INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

Review Article

Antibiotic Stewardship Future for Healthy India

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ARTICLE INFO

Published: 9 Apr 2026
Keywords:
Antimicrobial resistance, obstacles, factors, India, issue load, approaches
DOI:
10.5281/zenodo.19483663

ABSTRACT

In numerous low- and middle-income nations, untrained providers play a significant role in the distribution of antibiotics, but their inappropriate use may exacerbate the problem of drug-resistant infections. In India's diverse healthcare system, informal providers (IPs) who practice allopathic medicine outnumber formal healthcare providers yet operate within a regulatory framework that lacks clarity regarding their legitimacy, leading to distinct challenges for antibiotic stewardship. Employing a systems approach, we examined the various intrinsic (provider-specific) and extrinsic (community, health, regulatory environment, and pharmaceutical industry) factors that influence antibiotic distribution by IPs in rural West Bengal to guide the development of community stewardship initiatives. We conducted a survey of 291 IPs in randomly chosen village clusters across two contrasting districts and carried out in-depth interviews with 30 IPs and 17.1

INTRODUCTION

Because of the growing problem of antibiotic resistance, a lot of groups like the Infectious Disease Society of America (IDSA), the Society for Healthcare Epidemiology of America (SHEA), and the American Society of Health System Pharmacists (ASHP) have said that managing antibiotic use is super important in healthcare these days. So, what exactly is managing antibiotic use? The IDSA basically says it's about using antibiotics wisely and in an organized way to get the best results. One way to do this is by setting up official programs in hospitals to oversee antibiotic use. This article aims to give you some ideas about what makes hospital antibiotic management programs work well.3

IMPACT OF AMR ON COVID-19 CLINICAL CARE.

Patients with COVID-19 may be given antimicrobial therapy for two primary reasons. First, the symptoms of COVID-19 often resemble those of bacterial pneumonia, making it difficult to differentiate between viral and bacterial infections. Diagnostic tools used for this purpose may be slow

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

or unreliable in urgent situations. For instance, rapid tests like C-reactive protein (CRP), which is typically elevated in bacterial infections, can also show increased levels in COVID-19 patients. As a result, many hospitalized patients receive empiric antibiotic treatment even without confirmed bacterial infection.

Second, COVID-19 patients may develop secondary bacterial co-infections that require antimicrobial treatment. Although current evidence suggests that the rate of such infections is relatively low (less than 20%), more comprehensive and high-quality data are needed to better understand their prevalence, causative organisms, and the influence of patient risk factors. Many existing studies have not focused primarily on co-infections, highlighting the need for standardized definitions and diagnostic criteria to enable more detailed analysis, especially in settings with adequate laboratory infrastructure.

Clinical decisions regarding antimicrobial use are often guided by local stewardship protocols and antimicrobial susceptibility patterns. Empiric therapy is generally broad-spectrum to cover a wide range of potential pathogens, but this approach must be balanced carefully. Clinicians face the challenge of ensuring effective treatment while avoiding unnecessary use of antibiotics, particularly those considered last-resort. Both overuse and underuse of appropriate antimicrobials have been linked to increased mortality.

Additionally, concerns about resistant pathogens may lead to excessive use of last-resort antibiotics in COVID-19 patients. In regions with high resistance rates, drugs like colistin may be used as first-line therapy for suspected infections, despite their higher risk of adverse effects. On the other hand, if empiric treatment does not align with local resistance patterns, patients may receive ineffective therapy, which can increase mortality rates and healthcare costs.10

HOW TO SET UP AN ANTIMICROBIAL STEWARDSHIP PROGRAM

The best way for a hospital to manage its use of antibiotics involves a core team of three people: a clinical pharmacology expert with a Doctor of Pharmacy degree and at least two years of specialized training in infectious diseases, ideally from a program recognized by the American College of Clinical Pharmacy. Also on the team should be an infectious disease doctor who is board-certified, and a doctorate-level director for the clinical microbiology lab, also board-certified. Ideally, all these key people should work full-time at the hospital running the program, though it's acknowledged this isn't always feasible. The clinical pharmacology specialist is expected to dedicate all their working hours to the program. The infectious disease doctor and the microbiology lab director would split their time between this program and other duties, with how much time they spend depending on how big and complex the hospital's antibiotic management efforts are. Of course, the number of staff needed might change depending on the hospital's size and the types of patients it serves.4

ANTIMICROBIAL DEFINED DAILY DOSE (DDD)

The most commonly used measure for antimicrobial consumption is the Defined Daily Dose (DDD). This concept was introduced in the 1970s and later improved by the World Health Organization Collaborating Centre for Drug Statistics Methodology.

DDD is defined as the average maintenance dose per day of a drug when used for its main indication in adults. In simple terms, it represents the typical

amount of a drug that an average patient would receive in one day for treatment.

However, DDD was not originally designed for antimicrobial stewardship purposes and has several limitations in this context. For example, it can overestimate drug use when combination therapy is used, even if such therapy is more appropriate or narrower in spectrum. It may also disadvantage situations where higher doses are required, such as in obese patients or those with central nervous system infections. On the other hand, reduced doses in patients with renal impairment can lead to underestimation of drug exposure.

DDD is also not suitable for pediatric patients, as dosing varies widely and cannot be accurately represented. Additionally, since actual prescribed doses often differ from standard DDD values, it becomes difficult to estimate the duration of therapy or compare the use of different antimicrobials.

Despite these limitations, DDD has advantages. It is relatively easy for hospitals to calculate using available pharmacy data, such as drug dispensing or consumption records. This allows institutions to express antimicrobial use as DDD per 1,000 patient-days. It also enables comparison of antimicrobial consumption between hospitals. Because of these benefits, organizations like the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America recommend using DDD per 1,000 patient-days as a standard metric in hospital antimicrobial stewardship programs.5

IMPROVING ANTIBIOTIC SUPPLY AND QUALITY

Improving the antibiotic supply chain and ensuring quality requires building on successful models such as those implemented in Delhi and Tamil Nadu, where procurement was centralized and prioritized essential medicines for the population. A similar strategy was adopted in India when revising the National List of Essential Medicines in 2011, reducing the number of listed antibacterial drugs from 28 in 2003 to 21. This reduction reflects progress toward minimizing antibiotic misuse, safeguarding the effectiveness of critical drugs, and limiting antimicrobial resistance.

However, the major challenge lies in effectively implementing this list across different levels of healthcare facilities and systems. Evidence from other countries shows that integrating essential drug programmes with procurement strategies can significantly reduce antibiotic use. Such programmes help streamline procurement processes and ensure that only necessary and appropriate medicines are purchased. Nevertheless, simply raising awareness about the drugs included in the essential medicines list is not sufficient to influence prescribing practices or improve outcomes.9

CHALLENGES

Key challenges in controlling AMR include:

- Weak surveillance systems
- Lack of standard treatment guidelines
- Inappropriate prescribing practices
- Easy availability of antibiotics without prescription
- Poor sanitation and high disease burden
- Low public awareness
- Limited government commitment and coordination
- Fragmented healthcare efforts. 11

STRATEGIES TO COMBAT ANTIMICROBIAL RESISTANCE

A national alliance should be formed to address antimicrobial resistance (AMR), involving all major stakeholders. This alliance must adopt a coordinated approach that includes both healthcare providers and the community. Key participants on the provider side include policymakers, healthcare planners, clinicians, pharmacists, hospital administrators, diagnostic and pharmaceutical industries, and the animal husbandry sector. On the consumer side, patients and the general public play an equally important role.

The execution of national AMR control strategies should be managed by a multidisciplinary national steering committee led by a senior health authority, supported by expert advisory groups.

Effective surveillance systems must be established in both human and veterinary health sectors to generate accurate data on AMR patterns, antimicrobial usage, and their economic and health impacts. This can be achieved through designated national and regional reference centers. Additionally, the use of antimicrobials for non-therapeutic purposes, such as growth promotion in livestock, agriculture, and fisheries, should be discouraged.

Standardized national treatment protocols and infection control guidelines should be developed and implemented across all healthcare and veterinary settings. Their success depends on proper training, continuous medical education, and the establishment of drug and therapeutic committees as well as infection control committees in healthcare facilities. Emphasis should be placed on cost-effective practices like patient isolation and proper hand hygiene.

To promote rational drug use and improve patient care, strict regulations are needed to prevent over-the-counter sale of antibiotics without a valid prescription. At the same time, uninterrupted availability of essential, high-quality medicines must be ensured in both hospitals and communities. Strengthening immunization programs is also crucial to reduce infection rates.

Operational research should be encouraged to better understand both technical and behavioral aspects of AMR prevention. The findings from such studies should be incorporated into national health policies and programs.

Collaboration with the pharmaceutical industry is essential to ensure proper regulation, ethical promotion, and marketing of antimicrobial drugs, as well as to support the development of new antibiotics and vaccines.

Awareness and educational initiatives should be conducted for both healthcare professionals and the general public to promote responsible antimicrobial use.

Finally, communicable disease control programs should be strengthened to reduce the overall disease burden. Greater emphasis should also be placed on infectious disease education within medical training and healthcare services.

Effective control requires strong national policies, better regulation, improved education, and coordinated action among stakeholders.11

EASE OF AVAILABILITY OF ANTIBIOTICS

In many developing countries, regulation of pharmaceutical sales is weak, making antibiotics easily accessible without a prescription. This widespread availability is a major driver of antibiotic resistance, as people often self-medicate or receive drugs from untrained health workers. For example, in Minya, Egypt, about 81% of pharmacists were found to prescribe antibiotics for common colds. Similarly, across regions in Asia,

Africa, and Latin America, antibiotics can be obtained from pharmacies, hospitals, roadside vendors, and even informal sellers without proper authorization.

In rural Bangladesh, a study involving 2,000 individuals revealed that 95% of medicines were obtained from local pharmacies, yet only 8% were prescribed by qualified doctors. In India, research on tuberculosis patients visiting 623 pharmacies in major cities showed that while 61% of confirmed TB cases were appropriately referred without dispensing drugs, only 13% of suspected cases received such proper management. The situation may be even worse in rural areas, where high illiteracy and the presence of unqualified practitioners further aggravate the issue. Although countries like India are working toward stricter regulations, significant progress is still needed.

Additionally, many rural regions face a shortage of trained and certified healthcare professionals. As a result, unqualified practitioners and traditional healers often take on the role of diagnosing and treating illnesses, frequently prescribing antibiotics without proper knowledge. A study in rural India on childhood diarrhea and pneumonia found that out of 340 healthcare providers, 80 had no formal education. These untrained practitioners were more likely to recommend inappropriate or harmful treatments, largely due to their limited awareness of the risks associated with improper antibiotic use.13

RESULTS

A total of 146 studies that met the inclusion criteria were analyzed. Most of these studies were carried out within the past five years, primarily in North America (49%), followed by Europe (25%) and Asia (14%). In contrast, only a small number of studies originated from Africa, South America, and Australia (each contributing about 3%). The majority of the research was conducted in hospitals with 500–1000 beds, focusing mainly on outcomes such as length of stay (LOS) and antibiotic expenditure. Most studies reported a reduction in LOS (85%) and antibiotic costs (92%) after implementing antimicrobial stewardship programs (ASPs).

The average cost savings differed depending on hospital size and geographic region. In studies conducted in the United States, the mean savings were approximately $732 per patient, with a range from $2.50 to $2640, and similar patterns were observed in European studies. The primary factor contributing to these savings was the reduction in hospital stay duration. Additionally, hospitals that implemented comprehensive ASPs—especially those involving therapy review and antibiotic restriction policies—achieved greater cost savings.6

CONCLUSION

Various animal health and drug-use practices that may contribute to antimicrobial resistance (AMR) have been identified. Their impact can be better understood by involving stakeholders through a “theory of change” approach. It is important to promote interventions targeting AMR from an animal health perspective and to explore incentives that encourage their wider adoption.8

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to all the researchers and authors whose valuable studies and publications formed the foundation of this review article. Their contributions, accessed through Google Scholar, have been extremely helpful in understanding the issue of antibiotic misuse and antimicrobial resistance in developing countries.

I am also thankful to my teachers and mentors for their guidance, support, and encouragement throughout the preparation of this review. Their insights helped in critically analyzing and organizing the information effectively.

Finally, I extend my appreciation to my institution for providing the necessary resources and environment to successfully complete this work.

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HOW TO CITE: Neha Kamble, Sanika Kadam, Srushti Kadam, Ashok Giri, Antibiotic Stewardship Future for Healthy India, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 4, 1483-1488. https://doi.org/10.5281/zenodo.19483663