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‘When global health meets global goals’: assessing the alignment between antimicrobial resistance and sustainable development policies in 10 African and Asian countries

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ABSTRACT

Background Sustainable development goals (SDGs) may play a pivotal role in mitigating antimicrobial resistance (AMR). This study examines how countries can integrate AMR mitigation with sustainable development strategies, providing evidence on the prioritisation of AMR-related efforts within both agendas.

Methods We conducted a comparative analysis of the international global action plan (GAP) and national action plan (NAP) on AMR and SDGs across 10 countries in Africa and Asia. We employed content analysis to map actions to AMR drivers, descriptive statistics to summarise the coverage and focus of the actions and inferential statistics to explore factors associated with the level of policy alignment.

Results Our findings highlight gaps in the current AMR policy landscape, where drivers are at risk of being redundantly addressed, narrowly focused or entirely overlooked. At the international level, over 50% of AMR drivers are addressed by both frameworks, but national-level overlap is lower (10.5%–47.4%), with Asian countries showing stronger alignment than African countries. Asian countries show a higher proportion of shared drivers than African countries. A considerable proportion of drivers are addressed solely by AMR-NAPs (23.7%–60.5%) or SDG-NAPs (13.2%–31.6%), raising concerns that actions may benefit either sustainable development or AMR at the expense of the other. Finally, 10.5%–26.3% of drivers, mostly distal, are not acknowledged by either framework, highlighting potential policy blind spots.

Conclusions The Agenda 2030 includes ambitious and cross-cutting goals with GAP-AMR, therefore it can facilitate intersectoral collaboration in addressing AMR. The effective implementation of both agendas will depend on national governments’ capacity to ensure that efforts in combating AMR also contribute to sustainable development.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The Agenda 2030 includes ambitious and cross-cutting goals with global action plan on antimicrobial resistance (AMR).

⇒ Commitment to achieving the sustainable development goals (SDGs) can significantly impact AMR, potentially equalling the influence of AMR-specific policies.

WHAT THIS STUDY ADDS

⇒ Our findings highlight a gap in the integration of SDGs into AMR planning and implementation at both international and national levels, where policy coordination between the two agendas can be strengthened.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Country should identify and prioritise a set of national targets that concurrently address both agendas in an integrated manner to enhance synergies and mitigate conflicts.

INTRODUCTION

Antimicrobial resistance (AMR) is one of the biggest global health challenges the world faces today. Each year, AMR is responsible for 1.3 million direct and 5 million indirect deaths due to infection.[1] These figures are estimated to considerably increase over the next two decades, with low and middle-income countries (LMICs) disproportionately affected. Beyond its severe impact on global health, AMR can undermine the achievement of the sustainable development goals (SDGs), particularly those related to economic development, poverty alleviation and equity.[2–5] However, given the broad set of topics addressed by the SDGs, achieving these goals will likely have profound implications for the future development and transmission of AMR.[6–9] This is because the emergence and transmission of

AMR are facilitated by a complex interplay of drivers, many of which are also sustainability issues such as poverty, inadequate sanitation, animal health and agricultural management, and appropriate management of hazardous waste.[10–14] For example, achieving the SDG 6 goal of universal drinking water, sanitation and hygiene coverage would reduce antimicrobial use among children by 24.6%[15] and prevent 5.7% of AMR-associated deaths in LMICs.[16] Therefore, addressing AMR requires a coordinated, interdisciplinary approach and is essential for fostering sustainable development.

Over the past decade, a range of global initiatives have been instituted to build and coordinate the global response to AMR. In 2015, the WHO's 194 member states adopted the global action plan (GAP) on AMR, a significant step towards a unified policy framework aimed at mitigating the emergence and spread of AMR.[17] Under the GAP, countries are mandated to submit their national action plans (NAP), detailing their commitments to address the growing threat of AMR. In 2016 and 2024, AMR received heightened political attention at the United Nations (UN) General Assembly High Level Meeting on AMR.[18 19] Although these efforts have resulted in political attention and commitments, they have not translated into sustained, consistent action at the national level.[20] As of 2024, the global response remains too weak and fragmented to match the escalating challenge of AMR. Although 178 countries have developed NAP, fewer than a fifth are funded or implemented.[21 22]

The call for an integrated, cross-sectoral approach is profoundly evident to mitigate the alarming threat of AMR. While countries have developed NAP on AMR (AMR-NAPs), they have also committed to national sustainable development plans (SDG-NAPs) as part of the 2030 Agenda. Each year, trillions of dollars are invested to achieve the SDGs, with an ongoing commitment to increase as global efforts are ramped up.[23] Given the broad scope of the SDGs, these SDG investments far outpace the dedicated finance for implementing AMR-NAPs. With the Agenda 2030 poised to remain a pivotal global policy framework for guiding development over the next decade,[24] there is an opportunity to use this platform to urgently improve the governance and pace of the response to AMR.[18] However, progress in integrating SDGs into AMR interventions remains slow and continues to be elusive, often due to stakeholders being unaware of the issue and holding competing, sometimes contradictory explanations of the problem.[10] To date, research on this integration has largely focused on high-level, conceptual discussions,[5–7 14 25–28] with limited examination in varied economic settings where tailored strategies are essential. The second high-level meeting on AMR, convened by the UN in 2024, emphasised the urgent need for bold, unified goals and effective mechanisms to reaccelerate country's actions on AMR.[6 20 29] This study seeks to address these gaps by examining how the drivers of AMR are addressed within AMR and SDG agendas, uncovering their overlaps and complementarities, thereby providing actionable insights to guide policy development and implementation.

METHODS

Patient and public involvement

This study is based on online search of publicly available documents. No patients or members of the public were involved in the design of the study.

Case study selection

This study is based on analysing policy documents, primarily drawn from NAPs on AMR and SDGs. We first retrieved 134 available AMR-NAPs from the WHO library website. The sample was purposively restricted to only include the AMR-NAPs written in English, which reduced the number of documents in our sample to 87 AMR-NAPs. In addition, our focus was exclusively on NAPs developed after the release of the GAP in 2015, then only 85 AMR-NAPs were retained. Next, we mapped the retrieved AMR-NAPs to the corresponding SDG-NAPs by country. A SDG-NAP document was defined as 'any time-bound national plan with a set of coherent economic and sociopolitical objectives that articulates a vision for national sustainable development'.[30] Based on previous works,[30 31] we conducted an exhaustive web search and found 72 countries having their SDG-NAPs available online. SDG-NAPs written in other languages than English (n=10) or developed before 2015 (n=8) were excluded. From the remaining 54 countries, purposeful selections were made to ensure representation of at least two income groups per continent, with only Asia and Africa fulfilling the criteria. In total, 10 countries were selected including Ethiopia, Uganda, Rwanda, Zambia, Kenya (LMICs), Thailand, China, Philippines, Japan and Saudi Arabia (middle and high-income countries). Country income was categorised based on the World Bank definition.[32] Further information on the selection process and a list of the selected countries and documents are found in online supplemental figures S1 and S2 and table S1 of the supplementary document (an interactive version is available online at https://gedb.shinyapps.io/sdg-amr-explorer).

Analytical approach

In order to maintain consistency and comparability while evaluating two different policy processes across various income settings, a stepwise approach was adopted including the analysis of both international and national policies. For the international analysis, the GAP-AMR and the UN-SDG documents were selected. A predefined list of AMR drivers identified from a previous study[10] was retrieved for the analysis and categorised into two main groups: proximal and distal drivers. Proximal drivers are those directly associated with the transmission of AMR, or issues related to the access and inappropriate use of antibiotics. Conversely, distal drivers typically encompass broader sustainability challenges and are associated with

risk factors for infection (eg, sanitation and hygiene) and socioeconomic conditions, etc.

International policy documents analysis

The unit of analysis was defined as the descriptions of goals and targets within the GAP-AMR and the UN-SDG documents. Initially, the documents were thoroughly reviewed until the content was familiarised. Several relevant sectors addressing AMR were then defined, including human health, agriculture and food production, the environment and economy and infrastructure. Each identified goal or target was subsequently coded based on its relevance to the predefined AMR drivers and corresponding sectors, assessing whether the achievement of these goals as outlined in the agendas would address these drivers. Following the mapping of drivers to policy documents, the overlap index $J(AMR_i, SDG_j)$ was calculated using the Jaccard similarity coefficient,[33] which is a statistical measure of the similarity between two sets. Here, it is defined as the proportion of the shared drivers between an objective of the GAP-AMR and a goal in the SDG agenda, as shown in the formula (1)

$$J(AMR_i, SDG_j) = \frac{AMR_i \cap SDG_j}{AMR_i \cup SDG_j} \quad (1)$$

In addition, the coverage of proximal and distal drivers of AMR by the two agendas was also calculated. A mixed Poisson regression model was employed to explore factors influencing how often drivers are targeted in policy documents. The model specification included type of driver, policy agenda and their interaction as fixed effects, with drivers as the random intercept.

National policy document analysis

The analysis of national policy documents was conducted on the selected 10 countries. While actions under AMR-NAPs inherit mainly from WHO AMR-GAP targeting directly on AMR drivers,[34] the adoption of UN-SDG agenda in country development plans varies. An SDG-NAP document can take various forms, such as long-term broad national visions, short-term action plans or sectoral plans, with only a few using the SDGs as a base for their structure or explicitly mentioning the framework within their content.[31] This variation in the structure of SDG-NAPs poses a challenge for the assessment process. To address this challenge, an indirect approach was employed. The SDGs identified in the UN-SDG document were used as proxies to connect SDG-NAPs with AMR drivers. First, the 17 SDGs were grouped into four thematic areas, including (1) social goals: poverty—inequality—basic services access (SDG 1, 2, 3, 4, 5 and 10), (2) economic goals: economic growth—infrastructure—responsible consumption and production (SDG 7, 8, 9 and 12); (3) environmental goals: water and sanitation—biosecurity—environmental contamination (SDG 6, 11, 13, 14 and 15) and (4) political goals: peace and justice, strong institutions—partnership (SDG 16, 17). Subsequently, actions under SDG-NAPs were systematically assigned to the relevant thematic areas, compared and mapped with the corresponding targets within the UN-SDG agenda. Next, they were mapped against AMR drivers based on the pattern identified from the international analysis. Mixed logistic regression models using country and continent as random factors were employed to assess the factors associated with the coverage of AMR drivers in national policy agendas. We also conducted a subgroup analysis on income level to examine if there is any difference in the prioritisation of actions targeting drivers under AMR-NAPs and SDG-NAPs across various social-economic contexts.

RESULTS

Overlap between the GAP-AMR and UN-SDG agenda

Almost all drivers of AMR (97.3%) can be targeted either through GAP-AMR or UN-SDG agenda. Our analysis indicated a moderate overlap between the two agendas, with 20 out of 38 AMR drivers (52.6%) being shared. Specifically, the GAP-AMR targets 29 drivers, comprising 17/18 (94.5%) proximal and 12/20 (60.0%) distal drivers. Actions under the UN-SDG agenda can target 28 drivers, including 11/18 (61.1%) proximal and 17/20 (85.0%) distal drivers. Although both agendas share common drivers, the GAP-AMR addresses a unique set of drivers related to the conservation of antibiotic effectiveness and the containment of AMR dissemination, accounting for 9/38 (23.7%). Similarly, the UN-SDG agenda addresses 8/38 (21.1%) unique drivers, mainly regarding cross-cutting challenges such as poverty, sociodemographic changes (eg, overpopulation, urbanisation, globalisation), environmental degradation and climate change (table 1, online supplemental figures S3 and S4). Neither agenda takes into account the driver of global travel and migration.

Objective 1 of the GAP-AMR, which aims to improve awareness and knowledge on AMR, intersects mostly with the targets of SDG 2 and SDG 6, which shares approximately 13% of AMR drivers, respectively. Objective 2, which aims to strengthen surveillance and research, shows a high overlap with SDG 3 (38%) and low overlap with SDG 8, 9 and 17. The third objective of GAP-AMR aims to reduce the incidence of infection through effective sanitation, hygiene and infection prevention measures. This goal has moderate association with SDG 3 (35%), SDG 6 (17%), SDG 9 (17%) and SDG 11 (16%), indicating that improving infrastructure in water and sanitation and waste treatment sector are associated with infection prevention and control. Objective 4 of the GAP-AMR demonstrates a moderate overlap with SDG 3, 6 and 9, with overlap percentages of 21%, 14% and 14%, respectively. Finally, objective 5 of the GAP-AMR, which is to promote sustainable investment and increase funding for new medicines, vaccines and diagnostic tools, aligns strongly with SDG 8 (29%), SDG 9 (25%) and SDG 16 (20%) (figure 1).

The number of linkages between AMR drivers and actions under the policy agendas is also different. We

Table 1 Coverage of AMR drivers in the two international policy agendas

Characteristic	Shared policy	Targeted by only one policy		Untargeted	P value*
		GAP-AMR	UN-SDG		
Type of driver					**0.04**
Distal	10 (52.6%)	2 (10.5%)	7 (36.8%)	0 (0%)	
Proximal	10 (52.6%)	7 (36.8%)	1 (5.3%)	1 (5.3%)	
Total	20 (52.6%)	9 (23.7%)	8 (21.1%)	1 (2.6%)	
Challenges of AMR governance (intervention-focused area)					**<0.001**
Access	4 (100%)	0 (0%)	0 (0%)	0 (0%)	
Conservation	0 (0%)	8 (80%)	2 (20%)	0 (0%)	
Containment	5 (71.4%)	1 (14.3%)	0 (0%)	1 (14.3%)	
Infection prevention	3 (100%)	0 (0%)	0 (0%)	0 (0%)	
Innovation	2 (100%)	0 (0%)	0 (0%)	0 (0%)	
Surveillance	2 (100%)	0 (0%)	0 (0%)	0 (0%)	
Multiple challenges	4 (40%)	0 (0%)	6 (60%)	0 (0%)	

Boldface values in table mean statistical significance (p-value < 0.05)
*Fisher's Exact Test.
GAP-AMR, Global Action Plan-Antimicrobial Resistance; UN-SDG, United Nations Sustainable Development Goal.

identified a total of 77 links between UN-SDG agenda and drivers of AMR, among which 48 links are on distal drivers and 29 links are on proximal drivers. With the exception of SDG 3, which targets equally proximal and distal drivers, other SDGs tend to target distal drivers. Specifically, social goals focusing on mitigating poverty, inequality and shortage in accessing basic services show the highest number of linkages (n=36, 21 on distal drivers and 15 on proximal drivers). This is followed by environmental goals, which accounted for 19 links (12 on distal drivers and 7 on proximal drivers). Economic goals, which aim to foster economic growth and promote responsible consumption and production comprise 17 links, 11 associated with distal drivers and 6 with proximal drivers. Political goals outlined in SDGs 16 and 17, which strive for peace, justice, strong institutional frameworks and enhanced partnerships, show the fewest linkages (n=5), with 4 on distal and 1 on proximal drivers. In addition, 63 links between GAP-AMR strategic objectives and drivers of AMR were also found (26 on distal and 37 on proximal drivers).

We found that drivers of AMR are generally less targeted by the UN-SDG agenda than the GAP-AMR (IRR=0.59, 95% CI (0.42, 0.82), p=0.002), and distal drivers were targeted less than proximal drivers (IRR=0.63, 95% CI (0.38, 1.04), p=0.073). However, a significant interaction term between type of driver and policy agenda (IRR=2.78, 95% CI (1.77, 4.38), p<0.001) suggests that distal drivers are more likely to be addressed under the SDG agenda. It is also observed that the UN-SDG agenda is relevant to address the most distal drivers of AMR, such as poverty, crisis events, socioeconomic factors (figure 2).

Investigating the alignment of AMR and SDG action plan in national agenda

Figure 3 compares the coverage of AMR drivers in national policy agendas of the 10 countries investigated. Overall, AMR drivers are primarily addressed through AMR-NAPs, with exclusive coverage ranging from approximately 23.7% to 60.5%. In addition, SDG-NAPs can complementarily address about 13.2%–31.6% of unique drivers. The average overlap between these two policy processes at the national level ranges from 10.5% to 47.4%, which is lower than the overlap observed in international agendas. Notably, the proportion of drivers not targeted by any agenda is significant, ranging from 10.5% to 26.3%.

Proximal drivers remain the main target in AMR-NAP, with a total coverage ranging from 72.2% to 88.9% (online supplemental figure S5), including both drivers that are exclusively addressed by AMR-NAPs and those that overlap with SDG-NAPs (online supplemental figure S6). However, the degree of overlap among national agendas is lower than in international agendas and varies significantly across the countries, between 11.1% (Rwanda) and 50% (China). In particular, China, Thailand, Japan and Uganda show a moderate overlap, with overlaps between 33.3% and 50.0%, whereas other countries observed less than 30% overlap (figure 3). Notably, the percentage of proximal drivers covered in SDG-NAPs is lower in African countries than in Asian countries (online supplemental figure S5). Additionally, about 5.6%–22.2% of proximal AMR drivers are not targeted by any national policies (figure 3). Conversely, distal drivers of AMR are less targeted within AMR-NAPs, with coverage ranging from 30% to 60%, while a significant proportion of distal drivers can be addressed exclusively

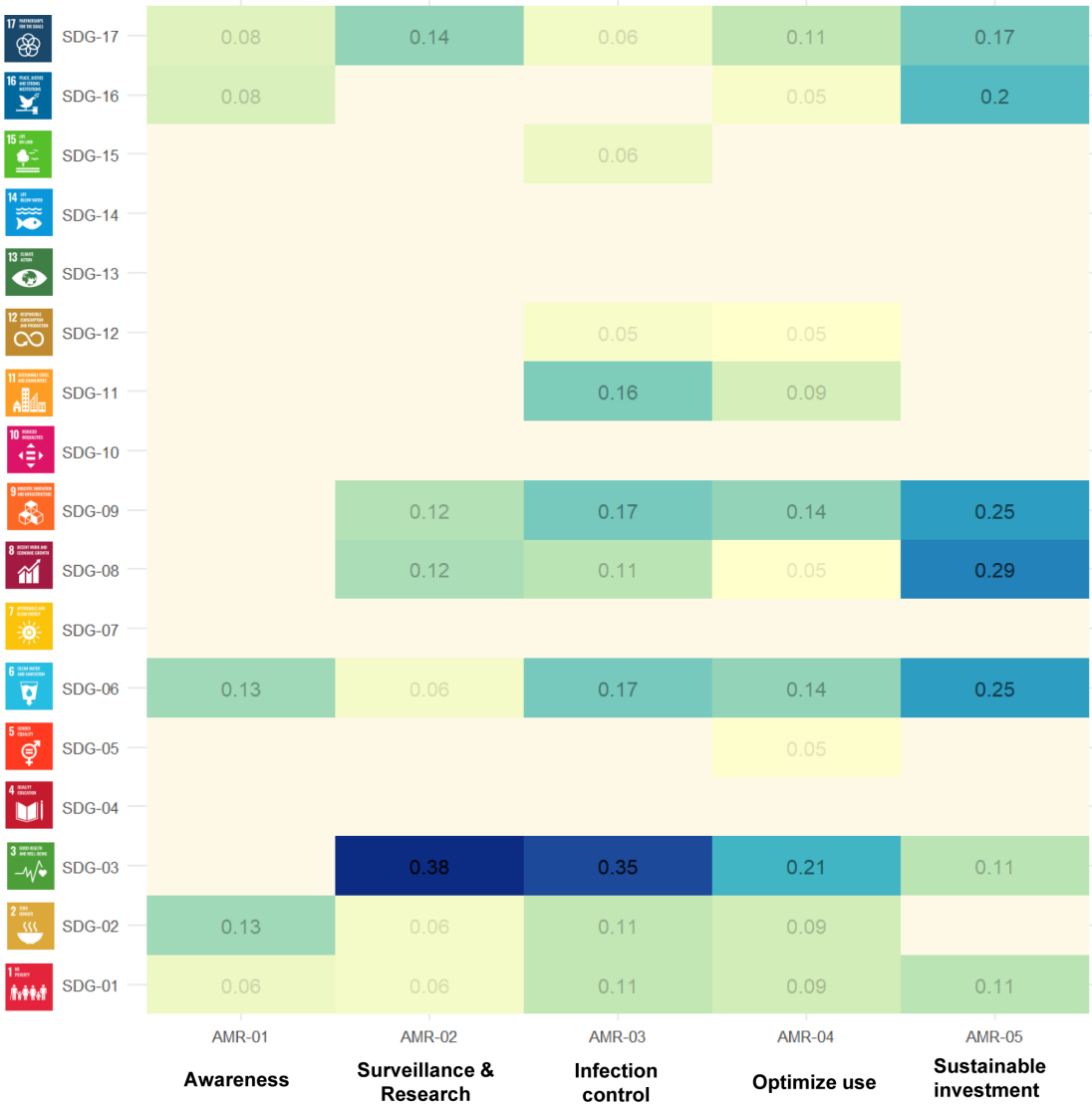

Figure 1 Overlap between the GAP-AMR and UN-SDG agenda. Each cell in the heatmap represents a calculated overlap score (range from 0 to 1) between GAP-AMR objectives and UN-SDG targets. The colour intensity in the heatmap corresponds to these scores, with deeper shades indicating stronger overlap. GAP-AMR, Global Action Plan-Antimicrobial Resistance; UN-SDG, United Nations Sustainable Development Goal.

through SDG-NAPs, ranging from 20% to 55% (online supplemental figure S5). The degree of overlap between AMR-NAPs and SDG-NAPs for distal drivers is generally lower than that for proximal drivers, ranging between 0% (Zambia) and 45% (China). Nonetheless, China, Thailand, Japan and Uganda continue to demonstrate higher overlap between AMR and SDG policies. Additionally, the proportion of distal drivers not targeted by any policy agendas is also higher compared with proximal drivers, ranging from 10% to 35% (figure 3).

The results from the mixed logistic regression models in table 2 indicate that the likelihood of an AMR driver being targeted by actions under national agenda is not associated with the country's income level; rather it depends on the type of driver and the specific policy agenda used to address it. Distal drivers were generally less likely to be addressed (OR=0.53, 95% CI (0.37, 0.75), p<0.001) in comparison with proximal drivers in the national agenda. However, a significant interaction between type of driver and policy agenda was observed. The interaction term between type of driver and policy agenda yielded an OR of 3.33 (95% CI (2.40, 4.62), p=0.001), highlighting a significantly higher likelihood of MHICs targeting distal AMR drivers within their SDG-NAPs.

MHICs significantly demonstrated lower odds (OR=0.59, 95% CI (0.42, 0.83), p=0.003) of addressing AMR drivers in their AMR-NAPs, but higher odds in their SDG-NAPs (OR=1.36, 95% CI (0.87, 2.14), p>0.05). Notably, distal drivers are significantly less likely to be targeted in AMR-NAPs (OR=0.6, 95% CI (0.39, 0.91), p=0.02; however, they are two times as likely to be addressed in SDG-NAPs. In addition, we did not find any interaction between country's income level and type of driver.

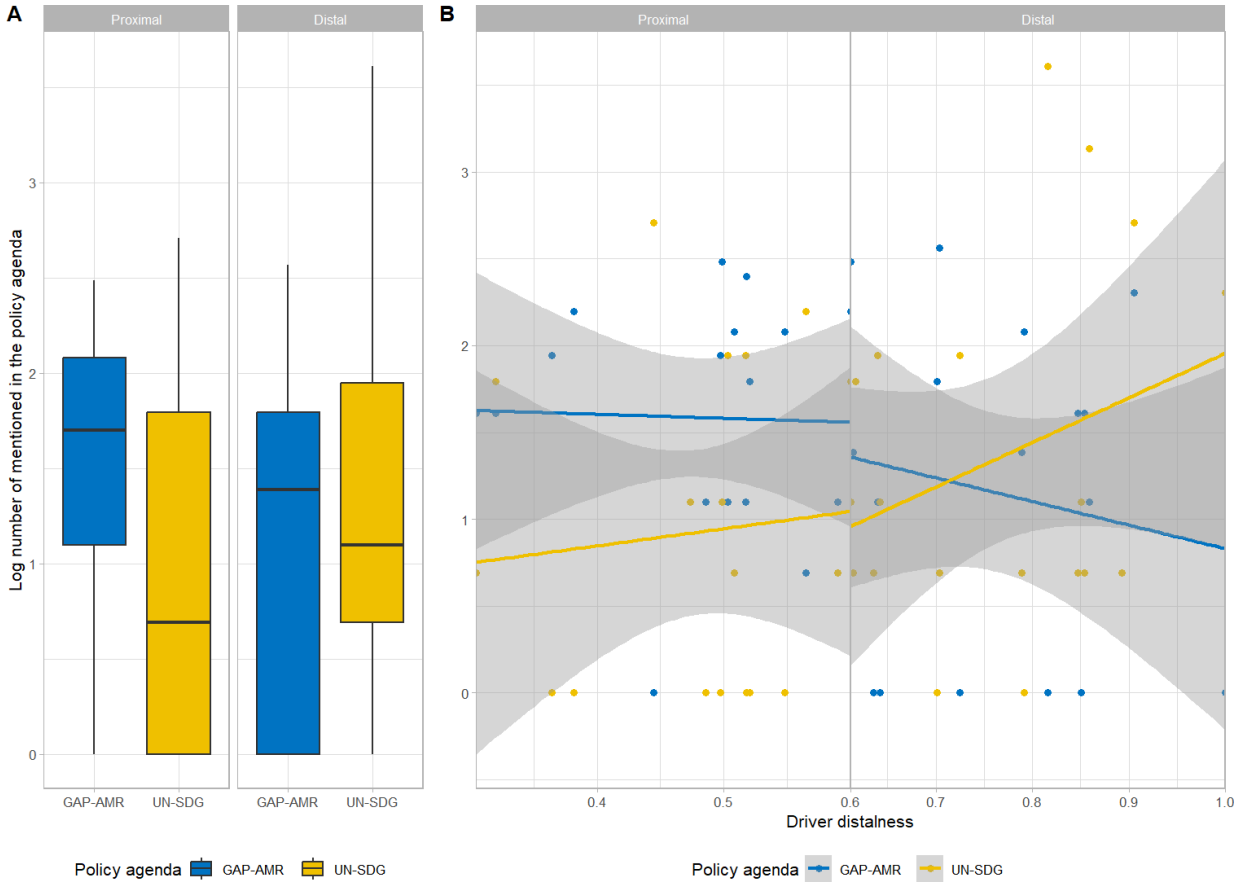

Figure 2 Difference in the coverage between proximal and distal drivers in the international policy agendas. (A) The box plot compares the averaged logarithm-transformed links of mentioned drivers to GAP-AMR and the UN-SDG. (B) Scatter plot with fitted regression lines illustrates the relationship between the driver distalness (a proxy for causality, ranging from 0 to 1, smaller values indicating direct causes) and the counts of links to policy agendas. GAP-AMR, Global Action Plan-Antimicrobial Resistance; UN-SDG, United Nations Sustainable Development Goal.

DISCUSSION

To integrate action on AMR drivers, it is important to identify areas of potential collaboration along with strategies for enabling policy coordination among AMR-specific and AMR-relevant policy avenues. Our findings highlight gaps in the current AMR policy landscape, where drivers are at risk of being redundantly addressed, narrowly focused or entirely overlooked by AMR and SDG policy. The overlap between AMR-NAPs and SDG-NAPs is lower at the national level compared with international alignment, with Asian countries showing a higher proportion of shared drivers than African countries. Proximal drivers are the primary targets of AMR agendas, while distal drivers are often addressed through SDG-NAPs or remain overlooked (figure 4).

The risk of uncoordinated policies: AMR drivers acknowledged by both frameworks

Drivers addressed by both the AMR and SDG-related policy agendas could be seen as encouraging, as they suggest progress towards policy integration. This integration increases the likelihood that actions will simultaneously consider sustainable development objectives and specific AMR challenges. Our analysis shows that, at the international level, despite the GAP-AMR and the SDG agenda being negotiated under different multilateral processes, more than half of AMR drivers can be addressed by both agendas.[6 7 35] This demonstrates that AMR is a sustainable development challenge. This overlap is mainly observed between objectives 3 and 4 of the GAP-AMR and 10 of the 17 SDGs, especially SDG 3, 6, 9 and 11. The finding is in line with a study conducted by Wernli *et al.*, highlighting that antibiotics stewardship and infection prevention are the primarily collaborative area within the UN system—including the UN and related organisations involved in addressing AMR.[36] At the national level, the overlap between AMR-NAPs and SDG-NAPs is lower, ranging from 10.5% to 47.4%. No correlation was found between a country's income level and the extent to which AMR drivers are addressed, however, regional disparities were apparent. Most Asian countries in the study have a higher proportion of shared drivers with SDG-NAPs than African countries.

This national variation might be attributed to several factors. First, SDG-NAPs are tailored to national contexts, with less developed countries often prioritising a narrower set of SDGs focused on economy or governance, which

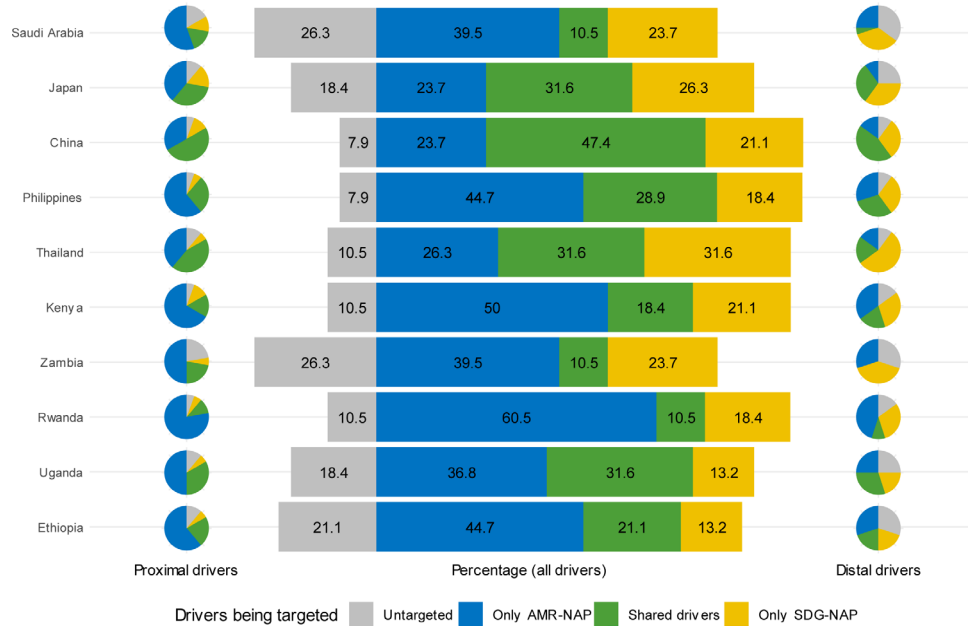

Figure 3 Coverage of AMR drivers in national policy agendas. The bar chart shows the percentage of drivers being targeted by either only AMR-NAP or SDG-NAP, by both or no targeted. The pie charts on the sides show the distribution of these categories by type of driver. The figure compares the coverage of AMR drivers in national policy agendas among 10 countries studied. The bar chart indicates the percentage of drivers targeted only by AMR-NAP, only by SDG-NAP, by both, or not targeted at all. The accompanying pie charts illustrate the distribution of these categories for proximal and distal drivers in each country. AMR, antimicrobial resistance; NAP, national action plan; SDG, sustainable development goal.

may result in a lower alignment with AMR objectives.[31] Second, competing priorities and goals in other sectors, combined with the absence of an integrated response framework, may delay the engagement of these sectors in responding to the AMR challenge.[26 36–38] Experiences from addressing complex global challenges in the past, such as climate change, emphasise the need for a mechanism or platform to synthesise evidence on AMR.[38 39] The Intergovernmental Panel on Climate Change, for example, has been instrumental in establishing formal mandates and engaging national commitment to integrate climate change into all aspects of national development. Coordination between the implementing bodies is crucial to ensure that the efforts to achieve SDGs are aligned with and reinforce the strategies to combat AMR.[20 38 40 41] Otherwise, actions could be at the risk of being redundant and in the worst case working counteractingly towards one another.

One possible reason for the low level of integration of SDG policy into AMR is that stakeholders are often

Table 2 Associated factors to the coverage of AMR drivers in national agenda

	Coverage of AMR driver in national agenda		
	Both agendas	AMR-NAPs	SDG-NAPs
Predictors	**OR (95% CI)**	**OR (95% CI)**	**OR (95% CI)**
Income (MHIC vs LIC)	0.85 (0.65 to 1.11)	**0.59** (0.42 to 0.83)**	1.36 (0.87 to 2.14)
Driver (distal vs proximal)	**0.53** (0.37 to 0.75)***	**0.6** (0.39 to 0.91)*	**2.02** (1.30 to 3.14)**
Policy agenda (SDG vs AMR)	**0.2** (0.16 to 0.25)***		
Interaction			
Income x Driver (MHIC×Distal)	1.27 (0.89 to 1.79)	1.07 (0.64 to 1.79)	1.03 (0.62 to 1.71)
Policy Agenda x Driver (SDG x Distal)	**3.33** (2.40 to 4.62)***		

*p<0.05, **p<0.01, ***p<0.001.
Boldface values in table mean statistical significance (p-value < 0.05).
AMR, antimicrobial resistance; LIC, low-income countries; MHIC, middle- and high-income countries; NAP, national action plan; SDG, sustainable development goal.

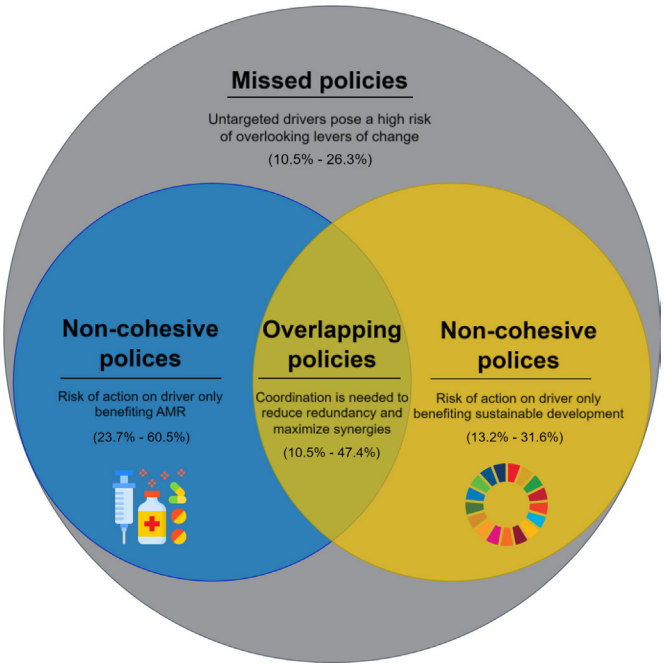

Figure 4 Policy gaps in integrating SDGs into AMR planning and implementation. The Venn diagram illustrates three governance risks. Overlapping policies, where AMR drivers are targeted by both agendas, risk redundancy. Non-cohesive policies, where AMR drivers are acknowledged by only one framework, presenting a risk of only benefiting sustainable development or AMR at the expense of the other. The outer grey area highlights the risk of missed policies due to untargeted drivers, highlighting the risk of overlooking significant levers of change. AMR, antimicrobial resistance; SDG, sustainable development goal.

unaware of AMR or sometimes hold competing resources and explanations for the problem.[10] To achieve higher levels of policy coordination, AMR should be framed as a long-term, multidimensional development challenge and be incorporated into sectoral regulatory frameworks, such as economic and trade policy at global and national levels.[38] Examples from LMICs that have adopted Health in All Policies in their national development plans by positioning health as a central element of development have demonstrated the benefits of how a health-focused agenda can drive progress on the SDGs.[28 42 43] Relevant sectors should assess how the spread of AMR is caused or contributed to by their sector and how AMR could impact their sectoral goals, thereby helping to identify key interdisciplinary overlaps and entry points for coordinated efforts to address AMR.[7 26 44–46] For example, strengthening occupational regulations regarding working conditions for high-risk groups in agriculture sector, including food animal production and meat-processing sectors, can enhance the implementation of AMR control interventions.[47]

The risk of narrow policies: AMR drivers that are only acknowledged by one framework

We find that 23.7% of AMR drivers, mainly proximal drivers related to the uncontrolled antibiotic use and prescription practice, are covered by the GAP-AMR. Meanwhile, most distal drivers (21.1%) are the targets of the UN-SDG agenda. Distal drivers, which are interconnected with various pathways leading to AMR, are important for governance. Previous findings in the literature indicating that there is little to no recognition of addressing distal drivers in national AMR policy.[48–50] Therefore, progress to achieve SDGs can complement progress on AMR by disentangling the root socioeconomic and environmental drivers of AMR that may have been usually overlooked, such as poverty, sociodemographic changes (eg, overpopulation, urbanisation, globalisation), environmental degradation and climate change and in humanitarian crisis events.[10 35 51–54] While addressing proximal drivers is crucial, an overemphasis on them comes at the risk of not addressing longer term systemic issues that ultimately help drive increases in antibiotic-resistant infections.[35 55–57] In addition, the limited overlap with SDG-NAPs results in a higher proportion of drivers being addressed solely by AMR-NAPs. Specifically, AMR-NAPs tend to address 23.7%–60.5% of drivers not mentioned in the SDG-NAPs. Take, for example, education and gender. Both are important drivers of AMR because of their influence on health literacy, access and use of antibiotics,[58] but SDG-NAPs often lack explicit strategies on how to support the AMR-NAPs in addressing them. On the other hand, about 13.2%—31.6% of AMR drivers are only addressed in the SDG-NAPs.

Actions on drivers only addressed by one of the agendas present a risk of only benefiting either sustainable development or AMR at the expense of the other issue. For example, many AMR-NAPs call for the reduction of antimicrobial use in the agri-food production sector, but the evidence has shown that efforts to improve national food security (SDG 2), such as through investment in irrigation or intensification of livestock production, have substantially increased the risks of infectious diseases, antimicrobial use and antibiotic residues.[59–63] On the other hand, drivers that are addressed by AMR policies only could involve trade-offs for other areas of sustainable development, such as neglecting socioeconomic and gender implications (SDG 5, 8, 10). For example, a pathogen-centric approach that only advocates biosecurity interventions to control animal diseases can disproportionately affect smallholder incomes.[59 64] Similarly, policies and education campaigns to limit antimicrobial use may inadvertently have negative impact individuals in situations of vulnerability.[28] To guide national policy-making and improve AMR outcomes, additional research is needed to assess synergies and trade-offs of SDG and AMR policies to ensure that interventions are holistic, equitable and effective across various contexts.[28 65]

The risk of overlooked levers of change: AMR drivers not acknowledged by any framework

Drivers that are not acknowledged by any of the two frameworks may indicate a general policy blind spot, where an area of potential concern or a lever of change

for both AMR and potentially the SDGs is being overlooked. Several reasons could explain this, including the drivers not being a feasible lever for change, considered taboo or just forgotten. We found that the driver of global travel and migration are not acknowledged in the global agenda. To curb travel-associated AMR due to migration and international travel or food-animal trading activities, several measurements including vaccination, increased hygiene and isolation, etc[66–72] are required. Yet, the transnational nature of human travel and trade means that efforts to curb AMR must be globally synchronised to be effective. This requires robust international frameworks and agreements, which can be sometimes challenging in the implementation due to varying national legal systems. There are also significant logistical and practical challenges in implementing measures because they require substantial infrastructure, training and resources to be effective.

At the national level, the proportion of drivers not targeted by any agenda has significantly increased from 10.5% to 26.3%. Actions to address the increasing demand for meat consumption are usually neglected in national agendas for both AMR and the SDGs, alongside other drivers of the expansion of intensive husbandry farming. In fact, addressing these drivers often fall outside the immediate purview of AMR-focused policies but is crucial for effective AMR management. Balancing economic development with AMR governance presents a complex challenge, and requiring careful coordination to ensure that efforts in one area do not undermine progress in another.[55] Shifting mental models and social norms, for example, promoting antibiotic-free food products, may take a long time but can significantly contribute to reducing AMR and achieving sustainability goal like zero carbon emissions[61 72]

Limitations

This study acknowledges that AMR is a multifaceted global crisis; however, the analysis presented herein is limited to a selection of 10 countries. The national assessment was based on document availability; therefore, the findings may not reflect the full spectrum of policy variations worldwide and should be interpreted with caution. Instead, the results should be interpreted as a preliminary guide to understanding the benefits of an integrated and mutually reinforcing approach to the implementation of AMR and SDG. In addition, the relationships between AMR and SDGs identified in our study are 'potential', signifying the direction of the relationship rather than the magnitude of the associations. The intricacies of the interactions between SDGs and AMR objectives were also not explored within the scope of this study. More research must be directed to assist policymakers who work on AMR and sustainable development issues to undertake comprehensive analyses of both positive and negative interactions between the two agendas in order to find ways to prioritise actions and use of resources in ways that optimise the linkages.[73]

CONCLUSION

Our study demonstrates substantial potential for alignment between the AMR and SDG agendas, presenting opportunities to address AMR while promoting sustainable development. The commitment to meeting the SDGs can significantly impact AMR, potentially of the same magnitude as the influence of AMR-specific policies. However, policy gaps remain where AMR drivers are addressed by only one agenda or by neither. Therefore, the effective implementation of both agendas in an integrated manner will depend on national governments' capacity to formulate and implement a set of national targets that concurrently address both agendas, enhance synergies and mitigate conflicts.

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