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REVIEW ARTICLE

Silent Tsunami: Tackling Antimicrobial Resistance at the Community Level

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ABSTRACT

Antimicrobial resistance (AMR) is an escalating global public health crisis with far-reaching consequences. In India, AMR poses a formidable challenge, driven by irrational antibiotic use in humans and animals, unregulated over-the-counter (OTC) sales, and inadequate surveillance at the primary care level. This editorial examines the multifactorial roots of AMR in Indian communities, evaluates national responses such as the National Action Plan on AMR (2017-2021), and highlights the critical need for community-centered interventions. Strengthening stewardship at primary healthcare, enforcing pharmacy regulations, addressing veterinary misuse, and integrating AMR awareness into public health programs are essential strategies. Without decisive and coordinated community-level action, the silent tsunami of AMR threatens to reverse public health achievements and compromise India's journey towards universal health coverage.

Key Words: Antimicrobial resistance (AMR), Silent Tsunami, Community,

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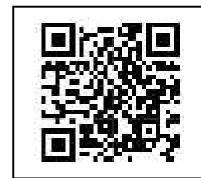

Introduction

Antimicrobial resistance (AMR) represents one of the gravest threats to global health, food security, and economic development in the 21st century. The World Health Organization (WHO) warns that AMR could cause 10 million deaths annually by 2050 if unaddressed, surpassing the current toll of cancer-related deaths worldwide[1]. In India, the problem is more acute due to the high burden of infectious diseases, widespread antibiotic misuse, and fragile health system governance. The Indian Council of Medical Research (ICMR) reported alarming resistance patterns in pathogens such as *Klebsiella pneumoniae* and *Escherichia coli*, rendering common antibiotics ineffective[2].

Although often framed as a hospital or clinical problem, AMR is fundamentally a **community-driven crisis**. The overuse of antibiotics in primary care, OTC sales without prescriptions, self-medication, and misuse in agriculture and animal husbandry are major drivers[3]. This silent tsunami is eroding the efficacy of antimicrobials at the grassroots level, disproportionately affecting rural and underserved populations who already face healthcare access barriers.

Community Roots of Resistance

***Over-the-Counter Sales and Self-Medication*:** One of the most significant contributors to AMR in India is the easy availability of antibiotics without prescriptions. Studies indicate that more than 66% of antibiotics are sold OTC in Indian pharmacies without proper medical advice . The lack of enforcement of Schedule H and H1 drugs under the Drugs and Cosmetics Act allows informal dispensing, even of last-resort antibiotics like carbapenems .

Self-medication for fever, cough, or diarrhea is prevalent, driven by poor awareness, prior treatment experiences, and long waiting times at government facilities . This unregulated usage often involves incomplete courses or wrong dosages, enabling bacterial adaptation and resistance development.

Informal Providers and Empirical Prescribing**:** In many rural settings, unqualified or semi-qualified providers deliver frontline care. These practitioners often prescribe broad-spectrum antibiotics as first-line treatment, regardless of clinical indication . Even among qualified physicians in low-resource settings, empirical prescribing is common due to lack of diagnostics, patient pressure, and pharmaceutical influence .

Livestock and Agricultural Antibiotic Use**:** India's expanding poultry, aquaculture, and dairy sectors have become significant sources of AMR emergence . Antibiotics are routinely added to animal feed for growth promotion or prophylaxis. These antimicrobials, often the same classes used in human medicine, lead to resistant bacteria in animals that can transfer to humans through food, water, or direct contact[1] .

Waste from farms and a slaughter house contaminates water bodies, creating reservoirs of resistant genes in the environment. Alarmingly, antibiotic residues have been detected in retail meat, fish, and even in household drinking water samples[11].

Environmental Dimensions of AMR**:** Environmental pathways of AMR spread are increasingly recognized. Untreated hospital wastewater, pharmaceutical effluents, and human waste containing resistant bacteria and residues reach rivers, lakes, and soil[12]. Open defecation, lack of wastewater treatment infrastructure, and poor solid waste management further exacerbate the situation[13].

Urban slums and peri-urban areas often were lacking adequate sanitation, become hotspots for resistance transmission. A One Health approach recognizing the interconnectedness of human, animal, and environmental health is essential to address these pathways holistically[1] .

National Action Plan on AMR: Progress and Gaps**:** India was among the first countries to develop a National Action Plan (NAP) on AMR (2017-2021), aligning with the WHO Global Action Plan[1] . The NAP outlines six strategic priorities: awareness generation, rational antibiotic use, infection prevention and control (IPC), AMR surveillance, research, and international collaboration. Despite this progress, implementation has been uneven. While tertiary hospitals have established Antimicrobial Stewardship Programs (AMSPs) and laboratory-based surveillance networks under ICMR's AMRSN, primary healthcare centers (PHCs) and community settings remain excluded from formal stewardship frameworks[1] .State Action Plans on AMR (SAPs) have been developed by a few states Kerala, Madhya Pradesh, and Delhi but many others lag behind due to lack of funding, technical expertise, or political priority[1] .

Bridging the Community Gap: Strategic Interventions: To effectively tackle AMR at the community level, India must adopt a decentralized, people-centered approach. The following strategies are recommended:

1. ***Strengthening Stewardship at Primary Healthcare*****:** Integration of Standard Treatment Guidelines (STGs) into PHC workflows is essential. Medical Officers should be trained to distinguish bacterial from viral infections, guided by point-of-care tools where possible[1] . PHCs and Urban Primary Health Centers (UPHCs) must conduct periodic audits of antibiotic prescriptions to monitor trends and improve practices.
2. ***Enforcing Pharmacy Regulations*****:** The Schedule H1 regulation, introduced to restrict OTC sales of critical antibiotics, requires urgent enforcement. State drug control authorities should strengthen surveillance, penalize errant pharmacies, and conduct regular inspections[1] . Community pharmacists must be sensitized to the public health risks of irrational antibiotic dispensing.
3. ***Community Engagement and IEC Campaigns*****:** AMR awareness must be mainstreamed into Village Health, Sanitation, and Nutrition Committees (VHSNCs), Mahila Arogya Samitis, and school health programs. ASHAs, ANMs, and teachers can be trained to deliver behavior change communication on responsible antibiotic use and hygiene.
4. ***Surveillance in Community Settings*****:** Expansion of surveillance beyond tertiary care to **CHCs, PHCs, and private clinics** is crucial. Rapid reporting systems under Integrated Disease Surveillance Programme (IDSP) should include AMR indicators to detect community-level trends. Public-private partnerships may aid in building laboratory capacity.
5. ***Veterinary Sector Regulation*****:** The Food Safety and Standards Authority of India (FSSAI) and Ministry of Fisheries, Animal Husbandry and Dairying must regulate veterinary antibiotic use. Guidelines on withdrawal periods, labeling, and residue monitoring in meat and milk should be implemented strictly[2] .

6. ***Environmental Monitoring and Waste Management*****:** Hospital effluents, pharmaceutical manufacturing waste, and agricultural runoff must be treated before environmental discharge. AMR-sensitive environmental indicators should be monitored under programs like Swachh Bharat Mission and National Water Quality Monitoring Programme.

Community Awareness through Color Coding of Antibiotics

A promising initiative to curb inappropriate antibiotic use at the community level in India is the adoption of colour-coded indicators on antibiotic packaging. The most widely implemented measure is the Red Line Campaign, launched in 2016 by the Ministry of Health and Family Welfare. A red line drawn on the blister packs of certain medicines signifies that the drug falls under Schedule H or H1 and must not be taken without a valid prescription. The goal is to provide a visual cue to both pharmacists and the general public, warning them against over-the-counter or casual purchase of such medications without proper medical advice[21].

Despite its significance, the campaign has faced challenges due to low community awareness, limited campaign reach, and inconsistent enforcement[22]. A 2022 evaluation of dispensing practices in pharmacies reported that many personnel either ignored or misunderstood the meaning of the red line, and only a fraction of the population was aware of its message[23].

To overcome these barriers, the Kerala state government pioneered an innovative campaign under the ROAR (Rage on Antimicrobial Resistance) initiative, introducing blue covers and blue colour coding for antimicrobial drugs including antibiotics, anti-virals, anti-fungals, and antiparasitics[2] . This measure enhanced visual identification and public vigilance, leading to a reported 20–30% reduction in irrational antibiotic use over one-year[2] .

Encouraged by the Kerala model, discussions are underway at the national level to adopt a blue stripe coding system for all antimicrobials across India[2] . If implemented, such symbolic yet powerful tools coupled with health worker-led education campaign scan significantly improve community awareness and behavioral change regarding responsible antibiotic use[2] .

AMR and Universal Health Coverage: The rise of AMR threatens to derail India's pursuit of Universal Health Coverage (UHC). Drug-resistant infections lead to longer hospital stays, costlier treatment, and higher mortality, pushing vulnerable families into poverty. Programs like ***Ayushman Bharat Pradhan Mantri Jan Arogya Yojana*** (AB-PMJAY) must account for the higher costs of treating resistant infections and prioritize infection control in empanelled hospitals. Moreover, public drug procurement schemes must ensure the availability of narrow-spectrum antibiotics at PHCs and discourage irrational fixed-dose combinations.

Conclusion

Antimicrobial resistance is a slow-burning pandemic that thrives in silence, exacerbated by fragmented systems, unregulated markets, and public apathy. In India, the problem is rooted deep in the community where antibiotics are used freely and resistance spreads quietly, beyond the gaze of policymakers. Tackling AMR requires more than high-level policies; it demands a fundamental shift in community health behavior, stronger regulations, and a coordinated multi-sectoral response.

The clock is ticking. Without urgent, community-focused action, we risk entering a post-antibiotic era where minor infections become lethal and routine surgeries turn perilous. It is time to move from awareness to accountability, from prescription to prevention, and from silence to sustained public health action.

References

1. O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. London: Review on Antimicrobial Resistance; 2016.
2. World Health Organization. Global action plan on antimicrobial resistance. Geneva: WHO; 2015. https://www.who.int/ publications/i/ item/9789241509763.
3. Government of India. National Action Plan on Antimicrobial Resistance 2017 2021. New Delhi: Ministry of Health and Family Welfare; 2017.
4. Laxminarayan R, Duse A, Wattal C, et al. Antibiotic resistance the need for global solutions. Lancet Infect Dis. 2013;13 (12):1057-1098.
5. Gandra S, Joshi J, Trett A, et al. Scoping report on antimicrobial resistance in India. Washington, D.C.: Center for Disease Dynamics, Economics & Policy; 2017.

6. Chokshi A, Sifri Z, Cennimo D, Horng H. Global contributors to antibiotic resistance. J Glob Infect Dis. 2019; 11 (1):36-42.
7. Dik JH, Poelman R, Friedrich AW, et al. An integrated stewardship model: antimicrobial, infection prevention and diagnostic stewardship. Curr Opin Infect Dis. 2016; 29(4):395-400.
8. Van Boeckel TP, Glennon EE, Chen D, et al. Reducing antimicrobial use in food animals. Science. 2017; 357 (6358):1350 1352.
9. ICMR. Antimicrobial Resistance Surveillance Research Network (AMRSN) Annual Report 2022. New Delhi: Indian Council of Medical Research; 2023.
10. Sriram A, Kalanxhi E, Kapoor G, et al. State of the World's Antibiotics 2021: A Global Analysis of Antimicrobial Resistance and Its Drivers. CDDEP and GARP; 2021.
11. Klein EY, Van Boeckel TP, Martinez EM, et al. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. Proc Natl Acad Sci USA. 2018; 115(15): E3463 E3470.
12. Bhardwaj P, Hans C, Mudgal A, et al. Knowledge, attitude and practice regarding antibiotic use and resistance among undergraduate students of a medical college in Delhi, India. Int J Comm. Med Public Health. 2020; 7(5): 1711-1716.
13. Farooqui HH, Selvaraj S, Mehta A. Outpatient antibiotic prescription rate and pattern in the private sector in India: evidence from medical audit data. PLoS One. 2019;14(11): e0224848.
14. Gandra S, Kotwani A. Need to improve availability of "access" group antibiotics and reduce use of "watch" and "reserve" group antibiotics in India for optimum antimicrobial resistance containment. J Pharm Policy Pract. 2019; 12:20.
15. Fleming Fund. Antimicrobial Resistance Country Progress Report: India 2021. https://www.flemingfund.org
16. Ahmad A, Khan MU, Moorthy J, et al. Evaluation of self-medication practices in rural and urban regions of India. Ther Clin Risk Manag. 2015; 11:1697 1704.
17. Bhatia R, Narain JP. The growing challenge of antimicrobial resistance in the South-East Asia Region are we losing the battle? Indian J Med Res. 2010;132(5):482 486.
18. CDDEP India. Antibiotic use and resistance in food animals: India Overview. CDDEP; 2020. Available at: https://cddep.org
19. Sahoo KC, Tamhankar AJ, Johansson E, et al. Antibiotic use, resistance development, and environmental factors: a qualitative study among healthcare professionals in Odisha, India. BMC Public Health. 2010; 10: 629.
20. Mathur P, Dhawan B, Kumar S, et al. Surveillance of antimicrobial resistance in India. Indian J Med Microbiol. 2019; 37 (4):555 562.
21. Government of India. Press Information Bureau. Red Line Campaign for Antibiotics. 2016 [Internet]. [cited 2025 Jul 29]. Available from: https://pib.gov.in/PressReleasePage.aspx?PRID=1479230
22. Ahmad A, Patel I, Mohanta GP, Balkrishnan R. Evaluation of knowledge, attitude and practice about self-medication among rural and urban North Indian population. Int J Pharm Pract. 2015; 23 (6):354–60.
23. Khan ZY, Singh S. Red Line Antibiotics in India: Community Knowledge and Challenges. Int J Pharm Sci Res. 2022; 13 (3):1457–63.
24. OnManorama. Kerala's blue antibiotic packs aim to reduce drug misuse. 2025 May 9 [cited 2025 Jul 29]. Available from: https://www.onmanorama.com/lifestyle/health/2025/05/09/antibiotics-blue-packaging-in-kerala- reasons.html
25. Business Standard. India considers blue strips for antimicrobials to combat misuse. 2024 Sep 18 [cited 2025 Jul 29]. https://www.business-standard.com/india-news/india-considers-blue-strips-for-anti-microbials-to-combat-drug-misuse-124091800471_1.html.
26. Sharma S, Gupta A. Public Perception of the Red Line on Antibiotics: A Cross-sectional Study in Delhi. J Family Med Prim Care. 2020; 9 (12):6250–4.
27. Darshan Medical College Blog. Cracking the Code: Meaning behind the Red Strip. 2024 Mar 18 [cited 2025 Jul 29]. https://medcollege darshan.com/ index.php/2024/03/18/cracking-the-code-the-hidden-meaning-behind-medicines- red-strip/.