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Agile policies for antimicrobial resistance: A contextual approach to sustainable health challenges

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ABSTRACT

This paper examines contextual conditions for antimicrobial resistance (AMR) policy implementation in Zimbabwe. As an emerging global sustainability challenge, AMR constitutes risks for human, animal and environmental health as well as the long-term viability of livestock and farming with implications for communities' economic stability and food security. The study uses participatory research workshops as a data generation method, engaging with interdisciplinary groups of students and lecturers at two universities in Zimbabwe. Utilising a combination of One Health approaches and theories of policy integration and coherence as our analytical framework, we outline the concept of agile policies, adapting policy content to contextual conditions. Results illustrate the interplay between social, economic and institutional contexts for AMR policy implementation and how especially economic pressures and social tensions represent obstacles to contextually relevant implementation. Limited resources and infrastructural support as part of monitoring and enforcement efforts related to antimicrobial use pose further challenges. This paper calls for AMR policy to be aligned with economic, agricultural and educational policies. Through such policy coherence and integration, One Health cross-sector collaborations could be developed, resulting in more policies while lessening the compliance costs for communities in implementing AMR policy in their practices.

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SDG 3: Good health and well-being; SDG 4: Quality education

Introduction

As an emerging global sustainability challenge, antimicrobial resistance (AMR) constitutes risks for human, animal and environmental health as well as the long-term viability of livestock and farming with implications for communities' economic stability and food security (Hernando-Amado et al., 2019). AMR constitutes a wicked problem of critical importance to global health. This issue is particularly pertinent in Southern African countries such as Zimbabwe due to two key factors: (1) the increasing prevalence of microbial resistance to pathogens responsible for tuberculosis, HIV/AIDS and malaria and (2) limited and inconsistent access to essential antimicrobial treatments for these diseases. Wicked problems are defined by their inherent complexity

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and multifaceted nature, which renders simplistic or universally applicable solutions neither feasible nor effective (Littmann et al., 2020; Matthiessen et al., 2022; Rickard et al., 2023). Efforts have been made both globally and nationally to address AMR through policy with the WHO launching the Global Action Plan of AMR in 2015 (WHO, 2015) with subsequent national action plans developed during the coming couple of years, including the 2017 Zimbabwean One Health national action plan on AMR (MOHCC, 2017). The concept of One Health is an integrated, unifying approach to balance and optimise the health of people, animals and the environment. It is particularly important to prevent global health threats such as AMR. In this study, we particularly focus on the human aspect within the farming and agriculture sector. The implementation process of such policies is not a straightforward process with significant diversity between settings and a range of contexts. Shawoo et al. (2023) argue that flexibility, adaptation and sensitivity to these contextual conditions are crucial for effective policies that are able to engage with communities around sustainability challenges such as AMR. With the WHO Global Action Plan setting out ambitious objectives for addressing AMR, the choice of study country is based on how this paper can contribute knowledge on AMR policy implementation in low- and middle-income-country settings. These settings are characterised by traditional medical practices being a significant part of the healthcare landscape due to limited access to conventional medical practices and services, especially in rural areas. The pressures of food security and economic stability influence community choices and practices regarding antimicrobials. These pressures, together with limitations in institutional infrastructure and resources, affect the capacity for regulation, enforcement and education on antimicrobials and the risks of AMR (Chatora & Tumusiime, 2004). Pokharel et al. (2019) highlight that securing funding for monitoring, enforcement and education around AMR, especially in rural farming areas, poses significant challenges to the implementation of health policies in practice. These gaps in the efficiency of AMR policy implementation are further exacerbated by a lack of monitoring infrastructure to document and follow up regarding antimicrobial use, contributing to competing political priorities and limited institutional capacity (Makuwerere Dube, 2021; Maponga et al., 2022; Matope et al., 2024).

As noted in previous research (Hedman et al., 2020; Palanco Lopez & Chandler, 2020; Sono et al., 2023) food security, economic stability and survival can come to overshadow awareness and concerns about the longer-term impacts of antimicrobial use, especially when livestock fed with antimicrobials become more resistant to blackleg disease,¹ grow quicker and offer economic benefits for individuals and families. In addressing such societal-wide challenges, Candel (2021) argues for the need for comprehensive policy approaches where policies are integrated across sectors such as health, agriculture and education to build coordinated national action. With Zimbabwe being a significantly agricultural economy, Caudell et al. (2020) note that when engaging with antimicrobial use and resistance in farming practices, it is key to consider the perceptions, understandings and motivations that are guiding these practices. There is often a knowledge gap regarding the longer-term implications of antimicrobial use and the risk of resistance emerging and spreading for the health of the farmers themselves, their animals as well as the environment they live in and the communities they are part of (Munengwa et al., 2020; Mwansa et al., 2023). The aim of this paper is to explore contextual conditions for AMR policy implementation in Zimbabwe.

Materials and methods

This study consists of two participatory research workshops that provide an avenue for exploring contextual conditions of AMR policy implementation. The one-day workshops were held at two Zimbabwean universities, Midlands State University in Gweru and the University of Zimbabwe in Harare (Bergold & Thomas, 2012; Ørngreen & Levinsen, 2017; Spinuzzi, 2005). Researchers at the study sites contributed to refining the methods and piloting materials to ensure linguistic accessibility and comprehension. The development and organisation of the workshops drew on previous research (Mickelsson et al., 2019) and aimed to explore AMR education as a sustainability

challenge. The authors co-facilitated the workshops, supported by colleagues at the universities who did note-taking.

The sampling method involved convenient and purposive sampling of 10 lecturers and 20 students from each university, with the study including sixty (60) interdisciplinary participants in total. Convenient sampling allowed for practical recruitment based on the availability and accessibility of participants, with a higher ratio of student participation due to the group being easier to recruit because of students being more numerous at the higher education institution. The use of purposive sampling meant that we could ensure a diverse representation of expertise among the participants (Etikan et al., 2016; Palinkas et al., 2015). Through this approach we arrive at 30 participants at each higher education institution (60 participants in total), which meant that every key faculty and department was represented by multiple participants. While the number and diversity of participants ensured rich and varied data, the recurrence of themes across the workshop discussions indicate thematic saturation, with further data collection unlikely to contribute with new insights. This ensured the inclusion of participants with expertise relevant to the topic, with both lecturers and students entering into interdisciplinary discussions and knowledge co-creation that included contributions from medicine, pharmacy, veterinary science, education, agriculture, environmental science and policy. Crucially, we did not observe any differences in responses between the lecturers and students in how they discussed the topics from their respective subject expertise and experience.

The participants were not remunerated to participate but were offered lunch at the site. The choice to focus on participants from universities was based on the emphasis put on educational efforts by both international (WHO, 2015) and national (MOHCC, 2017) policy, as framing all other efforts on AMR, including policy implementation. As such, we decided to start by exploring how AMR policies are implemented among lecturers and students at a higher education institution. We intend to build on the current study to engage with the respective areas that the workshop discussions engaged with, including policymakers and farmers.

The workshops centred on using case vignettes to engage with real-world situations and experiences of antimicrobial use and the subsequent emergence and spread of resistance (Converse et al., 2015; Kathiresan & Patro, 2013; Payton & Gould, 2022; Veloski et al., 2005). Vignettes were chosen as a tool to elicit perceptions, opinions and attitudes from responses in connection to scenarios that allow situational AMR contexts to be explored.

Vignettes utilising fictional names were developed and piloted with an interdisciplinary group of colleagues knowledgeable about the challenges of AMR in Zimbabwe. Feedback from this group contributed to improving the narrative, contextual relevance and linguistic clarity of the case vignettes. The cases were selected with the purpose of, through narrative engagements, enabling participants to discuss the challenges of AMR and generate data regarding AMR conceptual and ethical reasoning on the part of the participants. Operationalising the participatory research workshops as a data generation method allowed for knowledge co-creation with the interdisciplinary group of participants around AMR as a challenge of research, policy and practice. Audio recordings were collected from the workshops and transcribed by the authors. During the analysis, these transcribed workshop discussions were complemented by notes taken during the workshop, adding depth and accuracy to the transcripts. The data management process followed the guidelines of the Swedish Research Council and the global code of conduct for research in resource-poor settings (Trust, 2018). Collected data was stored at Uppsala university server, backed up on a password-protected external hard drive. To guarantee traceability, files were consistently named and versioned. To ensure participant confidentiality, transcripts were anonymised and stored separately from participant information used in the process of recruiting.

Analytical approach

In response to the need to examine holistic and cross-sectoral perspectives in policy implementation that consider contextual conditions (Graham et al., 2006), this paper utilises an inductive

analysis method (Elo & Kyngäs, 2008). The results from this analysis are then discussed in relation to a theoretical framework that combines a One Health approach (Zinsstag et al., 2021; Zinsstag et al., 2023; Zinsstag et al., 2024) and a theory of policy integration and coherence (Candel, 2021; Shawoo et al., 2023). This is what we conceptualise as agile policies that adapt the content of policy to contextual conditions.

As part of the theoretical framework, the One Health approach provides a holistic understanding where the health of humans, animals and the environment are interrelated and where objectives of human health are dependent on sufficient concern for the health of the animals we live with and the environments we live within (Zinsstag et al., 2021; Zinsstag et al., 2024). To address challenges such as AMR, One Health, according to Zinsstag et al. (2023), argues for systems thinking where efforts are cross-sectoral, including medicine, veterinary and environmental researchers and practitioners working together with communities, especially at points of interaction between humans, animals and environment, such as agriculture. Such systems thinking forms the basis for collaborative governance that has stakeholders including government, researchers, medical, veterinary and agricultural practitioners as well as communities joining around shared matters of concern such as the emergence of diseases and the risks posed by antimicrobial abuse and subsequent emergence and spread of resistance (Zinsstag et al., 2021; Zinsstag et al., 2023; Zinsstag et al., 2024). Characteristic of One Health's efforts to address AMR is prevention, focusing on how root causes of disease outbreaks, abuses of antimicrobials and the risks of resistance are best addressed before they materialise (Zinsstag et al., 2021). This paper has a focus on One Health within farming and agriculture, highlighting how within these areas the health of humans, animals and environments intersect. While not engaging with the sectors of environmental management or healthcare is not the focus, this paper does include how both human and environmental health are closely linked to the health of the animals we rely on for food. As shown in the case vignettes utilised in the study, the impact of antimicrobial use in animals affects both the environment in terms of pharmaceutical contamination and the health of both farmers and surrounding communities.

To operationalise the One Health approach regarding AMR policy implementation as part of the theoretical framework, we utilise Candel's (2021) concept of policy integration. The concept highlights how, in order to address society-wide challenges such as AMR, sectoral policies need to be aligned normatively, institutionally and operationally. Normative policy integration involves developing policy implementations that work toward a shared goal of One Health, for example, that economic or agricultural policies should support healthcare policies of limiting antimicrobial abuse and the emergence and spread of resistance. In turn, institutional policy integration encompasses how the practices of government departments create conditions for collaboration in the implementation of policies between for example medical, veterinary and agricultural agents and local communities. Ultimately as noted by Candel (2021) any policy integration relies on what happens in practice, on the level of operational policy integration where collaborative efforts, sharing of data and knowledge and pooling of resources within government but also with communities are key to bridging the gap between policy ambition and policy realisation. To be effective in addressing health challenges such as AMR, policies need to be what Shawoo et al. (2023) call coherent policies, vertically from global prescriptions, through national directives to local practical implementation and horizontally between sectors, for example, interests of economic or agricultural policies should be negotiated to support the policies in other areas such as medicine. Without coherence, a recurring risk is that the aims of agricultural policies prompting production would drive the need for antimicrobials, undermining the health policy goals of addressing AMR.

The theoretical framework centres on cross-sectoral collaboration where government actors and communities collaborate based on the shared goal of One Health, encompassing human, animal and environmental health, while negotiating conflicting interests such as increased agricultural livestock production and long-term health for all.

To describe the inductive analysis in more detail, in the first step, we read the transcriptions several times. In the second step of the analysis, both the first and the second authors of the article read

and coded interesting features of the data, particularly persisting patterns of conversations in relation to the theoretical framework, addressing different dimensions of AMR policy implementation. The codes were sorted into categories as potential themes. Three primary categories were identified. In a fourth step, within each category, different constructions of themes were identified.

Ethical considerations

The study received ethical approval from the Medical Research Council of Zimbabwe [MRCZ/A/2920]. Throughout the study, we adhered to the principles of informed consent and voluntary participation. This was done by seeking permission from the lecturers and students at each university to collect data and providing consent forms and information sheets detailing the study purpose and the workshop process. How research data would be collected, documented and managed was also shared through the information sheets. The content form clarified their voluntary participation in the workshops and provided the option to leave at any point without needing to justify this decision. Participants were provided opportunities prior to signing the consent form and during the workshops to ask questions regarding the research and workshop. When designing and conducting the study, we adhered to the global code of conduct for research in resource-poor settings (Trust, 2018). No participant names were recorded as part of data collection and participant codes were used in an effort to provide confidentiality.

Results

This section presents the results of the analysis focusing on contextual conditions for AMR policy implementation raised by participants (university students and lecturers) in the workshop discussions. There were no significant differences in the response between these two groups, so we presented the result homogeneously. Three primary categories with a number of themes are outlined; social context, economic context and institutional context.

Social context

The category includes the identification of three themes; traditional medical practices, community AMR awareness and community tensions. The theme of traditional medical practices emerging in the participants' discussions included the practices of using traditional medicinal plants with anti-microbial properties as alternatives to conventional medicines, lessening reliance on pharmaceutical antimicrobials. On the other hand, they include integrating traditional and conventional medical practices like using local herbs. As such, these cultural contexts signal dual movements; one shifting back to traditional medical methods and one moving forward, having both traditional and conventional medical contributing to the health of Zimbabwean communities.

I'm more interested about plants that have medicinal value. We're talking about black leg [in cattle], which is caused by chemical reactions. I'm trying to think about a lot of medicinal plants that have anti-bacterial effects. In a lab setup, try to look for plants that have anti-bacterial activity against the bacteria that exist in the plant. And also, to isolate compounds from plants that have antibacterial activity. Producing feed [for cattle] that has antibacterial value. (Workshop 1, Group 2, Participant 10)

So one way which could also help is also to look at more traditional ways of rearing the chickens which do not require those antibiotics. Because definitely, if you're keeping a thousand chickens, ten thousand chickens, for you to actually realise a good profit, you'd have to rely on these antibiotics because of the conditions which are present. Because the health of the chickens will be very compromised by the squalid conditions. (Workshop 2, Group 3, Participant 34)

The theme of community AMR awareness highlights the participants discussing the limited awareness of the risks associated with antimicrobial use. This extends to not understanding how

misuse and abuse of these drugs drive AMR. As highlighted by the quote, farmers often do not see their practices as problematic and do not provide documentation or information on how they use antimicrobials in their animals.

So from this whole situation, I think this poultry farmer, he wasn't well-educated, I guess, because imagine the risk. If anyone had heard that he was using ARVs [antiretrovirals], that they are eating chicken which was treated wrongly as ARVs. It's probably just not so good. So I'm just saying this person was not well-educated or rather he was very ignorant because he actually thought of himself rather than the whole community at large. [...] And even the environment, the surrounding environment, he didn't consider that. He didn't even consider what will happen to the people or what will happen to the chicken themselves. (Workshop 1, Group 2, Participant 8)

According to what I've heard, what happened is that the community was not aware of what can happen to them. They were ignorant about the things that are happening. When they consume meat from cattle, they didn't know that it is good for them to make some researches to see how healthy it is to take food from such cattle farms. So, I think that's how they suddenly got sick. They never knew how to make researches to see if it is safe to consume meat from cattle without much knowledge. (Workshop 1, Group 1, Participant 19)

Meanwhile, as seen in the following quote, consumers remain largely unaware of the risks of consuming meat from livestock-fed antimicrobials,

If someone is doing a cattle business, the people that buy that meat from the cattle must know the feeds that are being used to feed the cattle. There are some people who are doing broiler businesses. And there are cases that they were using maybe ARVs to make their animals fed. So that is the problem the consumers face. They face a problem because they don't know what is being used to feed the animals. They just go and buy. They see them fed. They just say, these are healthy animals, but they don't know the feeds that are being used, which can impact their health. (Workshop 1, Group 1, Participant 24)

This highlights that a key contextual condition of AMR policy is the lack of education about responsible animal husbandry, consumer food safety and the challenges of AMR.

Furthermore, the theme of community tensions emerging in the workshop discussions related to the social context included the participants' discussions on how, as seen in the quote below, individuals are upset realising the impacts of misuse of ARVs in livestock,

if people, in our economy, in our societies we notice that this person is giving ARVs to their chickens they'll raise, we'll have issues, I can say conflicts among the communities. Some will dislike the idea that it will lead to conflict. So, by doing this, it will lead to conflicts among the individuals. [...] we can look for the consequences, politically, socially, economically, all those ways, as well as in our health. (Workshop 1, Group 1, Participant 23)

As highlighted, a contextual condition that needs to be considered in AMR policy is the potential for social tensions and conflict as community members become aware of the impact of antimicrobial misuse and abuse.

Economic context

The category includes the identification of three themes; economic needs, financial pressures and cost of compliance. Economic needs is a crucial theme in the workshop discussions as illustrated by the following quote since both farmers' practices of misusing antimicrobials and communities buying meat from non-reputable sources are often motivated by the immediate economic needs of family and community,

I see the farmer was concerned about issues of food security and also income because he sells the animals and also use the animals for consumption. But I see the use of antibiotics, like what [other participant] said. Although it is being protected, which is good, it may cause problems in terms of later on with the animals developing systems. (Workshop 2, Group 3, Participant 3)

Because of the economic situation, if anything is cheap and let's say from us, from the clinics, we usually advise people, eat protein, eat this, eat that, so that you can have a multi-dietary diversity. That's how people end up

buying beef from black markets, from streets, it spreads very, very fast, because everyone is running there to buy and to eat. So regardless of what we tell people, because of the economic situation now and because we are also telling them, you need to be eating protein, they'll just go for meat. (Workshop 2, Group 3, Participant 18)

This theme is further emphasised in the quote below, illustrating how widespread chicken businesses are and how key they have become in communities' economic and food security.

In Zimbabwe now, with the setup that we have, not only farmers are having chicken. Chicken is now in the backyard. Everyone owns a chicken business, almost everyone. I understand his frustration when you're saying that there was competition, because in the high-density three, out of five houses sold chickens. We need to get down into the community level because that's where most chickens are being sold today. (Workshop 2, Group 3, Participant 18)

In contexts where cattle provide both economic stability and food security, the potential cost of disease taking hold in the cattle population and undermining these key pillars of life drives the preventive use of antimicrobials.

Furthermore, workshop participants highlighted, as seen in the quote below how this situation is perpetuated by a tendency among many people in Zimbabwe to engage with diverse farming practices without sufficient knowledge and information that is grounded in science. Rather people are taking up practices based on what they see others doing. This is partly caused by a gap created by weaker agricultural extension services who are to a lesser extent visiting small-scale farmers and sharing information.

It comes with the issue of adopting a strategy without enough information. It's just like saying, oh, my neighbour is doing this, let me also do that. There's no scientific basis for what [the farmer] was doing. So in the long run it's not just going to affect you and your family, it's now affecting the local communities, it's affecting the population. I know like in Zimbabwe, currently, a lot of people are doing training, are farming, they are doing cattle, they are doing crops, but they don't have enough knowledge, enough information. Our extension services are no longer as strong as they used to be. Because the extension people used to go there and share information. (Workshop 1, Group 1, Participant 7)

The next theme focuses on the non-immediate financial pressures of creating more long-term life improvements. As seen in the following quote, this theme encompasses the farmer prioritising the education of the next generation above his immediate need to take the retroviral drugs to slow down the progression of his HIV-AIDS infection.

The way I interpret the situation was he thought more on the future than focusing on the present. He thought his kids need to be well educated and he did not consider himself in the process, because if he's not taking drugs, it means he's going to get sick eventually. (Workshop 2, Group 3, Participant 3)

This prioritisation or improving his life and that of his children's future involved feeding ARVs to the chickens and thus focus on making a profit above considering the implications of not taking the drugs himself, as seen in the following quotes.

He was focusing on profit, but he was obsessed with making profit without thinking about these ARVs and their implications. My take on the case, it was like a fatherhood, a parental thing, for him. It was all about the parenthood that affected him so much to such an extent. (Workshop 1, Group 4, Participant 12)

Well, chicken farming is not an easy job. So to some extent, well, his actions are not justified, but then to some extent he was now making a living and his life improved. He was able to pay the fees for his children by feeding the ARVs to the chickens. (Workshop 2, Group 4, Participant 4)

As a result of the previous themes, a third theme relevant to the economic contexts of AMR policy development, closely linked to the previous themes is the cost of compliance. As highlighted by the quote below, small-scale farmers' initial profits from antimicrobial use can quickly become a new normal as access to further income can mean that farmers are settled with new expenses.

You might tell them [farmers] that these ARVs might cause such problems, but then they can still go on and do it. What people are thinking is we need money. So I think it's best to also talk to the consumers, people

should be taught, those who are going to buy should know, don't just buy chickens from anyone, because it might cause this. So knowledge should not be only to those who are keeping chickens, but to those who are also going to consume them. Yes, it may be cheap, but what is it going to do, what are the health implications after I buy them? (Workshop 1, Group 1, Participant 15)

The quote illustrates how economic needs and financial pressures can result in farmers, despite knowing the risks, not complying with the prescribed use of antimicrobials and misusing ARVs to promote growth in the animals. AMR educational efforts should also be directed at buyers and consumers as much as the producers.

Institutional context

The category of institutional contexts encompasses the themes of gaps in AMR regulation and enforcement and AMR education and guidance. Gaps in AMR regulation and enforcement. Gaps in regulation and enforcement are a key theme that emerged in the participants' discussions on institutional contexts affecting AMR policy development. This was expressed in the participants' discussions about an intervention aimed at securing the quality of meat as seen in the following quote,

There is an operation going on in the country right now, Operation Nyamayake, it's an operation where did the meat come from? With the police, the Veterinary Department and other stakeholders, because they realise that meat is flooded, which happens in the market, that is not known where it came from and whether it's safe or not. But I'm not very optimistic, because of a lot of other things, the corruption, the butcheries can just frighten the police so that they can continue selling the meat. (Workshop 2, Group 3, Participant 2)

Another theme is the need for AMR education and guidance, expressed by participants as shown in the quotes below, focusing on the responsibility of government actors such as veterinary services and agricultural extension officers in guiding and educating communities and farmers about farming practices and the risks of misuse of antimicrobials.

Zimbabwe is an agricultural economy. Most of the people in the rural areas, they are farmers. So from what I can see all these things are coming from the agriculture side. So I think there is a need for revising the curriculum of agriculture extension workers to educate the community. All this [challenges of AMR] is coming from lack of knowledge of the people. (Workshop 2, Group 2, Participant 9)

I think there is a knowledge vacuum, in terms of what are the implications, regarding the various practices, that are involved in livestock production. [...] there's a disconnection, amongst the various sectors, such as the Veterinary Services Department and Agricultural Extension. (Workshop 2 Group 3, Participant 8)

if these are new farmers and everyone is up to making profit, I think there should be some awareness campaigns by the veterinary people, by the agri-techs and all other responsible authorities. But my question is, is this feasible in our situation? (Workshop 1, Group 2, Participant 11)

This illustrates the key role of farming and agriculture in Zimbabwe and how different actors need to work together in providing education and guidance for farmers, who are a majority of the population, especially in rural areas.

Furthermore, as seen in the following quote the workshop discussions highlight the need to shift some responsibilities from farmers towards government in terms of addressing the challenges that drive AMR.

In some cases, whenever the government intervening in the movement of animals, say to some areas where there is a certain disease so that the disease is prevented from spreading, the government actually makes a recommendation that animals cannot move from zone A to zone B because of the likelihood of disease transmission. So in this case, the prevention of those endemic diseases in animals should be rather the responsibility of the government in collaboration with the farmers. (Workshop 1, Group 4, Participant 2)

In the quote, the role of government is highlighted as the actor that should take the lead in preventing diseases. This involves not outsourcing responsibility to farmers but working closely with farmers and supporting them in preventing the emergence and spread of disease.

Discussion

The discussion engages with the, what, how and why of adaptation in AMR policy implementation. The categories identified in the result provide a comprehensive framework for addressing different dimensions of AMR policy implementation that are discussed in relation to the theoretical framework. As such, this paper contributes with knowledge on strategies for policy implementation in context. This includes tailoring AMR interventions and educational programmes. As argued by Shawoo et al. (2023) policies need to fit local contexts, such as through pilot programmes, context-specific guidelines and flexible regulatory frameworks.

Highlighted in the results are several aspects for consideration to ensure implementation of AMR policy. First of all, it necessitates engagement with social, economic and institutional contexts and subject contextual conditions. Social contexts impact AMR policy implementation where the challenges of the conventional health care system to provide accessible and comprehensive care means that traditional medical practices are a key part of the health care available to many communities in Zimbabwe (Chatora & Tumusiime, 2004). This highlights how AMR policies need to include and explore how traditional medical practitioners can be brought on board in addressing the challenge of AMR as they represent a significant part of the healthcare providers communities engage with on a daily basis (Candel, 2021).

Furthermore, AMR policy implementation needs to consider the perceptions and levels of AMR awareness that are informing communities' behaviours and practices (Caudell et al., 2020). As highlighted by the results and emphasised by Munengwa et al. (2020) and Mwansa et al. (2023) communities including small-scale farmers might not understand how AMR affects their lives and the lives of their communities. AMR risks are seldom immediately realised which means that farmers don't perceive the problems while communities might not have the knowledge and skills to investigate what meat is safe to eat and how adding ARVs could affect their health and that of the environment (Founou et al., 2017; Founou et al., 2021; Gonah et al., 2024). Crucially, the results illustrate how raising AMR awareness in communities can lead to social tensions between individuals benefiting financially from healthier and faster-growing livestock and the community's values of human and environmental health.

A further contextual consideration for AMR policy as showcased in the workshop discussions is how the economic challenges faced by communities in Zimbabwe create needs and pressures related to food security and financial stability. The results align with Pokharel et al. (2019) who notes the country's economic problems are a major factor impacting the possibilities of implementing health policy as government resources and services within both health and agriculture are severely limited. These limitations in public funding extend to the ability of the government to regulate and control the availability and selling of antimicrobials (Palanco Lopez & Chandler, 2020; Sono et al., 2023). In such a situation where monitoring of AMR use is limited, especially in rural areas, the need to provide food and stability for the immediate family quickly outpaces prescriptive policy and directives regarding antimicrobial use. Highlighted by the results and supported by Hedman et al. (2020). AMR policy must consider conflicting priorities, where the misuse of antimicrobials can be seen as an opportunity to increase income and secure a better future for one's children. The results showcase that a key condition to consider is the cost of compliance. For communities and especially farmers to implement AMR policy in their everyday lives and align their practices can incur costs in terms of food security, financial stability and the ability to make a better future for the next generation.

The considerations outlined above for AMR policy implementation are further compounded when considering the institutional context where long-term challenges to effective health and agricultural governance have undermined the healthcare system and the system of agricultural extension officers able to engage with farmers on a regular basis (Makuwerere Dube, 2021; Maponga et al., 2022). While Zimbabwe has a record of comprehensive health policies, including the One Health National Action Plan on AMR (MOHCC, 2017), implementation has been shown to be

difficult. This can be attributed to governance challenges and often faltering and competing political priorities leaning towards addressing immediate health risks to the determinant of AMR which is often perceived as a longer-term concern (Matope et al., 2024). Along with governance challenges, the capacity of institutions necessitates careful consideration in AMR policy implementation. As highlighted in the results, persistent limitations in infrastructure create gaps in the ability of institutions to regulate and enforce policies and directives around AMR by consistently monitoring antimicrobial use and being able to early identify the emergence and spread of resistance throughout Zimbabwe (Wernli et al., 2017). In addition to monitoring and enforcement of behaviours and practices, the workshop discussions also highlighted the key role of AMR education and guidance in policy implementation as it has a greater potential in bringing communities on board and encouraging community members and farmers to self-monitor and regulate their antimicrobial use outside (Fuller et al., 2023).

Figure 1 illustrates crucial contextual considerations for the agile implementation of AMR policies. The figure visually shows how social, economic and institutional contexts together constitute a complex and dynamic setting for AMR policy implementation illustrating how contextual conditions of for example community AMR awareness, intersect with economic needs and cost of compliance in situations where there are gaps in regulation and enforcement of policies and AMR guidance and education available to communities is limited. Through outlining these interconnections in the context of AMR policy implementation, the figure shows the key role of agile policies that consider the specific contextual conditions facing communities when they are expected to become part of policy implementation. Through consideration of the relationships mapped in the figure, better-informed decision-making and practice could be achieved when implementing AMR policy, aligning it with the complex challenges communities deal with on a daily basis.

Furthermore, in line with Shawoo et al. (2023), the contexts for AMR policy implementation outlined in this discussion and Figure 1. illustrate how AMR policy cannot be easily separated from other areas of policy and must be part of policy coherence and integration for sustainability. As noted by Van Boeckel et al. (2017) and highlighted in the results, the Zimbabwean economy is

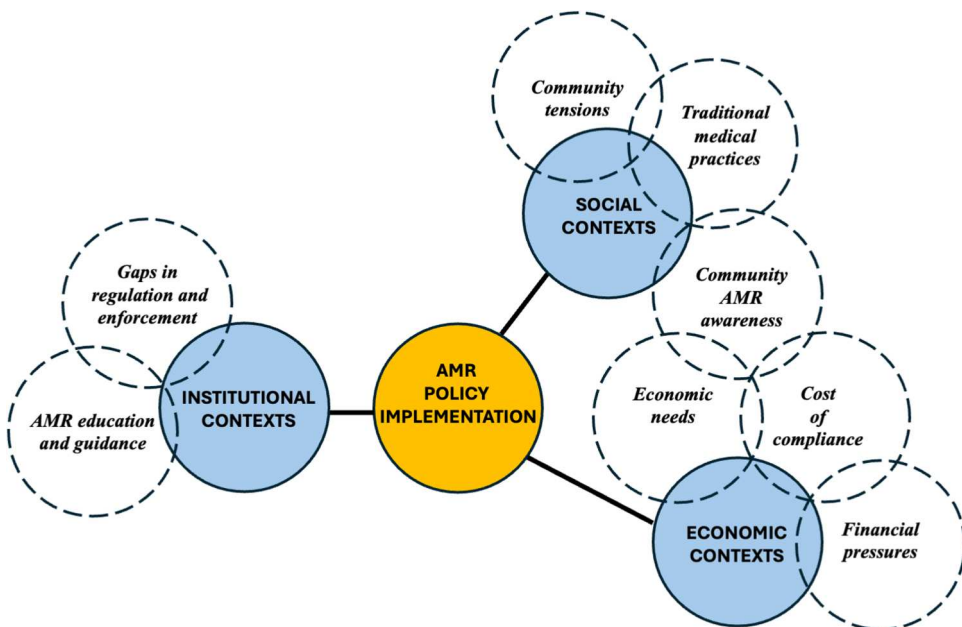


Figure 1. Contextual conditions for AMR policy implementation, the impact of social, economic and institutional contexts on AMR.

highly dependent on agriculture and the raising of farm animals for food security, economic stability and the potential for a better life. As such, farming practices impact not only the economy of communities but also their health, with the abuse of antimicrobials and AMR posing long-term risks to the One Health of humans, animals and the environment (Hernando-Amado et al., 2019). AMR policy implementation can productively engage with the interconnected contexts of antimicrobials in human health, animal raising and agriculture, creating conditions for inter-sectoral and interdisciplinary collaboration to address this shared sustainability challenge. To this end, policy integration and coherence on the basis of a One Health approach is needed where economic, agricultural and educational policies are aligned to lessen these costs for communities and encourage implementation of AMR policy (Candel, 2021; Shawoo et al., 2023).

Limitations of the study

Every method has its weaknesses. Case vignettes often focus on specific scenarios that may not capture the diversity or complexity of all real-world situations. Even though we put down a lot of work to make the vignette contextually relevant and embedded with ethical dilemmas in relation to real AMR situations. The vignettes may still oversimplify some real-world complexities, leading to responses that do not fully reflect actual decision-making processes in some natural settings even though we tried to contextualise the scenarios. For example, in relation to the ethical dilemmas that were included in the vignette: the participants may respond differently to hypothetical vignette scenarios compared to real-life situations where emotions and stakes are higher. However, we tried to address this issue by piloting the vignettes.

Future research

Future research opportunities include evaluating the implementation of antimicrobial resistance-related policies and regulations at the national level. This includes exploring the contextual adaptation of AMR policies to diverse educational settings while considering how social, economic and institutional factors impact the implementation process. Future research could also study pathways to reduce compliance costs for stakeholders. The study could be expanded to include policymakers, agriculture extension officers and farmers to study the implementation of AMR policy in these areas.

Conclusion

This paper explored contextual conditions for AMR policy implementation in Zimbabwe through participatory research workshops with lecturers and students from two universities in Zimbabwe. The results detail what these contextual conditions are through the identification of the themes of social context, economic context and institutional context. Based on these results, the discussion highlights how these contextual conditions for AMR policy implementations in Zimbabwe can be accounted for by drawing on the policy integration framework, outlining how AMR policy implementation in Zimbabwe would need to account for normative, institutional and operational integration across different policies. This paper thus contributes insights regarding how the contextual conditions identified in the results necessitate the integration of AMR policy with a broader range of policies in a coherent manner that includes agricultural, food and educational policies. We thus show how AMR policy implementation necessitates an approach that considers the context of AMR in a holistic manner, drawing on One Health. Social contexts cannot effectively be engaged outside of also including economic and institutional contexts where interventions are adapted to local conditions as part of agile policies for AMR. In the Zimbabwean case, such agility includes accounting for the sometimes complex intersections between traditional medical practices, community concerns for food security, economic stability and a better future along with institutions limited

in their abilities to monitor, regulate, enforce, educate and guide communities around AMR. This paper illustrates how AMR policy implementation needs to expand beyond a focus on ‘problematic’ community practices to consider how such practices are shaped by perceptions, pressures and priorities. As highlighted in the workshop discussions, prescriptive policies often impose compliance costs for communities resulting in conflicts between policy and community priorities. To enhance the contextual relevance and policy adoption, AMR policy could be aligned with economic, agricultural and educational policies. Such policy coherence and integration for AMR could strengthen One health’s cross-sector collaboration to address the sustainability challenge while limiting the compliance costs for communities promoting policy implementation. In conclusion, agile policies for AMR that are sensitive to multi-faceted contextual conditions and preferably supported by capable institutions, emerge as crucial in addressing AMR as a holistic and society-wide One Health challenge.

Note

1. A severe cattle disease caused by the bacteria *Clostridium chauvoei* that affect the young and is responsible for a significant part of cattle mortalities in Zimbabwe.

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