

Part 2b: Case study – Governing AMR in Bangladesh

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Introduction

Increasing resistance to antimicrobials¹ is a major challenge facing society now. Antimicrobial resistance (AMR) occurs when antimicrobial medicines (including but not limited to antibiotics) lose their ability to kill pathogens that cause illness in humans and animals, thus affecting the health and wellbeing of people and societies. The simplest explanation is that this occurs because of over- and inappropriate use of these medicines, and the transmission of drug-resistant pathogens. This is not a novel problem – indeed, the risk of resistance to antimicrobials was recognised immediately following the discovery of penicillin (Rosenblatt-Farrell, 2009). However, with the discovery of a broader group of antimicrobials and their increasingly ubiquitous use over the decades, resistance has grown manifold in health, agriculture, and other sectors (Hincliffe et al., 2018; Pearson & Chandler, 2019; Van Boeckel et al., 2015). In recent years, the threats posed by AMR have been compared by the UK Chief Medical Officer and the World Bank to terrorism, cancer, climate change and a slow motion tsunami (Davies, 2011; Walsh, 2013, 2014; World Bank, 2019). Increasingly framed as a global concern, the problem has led the WHO to launch the Global Action Plan on AMR (GAP) in 2015 (WHO, 2015).

Although AMR is primarily framed as a healthcare issue (Wernli et al., 2017), the GAP has also acknowledged that its 'contributing factors and the consequences, including economic and others, go beyond health', and thus that there is a need to develop 'a coherent, comprehensive and integrated approach [...] involving different actors and sectors such as human and veterinary medicine, agriculture, finance, environment and consumers' (WHO, 2015, p. 1). The engagement of such a wide array of different actors, each with their own unique perspectives and incentives in relation to AMR, underscores the challenge of governing AMR response across sectors, functions and geographies (Legido-Quigley et al., 2019). This has resulted in calls for developing collaborative responses which unite 'social- ecological and bio-ecological perspectives' in order to confront AMR (Wallinga et al., 2015, p. 1314).

Despite recognition of this complexity from some quarters, however, policy literature around the issue is dominated by biomedical and global health security framings (Wernli et al., 2017; Will, 2019) which have also tended to marginalise national and more local points of view (Khan et al., 2019; Rubin, 2019). The experiences, perspectives and complexities of AMR and AMR policy making at national and sub-national levels in low- and middle- income countries (LMICs) are particularly underrepresented in literature. Researchers have pointed out that there are very few conceptual frameworks to help theorise these policy processes, as well as a limited evidence base on interventions for AMR across both clinical and social sciences (Legido-Quigley et al., 2019; Wilkinson et al., 2019).

This case study considers AMR through the lower-middle income country (LMIC) of Bangladesh which, along with other countries in Southeast Asia, is considered to be at high risk for the emergence of AMR (Chereau et al., 2017). It is an ideal case to study in that Bangladesh has characteristics common to many LMICs, including a large informal sector. To the extent possible in this literature review, this case study attempts to describe the policy processes, governance mechanisms, and prevailing discourses that have emerged around the issue in the country in recent years. In keeping with the overarching review's broader aims, this case study also attempts to bridge conventional understandings of governance – formal institutions, structures, regulations and policy – with more 'bottom up' and 'messy' perspectives from social science. Such views provide crucial nuance to understandings of the drivers of AMR, and highlight the perspectives, incentives, constraints and capacities of

¹ The term 'antimicrobials' refers to a wide range of medicines that include anti-viral, anti-fungal, anti-parasitic and anti-bacterial drugs used in human and animal health, while antibiotics refer to the latter class of drugs, which specifically target bacterial infections. This report refers to the more general concept of anti-microbial resistance (AMR) throughout, unless the research or ideas being discussed are more specific to antibiotic medicines and resistance.

actors 'from below' (such as formal and informal health workers, pharmacists, salespeople, patients, farmers and others 'in the community') which are often otherwise ignored. Calling attention to these aspects and perspectives can help to identify alternative models for governance that may be more adept at overcoming the 'policy failures' of standard top-down and technical responses to AMR (Wallinga et al., 2015). In doing so, we aim both to contribute to thinking and policy action around how AMR is being addressed in Bangladesh specifically, as well as to illustrate these lessons for broader application to AMR governance debates in other countries (particularly LMICs) and at the global level where AMR agendas have been set and continue to evolve. The report begins with a description of the challenge of AMR in Bangladesh before providing a picture of the more formal governance landscape. It then offers some perspectives from the social sciences and explores some emergent understandings of AMR governance in Bangladesh, as well as how that governance might be made more effective by integrating perspectives from 'below.'

The challenge of AMR

Globally, AMR levels have increased markedly in recent years. A review of literature suggested a conservative estimate of 700,000 deaths occurring annually due to AMR, which might climb up to 10 million deaths a year by 2050 (O'Neill, 2016, p. 10). Another study has estimated that antibiotic consumption has increased by 65% from 2000 to 2015, with much of this increase occurring in LMICs (Klein et al., 2018). Although consumption levels in LMICs are yet to reach those of high-income countries (HICs), many have experienced substantial economic growth which has spurred demand for, as well as production of, antimicrobials in these countries. While this has increased access to important medicines for more of the world's population, it has also generated risk for the emergence of AMR. In contexts of weak regulatory infrastructure and fragmented public health systems characteristic of many LMICs, much of the antibiotic consumption in these countries is driven by widespread availability of drugs, and non-formal health providers whose practices may not be 'evidence-based' (Broom et al., 2018).

Although data on AMR generally remains 'thin on the ground' across most LMICs, including Bangladesh, there have been many small-scale attempts to measure and map resistance, as well as antimicrobial consumption in the country over the last decade, driven in part by AMR agendas set at the global level (iccdr,b, 2016b). One study, which analysed blood samples collected between 2005 and 2014 for pathogenic bacteria in a Dhaka hospital, found that a substantial percentage of bacteria in positive samples were multi-drug resistant (MDR), with the proportion of (gram-positive) MDR bacteria doubling over the course of the research (Ahmed et al., 2017). Another study found that children in Dhaka under the age of two took an average of 10 courses of antibiotics a year (compared to 1.3 in the US, for instance) (Rogawski et al., 2017). Yet another found an alarmingly high number of infants in a rural area of Bangladesh with MDR *E. coli* in their stools (Islam et al., 2019).² A 2019 systematic review by Ahmed and colleagues (2019) of 46 studies on antibiotic resistance (ABR) concluded that its prevalence in the country is 'very high'. The review also called attention to significant data gaps and data quality issues, particularly for areas of the country beyond Dhaka where 82% of the studies identified were conducted, reflecting a lack of systematic national surveillance and measurement standards.

As already suggested above, a commonly identified factor behind high rates of AMR in Bangladesh and other low-income settings relates to the ease with which antibiotics can be attained. A significant proportion of the Bangladeshi health sector (and indeed, its wider economy) is made up of informal actors. Although the country has made some impressive health gains over the last two decades, in part due to the informal health sector (Ahmed et

² While most strains of *E. coli* are non-pathogenic, transference of resistance genes from non-pathogenic to pathogenic strains is possible, and poses a serious risk to human health (Salvadori et al., 2004

al., 2013; Bloom et al., 2011), there is an absence of adequate coverage of trained medical professionals, especially in rural areas. For this reason, many people are forced to rely on informal health providers for services. Because of this, 'irrational' prescriptions and practices of self-medication occur very frequently, as antimicrobials are made available for over the counter sale in local drug shops to meet consumer demands and pushed by a highly competitive but weakly regulated private pharmaceutical industry (Ahmed et al., 2013; Ahmed & Islam, 2012; Hoque et al., 2020; Rousham et al., 2019). The complex human drivers of AMR in Bangladesh, as they are embedded in and conditioned by the country's 'pluralistic' health system – inclusive as it is of a wide array of actors and behaviours – is illustrated by Bloom and colleagues (2017) in Figure 1 below.

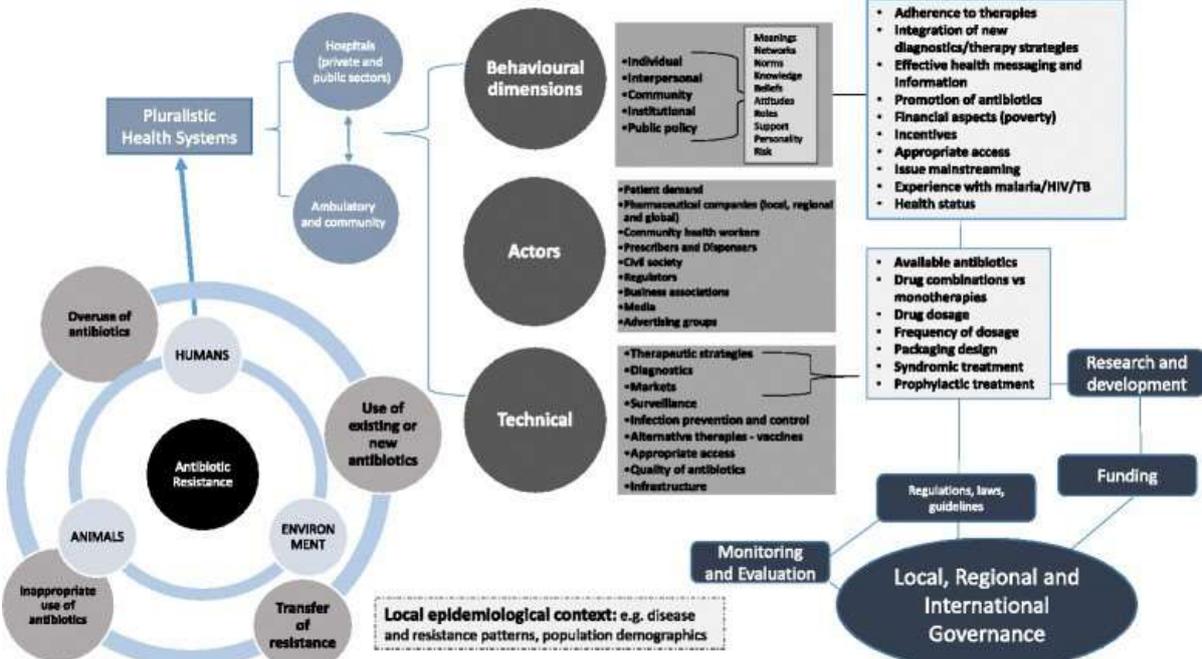


Figure 1. A complex system: human drivers of antibiotic resistance in pluralistic health systems, from Bloom et al., 2017.

While approaches to understanding and tackling AMR usually centre complex drivers in human health systems, the challenges of AMR are further compounded by the actions and behaviours of actors beyond human health, such as in the animal and agricultural sectors. Indeed, globally, most antimicrobial usage occurs within the agriculture sector. In the United States, for instance, it has been reported that more than 80% of all antibiotics sold are used on livestock, while 70% of these are types which are also used in human medicine (FDA, 2013; Martin et al., 2015). While many countries have introduced full or partial bans on the use of antimicrobials in food animals for the purposes of animal growth promotion, loopholes, limited enforcement and economic dependencies have ensured continued and even growing usage (Kirchhelle, 2018; Van Boeckel et al., 2015).

Agricultural antimicrobial use is likely to be particularly pronounced in Bangladesh. Individual studies have reported high levels of residues of broad spectrum antibiotics in meat samples, in poultry droppings (which are used as manure), and in runoff into water bodies where they cause further disruptions to economically vital fisheries and aquaculture sectors (Hoque et al., 2020; Nahar et al., 2016). A global study which tested river water at 711 sites in 72 countries around the world found a site at Bangladesh's Kirtankhola River to be the most heavily polluted with antibiotics (Wilke, 2019). Antibiotic resistant bacteria have also been found in treated drinking water supplies. A 2019 study in Dhaka, for instance, found MDR E. coli in drinking water samples taken from across the city (Talukdar et al., 2013). Other studies have found MDR bacteria present on nearly all 'salad vegetables' researchers purchased in both open markets and supermarkets in Chittagong and Dhaka, likely reflecting use of contaminated inputs such as water and animal manure (Ahmed et al., 2014; Nipa et

al., 2011). Environmental contamination has also been recorded through the hospital wastewater pathway in Dhaka. Researchers found highly drug resistant NDM-1-producing bacteria in 71% of water samples taken from areas near hospitals (Islam et al., 2017). The presence of antibiotic residues and resistant bacteria in animal products, water supplies and crops may contribute to additional resistance, as well as put individuals at risk of contracting potentially difficult to treat water or foodborne diseases (Salvadori et al., 2004).

That this complex interplay between human, animal, agricultural and environmental systems is implicated in the rise of AMR has led researchers and policy actors to frame AMR as a 'One Health' issue (Robinson et al., 2016). This requires approaching AMR as an issue of human, animal and environmental health and systems, both in conceptualising it as a problem and developing solutions to address it which are sufficiently multi-sectoral in nature. Failing this, approaches to AMR in Bangladesh and elsewhere are likely to fall short of being able to stem the slow but rising tide of AMR. This is not just a challenge of getting representatives from every sector to the table. It also requires recognition of the different and often conflicting understandings of - and levels of power and control over - AMR that are held by diverse actors both within and between sectors. Some of these differences are unpacked in more detail later in this paper. But it suffices here to say that this requires moving beyond conventional structured ways of thinking about bureaucracies, governance and interventions and will require political, administrative as well as technical capacities far beyond the reach of most health ministries. Prior to exploring these issues of complexity and power in more depth through the lens of critical social science, the next section will describe more formal governance for AMR in Bangladesh.

Governing AMR in Bangladesh

Although data remains patchy, that which does exist suggests that AMR is a significant and growing problem in Bangladesh. In this section, we outline the 'story' of governance for AMR in Bangladesh. In this, we include not only the more recent 'objects' of governance explicitly designated for addressing AMR (such as the Bangladesh National Action Plan for AMR), but also important aspects and developments of the country's health system and broader policy history and environment. Developments such as the National Drug Act of 1982 and the subsequent evolution of the relationship between the state and private pharmaceutical sector (including both human and animal health) have resulted in profound 'path dependencies', with important implications for AMR and governance in the human health sector. Managing antimicrobial use in animals in the context of a powerful pharmaceutical industry, alongside the economic imperatives of agricultural production, has presented similar challenges. All of this must also be considered within the context of Bangladesh's unique health system as an eclectic patchwork – or 'pluralistic' system – of formal and informal, for profit and non-profit, and public and private sector actors. This multiplicity of actors and their diverse incentives and logics have profound implications for AMR and its governance now and in the future.

Building the pharmaceutical industry: the National Drug Policy of 1982

As depicted in Figure 1, the drivers of AMR within the human health sector encompass a wide range of actors, of which the pharmaceutical industry is an important component (Bloom et al., 2017). However, the pharmaceutical industry cannot exist on its own, and it too is dependent upon a range of structural and situational factors including formal state governance mechanisms. The National Drug Policy of 1982 was an early initiative of the Bangladesh government developed both to improve access to essential drugs as advocated by the WHO, and to respond to the needs of domestic pharmaceutical manufacturers. Its effects have had significant implications for AMR in the country.

In the 1970s, during its early years as an independent nation, the pharmaceutical industry in Bangladesh was dominated by a handful of multinational corporations which developed 75% of all products. Their production focus was not tuned to national health needs, and one report estimated that as many as a third of the over 4500 registered brands were 'useless, unnecessary, or harmful' (Islam, 1984, p. 3).³ The WHO was, at the time, encouraging member states to develop national drug policies and to produce their own essential drugs lists. Accordingly, Bangladesh was among 14 early countries to act on this (Chowdhury et al., 2006). Widely hailed and promoted as 'an example for the third world', the government enacted the National Drug Policy of 1982 (NDP) despite significant opposition from international and domestic actors with vested interests against its passage (Islam, 1999; Reich, 1994). The policy resulted in the development of a list of essential drugs mandated to be stocked in all health facilities, and allowed local pharmaceutical companies to buy raw materials. While implementation remained patchy due to capacity and resourcing issues for some time, the policy did result in major changes to the way the industry was organised and, most significantly, increased access to safer and cheaper drugs.

The years following the launch of the NDP witnessed rapid development of the local pharmaceutical industry (Chowdhury et al., 2006). It experienced 'near exponential growth in yearly drug sales to US\$1.25 billion in 2011; a more than 100-fold growth in 30 years' (Ahmed et al., 2013, p. 1750). The number of domestic drug companies increased from 177 in 1982 to 300 in 2004. There was a huge increase in the volume of local production of essential drugs as well as a stabilisation of drug prices, which decreased in real terms, factoring in inflation. The country saved expenditure on drug imports, and indeed began exporting to around 70 other countries, generating valuable revenue (Chowdhury et al., 2006, p. 368).⁷

Although the effect of the NDP in increasing the availability of essential and affordable drugs was undoubtedly a positive development in the country, the massive expansion of the domestic pharmaceutical industry and its production capacity, as well as increased drug consumption patterns, have led to several challenges. As described by national researchers, the pharmaceutical industry is today very large and very weakly regulated. Like many other drugs in the country, antimicrobials are widely available as over-the-counter medications from over 200,000 drug retail outlets, an estimated half of which are unlicensed (Ahmed & Islam, 2012; Rousham et al., 2019). Only 51% of pharmacists are trained and, even among them, the vast majority (91%) have only been trained through a short 12-week programme instead of through longer and more rigorous diploma or degree courses (Rousham et al., 2019).

Furthermore, policy researchers have described how the pharmaceutical industry – today dominated by a handful of large national companies with ties to global firms (Bloom et al., 2015; Mohiuddin et al., 2015) – has managed to renegotiate its authority. Murshid and Haque (2019) illustrate how industry actors shaped subsequent revisions of the NDP in 2005 and 2016 which have led to a relaxation of norms around drug pricing, the prescription, sale and use of combination drugs, and the composition of the Essential Drugs List. This, along with limited capacity for enforcement, has led to a deterioration in the quality, availability and access to essential drugs as envisioned and promoted by the original iteration of the NDP.

One 2012 study revealed that very few clinics even had most of the essential drugs they were mandated to stock (Ahmed & Islam, 2012). Limited availability of these key drugs, especially in public facilities, forces people to purchase them in the private sector through

³ Islam (1984), reporting on the findings of an Expert Committee set up to evaluate registered pharmaceutical products, further described the then-dominant multinational companies as 'engaged mostly in the formulation of simple drugs including many useless products such as vitamin mixtures, tonics, gripewater, digestive enzymes and the like' despite having the technology and resources to produce 'sophisticated, essential drugs' (p. 3).

out-of-pocket expenditure (Kasonde et al., 2019; Mendis et al., 2007). Huge price variations of up to 500% for key medicines have been observed in Bangladesh (Ahmed & Islam, 2012), in spite of the fact that the Bangladesh Directorate of Drug Administration (DDA) is tasked with establishing the prices of essential drugs. Islam has commented that drug control authorities appear to be 'reluctant to negotiate with the companies to fix prices' (Islam, 2008, p. 24). One explanation for such high variability, highlighted by Chowdhury and colleagues (2006), is that drugs belonging to the same class are often manufactured with minor tweaks so they can be sold at much higher prices. The clear incentive to profit and generate revenue in a competitive market also results in aggressive and unethical marketing, especially to providers of antibiotics (Mohiuddin et al., 2015). This, in the context of lax regulation and coupled with patient expectations for antibiotics, results in 44% of clinical consultations resulting in their prescription in Bangladesh (Ahmed & Islam, 2012; Rousham et al., 2019).

The legacy of the NDP has shaped the environment and conditions into which AMR is now emerging in the human healthcare system. Although it paved the way for the development of an indigenous pharmaceutical industry and expanded availability and access to essential drugs, including antibiotics, the growing size and influence of this now very large private sector with which regulatory authorities are unable to keep up has resulted in a situation conducive to the emergence of AMR.

The limits of formal governance in a pluralistic health system

Although extremely significant, the large domestic pharmaceutical market and its array of associated actors (from manufacturers, to marketing firms, to distributors to formal and informal pharmacies and drug salespeople) is only one component of what scholars have called the 'pluralistic health system' in Bangladesh (Ahmed et al., 2013; Bloom et al., 2015). As in many LMICs, a range of other actors have also emerged to fill in the gaps left by the public health system. These include private clinics and hospitals run by for-profit and non-profit actors, as well as physicians, traditional health practitioners and 'village doctors' (unqualified allopathic providers, who often also sell drugs and medicines). Like the informal pharmacies referenced above, a substantial portion of these actors and entities lie outside the formal sphere, and thus operate with little oversight from the state. The boundaries between public and private and formal and informal entities and actors are also blurred as, for instance, informal user fees may be demanded in ostensibly free or low-cost public clinics, while formal clinics or hospitals may prescribe medications which patients are expected to purchase in private and/or informal drug shops (Bloom et al., 2015; Lucas et al., 2019). The majority of antimicrobial medicines flow through the many informal and semi-formal channels within this system which, despite the lack of oversight, has played a significant role in improving population health.

Bangladesh has been variously referred to as both an exceptional health performer and a paradox, because it has witnessed major reductions in mortality in the face of persistent challenges presented by poverty and natural disasters (Chowdhury et al., 2013). A key contributor to this performance has been the presence and tolerance of the above cited diverse array of health actors which have complemented state efforts. Sen has noted the 'general acceptance of a multiplicity of instruments in the public and private sectors for rapid social advancement' to be a 'striking feature of the Bangladesh story' (Sen, 2013, p. 1967). This 'pluralism' – or the participation of a 'multiplicity of stakeholders and agents engaged in health production' through diffused, messy and ad hoc processes and dynamics - is recognised as having supported remarkable health progress in the country, particularly among the very poor, and is a crucial contextual dimension of the health governance 'ecosystem' in Bangladesh (Ahmed et al., 2013, p. 1746).

NGOs in particular have played a significant role in the facilitation of human development in Bangladesh, and particularly in the health sector. Indeed, Bangladesh is widely known for

the 'size, scope, and success' of its NGOs (Chowdhury et al., 2013). It is home to internationally reputed organisations such as BRAC – said to be among the largest NGOs on earth – and the Grameen Bank, whose founder, Muhammad Yunus, was awarded the Nobel Peace Prize in 2006 for the organisation's innovative approach to finance for the poor. While the achievements of NGOs in Bangladesh are undoubtedly a result of the ingenuity, persistence and efforts of their workers, other larger factors have also contributed to their performance and cemented their presence and operational roles in the country's development. Historically, for instance, the weak bureaucratic capacities of the newly formed republic, further hampered by political instability and natural disasters in its early years, created a space into which NGOs stepped (Ahmed et al., 2013). They demonstrated their credibility through long-term engagement, managing to ensure external funding for their activities, and to win acceptance by state agencies who themselves have shown willingness to partner with NGOs, contracting them to provide health services (El Arifeen et al., 2013).

As suggested in the overarching review, the types of measures usually invoked by the concept of 'governance' are the formal laws, rules, regulations and policies instituted by a government. The pluralistic health system that has emerged in Bangladesh is an example of the limits of this conceptualisation of governance, if also illustrating how formal laws can themselves have unintended consequences. In this case, the NDP led to the entrenchment of a large, ad hoc and chaotic mesh of private and informal actors who operate beyond the reach of formal regulation, and through which antimicrobials flow easily and cheaply from manufacturers, to providers, to consumers. Although there are obvious limitations to the potential of conventional governance and policy approaches to 'bring order' to such a system, and more innovative strategies will clearly be required, the government of Bangladesh has passed policies with explicit aims to regulate the flow of antimicrobials. These are described below.

Governing AMR risk in animals and the environment

Antimicrobial use in the agriculture sector is a major driver of AMR globally. Accordingly, the problem of AMR has been identified as well suited for the application of the One Health approach. One Health is a relatively recently coined term that seeks to integrate perspectives from animal, environment, and human health sectors in a bid to decrease disease risks in humans and other species (Cassidy, 2018). This framing has also recently been embraced in Bangladesh where, like in many other LMICs, a high proportion of the population relies on livestock for sustenance or income (Hoque et al., 2020; Orubu et al., 2019). Indeed, it has been claimed that the Ganges floodplain upon which Bangladesh is situated 'supports more humans and animals than any other place on earth' (FAO, 2018). This density of humans and animals provides ample opportunity for pathogens and resistance genes to spread. Alongside the extensive availability of antimicrobials, as well as the growth promoting effects of these drugs, plenty of incentive exists for people to treat their animals with antimicrobials, and usage in terrestrial and aquatic animals is understood to be very high (Chuanchuen et al., 2014; Hoque et al., 2020). As earlier discussed, excessive usage in animals can lead not only to the development of resistant bacteria and infections in animals themselves, thus limiting their productivity and threatening human food supplies and economies, but also to dissemination of antimicrobial residues and resistant bacteria into the environment and communities.

Recognising these risks over a decade ago, the Ministry of Fisheries and Livestock noted the limited capacity of veterinary services and regulatory enforcement as barriers to addressing AMR in the 2007 National Livestock Development Policy (Hoque et al., 2020). Nevertheless, the national government pressed ahead to enact a set of three regulations prohibiting the use of antimicrobials in animal and fish feed for growth promotion between 2010 and 2013, the flouting of which could lead to a year's imprisonment or a US\$650 fine (Hoque et al., 2020; Orubu et al., 2019).

The extent to which these regulations have been effective is questionable, however. As in the human health sector, there is widespread availability of drugs through informal and/or unregulated sales networks that make enforcement difficult (Goutard et al., 2017). Additionally, the regulations did not ban antimicrobials in water provided to animals. Manufacturers have exploited this loophole by expanding products designed for this purpose, as well as deploying dealers and industry linked veterinarians to aggressively promote them among farmers (FAO, 2018). In a video produced by the FAO, Pabna, a poultry farmer, explains that veterinarians had warned her that her animals would die if she did not use these products (FAO, 2018). While therapeutic use of antimicrobials for animals in Bangladesh remains and should be permissible, particularly given the difficulty of engaging in otherwise biosecure farming practices, current levels of use are recognised as being unnecessarily high, buoyed by the financial incentives of the pharmaceutical industry and of farmers utilising drugs for growth promotion (FAO, 2018).

More recently, the Bangladesh Antimicrobial Resistance Alliance (BARA) has been established with support from the WHO and FAO, and with funding from the Bangladeshi government. Through a One Health approach, it brought together veterinary and medical experts to develop guidelines to address AMR in each respective sector. The guidelines are now available via a mobile phone app for use 'in the field' and through a training programme, while a social-media based 'community of practice' has been established where practitioners including veterinarians, animal health workers and extension officers are said to share advice and resources (Fleming Fund, 2018b; IACG, 2018b). Along with the One Health Secretariat established in Bangladesh, and training programmes for farmers on rational use of antimicrobials run by the Department of Livestock Services (DLS), BARA has been highlighted as a positive example of implementation of AMR policy in Bangladesh (Orubu et al., 2019). The extent to which these guidelines, training programmes and communities of practice are changing practices on the ground (including who they may or may not be reaching), however, is unclear, and research is needed to ascertain this.

A review by Hoque and colleagues (2020) found no laws or regulations regarding environmental contamination which make explicit mention of AMR. However, relevant policy and legislation does exist, and indeed has been around for some time. These include the Guide for Assessment of Effluent Treatment Plants 2008; the Medical Waste Management and Processing Rules 2008; and the Environmental Protection Act of 1995.

The Bangladesh National Action Plan for Antimicrobial Resistance Containment

The most explicitly relevant national policy to address AMR in Bangladesh is the Bangladeshi National Action Plan for Antimicrobial Resistance (BNAP), developed in the wake of the call from the WHO for countries to develop strategies to address AMR (MOHFW et al., 2017). The plan and a roadmap for its implementation (WHO, 2017) was launched in 2017. The plan outlines that it is overseen by a National Steering Committee encompassing representatives from the Ministry of Health and Family Welfare and the Ministry of Fisheries and Livestock, as well as representatives from the UN and professional bodies, and 'different stakeholders'. Multisectoral coordination and planning is specified down to the sub-district level, with terms of reference and membership for local committees suggested (Fleming Fund, 2018a).

The BNAP lists its objectives, largely aligned with the WHO's global NAP, as follows:

1. To establish a multi-sectoral approach for planning, coordination and implementation of antimicrobial resistance containment (ARC) activities;
2. To promote and ensure rational use of antimicrobial agents in human health, livestock and fisheries sectors;

3. To promote and strengthen infection prevention and control measures in both human and animal sectors to minimize the emergence and spread of AMR;
4. Promoting and strengthening biosafety and biosecurity principles and practices and containment measures;
5. To review, update and strengthen regulatory provisions;
6. To establish and strengthen surveillance systems for AMR to monitor use, including through web-based networking;
7. To promote basic, experimental and operational research and education in the area of AMR;
8. To establish Advocacy, Communication and Social Mobilization (ACSM) for ARC activities.

Of all the objectives, it is the second on the promotion and ensurance of 'rational use of antimicrobial agents in human health, livestock and fisheries' – priorities often referred to as 'stewardship' – which is elaborated upon most. Several more specific activities associated with this objective include:

- a. The development and updating of standard treatment guidelines for human and animal health and the ensurance of adherence to these;
- b. Availability of antimicrobials at all healthcare facilities;
- c. The development of antibiotic policy;
- d. The establishment and strengthening of a national reference laboratory and regional microbiology labs, and ensurance of good lab practices (GLP);
- e. Enforcement and enhancement of regulatory provisions for antimicrobials;
- f. Ensurance of good pharmacy practice (GPP) at points of sale for antimicrobials;
- g. Assuring good manufacturing practices (GMP) in pharmaceutical sector.

Altogether, the roadmap lists 125 activities measured by 160 output indicators. As it is still relatively recent, no commentary on the policy process of the BNAP's development could be found, while little has thus far been published on its content and implementation. One recent exception comes from Orubu and colleagues (2019), who assessed the extent to which implementation of the plan has taken place so far, counting as evidence 'any publication' including news, grey literature and government material which describes an activity proposed in the BNAP. They conclude that while there has been action in some areas – such as the establishment of the aforementioned One Health intersectoral coordinating bodies such as BARA, as well as drug quality initiatives for human medicines – many activities which were proposed to have been completed by the time of their research had yet to be undertaken. Other researchers have mentioned a recently introduced Model Pharmacy programme through which the state aims to accredit drug shops that adhere to high standards of practice (Lucas et al., 2019). These standards ostensibly include compliance with recommended treatment guidelines. In 2018, however, less than 300 pharmacies were listed under the scheme (Lucas et al., 2019).

Overall, Orubu and colleagues (2019) note three major policy gaps in the BNAP, with potentially significant implications for its effectiveness and sustainability: 1) an absence of a dedicated funding mechanism; 2) a lack of monitoring and evaluation strategies; and 3) minimal action on stewardship activities in the veterinary sector. In relation to funding specifically, activities are largely reliant on donors including the Fleming Fund, USAID and Global Antibiotic Resistance Partnership (GARP), posing questions for sustainability.

Thus, while there has been movement in terms of establishing more comprehensive priorities and policy at the national level to address AMR, most recently and most explicitly through the BNAP, serious technical challenges remain. At the same time, the still nascent status of the BNAP and associated activities mean that there is much potential for building approaches that go beyond the language of policy documents, and the technical dimensions and

measures of their enactment. The next section discusses perspectives from the social sciences which spotlight the importance of recognising multiple perspectives and power. This challenges us to reframe the problem of AMR to one which requires us both to think more broadly in the sense of the range of factors and perspectives considered relevant, as well as in a more focused way to include important contextual specificities and configurations. Such an approach, we argue, offers more fertile ground for developing the kinds of innovative strategies that will be necessary to tackle AMR in the complex context of Bangladesh, with its multiplicity of private and informal sector actors and weak formal governance capacity.

Social science perspectives

Several scholars have discussed how social sciences can contribute to AMR debates on science, policy and practice generally (Chandler et al., 2016; Craddock & Hinchliffe, 2015; Denyer Willis & Chandler, 2018), as well as examined specific areas of infectious disease debates, such as securitisation (Elbe, 2011; Hinchliffe & Ward, 2014), health access (Bloom et al., 2015; Brown & Nettleton, 2017; Merrett et al., 2016) and specific interventions (Kirchhelle, 2018; Wilkinson et al., 2019). The aim of this section is to highlight two broad sets of social scientific analytic approaches that have a role to play in informing the governance of AMR control efforts, as explored through the lens of Bangladesh.

Diverse actors, divergent framings

The first theme speaks directly to the complex network of stakeholders who influence how antimicrobials are produced, distributed, and used across multiple sectors. Social science researchers interrogate the different meanings the same phenomenon can hold for differently located individuals or organisations. People's cognitive biases and individual interests can influence their responses (Haley & Stumpf, 1989; Parker & Allen, 2014). This can result in the same policy issue being framed in different, and even conflicting ways (Leach et al., 2010). In the case of AMR, social scientists have described how it has been variously framed in high-level policy discourse as a threat to public health, economic progress, global security, and as a sustainable development challenge (Hutchinson, 2016; Khan et al., 2019). The significance of this is that the ways in which a problem is framed has consequences for how it is then addressed.

The predominant framing of AMR, in spite of One Health rhetoric in high-profile AMR discourse, is as an issue of human healthcare (Wernli et al., 2017). This framing centres on clinical human health settings and patient-provider interactions. In this framing, interventions such as information and education, treatment guidelines, and other 'stewardship' activities are seen to be needed in these settings to govern the flow of antibiotics and thus reduce unnecessary or improper use. While infection control is increasingly also advocated through, for instance, hospital hygiene measures, the dominant focus is on individualising measures that 'responsibilise' patients and providers to make the right decisions (Chandler, 2019).

The conceptualisation of AMR as a primarily human healthcare issue is seemingly also apparent around AMR in Bangladesh, and has been for some time. In a 2014 interview, Dr Mohammad Aminul Islam of the International Centre for Diarrhoeal Disease Research, Bangladesh (iccdr,b), and member of the WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance, seemed to suggest that what was then still anticipated policy action would initially focus on tertiary hospitals (Johnstone, 2014). A recent review of AMR research in Bangladesh by Hoque and colleagues (2020) found that only four papers in the set of 46 that matched their selection criteria (which included animal health) concerned AMR in the livestock sector. Seven concerned environmental contamination while 35 (76%) focused on the human health sector. Thus, despite the fact that widespread and indiscriminate antimicrobial use occurs in the animal sector, little data is actually available on this in the country (GARP and CCDEP, 2018). In their own review of research on interventions across LMICs, Wilkinson and colleagues (2019) found a similar dearth of papers about AMR

interventions in the livestock sector, possibly reflecting limited action in this area, but, certainly, the dominance of the human biomedical frame overall.

Despite what seems like a focus on human health, however, the One Health framing does have traction in Bangladesh. Bangladesh' relatively early moves to restrict antimicrobials in animal and fish feed, for instance, reflects acknowledgement that action in the sector is required. At the same time, however, the apparent limited movement on stewardship activities in the livestock sector noted by Orubu and colleagues (2019) may suggest less of a willingness to take serious action in this area. For instance, while the researchers found evidence of action to improve drug quality in the human health sector – a move seen as necessary to reduce AMR – evidence for corresponding actions in the animal drug market were not found.

Indeed, one of the challenges of animal-human health collaborations highlighted by social scientists is that both sectors tend to view and value health differently. While human health is rarely valued in monetary terms, livestock are usually seen as a form of capital and are valued accordingly. Livestock farmers, like most small business holders, are deeply concerned about the costs involved in managing their operations and therefore assess risks and associated interventions accordingly. Considering this from a national level, Khan and colleagues (2019) argued that what they perceived to be a soft touch on the livestock sector in AMR policy in Pakistan reflects its important economic position in the country. Wholesale retraction or restriction of antimicrobials in the livestock sector in LMICs may indeed represent a major economic threat not only to national economies but also to households who depend on the productivity of their animals for livelihoods and for sustenance in the short term (Laxminarayan et al., 2016). Although AMR itself presents a significant threat to the livestock sector as a whole, and the wellbeing of its smallholders in the medium to longer term, the urgency of this may be outweighed by that felt to generate GDP at the national level, and to put food on the table at the local level.

While this may demonstrate a disjuncture between the perspectives and priorities of the human and animal health sectors, it may also represent divergence between the perspectives and priorities of low and high-income countries (and the global health apparatus which the latter dominate). Recognising that different actors frame issues in divergent ways which reflect their own positions and priorities can help us to work towards multi-actor and multi-pronged solutions necessary to meet the challenge of AMR. This is an undertaking the One Health approach at least rhetorically embraces. However, another crucial dimension to building effective approaches is an appreciation of power. As the next section discusses, not all actors have the same amount of agency to act or to influence policy or outcomes, and, indeed, behaviours are conditioned by the broader economic and social structures and flows in which they are embedded.

Seeing power

The second and closely related contribution of the social sciences to thinking about governance for complex problems like AMR is the interrogation of power. The disciplines of anthropology and sociology consider power to play a central role in influencing how policies are formulated, take shape, and are implemented, and recognise the political agency of different actors involved in and affected by policy processes from elites, to managers, to implementers, and citizens (Bardosh, 2014; Parker & Harper, 2006; Shore & Wright, 2003). In contrast, while research traditions in health with more positivist leanings – such as epidemiology and public health – may recognise the importance of agency and constraints of actors, these dimensions are usually not made the focus of research (Edelman, 2018; Krieger, 2012; Roth & Mehta, 2002).

The strength of a power-aware approach is that it moves beyond an instrumentalist view of policy to reveal how it reflects the perspectives and priorities of those who construct it, while

excluding those of less powerful actors. In this process, pertinent contextual realities, including political, historical, economic, social, cultural and environmental dynamics may be overlooked, ultimately leading to less effective outcomes. The social science tradition of STS (science and technology studies), for instance, examines how powerful policy actors, including scientists and politicians, can frame insights from scientific research to promote narrow conceptualisations of reality (Jasanoff, 2003; Collins and Evans, 2007).

Although One Health was conceived in the spirit of overcoming some of this siloing in the study of complex health and environmental issues like AMR, critical scholars have observed similar forms of 'closing down' around particular forms of positivist scientific expertise and knowledge, with insights from the social sciences continuing to be marginalised (Bardosh, 2016; Parker & Harper, 2006; Waltner-Toews, 2017). More broadly, development agendas insulated from political realities have been said to give rise to 'anti-politics machines': scenarios in which policies or projects, designed in a top-down manner, fail to achieve their goals (and even have additional unintended negative consequences) due to failures to account for contextual realities and the embeddedness of actors in webs of power (Ferguson, 1994; Parker & Allen, 2014).

What lessons do these insights have specifically for AMR governance? In her review of global AMR debates and evolving global governance, Hutchinson (2016) describes how current efforts at this level have aimed to establish new global norms through international instruments such as an international treaty that would legally bind countries to AMR commitments. Hoffman and Outterson (2015), for instance, outline a three-pronged strategy for such an international treaty that incorporates concerns regarding access (ensuring equitable and quality health services), conservation (restricting overuse of antimicrobials) and innovation (to support a drug development pipeline). Such an approach, they argue, will be able to address the concerns of most stakeholders in a responsible way, while establishing 'robust accountability'.

Despite the attraction of such an approach, the above-referenced social science literature cautions us against depending heavily on formal, legalistic and top-down strategies for their prescriptive nature, and blindness to context and power. Indeed, even more flexible strategies at the global level advocating voluntary stewardship and surveillance systems (Seale et al., 2017) risk being too rigid. The global top-down model to AMR, with or without legal mechanisms for accountability, has been critiqued as a western formulation of a one-size-fits-all approach which reflects HIC contexts while being insufficiently aligned with the priorities and practicalities of LMIC systems (Kakkar et al., 2018; Khan et al., 2019; Legido-Quigley et al., 2019; Rubin, 2019).

Parallel to, as well as bound up with the power dynamics and disjunctures between LMICs, wealthy countries and global health entities dominated by the latter, are sets of power relations and complex dynamics *within* regions, countries, sectors and communities. Actors operating at, between and within these different levels do so under diverse and complex incentives and forces, with different levels of agency and power. Some hold more than others. Lipsky's theory of street level bureaucrats demonstrates how those tasked with frontline policy implementation can exercise their agency in translating policy agendas according to their own worldviews (Lipsky, 2010). At the same time, limited resources available to frontline state actors in LMICs may also severely constrain their abilities to implement policy in any way resembling what might be envisioned, rendering policy, such as Bangladesh' restrictions on antimicrobials in animal feed, largely ineffective.

Within communities, as already suggested in this paper, smallholders who are reliant on their animals for survival may have no other choice but to use antimicrobials on their animals in the absence of biosecure ways of farming, and to turn even the smallest margin of profit in increasingly marketized systems (Chandler, 2019; Kakkar et al., 2018). They may also be reliant upon drug salespeople for information, given the limited reach of public veterinary

services. Indeed, informal village doctors and pharmacies with limited training and profit incentives may be the only health services available to people, providing vital care and information (Ahmed et al., 2013). Furthermore, people may be unable to afford missing (often precarious) work due to illness (Haenssger et al., 2019), or may be compelled not to complete a course of antibiotics in order to share, save the rest, or because the medicines are perceived as very 'strong' (Bloom et al., 2015; Lucas et al., 2019). Social scientists have emphasised the 'infrastructural' position that antibiotics play, upholding life and economies in the absence of social determinants of health like adequate hygiene and sanitation, and social protection such as sick leave (Chandler, 2019; Kakkar et al., 2018). These absences are themselves linked to broader historic and ongoing processes of power at the global level, such as structural adjustment policies and neoliberal reforms imposed by powerful global actors (Aminuzzaman, 1994; Denyer Willis & Chandler, 2018).

These complexities, particularly those rooted in the practical and everyday experiences, needs, constraints and agencies of people in communities, are not easily addressed in rigid, top-down governance strategies, whether formulated at the global or even national level. Interventions such as public information campaigns that seek to educate and implore responsible use, so often a key feature of AMR approaches, cannot shift the interacting forces and incentives which shape behaviour (Chandler, 2019; Haenssger et al., 2019). What can be done in the face of complex webs of differing perspectives and power relations which condition the abilities and motivations of states, providers and consumers? The next section discusses forms of potential community-based action which we argue can complement and fill in the gaps inherent to high-level governance efforts. These 'bottom-up' approaches to AMR governance are more rooted in local realities, which is particularly important in LMIC settings such as Bangladesh for the reasons outlined above.

Emergent models of governance and understanding: 'bottom-up' and collaborative approaches

In recent years, the major policy thrusts around AMR in Bangladesh and elsewhere have been around the development of national action plans to promote stewardship and surveillance. At the same time, calls have continued for an instrument such as a treaty to promote antimicrobials as public goods and to legally bind member states to their commitments. However, these strategies are unlikely to work in isolation even if followed up by more specific implementation plans like Bangladesh' roadmap – even if noted gaps such as the absence of a sustainable funding mechanism and monitoring and evaluation strategies are addressed. In the absence of dialogue and engagement at all levels of action among different stakeholders in ways which recognise multiple perspectives and capacities, these top-down policy instruments are likely to be seen as formulaic, not immediately relevant to the individual circumstances of communities and people, and thus less likely to be effective. Fortunately, Bangladesh has shown the will and ability to make significant progressive moves for public health governance in the past through the passage of the NDP. However, as discussed earlier in this paper, the proliferation of private and informal actors resulting from this move has also led to over and inappropriate use of antimicrobials. The fact that the majority of the flow of antimicrobial distribution and usage occurs beyond the reach of state regulatory apparatus requires alternative forms of governance that complement more formal action 'from above'. Below we highlight emerging models for action on AMR in Bangladesh which focus not on high-level policy and top-down regulations, but on more locally embedded and fluid approaches rooted in networks and community-level institutions. We argue that these strategies should not just be seen as 'interventions', but as forms of governance at the local level which have potential to be flexibly replicated, particularly in low-resource contexts, and their learnings incorporated into responsive governance structures at meso, national and global levels.

Targeting citizens: community dialogues for behaviour change

The Community Dialogue Approach (CDA) is a participatory method which has been deployed in a variety of LMIC settings to address an array of health issues including malaria, diarrhoea and schistosomiasis in recent years. It aims to trigger behaviour change at the community level through knowledge sharing, and the facilitation of collective decision making for local action. Very recently, it has been applied to the AMR issue in Bangladesh by researchers based in the UK and Bangladesh seeking to explore its potential to activate behaviour change at the local level among citizens in relation to antibiotic use. Taking on board a critique of intensive community engagement activities as being resource intensive, King and colleagues (2020) explain that they sought to embed their initiative in existing health system and community structures with the assumption that this would not only make use of existing resources, but also make absorption into routine processes and community life easier, as well as more acceptable to participants.

The pilot entailed the recruitment of 55 volunteers across five clinic catchment areas in a district east of Dhaka. They facilitated community meetings supervised by local Community Support Groups, themselves linked to Community Clinics – the lowest tier clinics in the public health system. Trained on antibiotic basics and facilitation skills, the volunteers conducted over 200 dialogues, attempting to stimulate discussion among attendants – anyone from the community who wanted to come – through facilitation and carefully designed visuals (King et al., 2020; Malaria Consortium, 2020).

Despite the novelty of the approach to AMR in this context, there are several immediately obvious limitations. Firstly, such an intervention does not address supply side factors such as the widespread availability and aggressive marketing and sales of antibiotics – factors that are well established drivers of antimicrobial use in Bangladesh. Basic information about antibiotics at community meetings is unlikely to be a match for the asymmetrical information between patients and drug sellers or even clinical consultations with village doctors, even if the doctors do not themselves have accurate information to deliver. Furthermore, although the researchers did attempt to consider issues such as gender in the design of the programme, it is not clear if other power relations at the community level that might have affected participation and trust were considered. A challenge experienced throughout the project noted by the researchers was the tendency for volunteers to ‘dominate’ more than facilitate the sessions. Without attention to power, community-based initiatives run the risk of failing to add up to more than the sum of their mechanistic functions (Joshi & Houtzager, 2012).

That said, community-based approaches are not new to Bangladesh. Indeed, many of the positive health outcomes that have occurred in the country have been attributed to the community centred work of NGOs such as BRAC (Ahmed, 2008). State actors have also embraced community-based action. Another dialogue based approach, although occurring among not just citizens, but health workers, managers and policy actors, are ‘Health Dialogues’ – an initiative of the Directorate of General Health Services (DGHS) ‘to ensure that peoples’ voices are at the centre of discussions about health policy’ (iccdr,b, 2016a). The point of these discussions is to facilitate ‘two-way’ communication between a wide array of community stakeholders to collectively recognise and articulate local health needs and shortcomings, and to make decisions and set up community-based structures for accountability in a participatory manner (ibid.).

Despite the limitations and small scale of the CDA initiative, there is scope and potential for the approach to be experimented with and explored further, ideally with more fine tuning to issues of power in the community. As findings from this research have not been comprehensively published, we may yet be treated to some compelling insights with

potential learning for approaches that could be scaled and incorporated with action in other sectors and at other levels of the system. Dialogic approaches have potential to allow communities to reformulate norms and behaviours around demand for antibiotics at the local level – invisible forms of local ‘governance’ that have profound implications for AMR. It also leaves access to medicines intact – an important factor for health equity in Bangladesh.

Targeting drug sellers: community-based regulation

While the previous example focused on getting citizens to change their behaviour, other examples of ‘bottom-up’ action have focused on innovative ways of ‘regulating’ drug sellers. As earlier discussed, innumerable private and informal drug shops in the country have become an entrenched component of the health system, relied upon by the population to access medicines, and yet are central drivers of antimicrobial overuse (Lucas et al., 2019). Due to the existence of these actors beyond the reach of the formal regulatory system, conventional approaches to state-based regulation which may work in high-income settings are inappropriate in contexts like Bangladesh. An innovative community-based model to get around these issues has been tested in Bangladesh in 2007 in a project led by the research institution icddr,b (Bhuiya, 2009; Bloom et al., 2011). In a rural district, village doctors were invited to participate in a series of trainings and provided with a handbook of treatment guidelines. A local professional association was established for them, into which the doctors who successfully passed a post-training evaluation were offered membership, and permission to use the association’s logo. To keep them accountable, a governing committee which followed the model of a national level monitoring organisation called Health Watch was established to create the membership criteria and recertify or dismiss members accordingly. The committee comprised of local stakeholders including civil society representatives, health experts, and government and religious leaders (Bloom et al., 2011).

Understanding that behaviour change does not necessarily occur simply with the provision of information, this project attempted to alter the incentive structure of the village doctors by making them accountable to a local governing body, and providing them with the legitimacy offered by professional association. This can be viewed as an attempt to harness the dynamics of a ‘reputational economy’ – a notion previously used to describe the incentive felt by doctors to prescribe antibiotics, a service perceived to be desirable by potential customers (Broom et al., 2018). In contrast, this example links the notion of ‘good reputation’ to accreditation, the maintenance of which is partially requisite on responsible drug dispensing. This system allows the community itself to govern the local market of drug shops through its demand for and patronisation of accredited establishments. Although this particular initiative had the broader aim to protect Bangladeshis from ‘incompetent medical practices and dangerous medicines’ that may be on offer in these establishments (Bloom et al., 2011, p. 8), concerns about over and unnecessary prescriptions and proper information provision about antibiotic use could also be incorporated. Comparable models might also work in the animal health sector, through associations of drug shops and animal health workers.

Similar approaches might leverage associations of drug shops to govern themselves through provision of training and resources to members (such as access to bulk buying schemes), and auditing practices as a condition of membership. Such approaches are said to have been successful in other LMIC settings, such as Nigeria, in relation to stemming the sale of counterfeit or expired products in informal shops (Oladebo et al., 2007). A risk of these types of approaches is that communities may end up with a two-tiered hierarchy among providers, in which unaccredited shops, selling inferior products and with less accurate information but at cheaper prices, continue to cater to the poorest and most vulnerable while those better placed are able to patronise accredited shops in ‘compliance’ with association rules. Strategies to avoid this would need to be explored.

As mentioned earlier in this paper, the Bangladesh government has launched a Model

Pharmacy programme to accredit informal drug shops (Lucas et al., 2019). However, the success of this model may be contingent on state collaboration with and leveraging of existing community structures to hold drug shops accountable, as in the icddr,b designed project. In Uganda, Tanzania and Liberia, a scheme called the Accredited Drug Dispensing Outlet has provided a similar, and clearly scalable model, based on cooperation between state and private actors working together to ensure accountability (Lucas et al., 2019). This 'decentred understanding of regulation recognises that states, on their own, cannot ensure the effective functioning of complex markets' (Bloom et al., 2015, p. 8), and flips the focus from a top-down to bottom-up strategy.

Co-constructing pathways in aquaculture

The previous two examples have suggested emergent models of locally embedded action for AMR. The final example comes from a participatory anthropological research exercise from Hinchliffe and colleagues (2018), which offers a much richer depiction of the context, complexities and power dynamics surrounding antimicrobial flows and the emergence of resistance, specifically in the Bangladesh shrimp and prawn industry in which it is understood that substantial antimicrobial use occurs. Through centring the opinions, knowledge and experiences of actors within the system, a much richer understanding of the 'social situatedness' of their risks and practices emerges. This enables the establishment of more productive dialogue, and the 'co-producing of alternative strategies'. Rather than offer a straightforward model for local governance, this example holds lessons for any such attempt, underscoring the need to centre the perspectives of people on the ground and to be adaptive rather than prescriptive and technical.

The authors describe the different sites, farming systems and aquaculture management practices undertaken in the area, including processes in and between hatcheries and smaller independently owned fisheries. Several pathways through which antimicrobials – and resistance – might be introduced in the production chains are identified, alongside corresponding economic and biological pressures which threaten the viability of the whole process, and thus the livelihoods of operators. Due to a wide range of constantly shifting and interacting factors outside of operators' control, disease threatens to wipe out entire batches at every stage. At the local level, this includes the poor quality of broodstock available to hatcheries and the cost prohibitiveness of disease testing and biosecurity, while increasing competition in international markets at the global level exerts constant downward pressure. Thus, a wide range of antimicrobials are used to treat infected broodstock, live feed, and larvae in order to keep livelihoods afloat. The poor quality and effectiveness of antimicrobial products, thought to be repackaged terrestrial animal drugs, is also a constant frustration. By mapping the system in this way, the authors illustrate how 'the emergence, persistence and transmission of antimicrobial resistance may relate to a host of drivers or ecologies and are not reducible to medicine use alone' (Hinchliffe et al., 2018, p. 2).

The authors argue that conventional behaviour change models focused on educating farmers to reduce disease risks and antimicrobial use is unlikely to work in these settings, given how strongly practices are 'embedded in social ecologies of food production' (Hinchliffe et al., 2018, p. 8). In other words, farmers are only one node in an extensive ecosystem of actors including stock suppliers, technicians, feed suppliers and retailers, who interact with each other and modify their practices each production cycle based on their individual and collective experience, as well as the exigencies of the situation at the time. The researchers propose an alternative model capable of accommodating this complexity; this requires reframing AMR as an adaptive rather than merely technical challenge, and engagement and co-ownership of involved stakeholders in processes of experimentation and change. 'Only by understanding those [social] ecologies and by working with key actors can we co-develop pathways to reducing the burden of AMR' (Hinchliffe et al., 2018, p. 2).

Attempting to support such co-development, the researchers facilitated 'competency groups'

of farmers, suppliers, and government officers. Drawing on their collective expertise, the participants were able to articulate the complex disease and AMR risks associated with current practice, and identify factors such as lack of affordable finance and access to quality inputs as systemic challenges, as well as sources of resistance over which they had no control. Figure 2 illustrates the system map they produced, reflecting the multiplicity and complexity of pathways through which disease and AMR risks emerge, many over which participants had no control.

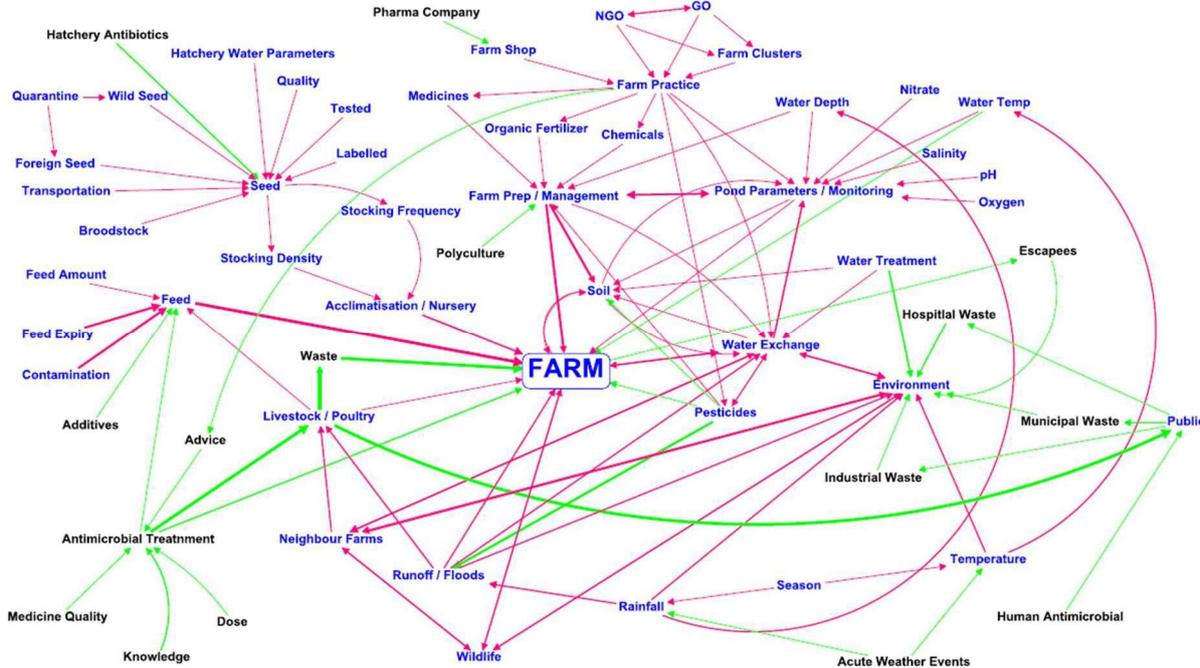


Figure 2. Shrimp and prawn production system map produced by participants of competency groups, from Hinchliffe et al., 2018.

Such production and articulation of shared understandings among ‘competency groups’ provides a starting point from which to build pathways to addressing AMR through cooperation and mutual understanding, and also, crucially, by producing critical information to feed into higher levels of the governance ecosystem where key structural aspects might be addressed – whether through formal regulations, and/or more flexible and innovative governance models like the association-based accountability models described above. We can argue that this represents not only a step towards local governance but to ‘governance from below’, with insight from actors at the grassroots level providing expert information to inform action and resource mobilisation at higher levels.

Fostering a responsive governance ecosystem, starting ‘from below’

The above presents a set of increasingly complex examples of what might be understood as ‘bottom-up’ governance, or ‘governance from below’, with emphasis on three key sites of AMR in Bangladesh: healthcare seeking among citizens, health service provision among private and informal drug sellers, and antimicrobial use and resistance in an aquaculture system. Although each example may be considered independently from one another, and indeed they have been gleaned from unrelated sources, it is fruitful to consider how systems of similarly decentralised, community-based models could mutually reinforce one another, as well as governance action taken at other levels of a system (regionally, nationally, globally) in the ultimate objective of reducing AMR. Indeed, the objectives of one without action towards those of another are unlikely to meet success – a core tenet of the One Health approach. For instance, research from Tanzania has shown that accreditation and adequate

knowledge of drug shop attendants did not ensure rational sales of drugs as consumers demanded them (Dillip et al., 2015). This underscores the need for action on multiple fronts, and suggests the ways in which citizen-centric initiatives such as the Community Health Dialogues targeting norms and knowledge described above, might complement initiatives to support drug shop accreditation in a governance 'ecosystem' which is ultimately greater than the sum of its parts. The deep mutual learning processes demonstrated in the aquaculture case study revealed the many interdependent factors shaping practices at different steps of the production process, and in the emergence of AMR. Similar processes of knowledge co-production and mutual understanding can be applied to other types of initiatives tackling different aspects of AMR production in the community, with potential for synergy between strategies not only in different sectors locally, but at other levels of the system.

In the absence of significant state capacity, what potential is there to support such approaches, and learning and synergies between them? As King and colleagues (2020) have noted, small-scale community-based models for triggering change are often critiqued for being resource intensive. For this reason, those behind the CDA attempted to map the initiative onto already existing health system and community structures – a reasonable and welcome design. However, this assumption presents a paradox. Contexts with limited resources are both less likely to have formal systems and institutions in place that can support and facilitate appropriate flows and usage of antimicrobials, and thus are arguably good candidates for decentralised and grassroots strategies, while, at the same time, the resources required for such approaches may themselves be in short supply. This concern also relies on the premise that contextualised, intensive community-based solutions and social mobilization yield 'less bang for the buck' overall. Recent experience during the West African Ebola virus epidemic has called this assumption into question in some circles, which have emphasised that intensive and power-aware community engagement strategies may have outsized impact on turning epidemics around in relation to their costs (Bedson, 2015; Parker et al., 2019).

Notwithstanding these concerns, Bangladesh does have indigenous institutions that can support innovative, collaborative and bottom-up strategies. As health systems analyses from Bangladesh have pointed out, the private and informal sectors in the country have routinely moved in to provide much needed services in the absence of public and formal providers. Researchers have argued that Bangladesh' successes in public health outcomes have been in large part due to the willingness of the government both to tolerate the presence of non-state and informal actors operating in these spaces, as well as to partner with NGOs and to readily adopt innovations originating in this sector (El Arifeen et al., 2013). The scale and reach of NGOs in Bangladesh, and their considerable experience with community-based programming and convening of multiple and diverse actors, presents unique opportunities for collaboration between the state and private sectors. These opportunities are not only in the realm of the design and delivery of community-based activities, but for the types of monitoring and accountability that may be necessary to support initiatives such as those based on accreditation of drug sellers. As earlier suggested, NGOs have a long history and established presence in Bangladesh. BRAC, thought to be the world's largest NGO, is said to have supported 126 million people. NGOs have proven to be more agile and responsive, capable of adapting activities in light of learning and experience as programmes and initiatives unfold on the ground. More effectively enlisting and leveraging the capacities of NGOs as existing institutions with experience and intimate knowledge of contextual realities and power relations can go some way to reducing the costs associated with intensive community-engagement, with potentially significant dividends for AMR reduction. The state's willingness to work with the private pharmaceutical industry in the past for the production of public health goods, such as increased access to medicine and health services, is also a good sign for collaboration over AMR.

Conclusion

As laid out in the overarching review, there are limitations to the instrumental and legalistic approaches of governance as adopted in policy processes, which are often also 'power blind'. The limited implementation of the BNAP is no doubt partially due to its relatively recent adoption. Its development is also undoubtedly a positive step in that it establishes AMR as a priority issue, deserving of its own comprehensive and multisectoral strategy. In reference to the BNAP and other legislation, Hoque and colleagues (2020) suggest that while there is 'no dearth of policies and strategies' for AMR in Bangladesh, substantial challenges remain. From a technical perspective, these include limited awareness among policy makers and practitioners who are not directly involved in AMR work, the continuing lack of a comprehensive surveillance system for the monitoring of AMR emergence, and limited resources for implementation – challenges shared by many LMICs (IACG, 2018a). We suggest there is evidence that this is best complemented by 'bottom up' approaches that can be more nuanced and offer innovative ways to getting beyond purely state-centric understanding of change processes reflected in conventional understandings of 'governance', including in the realm of AMR. Indeed, however, within specific situations it is likely there will be different understandings of: what governance is; what problem it is that requires being addressed; what should be prioritised in doing this; who should be leading it and/or involved; and whether such processes can be reflected in informal institutions such as social networks or norms, or more deliberate spaces such as 'competency groups' and committees. For these reasons, we argue that an effective and equitable system of governance for AMR should be power-aware, networked, deliberative and adaptive (Leach et al., 2007), and that this requires the integration of bottom-up perspectives, governance, and action. Such an orientation offers the capacity to flexibly anticipate, influence and facilitate change, rather than directing what must happen through formal directives. Additionally, we argue there are four main related challenges to cultivating and sustaining such an approach, outlined below.

Inclusivity challenge

Governance approaches are too often conceived without the input of those who are most vulnerable to the very complex problems that governance is trying to address. This rings true at the level of global governance, where the priorities and realities of LMICs have not been adequately reflected in discourse for action on AMR, as much as it does in the villages and slums where AMR is produced and experienced, with significant implications for human wellbeing and community development. Incorporating the views of, and indeed taking leadership from, these actors who are experts in their own everyday challenges and constraints, capacities and strengths will be key for successful action on AMR. This means including these actors in high-level governance processes, as well as empowering them to lead their own deep learning and governance journeys with other relevant stakeholders in local AMR ecosystems, and learning from feedback at these levels. Crucially, interrogations of 'community' will be important as well, with power dynamics along class, gender, ethnic and other lines needing to figure centrally in action at every level in order to avoid reproducing social exclusions, a phenomenon which itself contributes to AMR.

Multisectoral challenge

The imperative of inclusivity also extends to the challenge of ensuring that governance approaches are multisectoral in nature. This goes for governance at any level as AMR, as has been made clear, is a complex challenge which spans 'multiple processes, bugs and drugs' in human, animal and environmental systems (Chandler, 2019). The most obvious iteration of what multisectoral means in relation to AMR is that which is evoked through the One Health lens, which emphasises human health and animal health systems, as well as environmental dimensions of AMR production and dissemination. We have suggested that even where there are initiatives in place to address issues in one of these specific realms, they may reinforce

those in another. That said, while we welcome decentralised forms of action that are not necessarily explicitly joined up with actions in other sectors, there is potential for synergy and learning between these sectors which can make their collective impact even more effective. Modes of doing this should be explored and encouraged, including through the leveraging of existing institutions such as the non-profit sector. Indeed, also important will be partnerships between the state, civil society actors such as NGOs, and the private sector. This is particularly pertinent in Bangladesh, where informal markets prevail as the mechanisms through which most antimicrobials flow. As stated, the country has a legacy of successful partnership between these three sectors which should be harnessed. That said, multisectoral partnerships, like all inter-actor relations, are beset by power relations which, if unrecognised and unaddressed, may render efforts inert.

Scalability challenge

AMR will continue to develop in Bangladesh and the world over, to threaten ever more lives today and in the future, unless significant changes are made to the ways in which human and animal systems use, and indeed are dependent upon, antimicrobials. Importantly, these changes need not only be in the realm of behaviour change among prescribers, sellers and consumers at the grassroots level, but also to the social and economic systems which drive their behaviours in the first place. This will require action at meso and macro levels. Preventing infection, for instance, should be as much a priority as the promotion of rational use, particularly in countries like Bangladesh with very high burdens of infectious disease. Although the country has made much progress in water, sanitation and hygiene through the laudable efforts of NGOs like BRAC, and scalable bottom-up strategies such as Community Led Total Sanitation (CLTS), yet more improvement is urgently needed. At the same time, measures to restrict access to antimicrobials should be regarded with caution. A high court in Bangladesh has recently directed the government to ban the sale of antibiotics without prescription from a qualified medical practitioner (Lucas et al., 2019). Such a move presumes that people have access to formal prescriptions and that qualified doctors make 'rational' prescriptions, while failing to recognise the crucial role that informal practitioners have played and continue to play in positive health outcomes in Bangladesh, particularly for the poor. Furthermore, this would likely result in driving more covert production, sales and consumption, with potentially even more devastating consequences.

To be sure, we do not mean to suggest that global governance processes for AMR are unwelcome. Indeed, global discourse has leveraged action at the national level in contexts where it might not otherwise arise. LMICs face many immediately pressing challenges which compete for policy attention. That said, the priorities for LMICs should be taken seriously. Indeed, addressing many of them – such as general strengthening of health systems and governance capacities – will help to curb AMR in these contexts and beyond. As argued in this paper, it is crucial that strategies be appropriate to the contexts in which they are deployed from the national to the most local of levels. The existing global governance 'ecosystem', and the national level policies borne out of this, have been critiqued as reflecting the contexts and priorities of HICs where, for instance, health systems are comparably well organised and equipped, and data abounds.

We also do not mean to suggest that medical and technological investments and innovations are not important, as indeed new antimicrobials, diagnostics, and vaccines are profoundly necessary, especially for more vulnerable populations in LMICs. Action at the global level on models to overcome 'dry pipelines' in these areas is important. That said, as highlighted by Hutchinson (2016):

while there has been action at global level to enable the development of commodities that are needed to manage AMR, attention also needs to turn to the structural and infrastructural drivers of AMR to address path dependencies and reduce the reliance upon antimicrobials for human health. (p. 23)

The scale of investment for governance between addressing gaps for high technologies, such as new drugs, diagnostics and vaccines, far outweighs that which has been dedicated to the politics of AMR, by which we primarily refer to the entangled and interdependent webs of social, economic and ecological systems which influence antimicrobial use and resistance, particularly at the grassroots level. This is most effectively addressed through richly informed understandings of conditions on the ground, particularly in LMICs. Empowering people and networks at this level not only to understand AMR, but also their place in its production and reduction, can also feedback valuable information to direct governance resources at higher levels, as well as serve as models for learning and scaling to other contexts within and between countries.

Interdisciplinary challenge

As in many spheres of global health, social science perspectives remain marginalised, even where One Health logics are deployed to argue for interdisciplinary approaches to complex problems. And yet, social science perspectives and skills are crucial for two key reasons illustrated in the paper. Firstly, they can provide conceptual and analytical tools useful for mapping 'thick descriptions' of the contexts of AMR, both on the global level through macro-political economic analyses, and on subordinate levels all the way down to a broodstock pond in the Bangladeshi wetlands. These contextually rich descriptions reveal the complexities and interdependencies of systems, incentives and actors, highlighting where there is agency and where there are structurally determined obstacles to change. This insight allows the development of contextually appropriate pathways to addressing AMR which are rooted in the actual lived realities of people and communities, and thus more likely to be relevant and useful to them in their own journeys to change. The second crucial skill that social scientists offer is in convening diverse groups of actors and facilitating co-production of understanding and of pathways to change. Often outsiders to the communities in which they may do this work, and cognisant of the need to link up with higher levels of the system, social scientists are also keen to work with policy actors to influence policy in effective and equitable ways. Social scientists can thus help to increase the likelihood that learning from the ground is appropriately translated into resource mobilisation or policies that will be equitable and effective, including through the empowerment of local institutions. More meaningfully incorporating social scientists and their perspectives will mean challenging entrenched and tacit hierarchies in relation to what types of methodologies and knowledges are considered relevant for addressing complex problems like AMR, which are primarily framed as biomedical or natural scientific issues.

List of acronyms

ABR	Antibiotic resistance
ACSM	Advocacy, Communication and Social Mobilisation
AMR	Antimicrobial resistance
ARC	Antimicrobial resistance containment
BARA	Bangladesh Antimicrobial Resistance Alliance
BNAP	Bangladeshi National Action Plan for Antimicrobial Resistance
CDA	Community Dialogue Approach
CLTS	Community-led Total Sanitation
DDA	Bangladesh Directorate of Drug Administration
DGHS	Bangladesh Directorate of General Health Services
DLS	Bangladesh Department of Livestock Services
FAO	Food and Agriculture Organization of the United Nations

GAP	World Health Organization's Global Action Plan
GARP	Global Antibiotic Resistance Partnership
GDP	Gross Domestic Product
GLP	Good Laboratory Practice
GMP	Good Manufacturing Practice
GPP	Good Pharmacy Practice
HIC	High-income country
LMIC	Low-to-middle-income country
MDR	Multi-drug resistant
NAP	National Action Plan
NDP	Bangladesh National Drug Policy
NGO	Non-governmental organisation
STS	Science and technology studies
UN	United Nations
USAID	US Agency for International development
WHO	World Health Organization

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