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RESEARCH PAPER

Antimicrobial resistance as a problem of values? Views from three continents

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ABSTRACT

Much has been written about the problem of antimicrobial resistance (AMR) and the action required to rein in this emerging global health threat. Addressing AMR is often operationalised as requiring 'behavior change' of clinicians and of patients, in combination with improving the drug development pipeline. Few have approached AMR as a challenge fundamentally embedded within the cultural fabric of modern societies and the (varied) ways they are organised economically, socially and politically. Here, drawing on a decade of work across a range of health contexts, we approach the problem of AMR as one of values and culture rather than of individual behavior. We reframe AMR as a social and political concern resulting from a confluence of factors and practices including: temporal myopia, individualisation, marketisation, and human exceptionalism. To effectively tackle AMR, we advocate solidaristic models that espouse collective responsibility and recognise relative opportunity to act rather than a continuation of the individualistic behavioural models that have, so far, proven largely ineffective.

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Introduction

Antimicrobial resistance (AMR) or the resistance of microorganisms to the antimicrobial agents that once reliably killed them is, in part, a natural, evolutionary process. However, the social organisation of human and animal health has provided the socio-microbial conditions for the recent acceleration of AMR. Particular social and political forces – including the vagaries of pharmaceutical research and development, the financing of healthcare systems, expectations of patients, and systems of rewards and consequences for healthcare practitioners – have contributed to an environment in which the microbial evolution of resistance has flourished. As a result, AMR has become a problem that is global in nature. As AMR increases, it is not hard to imagine a scenario in which current approaches to antimicrobial stewardship (AMS) that espouse *surveillance, restriction* and *correction* of antibiotic usage, will be punitively imposed across nations, health and agricultural systems. Yet, to date, AMS programmes have had disappointing outcomes despite considerable and escalating investment, with data showing persistent over-use of antimicrobial agents even in well-resourced health settings, and across economically wealthier nations (European Centre for Disease Prevention and Control (ECDC), 2019; Prestinaci et al., 2015).

Prevailing approaches to combatting AMR so far have focused on two key strategies: first, restricting access to antimicrobials and changing the behaviour of individual prescribers (Barlam et al., 2016; Charani & Holmes, 2019; Davey et al., 2013); and second, pushing for public and private

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sector pump-priming of a highly lethargic antibiotic pipeline.[1] These strategies have focused on changing individual behaviour, while neglecting the societal, species or planetary-level considerations that a growing body of social science literature highlights as crucial to the dynamics of AMR (e.g. Chandler, 2019; de Lima Hutchison et al., 2018; Lorimer, 2017, 2017a, 2017b; Hutchinson, 2017). We argue that the focus on individual behaviour change is rooted in a one-dimensional characterisation of the AMR threat that does not sufficiently account for the social-structural forces underlying persistent suboptimal practices. Drawing on a decade of work on AMR across a range of health contexts, we articulate a range of key social and political dynamics that pose critical barriers to current AMR 'solutions', such as those being adopted by individual nation-states and pan-National organisations, including the World Health Organization (WHO, 2015). We propose a solidaristic model that espouses collective responsibility and recognises relative opportunity to act in order to more effectively mitigate the global AMR threat.

The hegemony of individual behaviour change

Why is the three-pronged approach to AMS of surveillance, restriction, and correction ineffective? As we unpack below, such an approach does not sufficiently account for the roles of societal and cultural values, informal knowledges, shared practices, organisational culture, and economic and political system-level concerns, all of which shape people's actions. Behaviour-driven approaches are thus, we argue, unwittingly complicit in preventing meaningful change (for useful discussion see Tarrant et al., 2019). Most concerning is how the logic of *correcting* 'irrational' behaviour will impact on economically poorer countries (e.g. Broom et al., 2020). That is, nations who appear as the 'most irrational' consumers in terms of the overall global burden of antibiotic mis-use, and as 'hotspots' for AMR (Laxminarayan & Chaudhury, 2016), are likely to attract the greatest (future) regulatory scrutiny despite the fact that they are (structurally) least-well positioned to intervene.

Our analysis below thus seeks to move beyond the individual behaviourism latent in the global approach to AMR, examining some of the social and structural underpinnings of antimicrobial practice in health contexts. Firstly, we map out some of the *system-level characteristics* that give rise to, and currently exacerbate, the problem of AMR, though often on opaque ways. Secondly, we outline a *system- and values-focused re-orientation* that is necessary to improve the global response. This reorientation involves broadening lines of accountability beyond individual prescribers and consumers to include those often viewed as peripheral to the problem, for example the executive and political classes, health funders, investors, and insurers, all of whom play an important role in perpetuating the structural conditions in which AMR is currently flourishing.

Our analysis draws on data from a decade-long program of research on AMR and stewardship in health contexts. This includes 302 semi-structured qualitative interviews with clinicians across 8 study sites in Australia, the UK, and India (See Table 1), carried out between 2013–2019 with ethics approval provided for each study by local health services ethics committees. The data sets have an unusual degree of coherency given that one interviewer (the lead author) led each study, ensuring a similar style and approach and enabling an integrated analysis across contexts. Despite considerable variation across geographic region and healthcare system structure, a consistent and enduring set of issues arose within the everyday accounts of practice. Each period of fieldwork was designed to examine healthcare professionals' perspectives and experiences of infection management, the rise of resistance and institutional/professional practices therein. Our recruitment strategy was designed to facilitate rich and in-depth accounts from interested participants across a range of sites in order to access a range of experiences according to, for example, metro/regional setting, profession, subspecialty, and level of seniority. All interviews were digitally audio-recorded and transcribed verbatim.

Our methodology draws on the interpretive traditions within qualitative research, and uses data gained through semi-structured interviews to achieve a detailed understanding of participants' practices and social worlds. Earlier analyses of individual data sets (e.g. Broom et al., 2014; Broom

Table 1. Institutions and participants.

Site	Country	Institutional context	Years of data collection	Geographical setting	Public/ private	D	N	P	M
1	Australia	Hospital	2013-2015	Regional	Public	30	30	19	5
2	Australia	Hospital	2015-2017	Metropolitan	Public	35	15	5	8
3	Australia	Hospital	2015	Metropolitan	Public	0	0	0	10
4	Australia	Hospital	2016	Remote	Public	11	15	3	3
5	Australia	Hospital	2016	Regional	Private	9	19	4	1
6	United Kingdom	Hospital	2014	Metropolitan	Public	20	0	0	0
7	India	Community	2016	Metropolitan	Private	15	0	15	0
8	Australia	Hospital	2018-2019	Metropolitan	Public	5	4	6	15

Total interviews = 302.
D = Doctors, N = Nurses, P = Pharmacists, M = Managers.

et al., 2016; Broom et al., 2018; Broom et al., 2020; Broom et al., 2017), helped illuminate localised practices, paving the way towards the current analysis of trans-local and pan-national considerations. AB undertook primary analysis across the amalgamated data sets with a focus on pan-national themes and meso/macro level considerations that shape AMR/AMS across contexts. Initial interpretations were challenged and tested by the other authors, re-tested against the data, and compared with additional scholarly literature in generating a final interpretation of the data presented here. These themes, as we examine in detail below, include (a) *temporal myopia*, (b) *individualism*, (c) *marketisation*, and (d) *human exceptionalism*. In undertaking this pan-national analysis, we seek to reposition individual 'irrational' behaviour as an outcome of system praxis, and propose a values-led approach to enact change.

Temporal myopia and the individualisation of everyday life

A key structuring force in the AMR crisis is the pervasive and persistent *temporal myopia* of modern social life. We use this term to capture the structural impediments to thorough consideration of long-term outcomes in decisions about more proximal action, and the delimiting of 'value' to matters of immediate returns. How is this articulated in medicine, or more specifically, with regard to AMR? Currently, institutional incentives heavily skew towards immediate infection management – diagnosing and treating the infection, avoiding patient deterioration and securing a positive patient outcome. These manifest as the *satiated* consumer and the *covered* doctor in the short term, but nowhere does our collective and long-term antimicrobial security become an institutional priority. In securing immediate 'value' in terms of satisfied patients, complying doctors and (over)treated infections, this cycle produces future risks – through heightening selective pressure, risking resistance in the (current) patient, and the development of (future) multi-resistant organisms. In essence, the protracted timescale of negative consequences of the AMR epidemic clashes with many of the immediate, and more readily quantifiable, imperatives of modern medicine including annual reporting around budget deficits and patient outcomes.

Temporal myopia, as we emphasise, is not a practice of irrational or egocentric individual persons, nor is it exclusively a feature of the immediacy of (much) institutional accountability. Instead, it emerges through the intertwined practice of individual and collective actors within institutions that reward rapid, measurable, and quantifiable successes. This also links to how temporal myopia works in the everyday: In our fieldwork, clinicians articulated this in a number of ways, including the centrality of immediate 'measurables', and the individualisation of consequences for negative patient outcomes. As a result, while many of our respondents recognised the systemic nature of the problem of AMR, in their own practice, more immediate 'measurables' took priority for action:

Doctor: I probably tend to over treat rather than under treat.

I: And why is that?

> Doctor: Oh, fear of relapse and uncertainty that they're going to get better. And actually lack of evidence-based knowledge in myself. Safety for us is not making a mistake, not missing something, where a patient has a bad outcome. Mis-prescribing is more of [a broader] issue. [**Australia**, Consultant, Paediatrics]

> Doctor: [Doctors] want the patient to get better; they don't want their reputation to get affected by patient not getting better. So they will not take any chances, they would give antibiotics right from beginning. [**India**, Consultant, Pathology]

> Hospital Manager: I honestly believe lip service is paid to it [antimicrobial mis-use]. You could go start preaching from the mountaintops telling people how much we're spending [on antibiotics], what it's [antibiotic resistance] costing us [. . .] It's just as I said [. . .] there's no measurable in it so therefore it doesn't matter. [**Australia**, Divisional Director]

> Hospital Manager: I guess it's whether [AMR is] an immediate measurable good. I think that's the challenge that we have with a lot of these things." [**Australia**, Multi-Divisional Director]

> Doctor: . . . the clinician is ultimately responsible for the patient's care, so if something's not done . . . if this person dies it's me that faces the consequences . . . (**United Kingdom**, Consultant, Respiratory)

Budgetary impact, individual patient outcomes, and individual clinician's autonomy and accountability articulated some of the broader institutional values and practices. Notably absent from these concerns were the broader issues of community-level infective risk, AMR, and the long-term viability of antimicrobial therapy. As such, debates about AMR and AMS in everyday practice remain couched in terms of individual risks and needs.

The foregrounding of individual-level behaviour and measurement is not merely an institutional choice, but it is related to the axiomatic status of the individual in Western thought. As Beck and Beck-Gernsheim (2002), have pointed out, people are 'condemned to individualization' (p. 4) because of the extent to which the axiom of independent individual agency has been inscribed into our social, economic, and political institutions (see also Bauman 2013, xvi, Siedentop, 2014). In this way, acting in self-interest – or in this case in the dual self-interest of securing individual clinicians' professional reputations through the avoidance of 'bad' individual patient outcomes – is 'imposed on individual citizens by modern institutions' (Beer & Koster, 2010, p. 55). This contrasts with, for example, a relational ontology of practice that considers personal and collective needs, interests, and stakes not as dichotomous, but as mutually shaping one another (see Mackenzie & Stoljar, 2000). Responding to AMR, which inevitably means acting relationally, becomes a structural challenge rather than a behavioural imperative.

This culture of individualisation has been reinforced in Australia (as in many other world regions) by a particular political and economic order, namely through advanced capitalism and the steady rise of privatisation. Market logics have spread well beyond overtly commercial space to infuse public institutions (Birch, 2017; Birch & Siemiatychi, 2016; Meek, 2014), providing a critical additional contextual layer to the problem of AMR and the capacity to intervene in practice.

Marketisation, consumerism, and health across continents

Advanced capitalism provides the unifying pan-national environment in which AMR is currently escalating. Albeit to variable degrees across contexts and countries, the market has driven the direction of biomedical innovation including, in recent decades, away from new antimicrobials and toward higher return drugs, for example those for prominent chronic conditions or cancer (Luepke et al., 2017). But it is not only pharmaceuticals – and the lacklustre antimicrobial pipeline – that has been inflected by market logics. The broader political and economic milieu has fundamentally shaped the logics of healthcare delivery, regardless of the specific funding structures of healthcare systems, which in this article include the largely private environment in India, the partially state-funded structure of Australia and the fully state-funded model of the NHS.

Australia's unique mix of public and private hospital sectors provides an interesting case (Cotta et al., 2016). There has been greater difficulty in rolling out antimicrobial surveillance or

implementing behaviour change interventions in Australian private contexts relative public health-sector institutions. In part, this is due to the dynamics of immediate financial return that are more pronounced in Australia's private hospitals (Broom et al., 2018). In this context, securing a positive outcome for the paying consumer 'at all costs' (i.e. to the future, to others, to the community) becomes the overriding imperative. Although the data is limited, there is evidence both in Australia and internationally that management of community acquired pneumonia in private hospital settings, for example, is frequently non-compliant with guidelines, and in one study private insurance was significantly associated with an increased likelihood of receipt of broad spectrum antimicrobials in children with pneumonia (Robinson et al., 2014; see also Handy et al., 2017). Existing payment models also create perverse incentives in the context of AMR as they incentivise pre-emptive treatment in order to minimise the financial risk of subsequent infection that, though costly to treat, is not 'billable' if it is acquired in the course of receiving treatment (e.g. surgery).

Market logics are not exclusive to private-practice settings and have fundamentally shaped relationships of accountability across public and private health services in many countries, including in the National Health Service in the United Kingdom (cf. Hunter, 1996). Our work with doctors in the United Kingdom in particular illustrated how, despite the National Health Service being the largest publicly funded healthcare system in the world, a broader culture of healthcare consumerism profoundly curtailed attempts to rein in prescribing of unnecessary antibiotics (Broom et al., 2016; Kizer, 2001). Similarly, the structural context of private and fee-for-service healthcare provision in India fundamentally shapes prescribing practices of physicians. Marketisation and healthcare consumerism as political, economic, and social dynamics, and the respective assumptions about value, profit, loss, liability, and so forth, deeply inflect practices and priorities:

> Doctor: … they've [the patients] probably become a lot more demanding and have quite high expectations when they come into hospital. So often they think it's their right to come in, and whether they need it or not have iv access, and have their iv antibiotics for their common cold … with the complaints culture, and the amount of litigation going on, I think a lot of doctors are afraid to stand up and say 'no, you really don't need antibiotics', or 'there's really no indication', or 'you're alright for now, let's just wait and see what the blood test shows', or things like that. [**United Kingdom**, Junior Doctor, Infectious Diseases**]**

> Doctor/Department Head: The private hospital has, as far as I can tell, no antimicrobial stewardship system whatsoever, and it's in the same building as the public hospital, with a lot of staff that are shared between, well, a lot of medical staff that are shared between the two facilities. … I think I can totally do my own thing up there. I fling more broad-spectrum antibiotics around up there than I do here … I think that we should, as the public hospital, probably offer to or even demand that our AMS do rounds up there, because we've got staff carrying the germs back and forth. [**Australia**, Consultant and Department Head]

> Doctor: I think we all feel that pressure from various sources. I mean it's very clear that the hospital likes to get people out [of hospital] quickly. We understand that. They've got to make a profit, and also the situation at the moment is there's such a demand for beds almost all year round that we've got people waiting for beds. But you've also got to balance that against the cost of people bouncing back in [readmission]. [**Australia**, Consultant, Respiratory]

> Hospital Manager: It's like my clinician is coming in and telling me they're going to save half a day bed day, length of stay, by doing something. Am I ever going to see the dollars that come from that? Absolutely not, because there will be another patient in that bed. So, antimicrobial stewardship is due to the good that it does at the time. That's kind of where it feels like for me. I don't feel like there is something that I could do that would significantly move the dial enough on the dollars for me to be able to measure it to say, 'Actually, I've saved $1 million this year because we've done this' [**Australia**, Multi-Divisional Director]

> Pharmacist: This may be health care and people may not see it as commercial activity but there is a lot of commercial component in this field. And unfortunately, doctors are the ones who comes under a lot of pressure both from the management and pharmacy corporate because they are the ones who are prescribing the drugs and advising for tests. Then they come under pressure from patients for quick results. They are caught between a lot of counteracting forces. [**India**, Supervisor, Pharmacy]

> Doctor: [medical] practice has become 'hit them hard, hit them fast'. High order antibiotics are grossly misused, that's what people do. […] People want quick response, both the physicians and the patients, which is easily

> done with high end antibiotic but can put the patients at great risk in the future … The point is once it worsens he [patient] will go to different doctor. He will say [the former] doctor didn't give right medicines for me. None of the doctors are that confident. [**India**, Doctor, Endocrinology]

The construction and perpetuation of health systems according to market logics is thus an important consideration in enacting AMR solutions. A 'marketisation ethic' interplays with structural conditions (e.g. the Indian healthcare milieu), profoundly constraining people's capacity to act judiciously and is, paradoxically, often invoked as an excusing condition in the global effort to combat AMR, as we outline below.

Responsibility, visibility, and excusing conditions in the global context

One of the difficulties of AMR is that the extent of the problem is only revealed by large-scale system-wide data on prescribing and resistance patterns, making surveillance – or aggregate data on individual behaviour – a necessary precursor to effectively addressing AMR. Yet, increased surveillance has demonstrated that visibility of the problem does not lead to change in any smooth or straightforward way. Moreover, precisely *how* 'the problem' is framed and described (e.g. as individual mis-use versus practice as inflected by pervasive structuring forces) fundamentally shapes which solutions are seen as possible (e.g. Kolker, 2004). The move from de-contextualised information (data) to social action is highly dependent upon various forms of social relations, power dynamics, and the institutionalisation of professional and political practice. In the context of AMR and AMS, the (in)visibility of resistance to individual clinicians in day-to-day practice, lack of clear accountability regarding who is responsible for the (global and local) problem of AMR, the relative scale of, and response to, AMR across national contexts, and the temporality of the political cycle, all pose difficulties in effectively countering its advance. Yet as we note above, current approaches to AMS do little to address these more complex systemic issues. As Scott (1998) has observed, '[c]ertain forms of knowledge and control require a narrowing of vision … The great advantage of such tunnel vision is that it brings into sharp focus certain limited aspects of an otherwise far more complex and unwieldy reality … mak[ing] the phenomenon at the centre of the field of vision more legible' (p. 11). However, legibility comes at a cost, as such narrow visions become 'an authoritative tune to which most of the population must dance' (p. 83) regardless of the negative consequences that arise from disregarding broader complexities. Current approaches to surveillance of AMR produce legible renderings of antibiotic use and patterns of resistance. Yet in narrowing the vision to focus primarily on individual prescribing practices – and on how to tackle these, current approaches unwittingly exclude the broader systemic considerations that we are concerned with here, and obfuscate relations of responsibility for addressing AMR.

In the context of our work across the UK, Australia, and India, what we see is an interesting series of themes around visibility, responsibility, and the lack of solidarity (more on this below) around local practice and global crisis:

> Doctor/Hospital Manager: One of the comments that has been made with the clinicians is, if we're going to be compelled to restrict our antibiotic use and/or comply with guidelines, then they need to do something about the industrial and/or agricultural use of antibiotics. So there's that argument that comes into it. One could say, well, why are we doing it if China doesn't, et cetera? [**Australia**, Consultant, Multi-Divisional Director]

> Doctor/Department Head: … short-term financial gain should not be the driving factor. But then you have problems where you can make laws in Australia, but no one's going to make laws in India to stop it. So, what should we do? It's like climate change, isn't it? Is it worth our while doing anything for climate change … if China and India don't change, is it worth our while changing? That same debate. Do you lead by good example or do you just wait until the big boys [sic] change their behaviour? [**Australia**, Consultant, Department Head]

> Doctor: If your patient is in US [United States] … I will not refer an antibiotic at all because of clean air and clean water and all that, whereas [the] Indian scenario is little different. The patient is exposed to dust, pollution, unhygienic food, water and such other things. If I don't give antibiotic from the day one the patient is likely to have some cough, diarrhoea or something like that. [**India**, Doctor, Private Practice]

> Hospital CEO: We can see where we're going, but there's no will to make a change. … I don't quite know what you need to do to be able to make the public understand that this is important and therefore drive the political masters to do something. Because our political masters, the way they work in the media cycle now, they won't bite off anything unless they feel like there's votes. So, unless the public is interested in it, they're not going to be interested in it. … . [**Australia**, Manager, Multi-Divisional Director]

> Doctor/Department Head: … I think we're all allowed to operate in little bubbles. Just with regard to antibiotics … really, there is no easy way of me working out how things stand with regard to the Departmental use of antibiotics and how each of my peers is using antibiotics … … We have no data. If people were sending me reports and I could see that we were using much more ceftriaxone than other departments, well, that would definitely drive some change. But I never get any data. I'm in a blissful ignorance about our mis-prescription of antibiotics. [**Australia**, Consultant, Department Head]

In part, how AMR is made *visible and knowable* shapes not only how institutions respond to AMR, but also the meanings that are attributed to it by both communities of clinicians and laypersons. If antibiotic 'mis-use' is portrayed as the problem of individual healthcare professionals, then the latter can be blamed if this strategy is not successful despite performance metrics, reimbursement systems, and other structure factors that shape the practices of clinicians. As long as these pressures on clinicians to improve *their own individual* performance are maintained, AMS strategies that may worsen performance metrics or clash with current funding mechanisms are likely to continue to be unsuccessful. If, on the other hand, we make the problem of AMR legible in ways that capture interconnected practices and emergent properties of healthcare systems – such as how financial incentives and performance assessments create shared values that then, in turn, shape practices – then accountability may also become a collective endeavour, for which a shared sense of responsibility may emerge.

Human exceptionalism and mortality in the Anthropocene

In considering emergent and systemic effects, we must first define the parameters of the system at issue. In the case of AMR, the most relevant system, we argue, is neither the individual doctor–patient relationship, nor the individual hospital, nor even national health infrastructures. Instead the relevant system is, in fact, the Anthropocene. The Anthropocene is a relatively recent concept that seeks to capture the impact and significance of human activity on the atmospheric, hydrologic, biospheric, and other levels during the Earth's most recent geologic time period, which has inspired new pluralistic modes of inquiry (Lewis & Maslin, 2015; Lorimer, 2017b). In particular, the Anthropocene has witnessed the consequences of humankind's steeply rising consumption rates – especially during the past 50 years – on the atmosphere and the biosphere such that natural history is now fundamentally driven by human activity. Such considerations are crucial to AMR given the centrality of human-bacterial-antibacterial relations and their (relatively) recent reconfiguration due to human intervention. The Anthropocene has been accompanied by pervasive anthropocentrism and human exceptionalism as a central tenant of almost all social organisation. Human exceptionalism, as a political ideology, has far ranging consequences in terms of how we treat animals and the environment (Boddice, 2011), and also influences healthcare in terms of our relationships with bacteria as well as our often herculean efforts to extend human life. In many respects what underlies the problem of AMR is the broader idea of human primacy and the unassailable priority placed on humans – to live, to prevail, to receive best care from the state/practitioner. This set of assumptions – however, varied across populations, communities, and nation states – inflects the aforementioned immediacy of individualisation logics, is spurred on by the marketisation of life and healthcare, and is amplified by a *human-centred* myopic temporal focus. It is the intersection of these social forces that have so dangerously accelerated AMR.

In this milieu, bacteria – and resistant ones in particular – are cast as villainous bugs, despite their often harmless and sometimes protective qualities. AMR is constructed as an exogenous threat to humanity, despite being a product (in its accelerated form) of shared human practices such as

innovation, and in spite of the constitutive role that microbes play in our microbiomes, our health and, ultimately our species (Lorimer, 2017, 2017b). The end result is an assemblage of individualised risk, perpetuation of the idea of bacterial threat, and anxieties about human vulnerability. This is mirrored within the hospital setting; a situation where human exceptionalism intermingles with medical mastery but in which we are ill-equipped to address the challenge of AMR as socially, politically and economically embedded. As shown in our interviews, AMR thus becomes narrowly defined as an enhanced threat to human lives – reinforcing the problematic dynamics around individualised patient outcomes, measurable threats, bureaucratic lines of responsibility and short-term media and political cycles described above:

> Doctor: People are now like, you know 'you're not allowed to die on my shift. So I'm going to do everything that I can, you know, I'm going to do everything, just give you antibiotics or whatever you need, so that at eight in the morning someone else can make that decision'. [**Australia**, Consultant, Geriatrics]

> Doctor: [My concern is] someone who's going to die in the next hour, or someone who's bleeding to death, or someone who's had a major pulmonary embolus. So antibiotic prescribing I think isn't viewed in the same light. We worry about this patient, and we don't have the big picture, so we don't worry as much about what's happening in the community, about resistance patterns, about community-wide use of antibiotics. [**Australia**, Consultant, Respiratory]

> Doctor/Department Head: . . . the best learning moment is when the outcome you weren't expecting happens, which is the death of the patient from a multi drug-resistant organism because you were using all the others when you didn't need to. There's your learning moment. So, the learning moment in this organisation is when we harm people, when we don't actually execute our mission and provide exceptional care. We provide exceptional harm. But people have to die for it to happen, but don't waste a death. Don't waste that death. [**Australia**, Consultant, Department Head]

The above dynamics, reflected extensively across our various data sets, outline the paradoxical character of the entrapment of immediacy and the drive to (over)treat, but also the acknowledgment of the emerging harm it *can* produce and the need for rethinking practices in the short to long term. The inevitable question then becomes: what types of responses can challenge the entrenched social, economic, and political forces outlined thus far? Below we suggest a series of ways of potentially rethinking AMR and its proposed solutions.

Solidarity, justice, and the microbiome

The system-level critique offered above illuminates some of the concealed dimensions of the problem of AMR and some important limits to current-individualised 'solutions' in the form of AMS programs. But where does this lead us? Here we propose a solidarity-based model of responding to AMR (cf. Tarrant et al., 2019), that shifts the emphasis beyond the individual to a more thoroughly institutionalised, relational, and collective approach that requires action across organisational hierarchies. Following Prainsack & Buyx (2017), we note that solidarity is *not* merely a sentiment of empathy or charity, nor is it simply equivalent to the common good. Rather, solidarity is an enacted commitment to bear some of the 'costs' (e.g. financial, social, emotional, etc.) to assist others with whom a person or persons recognise some form of similarity or commonality in a relevant respect. Solidaristic practice enacted by specific people, or within specific communities, can also solidify into legal, administrative, and bureaucratic norms; examples include progressive taxation, universal healthcare, or national organ donation registries. In all of these systems, responsibility is both personal and collective. At the level of institutionalised solidarity, what people contribute is not nominally equal, but it could depends on what the person an reasonably contribute. In other words, what a fair share is depends on one's position on justice (see e.g. Stone, 1997). At the same time, making sure that nobody who is part of the system is left alone in times of need is a collective responsibility. Reciprocity within solidaristic systems needn't be equivalent in kind or

extent. Instead, it is indirect reciprocity where everybody who contributes to the system can trust that they will receive support as they need it.

We argue that AMR is a problem ripe for solidaristic approaches. Whereas existing models of AMS tend to focus on the immediate transaction between patients, practitioners, and service providers, a solidaristic approach would recognise similarities between both immediate and more distant actors in the field (i.e. future patients, the next generation of practitioners, those at risk in the community, etc.). As such, a solidaristic approach could help drive action in the present in order to forestall future resistance. Similarly, costs need not be limited to financial expenses such as the cost of pharmaceuticals or longer hospital stays due to infection. Instead, the 'costs' of addressing AMR could include increased infective risk, the 'hassle' of awaiting results of bacterial cultures as a necessarily precursor to antibiotic treatment, or enhanced vaccination regimens in order to collectively preserve our antimicrobial futures.

A well-institutionalised solidaristic approach would require a broader personal and collective willingness to bear some of the costs of more judicious antimicrobial use – including the potential risk of increased individual adverse events if/when antibiotics are withheld. Any solidaristic approach to AMR must be underpinned by interpersonal and group-level willingness to bear some costs associated with more judicious use of antimicrobials, including this increased risk of negative patient outcomes. This requires not just individual commitment to addressing systemic issues and goals; in order to be feasible and sustainable, it requires a change in the organisation and institutionalisation of accountability, reward, and responsibility.

Besides failing to foster systemic change, holding individual clinicians responsible for AMR prescribing also compromises perceived fairness in terms of responsibility for restricting antimicrobials and the costs therein. In our fieldwork, this problem was most obvious in the private sector, but permeated all institutions we studied:

> Doctor: … people [doctors] are scared that the buck stops with them. If they stop using prophylactic antibiotics for this, this, this and this that they're going to wear the cost for the potential, perceived potential, for an increase in infections, which they will then end up dealing with … the lawyers are going to start saying, "Oh yes, but you could have given it [antibiotics], therefore you could have abolished it [infection] … So I think that's part of what's driving this fear that you're going to be corralled into a corner where you're not allowed to give that stuff [antibiotics], but you're still the one that is facing down the barrel of the gun. [**Australia**, Consultant, Surgery]

The issue of perceived fairness relates to the extent to which such restrictions or regulations imbue reciprocity throughout the organisation and whether groups and individuals believe that the costs and responsibility for AMR solutions are distributed. This can require new forms of reciprocity that are not necessarily interpersonally quid-pro-quo, but rather, much more general, including the belief that the institution 'has your back' and is 'absorbing' some of the risk/cost associated with responding to the AMR crisis. Codifying this distribution of responsibility within institutional policy may contribute to an atmosphere of shared responsibility, regardless of the economic modes of operation of the institution. Regulation may be one way to institute solidaristic practice, even in the absence of firmly entrenched (or perhaps in the case of AMS, still evolving) interpersonal or group norms. Similarly, solidaristic practice need not necessarily entail an expectation of a net return – that is, much like the function of insurance – it is expected to advance progress towards a common goal through both potentially distant and immediate returns. This makes a solidaristic model equalising:

> The defining characteristic of a solidaristic act is that there is no equivalence between what one contributes to others or to the group as a whole and what one gets in return. Those who are best off will generally contribute the most, those who are worst off will benefit from the others. Acts of solidarity thus reduce the gap between the fortunate and the unfortunate. (Beer & Koster, 2010, p. 18)

Above we outlined fault lines in the AMR response around questions of responsibility and relative opportunity to act. Here we emphasise the usefulness of a solidaristic approach in overcoming such obstacles to effective stewardship. That is, in order to *achieve* deceleration of AMR, there is a need to recognise the global dynamics of proportionality, capacity to act, and justice in responses to AMR. As

shown in an interview excerpt from an Indian pharmacist below, and across the Indian fieldwork more broadly, the issue of disadvantage permeates antimicrobial mis-use in the sub-continent, with the vulnerability and precarity endemic to structurally disadvantaged contexts severely compromising the capacity to rein in mis-use:

> Pharmacist: Poverty … forces them to attain medications over the counter without proper consultation or advice … Many a times people are not able to afford buying antibiotics, so like, if people are given a course of one month, they are only able to buy for like a week or two, so they leave the treatment incomplete … these people are often driven by the needs to continue working and get wages which may be on daily basis, so they cannot afford to miss jobs or working hours, they may not have enough money to meet doctors too or buy adequate medications, so they may go to retail shops and buy antibiotics directly without advice … [**India**, Pharmacist]

Vast structural inequalities evidenced by this excerpt, coupled with the global mobility of resistant genes and bugs, speaks to the importance of cultivating *globally solidaristic* models to counter AMR. Such an approach would recognise shared vulnerability alongside disproportionate capacity to act, ideally fostering a willingness among those well positioned to act to accept some of the 'costs' of local action. In some circumstances, the limited access to antimicrobials in certain African or Pacific-Island contexts, this may mean more widespread use of, for example, broad spectrum antimicrobials, than is currently the case (e.g. Norris & Nguyen, 2007). This is where a solidaristic relation becomes particularly powerful, positioning the global AMR response as context-specific depending on structurally determined capacity to act.

Because stewardship has largely been deployed in de-contextualised ways, few have considered the very relationship of humans to bacteria. Yet there is growing awareness of the constitutive role that the microbiome plays in human health; the 'metagenome' or genetic content of our bodies including the microbiome, comprises 98 percent microbial genes and only 2 percent human genes (Lock, 2018). Increasingly innovations are utilising 'good bacteria' (Khanna, 2018), warning against 'disrupting the microbiome' (Biragyn & Ferrucci, 2018), and even utilising bacteria to ward off multi-resistance organisms in hospital wards (Eggers et al., 2018). The need to rethink our current socio-microbial relation was touched on across the fieldwork sites, with current approach to antibiotic use cast as a type of harm:

> Nurse: I realise that it is very important to work holistically and think about the consequences antibiotics does have … I used to work in rural Australia and we used to use antibiotic *flagyl*, for example … What we're doing is we're just putting in this medication into people's bodies and destroying more of the good bacteria and [creating] resistance, immune system, blood and we are causing a lot of this bacterial resistance … Antibiotics very often do work but in the long-term it is not a solution. I believe that solution would rather be for the patient to struggle with that infection and get the body to fight. It, of course, depends on infection but very often there are smaller infections and I have also seen viruses where we have given antibiotics and that's really harmful. [**Australia**, Registered Nurse, Respiratory]

This diverse and emerging area of work suggests the importance of (re)considering our relationship with bacteria (and different kinds) as central to the problem of AMR. And moreover, acting positively in relation to bacteria as crucial to maintaining health. This fundamentally shifts our relationship with antibiotics, but also the logics which inform over-use, mis-use and which drive many of the anxieties that currently prevent change.

Conclusion

Antimicrobial stewardship (AMS), and the attempts to tackle AMR more broadly, are deeply embedded in, and dependent on, the economic and political priorities and structures of our societies. In this paper, we advocate a paradigm shift to include sociologically-informed solutions to AMR that are attentive to systemic and emergent practices and critically explore the values and organisational structures that drive the acceleration of AMR. Similarly, we emphasise the need for a values-conscious framework to help generate potential solutions. In particular, we posit that a relational ontology of practice will be crucial to more effectively

addressing AMR and reining in prolific antimicrobial mis-use. This means no longer portraying AMR as the result of the actions of individual healthcare professionals but instead as a systemic problem that is structured by the complex interplay of social, political, and economic forces, and institutional practices such as metrics that make the intense use of antimicrobial agents more 'rational' in economic terms than other strategies that would benefit public health. Such a re-conceptualisation of the problem of AMR suggests different solutions to the problem than the ones we have tried so far. For example, instead of enacting AMS programs which are punitive at the individual level ('bad prescribers', 'good prescribers'), a systemic approach to countering AMR would direct attention to addressing the financial and reputational incentives for institutions and for the people working in them. As long as performance ratings of healthcare professionals and institutions benefit from aggressively treating problems so as to avoid possible complications, guidelines that demand the opposite will not be successfully implemented. We need to make legible, and quantifiable, the measures that people and institutions undertake to help reduce and prevent AMR, even if it means that the cost-effectiveness of their immediate interventions may decrease, or other measurable indicators may worsen. Ensuring that all people have access to good and affordable healthcare would help to address the systemic causes of AMR as it would remove the pressure for 'quick fix' solutions (and, in many cases, prevent situations where antibiotics are needed through better prevention and early treatment of serious health problems). When such conditions are met, we also need to create an understanding that all of us, also patients, are responsible for supporting the collective. Such an approach would be underpinned by the substantive value of solidarity, where people are willing to accept certain 'costs' (financial or otherwise) to support others, while knowing that also they, if they need support, will receive it. After all, AMR is somewhat unique as a health threat in that everyone will benefit from the collectivisation of responsibility and accountability for AMS.

We would like to emphasise that such an approach that is underpinned by a relational ontology of practice – that sees the subjectivities and interests of people and other agents as shaped, in part, by their relations to their human, natural, and artefactual environments – does not undermine autonomy. Instead, it positions autonomy and solidarity as compatible, and in fact, a desirable coupling in seeking to prevent a post-antibiotic epoch. This will in turn necessitate commitment to unknown benefit (for others, future others, unknown others, ourselves) and acknowledgment that things are, as they are, because of ways in which we have organised social and political life.

Note

1. Currently, there are only 42 antibiotics in development: 1 in 5 drugs receive FDA approval. Only 11 of these drugs target 'critical threat pathogens' (see www.pewtrusts.org).

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