Part 2: The Governance of AMR – An Overarching Review

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Introduction

Antimicrobial resistance is increasingly recognised as a global priority and a major threat to human health and wellbeing, as well as to economies and national and global security. Anxieties about the emergence, movement and transmission of drug-resistant microbes (and genes) in the context of globalisation, and the resulting decreasing utility of antimicrobial drugs, are catalysing calls for action. As with epidemics, the emerging discourse about 'governance' in the context of AMR is most frequently tied to the realm of the 'global'. These discussions generally revolve around the roles and responsibilities of, and formal

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collaboration between, major global governance structures and entities such as the United Nations (UN), World Health Organization (WHO), Food and Agriculture Organization (FAO), World Organisation for Animal Health (OIE) and World Trade Organisation (WTO), and national governments. Researchers and private actors, including industry and civil society, are also seen as necessary for successful response at these levels, but their roles are less fleshed out in these high-level discourses which focus on institutional relationships and accountability at the global level, and which centre biomedical and technical approaches to response. Increasingly, however, anthropological and other social science researchers have considered the emerging discourses around AMR through more critical lenses, as well as analysed AMR and antimicrobial use as they are embedded in complex social, economic and political contexts and thus provide valuable insight and lessons for governance. This review attempts to map the broad contours of 'governance' debates around AMR, and bring these together with perspectives from the social sciences.

Global governance for a global challenge

In much of the contemporary 'AMR governance' literature, the problem of AMR is framed as a crisis of the global commons, and depletion of a global public good whereby the 'irrational' use of antimicrobials by some compromises their use by others and by our future selves and generations (Barlam & Gupta, 2015; Padiyara et al., 2018; Rochford et al., 2018; Tarrant et al., 2019). Due to globalisation, resistance, it is emphasised, does not respect borders and thus a problem of AMR in one locale is a problem for every locale. Such global framing of the problem suggests the necessity of crafting integrated global governance and solutions. Although concerns about AMR from various actors have peppered history, an explicitly global framing of AMR emerged in the 1980s (Podolsky, 2018; Podolsky et al., 2015). The conservative politics of the day meant, however, that little political mobilisation or resources were directed towards the issue. Gradually, increasing attention led to the WHO's Global Strategy for Containment of Antimicrobial Resistance in 2001 (WHO, 2001), the formation of new interest groups such as ReAct and some isolated calls for international collaboration among scholars (Martin, 2006), but substantial political support remained lacking. A new era began with the Chief Medical Officer of Great Britain's pivotal report 'Infections and the Rise of Antimicrobial Resistance' (Davies et al., 2013). This was followed by a cascade of other reports, action plans and strategies, primarily out of the US and UK, but also international agencies including the WHO, FAO, OIE and World Bank. Some of these include:

- UK Five Year Antimicrobial Resistance Strategy 2013 to 2018 (Davies & Gibbens, 2013)
- US National Action Plan for Combating Antibiotic-Resistant Bacteria (US Government, 2015)
- Global Action Plan on Antimicrobial Resistance (often referred to as the 'WHO GAP') (WHO, 2015)
- The OIE (World Organisation for Animal Health) Strategy on Antimicrobial Resistance and the Prudent Use of Antimicrobials (OIE, 2016)
- The FAO Action Plan on Antimicrobial Resistance 2016–2020 (FAO, 2016)
- Tackling Drug-Resistant Infections Globally: Final Report and Recommendations (UK) (O'Neill, 2016)
- Drug Resistant Infections: A Threat to our Economic Future (Adeyi et al., 2017)

This emerging discourse reflected the global framing outlined above, and began to not only emphasise the impact of AMR on health and mortality, but increasingly leveraged anticipatory logics about future economic and security impacts (Chandler, 2019; Khan et al., 2019; Podolsky, 2018). The launch of the Sustainable Development Goals in 2015 and the UN General Assembly's 2016 Political Declaration on AMR, with members committing to develop AMR national action plans (NAPs) based on the WHO GAP (UN, 2016) and establishing the Interagency Coordination Group on AMR to initiate coordination between the

WHO, FAO and OIE (reflecting the 'One Health' framing of AMR – see below) would further add momentum to an evolving agenda. While a growing number of national action plans have been and are being developed (FAO et al., 2018), calls from scholars in law, international relations and global health have lamented 'patchworks' of initiatives and policy. Many continue to advocate for a stronger, legally binding international agreement, alongside resources and support for poor countries to implement their mandates (Padiyara et al., 2018; Rochford et al., 2018; So et al., 2015).

An entire special issue of Law, Medicine and Ethics, edited by Hoffman and Outterson, was dedicated to this idea in 2015. They argued that the problem of AMR uniquely required such an instrument (in the form of a WHO treaty, or a mechanism modelled off the IHR, trade and economic treaties or global environmental agreements) in order to foster real action and accountability in a critical 'tripod' of areas: 1) access (universal access to prevention, diagnostics and therapies to lower burden of infectious disease), 2) conservation (reducing need for and ensuring responsible use of antimicrobials including through infection control, prevention and surveillance) and 3) innovation (development of new antimicrobials and other biomedical and technologies) (Hoffman & Outterson, 2015) (see Figure 1 for a pictorial representation of this framework). Others have variously endorsed similar goals and objectives, with more or less specificity. The WHO GAP, along with the FAO's and OIE's individual plans, reflect 5 strategic objectives: surveillance, infection control, awareness, responsible use, and innovation for successful containment of AMR emergence and spread (Padiyara et al., 2018). Rochford and colleagues (2018), noting conclusions from a recent ICGA meeting in the UK, claim that consensus has emerged around several objectives: 1) appropriate use of antimicrobials, including especially the elimination of 'unnecessary' application in animals (stewardship); 2) the treatment of effluent in animal and human health (to curb environmental diffusion of AMR); 3) infection prevention and control including through water, sanitation and hygiene across sectors; 4) ensuring access to a regulated supply of antimicrobials to all who need them; and 5) development and stewardship of new antibiotics and alternatives, as well as diagnostics and vaccines. Historic market failures (a problem of a 'dry pipeline') and perverse incentives around antimicrobial innovation are seen as a key obstacle. While measures to reduce demand and use of antibiotics have so far been rather diffuse, the most attention and funding – and mostly in HICs – has gone to the development of new antibiotics. 'Push' and 'pull' mechanisms are advocated to delink innovation from its traditional drivers of higher prices and large quantities (which would compromise access and conservation respectively) and overcome market disincentives posed by future resistance (Podolsky, 2018).
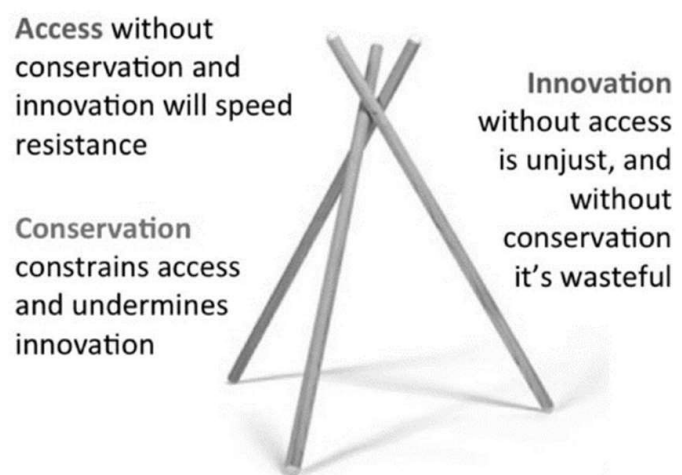
Figure 1 'Tripod' conceptual framework promoted in special issue of Law, Medicine and Ethics, from Hoffman & Outterson, 2015

While many have made impassioned arguments for internationally binding legal agreements, Hutchinson (2016) has argued for more flexible, 'normative' instruments at the global level like guidelines, regulations and codes of conduct. These can respond to emerging scientific learning and changes in context, and facilitate learning and exchange. More rigid structures might be confounded by the extreme complexity of AMR, the multiplicity of actors at multiple scales, sectors and sites, and the dynamic and specific contexts in which it emerges. A

recent commentary from Rubin (2019) has also cautioned against the focus on global, legally binding mechanisms, suggesting that more pragmatic, context-appropriate baskets of solutions may be more appropriate. He argues for 'glocal governance' which acknowledges and is more adept at reconciling 'tensions between the universal (global) and the particular (local)' (p. 2). This approach might entail encouraging organic processes of policy diffusion and adaptation at the national and subnational level, and focusing on tackling specific problems in specific places over an emphasis on 'best practices'.

Dominant themes in global framings of AMR

Despite the perception by some of emerging consensus around global objectives and actions, others have attempted to tease out various narratives, and the values, interests and priorities behind them. Wernli and colleagues (2017), for instance, have called the growing attention to AMR a 'policy cacophony' in which 'it is increasingly difficult to identify where ideas come from and what they entail and prioritise' (p. 2). Through analysis of major policy documents (including many of those listed above), they note major policy framings including what they argue to be the most ubiquitous and longstanding, 'AMR as healthcare'. This framing, rooted in the biomedical paradigm, is focused on clinical settings and provider-patient relations and tends to advocate technical interventions centred around individual use and antimicrobial stewardship in clinical settings, and, increasingly, infection prevention.

Khan and colleagues (2019), considering many of the same major policy documents, found that AMR was predominantly framed as a threat to human health security and economic progress. Indeed, they and others have argued that it is precisely these framings which have emanated from and generated political support for addressing AMR in HICs and global power centres, and thus which currently drive the global agenda. Chandler (2019) similarly identifies the security and economic threat narratives, offering the further analysis that, as with epidemics, the uncertainty and complexity surrounding AMR has required a speculative language suggesting future catastrophe to mobilise resources and action. Far from being a singular issue, AMR as an object 'captures multiple processes, bugs and drugs' (Chandler, 2019, p. 4) which change and interact in non-linear, unpredictable, difficult to measure and context dependent ways. This 'wickedness', and the 'actuarial challenge' it presents, is thus met with anticipatory logics that legitimate a 'sentinel' approach focused on surveillance, monitoring and pre-emptive action through reduction of antimicrobial use and technological innovation. Indeed, Wernli and colleagues (2017) identified AMR as an innovation issue as a frame in and of itself. As discussed in the previous section, this strand of AMR discourse and objectives – also primarily articulated by HIC actors – focuses on the development of new antimicrobials, diagnostics and vaccines and new ways of doing so in order to overcome market disincentives. It is to these activities which the bulk of global resources for AMR are dedicated (Podolsky, 2018).

One Health

Wernli and colleagues (2017) further identified One Health as a more recent but powerful, overarching frame utilised to root global discourses on AMR. The One Health frame calls attention to the role of extensive use of antimicrobials in animal agriculture (especially for non-therapeutic use), and the environmental dissemination of resistant genes and antimicrobial residues in the rise of AMR. Indeed, massive and increasing amounts of antibiotics have been and continue to be used in agricultural sectors across the globe (Van Boeckel et al., 2015), and concerns about this have been expressed for decades (Kirchhelle, 2018b). However, the rising profile of AMR on the global agenda today has seen the deployment of this systems framing by a growing number of actors including governments, international agencies and researchers. In a highly cited article, for instance, Robinson and colleagues (2016) have called for interdisciplinary research to better understand and tackle

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'the quintessential One Health issue' of AMR.

In addition to framing research, One Health logic has underpinned arguments for governance. The 'One Health' approach to AMR governance envisioned by So and colleagues (2015) also recognises the economic dimensions of global trade in animal products and veterinary antibiotics, and the need to safeguard human food chains including through the development of alternatives to antibiotics in animal agriculture.

One Health also underpins the promotion and design of mechanisms for intersectoral collaboration. At the global level, this is conspicuously embodied by the tripartite collaboration of the OIE, FAO and WHO which claims to advocate 'for effective, multi-sectoral collaboration at the local, national, regional and global levels' and provide 'guidance on complex issues', including AMR (FAO et al., 2017, p. 2). Indeed, the WHO GAP on AMR is a result of this global collaboration, and its fourth objective calls for the 'optimisation' of antimicrobial use in humans and animals reflecting a One Health lens. It also emphasises surveillance and data collection of antimicrobial usage and AMR in both humans and animals.

There is no question that One Health has served as a catalysing frame for AMR debates at the global level, and, indeed, the complexity of the problem of AMR warrants such a framing. However, as will be explored later in this report, the ways in which the One Health framing (or any framing) are or are not adopted and translated into policy or interventions varies with actors' priorities, capacities and economic interests (Wernli et al., 2017).

Access, development and equity framings

Khan and colleagues (2019) argue that the AMR security discourses emanating from HICs tend to frame LMICs as a source of threat – as 'reservoirs' and 'hotspots' of AMR. Thus, to protect against 'imported infections' in HICs, LMICs are required to be monitored, and provided with support and assistance to curb AMR from arising. That said, AMR is also positioned as a development issue in global AMR discourse, if secondarily so to a health, security and economic issue. This framing focuses greater attention onto the unequal disease burdens in LMICs, and related issues of sanitation, poverty, weak health systems, inadequate access to drugs which themselves are poorly regulated, and the threat AMR poses to achievement of several SDGs (Wernli et al., 2017). These narratives are adopted most frequently by LMIC governments, aid-related agencies in HICs, and international NGOs. Khan and colleagues (2019), however, argue that developmental and equity framings tend to forego sufficient engagement with 'upstream' structural issues and inequities faced in LMICs. Thus, solutions still tend to focus on downstream access to, and appropriate use of, quality medicines and healthcare.

The issue of access is not, however, confined to discourse which more heavily relies on developmental or equity framings. As suggested earlier in this report, access to quality antimicrobials for those who need them is also considered important for the sake of mitigating AMR itself, and lack of access to antibiotics is still recognised as a major global health issue. One highly cited study found, for instance, that lack of access to antibiotics results in more deaths than does resistance itself (Laxminarayan et al., 2016). Indeed, many major AMR reports and policy documents pick up on both the equity and AMR mitigation dimensions of access, even if these discussions are secondary to other framings. For instance, the UK's influential Tackling Drug-Resistant Infections Globally – known for centring economic dimensions of AMR – states that it is 'crucial that any package to address drug resistance […] has considerations of access and affordability at its heart' (O'Neill, 2016, p. 57), and that

> Improving access to good medical care for all, is of course not just
> important for AMR, it is an integral part of countries' development process

– something which should ultimately be about improving people's lives. (p. 44)

Access is also centred in the stated objective of the WHO GAP:

> *to ensure, for as long as possible, continuity of successful treatment and prevention of infectious diseases with effective and safe medicines that are quality-assured, used in a responsible way, and accessible to all who need them.* (WHO, 2015, p. 2)

Indeed, sentiments emphasising 'access not excess' pepper the mainstream literature on AMR governance. Argued by Daulaire and colleagues (2015) in the special issue of Law, Medicine and Ethics mentioned above, access is an 'essential feature of global collective action against AMR' (p. 17), and of the right to health which is affirmed in the issue. One area where access is seen to be potentially threatened is in the innovation of new antimicrobials and medical technologies – framed as a key objective in AMR governance discussions – which may be unaffordable in poorer contexts. To address this, many have suggested that innovation be delinked institutionally and financially from traditional market incentives of high prices and/or large quantities which would compromise access and conservation respectively, and that governance mechanisms be established to facilitate this (Balasegaram et al., 2015).

Beyond issues related to innovation, however, the practical implications of the inherent tensions between access and conservation of antimicrobials, the latter upon which more emphasis seems to be placed, remain underdeveloped in mainstream global AMR 'governance' literature and reports. This includes, for example, issues relating to private and informal human and animal health markets. This may be the result of the fact that much of this literature is written from the perspectives of HIC contexts with relatively small informal sectors.

National policy processes

Much of the literature invoking 'governance' for AMR relates to formal global collaboration and sketching out broad objectives. However, WHO member states have also been expected to develop their own AMR national action plans (NAPs) in pursuit of the five objectives set out in the WHO GAP:

1. Improving awareness and understanding of AMR through communication, education and training.
2. Strengthening the knowledge and evidence base through surveillance and research.
3. Reducing infection through effective sanitation, hygiene and other prevention measures.
4. Optimizing the use of antimicrobials in humans and animals.
5. Developing the economic case for sustainable investment in line with national needs, and increasing investment in new medicines, diagnostics, vaccines and other interventions.

Countries were given two years to develop these plans. In a short commentary from 2016 and early in the NAP process, Abdula and colleagues (2016) enthusiastically presented examples of emerging governance at the national level to showcase that, while LMICs face considerable challenges (limited health system and enforcement capacity and high disease burdens), several had already begun making progress. This included undertaking formal assessments, establishing committees, developing surveillance, stewardship and awareness-raising programmes, and investing in novel drugs and multisectoral cooperation. One highlighted policy in India, for instance, featured the restriction of two dozen antibiotics to doctor prescription only. However, such initiatives, which seek to 'gate' access to certain

antimicrobials – and which are almost universally regarded as necessary for curtailing AMR – embody the tension between conservation and access introduced in the previous section. This conundrum speaks to broader questions about just what kinds of policies might work in LMICs to curb unnecessary use while preserving, and even expanding, access.

One problem frequently pointed out in relation to this is the lack of data in LMICs on both antimicrobial use and AMR. Kakkar and colleagues (2018) argued that national policy approaches in LMICs have historically been 'hamstrung by the lack of locally relevant evidence' and have 'had to depend on evidence generated in developed country settings' (p. 2), with inappropriate results. HIC-modelled access-limiting interventions in the form of bans or additional fees on antimicrobials in animals, for instance, have been cast as potentially damaging to livelihoods and food security of vulnerable populations (Kakkar et al., 2018), as well as significantly economically damaging for LMICs more broadly (Laxminarayan et al., 2015). Goutard and colleagues (2017) have additionally flagged them as likely to fail to curtail AMR due to difficulty of enforcement. For this reason, Kakkar and colleagues have argued that health and data systems strengthening are more context-appropriate approaches which are more realistically aligned to local needs and capacities. In the meantime, some countries have pursued data collection on an *ad hoc* basis with the support of donors, as described by Opintan (2018) in the case of Ghana. Additional challenges are presented by lack of policy coherence within countries in some contexts. Lack of coordination between groups charged with developing treatment guidelines and lists of essential medicines at country level have been shown to cause confusion among doctors in Namibia and China (Kibuule et al., 2017; Reynolds & McKee, 2009).

As noted above, development of national surveillance infrastructure and research capacities for AMR is indeed a priority under the WHO GAP, but even the establishment of such systems is a major challenge for LMICs. Thus, while just over half of WHO member states have developed NAPs, implementation at scale is an entirely different challenge (FAO et al., 2018; WHO, 2019). The WHO's Global Antimicrobial Resistance Surveillance System (GLASS), which requires the development of laboratory and human resource capacity, has been designed with the collection of national and locally specific data in mind, but low-resource countries are unlikely to be able to participate without substantial support, or to implement all of its components (Seale et al., 2017). Indeed, as of 2018, only a third of WHO member states had enrolled in the program, and many fewer had submitted any data (FAO et al., 2018). International mechanisms such as the UK's Fleming Fund have emerged to support LMICs to develop their data collection capacities, while alternatives to country-based systems, such as regional laboratory facilities, collaboration and data sharing have been proposed as opportunities for countries with limited resources (Wellcome Trust, n.d.).

Antimicrobial use in animal agriculture

As national-level policy processes are still very nascent, little critical analysis has yet been published on how these processes have or are unfolding, or to whether and to what extent plans might actually represent purely symbolic action or reflect divergent priorities. A recent paper by Khan and colleagues (2019) is, in some ways, an exception. They have drawn attention to the fact that AMR may ultimately not be a significant priority in LMICs, as these countries face a great number of urgent issues which compete for policy attention and scarce resources. More specifically, they demonstrated divergences between framings deployed in national AMR policy documents of Pakistan, including the country's national action plan, and major global policy documents such as the WHO GAP and the UK's Tackling Drug Resistance report. While the latter two insist on a phase out of the use of antibiotic growth promoters in animal feed 'head-on', the authors claim that Pakistan's policy documents articulate a comparatively generous approach to this, reflecting its national economic interests:

> *This very much reflects the internal power dynamics in Pakistan, especially*

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the power of livestock producers; the poultry industry in Pakistan, for example, is the second largest in the country and contributes substantially to employment and economic growth. It may also reflect the issues of food security that face many sections of the Pakistani population, whose low income means they are less concerned with AMR in the near future and more with the reality of dealing with food insecurity and malnutrition on a day-to-day basis. (p. 185)

The influence of industry and economic concerns on national AMR policies, however – particularly in relation to animal usage – is not unique to Pakistan, LMICs or the contemporary era. Despite the unprecedented rise of AMR on the modern global agenda, concerns and policy debates date back decades. The use of antibiotics as growth promoters in animal agriculture in particular reveal the operation of national-level power dynamics. Kirchhelle (2018a) extensively documents the development and legacy of the UK's 1969 Swann Report, widely considered a significant historical moment as this would go on to shape policy for antibiotic use in animal agriculture across Europe for decades. Despite growing concern among some researchers and the public about evidence of resistance on farms and in humans, compromises resulting from era-typical 'corporatist' negotiations between scientists, state officials, farmer unions, agriculturalists, pharmaceutical companies and veterinarians would result in policy which instituted only partial bans on drugs considered therapeutically useful in humans. More specifically, low-dose usage of these drugs – such as might be delivered through feed as animal growth promoters (AGPs) – was banned, but high-dose therapeutic usage, so long as prescribed by a veterinarian, remained legal. This would ultimately do little to curtail resistance, especially given the reality of horizontal gene-transfer which, although discovered during the course of negotiations, failed to move the 'compromise'. The report, and its resulting policy, would go on to serve as an 'international policy matrix for antibiotic regulation' (p. 320) that was replicated across the European Economic Community until the turn of the century. However, therapeutically 'irrelevant' antibiotics were still widely available, and veterinarians had an economic incentive to dispense high-dose prescriptions. Over the next thirty years, agricultural usage – and resistance – continued to grow, and shifts in the classification of 'therapeutically relevant' drugs would make matters even more complex.

For all its shortcomings, the Swann Report marked an end to previously completely laissez-faire antibiotic usage in food animals in much of Europe. After decades of eroded enthusiasm and failure to address major policy gaps in the 'Swann doctrine', the UK would eventually support the European Union in enacting bans on all AGP use in 2006, although therapeutic prescriptions increased in response to this. An outlier, Sweden had reached this point much earlier with its own universal ban of AGPs in the 1980s. A number of countries around the world have begun initiating their own partial or total AGP bans or regulations on antibiotic use in animals. Among these are South Korea and Japan, but also, more recently, a number of LMICs. Brazil and China, for instance, have banned colistin for animal use (Kirchhelle, 2018b). Several countries in Southeast Asia, such as Vietnam, Sri Lanka, Thailand and India, have passed or are planning for total or partial AGP bans, and/or other regulations to restrict antibiotic use in animals, but concerns remain about capacity for implementation and enforceability in these contexts (Goutard et al., 2017). The United States remains a conspicuous outlier, where scientific uncertainty has been successfully wielded by industry for decades. The country's Food and Drug Administration (FDA) attempted to lobby for regulatory measures on agricultural use of antibiotics in the 1970s in the wake of the Swann Report, but has been largely unable to stand up against industry objections both then and now (Podolsky et al., 2015). Voluntary guidelines on drug labelling introduced in recent years appear to have contributed to reductions in usage of medically relevant antibiotics as growth promoters, but this reduction may also be linked to shifting consumer demand or decreasing efficiencies of AGPs (Kirchhelle, 2018b).

Despite the above outlined attempts to limit antimicrobial use in food animals around the world, these efforts have so far failed to liberate agricultural systems from their reliance on these drugs. Kirchhelle (2018b) demonstrates that it has not only been industrial pressures driving widespread national ambivalence towards agricultural usage, but also the political incentives of leaders and governments across the political ideological spectrum: 'Reacting to genuine agricultural demand and concerned about reducing imports, freeing agricultural labour, preventing communism, or sating the appetites of restive citizens, capitalist and communist planners alike licensed one antibiotic application after another' (p. 10). Further, he states 'the most important reason for this story of failure is that many countries have historically favoured reliable access to cheap meat over broader agricultural and antibiotic reform' (p. 10). Although data remains incomplete, agricultural use of antimicrobials likely dwarfs human usage globally and is projected to continue to substantially increase (Laxminarayan et al., 2015; Van Boeckel et al., 2015). Yet countries have continued to focus on the human health sector. The progress report on national action plan development in 2018 revealed that the vast majority of activity at country level in the areas of education, surveillance, monitoring and regulation has been in this area. Only a few better placed countries had functioning mechanisms in place for multisectoral coordination, and only 41.2% had moved to restrict the use of therapeutically important antibiotics as growth promoters (FAO et al., 2018).

Social science perspectives on AMR

Reimagining AMR, reimagining governance

While discourse for AMR governance acknowledges the complexity of the problem of AMR, the myriad challenges posed by actual implementation of proposed solutions (from development and collaboration of formal governance structures and policy/regulation to the on-the-ground implementation of interventions and regulatory enforcement) are not taken on in very substantive ways, nor are conventional approaches considered very critically in the 'governance' literature. While not necessarily deploying a discourse of 'governance', anthropologists and other critical scholars offer more nuanced and contextualised perspectives on microbes, antimicrobials, AMR and on conventional response and intervention that allow for the reimagining of AMR problems, governance, and pathways of response. This is particularly important in the context of LMICs where pluralistic health systems and weak regulatory capacities exist alongside high burdens of infectious disease, and both limited access to effective treatments and unnecessary use of antibiotics (Merrett et al., 2016). This section of the report attempts to present some of the insights offered by this more critical literature, with consideration of the implications for governance. Indeed, by highlighting the many contextual factors and forces influencing AMR, it becomes clear that AMR is not only 'governed' by formal and deliberate policies and interventions targeting it, but also by complex social, economic and ecological relations which need to be considered in pathways to tackle AMR.

Antibiotics as infrastructure

Chandler (2019) advances an argument which positions antibiotics as so entangled in and upholding systems of modern life so as to be regarded as *infrastructure.* The problem of AMR, Chandler argues, allows for the 'rendering visible' of the work antibiotics do to 'enable the current tempo of life—indexed to productivity and consumption' (p. 10) and thus, indeed, to sustain modernity itself. A useful way of conceptualising this notion adopted by Denyer Willis and Chandler (2019) is the idea of the 'quick fix':

> [Antibiotics] are a quick fix for care in fractured health systems; a quick fix
> for productivity at local and global scales, for humans, animals and crops;
> a quick fix for hygiene in settings of minimised resources; and a quick fix

for inequality in landscapes scarred by political and economic violence. (p. 1)

Thus, antibiotics underpin social and economic systems in a variety of ways. This is particularly amplified in LMICs where they stand in for limited resources, weak institutions and a lack of equity. As 'quick fixes' for care, for instance, they take the place of the limited time and resources healthcare workers have to spend with patients (Kotwani et al., 2012), and indeed also save time for patients who are incentivised to remain productive by minimising any time off work due to illness. In India, Broom and colleagues (2018) observed that antibiotics helped satisfy the 'necessity of uninterrupted workforce participation' (p. 5) in a context of poverty and precarious labour relations. In many contexts where they can be acquired over the counter, the ability to self-medicate also allows people to save on costs otherwise spent on visiting a doctor.

Antibiotics also stand in for the lack of sanitation and hygiene which cause infections in hospitals and communities. This reality may compel doctors to prescribe and people to self-medicate as treatment or prophylactic. A common assumption holds that health workers are simply insufficiently aware of AMR, but research is beginning to suggest this is not always the case (Pearson & Chandler, 2019; Wilkinson et al., 2019); their prescription or sales practices may rather be linked to their knowledge of the unhygienic contexts their patients or customers face (Kotwani et al., 2010). In the same study referenced above, Broom and colleagues (2018) found that Indian doctors did indeed recognise the risk of AMR and yet often reasoned that the lack of hygienic conditions in hospitals and communities justified on moral grounds the prescription of antibiotics for patients at risk of infection in these environments. Although prescribers in HICs may not face this added dimension, such aposition of 'moral hazard' is not unique to LMICs, as doctors in the former also face trade-offs between privileging the immediate needs of their patients and the uncertain and diffuse effects their actions may have on AMR (Tarrant et al., 2019).

As suggested earlier, global and growing demands for animal-source products and industrialisation of livestock production have resulted in intensified food systems that are reliant on antibiotics (Kirchhelle, 2018b). Although Kirchhelle emphasises that antimicrobials continue to underpin the intensive agricultural systems pioneered, developed and still operating in the global north (and which have been exported elsewhere), Kakkar and colleagues (2018) suggest that antibiotics are even more crucial to agricultural systems in LMICs where they serve as a 'crutch' – or indeed a 'quick fix' in the words of Denyer Willis and Chandler – in the absence of capacity for 'comprehensive hygiene and biosafety'. Laxminarayan (2015) demonstrated that economic losses resulting from the retraction of antimicrobials in agriculture in LMICs would be considerably more significant in these contexts than in HICs. Increasingly, the role of antimicrobial use in crops is also recognised as they protect against losses and ensure standardisation in ways that enable participation in global trade (Denyer Willis & Chandler, 2019). This view of the infrastructural position of these drugs makes clear that losing them, whether through AMR or indeed, for many, through restricting their use, will have significant implications not only for health, but for economies, wellbeing, livelihoods, food security and a number of other developmental dimensions.

Reframing 'misuse'

Recognition of the infrastructural role of antibiotics, especially in LMIC contexts, allows for the reimagining of their 'mis-' or 'irrational' use. For instance, an ill labourer's decision to take antibiotics can be seen not as 'irrational,' but rather as imperative to maintaining her job, and feeding her family (Haenssgen et al., 2019). A poor farmer can be seen not to 'indulge' in using antibiotics on his animals, but to be reliant upon them for his livelihood and thus requiring other forms of support to change behaviour, and a doctor without access to reliable

diagnostics can be seen to prescribe antibiotics justifiably to her patient who she knows will return home to an informal settlement without access to sanitation. This perspective allows a moving away from individualising interventions which imply the existence of 'choice' and impose responsibility on patients and prescribers to simply change their behaviour. Yet discourses which deploy notions of 'irrationality' and fail to connect to broader social and economic realities are common. They serve to cast blame and imply moral failing on users and prescribers of antimicrobials, and have reinforced the notion that what is to be governed is the behaviour of individuals. Against the backdrop of broader framings of AMR as a complex and intertwined One Health issue, these individualising tendencies and orientations of interventions towards behaviour change represent something of a paradox (Chandler, 2019). Kakkar and colleagues (2018) have attributed this tendency to the fact that most evidence, assumptions and thinking on AMR – and thus approaches and solutions – have thus far focused on high-income countries.

Convincing the public

One of the main types of interventions associated with individualising approaches are public awareness campaigns (Davis et al., 2018). Despite mounting research demonstrating that knowledge does not necessarily lead to behaviour change in neat and linear ways, especially in LMICs, public awareness campaigns continue to represent the principal strategy adopted to shift AMR-related behaviours among populations (Haenssgen et al., 2019). These tend to rely on 'deficit' models of communication that assume it is simply lack of awareness of the problem of AMR which drives 'misuse' by both lay publics and prescribers, and that provision of the 'right' information will lead people to change their behaviour in desirable ways. However, awareness campaigns interact with contexts in complex ways, not least of which isthe fact that information cannot change the ways in which modern social and economic systems depend on antibiotics as suggested above. For instance, people may interpret the messages of awareness campaigns in unexpected ways, leading to what might be considered 'adverse' outcomes such as avoidance of antibiotics altogether or even all types of medicine when they are needed (Lambert et al., 2019), or perhaps even lead to increased consumption by reinforcing notions about antibiotics as 'strong' medicines. During evaluation, such unintended outcomes are often ignored for a focus on desired or predetermined outcomes (Pearson & Chandler, 2019).

Charoenboon and colleagues (2019) offer a detailed account of a recent AMR information campaign, including the 'unforeseen and context specific interpretations and consequences that can result from educational messages relating to medicine and healing' (p. 20). As part of a broader programme, these researchers conducted AMR education activities in a number of rural villages in Thailand. Even though their activities, which included face-to-face interaction and two-way dialogue with some villagers, represented a deeper form of engagement than what most passive public messaging campaigns offer, they nevertheless ran into several complications.

Firstly, they found that biomedical terms and concepts of 'antibiotic' medicines and the way they work did not resonate locally (see also Dixon et al., 2019). Even when researchers attempted to build the more locally meaningful language of 'anti-inflammatories' into communication activities, they found that the concepts did not neatly overlap. The in-person activities, and the posters resulting from their activities and posted in public locations would also go on to be variably received across the villages for a number of other reasons as well. Linguistic boundaries existing among different ethnic groups in one village meant the information was largely inaccessible to many, and indeed may not have resonated with various other conceptions of illness and medicine. Other unintended effects included interpretations of medicine as dangerous, increased sales of antibiotics from informal providers who felt more confident in their knowledge as a result of the training, and reinterpretation of the campaign in the context of a resented parallel public health initiative

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which had resulted in the contraction of medicine availability. Indeed, the mediating effects of broader public health contexts have been acknowledged elsewhere. Bloom and colleagues (2015), for instance, point to how long histories of public health campaigns in LMICs, which have often focused on the treatment of particular diseases with antimicrobials or, more broadly, on expanding access to drugs, have contributed to the normalisation of indiscriminate use of antibiotics.

While Charoenboon and colleagues (2019) note 'it would be insensible to ignore the ungovernable implications' (p. 21) of their communication activities, consideration of unintended consequences, and the highly contextualised ways in which the effects of messaging campaigns may unfold are rarely considered in conventional approaches to interventions, and indeed to governance more broadly. If acknowledged at all, they may be interpreted as further evidence of irrational behaviour or resistance to expert advice (Davis et al., 2018). The clear lesson here is that thorough understanding of and engagement with context, as well as co-production of public communication activities with local people is probably likely to yield more successful results.

Prescription in context

As with antibiotic use among lay people, prescription behaviour among doctors or other gatekeepers who are themselves often the targets of antibiotic 'stewardship' interventions, also does not occur in a vacuum. Although evidence about such initiatives in LMICs remains scarce overall, a recent review by Wilkinson and colleagues (2019) of 'supply side' interventions to address AMR in LMICs – most of which they found targeted doctors informal clinical settings – has shed light on some of the common factors influencing prescribing behaviour in these contexts, and thus playing a part in 'governing' AMR. Although varying considerably by context, these include but are not limited to:

- limited knowledge of AMR and appropriate use of drugs
- lack of availability of appropriate drugs
- limited diagnostic facilities leaving prescribers little option but to make syndromic diagnoses
- the unlikelihood of vulnerable patients to be able to afford tests or return after results
- the absence of antibiotic guidelines
- lack of quality rural intensive care facilities
- perceived and actual patient demand and expectations based on experiences of past prescriptions
- the need to use up soon-to-expire stock (based both on market and bureaucratic pressures in private and public facilities respectively)
- desire to retain patients in contexts of competition in the private sector

Further illustrating the focus on doctors and prescribers, the review found no examples of interventions among pharmaceutical companies or drug detailers despite their significant influence in these contexts, and an emphasis in the WHO GAP on their often outsized power to promote drugs in relation to national capacities to support AMR interventions. Indeed, the influence of the pharmaceutical industry is frequently observed in empirical studies, with doctors (both private and public), pharmacists, and even farmers reporting to rely on drug company representatives or salespeople for information and advice (Bloom et al., 2015; Hinchliffe et al., 2018; Pearson & Chandler, 2019). In some contexts, due to limited enforcement capacity, regulations which do exist to regulate the activity of these private actors may be rather meaningless (Pearson & Chandler, 2019). Yet in the absence of reliable information, guidelines and support, they may be filling a critical information gap for health providers, and indeed for purchasers and users of antibiotics.

These conditioning pressures, many of which are not usually of issue in HICs, illustrate the complexity of implementing interventions to restrict or limit antibiotic prescribing in LMIC

contexts. Issues relating to lack of resources in particular call into question interventions which might target prescribers' supposed 'irrational' behaviour, as do those which justify their actions on moral grounds such as the provision of antibiotics to vulnerable patients they know cannot afford tests or return visits. Even in the context of HICs, however, healthcare systems are not monolithic, and context mediates practice around antimicrobial prescription. Broom and colleagues (2017), conducting research in a hospital setting in rural Australia, observed that doctors routinely invoked notions of 'remote exceptionalism' in relation to what they perceived as the accepted 'norm' of healthcare settings in the urban core. They framed their prescription practices, which they recognised diverged from 'optimisation guidelines' designed in and for urban settings, through contextualising logics: they regarded their patients as vulnerable, transient, and unreliable; they needed to be '*hit… quite hard and quite often*' (p. 58) with antibiotics if infections were to be addressed. The need for more contextually appropriate intervention is clear in this example; it has implications for AMR governance in HICs as much as it is conceptually parallel to the inappropriate imposition of HIC-conceived strategies and approaches in LMICs. As the authors conclude, 'any strategies of "antibiotic optimisation" now and into the future must be embedded in an understanding of the importance and complexity of the locale they aim to regulate' (p. 61).

One frequently invoked challenge in discussions of AMR is that of patient demand. Doctors and pharmacists across contexts report that patients expect to receive antibiotics (Wilkinson et al., 2019), and indeed, with little time to spend providing alternative forms of 'care' or convince patients otherwise, they are wont to oblige (Kotwani et al., 2012, 2010). This is not necessarily the case everywhere. Norway, for instance, heeding early warnings, took serious measures to limit antibiotic use in human clinical settings in the 1940s, and this has shaped prescribing patterns and patient expectations even today (Podolsky et al., 2015). Additionally, some research has suggested that patients may not be as demanding as they are often represented to be, although knowledge in this area is lacking, partially because it is difficult to study (Wilkinson et al., 2019). Nevertheless, perceptions of these medicines as powerful, and associated with modernity and Western medicine in some contexts, may increase their desirability, as does the tangibility they bring to illness and cure (Bloom et al., 2015; Chandler et al., 2016). Denyer Willis and Chandler (2019) ask to what extent 'healthcare has been stripped down to the provision of medicines, such that to demand medicines is to demand care' (p. 3), and connect this to the broader project of the 'pharmaceuticalisation' of global public health. Indeed, decades of campaigns promoting the use of antibiotics and other drugs as the best way to cure disease has contributed to the understanding of care as the provision of drugs, with some pointing to the 'indigenisation' of biomedicine. This is evident, for instance, in the training and practice of cadres of health workers in LMICs. In their ethnographic research in east Africa, Denyer Willis and Chandler (2019) observed that health workers provided with malaria diagnostic machines rendered patients that tested negative as 'undeserving' of drugs, and thus of care. This 'dug-in' and structuralised manifestation of care as provision of drugs obscures and even pushes alternatives out of reach, and is reinforced by the global focus on innovation of new drugs.

Pluralistic health systems

In many LMICs a wide range of often unorganised actors operate alongside (and in place of) poorly resourced public health systems, and include formal and informal private practices, traditional healers, pharmacies, drug salespeople and more. Although quality of service and medicine in these systems is variable and can cause substantial harm to their mostly poor patients, the presence of private and informal health markets has been shown to support significant population health improvements, including through the facilitation of antibiotic access (Ahmed et al., 2013; Bloom et al., 2011). Indeed, such practitioners, and particularly informal ones – lamented as they may frequently be by authorities – can also be seen as filling critical gaps left by weak or retreating public health systems (Pinto, 2004).

Charoenboon and colleagues (2019), interacting with villagers in rural Thailand, found that local informal providers and drug shops were highly valued locally. Public health attempts to limit the ability of these actors to sell antibiotics spawned resentment as villagers begrudged having to travel far to acquire drugs from formal health services. Indeed, it is a common assertion that to contain AMR, it is 'crucial to ensure that only trained staff with prescribing rights can access antibiotics' (Tarrant et al., 2019, p. 3). In reality, doing so risks restricting access to marginalised populations, and, as in the example above, generating mistrust which might itself go on to have further negative unintended consequences. Maligning informal providers and curtailing their activities without consideration of their role and value in communities can be counterproductive. Furthermore, it has been shown that informal providers are not always necessarily 'worse' than their formal counterparts when it comes to quality of care, knowledge, or prescription practices (Das et al., 2012).

Despite the health and, indeed, developmental gains generated by private and informal health actors, the widespread availability of antibiotics in such systems, and the economic incentives to sell and consume them, is likely to contribute to AMR. The prevalence of pharmacies at which antibiotics can be purchased over the counter and without a prescription in many countries, for instance, provides ample opportunities for patients to self-medicate, allowing them to save time and money on doctor consultations and with more control over when and how antibiotics are consumed (Broom et al., 2018; Whyte, 1988). Poverty, for instance, may drive them not to take a full course, or to purchase lower quality drugs. Widespread pharmaceutical marketing encourages sale and purchase, and even where regulatory infrastructures exist to counter sub-standard drugs or the sale of antibiotics without prescription, capacity for enforcement may be weak or mediated by other factors (Broom et al., 2018). The global focus on the development of new antibiotics is articulated alongside the imperative that such drugs must be used 'rationally'. The ability of many pharmaceutical manufacturers to copy, market and distribute newly developed drugs in laxly regulated systems poses massive risks to this strategy, and calls its assumptions into question.

Informal and private providers in these systems face many of the same pressures faced by doctors in the public sector, but as for-profit businesses they may have even stronger financial incentives to sell antibiotics and to ensure satisfied customers. Broom and colleagues (2018) linked this to the notion of 'reputational economies' in India, where private doctors are wary of patients' willingness to 'doctor shop'. Further, as Bloom and colleagues (2015) have emphasised, the boundaries between public and private and formal and informal in many of these contexts are also porous. Practitioners may operate in both public and private settings, while low public sector pay may result in expectations of informal payment. Business arrangements may develop between and among formal and informal, and/or public and private actors. Profit-sharing agreements, for example, between prescribers and pharmaceutical companies have been observed, and indeed in China, drug sales have accounted for large amounts of health facility revenue (Li et al., 2012; Reynolds & McKee, 2009).

Systems and adaptive perspectives

As is clear in the above discussion, governance challenges in complex pluralistic health systems are immense, and yet countering AMR while not compromising, or even indeed expanding access is imperative for a just future (Merrett et al., 2016). The view of a monolithic heath system, operating under a kind of central command and control model frequently envisioned in AMR policy discourse, is simply not at play in many LMICs where health systems are decentralised, dynamic, and made up of many different actors operating under different logics and incentives. Ahmed and colleagues (2013) have argued that such 'dynamic pluralism' 'challenges static and antiquated notions of policy and governance identified, for example, in the building block approach of the WHO Health Systems Framework or in the efforts to align development partners around a single country health

plan' (p. 1753). Tomson and Vlad (2014) have similarly argued that 'building block' logics are too simplistic. Instead, they advocate a 'systems perspective' that recognises the dynamics and interdependencies in health systems, and emphasise vertically integrated 'multi-level governance' which takes into account factors from the individual, household, community, health sector, national and global levels, with the participation of both state and non-state actors at all such levels. Governance at the global level, in this view, is seen to enable and encourage national action – providing there is political commitment – to develop and encourage contextually appropriate policy, collaboration and intervention at lower levels.

Due to a still persistent focus in AMR research on high-income settings, however, still relatively little is known about antibiotic use, AMR, and what might work in highly complex systems such as those found in LMICs, especially among informal health providers (Wilkinson et al., 2019). Bloom and colleagues (2015) argue for multi-pronged approaches which target many of the same issues highlighted by the broader AMR governance discussions, but which are more attuned to context and sensitive to the needs of the poor. This will require pro-poor advocacy and coalition building at national and global levels where these voices are under-represented, and might also include the following:

- the generation of surveillance data and the use of this to inform the production and updating of treatment guidelines
- the development and dissemination of context-appropriate diagnostics
- the provision of quality information to antibiotic providers of all types, including through the potential of increasingly wide-spread mobile phones
- ensuring affordable and good quality antibiotics including through regulatory partnerships between government, pharmaceutical industry and citizen groups
- incentivising provider behaviour change at scale through mechanisms such as accreditation, modification of remuneration models and community-based technical support and monitoring
- provision of context-appropriate information to consumers

Underpinning any set of 'prongs', it is emphasised, should be a learning approach to governance: 'there are no blueprints for implementing multi-level changes at scale in complex and rapidly changing contexts' (p. 12). Similarly, Ahmed and colleagues (2013) have argued that pluralistic health markets require adaptive 'active management' and that policy processes must formally include crucial stakeholders from across the health system, especially informal actors and civil society. More participatory governance can yield better designed information collecting and sharing instruments, regulations and accountability mechanisms, including community-based monitoring.

The SDG 3 includes a commitment to the establishment of universal health coverage by 2030. Bloom and colleagues (2017) have stressed that such commitments should go hand in hand with strategies to address AMR, and argue that attempts to strengthen and expand health systems must proceed through a systems approach with attention spanning across infection prevention, access and responsible use, the realignment of financial incentives, the strengthening of governments' regulatory capacities to include private and informal sectors, and the cultivating of partnerships among all relevant stakeholders.

One Health, complex realities

As detailed earlier in this report, animal and environmental health, and especially animal agriculture, are deeply implicated in AMR and are also integral to a systems approach. Despite the rhetoric of One Health so frequently deployed to frame AMR in the main, the majority of action for AMR in this area seems to be in the realm of regulating the use of antibiotics as growth promoters in terrestrial animals, while therapeutic high-dose prescribing remains widespread and legal (Kirchhelle, 2018b). What actual practices – whether related

to AGPs or prescription – look like on the ground from a qualitative perspective, let alone how interventions might play out, is uncertain, and more research is needed in this area. In their review of interventions in LMICs, Wilkinson and colleagues (2019), for instance, found no interventions addressing veterinary prescribing behaviour. Yet animal health systems are likely to be even more dominated by private and informal actors, particularly in LMICs, and thus issues of financial incentives and regulatory capacity are even more deeply implicated as challenges to addressing AMR in these areas.

Calls for a One Health approach to AMR that extend beyond antibiotic use in terrestrial animal agriculture to more fully appreciate the role of aquaculture, wildlife and the environment have been made (White & Hughes, 2019). Little evidence yet exists in these areas, and thus considering what effective interventions or governance might look like is even more difficult. Attempting to shed some light in this area, Hinchliffe and colleagues (2018) offered a unique anthropological perspective drawing attention to small scale aquaculture activity in Bangladesh. Here, they illustrate that AMR results from complex 'social ecologies of food production' (p. 2) and that any understanding of AMR must be situated and understood through the lens of the 'sociobiome'. They show that operating within highly tenuous biological and economic margins, small-scale actors in the shrimp and prawn supply chain are left reliant on antimicrobials to sustain their livelihoods. Through this, AMR is re-framed from a problem requiring the 'governing of medicine' through individualising interventions focused on awareness and behaviour change to one which must be seen as embedded within complex social, economic and ecological contexts and which require engagement with localised knowledge and needs to find sustainable pathways for change. By demonstrating the 'infrastructural' role that antibiotics have taken on in these complex aquaculture systems, the question of what is to be governed, as in human health systems, broadens.

Conclusion

Governance of what?

Departing from a position which recognises antimicrobials as infrastructure, the question of what is to be governed broadens from the behaviour of individuals who prescribe, sell and consume antimicrobials to the social and economic systems in which they are embedded. These systems, characterised by structural inequalities and neoliberal logics of productivity, are fundamentally upheld by antimicrobials, and thus systemic change is required in key areas. Firstly, fractured health systems need to be strengthened and supported, particularly in LMICs. While this means the provision of 'stuff' such as context-appropriate diagnostics, vaccines and, yes, essential medicines including quality antimicrobials, it also means expansion and support of staff. This includes training to support forms of care beyond widget-like assessments of whether patients are 'worthy' of antibiotics, as well as adequate pay, time and information. Information, such as antibiotic guidelines, must be supported and informed by quality surveillance and data collection systems whether at regional, national, or even local levels. The project of Universal Health Coverage by 2030 is an opportunity for the kinds of health systems strengthening that are required, as well as for the crucial expansion of access to quality healthcare, including antimicrobials, to all people who need them. While mainstream debates about AMR do invoke the imperative of access, this is generally regarded with secondary status to conservation or 'optimisation' efforts which focus on reducing unnecessary use of antimicrobials. Crucially, informal and private providers such as for-profit businesses and NGOs must be considered and included in innovative ways.

Secondly, assumptions and expectations of human and animal productivity must be seriously considered, and attention to the inequalities at multiple scales which lead to infections in the first place should be more central to countering AMR. Fundamental questions about the economic imperatives of uninterrupted labour which push people towards the 'quick fix'

might be met with efforts to support workers in other ways including through social safety nets, supports for sick pay and alternative care, but also, importantly, access to appropriate doses of antibiotics when needed. In relation to animal production, which provides livelihoods for millions of the world's poor, AMR-sensitive medical-technological and systems innovations and access to these must be supported in ways sensitive to the social and economic needs, circumstances and capacities of farmers operating at different scales. Kirchhelle (2018b) has stressed that HICs which 'pioneered and exported anti-biotic-dependent production and consumption since the 1940s have a moral responsibility to contain the fallout of these systems in other parts of the world' (p. 2). Large-scale intensive farming operations which are patently dependent on antibiotics need to be rethought. Crucially, economic incentives around the sale of antibiotics in both human and animal health need to be delinked from their provision. Equitable infrastructural improvements and planning for sanitation in urban and rural environments, and hygiene in healthcare settings need to be prioritised to prevent infection.

While systemic change at scale and on multiple fronts is slow, it is crucial that these broader issues, connected to systemic inequalities, are not obscured by an overly myopic focus on individualising interventions which focus on convincing people to change their behaviour. This is not to say that attention and resources should not also be devoted to behaviour change interventions among citizens, farmers, providers, and others, but all such efforts must be rooted in and tailored to the social and economic contexts in which they are to be deployed. Additionally, regulations governing medicine quality, distribution and access are important, but must not come at the expense of universal access. Capacity for enforcement, including through participatory and community-based monitoring, also needs to be developed. This brings us to a final discussion about four key challenges for more effective governance.

Towards more effective AMR governance: four key challenges for change

As a profoundly complex challenge, addressing AMR requires the mobilisation of actors at all levels and across society. However, due to the specificity of contexts and the many place-based contingencies of AMR and antimicrobial use, we argue that space for more decentralised forms of governance be supported, and for knowledge, solutions and stakeholders 'from below' to be centred when conceiving of approaches to tackle AMR. Top heavy, centralised command-and-control governance models shot through with assumptions are not flexible enough to deal with the complex and dynamic realities of AMR. We argue that four key challenges should be considered for more effective AMR governance informed 'from below'.

Inclusivity challenge

The vast array and diversity of people, entities and institutions involved in the production of AMR, and their equally diverse knowledge, interests, and incentives, demand that approaches to tackling AMR be as widely inclusive as possible. At present, the voices of people most vulnerable to AMR, who are most likely to suffer from any contraction in the flow of antimicrobials, and who live in systems where AMR may be more likely to arise, are least represented in decision-making spaces. Policy and interventions must be people-centred and prioritise the needs and experiences of the poorest and most vulnerable. Without engaging the realities and constraints that they face, policy and interventions for the conservation of antimicrobials, for instance, risk cutting them off, ensuring their continued exclusion from access, or simply being ineffectual. This tenet can be applied to the national level. LMICs, currently under pressure to develop NAPs in the image of the GAP, may themselves not be in a position to prioritise AMR, and yet may still face significant future consequences. In addition to continued support from the global community to help these

countries overcome their constraints (as is the promise of initiatives like the Fleming Fund), more robust inclusion of citizens and civil society can create pressure from below on national governments to take AMR more seriously, while communities themselves can be sites for community-based monitoring, data collection and enforcement.

A bias in the literature and in policy debates towards formal and urban human healthcare settings also reflects the exclusion of the needs, priorities and circumstances of rural citizens, as well as the informal and private human and animal health system actors that populate healthcare landscapes in many countries. More meaningful consideration and action on AMR beyond the urban, formal domain is urgently needed, with much more attention paid to the voices of people in these spaces.

Intersectoral challenge

Despite rhetoric invoking the complexity of AMR through the lens of One Health, AMR has continued to be primarily framed and approached as an issue of clinical human health. This is evidenced, for instance, by the fact that a review of interventions found few of any other type, and by the reality that few countries have functioning multisectoral coordination mechanisms or plans for limiting the use of antibiotics as animal growth promoters. Indeed, still very little is known about prescription practices in the animal health sector. It is essential that governance approaches strive to encourage data collection and action in these areas, as well as on the environmental dimensions of AMR. Again, this will require the input and inclusion of a wide range of state and non-state actors to co-produce context-appropriate and effective approaches that can address the systemic issues behind AMR in non-human health areas and which are sensitive to the needs of the many millions who rely on animal production for their livelihoods. This means that those invited to the table represent not only 'big' agriculture, but also smallholders and those who subsist at the margins, and may be profoundly reliant on animal antibiotic use to keep from slipping into poverty. Actors in sanitation and hygiene are also crucial to tackling AMR, as preventing infection in the first place removes the need for antibiotics altogether, and, obviously, comes with many other benefits for people. This links with broader questions about equity and social justice.

Convening such a diverse array of actors at multiple levels of the system is a challenge in and of itself, while devising coordinated ways of action poses an even greater one, and indeed is not without its dangers. As historical experience of the UK's Swann Report shows us, multisectoral decision-making can result in diluted and ineffectual policy. This strengthens the case for a multiplicity and decentralisation of governance with many different sets of actors working in different configurations and at different levels to mount approaches from multiple angles and in ways appropriate to context.

Scalability challenge

Although it has activated political will and initiated an unprecedented process of national policy making, the current global emphasis in relation to AMR has obscured the multiplicity and diversity of contexts in which AMR is produced and must be tackled. AMR is not a monolithic challenge that will be solved by narrow reforms conceived in spaces and places quite unlike many of those in which it unfolds, and often based on the needs, interests and experiences of HICs. Decentralised governance approaches, more flexible to the reality and circumstance of individual context, such as the extent to which populations rely on informal or private healthcare actors, or are dependent on antibiotics to sustain animal-based livelihoods, must be supported. The question of what is to be scaled may not necessarily be technical solutions themselves – although technical interventions or policy that work well in a particular context may indeed be worth emulating in other similar contexts – but indeed may be the kinds of flexible governance models or approaches that can support tailored strategies, and opportunities for learning and sharing. The challenge of scalability also includes the need for approaches and strategies at any level, including more localised ones,

to be cognisant of how factors and forces interact *across* levels of the system to influence AMR on the ground. Inclusion of voices from across the system in discussions and policy planning can support this, and can facilitate complementarity and synergy between different strategies at different levels and in different places.

Interdisciplinary challenge

The majority of funding and investment for AMR research has been directed towards medical and technical innovation including new antibiotics and diagnostics. While such technical innovation is undoubtedly important, this emphasis on particular forms of knowledge and expertise has obscured the crucial role the social sciences can play in understanding and tackling AMR in its multiple dimensions and contexts. Haenssgen and colleagues (2019) have reported that only 2% of AMR-related publications come from the social sciences. While interdisciplinarity in AMR research has been recognised as important in mainstream AMR governance literature, particularly as articulated through One Health framings, this has not often been specified to include a wide range of social science perspectives, apart from, perhaps, economic, historical, law, and political science disciplines (see for instance Hoffman & Outterson, 2015). Although these perspectives are indeed essential - economic articulations of the current and future costs of AMR have, after all, played a significant role in getting AMR onto the global agenda - largely missing from mainstream AMR governance discussions has been the value of social science perspectives which are more adept at providing the kinds of 'thick' descriptions of context vital for deeper understanding of the issues. Such research, which highlights power dynamics, the complexity of systems, and the links between multi-level social, economic and political structures and individual understandings, incentives and behaviour, is vital not only for understanding the dynamics of AMR, but for informing intervention and policy at all levels. This includes monitoring the impacts and, indeed, the unintended consequences of existing policy and intervention, but also, crucially, for whom and how it might or might not work. It is essential that the answers to critical questions like these be attributed equal value as 'evidence' in the formulation and, indeed, continual adaptation of policy if AMR is to be tackled equitably and effectively. A challenge for formal governance processes will be the systematic and meaningful inclusion of a greater diversity of disciplinary perspectives such as anthropology and political economy in the shaping, implementation, monitoring and adaptation of strategies, or, at least, more informal engagement with the considerable literatures generated by researchers in these fields.

Anthropologists' skills in in-depth research, network analysis and stakeholder engagement are also indispensable to convening not only interdisciplinary, but also intersectoral conversations among and between state and non-state actors. Engaging citizens and civil society in particular, and exploring and supporting the roles they might play in decentralised forms of AMR governance, is perhaps an area of particular promise in LMIC contexts.

Anthropologists and other critical scholars bring an indispensable lens to the project of addressing AMR. By considering antimicrobials in historical, political, economic and social contexts at both micro and macro levels, including the infrastructural role they play in reproducing modern life, otherwise unforeseen challenges (including the imperative of expanding and maintaining access to antimicrobials to vulnerable populations) are brought to light, and opportunities for new ways of addressing AMR begin to become visible. At present, the 'governance of AMR' discourse lacks these perspectives. That is not to say that the considerable and growing work of critical scholars on antimicrobials and AMR do not have implications for governance – this review has attempted to frame some of this work in a way which more explicitly connects it to 'governance' – but more such connection must be made if truly multi-sectoral, inclusive, scalable and interdisciplinary governance approaches that can better address AMR are to emerge. Although a politics of knowledge which continues to privilege biomedical and public health logics (alongside economic and security framings) prevails in debates and discussions of AMR, critical social scientists must also more clearly assert themselves at the 'governance' table(s) where 'solutions' are negotiated and resources

are mobilised. The inclusion of anthropologists in the 'doing' of governance of global health issues is not without recent precedent. Indeed, as highlighted elsewhere, the participation of anthropologists in the quelling of the West African Ebola epidemic illustrates the profound impact of having anthropological perspectives at the table in the midst of crisis.

List of acronyms

AGP	Animal growth promoters
AMR	Antimicrobial resistance
FAO	Food and Agriculture Organization of the United Nations
FDA	US Food and Drug Administration
GAP	World Health Organization's Global Action Plan
GLASS	World Health Organization's Global Antimicrobial Resistance Surveillance System
HIC	High-income country
IACG	United Nations Interagency Coordination Group on Antimicrobial Resistance
LMIC	Low-to-middle-income country
NAP	National Action Plan
OIE	World Organisation for Animal Health
SDG	Sustainable Development Goal
UN	United Nations
WHO	World Health Organization
WTO	World Trade Organization

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