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The governance of antimicrobial resistance in Brazil: Challenges for developing and implementing a one health agenda

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ABSTRACT

This article explores stakeholders' perceptions of the challenges for developing a One Health agenda to tackle antimicrobial resistance (AMR) in Brazil, including the development and implementation of the Brazilian National Action Plan (BR-NAP). The data originate from 27 interviews conducted with human, environmental, and animal health stakeholders, including academics, managers, and policymakers involved in developing the BR-NAP. Through thematic analysis, we identified three interconnected themes: governance, the health system, and technical and scientific challenges. The findings draw particular attention to failures in the agenda-setting process, revealed by interviewees strongly emphasising that AMR is not considered a policy priority in Brazil. The lack of political will and awareness of the clinical, social, and economic impacts of AMR are considered the main impediments to the agenda's progress. The joint work across disciplines and ministries must be reinforced through policymaker engagement and better environmental sector integration. The agenda must include sustainable governance structures less affected by political winds. Policies should be designed jointly with state and local governments to create strategies to engage communities and improve their translation into effective implementation.

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Antimicrobial resistance; governance; one health; health policy; global public health

Introduction

Antimicrobial resistance (AMR) is among the top 10 threats to global public health security and human development (WHO, 2015). A recent study estimated that about 1.2 million people died from antibiotic (AB)-resistant bacterial infections in 2019 (Murray et al., 2022). Furthermore, the World Bank estimated that if no action is taken on AMR, the global gross domestic product will decrease by more than $1 trillion annually until 2030, with low-income countries worst affected (Jonas et al., 2017).

In 2015, the World Health Organization (WHO) published the *Global Action Plan (GAP) on Antimicrobial Resistance* (WHO, 2015), created in partnership with the Food and Agriculture

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Organization (FAO) and the World Organization for Animal Health (WOAH). The GAP aimed to align global strategies for coping with AMR and serve as a basis for developing national action plans. It emphasised the need for coordinated multisectoral actions based on the One Health approach, advocating global, regional, and national involvement in human, animal, and environmental health fields (WHO, 2015). In 2016, AMR was included in the agenda of the High-Level Meeting at The United Nations (UN) General Assembly, and the Political Declaration was adopted. Brazil was one of 196 countries that signed the global commitment to working towards developing a national action plan (WHO et al, 2018).

While AMR has gained international policy relevance with the multiplicity of initiatives by countries and organisations, the 'implementation gap' of national action plans still needs to be addressed (WHO, 2019). The challenge of translating political commitment into action has been a focus in the academic literature due to the few advances made at the national level, especially in low- and middle-income countries (LMIC) (Cars et al., 2021; Chandler, 2019; Munkholm & Rubin, 2020; Rubin & Munkholm, 2022; Weldon & Hoffman, 2021).

In response, the WHO (2019) produced *Turning Plans into Action for AMR* to help advance national agendas. This publication stressed that few resources had been made available to cope with AMR. Most activities focused on research and development for new drugs or on strengthening laboratory and surveillance capacity, with lower prioritisation of measures for improving prescription practices and strengthening infection prevention and control programmes, which are also important (WHO, 2019).

This article aims to contribute to the academic debate on AMR governance by analysing the Brazilian context. We examine the political process around elaborating strategies to control AMR in Brazil by analysing the perceptions of animal, human, and environmental health stakeholders. The primary focus is on the challenges to policy development, including barriers to implementing the Brazilian One Health National Action Plan for the Prevention and Control of Antimicrobial Resistance (BR-NAP) (Brazil MoH, 2019). The case of Brazil is emblematic because it has one of the largest public health systems worldwide, with successful experiences in controlling infectious diseases (e.g. acquired immunodeficiency syndrome and viral hepatitis) (da Fonseca et al., 2019).

While AMR-related actions were developed earlier, a national agenda to confront AMR was formalised with the publication of the BR-NAP in 2018. The Brazilian Ministry of Health (MoH) coordinated the plan's development with the Brazilian Health Regulatory Agency and the Ministry of Agriculture, Livestock, and Food Supply (MAPA), among others.

The few studies documenting the development of the AMR agenda in Brazil have centred on formulating the response within the global health context (Estrela, 2018). We seek to fill a research and knowledge gap on the governance aspects of AMR in Brazil to help advance the national agenda and provide reflections that can serve as a reference for the broader Latin American region and other LMICs worldwide.

Materials and methods

This qualitative study centres on data from semi-structured in-depth interviews conducted between June and December 2021 with 27 stakeholders from the human, environmental, and animal health sectors. Interviewees included academics, managers, representatives of professional associations, and policymakers involved in developing the BR-NAP. Additionally, relevant documents, including policies and national reports, were reviewed to complement the information obtained from interviews. The study design was considered appropriate for an in-depth exploration of views from diverse key informants at the governance level.

The findings presented are part of a broader qualitative study aimed at identifying key 'One Health' factors and interventions for consideration to ensure appropriate and effective AB use that comprises three interconnected work packages (WPs): WP1 explored AB use practices from the patients' perspective (Zago et al., 2023); WP2 examined the practices of prescribing and dispensing

ABs by health professionals in primary healthcare (PHC) services (da Silva-Brandao et al., 2023); and WP3 analyses stakeholders' perceptions of the challenges and facilitators for developing a One Health agenda to tackle AMR in Brazil, including developing and implementing the BR-NAP. This article focuses on the results identified in WP3. This study was oriented by the One Health approach to AMR research. It considers One Health a collaborative, multisectoral, and transdisciplinary approach to achieving optimal health and well-being outcomes by recognising the interconnections between humans, animals, plants, and their shared environment (Adisasmito et al., 2022).

To recruit the participants, we first identified key actors in elaborating the BR-NAP at the institutions listed in the published plan. We soon learned that many were no longer involved with the BR-NAP. Therefore, to obtain as complete an understanding as possible of the process, we used snowball sampling to interview professionals who participated in different stages (2015–2021). Due to the coronavirus pandemic (Covid-19), potential participants were contacted through email and invited to an online interview. We also approached academics who are experts on AMR in Brazil. In total, 40 potential participants were approached by email, of which 27 agreed to participate in the study.

We developed a semi-structured interview guide covering questions related to the AMR policy agenda and developing and implementing the BR-NAP. The guide was divided into several sections: professional background and experience with AMR; AMR-oriented institutional policies; participation in developing and implementing the BR-NAP (historical perspective, agenda drivers, AMR views, and policy development challenges and facilitators); and knowledge of the One Health approach. As the study progressed, the interview guides were tailored according to each interviewee's area of expertise while still including broad questions to capture their perspectives and knowledge about the ongoing work in different AMR domains and sectors. The first author conducted, audio-recorded, and fully transcribed the interviews. The audio recordings and the transcripts were anonymised. These materials were then subject to thematic analysis (Patton, 2002) to extract the most relevant meanings from the stakeholders' perceptions. Line-by-line interpretation and analysis of each transcript involved categorising the text's thematic contents. Quotes with a shared underlying meaning were summarised into a specific code for each domain. The excerpts presented in this article were translated from Portuguese to English by the authors. The second, third, and fourth authors collaborated with the first author to create and refine the codes. A coding scheme was developed based on the initial data analysis, which then guided the analysis of the remaining transcripts. Discussions on coding were conducted with the research group throughout the study, ensuring consistency throughout the study's different areas. The authors generated specific themes across transcripts and grouped them into three major interconnected broader themes relevant to the AMR governance scenario in Brazil: Governance Challenges, Health System Challenges, and Technical and Scientific Challenges. A minimum of 20 interviews was predetermined for this exploratory study. However, given the different health areas and the high turnover, expanding the number of participants was necessary to further explore the core questions. The interviews were completed when no new answers were identified, and we understood the research questions' nuances (Creswell, 1998).

This study was approved by the Ethics Review Committee of the School of Nursing at the University of São Paulo and the National Commission on Ethics in Research (CONEP) in Brazil, under number 42442921.7.0000.5392. All study participants provided informed consent for inclusion and audio recording before they participated in the study.

Results

Twenty-seven interviews were conducted with participants from human, environmental, and animal health sectors, including representatives from the MoH, the Brazilian Health Regulatory Agency (ANVISA), and the MAPA (Table 1). Participants from academia represented in the sample were biomedical researchers (microbiologists, pharmacists, clinical biochemistry specialists, infectious disease specialists, and veterinarians). Interviews were conducted in Portuguese; all participants had Portuguese as their first language or were proficient in Portuguese.

Table 1. Institutions represented in each One Health Sector and their number of interviewees.

One Health sector	Institution	*N*
Human health	Ministry of Health (MoH)	10*
	Brazilian Health Surveillance Agency (ANVISA)	2
	Oswaldo Cruz Foundation (Fiocruz)	2
	Academia	6
Animal health	Ministry of Agriculture, Livestock, and Food Supply (MAPA)	2
	Brazilian Agricultural Research Corporation (EMBRAPA)	1
	Academia	1
Environmental health	Academia	3**
Total		27

*2 interviewees in this group were no longer working at the MoH when the interviews were conducted, but they provided relevant input on the draft of the BR-NAP.

**Members of academia in the environmental health group were specialists in resistance mechanisms who also worked with animal and human health.

The BR-NAP policy context

Brazil has been an active participant in international forums since the beginning of The WHO's discussions leading to GAP's approval, mainly through activities of the MoH, the Brazilian Health Regulatory Agency, and the MAPA. In 2016, AMR committees were created at the MoH, the Brazilian Health Regulatory Agency, and the MAPA to oversee the agenda's development. In addition, interministerial dialogues and meetings were held. Initially, six ministries and other institutions were involved in the process.

Brazil joined The WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS) in 2017 and developed the BR-GLASS in 2018. In May 2017, the Brazilian Health Regulatory Agency launched its sectoral action plan (ANVISA, 2017). In May 2018, the MAPA published its sectoral plan and instituted the National Program for Prevention and Control of Antimicrobial Resistance in Agriculture (MAPA, 2018). These two sectoral plans are associated with the BR-NAP, published in January 2019.

In 2019, there was a change in the Brazilian presidency, and all of the committees formed to advance the BR-NAP in 2016 were dissolved by presidential decree. In addition, there were changes in the internal structures of the MoH and other ministries. The immediate effect was the stagnation of the AMR agenda since official attention to the agenda came to a standstill.

The paralysis continued in 2020, exacerbated by the worldwide chaos caused by the Covid-19 pandemic. Brazil had one of the worst responses worldwide, with >600,000 Covid-related deaths by 2021 (de Almeida et al., 2022). Therefore, political upheavals before and during the pandemic and multiple changes in MoH leadership (four times between 2019 and 2021) contributed to the stagnation of the AMR agenda.

In August 2021, the AMR agenda was restored by a ministerial order establishing the Technical Group on Antimicrobial Resistance within the MoH under the General Coordination of Laboratories (CGLAB) authority. This group aimed to review the plan for the upcoming years and monitor the implementation of activities. The BR-NAP had an initial five-year term (2018–2022), with annual evaluations planned to adjust actions according to the needs of the areas responsible for its implementation. Nevertheless, as of December 2021, no annual evaluation has been conducted.

Governance challenges: 'AMR is not a policy priority in Brazil'

Interviewees generally recognised that the BR-NAP represented a step forward in formalising the need for an integrated agenda to tackle AMR. The main challenge identified was the lack of coordination at the federal ministerial level, hindering the sustainability of the agenda.

> My impression so far is that there are multiple groups with overlapping actions without coordination. One does not know what the other is doing, including within the same institution. [There is] a need to coordinate

actions. It's getting better, but it seems to me that right now [2021], it's in need of better harmonisation. (Interviewee 15, human health, academia).

Stakeholders attributed AMR not being considered a public health priority in Brazil, not even in the human health sector, to the lack of coordination and political will at the upper levels of the MoH. The development of the BR-NAP was seen as the outcome of international pressure exerted by The WHO, WOAH, and FAO rather than the response to a national need. The engagement of a broader range of national stakeholders, necessary for guaranteeing sustainable governance structures in the long term, has not occurred. One interviewee said that if Brazil did not commit to the AMR global health agenda, international trade relations, especially with the European Union, could be negatively impacted. For this respondent, this was the most pressing argument contributing to the development of the agenda in Brazil.

Most interviewees stated that AMR should be a policy priority, although they note that their views contrast with the general view of 'governmental leaders', 'society', or 'health care professionals'. Only one interviewee claimed that AMR should not be a national health priority or, rather, that AMR should not take precedence over other 'national' health priorities, such as tuberculosis (TB). This narrative offers important insights into understanding the lack of engagement from some stakeholders, especially those not directly involved with the AMR agenda. It also offers relevant input for improving the design of policy interventions. For this interviewee, front-line health professionals working with TB, for example, have other priorities to address. They lack the resources to work simultaneously with sensitive and multidrug-resistant TB (MDR-TB).

(…) For the service [the public health system] today, AMR is not a priority. With tuberculosis, we had to do the planning for next year and to put a goal. And I said, 'people, what about [M]DR-TB?' (…) Then a colleague said, 'we are not even able to make the diagnosis of sensitive TB'. 'Because of Covid, it dropped a lot; our incidence will go down'. So how do I talk about [M]DR-TB if I am not even able to organise the service for TB? It can't be our priority. Our priority must be restructuring the service, diagnosing and active case search. Will it have an impact on resistance? It will. But for you to do a resistance test, you spend much more (…). So as there are few cases, and we only have one bullet … . (Interviewee 24, human health)

This statement also shows the ambiguities in establishing AMR as a priority in the context of scarce resources and several pressing issues. Having 'one bullet' means resources are insufficient. For this interviewee, the priority is TB and acting upon it can contribute to AMR prevention and control. From this perspective, the global goal to prevent and control MDR-TB cannot come first and be the main issue; rather, it should be aligned and integrated with national policies to combat TB and the health system's challenges, which include diagnostic tools.

Here in tuberculosis, we can't afford the maintenance of the device that tests the resistance. There are two completely different worlds [AMR and TB] because here [Brazil – TB], while we are trying to do the basics, outside [global health context], we are promising that Brazil will report the pathogens. Sometimes I think there is a detachment from the national priority. (Interviewee 24, human health)

Other explanations were also provided to account for the lack of prioritisation of AMR. Frequently, interviewees refer to AMR as an 'invisible' pandemic, citing the lack of awareness of the clinical impacts between the public, healthcare professionals, and policymakers. The 'invisibility' of AMR makes it difficult to convince policymakers to move the agenda forward. In their views, the absence of data associating AMR with mortality and morbidity rates contributes to the alleged invisibility of the problem relative to other public health priorities, such as Covid-19 and dengue.

Another barrier to bringing AMR into the policy debate was the view that AMR is too 'technical' to be an object of social concern. Interviewees from different sectors report challenges in communicating with the public.

Among the lay public, I think AMR is something that no one understands very well. It's not very well explained (…) I don't know what the way would be to educate the public because the concepts are difficult. Everyone has an idea that this is a problem, but no one understands it very well because it's complex and

> probably because we don't explain it very well. The ones who understand the problem do not communicate it well to the public. (Interviewee 13, human health, academia)

The difficulties in developing an efficient and clear vocabulary for communicating about AMR to a non-specialist audience were recognised as an important barrier to overcome. Moreover, academic and policymaking stakeholders from animal and human health believe AMR to be an academic-centred, 'elitist' topic. For them, more attention should be paid to discussing the topic more widely and at a level those affected can comprehend.

> The impact is on the population, but the discussion is very elitist. The discussion of AMR is still a high-level discussion. This discussion of resistance is still from the academic point of view; it is [taken up by] few people. (Interviewee 17, human health)

> They're boring terms. There are a thousand resistance mechanisms. If I were to give a lesson about it, I would be in trouble. So, it's a topic at the same time a bit technical, complex, and ultimately, it's not palatable to society. (Interviewee 12, animal health)

To interviewees, social understanding is an important driver for moving the agenda forward and making policymakers more likely to act on AMR. The proposed solution was to replace the 'high-level', 'scientific', and 'elitist' discussions with a focus on the broader social agenda by engaging schools and front-line public health workers from PHC, for example:

> This must be on the discussion agenda of universities. It has to be on the agenda of schools. It has to be on the agenda of family health teams. You have to be talking about it in these places where the population is. If it's not part of a social agenda, I don't see a breakthrough. (Interviewee 17, human health)

Civil society's engagement with the topic was considered a powerful tool for advancing the agenda, even more than the work and regulations provided by governmental organisations. Interviewees from the agricultural sector mentioned the essential role civil society plays in pressuring the governmental agencies they represent and the industry to act to promote proper AB use.

> It is the work of society as a whole to realise the importance of antibiotics, which is a tool that we depend on, so sometimes it matters more than the work of the MAPA and the Ministry of Health because our strength is great, but it is limited. Society must fight this fight and embrace the cause. (Interviewee 11, animal health)

Another barrier related to governance was the belief that AMR is a 'problem of the future'. This belief reflects the lack of political will at the highest levels of ministerial administration. Interviewees stated that advocates for AMR prevention and control must convince managers that the problem is affecting people's lives in the present.

> No manager wants to know what's going to happen in the next 50 years. You're not going to convince the guy [manager] by telling him that 50 million people are going to die in 50 years or in 2030. (…) But the problems are from today. (…) the numbers of resistance today are already alarming. (Interviewee 17, human health)

Interviewees generally believed that the development of the BR-NAP was, from the beginning, a reaction to international pressure rather than a response to a national prioritisation of AMR. With the change in the Brazilian presidency in 2019, the new political configuration has been viewed as adding even more barriers to advancing the already fragile agenda-setting process. Several interviewees perceived that the political leadership under President Bolsonaro was less prone to collaborate with the global health agenda, including on issues related to AMR. This shift was considered a backlash compared to previous years.

> Brazil has been a very active voice, leading several discussions on the health agenda, including at the UN assemblies [and] at WHO. But these days, this leadership is, shall we say, a little blurrier. I think the interaction with most of the agendas that Brazil was aligning [with], the type of partnership changed a lot in this current government, and the type of priority is another as well. I do not think that the health issues have had the same priority. And the partnerships that Brazil had established about 4, 5 years ago became frayed because the political directionality changed. (Interviewee 15, human health, academia)

Several managerial problems were associated with the leadership and coordination of the BR-NAP: (a) the determination of authority and scope of the project, (b) the coordination of activities, and (c) ways to overcome the lack of political will. Firstly, interviewees mentioned the lack of clarity on where the responsibility for the BR-NAP should lie. Since it involves several sectors with relative autonomy to establish and conduct their own priority agendas, there is a need to define a governance architecture with sufficient power and authority above all the sectors to enforce the implementation of the BR-NAP.

Interviewees mentioned the limited capacity and power of the MoH to ensure the compliance of other ministries. Since AMR is not a specific issue and relies on the articulation between different areas inside and outside the MoH, some stakeholders believe that an entity with higher authority than any single ministry should lead the agenda, such as The Civil House.

> The Ministry of Health does not have hierarchical control over the MAPA or about[*sic*] the Ministry of the Environment. (…) So, for the Plan to bring together representatives from several ministries, it must be headed by a department at the highest level of the Executive [the President's Chief of Staff]. (Interviewee 17, human health)

There was no consensus on this topic, and considering the MoH's internal structure, some interviewees believed the MoH's Executive Secretariat should lead the agenda.

> For me, the [BR-]NAP should be in the Executive Secretariat because it is an area that is there the next to Minister's Office, above all departments of the Ministry of Health. (Interviewee 25, human health)

Attempting to overcome the coordination challenge and promote horizontal agreements, stakeholders tried to formalise an interministerial committee with the participation of the primary institutions involved with the BR-NAP. Nevertheless, the interministerial ordinance did not materialise, supposedly due to changes in governmental structures, the bureaucratic process, and lack of political support. The coordination challenge was still unresolved by the time interviews were conducted. While specific groups are working together in the Brazilian Health Regulatory Agency, the MoH, and the Ministry of Agriculture, Livestock and Food Supply, among other institutions, formal arrangements to formalise them have not materialised.

> Everyone is aware of the importance of creating the Interministerial Committee, even for each one to know how far their responsibility, their competencies, [and] their scope of action go. We understand that even for the integrated surveillance, we can only have it implemented when we have this clear governance. (Interviewee 11, animal health)

Another problem to be addressed is the lack of full-time personnel dedicated to coordinating BR-NAP activities. High turnover is another problem since it leads to a loss of the institutional memory of the elaboration process of the BR-NAP:

> (…) I think that for international agendas of this size, we need to have a Committee or a fixed group for this, or we get lost in the timeline because many people enter and come out of the Ministry of Health. (Interviewee 7, human health)

Implementing the plan requires overseeing the coordination of groups inside and outside the MoH and developing and implementing a plan to ensure compliance with international guidelines. Interviewee 17 described the process of the eventual placement of the BR-NAP under the General Coordination of Public Health Laboratories at the MoH:

> Regarding the Plan, people [at the MoH] usually said, 'that's not my responsibility', so the Plan was moved from department to department until it landed at the General Coordination of Public Health Laboratories, where the Plan is now. But the Plan is bigger than the Laboratory Coordination. (Interviewee 17, human health)

The lack of coordination impacts the alignment of actions inside and outside the MoH, affecting the communication between sectors. Since the BR-NAP may not be concretised as intended, the One Health approach is portrayed as an ideal that stakeholders consider potentially unattainable.

> The focus is on One Health, but it is not aligned, even within human health. We have a long journey to make the One Health happen (Interviewee 25, human health)

Regarding the integration with other areas, while the BR-NAP mentions the participation of six ministries and other agencies, the main protagonists are the Brazilian Health Regulatory Agency, the MoH, and the MAPA. The Ministry of the Environment was initially involved, but after the publication of the BR-NAP and the political changes in governmental structures, communication with that ministry became difficult, according to stakeholders from other sectors.

Health system challenges: 'The health system of the country does not work only at the federal level'

Brazil is a federal system with 27 states and >5,500 elected municipal governments. The Brazilian Public Health System (SUS) develops national policies but relies on states and municipalities to help develop and implement the policies in a decentralised manner. States and municipalities have different priorities, unequal resources, and relative autonomy, giving them the right to decide whether and how to engage in the AMR agenda.

> The health system of the country does not work only at the federal level. You have to articulate with the state, with the municipality, so for these actions to get there at the same end, and this requires a lot of discussion, so I think this is a big challenge (Interviewee 19, animal health)

For interviewees, it was also necessary to integrate state- and municipal-level challenges while planning policies at the federal level. The implementation and agenda-setting process must be built in partnership with state and municipal levels to guarantee that these regional and local spheres recognise AMR as a priority issue and implement aligned policies.

Several stakeholders mentioned regional inequalities as having added more complexities to developing an integrated One Health agenda. For example, in the monitoring and surveillance of AMR, local differences in laboratory infrastructure and human and financial resources are cited as barriers to collecting harmonised data. Additionally, there are challenges to integrating the data collected from other sectors.

> It's Brazil. There's a lot of these differences, [and] I think that's a problem. We have many central policies, and data is organised by local states. You have states that are more organised, others [that] are less [so]. (…) These state laboratories, we have some that have so many more actions than others, and that depends a little on the profile of the team, the challenges, [and] the money as well. Brazil is too big for us to make things equitable. And then when we take up One Health that depends on an integrated action of human, animal, and environmental health, then all these [complexities] are potentialised. (Interviewee 8, animal health)

In terms of organisational modes of the public health system to respond to the AMR problem, most interviewees mentioned the challenges related to tertiary care. Only some, including academics and managers, spontaneously mentioned gaps in other levels of care. To better understand the challenges related to other levels of care, it was necessary to ask interviewees directly about these challenges. Some responded by simply justifying why most antimicrobial-related interventions are placed within the hospital environment. Others exposed their views on the gaps in PHC and at the community level.

> The resistance problem is still much larger inside the hospital because you have selective pressure. Fifty (50%), 60% of patients who stay take antibiotics. In Intensive Care Units [ICU], this percentage reaches 100%, [and] hardly any of the ICU patients do not take antibiotics. (…) So microbial resistance is a very serious problem in the hospital, it is the main focus, but we are totally in the dark about what was[*sic*] happening in the environment and in the community. (Interviewee 5, human health, academia)

The views that hospitals are where the most 'dangerous microbials' are and the selective pressure is highest were the justification for focusing interventions at the tertiary care level, especially in the ICU, which was often described as the 'epicentre' of the problem. Nevertheless, some interviewees

challenged that emphasis by arguing that hospitals represent only a small part of the problem. They stated that the problem of AB use could be better addressed if interventions were also conducted in PHC.

> When a patient arrives in the ICU, he's already very serious. He has already used a lot of antibiotics. It's the tip of the iceberg. The correct thing would be to start interventions at [the] PHC level (… .) We have [a] few measures for the community scenario. (Interviewee 1, human health)

The question of reducing mortality rates was mentioned by one interviewee, who stated that the health system services are so overwhelmed that the focus has shifted. Instead of guaranteeing that the means and infrastructure are in place for prevention, such as the supply of diagnostic tools and the capacity and resources to prescribe appropriately, the health services' focus is 'do not let [the patient] die'.

> I think we have a lot to do to advance in this issue of primary health care, the strengthening of PHC as a gateway, and not waiting for the person to be serious to be able to treat. (…) The focus is always on 'do not let die'. And usually, those who are in primary care will not have a death effect so fast, maybe. (…) Avoiding death is always more important than empowering PHC professionals to prescribe according to urine culture, with[*sic*] blood culture and antibiogram and everything else. (Interviewee 7, human health)

Challenges involved in monitoring AB dispensing in PHC services were mentioned by one stakeholder working in pharmaceutical assistance at the MoH. The 'fragile' structures of PHC, characterised by the lack of professionals to collect the data and the unavailability of informational services, were identified as two main challenges observed in the most remote regions of Brazil. For this interviewee, how PHC services are organised impacts the quality of data considered relevant for monitoring AB dispensing at this level of care.

> The structure in[*sic*] primary health care ends up being more fragile in northern regions that do not have internet connectivity to make a computerised system record. The riverside cities are much more diverse and more complex … and the lack of professionals to do this type of activity, which requires a bit of patience to register all the prescriptions and must not have errors in the calculation in[*sic*] the amount of registration. The time he's doing this, he's failing to do other things. Having enough people to do everything that needs to be done is also another matter (Interviewee 21, human health)

The dilemmas and barriers front-line healthcare workers encounter were also mentioned regarding stewardship programmes developed in hospitals. Human resources, the availability of ABs, and laboratory capability were identified as important factors for compliance by healthcare professionals. In that sense, awareness and education measures are only effective when the resources are in place to implement the actions because the "rational use of antimicrobials" is highly dependent on them:

> The infectious disease physician can tell you to advise the use of antibiotics. So I need to have a[*sic*] work time available for it there. I need to have the proper antibiotic options in the pharmacy, a microbiology that works. I think people get more sensitised when they see that the suggested measures are actually possible to implement. To 'make a[*sic*] rational use of antibiotics' is not just an empty thing. (Interviewee 1, human health)

Technical and scientific challenges

One of the most ambitious objectives of the BR-NAP was establishing a national system of surveillance and integrated monitoring of AMR, including the use and dispensing of antimicrobials. Besides overcoming technical challenges, several agreements were necessary at different healthcare levels and between the different sectors and agencies in the human, environmental, and animal sectors to achieve this. One task involved integrating informational systems and existing databases with data quality problems. A well-articulated programme in the SUS was needed. Regarding the monitoring of AB consumption in Brazil, one interviewee currently researching this topic stated:

> Some initial studies using different databases show that each database gives many distinct numbers from each other for the same antibiotic. Absolutely different numbers. Even when you only measure usage or just consumption, when you take data from different sources that should talk about the same thing, the numbers that result for the same period are absolutely different. (Interviewee 15, human health)

While some recent investments have been made, much of the monitoring of AMR and AB use in human health is a product of local and regional research that is neither sustainable nor has a national scope.

> I think people underestimate the size of Brazil, [its] geographical[*sic*] and population. We cannot do research in São Paulo and say that this is the result of the country (…) if we cannot put the difference that is the Amazon, the difference that is Acre, the difference that is Roraima, this panel is not the same. (Interviewee 17, human health)

Other aspects of scientific research were also identified as barriers to implementing a surveillance and monitoring strategy. One concern was that topics that interest researchers do not always align with public health needs. Another concern was the translational ability of the research and the need to develop strategies to foster implementation, including sharing research data with policymakers and managers.

> I see with concern several groups working on the same topic and little information being made available in a timely manner, and little also being turned into public policy. Some things are immediate because people are dying of sepsis in hospitals. The cost of antibiotic-therapy treatment is very high. So, these things have to be public policy. They have to be translated urgently. (Interviewee 17, human health)

One interviewee who worked at the MoH on developing research priorities noted difficulties in disseminating and translating research results to inform policies and programmes.

> The researcher should see how important it is to show that result to the manager in a clear, objective way that the manager understands. It's no use arriving with a paper, with an article, [or with] a systematic review that the manager sometimes will not understand. (Interviewee 16, human health)

Data sharing was another problem. While some researchers are unwilling to share data, there is the need to have the capacity and the infrastructure necessary to compile and share the data and act upon it, as mentioned by one interviewee at the MoH:

> We discuss this a lot, but we find some barriers in relation to researchers because many think that the data is their own and don't want to share it (…). For the research[er] 'X', I remember that we put in the letter of approval that they should make the data available after the completion of the study. (…) But we end up hitting this barrier of how we will do it if we do not have the structure to be able to have a database of this size, if we do not have people for it, [and] if we do not have the resources for it. (Interviewee 16, human health)

Besides the challenges with research translation, stakeholders also referred to several uncertainties in the scientific field related to AMR risks. The lack of knowledge and research gaps relates to the connections between the animal, human, and environmental health sectors. Many questions were raised on the need for evidence of resistance acquired at the community and hospital levels to inform policy response. At times, professionals working at governmental organisations expressed some concern about not having all the answers they consider necessary for having an opinion about what should be done.

> Regarding resistance in the community, I think we don't even know the basics. We don't know where it goes. We don't know how it's coming, [or] how it shows. I do not understand if the most important [aspect] is the generation of resistant bugs or if it is the dissemination. If the dissemination happens, how it happens. (…) I do not understand the role of each of the determinants. And to act on these things, you have to understand them (Interviewee 13, human health, academia)

To stakeholders in the human health sector, policy interventions should consider managing those uncertainties and the need to build transparency. It also means that a research agenda for AMR should be developed to help advance the policy agenda.

Agricultural sector interviewees also considered scientific uncertainties. They focused on balancing public health risks and economic losses when deciding whether to prohibit using ABs as growth promoters. One interviewee explained her opinion about using growth promoters in farming:

> In pigs, I think it's 78 million [BRL] a year that Brazil would lose due to the prohibition of the use of promoters. I think we must have scientific evidence. I do not agree that we should say: it is forbidden to use growth promoters under any circumstance (…). There are some countries that ban all. They are guided by precaution, regardless of whether zoonotic transmission exists. (…) There are some countries that put a lot of pressure but do not have in their economy a[*sic*] very intense animal production. (Interviewee 8, animal health)

The increase in the production cost and its impact on the general population's access to food is another important factor to consider.

> We always have to remember that we live in a country where access to food is different from a reality like Denmark, for example. (…) They can afford to buy the[*sic*] chicken that used antibiotics only responsibly and that has a certification for this, but this all has costs until you implement it. None of this is for free (Interviewee 11, animal health)

Discussion

Our findings reveal stakeholders' perceptions that the BR-NAP represents a step forward in formalising the need for an integrated multisectoral agenda to tackle AMR in Brazil. Overall, interviewees recognised that the global call and the commitment to provide a plan to confront AMR was the main driver for a dialogue between different sectors at the national ministerial level that resulted in the BR-NAP draft. In the initial stages, economic interests were identified as an important factor for initiating the agenda in Brazil. The central idea was that lacking compliance with the AMR global agenda could risk damaging Brazil's farm industry image and economic losses. This risk is especially relevant in Brazil, a major food producer and exporter (Cardoso, 2019; Rabello et al., 2020).

The main governance challenge identified by stakeholders was the lack of national coordination, impeding the sustainability of the multisectoral agenda. For interviewees, the problem of lack of coordination relates to the fact that AMR is not considered a policy priority, even in the human health sector. Consequently, the topic did not receive the attention needed at the upper levels of governance in the MoH. It also did not receive specific funding or the institutional support of a strong Secretariat to move the agenda forward into implementation. Instead, responsibility for the plan was shifted from one sector to another within the MoH before landing in the laboratory department. The process and ultimate placement of the plan reflect the narrow view of AMR and its low relevance. While stakeholders recognised the key role of laboratory surveillance, and the efforts and advances made in this area to strengthen laboratory capacity nationally, they believe that a department with hierarchical authority over other departments should have coordinated and managed the BR-NAP. The decision on where to allocate the central coordination of a BR-NAP also remains a complex matter in other LMICs due to the nature of AMR and the need for cross-sectoral coordination (Frumence et al., 2021). This coordination problem is attributed mainly to the lack of adequate governance structures and mechanisms to bridge sectors, including governmental and nongovernmental partners and programmes that are usually fragmented (Frumence et al., 2021; WHO et al, 2018).

Despite the BR-NAP specifying 14 main objectives, 33 strategic interventions, and 75 activities, all aligned with the GAP's five strategic objectives, the publicly available document for the plan (Brazil. Ministry of Health, 2019), in its 'executive format', did not provide targets or clear directions on how to achieve the goals, nor clear indicators for monitoring and evaluation. Furthermore, while several ministries were listed in the planned activities, stakeholders revealed that some never sent representatives to the intersectoral meetings.

This study's findings show that much more must be done in agenda-setting and formulating an AMR strategy aligned to the Brazilian context and its public health system. Consistent with Munkholm and Rubin (2020), we argue that implementing the BR-NAP and the agenda-setting process should not be seen as separate processes in which The WHO provides global guidelines that national governments implement. Their findings show a strong vertical alignment between the GAP and the national action plans in the policies outlined but much lower levels of alignment in the actual policies implemented, as is the case in Brazil. The diversity of governmental structures, resources, and cultures worldwide demands that national challenges be considered when formulating global policy. The same pattern of viewing the formulation and implementation of the AMR policy agenda as separate processes appears to be the case at the national level in Brazil. While federal government agencies have taken the lead in developing an AMR agenda, there remains little alignment with subnational and local governments supposedly responsible for its implementation.

In our study, some interviewees expressed concern that AMR is viewed as an 'imported agenda' from The Global North, influencing the engagement of stakeholders in the sustainability of actions in Brazil at federal, state, and municipal levels and partially explaining why AMR is not considered a priority issue in the country. This finding suggests that the agenda must be seen as attached to the local realities of the countries and national public health policies and formulated accordingly (Charani et al, 2023). Otherwise, it risks having its status as a non-priority issue, as in Brazil. Cars et al. (2021) proposed applying a health system approach to AMR policy response, implying the recognition that acting upon AMR can strengthen the health system's capacities and positively impact other national health priorities (Cars et al., 2021). The fact that a broader range of stakeholders has not yet embraced the AMR agenda in Brazil raises the question as to how much of the implementation gap is due to the way the plan was initially formulated (i.e. the strong alignment with the GAP without acknowledging the local specificities, narrow framing of the problem, and poor integration of subnational and local governments).

The strategy of containing AMR intersects with barriers and contradictions the Brazilian Health System faces. Managing a universal, decentralised system involving three levels of government and social participation in a context where the private sector provides most public services poses several challenges (Castro et al., 2019). Due to the SUS's complexity and coverage inequality, these problems pose even greater challenges, particularly in the peripheral regions of urban centres and the country's rural and remote regions.

Academics and policymakers mentioned challenges associated with technical and scientific unknowns about AMR. These uncertainties refer to what remains 'unknown' by the general scientific community at the frontiers of knowledge and to what is 'unknown' in Brazil because of current research gaps. All these uncertainties can be used as excuses to impede political action. The lack of awareness of how knowledge is produced in other scientific domains is another problem, revealing little interaction between disciplines and stakeholders that could allow a more comprehensive understanding of AMR. In this regard, a few biomedical researchers interviewed reported their difficulties in making their AMR findings meaningful for a broader audience, including the non-academic public, and described it as a problem.

Policymakers in governmental institutions also identified concerns about scientific communication, dissemination, and research translation. In their view, scientific research on AMR should align with policy needs, and its findings should be addressed not only to academics but also to managers, policymakers, and society in general. Failure to do so is considered a barrier to research translation (Ploy et al., 2020). The mismatch between research findings and policymakers' needs has been reported in different health domains and is described as a key barrier to governance (Kakkar et al., 2012). Since AMR involves different sectors with different understandings of the problem and different solutions, its governance requires a multidisciplinary focus to help stakeholders at all levels deal with knowledge uncertainties and resulting differences in framing the AMR problem (Spruijt & Petersen, 2020).

One limitation of the study is that we received no responses from individuals contacted at the Ministry of the Environment. Another potential limitation is that we focused our interviews on professionals who oversaw the drafting of the BR-NAP and since the discussion of the plan did not move forward to the other levels of the governmental structure, the analysis highlights the perspective of professionals only at the federal level. Therefore, to fill this gap, future studies should consider other levels of the governmental structure in Brazil (state and municipal levels).

Conclusions

Our main findings draw particular attention to the failures in the agenda-setting process in Brazil, revealed by the interviewees' strong opinions that AMR remains far from being considered a public policy priority. Our study proposes possible pathways to overcome those challenges.

First, it is important to acknowledge the different dimensions of AMR at the policy level. Its nature as a 'wicked problem' entails different solutions in different domains, thus requiring the expertise of the implementation science field. AMR is not only a biomedical phenomenon and a public health issue but also a societal matter. It is necessary to recognise the social, political, and economic aspects of AMR and the need for a multidisciplinary perspective at the research level to make the problem visible and act upon it. In this sense, it is important to reflect on how the biomedical and social sciences can complement each other to make more meaningful policy recommendations for AMR in Brazil.

Second, since AMR is mainly considered an 'external priority' issue and not acknowledged as a nationally relevant policy matter, it is crucial to redefine the contours of the AMR policy debate in Brazil so that it can be recognised as a 'national' and international problem. Promoting policy advocacy and research is essential to influence professionals and public opinion in different sectors, including the neglected livestock sector. Understanding the concerns of other influential policy actors and governmental organisations is equally important.

Finally, we propose recognising AMR as a cross-cutting intervention area, connecting it with other priority agendas and national health policy plans rather than viewing it as a competing, separate agenda. We recommend designing multi-layered interventions involving subnational and local stakeholders in formulating and developing the response. We further propose that AMR becomes a public debate so that the views and needs of society at large are heard and accounted for when developing health policies.

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References

Adisasmito, W. B., Almuhairi, S., Behravesh, C. B., Bilivogui, P., Bukachi, S. A., Casas, N., Cediel Becerra, N., Charron, D. F., Chaudhary, A., Ciacci Zanella, J. R., Cunningham, A. A., Dar, O., Debnath, N., Dungu, B., Farag, E., Gao, G. F., Hayman, D. T. S., Khaitsa, M., Koopmans, M. P. G., … Zhou, L. (2022). One health: A new definition for a sustainable and healthy future. *PLOS Pathogens*, *18*(6), e1010537. https://doi.org/10.1371/journal.ppat.1010537

ANVISA. (2017). *Plano de Ação da Vigilância Sanitária em Resistência aos Antimicrobianos*. https://www.ismp-brasil.org/site/wp-content/uploads/2018/01/Plano-de-a—-o-nacional-em-AMR.pdf.

Brazil MoH. (2019). *Plano de Ação Nacional de Prevenção e Controle da Resistência aos Antimicrobianos no Âmbito da Saúde Única 2018–2022*. www.saude.gov.br/svs.

Cardoso, M. (2019). *Antimicrobial use, resistance and economic benefits and costs to livestock producers in Brazil. OECD food, agriculture and fisheries papers, No. 135*. OECD Publishing. https://doi.org/10.1787/27137b1e-en.

Cars, O., Chandy, S. J., Mpundu, M., Peralta, A. Q., Zorzet, A., & So, A. D. (2021). Resetting the agenda for antibiotic resistance through a health systems perspective. *The Lancet Global Health*, *9*(7), e1022–e1027. https://doi.org/10.1016/S2214-109X(21)00163-7

Castro, M. C., Massuda, A., Almeida, G., Menezes-Filho, N. A., Andrade, M. V., de Souza Noronha, K. V. M., Rocha, R., Macinko, J., Hone, T., Tasca, R., Giovanella, L., Malik, A. M., Werneck, H., Fachini, L. A., & Atun, R. (2019). Brazil's unified health system: The first 30 years and prospects for the future. *The Lancet*, *394*(10195), 345–356. https://doi.org/10.1016/S0140-6736(19)31243-7

Chandler, C. I. R. (2019). Current accounts of antimicrobial resistance: Stabilisation, individualisation and antibiotics as infrastructure. *Palgrave Communications*, *5*(1), 53. https://doi.org/10.1057/s41599-019-0263-4

Charani, E., Mendelson, M., Pallett, S. J., Ahmad, R., Mpundu, M., Mbamalu, O., … & Holmes, A. H. (2023). An analysis of existing national action plans for antimicrobial resistance—gaps and opportunities in strategies optimising antibiotic use in human populations. *The Lancet Global Health*, *11*(3), e466–e474.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. SAGE Publications Ltd.

da Fonseca, E. M., Shadlen, K., & Bastos, F. I. (2019). Brazil's fight against hepatitis C — universalism, local production, and patents. *New England Journal of Medicine*, *380*(7), 605–607. https://doi.org/10.1056/NEJMp1812959

da Silva-Brandao, R. R., de Oliveira, S. M., Correa, J. S., Zago, L. F., Fracolli, L. A., Padoveze, M. C., & Currea, G. C. C. (2023). Coping with in-locus factors and systemic contradictions affecting antibiotic prescription and dispensing practices in primary care-a qualitative one health study in Brazil. *PLoS ONE*, *18*(1), 1–21. https://doi.org/10.1371/journal.pone.0280575

de Almeida, L., Carelli, P. V., Cavalcanti, N. G., do Nascimento, J.-D., & Felinto, D. (2022). Quantifying political influence on COVID-19 fatality in Brazil. *PLOS ONE*, *17*(7), e0264293. https://doi.org/10.1371/journal.pone.0264293

Estrela, T. S. (2018). Resistência antimicrobiana: enfoque multilateral e resposta brasileira. In *Saúde e Política Externa: os 20 anos da Assessoria de Assuntos Internacionais de Saúde: (1998-2018). Brasil. Ministério da Saúde.* https://bvsms.saude.gov.br/bvs/publicacoes/saude_politica_externa_20_anos_aisa.pdf.

Frumence, G., Mboera, L. E. G., Sindato, C., Katale, B. Z., Kimera, S., Metta, E., Durrance-Bagale, A., Jung, A.-S., Mshana, S. E., Clark, T. G., Rweyemamu, M., Legido-Quigley, H., & Matee, M. I. N. (2021). The governance and implementation of the national action plan on antimicrobial resistance in Tanzania: A qualitative study. *Antibiotics*, *10*(3), 273. https://doi.org/10.3390/antibiotics10030273

Jonas, O. B., Irwin, A., Berthe, C. J., Le Gall, F. G., & Marquez, P. V. (2017). *Drug-resistant infections: a threat to our economic future.* (Final report). World Bank Group. http://documents.worldbank.org/curated/en/323311493396993758/final-report.

Kakkar, M., Venkataramanan, V., Krishnan, S., Chauhan, R. S., & Abbas, S. S. (2012). Moving from rabies research to rabies control: Lessons from India. *PLoS Neglected Tropical Diseases*, *6*(8), e1748. https://doi.org/10.1371/journal.pntd.0001748

MAPA. (2018). *Plano de Ação Nacional de Prevenção e Controle da Resistência aos Antimicrobianos, no Âmbito da Agropecuária. Brasília. https://www.gov.br/agricultura/pt-br/assuntos/insumos-agropecuarios/insumos-pecuarios/resistencia-aos-antimicrobianos/pan-br-agro/PANBRAGROv.1.0maio2018.pdf*.

Munkholm, L., & Rubin, O. (2020). The global governance of antimicrobial resistance: A cross-country study of alignment between the global action plan and national action plans. *Globalization and Health*, *16*(1), 109. https://doi.org/10.1186/s12992-020-00639-3

Murray, C. J. L. J., Ikuta, K. S., Sharara, F., Swetschinski, L., Robles Aguilar, G., Gray, A., Han, C., Bisignano, C., Rao, P., Wool, E., Johnson, S. C., Browne, A. J., Chipeta, M. G., Fell, F., Hackett, S., Haines-Woodhouse, G., Kashef Hamadani, B. H., Kumaran, E. A. P., McManigal, B., & Naghavi, M. (2022). Global burden of bacterial antimicrobial resistance in 2019: A systematic analysis. *The Lancet*, *399*(10325), 629–655. https://doi.org/10.1016/S0140-6736(21)02724-0

Patton, M. Q. (2002). *Qualitative research and evaluation methods*. SAGE Publications Ltd.

Ploy, M.-C., Andremont, A., Valtier, B., Le Jeunne, C., Dumartin, C., Guillemot, D., Bousquet-Melou, A., Brun-Buisson, C., Coignard, B., Concordet, D., Couet, W., Del Bano, J., Guilhaumou, R., Guyard, C., Jouvin-Marche, E., Kerneis, S., Khelifa, M., Mourez, M., & Verdier, M.-C. (2020). Antibiotic resistance: Tools for effective translational research. *Therapies*, *75*(1), 7–12. https://doi.org/10.1016/j.therap.2019.12.003

Rabello, R. F., Bonelli, R. R., Penna, B. A., Albuquerque, J. P., Souza, R. M., & Cerqueira, A. M. F. F. (2020). Antimicrobial resistance in farm animals in Brazil: An updated overview. *Animals*, *10*(4), 552. https://doi.org/10.3390/ani10040552

Rubin, O., & Munkholm, L. (2022). Isomorphic dynamics in national action plans on antimicrobial resistance. *Public Administration and Development*, *42*(2), 142–153. https://doi.org/10.1002/pad.1966

Spruijt, P., & Petersen, A. C. (2020). Multilevel governance of antimicrobial resistance risks: A literature review. *Journal of Risk Research*, *25*(8), 945–958. https://doi.org/10.1080/13669877.2020.1779784

Weldon, I., & Hoffman, S. J. (2021). Bridging the commitment-compliance gap in global health politics: Lessons from international relations for the global action plan on antimicrobial resistance. *Global Public Health*, *16*(1), 60–74. https://doi.org/10.1080/17441692.2020.1788623

WHO. (2015). Global action plan on antimicrobial resistance. *Microbe Magazine*, *10*(9), 354–355. https://doi.org/10.1128/microbe.10.354.1

WHO. (2019). *Turning plans into action for antimicrobial resistance (AMR) Working Paper 2.0: Implementation*. https://www.who.int/publications/i/item/turning-plans-into-action-for-antimicrobial-resistance-(-amr)-working-paper-2.0-implementation-and-coordination.

WHO, FAO, WOAH. (2018). *Monitoring global progress on addressing antimicrobial resistance: analysis report of the second round of results of AMR country self-assessment survey 2018*. https://apps.who.int/iris/handle/10665/273128.

Zago, L. F., Correa, J. S., da Silva-Brandão, R. R., Fracolli, L. A., Padoveze, M. C., de Oliveira, S. M., & Corboda Currea, G. C. (2023). Experiences of antibiotic use among Brazilian healthcare users: An exploratory study. *Health Expectations*, *26*(1), 343–354. https://doi.org/10.1111/hex.13664