Focus areas for the forward momentum of sub-national action plans on antimicrobial resistance (AMR) - Perspectives from three states in a Low-and middle-income Country

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Abstract

Background

Antimicrobial resistance (AMR) is a critical public health threat that could impact healthcare systems and economies. The role of national action plans (NAPs) in containing AMR is well-recognized. India has taken multiple steps, including decentralizing action plans by encouraging states to adopt sub-national or state action plans (SAPs) on AMR. Only four states (Out of 28 States and 8 union territories) have a SAP on AMR. To understand the factors and focus areas needed to formulate such SAPs, we report the perspectives of key One Health stakeholders' from three states in India.

Methods

Two states and one union territory that did not have SAPs on AMR were chosen. A desktop situational analysis was done to identify key stakeholders involved in AMR work in these states and understand the AMR challenges in these states. Local public health champions were also invited. One-day consultation meetings were conducted at each site. A total of 118 stakeholders participated in the meetings. Seventeen in-depth interviews were also held with participants after the meetings to add further insights. The inputs from the meetings and in-depth interviews was subjected to latent and manifest content analysis to identify themes.

Results

The meetings and in-depth interviews led to identifying AMR drivers and potential interventional strategies and requirements such as improving awareness with targeted communication strategies, strengthening and expanding surveillance in both human and animal sectors, improving community hygiene, stepping up financing mechanisms, and enhancing governance through multisectoral secretariats. The need to decrease the consumption of antibiotics through a strong foundation of public-private partnerships and the scale-up of stewardship efforts was highlighted. An urgency to integrate AMR strategies into other vertical health programs was noted.

Conclusion

In large lower and middle-income countries, inspite of the presence of NAPs, various challenges exist in containing AMR in states. The perspectives of the stakeholders highlight the focus areas within the NAPs, the contextual challenges, and the need to urgently formulate these SAPs with tailor-made approaches. Utilizing the expertise of multiple stakeholders in each state to materialize SAPs that incorporate these valuable local insights is likely to optimize forward movement.
Introduction

Antimicrobial resistance is one of the top global public health threats\(^1\). In a comprehensive assessment of the global AMR burden, there were an estimated 4.95 million deaths associated with bacterial AMR in 2019, including 1.27 million deaths directly attributable to it \(^2\). If unchecked, AMR may devastate the economy, causing up to a 3.8% loss of global annual gross domestic product (GDP) in a worst-case scenario\(^3\). Besides, AMR hinders progress towards the achievement of several of the Sustainable Development Goals 2030 (SDGs) indicators\(^4\).

Following the launch of the Global Action Plan (GAP) on AMR and the request for member states to adopt National Action Plans (NAP) on AMR, India published its NAP on AMR in 2021\(^5\). India has consistently taken measures to address the issue of AMR and curb inappropriate use of antibiotics, through the Jaipur Declaration, the introduction of Schedule H1, the initiation of the Redline campaign, the setting up of surveillance networks such as the National Antimicrobial Resistance Surveillance Network (NARS-Net) and the Antimicrobial Resistance Surveillance and Research Network (AMRSN), the adoption of related policy and regulatory measures, and so on.\(^6\)–\(^8\)

Despite these efforts, several challenges remain for optimal implementation of the NAP AMR. One of the main challenges is the distribution of health-related responsibilities between the federal and state governance systems. Indian states vary widely in health-related determinants such as the proportion of urban, rural, and tribal populations, spending on health, access to quality primary healthcare, knowledge levels of formal and informal healthcare providers etc.\(^9\)\(^(10\)–\(^12\)\) These differences also influence access to antibiotics, drivers of antibiotic resistance and resistance rates among microorganisms, the availability of veterinary healthcare structures, regulations on animal husbandry, poultry, and aquaculture, and the sale and distribution of drugs in the human and animal health sectors. Given these variations, operationalizing the national action plan requires further adaptation to state-specific capacities and priorities.

Recognizing the need for such adaptation, the central government and the National Centre for Disease Control (NCDC), which is the central body tasked with coordinating the NAP AMR, urged states to adopt their respective state action plans (SAPs) on AMR and published a guidance document titled “Guidance for developing State Action Plans for Containment of Antimicrobial Resistance (SAP CAR)”\(^13\). Kerala was the first state to publish SAP on AMR in 2018, giving impetus to other states to launch their SAPs, with Madhya Pradesh (2019), Delhi (2020), and Andhra Pradesh. Few other states are in the final stages of adopting.

Taking into consideration the needs, challenges, and realities towards formulating and implementing SAPs, a need was felt to understand these better so that states which had not yet developed their SAPs, could then move towards SAPs which are more contextualized to their regions. Towards this, ReAct Asia Pacific, a regional node of ReAct, one of the first independent networks to articulate the complex nature of antibiotic resistance and its drivers carried out this work as part of our advocacy efforts for the prioritization of AMR and catalyzing action\(^14\). This manuscript documents the perspectives of different
stakeholders with respect to AMR and the need for an action plan in the context of three administrative regions (two states and union territories). The three sites are geographically distant from each other and have different governance mechanisms (one being a Union Territory), different socio-economic profiles, and different AMR-related challenges. The manuscript also lists out the challenges, barriers, and enablers in each of these administrative regions that could influence the drafting and implementation of state-specific SAPs for AMR and concludes with suggestions for the way forward for states who have not yet developed their SAPs. These findings may be applicable not just to India but to other LMICs where a federal system of government is prominent and sub-national action plans are developed/implemented.

**Methods**

The project took place in 2021 and 2022. Ethics committee approval was from Pushpagiri Institute of Medical Sciences, Thiruvalla (Reference number 09/08/2022) dated 16th August 2022. In the three states chosen, local collaborators were identified and partnered with in order to have consultative group discussions and in-depth interviews. Short-term consultants with public health expertise were recruited to facilitate these meetings. The consultants undertook stakeholder mapping and identified experts from human and animal health AMR researchers, government health officials, and civil society organizations (CSOs). The potential participants identified through this exercise were invited in person or through email to participate in these meetings.

One consultative physical meeting was conducted in each state in October 2021. During the physical meeting, a structured group discussion was held on different themes, and these were documented.

**Indepth interviews:**

Indepth interviews were also held to supplement the information gained through the above group discussions as per the discussion guide (supplementary material 1). Key informants were policymakers and other experts who worked with antibiotics in animal health, human health, animal husbandry, and the environment as identified from stakeholder mapping. The team of two researchers conducted 17 in-depth interviews using a structured interview guide. The average length of the in-depth interviews was 45 minutes.

The documented material underwent manifest and latent content analysis. The researchers did the coding manually, and any differences of opinion regarding the coding process were sorted through discussion and joint coding.

Ethics committee approval was from Pushagiri Institute of Medical Sciences, Thiruvalla (Reference number: 09/08/2022) dated 16th August 2022

**Results**
Three consultative meetings took place in October 2021, and a total of 118 stakeholders participated in the meetings (38, 49, and 37 participants in the three states). See Table 1 for distribution of participants.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Number of participants</th>
</tr>
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<tbody>
<tr>
<td>Agriculture</td>
<td>6</td>
</tr>
<tr>
<td>Animal Husbandry</td>
<td>6</td>
</tr>
<tr>
<td>Aquaculture</td>
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<tr>
<td>Environment</td>
<td>3</td>
</tr>
<tr>
<td>Human Health</td>
<td>50</td>
</tr>
<tr>
<td>Molecular Biology</td>
<td>10</td>
</tr>
<tr>
<td>Public Health</td>
<td>24</td>
</tr>
<tr>
<td>Research and Development</td>
<td>5</td>
</tr>
<tr>
<td>Veterinary health</td>
<td>9</td>
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</tbody>
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The themes that emerged from the moderated group discussion on challenges, enablers, and steps in advancing the implementation of the AMR action plan are organized under headings that align with the national action plan for ease of reporting. Table 2 summarises Key recommendations for policy makers while framing SAPs.
Table 2
Key recommendations for policy makers while framing Sub-national action plans or SAPs

As part of Subnational Action Plans states should:

1. Implement a stakeholder-specific communication strategy that encompass actionable messages, channels for communication, and indicators for monitoring and evaluation.

2. Establish a consortium for AMR surveillance with the engagement of multiple public and private players to track resistance rates on a real-time basis. The consortium should also track trends in food-animal sector.

3. Mandate antibiotic stewardship programs in hospitals and restrict the empirical and unscientific use of antibiotics in human health and agriculture. State action plans should guide Hospital Infection Control Committees (HICCs) to implement a targeted approach that focuses on low-hanging fruits, such as the Central Sterile Services Department (CSSD), housekeeping, and intensive care units. A targeted approach can maximize impact while minimizing costs.

4. Invest in R&D into newer, more cost-effective point-of-care and rapid diagnostics and enforce diagnostic stewardship.

5. Set up systems for regular monitoring of antibiotic residues in effluents from pharmaceutical companies, animal farms, slaughterhouses, and hospitals.

6. Demonstrate political will to address AMR in a systematic fashion and incorporate funding for AMR in their health budgets.

7. Engage multiple stakeholders across different sectors to collaborate on developing sub-national action plans and implement these. Ensure collaboration across sectors.

8. Carry out and encourage behavioural and implementation research to understand why certain practices are followed, the root of the behaviour, and how this behaviour can be changed (from both human and animal sector).

9. Involve students/youth in raising awareness on OTC use of antibiotics.

10. Ensure all plans have sector-wise indicators for timely monitoring and evaluation with clear mandate to all stakeholders.

A. Advocacy, Communication and stakeholder mobilisation

The theme of awareness raising and communication was brought up in all the three meetings. To mitigate AMR, it is essential to educate and empower communities and stakeholders on the issue. One way to do this is to present updated, reliable data on the impact of AMR in a simplified format. This data can be used to raise awareness of the gravity of the problem and the need for action. The need for a communication strategy was highlighted. The theme of food safety was suggested as a way to piggyback AMR into public consciousness. Food safety has better traction with the public as compared to many healthcare issues. It is also important to raise awareness about the importance of AMR surveillance among the public and healthcare professionals.

An expert in promoting infection prevention and control practices suggested that 60% of the weightage in the effort against AMR should be given to public awareness, 20% to giving people access to healthcare professionals, and 20% to other measures such as penalties, regulation, and the like.
In addition, states should focus on educating farmers on the long-term adverse effects of using antibiotics as growth promoters and treating animal infections empirically without professional advice.

In curbing the easy availability of antibiotics over-the-counter (OTC), care must be taken to not overcorrect and hamper access to antibiotics, especially in regions where the health systems are weak. The participants mentioned that regulatory measures need to be implemented strictly, but community involvement and sensitization are also important. In this context, state governments should engage students and youth as change agents to raise awareness about avoiding OTC consumption of antibiotics, disposal of antibiotics, and the importance of hygienic practices and infection prevention.

States should also carry out behavioral and implementation research to understand why certain practices are followed, the root of the behavior, and how this behavior can be changed. India has successfully used celebrity-led mass media campaigns on TV, radio, and social media for behavioral change in health-seeking behavior for TB. This could be replicated for AMR.

B. Surveillance

AMR surveillance is essential to track the spread of AMR and inform effective interventions. Though the surveillance measures are consistently improving (through NASS-Net and AMRSN), there continue to be barriers in terms of diagnostic capacity in many of the secondary and primary centers, especially in rural areas. The current surveillance systems are limited in their reach and compile data from large tertiary and/or referral laboratories.

Investments in increasing diagnostic capacity, both in terms of equipment and human resources, are urgently required. It is important to scale up culture and susceptibility in rural areas to understand the true burden of AMR. It is not sufficient to merely establish labs; establishing quality control systems for labs should also happen in tandem. Efforts are needed to compile data from existing microbiology labs on a single platform, and this is one of the low-hanging fruits. WHONET can be used for easy compilation and reporting of data.

States should establish a consortium for AMR surveillance with the engagement of multiple public and private players to track AMR on a real-time basis. This will involve all the hospitals in the state and the healthcare sector, as well as veterinarians and animal health professionals. Veterinarians also called for a similar consortium for screening and surveillance of animal diseases and AMR among animals.

As an associate professor in the department of biotechnology said, "All efforts are isolated; once in a while, we undertake research studies and publish them. That is not going to shed light on the overall picture. It doesn't give a bird's-eye view. So, I feel that if you want to have proper surveillance, involve all the hospitals in [the state] and especially in the healthcare sector... Of course, it requires a lot of money."

Addressing these challenges will require a concerted effort from all stakeholders, including the government, the private sector, and academia.
C. Optimizing Antimicrobial use

It is essential to implement AMR stewardship measures in all sectors, including human health, animal health, and agriculture. There is a need to develop updated and practically applicable AMR stewardship modules for healthcare courses, focusing on situations requiring antibiotics, bug-drug combinations, etc. This will help to ensure that future healthcare professionals have the knowledge and skills to implement effective AMR stewardship practices. In addition, states should also ensure that antibiotic stewardship practices are reiterated through continuing professional education sessions for healthcare providers. It is also important to strengthen diagnostic stewardship among healthcare practitioners in order to encourage diagnostic testing prior to antibiotic intake.

States should mandate hospitals publish antibiotic stewardship protocols and antibiograms. Publishing antibiograms periodically at the regional or state level will aid in the sensitization and education of personnel in human and animal health, informing best practices in real-time.

Currently, people perceive that consuming antibiotics without performing diagnostic testing is cheaper. There is a need for R&D into newer, more cost-effective point-of-care and rapid diagnostics. This can change the mindset that antibiotics are cheaper than tests.

States should strengthen efforts to restrict the empirical and unscientific use of antibiotics in human health and agriculture. This can be done through public education, regulatory measures, and capacity building for healthcare professionals. States should focus on regulating the manufacture, sale, and use of such growth promoters by sensitizing livestock inspectors and field veterinarians, since the use of antibiotics as growth promoters is a major contributor to AMR. In addition to regulating medicines, building capacity of farmers to implement biosecurity measures on animal farms, along with introducing stringent regulations to enforce them, will reduce the need for antibiotics altogether in food animal production. Alternative medicines such as AYUSH should be considered in food production, subject to the availability of quality evidence on their safety profiles.

Mechanisms for systematic prescription audits should be experimented with in both the public and private sectors for human and animal health. State action plans could also suggest prescription audits during reimbursement of state-run insurance claims. This will help to identify and address inappropriate antibiotic prescribing practices.

By implementing these multipronged AMR stewardship measures, states can play a leading role in tackling this global public health threat.

D. Community Hygiene and Infection Prevention and Control (IPC)

One important step is to communicate to the public the importance of IPC in preventing AMR, similar to how messages on the prevention of COVID-19 were communicated. States should also sustain the
momentum of infection prevention and control (IPC) initiatives generated by COVID-19 to help reduce AMR. One way to improve efficiency and reduce duplication of effort is to integrate AMR efforts into existing public health programs. For example, states could incorporate AMR messaging into their COVID-19, TB, childhood pneumonia, and HIV outreach materials.

States should also build and consolidate IPC-related competencies across all healthcare cadres. This is important because healthcare-associated infections (HAIs) are often multi-drug resistant and contribute significantly to the burden of AMR. State action plans should guide Hospital Infection Control Committees (HICCs) to implement a targeted approach that focuses on low-hanging fruits, such as the Central Sterile Services Department (CSSD), housekeeping, and intensive care units. A targeted approach can maximize impact while minimizing costs.

Vaccines are another critical component of AMR action. By reducing the burden of infectious diseases, vaccines can decrease the need for antibiotics. Both the central government and states should focus on adult vaccination with the aim of decreasing overall morbidity and mortality. Reducing antibiotic use can be viewed as a critical and preferred by-product of adult vaccination programs.

E. Governance and financing

While AMR poses a grave threat to public health, its adverse effects are largely invisible, making it difficult to convince policymakers about the urgency of the situation. To bridge this gap, professional associations, civil society organizations, private and government academic institutions, and research facilities across all sectors must collaborate to collect and share data on AMR morbidity and mortality. In addition, the participants were of the opinion that developing state action plans is imperative for field-level activities on AMR to begin. A multi-disciplinary state-level network could be formed to facilitate this process and provide technical support to the state health machinery.

Regular state-level meetings should be held for representatives of various groups to foster intersectoral collaboration and break down silos. A strong state-level consortium with a One Health perspective is also essential for a coordinated effort to combat AMR. State governments should finance such consortia to ensure sustainability.

State action plans should spell out a comprehensive monitoring and evaluation strategy across different sectors at all levels. Each department must have its monitoring and evaluation roles and responsibilities clearly defined. States should also set up systems for regular monitoring of antibiotic residues in effluents, as this has been shown to be successful in some cases. By taking these steps, states can play a leading role in addressing the invisible crisis of AMR.

States should mandate that hospitals record AMR as a cause of death wherever appropriate. This will help to highlight the true burden of AMR and encourage policymakers to take the issue more seriously. States could encourage pilot projects with an implementation research perspective to create adequate political capital for the allocation of funds and scale-up of successful interventions.
F. Health system related challenges in addressing AMR

Lack of access to well-equipped clinics and hospitals leads to people turning to alternative treatment options available outside the hospital setting, which can contribute to the misuse of antibiotics. This is because people may be more likely to self-medicate with antibiotics if they are unable to see a doctor or access appropriate healthcare services. Additionally, some alternative treatment providers may promote the use of antibiotics for conditions that do not require them.

One state highlighted the lack of adequate human resources specializing in infectious disease and microbiology as an impediment to having a SAP. This is a significant challenge, as experts in these fields are essential for developing and implementing effective strategies to reduce the misuse of antibiotics.

Any efforts to limit the misuse of antibiotics should be centered on the needs of patients and small-holder farmers. This means ensuring that patients have access to affordable and timely healthcare services and that small-holder farmers have access to information and resources to help them use antibiotics responsibly.

The National Center for Disease Control (NCDC) encourages states to draft action plans to combat antimicrobial resistance (AMR). However, a major barrier in implementing these plans is a lack of funding earmarked for AMR. This has also hampered the establishment of AMR secretariats in states that have drafted action plans.

AMR is a complex problem that requires multisectoral efforts and, therefore, requires more investment than other public health problems. In addition to the lack of funding for control measures, research on AMR in humans, animals, and the environment is also underfunded.

The poor financing of AMR mitigation efforts can be attributed to a general lack of visibility among the public and policymakers. AMR also competes with other priority issues, such as non-communicable diseases, tuberculosis and other diseases, for resources.

One of the interviewees mentioned that their state has the potential to bring forth the implementation of AMR programs, but the state lacks political will. It is important to communicate to policymakers that while the states would incur costs for efforts to curb AMR, they also stand to lose much more should it remain unaddressed. “To solve this problem, we will have to educate the leaders and the bureaucrats because they are the main stakeholders. It is also crucial to educate regulatory bodies in charge of human health, animal health, fisheries, and agriculture,” commented a principal scientist in veterinary public Health.

Figure 1 below summarise the thematic network of focus areas as described above.

**Discussion**
India has 28 states and eight union territories. Only four states have an SAP in place currently, although a few states are now in the final stages of their own state action plans.

In India and other LMICs with federal governance mechanisms, health is often a state subject. The formulation of state action plans is therefore a critical step in making progress against AMR. In addition, engaging and involving representatives from human and public health, veterinary health, agriculture, and environmental health to implement SAPs is imperative. Kenya demonstrated how multisectoral collaboration could be achieved at the county level by establishing a one-health unit (15). Currently in India, for states with SAPs, the focal points are/were academicians from the human health sector tasked with the additional responsibility of implementing SAPs. This often limits the scope, reach, and quality of AMR mitigation efforts. Considering the diverse needs among sectors as noted from the participants of our study, it is important for states to invest in full-time multisectoral human resources who can focus on AMR mitigation. Also, considering the plethora of needs whilst implementing SAPs as mentioned by the study participants, we have highlighted below important focus areas which would be essential as core components for optimal implementation of SAPs.

i) The role of communication strategies to raise awareness, behavioural change and collaborative engagement

The knowledge of AMR varies widely among different stakeholders, while misconceptions are prevalent and mere knowledge is insufficient to bring about behavioral change. (16, 17) Hence, the suggestion of tailoring communication strategies to different stakeholders and grounding these strategies in the behavioral sciences is pertinent and topical. Wellcome Trust’s ‘Reframing Resistance’ is a useful resource that guides on how to communicate AMR effectively (18). Besides this guidance, some successful models from the UK and Belgium have used TV and social media as tools to increase awareness and engagement among different target groups(19, 20). COVID has also demonstrated how the social media handles of the central and state health machinery can act as effective communication tools [25]. States could choose from this wide variety of options to structure communication campaigns that suit the cultural context and their needs. Communication strategies should also focus on increasing capacity among farmers to deploy bio-security measures through well-designed and piloted toolkits, preferably in local languages.

ii) Platforms for data on surveillance and consumption across sectors:

Surveillance measures are consistently improving in India through NARS-Net and AMRSN which are predominantly focusing on data collection from tertiary care centres in urban cities. LMICs with federal systems should also focus on expanding the reach of surveillance systems by recruiting more laboratories from smaller hospitals and centers, especially in the rural areas. In addition, countries which have a large proportion of the population receiving healthcare services from the private sector should also collaborate with private institutions to collect surveillance data. In the animal sector in India, the
Indian Network for Fishery and Animal Antimicrobial Resistance (INFAAR) was launched by the Indian Council of Agricultural Research (ICAR) with support from the Food and Agriculture Organization (FAO) to facilitate laboratory-based surveillance of AMR in animals and aquaculture [27]. In addition to strengthening microbiological surveillance, it is also important to monitor at the state level antibiotic use, and engage state pollution control boards as major stakeholders to regulate antibiotic levels in effluents from hospitals, pharmaceutical manufacturing units, and animal farms.

### iii) IPC and antimicrobial stewardship:

One of the initial SAPs were from the state of Kerala. Kerala’s public-private partnership (PPP) developed and implemented a multi-pronged strategy to improve antibiotic stewardship (16, 21). This strategy focused on creating clinical guidelines, updating undergraduate and postgraduate medical education, and training all general practitioners on antibiotic stewardship [33]. Since in many federal structures, health is a state subject, SAPs could adopt similar PPP models and also develop strategies and steps to engage academic bodies and professional healthcare associations. These academic bodies can be enlisted to lead stewardship and awareness efforts.

To amplify the focus on infection prevention and control in NAP, the National Center for Disease Control (NCDC), MoHFW, in collaboration with WHO Country Office India, released the “National Guideline for Infection Prevention and Control in Healthcare Facilities” in 2020. Although poor infrastructure and poor funding are cited as causes for inadequate implementation of IPC measures, there is evidence to show that IPC can be implemented in low resource settings with clinical leadership and a sound knowledge of safe practices. (22–24)

### iv) Financing SAPs:

In LMICs with federal structures, incorporating AMR finance mechanisms into national and state-level budgets should happen concurrently to ensure that different dimensions of addressing AMR are adequately funded. In addition to investments earmarked for AMR, states should also invest in strengthening infection prevention and control, WASH, vaccination, the regulation of antibiotic manufacturing, the medicine supply chain, and the regulation of antibiotics in effluents. In addition, existing government programs could also be leveraged for AMR efforts. In India, programs such as the Rashtriya Krishi Vikas for the agricultural sector and Swasth Bharat Abhiyan for hygiene could be very useful. Similar to AMR mitigation efforts, which have focused on human health, research on AMR has also primarily focused on human health. According to a scoping review on AMR research from India, out of a total of 2152 studies, 48.3% focused on humans, 3.3% on animal health, 4.2% on the environment, and 0.5% on One Health. (25) States should earmark funds for research, especially for research on AMR in the animal and environmental sectors.

### Conclusion

LMICs with federal structures need to invest in an equitable and distributive manner, their financial allotments to implement SAPs if there needs to be optimal progress. The drivers and impact of AMR can
be very different between various provinces or states in a country, owing to variations in demographics, health systems, agricultural practices, affordability and access to healthcare, policies and regulatory oversight. Therefore, in the context of larger countries, it is not possible to have a 'one-size-fits-all' approach. Sub-national action plans are the way forward in larger LMICs to ensure that the NAPs create sustainable change in the AMR milieu.

It is hoped that this paper which has garnered participant insight and knowledge on the need for SAPs, their needs and challenges for implementation, will help encourage policy makers in other states in India and also in LMICs with federal structures to invest in regional and local action plans. Amidst the variety of needs, we have attempted to focus on the core areas such as awareness and behavior change, surveillance, infection prevention and control, and financial support that are essential for initiating, implementing and sustaining SAPs. It is our hope that regions and localities will act on the information contained in this paper and invest in such plans for optimal forward momentum to address and mitigate AMR.

**Declarations**

**Ethics approval and consent to participate** – Ethics committee approval was obtained from Puspagiri Institute of Medical Sciences. Approval number: 09/08/2022 dated 16th August 2022.

**Consent for publication - NA**

**Availability of data and material**: The data that support the findings of this study are available from the first author and the corresponding author and will be shared upon reasonable request.

**Competing interests**: All the authors declare no competing interests

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**Authors’ contributions:**

Study concept: PM, JR, SJC

Study design: PM, JR, JRB, SAT

Study execution: JRB, JR, PM, SJC, SAT

Indepth interviews: JRB, SAT

Data analysis and interpretation: JRB, JR, RR

Manuscript preparation first draft: JRB and JR
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References


Figures

Figure 1

A thematic network of focus areas for Sub-national action plans for AMR

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- InterviewGuideSAP1.pdf