred to specialized tertiary hospitals. This has an effect of concentrating resistant infections at tertiary hospitals. Thus, when surveillance focuses on tertiary facilities, this also focuses surveillance on more severe infections.

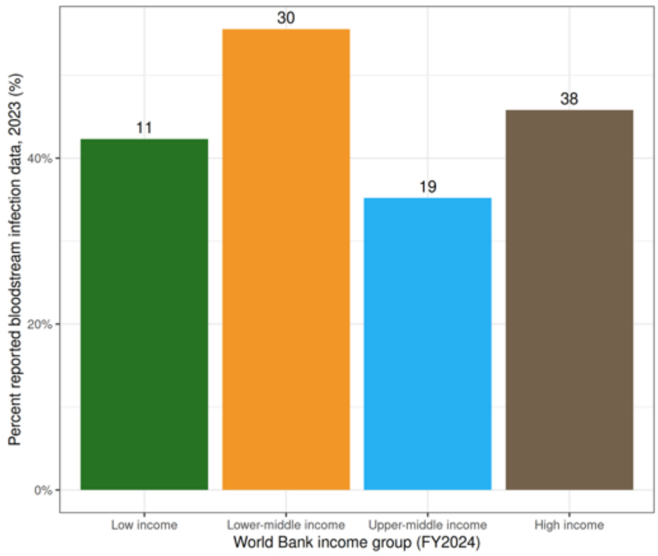
Figure 1. WHO GLASS surveillance sites in 2019



Data source: WHO GLASS Report 2021

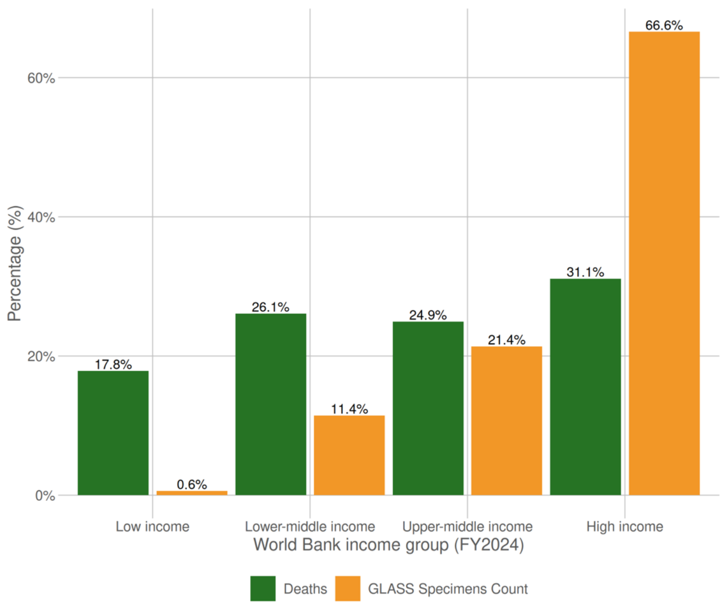
Bloodstream infection data shows how GLASS engagement differs between income groups. Bloodstream infections were the second-most common type of resistant infections leading to death. At an aggregate level, reporting for bloodstream infections appears rather equitable across income groups (Figure 2). However, when examining distribution from samples reported, it becomes apparent that LMICs face challenges in performing adequate levels of surveillance (Figure 3). Only, 0.6 percent of bloodstream samples reported to GLASS came from low income countries (LICs) and one-third from middle income countries (MICs). The remaining two-thirds of bloodstream samples came from high income countries (HICs). Two-thirds of deaths due to bloodstream infections in 2021 were in LICs and MICs.[13] In considering this figure, it is worth remembering the paucity of data for modeling such estimates in LICs.[14]

Figure 2. Country participation by reporting bloodstream infections to WHO GLASS in 2023, by World Bank income groups



Caption: Numbers on top of the bars is the number of countries reporting

Figure 3. Proportion of bloodstream infection deaths contrasted with the number of bloodstream infection specimens reported to GLASS, stratified by World Bank Income Group.



Caption: Bloodstream infection deaths (2021) come from the IHME MICROBE study.

Private sector

Private-sector led surveillance exists, primarily to evaluate susceptibility to specific drugs (e.g., registered drugs or new compounds). Data are standardized and high-quality, but they may not be representative and these networks do not usually support laboratory capacity building in LMICs.

For instance in the SENTRY program (funded by JMI Laboratories), 7 percent of their 454,974 isolates (n = 30,504) came from 13 middle-income countries and none from any low-income countries.[15] When discussing the inclusion of African countries, they recognize that they were not included "mainly due to limited commercial development opportunities and/or the compromised ability to establish collection systems in those geographic areas."[16] There is also the "Study for Monitoring Antimicrobial Resistance Trends" (SMART), which is supported by Merck.[17] The program focuses on Gram-negative bacteria and originally began in 2002 after the approval of the antibiotic ertapenem. In 2023, it includes 15 LMICs. Finally, Pfizer sponsors the ATLAS surveillance program.[18] In 2023, there were 66 sites from 21 countries that provided 12,412 samples. China (n = 13) and India (n = 10) had more than 5 sites, otherwise other countries had less than 5 sites.

Academic

In LMIC contexts, academic projects have largely focused on specific clinical research, not necessarily public health surveillance of AMR. For instance, there are several international studies relating to bloodstream infections. [19] [20] [21] While such studies are helpful for improving capacity, informing medical practices, and improving the epidemiological understanding of disease, research differs from public health surveillance.

It is important to recognize this distinction as secondary-source academic projects contributing to AMR surveillance are often derived from systematic reviews of the scientific literature (where the primary studies were undertaken to answer specific clinical research questions). They are thus susceptible to the factors that play into academic publishing (e.g., barriers to LMIC publication, non-publication bias, and focus on patients at specialized hospitals).

Balasubramanian and coauthors examined point-prevalence surveys from 2010 to 2020.[22] For instance, they found that MICs had the highest burden of hospital-associated drug-resistant infections. In a similar vein, the Global Point Prevalence Survey (funded by bioMérieux) presented international data using their standardized survey method.[23] While the project included eight LMICs, it did not have any sites from LICs.

While Ondoa and colleagues did not present surveillance information for 14 countries in sub-Saharan Africa, they found that only 1 percent of laboratories delivered bacterial testing.[24] This low laboratory coverage highlights a key barrier to establishing representative surveillance in sub-Saharan Africa.

Estimating AMR mortality

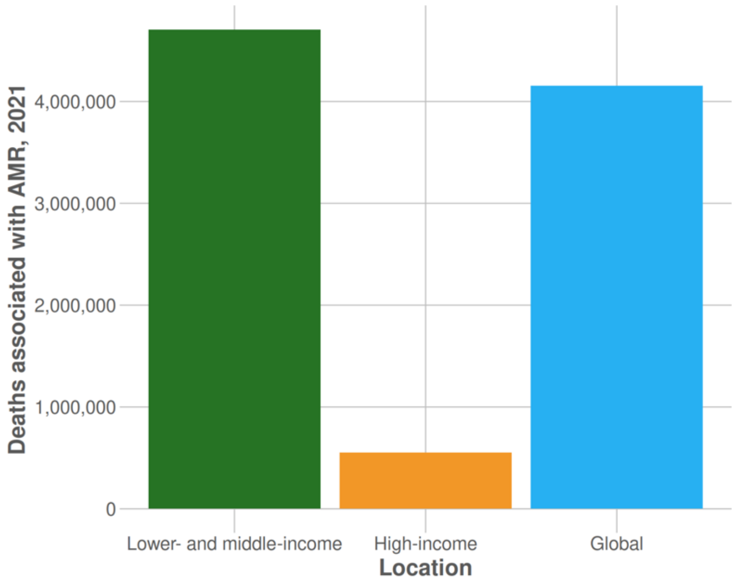
There have been several academic projects leveraging existing data to create statistical model-based estimates and projections of antimicrobial resistance burden and mortality. While such projects are not public health surveillance, they have played an important role in informing global AMR policy. As stated earlier, the target of the 2024 Political Declaration of the High-Level Meeting on Antimicrobial Resistance is to reduce the global deaths associated with bacterial antimicrobial resistance by 10 percent by 2030 against the 2019 baseline of 4.95 million." This baseline figure was the result of modeling efforts — models which are built from available surveillance data.

Earlier modeling efforts from the 2016 O'Neill Review on AMR were important for AMR policy messaging, but newer projects have worked to improve the transparency and methodological validity of estimates. [25] [26] Another example of modeling is Oldenkamp et al.[27] They used socio-economic characteristics of countries to model AMR prevalence data for countries where data was missing. Their findings highlighted how improving surveillance in specific countries could improve accuracy of international AMR modeling. However, their approach performed poorly for *Streptococcus pneumoniae*, which was the only community-acquired infections they examined. The authors suggested that this was because pneumococcal vaccinations have reduced the connection between national socio-demographic characteristics and resistance.

The Global Burden of Disease (GBD) study was an important contribution to the literature as it provided estimates of national level data. [28] [29] A later update also created AMR forecasts up to 2050.[1] Where the WHO GLASS method for estimating attributable mortality focuses only on antimicrobial resistant bloodstream infections, the GBD study included 12 infectious syndromes.[30]

The GBD study used several successive modeling steps to determine the burden of infectious syndromes and bacteria, how often those bacteria were resistant to antibiotics, and how many additional deaths resistance caused (Figure 4). A methodological value-add of the AMR GBD study is that their model estimated community- and hospital-acquired infections (community-acquired infections are a limitation of surveillance particularly in LMICs), though the final paper does not present these figures.

Figure 4. Distribution of AMR-associated deaths by income groups, 2021



Source: Institute for Health Metrics and Evaluation (IHME), University of Oxford. MICROBE.

However, the 2019 AMR GBD study may overestimate AMR mortality in LMICs for two main reasons. First, the underlying data disproportionately come from tertiary/specialized hospitals. While only 0.3 percent of cases in high-income settings were drawn from tertiary hospitals, 25 percent of cases in sub-Saharan Africa came from such facilities, which typically treat sicker patients and have higher mortality than district/general hospitals. Although the project team used statistical methods to adjust for this imbalance, most data still came from facilities that were mixed-classification or could not be clearly classified by level of care. Second, although the study's burden estimates included people who were not hospitalized, the estimates of death risk were based on hospital data. Hospital patients are generally more severely ill and more likely to die than those in the community. Applying these hospital-based mortality risks to the broader population may therefore lead to inflated estimates of AMR-related deaths in LMICs.

Thus, as LMIC data representativeness and quality improves and the need to make assumption from hospital data is lessened, this would reduce overestimation of AMR in future GBD modeling. This is worth keeping in mind, in the context of achieving the United Nations General Assembly (UNGA) 10 percent reduction of AMR mortality goal, where the baseline comes from estimates from the GBD model. These data can be helpful in the short-term, but the complex methodology and assumptions (particularly for AMR in LMICs) highlight the need to make progress in global AMR surveillance.

The lack of AMR surveillance in LMIC community settings represents a weakness in global AMR surveillance. This is driven by affordability constraints, as well as clinical and data infrastructure limitations.[31]

One step towards improving community-level data is nationally representative AMR surveys as an approach to implementing less costly population-level surveillance. The WHO methodology focuses on "obtain[ing] a nationally representative estimate of the prevalence of resistant blood-stream infections among hospitalized patients".[32] However, this approach focusing on hospitalized patients does not represent the overall epidemiology of AMR in a country. The Organisation for Economic Co-operation and Development (OECD) estimates that two-thirds of resistant infections were acquired in the community.[33] Furthermore, the dynamics of transmission are different in the community.[34] [35] Finally, resistant healthcare-acquired infections posed a greater risk of death than resistant infections in the community. It is for these reasons that hospital-focused AMR surveillance can miss out on the bigger picture of AMR in a country.

Complementary survey approaches have been proposed that focus on community-acquired urinary tract infections.[36] An ambitious approach is the WHO integrated global surveillance with a "One health" approach for Extended spectrum beta-lactamase-producing *Escherichia coli* bacteria.[37] This approach defines a standard protocol for sampling across human, animal, and environment to determine the correlation and interaction of AMR bacteria in three sectors. Surveillance of AMR in wastewater is a promising One Health-sensitive approach of examining the presence of AMR in the community. [38] [39] The challenge remains to move from pilots to regular surveillance with standard protocols, underpinned by adequate and sustained human and financial resources. Accordingly, this level of integrated surveillance is more appropriate when countries have developed adequate capacity.

3. Conclusion: Pathways Forward for Improved Surveillance in LMICs

Despite the current and future burden of antimicrobial resistance, as of 2024, only 11 percent of countries had dedicated funding in their national budgets for implementation of multisectoral national action plans on antimicrobial resistance. Furthermore, only 48 WHO Member States reported having all WHO-recommended core components of a robust national surveillance system. These gaps are most pronounced in LMICs, which face persistent structural and resource constraints. Achieving the UNGA 2030 target—where 80 percent of countries can test resistance in all GLASS pathogens—will require substantial investment, technical support, and sustained political commitment.

One of the areas of focus should be increasing capacity for diagnosis of infections in LMICs, including detecting resistant infections. The diagnostic tools also need to be adapted to LMIC settings, with affordability as a key consideration for sustainable uptake and use. An estimated cost for developing an AMR surveillance laboratory in Southeast Asia was between $USD 250 000 to $USD 887 000.[40] Despite the conservative estimation, the unit cost of testing was too expensive to be maintained by LMIC health systems – highlighting a need to reduce equipment and reagent costs. The Mapping Antimicrobial Resistance and Antimicrobial Use Partnership proposed "that tests for pathogen isolation, identification, and [antimicrobial susceptibility testing] should be made available in at least 50 percent of clinical laboratories or accessible to at least 80 percent of the population, as an ambitious yet feasible target for countries scaling up bacterial testing services."[41] The Antibiogo diagnostic aid medical device developed by Médecins sans Frontières demonstrates the need for practical approaches to resolving some of the challenges in settings where access to clinical bacteriology laboratories is limited. Now used in 9 countries, the free Antibiogo application is helping laboratory technicians to correctly interpret antimicrobial susceptibility testing to provide accurate results for prescribing the most effective antibiotic.[42] Furthermore, integrations with WHONET and similar laboratory information management systems are planned.

Universal health coverage and integration into primary health care of low-cost diagnostics is a policy approach to reduce barriers to accessing diagnostics. To this end, expanding local production of quality-assured reagents and diagnostics, developing national essential diagnostic lists to inform procurement have been highlighted as a means of making surveillance more affordable and sustainable. [43] [44] [45] The national essential diagnostics lists can be informed by the WHO essential diagnostics list, which includes urine analysis testing, microscopy, blood culture, pathogen identification testing, and antimicrobial susceptibility testing.[46] A national essential diagnostic list could also help inform pooled procurement strategies at regional or global levels for essential antimicrobials and diagnostics. This approach has already been utilized to support LMIC AMR surveillance.[47]

Notwithstanding the commitments articulated in the UNGA 2024 Declaration on AMR to mobilize financing for NAPs[3], global health funding is stagnating, and dedicated AMR-specific financing streams are shrinking. In the absence of dedicated AMR financing, one consideration is the strategic alignment of surveillance efforts with health system strengthening and pandemic preparedness and response. Investments in laboratory infrastructure, diagnostic capacity, and a trained technical workforce justify the inclusion of AMR surveillance within broader health system and preparedness financing. Such an approach would enable eligible LMICs to leverage established financing mechanisms, notably the Pandemic Fund[48] and the Global Fund.[49]

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