



Antibiotics, rational drug use and the architecture of global health in Zimbabwe

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ARTICLE INFO

Keywords:

Antimicrobial resistance
Antibiotic use
Ethnography
Global health
Rational drug use
Stewardship
Zimbabwe

ABSTRACT

Rising concerns around antimicrobial resistance (AMR) have led to a renewed push to rationalise antibiotic prescribing in low- and middle-income countries (LMICs). There is increasing unease in conceptualising antibiotic use as individuals behaving '(ir)rationality' and recognition that rising use is emergent of and contributing to wider economic and political challenges. But in between these individual and societal 'drivers' of antibiotic use is an everyday articulation of care through these substances, written-in to the scripts, delivery chains and pedagogics of global healthcare. This article focuses on this everyday 'architecture' that over time and across spaces has knitted-in antibiotics and rhetorics of control that inform current responses to AMR. Based on historically informed ethnographic research in Zimbabwe, we examine points of continuity and change between 20th Century rational drug use (RDU) discourses and contemporary socio-political formations around AMR and antimicrobial stewardship (AMS), paying particular attention to their co-evolution with the process of pharmaceuticalisation. We illustrate how the framework and techniques of RDU were embedded within programmes to increase access to essential medicines and as such complemented the building of one of Africa's strongest postcolonial health systems in Zimbabwe. Whilst 20th Century RDU was focused on securing the health and safety of patients and affordability for systems, AMS programmes aim to secure medicines. Continuous through both RDU and AMS programmes is the persistent rhetoric of 'irrational use'. Health workers in Harare, attuned to the values and language of these programmes, enact in their everyday practice an architecture in which antibiotics have been designed-in. This research illustrates the struggle to optimise antibiotic use within current framings for action. We propose a reconfiguring of the architecture of global health such that frontline prescribers are able to provide 'good' care without necessarily turning to antibiotics. To design-out antibiotic reliance would require attention beyond '(ir)rationality', to the redrafting of blueprints that inscribe practice.

1. Introduction

Antimicrobial resistance (AMR) has emerged as a key health challenge of our time. The WHO's *Global Action Plan on AMR (2015, p.VII)* observes that drug resistance "threatens the very core of modern medicine and the sustainability of an effective, global public health response to the enduring threat from infectious diseases". AMR has been widely reported to be accelerated by the 'irrational' use of antimicrobial medicines, and considerable research, policy and interventions have been mobilised to optimise antimicrobial use, particularly antibiotics, in

human and animal medicine (IACG, 2019; OIE, 2016; O'Neill, 2016; WHO, 2015). Low- and middle-income countries (LMICs) have seen a significant rise in antibiotic use in recent decades (Klein et al., 2017) and have been identified as particular targets for intervention. Following the recommendations of the global action plan, many countries have developed national action plans on AMR that include commitments to the stewardship of antimicrobials.

In LMIC healthcare settings, numerous studies have highlighted widespread 'irrational' antibiotic prescribing, increasingly so since AMR rose to prominence on the global health agenda (e.g. Johansson et al.,

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<https://doi.org/10.1016/j.socscimed.2020.113594>

Received in revised form 11 November 2020; Accepted 7 December 2020

Available online 11 December 2020

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2016; Mashalla et al., 2017; Sulis et al., 2020). Such accounts benchmark practice against a conception of '(ir)rationality' based on an assessment of the alignment of prescriptions with clinical need. Efforts to address irrational prescribing have a long history dating back to their discovery (Podolsky, 2015). In the current era of AMR concern, these efforts operate under the framework of 'antimicrobial stewardship' (AMS). Broom et al. (2020, p.1) observe that current AMS approaches focus on "surveillance, restriction and correction of antibiotic usage". In this assemblage, surveillance, which renders antibiotic use legible via aggregate data on individual behaviour, tends to favour restrictive and corrective interventions including training/education, audit/feedback, formulary restrictions, guideline implementation and decision-support technologies (Cox et al., 2017; Wilkinson et al., 2018). Systematic reviews suggest such interventions can reduce prescribing, particularly when performed in tandem, but evidence in LMICs remains limited and difficult to draw conclusions from, and the sustainability of such reductions is not well understood (Akpan et al., 2020; Rowe et al., 2018; Van Dijk et al., 2017; Wilkinson et al., 2018). Reviews of national action plans further warn of misalignment between the global AMR agenda and local policy priorities, which has resulted in fragmentary implementation at national level (Ahmad et al., 2019; Pokharel et al., 2019).

Anthropologists and other social scientists have long contested narrow framings of '(ir)rationality' as neglecting the wider roles that antibiotics take on through their circulation in social, political and economic life (Geest and Whyte 1989; Whyte et al., 2002). In response to escalating concern about AMR, an expanding body of qualitative studies around the world has enhanced our understanding of these wider 'drivers' of antibiotic use, including fragmented access to healthcare, poor hygiene and sanitation infrastructure and a lack of alternatives to antibiotic use (Broom et al., 2017; Haenssger et al., 2019; Pearson and Chandler, 2019; Krockow and Tarrant, 2019; Rodrigues, 2020). Broadly, these studies contribute to an understanding of 'situated rationalities' (Lawson, 1997) of antibiotic use that, while 'irrational' from a biomedical perspective, are coherent within contexts of poverty and resource scarcity. These broader issues are understood to prioritise present antibiotic use over future efficacy and explain the limited traction of restrictive and corrective interventions (Broom et al., 2019, 2020; Chandler, 2019; Ledingham et al., 2019; Will, 2018). There is growing recognition that to bring about sustainable reductions in antibiotic use, 'AMR sensitive' interventions that respond to wider dependencies on antibiotics are needed (e.g. IACG, 2019; World Bank, 2019).

In between these conceptualisations of 'drivers' of antibiotic use through individual (ir)rationality and wider social, economic and political 'drivers', lies the everyday articulation of healthcare through antibiotics. Technical apparatus – in the form of clinical guidelines, delivery chains and pedagogics – can easily be overlooked in studies of behaviour and 'the social'. However, scholars of science and technology draw attention to these devices as scripts that are written and enacted. They are part of an 'architecture' of global health that follows particular imperatives, priorities and models of change that are retraced over time such that certain ways of knowing and doing become more inevitable (Dixon and Chandler, 2019; Herrick and Reubi, 2017). These 'grooves' can be traced back to previous health regimes (for example, 'international health'), yet as commentators have argued, continuity between eras has tended to have been overshadowed in recent years by narratives emphasising discontinuity and rupture (Geissler 2015; Greene, 2015). AMR has compelled critical reflection on the historical processes through which antibiotics have become embedded within systems of care globally. However, to date few accounts beyond high-income settings (Podolsky, 2015) have situated the current push to steward antibiotics within the longue durée of interventions on antibiotic prescribing to explicate how these cumulative processes inflect efforts to rein in AMR in the present.

In this research, we draw attention to the ways in which antibiotics have been written-in to the architecture of global health as the legacy of

the essential drugs movement of the 1970s and 80s. In particular, we foreground the technical apparatus that has endured from when the thrust of the essential drugs movement turned from selection of drugs to matters of implementation, which entailed greater attention to technical issues of procurement, distribution, safety, and 'rational drug use' (RDU) (Laing, 2003). A focus on the architecture of global health enables analysis of the writing-in of antibiotics as part of the long and complex process that scholars have referred to as 'pharmaceuticalisation' (Biehl, 2006; Greene, 2015) which, accelerated by the preference in the field of 'global health' for narrow technological interventions, has progressively stripped care in LMICs to little more than the provision (or not) of medicines (Denyer Willis and Chandler, 2019; Dixon and Chandler, 2019; Gouws, 2004). The development and deployment of clinical guidelines, many with iterations long pre-dating the global health era, have had a significant role in creating and sustaining this architecture under successive regimes of essential drugs, RDU and more recently global health and AMS. Understanding how these regimes converge and connect to produce healthcare that is articulated through antibiotics in particular settings is critical if concerns about the rise of AMR are to be taken seriously.

Our analysis is based on historically informed ethnographic research centring on in-depth fieldwork conducted in Harare, Zimbabwe in 2019. We embed qualitative and quantitative data from clinic and hospital settings within a broader historical analysis of the health system, incorporating perspectives of policymakers, health planners, scientists, facility managers, pharmacists, doctors and nurses. Through this wide-angle lens, we follow discourses around RDU along both temporal and spatial axes, in the process developing '(ir)rationality' as a temporally bound construct that has enduring, yet unstable meanings and unintended consequences as deployed and across time and space. Firstly, we trace RDU back to Zimbabwe's particularly successful essential drugs programme in the 1980s and 90s (ZEDAP and MoHCC, 1995) in order to evaluate its construction in public health, its embedding within the expansion of the country's postcolonial healthcare system (via the development of a national treatment guideline and surveillance apparatus) and its subsequent co-evolution with the political, economic and technical agendas of global health, culminating in current discourses around AMR/AMS. We then follow RDU discourses into to the 'normal emergency' (Fiereman, 2011) of clinic and hospital settings, first identifying patterns of non-indicated antibiotic use, before interpreting these as clinicians pushing back against increasingly abstract, distanced principles of RDU to provide care amidst mounting scarcity, vulnerability and pharmaco-dependencies. That such practices are nonetheless being configured in the era of AMR as 'irrational', requiring restrictive and corrective AMS interventions (Broom et al., 2020), reflects a very different architecture within which the logics and apparatuses of RDU now feature, one which is alarmingly unresponsive to the accelerated pharmaceuticalisation and fragmentation of care. This in turn leads us to critically reflect on the continued use of '(ir)rationality' as an epistemic framework for understanding antibiotic prescribing and to call for a reform of AMS that aims to design-out antibiotics from the architectural blueprints of global health.

2. Study setting and design

2.1. Zimbabwe

Zimbabwe is a low-income country with a population of 14.9 million, of which 1.5 million live in the capital, Harare. Following independence in 1980, huge strides were made in expanding access to healthcare, moving from an urban, curative and racially-biased health system to one focused on delivering primary healthcare (PHC) to underserved communities (Loewenson et al., 1991; Mutizwa-Mangiza, 1999; Woelk, 1994). A core part of this restructuring was a successful essential drugs programme with a strong emphasis on RDU. Zimbabwe came to boast one of Africa's strongest health systems, with thriving teaching

hospitals, excellent laboratory capacity, a well-trained workforce and a robust PHC infrastructure. However, the achievements of the 1980s–90s were undone by political instability, structural adjustment (which decreased public spending in favour of privatisation), hyperinflation, declining donor support and the HIV and AIDS epidemic (Green, 2018). Life expectancy remained <50 through the 2000s, with arguably the worst period the cholera outbreak in 2008–9 which, caused by dilapidated water and sanitation infrastructure, killed over 4000 people, disproportionately in high-density urban settings (Chigudu, 2020). Prospects appear little better today, with a lack of medicines and supplies, regular health worker strikes, and rising user fees and pharmaceuticals costs (Kidia, 2018).

2.2. Study design

The research on which this article is based was conducted in the context of a multi-country study on febrile illness and antimicrobial use in Africa and Asia called FIEBRE (Hopkins et al., 2020). We used a multi-sited ethnographic approach (Marcus, 1995) that centres here on fieldwork conducted in Harare between January 2019 and September 2019, but which draws upon insights gained from the broader FIEBRE study as they crystallised through its lifespan between 2017 and 2021. Our multi-sited approach was designed to follow discourses around the use of antibiotics spatially and temporally, which entailed an adaptive research process that deployed purposive and snowball sampling techniques and was responsive to findings as they emerged. The research was co-produced by a team that included two UK-based European anthropologists (JD and CC), a European clinical scientist based in Zimbabwe (KK), a Zimbabwean PhD student (SM) and a Zimbabwean research assistant (FK), supported by the wider FIEBRE consortium. Each brought knowledge, experience and networks that made this research possible, but also in a way that may have been different had the team dynamics been otherwise. One feature of our collective networks was their bias towards urban biomedical elites. While this had advantages, including facilitated access to policy networks, administrative centres and central hospitals, our findings lack the inclusion of rural, more peripheral local perspectives. This is a limitation we make explicit when relating our

findings.

The first phase of research involved in-depth interviews with stakeholders and analysis of policy and programme documents to understand the Zimbabwean health system, the history of RDU and its co-evolution with other international and global health discourses. We purposively sampled representatives of the Zimbabwe AMR Core Group (n = 2), the Ministry of Health and Child Care (MoHCC) (n = 1), the National Medicines and Therapeutics Policy Advisory Committee (NMTPAC) (n = 2), the Zimbabwe Essential Drugs Action Programme (ZEDAP) (n = 2) and biomedical scientists (n = 3) (total n = 10). Interviews were conducted by JD and SM in English at participants’ places of work or virtually, most of which took place immediately following the obtaining of written informed consent. Follow-up interviews were conducted where possible to pursue emerging themes and assess changes in views over time (total interviews n = 17). Documents were identified through an iterative process involving literature searches, bibliography reviews and recommendations from interviewees. The latter were valuable for identifying grey literature documenting the development of ZEDAP and the national surveys it conducted periodically since the late 1980s. A tabulated overview of policy documents and interviews is available in here.

The second phase involved fieldwork in Harare Central Hospital (henceforth Harare Central) and two purposively selected public clinics in Harare City (Fig. 1), during which JD and FK conducted participant-observation and in-depth interviews with nurses (n = 16), doctors (n = 5), pharmacists (n = 4) and facility managers (n = 4). JD and FK worked together to ensure Shona language interactions were accurately captured, whilst all in-depth interviews were conducted in English. Public clinics in Harare are nurse-led, doctor-supported facilities in which most prescribing is performed by nurses, which has been the case since the integration of curative and preventative services following independence (Zimbabwe MoHCC, 1984). Clinic 1 is situated in Mbare, a high-density suburb well-known as a travel hub and for its sprawling marketplaces. This clinic serves a constituency of around 50,000, but in reality, it provides healthcare for far more because of the influx of travellers, both from within Zimbabwe and from neighbouring countries. Clinic 2 serves around 30,000 and is located in Budiriro, a

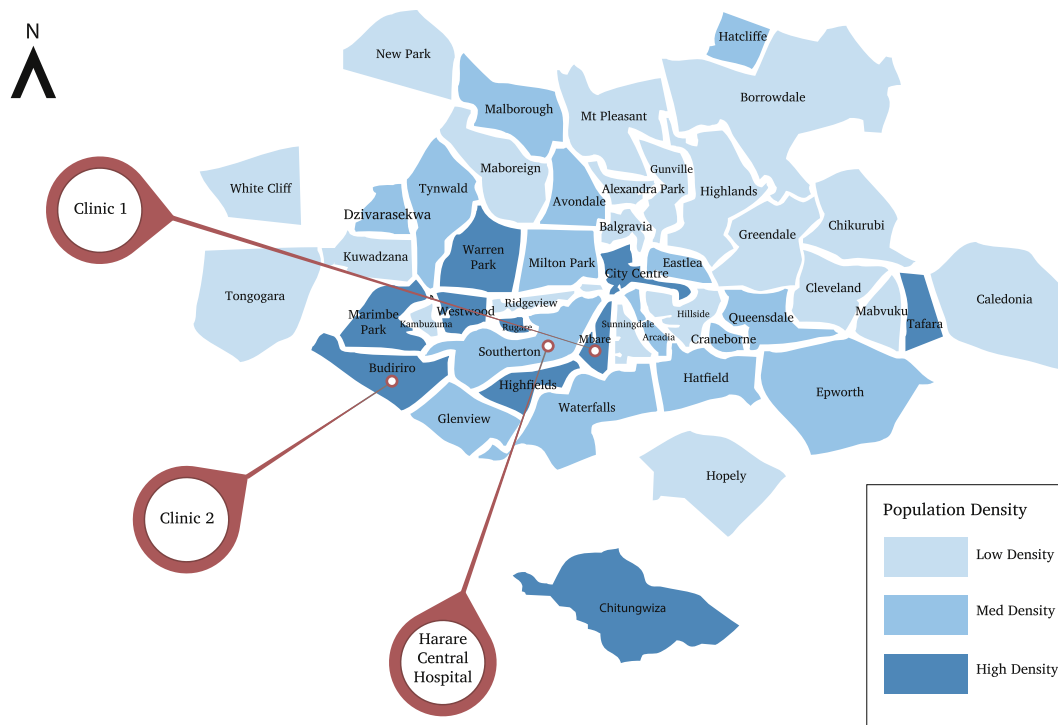


Fig. 1. Map of Harare showing the population density of the city’s suburbs and the location of Clinics 1 and 2 and Harare Central.

high-density suburb in the south-west that was among the worst-hit during the 2008–2009 cholera outbreak. Budiro was also a hotspot of another cholera outbreak during August–October 2018 and since the start of 2018 has experienced an ongoing typhoid outbreak. Harare Central is a referral hospital that admits patients from across Zimbabwe. As such, it is the hospital to which most patients from Harare clinics are referred to if they need care beyond the capacity of clinic services. Unlike clinics, the vast majority of antibiotic prescribing at Harare Central is performed by doctors.

Between June 2019 and September 2019, we observed 370 outpatient consultations at Clinic 1 and 371 at Clinic 2 ($n = 741$). While this sample was not statistically defined and did not involve specific daily targets (to allow us to follow up events of interest as they occurred), around 20 consecutive consultations were observed per day, alternating between morning and afternoon starting times, with both weekdays and weekend days included, to capture variations in presentations. In addition to field notes, basic information about consultations was captured, including patient age and sex, consultation length, presenting symptoms, tests and observations, diagnosis, treatment and referral information. This quantitative data was used to identify patterns of antibiotic prescription, including use beyond the national treatment guideline, to inform ongoing fieldwork. Alongside the clinic fieldwork, we observed doctors in Harare Central's casualty department and medical wards to learn how antibiotics were prescribed and courses adjusted. Because antibiotics are prescribed in many areas of the hospital, we did not capture quantitative data but instead draw on available secondary data.

Data analysis was conducted on an ongoing basis overlapping with data collection. During the first phase, stakeholder interviews and policy/programme documents were entered into NVivo 12 for preliminary thematic analysis, which was used to refine questions for the in-depth fieldwork phase. During the fieldwork phase, quantitative data was periodically analysed using R Studio 1.3.1093 (R Core Team, 2020) to identify patterns of antibiotic prescribing, the results from which were fed back into observation and interviews, including follow-up stakeholder interviews. As the project progressed, we moved back and forward between working hypotheses and data, gradually generating codes of progressively higher orders of abstraction to explain and theorise findings. These were fed back to facility staff, local health authorities and stakeholders, a process which in turn informed this article. The study received ethical approval from the London School of Hygiene and Tropical Medicine Ethics Committee (ref. 41616), the Biomedical Research and Training Institute, Zimbabwe (ref. AP146/2018) and the Medical Research Council of Zimbabwe (ref. MRCZ/A/2288). For further details on methodology and design of the broader study, a protocol is available on the FIEBRE website. In the following, all participant names are replaced with pseudonyms.

3. Rational drug use in Zimbabwe

Since antibiotics were discovered, they have taken on central 'infrastructural' importance enabling healthcare as we know it (Chandler, 2019). Following the WHO's Essential Drugs Programme in 1972, antibiotics became the cornerstone of essential drug lists around the world, access to which became an increasingly important indicator of health and economic development (Greene, 2015). At the same time, concerns around antibiotic use had been raised since their discovery (Podolsky, 2015) and received greater attention in LMICs in the 1980s when the focus of essential drugs programmes turned towards procurement, distribution, safety and 'rational' use (Laing, 2003). At a conference in Nairobi in 1985, rational use was defined as: "patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, at the lowest cost to them and their community" (WHO, 1985). An emergent RDU movement that included the WHO, Health Action International (HAI) and the International Network for Rational Use of

Drugs (INRUD) proceeded to engage with medical and economic dimensions of the RDU problem (Laing, 1990). A key concern was in reducing the influence of industry on clinical care, whose propriety interests and actions were understood to drive both increasing 'excess' use globally as well as persisting inequities in 'access', by implementing regulation to separate dispensing and prescribing, promote generic drug use and limit numbers of drugs registered (Greene, 2015; Trap et al. 2002). Zimbabwe came to be hailed a particular success story in implementing its essential drugs programme. The first Essential Drugs List of Zimbabwe (EDLIZ), adopted in 1985 by the newly-formed NMTPAC and updated every few years since, specified a limited number of generic medicines and the level of care at which they should be available. Unlike in most LMICs, EDLIZ also contained detailed empirical treatment guidelines, with RDU explicitly a core principle. To integrate EDLIZ into the Zimbabwe's expanding health system, ZEDAP was established in 1986 with support from the Danish government (Danida) and the WHO.

Made up of international and national representatives, ZEDAP took a 'bottom-up' approach that began with building capacity at the primary level. Much of ZEDAP's work in the 1980s involved a training programme for nurses and pharmacists that was co-produced by these end-users to manage and rationally use the increasing drug flow into previously deprived areas (Laing and Ruedzo, 1989). ZEDAP also reached out to hospital specialists to encourage wider uptake of EDLIZ, especially among doctors (Mutizwa-Mangiza, 1999), and indeed ZEDAP's work quickly spanned the whole health system, with regular national surveys based on WHO/INRUD (1993) indicators used to monitor programme effects (Trap et al., 1997). By the mid-1990s, the tone was extremely optimistic. One report (ZEDAP and MoHCC, 1995) proudly declared: "[v]isit any government health facility and find a well-thumbed copy of [EDLIZ]", citing a 1993 survey which found 94% of drugs were prescribed by generic name and 97.5% were in EDLIZ. It also claimed the Zimbabwean experience "provides valuable insight for other countries wishing to promote rational drug use" (ZEDAP and MoHCC, 1995, p. 17). However, the Zimbabwean experience also highlighted the contingency of such successes. ZEDAP members expressed that successes were dependent on strong leadership and political will, the unity of clinical, lab and pharmacy professions, and repeated interventions. All became harder to sustain as the 1990s wore on, with economic decline, structural adjustment, political turmoil and HIV placing unprecedented strain on the health system, and Danida pulled out of ZEDAP in 1999. Reflecting this shifting situation, surveys 1991–2004 showed that ZEDAP's target of ensuring 80% drug availability was met in 1991 but not since (Trap et al., 1997); the surveys also demonstrate declining levels of adherence to EDLIZ for key indications, variable rates of antibiotic prescribing and consistent increases in medicines per prescription (Table 1).

JD and SM spent many hours in the office of Dr Ndou, a consultant physician who had sat on the NMTPAC, taken part in revising EDLIZ and been involved in recent debates and discussions around AMR. Dr Ndou related the challenges of ensuring the rational use of medicines in the 21st Century. Firstly, public sector resource shortages had led to frequent medicine stockouts (undermining adherence to EDLIZ), a lack of diagnostics for surveillance and clinical care, and the erosion of the country's laboratory capacity. Secondly, the decline of the public sector had seen a corresponding rise in private and informal sectors, where there were fewer incentives to use medicines 'rationally'. Third, the proliferation of global health programmes that had arrived on the back of HIV had become increasingly difficult to manage. Programmes for HIV and TB, malaria, STIs, diarrhoeal diseases, the Integrated Management of Childhood Illness (IMCI) – each brought its own medicines and guidelines and, in the context of increasing private sector involvement in the field of global health, generally favoured bio-technological solutions to particular priority health challenges. Dr Ndou was reflexive about her positioning as an urban-based, public sector health planner, but was nonetheless frustrated that these combined factors had worked to

Table 1

Prescribing indicators from national surveys 1991–1993 (Trap et al., 1997), 1995–2004 (Euro Health Group, 2005) and 2011–2015 (Zimbabwe AMR Core Group, 2016). Surveyed facilities included central, provincial and district hospitals and primary facilities. Methodology based on WHO/INRUD (1993) indicators. Data presented combine all facility types.

Indicator		1991	1993	1995	1998	2001	2004	2011	2013	2015
Adherence to EDLIZ (%)	Mild acute respiratory infection	77	60	51	82	30	56	49	22	33
	Diarrhoea	–	48.5	45	53	62	21	27	23	45
Number of medicines per prescription		1.3	1.7	1.7	1.8	2.1	2.1	2	2	2.1
Patients prescribed antibiotics (%)		–	42	42	41	48	60	34	69	35
Availability of essential medicines (%)		87	73	75	74	62	73	–	–	–

undermine the centralised control EDLIZ had previously enabled over medicine selection and use with the “bigger picture” of the health system in mind. For instance, often programmes would start on the ground and then, having already changed medicines and prescribing, had to be retrospectively absorbed into EDLIZ, regardless of whether this was ‘rational’ for the broader system (in both medical and economic senses). Additionally, amidst these detrimental changes, various pressures had led to more injectable and broad-spectrum antibiotics being indicated and available at lower levels of care (elaborated below). Dr Ndou, in short, described an increasingly fragmented health system that both limited implementation of EDLIZ and was reflected within its pages. “We’ve lost control!”, Dr Ndou exclaimed.

During our fieldwork, ‘AMR’ was a new policy object on the radar of Zimbabwe’s public health community but being increasingly discussed. Following the WHO’s global action plan, in 2016 an AMR core group was established with members from human, animal and environmental health sectors, supported by the Global Antimicrobial Resistance Partnership (GARP), which was simultaneously working with multiple countries. Firstly, a situation analysis was conducted (Zimbabwe AMR Core Group, 2016), which reported resistance to several first- and second-line antibiotics among key gram-positive and -negative bacteria. In terms of antibiotic use, the situation analysis reports on a knowledge, attitudes and practice (KAP) survey, which found knowledge of AMR and antibiotic use among doctors, nurses and pharmacists was generally high. However, the report also documented widespread ‘irrational’ prescribing, based on a point prevalence survey of hospital antibiotic use and results from national surveys 2011–2015 (all facility types). The latter suggest that adherence to EDLIZ for mild acute respiratory infections (ARIs) and diarrhoea was highly variable and, as can be seen in Table 1, appeared lower on aggregate than the 1990s and 2000s. Zimbabwe’s national action plan was launched in 2017 (Zimbabwe AMR Core Group 2017), which emphasised the need to improve access to antimicrobials but also, with a focus on the behaviours of end users, stressed that “widespread irrational antimicrobial use” needed to be targeted. At the time of writing, existing and planned initiatives generally fell into the categories of “surveillance, restriction and correction” (Broom et al., 2020), including surveillance of resistance profiles, awareness campaigns and hospital therapeutics committees. To understand the context that this narrow framing of ‘irrational’ configured as a target for intervention, we turn now to our findings from fieldwork in clinic and hospital settings in Harare.

4. Context of antibiotic prescribing

4.1. A normal emergency

“We nurses are a frustrated group” commented Sister Chenai, who was working in the outpatient department (OPD) of Clinic 1 with JD observing. She had just finished the time-consuming task of filling the IMCI register for a baby girl who, after arriving with a high fever and difficulty breathing, had been classified as having severe pneumonia, which meant a shot of gentamicin and benzylpenicillin and urgent referral to Harare Central. Sister Chenai’s comment was understandable. The daily rhythms of the clinics exemplified what Fiereman (2011) has

described as the “normal emergency” of African public service provision. There was often only one nurse in OPDs because of short staffing, who with usually less than 10 minutes per patient (Table 2), had to obtain a clinical history and perform a series of observations and tests as defined by EDLIZ, followed by documentation in programme-specific registers. This was despite long queues, electricity and water shortages and medicine stockouts. Patients were prescribed what was available, and where necessary they were sent to a retail pharmacy to purchase medicines. These medicines might not actually be bought given the rising medicines costs, which often meant that patients eventually came back to the clinic, sicker than before. In fact, people were often making use of the informal sector and only coming to the clinic if severely ill. Because of rising user fees, if they could afford to come, they could often only come once.

The situation at Harare Central was no better. With around 2000 doctors and nurses and a further 1000 paraclinical staff, Harare Central offered a greater range of outpatient and inpatient services than at the primary level within its four constituent hospitals: paediatrics, adults, maternity and psychiatric. Despite its size and centrality, the hospital faced severe resource shortages, including stockouts, limited diagnostics, understaffing and regular strikes. The casualty department queues were comparable to the clinics, with even sicker patients, and the wards were frequently overflowing, particularly during outbreaks. Patients could be prescribed antibiotics at many points along the pathway through the hospital, including by the casualty officer (who triaged patients), by the specialist doctor or paediatrician (who made admission decisions) and at any stage as an inpatient. Following admission, patients were reassessed and changes (including to antibiotic regimens) were made based on clinical condition and available test results, as well as what the patient’s family could afford and what was available in the hospital pharmacy.

4.2. Background prescribing figures

While we did not seek to audit prescribing (to distinguish ‘correct’ and ‘incorrect’) or undertake a statistically rigorous comparison between Clinic 1 and 2, we identified prescribing patterns to guide ongoing fieldwork. As Table 2 shows, the proportions of patients prescribed at least one antibiotic were similar (56% and 58%), and both slightly higher than the average of 52% (95% CI: 51%–53%) identified in a

Table 2

Consultation and prescription data captured at Clinics 1 and 2.

Variable	Clinic 1	Clinic 2
Consultations (n)	370	371
Consultation length ^a (Mean mins, range)	7.5 (3–30)	9.3 (1–35)
Antibiotic prescription (%)	207 (56%)	217 (58%)
Febrile patients (fraction and % prescribed antibiotics)	60/69 (87%)	41/56 (73%)
Males (n, % of n prescribed antibiotics)	170 (61%)	174 (60%)
Females (n, % of n prescribed antibiotics)	200 (51%)	197 (57%)
Mean Age (Range)	27 (0.12–88)	20 (0.08–87)
< 5 Yrs (n, % of n prescribed antibiotics)	92 (55%)	155 (55%)
≥ 5 Yrs (n, % of n prescribed antibiotics %)	278 (56%)	216 (61%)

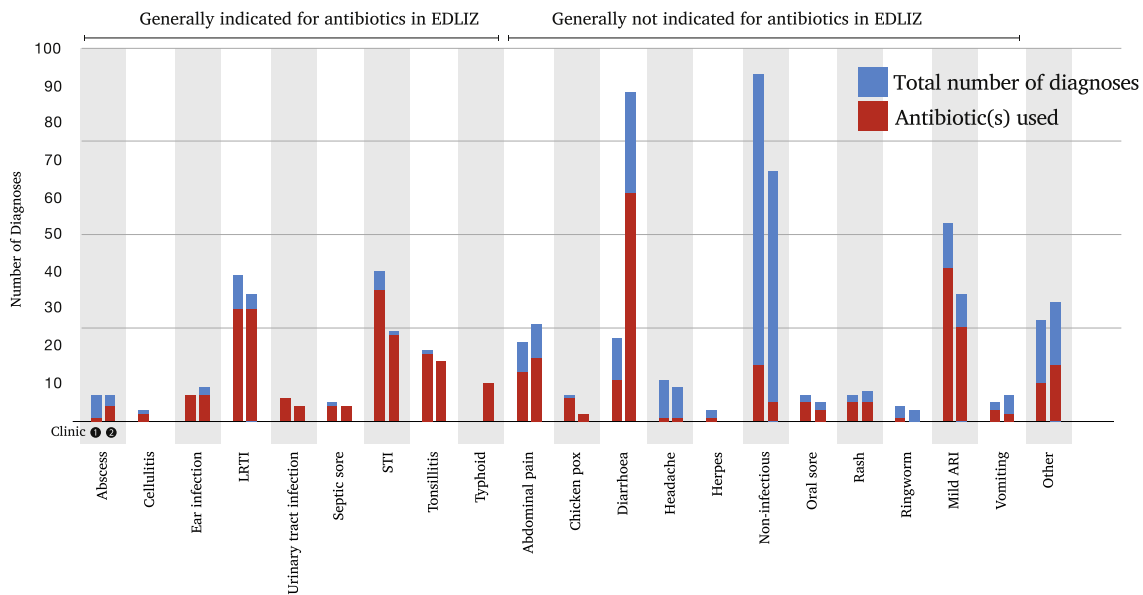
^a Nurses estimated that the optimal time needed to perform a complete consultation was around 15–25 mins.

review of prescribing in primary care in LMICs (Sulis et al., 2020). The prescribing rates between the two clinics were comparable when broken down by age and sex, but differences became more apparent when broken down by diagnosis and antibiotic selection. Fig. 2a shows more respiratory infections and sexually transmitted infections (STIs) were diagnosed at Clinic 1. Clinic 2 had a higher number of presentations due to diarrheal illness and gastrointestinal symptoms, which may be explained by the area's poor water supply, sanitation and typhoid epidemic. Fig. 2b further suggests that the choices of antibiotics were logical given the distribution of diagnoses. For instance, amoxicillin is

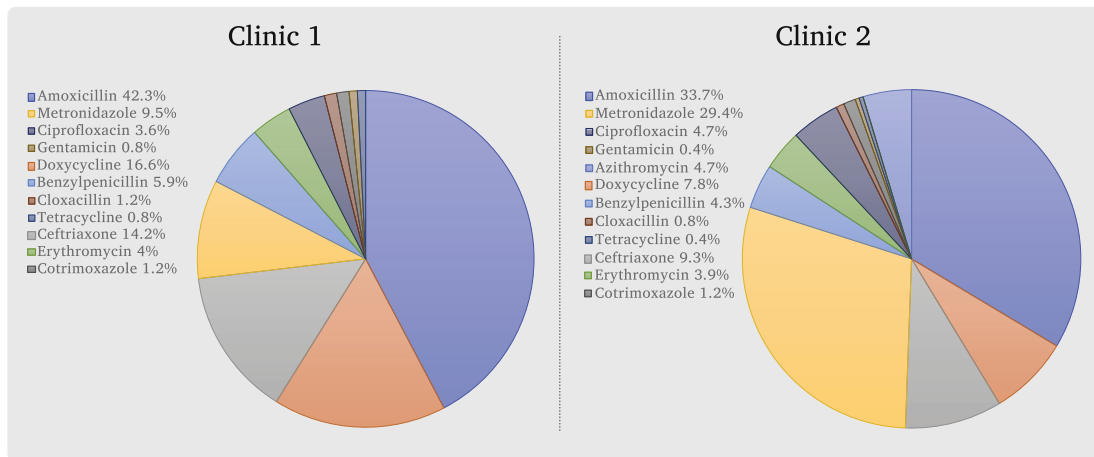
indicated for numerous conditions including pneumonia, tonsillitis and ear infections and is thus expectedly the most prescribed in both clinics. The greater proportion of ceftriaxone and doxycycline prescribed at Clinic 1 appears related to these being first line treatment for STIs; and at Clinic 2, the greater use of metronidazole and azithromycin is associated with the higher rates of diarrheal illness and gastrointestinal symptoms.

While antibiotic selection suggested a keen familiarity with the biomedical indications of antibiotics, we also found that clinic nurses were frequently treating mild ARIs and diarrhoea with antibiotics when generally not indicated by EDLIZ (Fig. 2a). This finding is consistent

a) Antibiotic prescription by diagnosis* (Clinic 1, n = 370 consultations; Clinic 2, n = 371 consultations)



b) Antibiotic prescription by class (Clinic 1, n = 253 prescriptions; Clinic 2, n = 258 prescriptions)



* Diagnostic classifications based on coding frameworks provided by Aung (2019) and Hardman (2020):

- “Mild ARI (acute respiratory infection)” combines cough/cold and upper respiratory tract infection
- “LRTI (lower respiratory tract infection)” combines pneumonia, severe pneumonia, query tuberculosis and chest infection
- “Diarrhoea” combines diarrhea and gastroenteritis
- “Abdominal pain” combines gastritis, abdominal pain and any mention of abdominal discomfort

- “Ear Infection” includes otitis media, otitis externa and ear infection
- “Non-infectious” includes definitively non-infectious causes, including chronic illnesses and injuries/burns
- “Other” includes all other, infrequent, potentially infectious, often vague, diagnoses

Fig. 2. Antibiotic prescription broken down by diagnosis and antibiotic class (Aung, 2019; Hardman, 2020).

with low levels of EDLIZ adherence for mild ARIs and diarrhoea that have been highlighted by national surveys over the last three decades (Table 1). Other non-indicated illnesses treated with antibiotics include abdominal pain, chicken pox, vomiting and rashes (Fig. 2a). Beyond evaluating prescribing against diagnoses, it was evident from our observations that to arrive at a full diagnosis ‘by the book’ (i.e. EDLIZ) given the limited time and resources was often impossible for the nurses in practice. Overall, our findings are consistent with the conclusion of the AMR situation analysis (Zimbabwe AMR Core Group, 2016) that knowledge of antibiotics and their uses was high but that such knowledge did not necessarily entail adherence, for reasons we explore below.

At Harare Central, the doctors we spent time with estimated that 90–95% of patients were prescribed antibiotics. “Rarely a patient goes home without an antibiotic”, remarked paediatrician Dr Maware. This is supported by a review of the records of 130 children at this hospital, which found that 121 (93%) of children were prescribed at least one antibiotic and that 57.5% of these were indicated by EDLIZ (Olaru et al., 2020). The doctors also observed that most antibiotics would be prescribed intravenously, and that the most widely used was ceftriaxone. The point prevalence survey conducted for the situation analysis found that ceftriaxone was the most frequently used at all central hospitals, comprising 35% of total antibiotic use (Zimbabwe AMR Core Group, 2016). The survey found that ceftriaxone was used for treatment across a broad spectrum of indications. Diagnoses likely to result in ceftriaxone use included diseases of the central nervous system (63%), ear, nose and throat infections (56%), systemic inflammatory response syndrome (50%), obstetric and gynaecological infections (44%) and pneumonia (39%).

5. Navigating guidelines in practice

5.1. Views of EDLIZ

The bedrock of medical curricula in Zimbabwe, EDLIZ was intimately familiar to the healthcare professionals we spent time with and, as Mutizwa-Mangiza (1999) had similarly observed of public sector doctors in the 1990s, almost unanimously expressed positive opinions of it. Indeed, it was commonly referred to as a medical Bible of sorts, mostly by nurses (“That is our Bible” – Nurse, Clinic 1) but by some doctors too, for its detailed guidance, dosing information and referral advice. We also noted recognition of and support for EDLIZ’s underlying principles and values, notably RDU. As well as often hearing the common mantra that there is not “a pill for every ill” (which has long featured in the foreword to EDLIZ), participants highlighted the broader role of EDLIZ in rationalising drug use across the system. Sister Makoma (Clinic 1), for instance, observed:

“When you are working in institutions like this one [Clinic 1], even at government hospitals it’s the same thing it’s amoxicillin first [laughs], because you have to follow the EDLIZ. Because if you start with something like ceftriaxone, then when someone fails on ceftriaxone, you won’t get something in public sector to give to that patient.”

The warm feelings towards EDLIZ can be contrasted with those towards the context of its current implementation, which respondents juxtaposed with the 1980s–90s. The issues raised mapped closely onto those highlighted by Dr Ndou, including medicine shortages (“We used to have all the antibiotics, long ago we had all of them – cloxacillin, you name it” – Nurse, Clinic 1); the rise of the private and informal sectors exacerbating the misuse of antibiotics (“the use of antibiotics was better governed back then” – Pharmacist, Clinic 1); and an increase in programmes and paperwork. The IMCI register was singled out for being especially time consuming and detracting from time caring for patients (“It takes long, it actually slows down management” – Nurse, Clinic 2).

5.2. Declining traction of EDLIZ

During our observations of consultations at clinics and, to some extent Harare Central, clinicians consciously pointed out when they did not use antibiotics, often against the norm or expectation of an antibiotic being given. For example, after treating a child for a mild ARI, Sister Chenai (Clinic 1) said, “I don’t give an antibiotic; I just give a painkiller”. And when Sister Chirambo (Clinic 2) treated a child with diarrhoea, she said to the mother she was giving “only” ORS, zinc and painkillers, adding: “I was explaining to the mother that an antibiotic is not needed, as she did not look satisfied with what I gave her. You must try to explain”. Of course, as Fig. 2a suggests, these were the illnesses for which antibiotics were most often ‘overused’. Nurses and doctors related the concerns that often resulted in non-indicated prescription:

“EDLIZ doesn’t allow any antibiotic when you personally assessed and said this is mild fever, mild cough or cold ... But it’s also difficult! The mother, we try to talk with them, you see there’s no consistency in terms of trying to explain the signs and symptoms, how it started, and how they will go and care for them at home. You’d rather cover them up.” (Facility Manager, Clinic 2)

“Sometimes you’re just pushed to give an antibiotic for diarrhoea. Because you know Harare is an outbreak area for typhoid and other diseases.” (Paediatrician, Harare Central)

The anticipatory use of antibiotics, often described as “covering”, occurred in the well-documented situation where clinicians feared missing an infection or complication (e.g. Broom et al., 2017; Cabral et al., 2015). The reality, we found, was that clinicians were faced daily with more complex socio-medical scenarios than were legible to the EDLIZ guideline. Not only was the diagnosis often uncertain; patients had paid a steep user fee, may already have taken antibiotics and were expecting medicinal care for a condition that was likely severe given that they had come at all. This was backed up by numerous examples of when they withheld antibiotics and these same patients had later seriously deteriorated. Forced to respond to the demands of context that were illegible to the guideline, even the fiercest advocates of RDU were frequently compelled to push back against the abstractions of EDLIZ and use antibiotics as structural prophylaxis against the everyday harms of the Zimbabwean context.

While evidence suggests adherence to EDLIZ regarding antibiotics has long been highly variable (Table 1), our observations and interviews suggest that it has become increasingly difficult to withhold antibiotics in the 21st Century. Dr Roland, a senior physician and HIV researcher, strongly advocated risk-averse prescribing because the noxious syndemic interactions between HIV, poverty and outbreaks meant that any febrile illness was “very likely” to be bacterial, and that therefore the seemingly neat distinction between viral and bacterial, written into EDLIZ, should be “discarded”. Taking a more moderate position, Dr Nakiso (Harare Central) suggested doctors could do more to narrow the likely causes of infection in the absence of diagnostics; but with nurses, EDLIZ’s apparent confidence in withholding antibiotics amounted to “passing the buck” of systemic uncertainty onto their consciences. EDLIZ, indeed, seemed to no longer instil the same confidence or have the regulatory power that it used to, even in the public sector. With EDLIZ revised only every four to five years, not only were programme activities and guidelines often ahead and given precedence (see above); EDLIZ revisions were constrained by increasingly sparse data and not always sensitive to the disease and resistance profiles clinicians were facing on the ground. This drove individual acts of ‘covering’ of the kind that we regularly observed; it had also resulted in several instances where EDLIZ had been overruled by local authorities. This includes a flu outbreak in which rates of secondary bacterial infection were so high all cases were treated with amoxicillin; and during our fieldwork, Clinic 2 was instructed to treat gastroenteritis with metronidazole, accounting for much of the metronidazole use we documented (Fig. 2b). What our

respondents were therefore pointing towards was a widening distance and disconnect of the EDLIZ guideline from Zimbabwean bodies, diseases and their social context.

5.3. Broad-spectrum antibiotics as ‘quick fixes’

As well as the question of when an antibiotic should be prescribed, we followed debates around antibiotic use at different levels of care. Dr Ndou (NMTPAC) explained that one of the principles of EDLIZ in the 1980s–90s was that clinic nurses would work with “simple antibiotics” such as oral penicillins, and that the “big guns” – broad-spectrum antibiotics that were more expensive, had higher resistance potential and/or more side effects – would be reserved for use by doctors. As noted above, however, over time such antibiotics have become more widely indicated at lower levels of care, which have often been introduced through specific programmes. There are good reasons behind this: ceftriaxone, ciprofloxacin and azithromycin for instance have all been introduced at the primary level because of resistance to other drugs and have moreover become considerably cheaper since the 2000s. At the same time, the danger expressed by Dr Ndou and other health planners we spoke to was that, because of resource scarcity, once these antibiotics were in the clinics they would then be used for other diseases, often amounting to “shooting budgies with a canon” (Ms Thorsen, Pharmacist, ZEDAP). During our fieldwork, we observed that antibiotic selection was often determined by stock: broad-spectrum antibiotics were sometimes used when the EDLIZ-specified antibiotic was unavailable or alternatively when a broad-spectrum antibiotic was nearing expiry and was used to avoid wastage. Additionally, ciprofloxacin was sometimes turned to for treating patients with multiple symptoms in the narrow window of time they had. For instance, Sister Chenai (Clinic 1), faced with a child with a sore throat, a high fever, diarrhoea and vomiting, reassured a worried-looking father: “I covered him with [ciprofloxacin] for all the symptoms”. While these practices would be classified by an audit as ‘irrational’, they demonstrate how knowledgeable the nurses were to be able to substitute antibiotics for one another to negotiate resource constraints while still having a reasonable coverage of organisms likely to cause an infection.

While primary-level antibiotic use was a source of concern, the general feeling among health planners, scientists and facility managers was that nurses were doing well under the circumstances to prescribe in line with EDLIZ, while hospital-level use by doctors was a greater challenge. Central hospitals were indeed to be the first targets of AMS following the national action plan, with plans to establish therapeutic committees underway. A particular focus in this regard has been the (over)use of ceftriaxone. Looking into the reasons for the prominence of ceftriaxone today, senior clinicians recalled that in the 1990s, when the health system and economy were more stable, benzylpenicillin was the most widely used antibiotic, often given with gentamicin or chloramphenicol; ceftriaxone was then still a specialist drug. Interestingly, while we found current discussions around ceftriaxone overuse have tended to emphasise ‘irrational’ individual behaviour – doctors too lazy to do proper histories, not acting on available blood results, bowing to patient pressure – it is perhaps no coincidence that the ascendancy of ceftriaxone in the 2000s has mirrored the decline of the system around it. First, ceftriaxone has better treatment outcomes for meningitis caused by *Streptococcus pneumoniae* than benzylpenicillin in the absence of susceptibility testing, especially in settings with high levels of penicillin non-susceptibility (Gouveia et al., 2011), a better safety profile than chloramphenicol and good penetration into cerebrospinal fluid. Jokingly referred to as “jik” or “domestos” (thick bleach), doctors explained that ceftriaxone was an ideal antibiotic given the country’s eroded laboratory capacity. Second, it only needs administering once or twice daily (cf. 4–6x daily for benzylpenicillin), reducing the burden on limited staff. Finally, from being an expensive drug only available in the public sector via foreign donors, it has become cheaper to rival benzylpenicillin, catalysing its ‘downward’ trajectory in EDLIZ. Reflecting

on these attributes, Dr Roland exclaimed “it was made for Africa! It fills the gaps in our system!” To his remark we might add that broad-spectrum antibiotics have for so long now been relied on as a ‘quick fix’ for care (Denyer Willis and Chandler, 2019) that they no longer fill gaps in the system but now *are* the system.

6. Discussion

This article provides an important additional perspective on the struggle to optimise antibiotic use in the global south. Adding to the existing evidence base that characterises behavioural as well as structural ‘drivers’ of antibiotic use (Broom et al., 2020; Chandler, 2019; Will, 2018), here we focus on everyday scripts through which antibiotics articulate healthcare. Through a historically informed ethnography of antibiotics in the Zimbabwean health system, we identify the ways in which essential drugs and RDU programmes embedded antibiotics – and their ‘misuse’ – in particular ways that have both continuity and disjunctures with current AMS efforts in the era of global health. Drawing on a range of primary and secondary, qualitative and quantitative data, our following of the evolving notion of ‘(ir)rationality’ along temporal and spatial axes reveals how the layering and retracing of imperatives, practices, models and programmes have come to form a global health ‘architecture’ (Dixon and Chandler 2019; Herrick and Reubi 2017). Here, the ideology of antibiotic use as a form of rationality continues, even while we observe a substantial shift in the focus of previous RDU programmes – set out to protect patient safety and the public purse – and more recent AMS programmes – set out to protect the efficacy of medicines themselves.

Anthropologists and other social scientists have contested biomedical constructions of ‘(ir)rationality’ for espousing one-dimensional renderings of antibiotic use that neglect context and history (e.g. Broom et al., 2017; Pearson and Chandler, 2019; Rodrigues, 2020). Our analysis supports these critiques but goes further by applying the same contextual lens to the construct of ‘(ir)rationality’ itself, revealing dynamic, evolving and not-so-obviously problematic deployments along its historical trajectory. We showed how discourses around RDU and essential drugs were configured together within a utopian set of aspirations to build robust health systems in LMICs in which essential drugs would be affordable, available and appropriately used. In Zimbabwe, this vision was written into the EDLIZ guideline, upon which the country’s once-renowned healthcare system was built, facilitated by the proactive, bottom-up initiatives of ZEDAP (Laing and Ruredzo, 1989). Even through economic decline, EDLIZ remains central to the organisation of medical education and care, and actors across the system remain advocates of EDLIZ and the principles of RDU, tending not to see ‘rationality’ simply as a matter of individual behaviour but as an attribute of a functioning health system towards which Zimbabwe aspired in the 1980s and early 90s. At the same time, however, EDLIZ, as a treatment guideline melded with a medicine list, has long reinforced the centrality of medicines to care (Greene, 2015), the implementation of which was evaluated by surveillance techniques that were focused primarily on prescribing outcomes. Whilst these technologies once painted Zimbabwe as a model for the promotion of RDU (ZEDAP and MoHCC 1995), their representations of practice have been neither broad nor reflexive enough to adequately respond to the increasing resource scarcity, privatisation and the whittling away of care to medicines that have made EDLIZ increasingly difficult update and to follow. Specifically, we highlighted the challenges the NMTPAC faced centrally managing antibiotic selection and use amidst the fragmentary, technological logics of global health and, in turn, the increasing importance of antibiotics to prescribers as structural prophylaxis and as ‘canon-s’/‘bleach’ in the face of vulnerability, immediacy, precarity and infrastructural pharmaco-dependency.

Anthropologists have observed that, while the phenomenon of AMR presents opportunity to bring into view and challenge the infrastructural role antimicrobials have taken on in place of more sustainable

interventions, paradoxically what has occurred is a doubling down on their centrality to care and the necessity of preserving their future efficacy at all costs (Chandler et al., 2016). What sets current discourses around AMR apart from those around 20th Century RDU is the heightened emphasis on global health security: we are locked in a ‘war on superbugs’ that travel porously across the globe and whose treatment in one place can undermine that in the next (Nerlich and James, 2009). Against the dystopian threat of entering a ‘post-antibiotic apocalypse’, the inherited language of ‘(ir)rationality’ appears to be playing a discursive role fuelling blame of people in ‘other’ places (Brown and Nettleton, 2017) and shifting conversations away from vulnerable people towards vulnerable medicines (Chandler et al., 2016). Offering initial insights into the grooves through which these new security configurations are moving, we showed how AMR discourse has entered Zimbabwe through a cut-and-paste approach driven by international agencies and selectively connected up with the country’s pre-existing RDU infrastructure. Whereas the RDU programmes driven by ZEDAP in the 20th Century were aspirational, bottom up and oriented towards building a strong healthcare system, existing and planned AMS programmes in Zimbabwe are defensive, firefighting and top-down and more a tool for fighting the ‘war on superbugs’ than (re)building the country’s fragmented and dilapidated healthcare system. Yet in its selective blindness to the ‘normal emergency’ (Feireman, 2011) within which clinicians must provide care, the language of ‘(ir)rationality’ is not simply a deficient framework, for it is a global politics of knowledge imposed on the local that is highly productive in its own right. Flipped without attention to context, it *produces* the local ‘irrationalities’ that are being configured as targets for restrictive and corrective intervention. In the process, despite prima facie tensions with pharmaceuticalisation, the framework of ‘(ir)rationality’ has paradoxically become part of an architecture sustaining the centrality of pharmaceuticals. While this may serve interests of powerful actors in the global north, we contend that this may, in the end, make the explicit aims of AMS impossible to achieve.

As we have shown throughout this article, however, the current global health architecture shaping responses to AMR is neither inevitable nor entirely determinative of present and future action. Building on social science critiques of AMS (e.g. Broom et al., 2020), our work calls for a reformed AMS framework that reverses the gaze currently trained on individual behaviour and turns it back not only upon the economic and political contexts of care but upon the architecture of global health itself. Such a reformed AMS means designing-out our reliance on antibiotics as a replacement for care and functioning healthcare systems, and simultaneously designing-back-in a fuller picture of care that foregrounds clinical attentiveness, non-medicinal care (e.g. concern, support, information) and disease prevention. At the same time, there are no ‘quick fixes’ for this and, given the systematic neglect of poverty, dilapidated infrastructure and multiple forms of structural violence, by the time patients are within the gaze of a health worker they likely *do* need antibiotics. In such scenarios, neat distinctions between viral and bacterial – a persisting feature of clinical guidelines – often end up passing systemic uncertainty onto the consciences of frontline prescribers. Instead of labelling these practices ‘irrational’, we must take their contextual knowledge seriously and equip them with accurate, up-to-date data on disease and susceptibility and thereby restore, perhaps, some of the faith in medical ‘Bibles’ like EDLIZ. While surveillance data is a core component of the current AMS framework, we stress that the emphasis should be not only on *resistance* (what *doesn’t* work) but as much on *susceptibility* (what *does*). As our data suggests, most of the antibiotics being prescribed, especially at clinic level, are old, “simple” agents. Determining where these antibiotics *are* efficacious is critical for the AMR agenda, to avoid raising undue concern over superbugs that might prompt more rapid use of the ever “bigger guns”.

7. Conclusion

In the context of global concerns around AMR, much is at stake in the way that this broad and extremely complex policy object is framed – whether it is a problem of structures, systems and transnational inequalities, or as a problem of ‘irrational’ behaviours on the part of individual antibiotic (ab)users. This article traces a slightly different track by focusing on the everyday scripts through which antibiotics come to articulate care in the global south. Our wide-angle ethnographic perspective on the emergent architecture of global health as it relates to antibiotic use in Zimbabwe illustrates the struggle to optimise antibiotic use within current framings for action. We propose a reconfiguring of the architecture of global health such that frontline prescribers are able to provide ‘good’ care without necessarily turning to antibiotics. To design-out antibiotic reliance would require attention beyond (ir)rationality, to the redrafting of blueprints that inscribe practice.

Credit author statement

Justin Dixon: Conceptualisation, Methodology, Investigation, Formal analysis, Writing – original draft. **Salome Manyau:** Methodology, Data Collection, Writing – review & editing. **Faith Kandiye:** Data Collection, Writing – review & editing. **Katharina Kranzer:** Formal analysis, Supervision, Writing – review & editing. **Clare I.R. Chandler:** Funding acquisition, Conceptualisation, Methodology, Supervision, Writing – original draft.

Declaration of competing interest

None.

Acknowledgements

This study was funded by the Foreign, Commonwealth & Development Office, United Kingdom (FIEBRE Project PO7856). We are grateful to all study participants who took part in this study and to the FIEBRE Consortium. Particular thanks go to Eleanor MacPherson, Coll de Lima Hutchison, Yuzana Khine Zaw, Heidi Hopkins, Rashida Ferrand, David Mabey, Amit Bhasin, Felicity Fitzgerald, Jack Hardman and Zay Aung for their insights, guidance and support. We thank three anonymous referees for their generous and thoughtful reviews. We finally thank Andrew Gomez for assistance with image design.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2020.113594>.

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