

Policy Reservation for Antimicrobial Resistance in India

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ABSTRACT

Antimicrobial resistance (AMR) is a pressing issue with significant implications for public health and industries such as agriculture. In a country like India, where antibiotic use is among the highest in the world and instances of AMR are correspondingly high, there is a critical need for intervention and policy amendment to contain and appropriately address the problem. This is especially urgent given India's significant role in global supply chains and the potential for infectious diseases to spread globally through trade. This paper thoroughly explores the current situation and challenges related to AMR in India. It evaluates the existing policy measures adopted in the country and provides policy recommendations within a comprehensive framework that includes education, restraint, and research.

Keywords: Antimicrobial Resistance, Public Health, Public Policy, Policy Framework, India

INTRODUCTION

Antimicrobial Resistance (AMR) develops when microorganisms continue multiplying in the presence of drugs designed to inhibit growth or destroy them. Antibiotics, antifungals, and antiseptics all come under the antimicrobial umbrella and are used to treat highly infectious diseases including but not limited to Ringworm, Strep throat, Salmonella, Tuberculosis, and Chlamydia (Cleveland Clinic, 2022). Variants of these medicines target specific strains, and

matching the drug to achieve the desired result is essential. Continued and indiscriminate exposure, use of the wrong medication, and partial consumption of the prescribed course can cause these microorganisms to undergo genetic mutations or acquire resistance genes. With this new genetic composition, the pathogens stop responding to the previously effective line of treatment. The resulting failure of the medicine contributes to the persistence of drug-resistant infections, increasing the risk of disease spread, severe illness, and death, posing a significant threat to public health worldwide.

Moreover, AMR is not limited to humans and has deep roots in agriculture (Thanner et al., 2016). The continuous overuse of antimicrobial drugs in the form of pesticides and herbicides by farmers impacts both animals and crops as they no longer protect from bacteria or pests. As these pesticides and herbicides become ineffective, there is a domino effect on the food supply chain with increased prices and dwindling stocks while the farmer faces financial loss.

The UN SDG 3, focusing on Good Health and Well-Being for All, specifically aims to ensure that each individual can access necessary healthcare services, taking into account economic and social inequalities, rapid urbanisation, threats to the climate and environment, as well as emerging challenges that arise from non-communicable diseases. SDG 3 consists of numerous sub-objectives, one of them being the prevention of infectious and noncommunicable diseases by 2030 (UNDP, 2017). With the limited

availability of effective antimicrobials, AMR has significant implications for SDG 3 goals. Patients may have to undergo financially inviable prolonged treatment regimens without a guaranteed outcome, diminishing the UN's ability to achieve its target of combating infectious disease epidemics by 2030 as this global public health crisis develops.

Statistics show that in 2019, AMR contributed to almost five million human deaths globally, making it the leading cause (Antimicrobial Resistance Collaborators, 2022). In India, 297,000 deaths were directly linked to AMR and 1,042,500 indirectly (IHME, 2023). India ranks first globally in the total consumption of antimicrobial drugs for human use. In India, the widespread availability of antimicrobials, coupled with the absence of government regulations, enables individuals to purchase and use these drugs indiscriminately. Studies show that in 2010 alone, the per-individual consumption in India was 12.9×10 units of antibiotics with an average of 10.7 units. The percentage change in total usage between 2010 and 2020 has increased by 48% (Van Boeckel et al., 2014). This high use of antimicrobials throughout the country significantly contributes to the spread of AMR, making it necessary for an effective policy framework to be developed and implemented in the country.

In line with the aforementioned, this research paper aims to answer the following research question: How can a comprehensive policy framework entailing education, restraint, and research help combat Antimicrobial Resistance (AMR) in India and what are the expected outcomes for the healthcare system and global health?

BACKGROUND AND PROBLEM STATEMENT

Antimicrobial resistance is a rising global concern with significant economic and societal repercussions, including increased healthcare costs and loss in economic productivity, with implications for public

health, particularly in India (Dadgostar, 2019).

In terms of increased healthcare costs, patients diagnosed with AMR require extended hospitalisation, more expensive medication, as well as specialized care. These factors result in inflated medical bills, rendering healthcare less affordable and accessible, potentially pushing families into poverty due to the added financial burden (World Bank Group, 2017). For instance, the World Bank reported that unchecked AMR could push an estimated 28 million people into poverty. In a country like India, where 11% of the population already lives in multidimensional poverty (Krishnan, 2024), the aforementioned can have dire effects. Furthermore, the financial burden, delayed intervention, and prolonged treatment of AMR can reduce the productivity of nations like India, especially given that more than 75% of the population is engaged in the informal sector (Murthy, 2019). In line with this, the estimated economic cost due to antibiotic resistance for India could be about \$770.38 – \$847.49 crore, potentially reaching \$2.4 billion by 2050 if left unaddressed (Tamhankar, 2020).

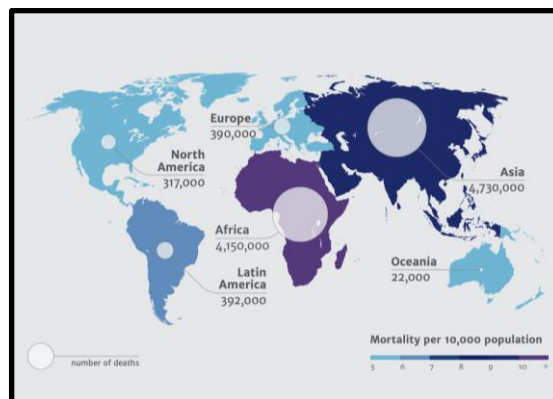
As mentioned in the introduction, AMR also poses a significant threat to the agricultural industry. The extensive use of antibiotics in crop production and livestock to prevent disease and boost growth has resulted in the emergence of resistant bacteria. As per the Food and Agriculture Organization, India is one the largest consumers of antibiotics in animal farming, and misuse has significant repercussions for both productivity and public health (Taneja & Sharma, 2019). Given that agriculture contributes approximately 18% to India's GDP (Majumdar, 2024), lower crop yield and livestock losses can have dire consequences for the country's economy as well as for the estimated 43% of the population that are directly employed in and rely on the agricultural industry as a source of livelihood (The World Bank, 2024). There are also further societal concerns with this decrease in agricultural productivity as it can exacerbate

issues pertaining to food security and lead to higher food prices. It is also important to consider that the transmission of resistant pathogens from animals to humans can create severe public health risks and trigger a vicious cycle whereby the population may witness outbreaks of zoonotic infections that are more expensive and harder to treat. Therefore, addressing AMR in agriculture should be a matter of priority for India if it wishes to safeguard the sector's productivity, maintain economic stability, and protect public health.

Additionally, AMR burdens the healthcare system as procedures that utilize antimicrobial drugs to reduce the risk of infection after surgeries will become a double-edged sword as the risk of post-surgery infection may outweigh the procedure's benefit. For example, AMR also affects cancer treatment. With compromised immune systems resulting from chemotherapy, patients are more susceptible to infections that they will not be able to fight off in the absence of effective drugs, making chemotherapy an impossible option for treatment. Since cancer has an estimated mortality of 7,70,230 in 2020, increasing to 7,89,202 in 2021 and 8,08,558 in 2022 (PTI, 2022), this is an extremely significant threat to India's healthcare sector.

Analysing this situation from a more global perspective, with India being a crucial player in the global supply chains, a rise in AMR strains could negatively impact the global economy through transmission via travel and trade. Over time, the emergence of drug-resistant infections could lead to a health crisis akin to the COVID-19 pandemic. The image to the left shows the number of deaths attributable to AMR by 2050, with the highest number in Asia. Within Asia, India is expected to have the highest mortality rate (Sihombing et al., 2023). Therefore, if India does not effectively address AMR, the country will become a significant contributor to AMR's continued rise globally. Consequently, addressing AMR in India is vital to protecting both national and

international public health and ensuring global stability.



(Image 2: McNulty et al., 2012)

To address these economic and social impacts of AMR, the Indian government formed the Inter-Sectoral Coordination Committee in 2017, with representatives from ministries of animal husbandry and fisheries, food processing, climate change, and forestry, as well as the Standard Drug Action Control organisation to develop a National Action Plan (NAP) on Anti-Microbial Resistance - a standout achievement in India's battle against AMR (Sharma, 2023). India's NAP lays a multidimensional strategic framework for tackling AMR by emphasizing the 'One Health' approach for dealing with health challenges at the human, animal, plant, and environment interface (Calistri et al., 2013). The plan showcases strategies for public awareness, surveillance, research and antimicrobial stewardship (Ranjalkar & Chandy, 2019). Additionally, addressing AMR as part of the G20 agenda, health ministers stressed infection prevention and control, water sanitation and hygiene, research and development, improving AMR awareness, promoting appropriate use of antimicrobial drugs across humans, plants and animals, and improved surveillance of antimicrobial resistance and drug consumption (Sinha, 2023).

India has recognized the role of antibiotic overuse and misuse as a leading cause of AMR and has taken steps towards regulating the sale of antimicrobial drugs (Bhatia &

Walia, 2017). The government has imposed strict policies to control the sale of over-the-counter drugs, making it difficult for individuals to obtain medications without proper prescriptions, thus reducing the risk of overuse and misuse. India has also actively engaged numerous stakeholders and established the AMR Surveillance Network, a combination of the Indian Council of Medical Research and the Department of Biotechnology, to monitor and respond to emerging drug-resistant threats (Walia et al., 2019). Such collaborations have contributed to progress in addressing AMR in India.

However, significant challenges exist in India's battle against AMR. These include designating funds to initiate activities proposed under India's NAP, enforcing regulations effectively, establishing mechanisms for streamlined cross-sector collaborations, and delivering expert guidance worldwide. Moreover, the emergence of new, drug-resistant strains of bacteria necessitates ongoing research and adaptation of treatment strategies (Nwobodo et al., 2022). Addressing these challenges requires sustained efforts by all stakeholders to protect public health and achieve India's NAP successfully.

REVIEW OF CURRENT POLICY & RECOMMENDATIONS

Currently, there are numerous existing policies and regulations in India related to AMR. Firstly, India's National Action Plan (NAP) is comprehensive and aligns with WHO's GAP regarding AMR. The plan lists five additional objectives for AMR control, specifically to strengthen India's leadership on AMR. The plan aims to achieve numerous aims using the 'One Health Approach', as mentioned above. Some strategies of the NAP are – improved awareness and understanding of AMR, reducing the incidence of infection through effective infection, prevention, and control, promoting investments for AMR activities, research and innovation, etc. The effectiveness of the NAP depends on its consistent implementation

across states. In 2023, the NAP is likely to lead to positive implications such as increased awareness and surveillance of AMR. However, this result is largely dependent on the regularity of policies imposed. To ensure this, there should be secure funding commitments at the national and state levels to support long-term surveillance, research and awareness campaigns. In addition, India's Drug and Cosmetics Act, implemented in 1940, still holds an important role in regulating pharmaceuticals, including antibiotics. The continued effectiveness of this policy largely depends on how well this act is adapted to the evolving pharmaceutical landscape and the emerging challenges in new antibiotic sales. In light of the current policies and actions taken this discussion aims to introduce a comprehensive strategy to combat AMR in India with the objective of finding a more functional and long-lasting solution. A key aspect of implementing these amended policies is identifying a defining group of beneficiaries. Stakeholders include a diverse spectrum of Indian society whose healthcare and well-being will significantly improve with a multifaceted policy focusing on Education, Restraint and Research. The following sections discuss each of these aspects in detail while setting out an appropriate policy proposal for AMR in India.

Implementing policies addressing antimicrobial resistance can be approached in two distinct ways: either at the state level, with each crafting specific policies tailored to their unique circumstances, or as a unified nationwide effort involving each industry impacted by or causing AMR in India. The choice between a horizontal approach versus a vertical approach is a matter of debate and consideration.

– A *horizontal approach* refers to strategies to address an issue and achieve a goal across various sectors and industries (Ben-Gera, 2009). It provides equal opportunities, adversities, and penalties to different categories of beneficiaries, such as farmers,

veterinarians, and medical professionals. In essence, this approach considers the multifaceted problem of antimicrobial resistance with its interconnected problems and consequences. It aims to develop policies and measures that cut across the sectors to target AMR from each unique angle effectively.

- Conversely, a *vertical approach* can also be considered when implementing an AMR reservation policy by prioritising specific antimicrobials and implementing laws and restrictions against them. This approach involves categorizing antimicrobial drugs based on their potency, spectrum of activity, or importance for treating critical infections and then implementing policies to ensure their appropriate and judicious use in specific healthcare settings or situations. For example, in a hospital setting, a vertical approach might involve reserving certain last-resort antibiotics, such as carbapenems or colistin, only for treating severe infections when no other alternatives are effective.

Common considerations when evaluating the horizontal or vertical approach include the following

- **Education and awareness:** In terms of education and awareness, the policy implemented should ideally be in the form of a horizontal approach to build an understanding in individuals from all backgrounds and sectors about the importance of responsible antimicrobial use.
- **Sector-Specific Interventions:** Certain sectors may contribute more significantly to AMR than others. In these cases, targeted vertical policies within those sectors may be necessary to address the root causes effectively. For example, Tuberculosis in India affects as many as 24.7 lakh people and is greatly affected by the prevalence of AMR (Ghosh, 2024). For this reason, the reservation policy should contain an aspect of a vertical approach to specifically spotlight the grave problem of tuberculosis.

- **Cross-Sector Collaboration:** AMR is a complex problem that requires cooperation across various sectors, including healthcare, agriculture, pharmaceuticals, and more. A horizontal approach can help facilitate collaboration and information sharing among these sectors.

Ultimately, the most effective approach for India should be based on a combination of horizontal and vertical strategies. The effectiveness of the policy will depend on its ability to reduce the misuse and overuse of antimicrobials, whether that is using the angle of education, research, or strict laws and regulations.

After analysing the different approaches to implementing a new AMR reservation policy in India, it is important to discuss suggestions regarding what the central government can consider to further strengthen AMR policies in the nation.

A key area to start with is knowledge and education, both in terms of public awareness and clinical and professional education and training. Firstly, clinicians involved in prescribing medication must remain current with emerging evidence on resistance and appropriate antibiotic usage through regular Continued Professional Development (CPD) programs that include the competencies required for effective antibiotic stewardship. Following the mandatory CPD requirements in countries such as Australia (AHPRA, 2023), a similar requirement should be mandated for all Indian healthcare professionals with prescribing authority, including physicians, nurse practitioners, and pharmacists. The CPD program must be designed to cover a range of topics, including the latest developments in antibiotic resistance, guidelines for appropriate antibiotic use, and strategies to promote patient education on antibiotic adherence. In addition to clinicians, patients also need more comprehensive knowledge regarding their intake of antimicrobials. For example, most patients incorrectly believe that once symptoms of an illness are relieved, they are no longer required to take the antimicrobial.

Studies show that this consequently leads to more than 50% of individuals being unsuccessful in completing their medical dosage, a practice that encourages antimicrobial resistance (Karuniawati et al., 2021). Similar to the UK, India could

consider adopting a multi-pronged approach, leveraging sources such as the radio, television, school classes designated to AMR, and public posters (see examples from the NHS below) to educate patients as well as the general public.



(Image 2: McNulty et al., 2012)

Furthermore, India could also consider establishing an 'Indian Antibiotics Awareness Day' similar to one that the European Centre for Disease Prevention and Control (ECDC) started organizing in 2008 as part of which all European countries were and continue to be encouraged to participate in the European Antibiotic Awareness Day (EAAD) by running antimicrobial awareness campaigns (McNulty et al., 2012).

A second key area to improve on in India's AMR policy is in terms of restraints. India has a track record of implementing potentially successful laws and regulations; however, it cannot carry them out effectively. An example of this is seen every day in India with traffic regulations. Though there are zebra crossings at each red light, we still see individuals crossing the roads wherever it is convenient, and there are no penalties to stop this. A similar problem is present in AMR policies in India but with higher stakes. To overcome this, India can use incentives and rewards to encourage compliance with AMR guidelines. For example, in the US, "antimicrobial stewardship is a coordinated program that promotes the appropriate use of antimicrobials (including antibiotics), improves patient outcomes, reduces microbial resistance, and decreases the spread of infections caused by multidrug-resistant organisms" (MDH, 2024). To

encourage healthcare providers and facilities to comply with the antimicrobial stewardship program (ASP), incentive payments through Centers for Medicare & Medicaid Services (CMS) initiatives such as the Value-Based Purchasing (VBP) program are offered (Nagel et al., 2014).

A third and last key area of improvement is the research conducted. India must prioritise and ensure continuous research and development of alternative approaches, including strategies that do not rely on traditional antimicrobials. Complemented with further research on optimal dosing with currently available antibiotics will consequently reduce the risk of overuse or misuse of antimicrobials.

CONCLUSION

In conclusion, addressing Antimicrobial Resistance (AMR) in India requires a multifaceted policy approach focusing on education, restraint, and research. The current state of AMR in India, with its high antibiotic consumption rates and the potential for devastating consequences outlined by the World Health Organization, demands immediate action.

Firstly, education and awareness play a pivotal role in changing behaviour and reducing the misuse of antimicrobials. A comprehensive public awareness campaign,

similar to initiatives in European countries and the United Kingdom, is necessary to ensure that individuals from diverse backgrounds understand the importance of responsible antibiotic use. Moreover, continuous professional development programs for healthcare providers are essential to keep them up-to-date with the latest evidence on antibiotic resistance. Secondly, implementing restraints through incentives and rewards, combined with strict penalties for misuse, is crucial to ensuring compliance with AMR laws. Encouraging healthcare facilities and professionals to adhere to guidelines through positive reinforcement can be a game-changer. Lastly, India must invest in research and development of alternative approaches to combat infections, reducing reliance on traditional antimicrobials. Additionally, optimizing dosing practices for existing antibiotics can mitigate the risk of overuse. Failure to implement these policies could result in negative consequences for India. The unchecked rise of AMR could lead to a surge in untreatable infections, higher mortality rates, increased healthcare costs, and a significant burden on the healthcare system. Furthermore, India's large population and diverse healthcare landscape necessitate immediate action to avoid a healthcare crisis.

The policies proposed here offer a comprehensive framework to address this pressing issue, safeguard public health, and ensure a sustainable future for the nation's healthcare system. Additionally, the larger global community benefits from India's proactive stance on AMR, as it aligns with international efforts to combat this global health crisis. By contributing to the containment of AMR, India not only enhances its healthcare system but also aids in preserving the effectiveness of antibiotics on a global scale, benefiting people worldwide.

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