



## ORIGINAL ARTICLE

# The Global Governance of Antibiotic Stewardship: A One Health Scoping Review and the Integrated Polycentric Glocal Governance Framework (IPGF)

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### Abstract

Antimicrobial resistance (AMR) poses a serious and growing threat to global public health, undermining decades of progress in infectious disease control. Antibiotic stewardship (ABS) — aimed at optimizing antimicrobial use across human, animal, and environmental health — has become central to this response. This article presents a scoping review of academic and grey literature sources to examine the global governance architecture of ABS. Anchored in a One Health lens and drawing on multi-level and polycentric governance theory, the review maps key actors, institutional arrangements, and policy mechanisms shaping international stewardship efforts. Despite growing consensus, stewardship governance remains fragmented, underfunded, and marked by stark disparities between high-income and low- and middle-income countries. To address these challenges, the paper proposes an original Integrated Polycentric Glocal Governance Framework (IPGF) and applies it to two case studies in the Middle East and North Africa (MENA) region. This model emphasizes decentralized coordination, stakeholder inclusivity, and adaptive learning to better align global norms with local realities. The findings call for structural reform and innovative governance approaches to strengthen global antibiotic stewardship and mitigate the accelerating AMR crisis.

**Keywords:** antimicrobial resistance, antibiotic stewardship, global health governance, One Health, polycentric governance.

## 1. INTRODUCTION

Dubbed a “silent tsunami” by the World Health Organization, antimicrobial resistance (AMR) was directly responsible for 1.27 million deaths worldwide and contributed to nearly 5 million deaths in 2019 alone [1]. This tragic figure is set to escalate to 10 million deaths per year without effective and comprehensive intervention. Economically,

AMR could cost the global economy \$100 trillion by 2050 [2], fueled by escalated healthcare costs, hampered productivity, and potential food shortages. The world is currently facing a salient global AMR pandemic.

Antibiotic stewardship (ABS) has emerged as a key strategy to curb resistance and preserve antimicrobial effectiveness [3]. Stewardship spans human, animal, and

environmental domains, increasingly framed through a One Health lens [4], as seen in the Quadripartite Joint Plan of Action [5].

Yet implementation remains uneven and under-resourced, especially in low- and middle-income countries (LMICs). Many National Action Plans (NAPs) lack financing, surveillance systems, and multisectoral coordination [6]. Global governance remains fragmented, with no binding treaty and limited enforcement beyond soft law and donor funding [7,8]. As a result, the gap between commitment and compliance persists.

In light of this, this paper introduces a novel focus on ABS within the broader discourse of AMR from a political science perspective. The stewardship crisis reflects deeper issues in how authority, responsibility, and resources are distributed across sectors and levels of the international system. Current models over-rely on centralized norm-setting without enabling locally grounded adaptation or sustained accountability. There is an urgent need for governance innovation that can respond to complexity, accommodate asymmetries, and promote cross-sectoral coherence.

To address these deficits, this article proposes a novel Integrated Polycentric Glocal Governance Framework (IPGF) for antibiotic stewardship. The IPGF combines the normative breadth of One Health with the structural insights of multi-level and polycentric governance. It emphasizes decentralization, regional empowerment, and problem-driven iterative adaptation as key design principles.

The paper proceeds as follows. Section 2 outlines the conceptual and theoretical foundations of the framework. Section 3 describes the methodology used to synthesize academic and policy literature. Sections 4 to

5 analyze the institutional landscape of stewardship, examine stakeholder dynamics, and identify systemic implementation challenges. Section 6 then presents the IPGF as a practical and theoretical model, and Section 7 applies this framework to two contexts in the MENA region.

## 2. CONCEPTUAL AND THEORETICAL FRAMEWORK

Effective antibiotic stewardship cannot be achieved through technical interventions alone. Stewardship challenges are deeply embedded in the ways institutions are structured, responsibilities are distributed, and decisions are made across sectors and levels of governance. This paper draws on two interrelated theoretical lenses - One Health and multi-level/polycentric governance - to understand and reimagine the institutional landscape of global ABS.

### 2.1 One Health Paradigm

One Health recognizes the interdependence of human, animal, and environmental health [1]. It is especially relevant to AMR, which spreads via zoonoses, food systems, environmental contamination, and global mobility [2]. Drivers include antibiotic use in livestock and aquaculture, pharmaceutical pollution, and medical overprescription [6,7].

One Health is now central to global AMR policy. The Quadripartite—WHO, FAO, WOAH, and UNEP—have endorsed it in their 2022–2026 Joint Plan of Action [1], emphasizing cross-sectoral collaboration, harmonized surveillance, and co-designed interventions.

Yet implementation remains limited. Ministries often operate in silos, with uncoordinated funding, data, and mandates, and few formal mechanisms for collaboration [6]. Global policy tends to prioritize high-

level alignment over subnational implementation—especially in LMICs.

Thus, while One Health provides a normative vision for integrated AMR responses, it lacks sufficient attention to institutional design, power asymmetries, and resource distribution. For this reason, a second conceptual layer — multi-level and polycentric governance — is required.

### 2.2 Multi-Level Governance

The second framework guiding this paper is multi-level governance (MLG), which examines how authority, accountability, and decision-making are distributed across levels — from global to local — and across sectors [7]. Initially developed for European integration, it now informs domains like climate change, food systems, and global health [8].

MLG helps illuminate the failure to translate global AMR commitments into local action. WHO and FAO issue guidance but lack enforcement power. National governments often lack funding or capacity, while local actors — hospitals, veterinary clinics, regulators — are rarely empowered to adapt policies. This disconnect is often coined the commitment-compliance gap [9].

Polycentric governance complements MLG by emphasizing multiple decision-making centers that operate autonomously but share accountability and norms [4,10]. These systems allow experimentation, local adaptation, and redundancy — key for tackling complex challenges like AMR.

For ABS, polycentric governance shifts from top-down control to distributed collaboration across global, regional, and local actors. It recognizes multiple authorities — public health bodies, veterinary associations, environmental regulators — and fosters coordination via shared data, standards, and platforms [11]. This distributed model also mitigates fragility:

reliance on one body or donor project makes stewardship vulnerable. Polycentric systems build resilience through shared responsibility and bottom-up accountability.

### 2.3 Integration of Frameworks

Combining One Health and MLG allows for a more nuanced analysis of ABS governance. While One Health provides the normative rationale for integration across health sectors and disciplines, MLG helps dissect the political and institutional mechanisms through which that integration is, or is not, realized. It directs attention to the structural bottlenecks that prevent coordination, such as inter-ministerial turf wars, donor-driven fragmentation, or lack of local implementation capacity [12]. This dual-theoretical approach not only enables mapping of the governance landscape but also informs the design of more resilient, adaptive, and equitable stewardship models. As the paper argues in later sections, an effective ABS governance strategy must be both polycentric and ‘glocal’ — anchored in global norms yet adaptable to local contexts.

## 3. METHODOLOGY

This scoping review employs a scoping review methodology to map and critically examine the governance landscape of ABS from a global, One Health perspective. Unlike systematic reviews, which focus on evaluating the effectiveness of interventions, scoping reviews are designed to identify key themes, concepts, gaps, and types of evidence across a broad body of work.

### 3.1 Research Questions

This review was guided by the following research questions:

1. What are the major institutional and policy frameworks currently governing antibiotic stewardship at the global level?
2. How are responsibilities and authority

distributed among international, national, and subnational actors?

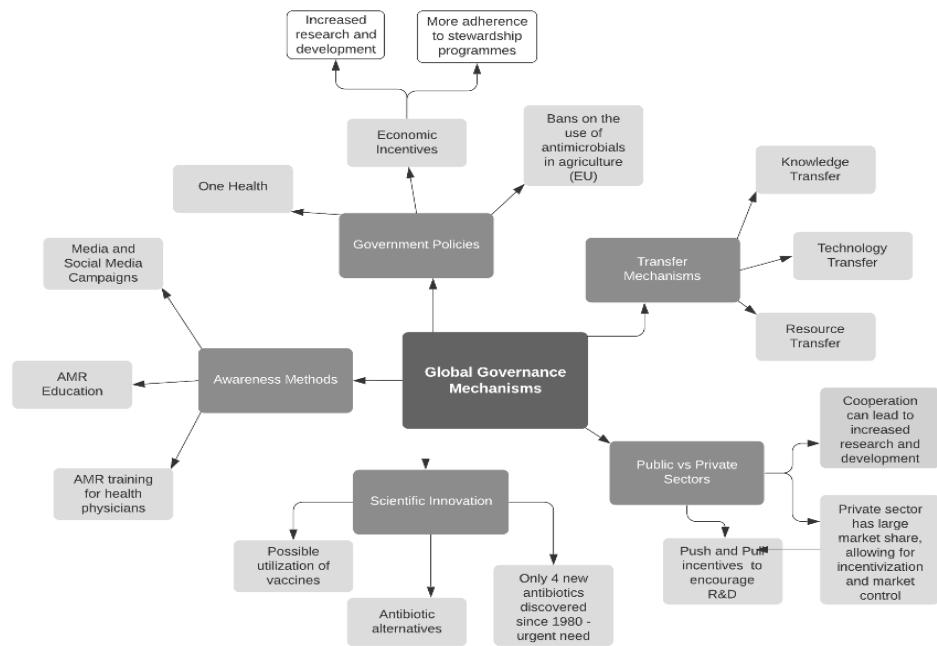
3. What are the principal challenges and limitations of current governance structures for ABS?
4. What models or frameworks have been proposed to improve coordination, accountability, and equity in global stewardship?

These questions were informed by the conceptual foundations discussed in Section 2, particularly the relevance of One Health, multi-level governance, and polycentricity to the global AMR challenge.

### 3.2 Data Sources and Search Strategy

This scoping review included peer-reviewed and grey literature from international organizations, NGOs, multilateral bodies, and think tanks. Grey literature was sourced from official portals of key actors such as WHO, FAO, WOAH, UNEP, World Bank, ReAct,

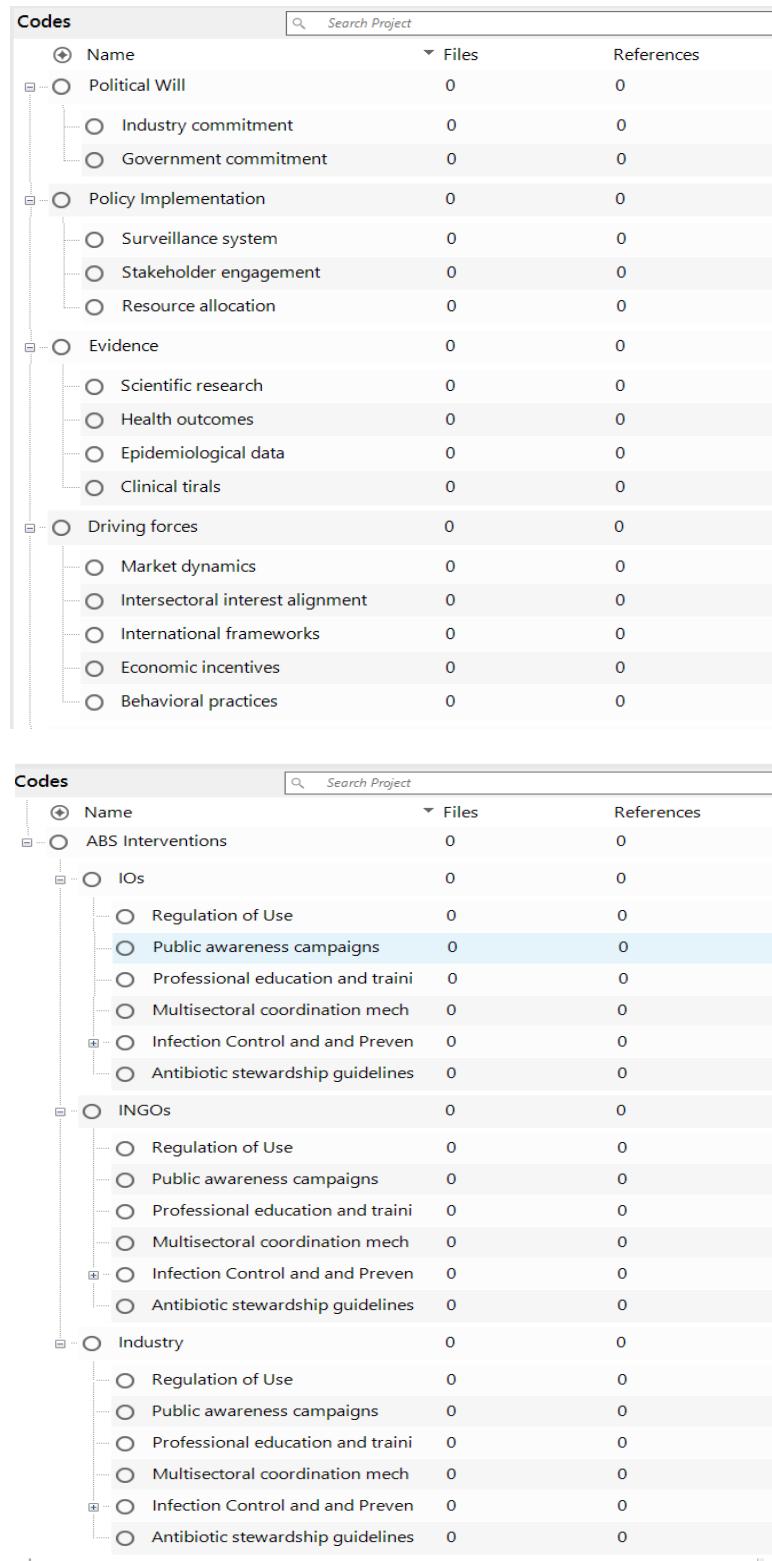
and the AMR Industry Alliance. Boolean operators and wildcard modifiers were used to widen the search scope. Searches were limited to English-language documents published between January 2010 and October 2023, reflecting governance developments after the 2015 WHO Global Action Plan. Of 1,333 titles screened, 203 documents were selected for full-text review (81 academic and 122 grey sources). Inclusion criteria emphasized relevance to antibiotic stewardship governance — institutional frameworks, policies, strategies, or stakeholder dynamics — with attention to One Health or intersectoral coordination, and sufficient conceptual or methodological content. Exclusions included pharmacological studies, inaccessible full texts, editorials, or documents lacking governance relevance. *Figure 1* presents a cluster map of governance mechanisms; *Figure 2* showcases the coding tree.



**Figure 1: Cluster Map of Global Governance Mechanisms found in the literature.**

Note: Cluster map of the coded governance mechanisms deductively found in the literature.

Source: Author's own work.



**Figure 2: ABS Governance Coding Tree.**

Note: Cluster map of the coded governance mechanisms deductively found in the literature.

Source: Author's own work.

### 3.4 Analytical Approach

Data were organized using a hybrid deductive-inductive thematic coding process. Deductive themes were based on the conceptual framework (e.g., polycentricity, vertical integration, surveillance asymmetries), while inductive themes emerged through repeated reading and memo-writing.

The five major governance themes that guided the analysis were:

1. Institutional coordination and fragmentation;
2. Stakeholder roles and power asymmetries;
3. Legal frameworks and compliance structures;
4. Financing and implementation gaps;
5. Governance innovations and models.

This framework informed the structure of the findings in Sections 4 and 5.

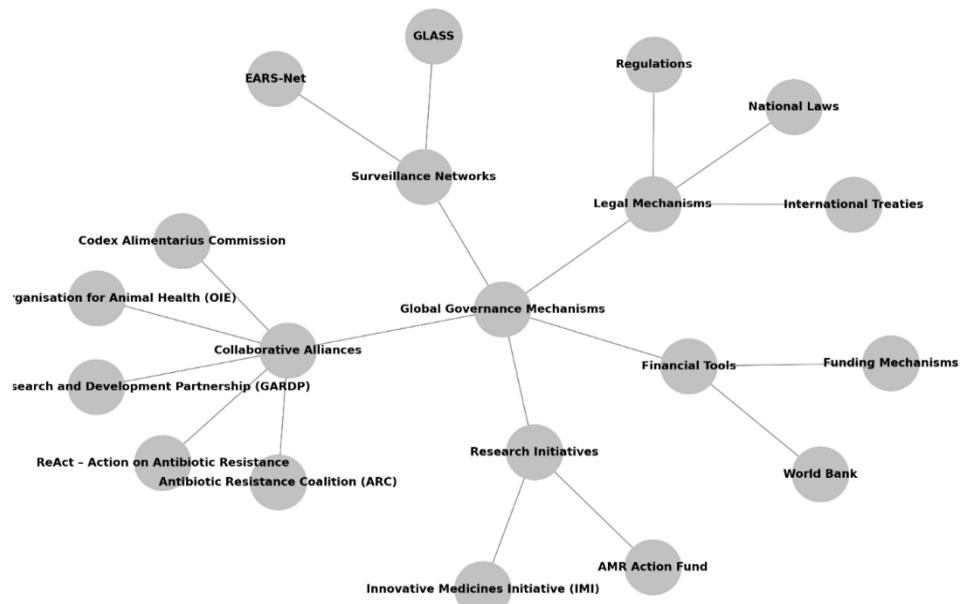
### 3.5 Limitations

As with all scoping reviews, this study

does not evaluate the quality of evidence in a formal sense. The broad scope allows for conceptual richness but may sacrifice depth in any one specific governance domain. Furthermore, the review is limited to English-language sources and may miss relevant regional perspectives.

## 4. STAKEHOLDER ROLES AND POWER DYNAMICS

Antibiotic stewardship governance is shaped by a wide array of stakeholders whose interests, capacities, and levels of influence vary significantly. The interactions among these actors reveal a complex web of cooperation, competition, and negotiation, all within a governance landscape marked by resource asymmetries and power imbalances. *Figure 3* showcases a cluster map of the various global governance mechanisms found in the literature.



**Figure 3: Mind Map: Global Governance Mechanisms in Combating AMR**

Note. Cluster mind map of global governance mechanisms in combatting AMR. *Source: Author's own work.*

#### *4.1 International Organizations: Norm Entrepreneurs with Limited Enforcement*

Multilateral organizations are key norm-setters in the AMR and ABS space. Through initiatives like the Global Action Plan on AMR and the Quadripartite Joint Plan of Action, these institutions have articulated technical guidance and promoted multisectoral cooperation [14]. WHO's role in launching the Global Antimicrobial Resistance and Use Surveillance System (GLASS) is also central to global data harmonization efforts [15]. However, these institutions lack enforcement powers. Their influence is largely normative and dependent on member states' compliance. Despite high-level commitments, many countries delay or dilute implementation due to domestic political priorities or capacity gaps. Moreover, overlaps between organizational mandates and weak inter-agency coordination have led to inefficiencies and policy fragmentation [16].

#### *4.2 National Governments: Sovereign Implementers with Unequal Capacity*

National governments are responsible for implementing ABS measures within their jurisdictions. Their roles include regulating antibiotic prescribing and sales, building laboratory and surveillance infrastructure, training professionals, and aligning agricultural and environmental policies with One Health principles. However, capabilities vary widely across contexts. High-income countries (HICs) are more likely to have dedicated stewardship programs, national surveillance systems, and enforceable regulations. In contrast, low- and middle-income countries (LMICs) face significant constraints, including underfunded health systems, weak legal frameworks, and dependence on external donors for surveillance and implementation [17].

Compounding these challenges is a global governance asymmetry. While HICs influence the agenda through funding and norm-setting, LMICs often bear the highest AMR burdens but lack equivalent policy influence or financial flexibility. This reinforces a cycle in which donor-driven projects are prioritized over long-term systems strengthening [18].

#### *4.3 The Private Sector: Powerful but Poorly Regulated*

Pharmaceutical companies play a central but contested role in stewardship governance. On the one hand, the private sector is critical to ensuring supply of effective antibiotics and driving innovation. On the other, commercial incentives often conflict with stewardship principles, especially where profit depends on high-volume sales [19].

Initiatives like the AMR Industry Alliance and the Davos Declaration have encouraged pharmaceutical companies to commit to responsible production, equitable access, and investment in research and development. However, many of these efforts remain voluntary, and transparency in reporting remains limited [20]. Moreover, antibiotic waste from manufacturing, particularly in countries with lax environmental regulation, contributes to resistance hotspots [21].

The veterinary and agriculture sectors also include powerful industry actors, particularly in regions where antibiotics are used as growth promoters or prophylactics. Resistance to regulatory reform in these sectors often reflects entrenched economic interests and a lack of oversight infrastructure.

### **5. CHALLENGES IN IMPLEMENTATION**

Despite a growing consensus around the urgency of antimicrobial resistance and the importance of antibiotic stewardship,

implementation at the global level remains plagued by fragmentation, inequity, and policy inertia. This section identifies the key structural and systemic barriers that have undermined effective stewardship, particularly in LMICs. These challenges are not simply technical; they reflect deeper governance failures, misaligned incentives, and asymmetrical power dynamics.

### 5.1 Fragmentation and Institutional Overlap

One of the most persistent challenges is the fragmentation of stewardship efforts across sectors, organizations, and governance levels. Ministries of health, agriculture, and environment often operate with independent mandates, poorly aligned data systems, and

competing priorities [24]. While the One Health approach aims to integrate these sectors, in practice most national AMR plans lack formal mechanisms to enforce collaboration or to co-finance joint programs [25]. Globally, coordination among the major international actors — WHO, FAO, WOAH, and UNEP — has improved through the Quadripartite alliance, but implementation remains parallel rather than integrated [26]. Without structured governance mechanisms to ensure vertical and horizontal alignment, policies risk duplication, inefficiency, or contradiction. *Figure 4* highlights the various institutional alliances currently active in instituting effective ABS stewardship.

Collaborative Alliance	Contributions	Interconnectedness	Impact on Policy and Research	Challenges and Limitations
Codex Alimentarius Commission	Endorses food standards, guidelines, and practices impacting AMR in agriculture.	Integrates food safety and AMR management.	Influences international food safety policies and agricultural practices.	Balancing food industry interests with public health goals.
World Organisation for Animal Health (WOAH)	Provides standards and guidelines for responsible antimicrobial use in animals.	Contributes to ecosystem balance by controlling antibiotic use in animals.	Guides national and international policies on animal health and antibiotic use.	Ensuring global adoption and compliance with guidelines.
Global Antibiotic Research and Development Partnership (GARDP)	Focuses on developing new antibiotic treatments and ensuring responsible usage.	Aligns with WHO's broader goals in combating AMR.	Informs global research agendas and healthcare policies on antibiotic development.	Navigating funding challenges and aligning with diverse health systems.
ReAct – Action on Antibiotic Resistance	Mobilizes funding for NAPs, focusing on capacity building and policy advocacy.	Complements national and international efforts in AMR policy formulation.	Advocates for effective AMR policies, especially in LMICs.	Addressing varying national priorities and resource limitations.
Antibiotic Resistance Coalition (ARC)	Shapes policy debates and fosters cooperation across civil society and intergovernmental organizations.	Brings diverse stakeholders together for a united approach to AMR.	Contributes to shaping international AMR policy discourse.	Harmonizing diverse stakeholder interests and policy perspectives.

Collaborative Alliance	Contributions	Interconnectedness	Impact on Policy and Research	Challenges and Limitations
Joint Programming Initiative on Antimicrobial Resistance (JPIAMR)	Streamlines resources and coordinates national research efforts in AMR.	Fosters global research collaboration and resource sharing.	Influences national research policies and priorities in AMR.	Coordinating efforts across countries with differing AMR challenges.
AMR Industry Alliance	Drives progress in research and responsible antibiotic use in the pharmaceutical, biotechnology, and diagnostics sectors.	Synergizes industry efforts with global health objectives.	Impacts industry standards and practices in antibiotic development and use.	Aligning industry actions with global public health needs.
Global AMR R&D Hub	Amplifies global AMR R&D endeavors, promoting efficient use of R&D resources.	Coordinates international investment in AMR research.	Guides global research funding and priorities in AMR.	Securing funding and managing research
Transatlantic Task Force on Antimicrobial Resistance (TATFAR)	Enhances cooperation in key areas such as therapeutic antimicrobial use and prevention strategies.	Facilitates cross-border policy and research collaboration.	Shapes international strategies for AMR prevention and drug development.	Overcoming political and regulatory differences.

**Figure 4: Table of AMR collaborative alliances**

Note. Table of collaborative alliances as well as their contributions, interconnectedness, impact and challenges. *Source: Author's own work.*

### 5.2 Legal and Regulatory Weaknesses

Many countries lack robust legal frameworks to enforce ABS principles. Over-the-counter sales of antibiotics remain common, especially in LMICs, due to regulatory loopholes, corruption, and limited access to formal health care [27]. In some settings, informal drug vendors and unlicensed pharmacies serve as the primary access point for antimicrobials. Even where laws exist, regulatory enforcement is weak. Surveillance agencies often lack funding, personnel, or political backing to monitor prescription practices, inspect supply chains, or penalize violators [28]. The absence of legal harmonization between sectors (e.g., veterinary vs. human medicine) further exacerbates gaps in control.

At the global level, stewardship norms are still based on soft law: voluntary guidelines,

political declarations, and non-binding targets. While these instruments allow flexibility, they offer no legal recourse when countries fail to act. Efforts to develop binding international mechanisms — such as AMR provisions in a future pandemic treaty — remain politically contentious [29].

### 5.3 Financing and Resource Constraints

Effective stewardship requires sustained investment in diagnostics, lab systems, training, monitoring, and public engagement. Yet, many national action plans remain unfunded or donor dependent. According to WHO, less than 20% of countries have fully costed and funded their AMR strategies [30]. Donor funding, while essential, is often short-term, project-based, and fragmented, leading to vertical interventions that are difficult to scale or sustain. Additionally, donor priorities may not align with national

needs, and funding uncertainty undermines long-term planning [31]. LMICs frequently face trade-offs between investing in ABS and addressing more politically visible health challenges such as maternal health, vaccination, or pandemic preparedness. As a result, stewardship is often deprioritized in national budgeting processes.

#### *5.4 Data Gaps and Surveillance Inequities*

Robust stewardship requires accurate, timely, and context-specific data on antimicrobial use and resistance patterns. However, surveillance capacity remains highly uneven. High-income countries are more likely to have electronic health records, centralized reporting systems, and laboratory infrastructure. In contrast, many LMICs lack even the most basic capacity for data collection, let alone analysis or dissemination.

Global platforms such as GLASS are important steps toward harmonized data collection, but participation is voluntary, and technical standards are not always feasible for resource-limited settings. As a result, data deserts persist, particularly in sub-Saharan Africa, South Asia, and parts of Latin America, obscuring the true burden of AMR and preventing tailored policy responses. The absence of data also perpetuates global inequities. Countries with limited surveillance capacity are often excluded from global risk assessments, funding allocations, and research collaborations, further entrenching disparities in knowledge, resources, and influence [22].

#### *5.5 Socio-Cultural Norms*

Efforts to enforce stewardship may clash with local political economies of healthcare and agriculture. In many contexts, antibiotics are used not only for treatment but also as proxies for care [34]. Restricting access without addressing these structural issues can

backfire, pushing antibiotic use underground or eroding public trust. In agricultural sectors, resistance to reform often reflects the economic dependence of smallholders and commercial operators on growth-promoting antibiotics. Top-down bans may provoke backlash or noncompliance unless accompanied by incentives, extension services, and affordable alternatives [35].

Cultural beliefs, informal norms, and historical relationships with the health system all shape antibiotic use behaviors. Stewardship must therefore be grounded in context-sensitive public engagement and co-designed strategies, rather than generic messaging or regulatory imposition [35].

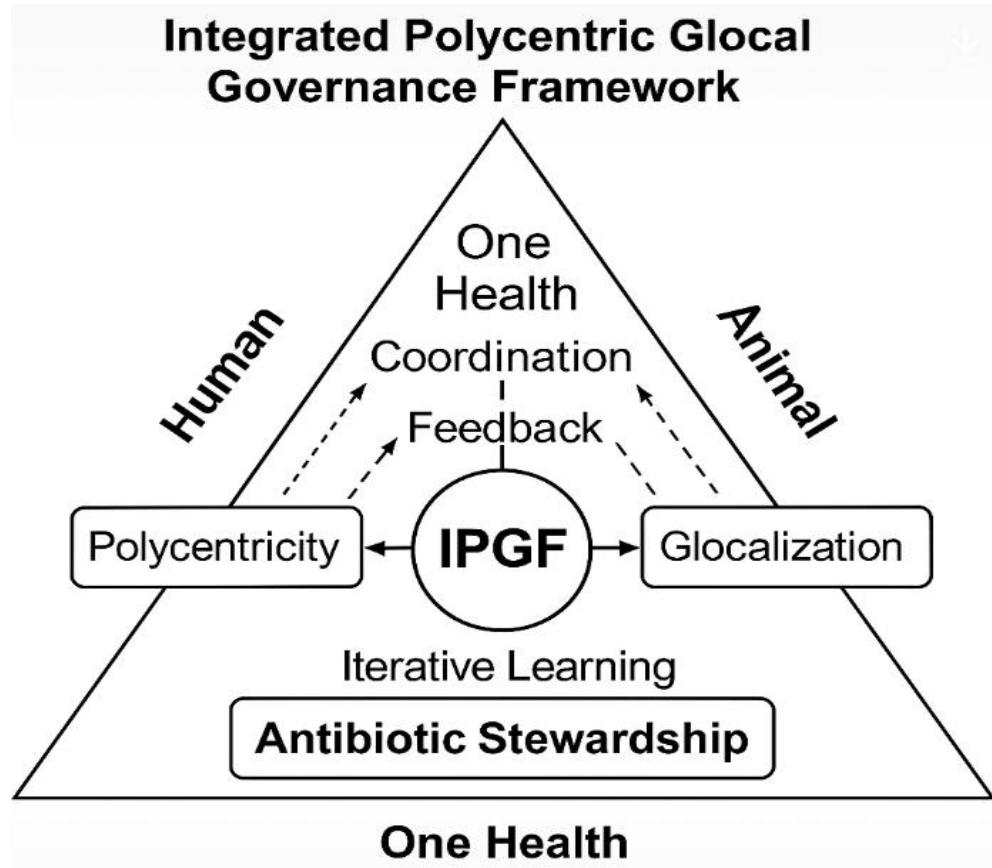
## **6. THE INTEGRATED POLYCENTRIC GLOCAL GOVERNANCE FRAMEWORK (IPGF)**

Addressing the global governance shortcomings of ABS requires more than marginal improvements to existing institutions [2]. It calls for a reimagined model of governance — one that is adaptive, inclusive, and capable of aligning global norms with local realities. This section proposes the Integrated Polycentric Glocal Governance Framework (IPGF) as a new approach to stewardship governance that bridges the commitment-compliance gap, distributes authority more equitably, and enables context-sensitive implementation.

The IPGF framework is built on three interlocking theories: (1) Polycentricity, the recognition that effective governance emerges from the interaction of multiple, overlapping centers of authority; (2) Glocalization, the strategic alignment of global objectives with locally grounded implementation; and (3) the Problem-Driven Iterative Adaptation (PDIA). Each component responds directly to the

institutional failures, power imbalances, and structural constraints detailed in previous

sections. *Figure 5* represents a schematic visualization of this framework.



**Figure 5: Schematic representation of the Integrated Polycentric Glocal Governance Framework**

Note: Schematic representation of the Integrated Polycentric Glocal Governance Framework (IPGF). The model emphasizes coordination and feedback across the human, animal, and environmental sectors in line with the One Health paradigm. Governance is anchored in principles of polycentricity, glocalization, and iterative learning to enable adaptive, multisectoral antibiotic stewardship. *Source: Author's own work.*

#### 6.1 Polycentricity: Decentralizing Authority for Resilience

The first pillar of the IPGF draws on the theory of polycentric governance, which emphasizes a system in which multiple semi-autonomous decision-making units operate within a framework of mutual recognition and coordination [8]. In contrast to hierarchical models, polycentric systems

promote innovation, reduce single-point failures, and allow diverse stakeholders to tailor policies to local conditions.

In the context of ABS, this means moving away from an overly centralized, WHO-centric model toward one in which regional networks, sub-national authorities, and sectoral actors are empowered to co-design and implement stewardship strategies.

Hospitals, professional associations, veterinary boards, municipal governments, and indigenous knowledge systems all hold critical knowledge and agency that must be integrated into the governance system.

A polycentric ABS regime would institutionalize horizontal linkages between peers (e.g., between countries in the Global South facing similar resource constraints) as well as vertical subsidiarity, where authority is allocated to the lowest level capable of effective action. This would also foster redundancy and resilience: if one node in the system fails — such as a weak national regulator — other nodes (e.g., regional health bodies or civil society watchdogs) can still uphold stewardship standards [24]. Crucially, polycentricity does not imply fragmentation [25]. What it demands is structured pluralism: a system of nodes connected by shared principles, mutual accountability, and mechanisms for coordination and learning.

### 6.2 Glocalization: Aligning Global Norms with Local Realities

The second principle of the IPGF is glocalization — the strategic fusion of global governance norms with local implementation. Current stewardship efforts often rely on top-down dissemination of guidelines, which may be scientifically sound but operationally infeasible or culturally mismatched [26, 32]. Glocal governance inverts this dynamic, insisting that global frameworks must be adapted, translated, and negotiated with local actors who understand the socio-economic, cultural, and institutional terrain. This principle addresses a key equity concern in ABS governance: the tendency of high-income countries and international agencies to set agendas without sufficient consultation or co-creation with LMICs [26, 28, 33]. By embedding stewardship within local governance structures — such as community

health systems, farmer cooperatives, or traditional medicine councils — policies gain legitimacy and traction [30].

Glocalization also recognizes that different countries face different stewardship challenges. In overuse hotspots, the emphasis may be on regulating private pharmacies and marketing practices [30]. In under-access contexts, stewardship may focus on supply chain management, quality control, and diagnostic support [27]. The IPGF allows for asymmetric policy design, rather than a universal template that fits no one well.

To operationalize glocalization, the IPGF calls for the establishment of regional or national platforms where global technical guidance can be translated into actionable, locally owned strategies. These hubs would facilitate dialogue between ministries, technical experts, civil society, and communities, ensuring policies are both evidence-based and socially grounded.

### 6.3 PDIA: Adapting Through Learning and Feedback

The third pillar of the IPGF is Problem-Driven Iterative Adaptation (PDIA), a model of institutional change [22]. PDIA challenges the assumption that governance solutions can be transplanted from best-practice models elsewhere. Instead, it proposes a method that starts with the specific problems stakeholders face in their unique contexts and builds solutions through trial, feedback, and adaptation.

PDIA would be institutionalized through a combination of flexible financing, robust data systems, and performance-oriented monitoring. Financing mechanisms must allow experimentation and risk-taking, enabling resources to support adaptive solutions rather than pre-fixed activities [31]. Local data loops should be built into stewardship systems to facilitate ongoing

monitoring, learning, and course correction. In parallel, governance scorecards should track not only service delivery outputs, but also institutional learning, accountability practices, and stakeholder inclusion. By embedding learning into the governance architecture, ABS systems can respond dynamically to changing resistance patterns, political conditions, and resource constraints.

#### *6.4 Institutionalizing the IPGF*

To move the IPGF from concept to practice, deliberate institutional innovations are required at both national and global levels. At the regional level, stewardship compacts can serve as collaborative agreements between neighboring countries to align policy standards, harmonize surveillance protocols, and coordinate procurement strategies. These regional platforms can also facilitate knowledge sharing and pool technical and financial resources.

At the national level, multistakeholder stewardship boards should be established with meaningful representation from government, academia, civil society, and the private sector. These bodies must be empowered with real decision-making authority, embedded in national governance structures, and linked to broader health and development priorities. To support sustainable implementation, equity-oriented pooled financing models should be developed. Drawing inspiration from platforms like Gavi and the Global Fund [13, 34], these mechanisms would provide predictable, long-term support to NAPs.

Finally, global accountability scorecards are needed to monitor progress in stewardship governance. These tools should be co-designed with LMIC stakeholders and built around a concise set of performance indicators that measure governance quality,

equity, and institutional resilience. By promoting transparency, benchmarking, and shared learning, such scorecards can help drive reform and foster global solidarity in tackling antimicrobial resistance.

## **7. PRACTICAL IMPLEMENTATION OF THE IPGF IN LMICS: FOCUS ON MENA COUNTRIES**

Implementing the IPGF in LMICs requires more than technical replication of global models. It demands adaptive, context-sensitive governance rooted in local realities of capacity, politics, and culture. The Middle East and North Africa (MENA) region illustrates both the challenges and opportunities of this approach. Jordan and Egypt offer contrasting examples of how IPGF principles – polycentric coordination, glocal adaptation, and iterative learning – can inform more effective ABS governance in the MENA region.

### *7.1 Jordan: Localized Adaption through Iterative Governance*

Jordan has taken meaningful steps toward stewardship aligned with the IPGF. Its 2023–2025 National Action Plan reflects WHO and One Health principles and has been operationalized through a polycentric structure involving both national authorities and hospital-level AMS teams [32, 34]. This distributed governance enables vertical coordination and peer learning [34].

In two pilot facilities, AMS teams co-developed surgical antibiotic prophylaxis protocols with national actors, adapting international guidelines to local clinical realities. This participatory process reflects glocalization, enhancing legitimacy and implementation [34]. The approach built local ownership and aligned stewardship with frontline practice.

Importantly, Jordan institutionalized

Problem-Driven Iterative Adaptation (PDIA): repeated implementation-audit-feedback cycles allowed for protocol refinement, with international support gradually replaced by national leadership [31, 34]. These cycles produced measurable improvements in adherence to best practices, including antibiotic timing, dosing, and documentation [34]. Jordan thus demonstrates the value of embedded learning systems, local adaptation, and distributed authority in realizing stewardship goals.

### 7.2 Egypt: Centralized Ambitions and the Implementation Gap

Egypt presents a contrasting scenario. While its national AMR strategy is comprehensive and aligned with One Health principles, practical implementation remains weak [33, 36]. Though policymakers and stakeholders contributed to its design, follow-through has been hampered by fragmented governance, limited enforcement, and poor surveillance systems [35, 36].

Antimicrobial access remains loosely regulated, particularly in informal healthcare and agricultural sectors, where over-the-counter use is widespread [25, 36]. This reflects a centralized but under-resourced system where policy commitments have not translated into local-level stewardship.

The IPGF points to alternative pathways. Empowering governorates, pharmacists, hospital committees, and local professional associations to co-develop policies would enhance polycentric coordination. Glocalization would involve tailoring stewardship to diverse community contexts, aligning policies with socioeconomic realities and building grassroots legitimacy.

Currently, Egypt lacks robust data feedback loops essential to PDIA. Without meaningful local engagement, stewardship

risks being perceived as externally imposed. A more effective approach would pilot targeted AMS programs, evaluate outcomes, and scale successful models — bridging the gap between global norms and grounded implementation [36].

## 8. CONCLUSION

Antimicrobial resistance is no longer a looming threat — it is a present and accelerating crisis that endangers human, animal, and environmental health. Antibiotic stewardship has emerged as a vital strategy to preserve antimicrobial efficacy, but its success depends not only on technical interventions or clinical guidelines — it depends on the quality and structure of governance. As this paper has shown, the global ABS regime remains fragmented, under-enforced, and disproportionately shaped by actors in high-income countries. While the rhetoric of One Health has gained traction, its implementation remains limited, and the institutional architecture supporting global stewardship has yet to evolve into a coherent, accountable, and equitable system.

This paper underscores several key findings. First, stewardship is governed by a polycentric array of actors — international agencies, national governments, the private sector, civil society, and academia — whose roles are often poorly coordinated and misaligned. Second, the absence of binding legal frameworks, sustainable financing, and robust accountability mechanisms severely limits the ability of global institutions to ensure meaningful compliance. Third, structural inequities between high- and low-resource settings hinder the equitable distribution of voice, capacity, and responsibility in global ABS governance.

At the same time, this paper has argued that these challenges are not insurmountable.

Through the lens of One Health and multi-level governance, it becomes clear that a different model is possible — one that embraces distributed authority, prioritizes locally grounded solutions, and institutionalizes adaptive learning. The IPGF proposed here offers a roadmap for achieving this vision.

Taken together, the IPGF's interrelated principles represent a shift in thinking: from stewardship as a compliance exercise to stewardship as a cooperative process of governance-building. This approach is not about abandoning global frameworks; rather, it is about making them more responsive, inclusive, and effective. The IPGF framework strengthens existing structures by providing a scaffolding for integration, alignment, and accountability. Translating this framework into practice will require both political and institutional innovation. Governments must be willing to invest in

cross-sectoral coordination and stakeholder engagement. Donors must support flexible, long-term financing that enables experimentation and capacity-building. International organizations must go beyond norm-setting to create inclusive governance platforms. Civil society must be empowered not only to advocate, but to co-govern. And researchers must continue to generate the systems-level evidence needed to guide reform.

Without transformative changes in how stewardship is governed, the global community risks squandering one of the most precious tools in medicine: the ability to treat infections effectively. AMR is not a technical problem with a technical fix. It is a governance challenge, one that demands imagination, courage, and a willingness to share power.

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# الحكومة العالمية لإدارة المضادات الحيوية: مراجعة نطاق الصحة الواحدة وإطار الحكومة العالمية والمحلية المتكاملة متعددة المراكز (IPGF)

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## الملخص

تشكل مقاومة مضادات الميكروبات (AMR) تهديداً خطيراً ومتزايداً للصحة العامة العالمية، مما يُؤوض عقوداً من التقدم في مكافحة الأمراض المعدية. وقد أصبحت إدارة المضادات الحيوية (ABS) – التي تهدف إلى تحسين استخدام المضادات الحيوية في صحة الإنسان والحيوان والبيئة – محورية في هذه الاستجابة. تُقدم هذه المقالة مراجعة شاملة لعدة مصادر أكاديمية وأدبية غير رسمية لدراسة هيكل الحكومة العالمية لإدارة المضادات الحيوية. وتستند هذه المراجعة إلى منظور "الصحة الواحدة" وتنسق إلى نظرية الحكومة متعددة المستويات ومتعددة المراكز، وتحدد الجهات الفاعلة الرئيسية والترتيبات المؤسسية وأليات السياسات التي تشكل جهود الإدارة الدولية. ورغم تزايد التوافق في الآراء، لا تزال إدارة الإدارات مُجزأة، وتقتصر إلى التمويل الكافي، وتتميز بتفاوتات صارخة بين البلدان ذات الدخل المرتفع والبلدان ذات الدخل المنخفض والمتوسط. ولمواجهة هذه التحديات، تقترح الورقة إطاراً مبتكرًا للحكومة العالمية والمحلية المتكاملة ومتعددة المراكز (IPGF) وتنطبقه على دراستي حالة في منطقة الشرق الأوسط وشمال أفريقيا. يُذكر هذا النموذج على التنسيق الامركزي، وشمول أصحاب المصلحة، والتعلم التكيفي لمواصلة المعايير العالمية مع الواقع المحلي بشكل أفضل. وتدعو النتائج إلى إصلاح هيكلية ونهج حوكمة متكررة لتعزيز إدارة المضادات الحيوية عالمياً والتخفيف من حدة أزمة مقاومة مضادات الميكروبات المتسارعة.

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