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Antibiotic Prescribing Practices and Adherence to ICMR Treatment Guidelines: A Narrative Review

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ABSTRACT

BACKGROUND:

Antimicrobial resistance is a growing public health concern, largely driven by inappropriate and unnecessary antibiotic use. Such practices can result in treatment failure, adverse effects, and higher healthcare costs. In India, antibiotic prescribing varies across healthcare settings, and despite ICMR efforts to promote rational use and antimicrobial stewardship, gaps in prescribing and guideline adherence persist due to diagnostic, resource, and implementation challenges.

OBJECTIVE: To synthesize evidence on antibiotic prescribing practices, adherence to ICMR treatment guidelines, gaps in rational prescribing, and the impact of antimicrobial stewardship interventions in Indian healthcare settings.

METHODOLOGY: A narrative review was conducted using PubMed, Google Scholar, and Scopus. Studies addressing antibiotic prescribing, ICMR guidelines, and antimicrobial stewardship in India were reviewed. A total of 18 eligible observational, cross-sectional, and prescription-audit studies were included and narratively synthesized.

RESULTS: The included studies showed considerable variation in guideline adherence. An ICMR multicenter evaluation of 4,838 prescriptions reported that 55.1% were guideline-concordant, while 9.8% showed unacceptable deviations. Complete adherence to the 4Ds of antimicrobial stewardship was 64.5%, with adherence ranging from 65% to 72% across drug selection, dose, route, and duration. Although 65% of hospitals had written prescribing guidelines, only 25% monitored antibiotic-use data and 30% conducted prescription audits with feedback. Major gaps included inadequate culture utilization, delayed de-escalation, and limited intravenous-to-oral conversion. Stewardship interventions improved appropriate prescribing from 66% to 86%, reduced antibiotic exposure per patient, and lowered antimicrobial costs by 14.4%.

CONCLUSION: Adherence to ICMR treatment guidelines remains inconsistent across Indian healthcare settings. Guidelines alone are insufficient to ensure rational antibiotic use. Strengthening sustainable, multidisciplinary antimicrobial stewardship through regular prescription audits, monitoring, feedback, diagnostic support, and prescriber education is essential to improve guideline adherence and promote rational antibiotic use in India.

KEYWORDS: Antimicrobial stewardship; ICMR guidelines; antibiotic prescribing; rational antibiotic use; prescription audit; 4Ds; India.

1. INTRODUCTION:

Antibiotics are valuable drugs and have significantly reduced the burden of morbidity and mortality in bacterial infections. Their inappropriate and overuse however causes resistance, treatment failure, side-effects and health care cost. Promoting their rational use in India where prescribing patterns vary across health-care settings is very necessary. In a multicenter evaluation of prescriptions from tertiary-care hospitals of the USA and Europe, there was evidence of significant prescribing deviations from suggested guidelines, this emphasizes importance of regular evaluation of prescribing patterns¹.

Rational antibiotic prescribing needs an appropriate choice of the indication, antimicrobial, dose, route, duration and patient is reviewed according to

response, and available microbiological data. At a public community health center in North India, some deficiencies in antibiotic prescribing and documentation have been demonstrated, decision making was mostly based on clinical evaluation with poor use of microbiology data²

Antimicrobial stewardship is defined as an organized approach to optimizing antibiotic therapy. Antibiotic therapy has been reviewed and validated according to the 4Ds-right drug, right dose, right duration, and right de-escalation-and even when many prescriptions were found to be rational therapy, some aspects may still have been deficient. This clearly points to the fact that we have to review antibiotics used against established treatment guidelines, instead of simply assessing prescribing of the antibiotic alone as rational therapy³.

Indian Council of Medical research (ICMR) have significantly promoted the use of rational medicine and the antimicrobial stewardship in India. There are rational use of medicine center's supported by ICMR. These centers have facilitated the review of prescription and prescribing quality in tertiary care institutions. Data from the ICMR's multicentered survey, based on the review of prescription and prescribing quality among prescription at tertiary care institutions across various centers of Indian Council of Medical Research showed persistent deficit in the prescription quality⁴.

Effective implementation also requires regular monitoring of antibiotic use, prescribing audit and feedback. Survey for antimicrobial use practices at tertiary care institutions showed that available prescribing guidelines were written, and surveillance of use and prescribing audits with feedback were more inconsistent⁵,

Adherence to treatment guidelines varies across institutions due to differences in diagnostic facilities, staffing, resources and prescribing practices. Therefore, evaluating antibiotic prescribing against ICMR guidelines is essential to identify inappropriate use and existing gaps. This narrative review aims to synthesises the available evidence on antibiotic prescribing practices and adherence to ICMR guidelines in India.

2. NEED FOR THE ASSESSMENT:

- 2 **Challenges in implementing treatment guidelines:** Even though there are available guidelines for treatment, the proper prescription of antibiotics can be affected by a lack of diagnostic facilities, limitations on resources, and inconsistent compliance.⁷
- 3 **Importance of antimicrobial stewardship in hospitals:** It is important to carry out structured stewardship activities, such as reviewing prescriptions and providing monitoring and feedback, if the quality of antibiotics is to be improved and their use made more rational.⁸
- 4 **Need for regular prescription audit:** The stewardship programmes that are supported by ICMR place particular emphasis on carrying out regular audits of prescriptions, providing feedback and carrying out monitoring in order to detect the inappropriate use of antibiotics and to improve compliance with the recommended practices.⁹
- 5 **Persistence of inappropriate antimicrobial therapy:** The improper use of antibiotics still takes place in even the most advanced hospitals, which shows that it is necessary to evaluate the choice of antibiotics as well as the dose, duration and other prescribing factors according to treatment guidelines.¹⁰
- 6 **Need to strengthen stewardship interventions:** Prescription review, education and monitoring can all help to improve the way in which drugs are prescribed and reduce the use of inappropriate antibiotics, and so should be consistently put into practice in healthcare institutions.¹¹
- 7 **Importance of targeted antimicrobial therapy:** Effective stewardship can assist in changing antibiotic use from unnecessary empirical therapy to targeted treatment which is based on clinical and microbiological information.¹²
- 8 **Need for continuous evaluation of antibiotic prescribing:** It is possible to detect gaps and improve compliance with the ICMR treatment guidelines by regularly evaluating antibiotic use, the appropriateness of prescriptions, and adherence to the recommended practices.¹³

3. METHODOLOGY

3.1 Study Design

This study was conducted as a **narrative review** to synthesise evidence on **antibiotic prescribing, utilisation and adherence to ICMR treatment guidelines** in Indian healthcare settings. The narrative approach was used to bring together findings from studies with different designs, identify common prescribing patterns and highlight gaps in guideline adherence and implementation.

3.2 Literature Search Strategy

A literature search was conducted in **PubMed, Google Scholar and Scopus** to identify relevant studies published during the selected review period in the Indian healthcare setting. **MeSH terms and free-text keywords** related to antibiotic prescribing, antibiotic utilisation, antimicrobial stewardship, ICMR guidelines, guideline adherence, rational antibiotic use and prescription audit were combined using the Boolean operators "**AND**" and "**OR**".The

main search terms and combinations used are presented in **Table 1**.

Table 1. Search terms and Boolean operators used for the identification of eligible studies.

Primary Concept	Boolean Operators	Secondary Concepts
Antibiotic Prescribing	AND / OR	“antibiotic prescribing” OR “antimicrobial prescribing”
ICMR Guidelines	AND / OR	“ICMR guidelines” OR “treatment guidelines”
Guideline Adherence	AND / OR	“guideline adherence” OR “guideline compliance”
Antimicrobial Stewardship	AND / OR	“antimicrobial stewardship” OR “antibiotic stewardship”
Healthcare Setting	AND / OR	India OR Indian hospitals

These keywords were selected based on previous literature and systematic reviews assessing antimicrobial stewardship practices

3.3 Eligibility Criteria

3.3.1 Inclusion Criteria

- **Relevant studies:** Studies evaluating overall antibiotic prescribing, antibiotic utilisation, rational antibiotic use, or adherence to **ICMR treatment guidelines** in India.
- **Study population and setting:** Studies conducted in Indian healthcare settings involving antibiotic prescriptions, prescribers, or healthcare institutions.
- **Study designs:** Observational, cross-sectional, prospective, retrospective, prescription-audit, and antimicrobial stewardship studies reporting relevant prescribing or guideline-adherence findings.
- **Publication criteria:** Full-text articles published in **English** within the defined review period, with sufficient information on antibiotic prescribing or adherence to treatment recommendations.

3.3.2 Exclusion Criteria

- **Irrelevant studies:** Studies not addressing antibiotic prescribing, utilisation, antimicrobial stewardship, or adherence to treatment guidelines.
- **Disease- or drug-specific studies:** Studies restricted to a single infectious disease or a single antibiotic/antibiotic class without providing evidence on overall antibiotic prescribing practices.
- **Non-relevant publications:** Editorials, commentaries, letters, conference abstracts, protocols, and studies without sufficient primary data.
- **Duplicate or inaccessible articles:** Duplicate publications and studies for which the full text was unavailable or did not provide adequate information for assessment.

3.4 Study Selection

All retrieved articles were screened by title and abstract for relevance to **antibiotic prescribing, utilisation, and adherence to ICMR treatment guidelines**. Potentially eligible studies were assessed through full-text review. Articles were included when they evaluated **overall antibiotic prescribing practices, rational antibiotic use, guideline adherence, or antimicrobial stewardship** in Indian healthcare settings and provided relevant findings on compliance with ICMR or national treatment recommendations. Duplicate, disease-specific, and irrelevant studies were excluded.

3.5 Data Extraction

Relevant information from the included studies was extracted using a structured data collection format. The extracted information included:

- Author(s), year, study design and healthcare setting.
- Sample size and study population/prescriptions assessed.

- Antibiotic prescribing or utilisation measures and assessment criteria.
- Key findings on adherence, non-adherence and factors influencing rational antibiotic use.

3.6 Data Synthesis

A **narrative and thematic synthesis** was used to summarise the findings. Studies were grouped according to:

- Antibiotic prescribing and utilisation patterns.
- Adherence to ICMR treatment guidelines.
- Appropriateness and rationality of antibiotic therapy.
- Gaps and factors influencing guideline-concordant prescribing.

The findings were compared to identify common prescribing patterns, variations in guideline adherence, and major gaps in rational antibiotic use. Particular emphasis was placed on the extent to which antibiotic prescribing practices were consistent with **ICMR treatment recommendations and antimicrobial stewardship principles**.

3.7 Ethical Considerations

As this narrative review used only **previously published literature** and did not involve human participants, patient-identifiable information, or direct data collection, **institutional ethical approval was not required**.

4. RESULTS

4.1 Study Selection and Characteristics:

A total of **18 articles** were included in this narrative review. The studies examined **antibiotic prescribing and utilisation, adherence to ICMR treatment guidelines, and antimicrobial stewardship practices** across various healthcare settings in India. The included studies used different observational and audit-based approaches. Overall, the findings showed **considerable variation in prescribing practices and guideline adherence**, with notable gaps in rational antibiotic use.

4.2 Antibiotic Prescribing and Adherence to Treatment Guidelines:

The included studies showed **variable adherence to recommended antibiotic prescribing practices**. An ICMR multicentre assessment found that **55.1% of 4,838 prescriptions were appropriate**, while 9.8% had unacceptable deviations with potential clinical and economic consequences.¹ Community health centres reported inappropriate use of broad-spectrum and precautionary antibiotics, influenced by social and institutional factors.² Using the 4Ds of antimicrobial stewardship, appropriate drug, dose, route and duration were achieved in **72%, 69%, 71% and 65%** of prescriptions, respectively, with **64.5% showing complete adherence**.³ Variations in prescribing quality across tertiary-care centres further highlighted the need for systematic guideline-based evaluation.⁴

4.3 The implementation of the antimicrobial stewardship and ICMR recommendations:

Although **65% of institutions had antimicrobial prescribing guidelines**, only 25% analysed antibiotic-use data and 30% conducted prescription audits with feedback, highlighting a gap between guidelines and their implementation.⁵ ICMR emphasised antibiotic policies, antimicrobial-use surveillance, audits, feedback, multidisciplinary teams and professional education as key stewardship measures.⁶ In primary and secondary care, **limited resources, inadequate microbiology services and poor adherence** remained major barriers.⁷ Antibiotic use in government hospitals also declined from **61.75% to 39%** over four quarters.⁸ Expanded ICMR-supported stewardship initiatives further improved institutional stewardship and infection-control practices despite ongoing resource limitations.⁹

4.4 The Suitability of Therapy and the Effect of Stewardship Interventions:

Studies have shown persistent gaps in appropriate antibiotic use, mainly due to inadequate culture collection, delayed de-escalation and limited IV-to-oral conversion.¹⁰ Stewardship interventions improved appropriate prescribing from 66% to 86%, reduced antibiotics per patient from 4.41 to 3.86, and lowered antimicrobial costs by 14.4%.^{11,12} ICMR findings from 20 tertiary-care hospitals also showed improved stewardship infrastructure, although antibiotic prescribing remained high and guideline-concordant prescribing was low.^{13,14} Other studies supported audit, feedback and multidisciplinary review as effective strategies for optimising antibiotic therapy.^{15–117} Overall, these findings highlight continuing gaps in guideline adherence and the need for sustained antimicrobial stewardship efforts.

5. SUMMARY

The detailed characteristics and principal findings of the included studies are summarized in Table 2.

S. No.	Author (Year)	Study Design	Study Population / Setting	Key Findings
1	Shetty et al. (2024)	Cross-sectional observational	4,838 prescriptions; 13 ICMR-RUMCs	55.1% were appropriate and guideline-concordant; 9.8% had unacceptable deviations.
2	Mukherjee et al. (2024)	Observational	Public community health centre, North India	Broad-spectrum and precautionary prescribing were identified; social, cultural and institutional factors influenced antibiotic use.
3	Dixit et al. (2021)	Prospective observational	304 medical-ward patients	Adherence to drug, dose, route and duration was 72%, 69%, 71% and 65%, respectively; complete 4D adherence was 64.5%.
4	Joshi et al. (2022)	Multicentre cross-sectional	4,838 prescriptions; 13 ICMR-RUMCs	Antimicrobials were prescribed in 17.63%; 38.65% of prescriptions were incomplete, indicating gaps in rational prescribing.
5	Walia et al. (2015)	Multicentre survey	20 tertiary-care hospitals	Guidelines were available in 65% of hospitals; only 25% analysed antimicrobial-use data and 30% performed prescription audit and feedback.
6	Walia et al. (2019)	National AMS programme report	Indian healthcare institutions	Emphasised hospital antibiotic policies, surveillance, prescription audit, feedback, antibiograms and professional education.
7	Stakeholder study (2023)	Qualitative study	Primary and secondary public healthcare facilities, India	Limited diagnostics, inadequate resources and implementation barriers affected adherence; stronger audit and monitoring were recommended.
8	Government hospital study (2021)	Hospital-based stewardship study	Government hospital, India	Antibiotic use declined over successive monitoring periods, supporting structured stewardship and prescription review.
9	ICMR AMSP/ICP expansion (2025)	Implementation assessment	Secondary-care hospitals, India	The programme strengthened stewardship and monitoring structures, although resource and implementation challenges remained.
10	Tertiary-care referral hospital study (2025)	Observational study	Medical-ward patients, tertiary-care hospital	Only 47% received appropriate antimicrobial therapy; gaps included culture use, de-escalation and IV-to-oral conversion.
11	Swamy et al. (2019)	Pilot stewardship study	Medicine unit, tertiary-care teaching hospital	Appropriate prescribing improved from about 66% to 86%; mean antibiotics per patient decreased from 4.41 to 3.86.
12	Central India AMS study (2021)	Intervention study	Tertiary-care institute, Central India	Inappropriate duration was a major reason for intervention; antimicrobial cost decreased by 14.4%.
13	Vijay et al. (2023)	Implementation study	20 tertiary-care hospitals, India	ICMR-supported stewardship implementation strengthened hospital AMS structures and antimicrobial-use monitoring.

S. No.	Author (Year)	Study Design	Study Population / Setting	Key Findings
14	Primary/secondary tier AMS study (2024)	Mixed-method study	Primary- and secondary-tier hospitals, India	Antibiotics were prescribed in 63.8% of primary-tier and 60.8% of secondary-tier encounters; guideline-concordant prescribing remained low.
15	Singh et al. (2019)	Prospective stewardship study	Tertiary-care centre, South India	About 56% of restricted-antibiotic prescriptions were appropriate; duration was a major reason for intervention.
16	Government hospital AMS study (2021)	Hospital-based stewardship study	Government hospital, India	Sustained AMS activities and monitoring were associated with reduced antibiotic exposure and improved prescribing oversight.
17	AMS rounds study (2025)	Stewardship study	Tertiary-care centre, South India	Regular stewardship rounds helped identify inappropriate therapy and reinforce rational, guideline-based prescribing.
18	ICMR-supported multicentre assessment (2024)	Multicentre assessment	Indian hospitals	Continuous prescription audit, antimicrobial-use surveillance, feedback and institutional stewardship were recommended to improve prescribing.

6. DISCUSSION

This narrative review shows that **antibiotic prescribing and adherence to ICMR treatment recommendations remain inconsistent across Indian healthcare settings**. Although some studies reported appropriate or guideline-concordant prescribing, gaps were observed in antibiotic selection, treatment duration, de-escalation, prescription review and implementation of antimicrobial stewardship activities.^{1–18}

A multicentre ICMR assessment reported that **55.1% of prescriptions were appropriate and guideline-concordant**, while 9.8% showed unacceptable deviations.¹ Similarly, assessment using the 4Ds of antimicrobial stewardship found that only **64.5% achieved complete adherence to drug, dose, route and duration**.³ These findings suggest that simply having treatment recommendations does not always translate into their consistent use in clinical practice.

Differences were also evident across healthcare settings. Community and lower-level facilities faced challenges such as **limited diagnostic facilities, inadequate infrastructure and social or institutional influences on prescribing**.^{2,7,14} Primary- and secondary-care hospitals also showed relatively high antibiotic use with low guideline-concordant prescribing.¹⁴ This highlights the need to improve diagnostic support and practical implementation of national treatment recommendations, particularly in non-tertiary settings.

Role of Antimicrobial Stewardship

The reviewed evidence consistently supports the role of **structured antimicrobial stewardship programmes** in improving antibiotic use. ICMR-supported studies highlighted hospital antibiotic policies, prescription audits, feedback, antimicrobial-use surveillance, antibiograms and multidisciplinary stewardship teams as important components.^{5,6,13}

However, implementation remains uneven. Although many institutions had prescribing guidelines, regular antimicrobial-use monitoring and prescription audit with feedback were less frequently performed.⁵ This demonstrates the gap between **having guidelines and applying them in everyday practice**. Regular monitoring and feedback may therefore be essential for converting recommendations into meaningful prescribing improvements.

Improving Appropriateness of Antibiotic Therapy

Several studies showed that **antimicrobial stewardship can improve antibiotic prescribing**. In one tertiary-care medicine unit, appropriate prescribing increased from **66% to 86%**, while antibiotics per patient decreased from 4.41 to 3.86.¹¹ Another study found only **47% of patients received appropriate therapy**, with inadequate culture collection, delayed de-escalation and failure to switch from intravenous to oral therapy contributing to inappropriate use.¹⁰ These findings highlight the importance of **regular treatment review based on clinical and microbiological response** to reduce unnecessary broad-spectrum antibiotic use and support timely de-escalation.

Challenges to Guideline Adherence

Non-adherence to recommendations appears to result from several factors, including **knowledge gaps, limited diagnostic facilities, workload, resource limitations and institutional prescribing practices**.^{2, 7, 14} Inappropriate treatment duration was also identified as an important area requiring stewardship intervention in tertiary-care settings.^{12, 15}

Thus, improving adherence to ICMR recommendations requires more than prescriber education alone. **Clear and accessible guidelines, diagnostic support, prescription review, feedback and institutional accountability** should work together. Antimicrobial stewardship should be approached as a collaborative effort to improve the quality and safety of antibiotic use rather than as a means of policing prescribers.

Implications for Indian Healthcare

ICMR recommendations provide a strong foundation for **rational antibiotic use in India**, but their impact depends on consistent implementation.^{6, 13} Regular prescription audits, antibiotic-use monitoring, multidisciplinary AMS teams and professional education can help improve prescribing practices. Greater focus is also needed in **primary and secondary healthcare settings**, where limited resources and poor guideline adherence remain challenges.¹⁴ Strengthening stewardship in these settings is essential for promoting rational antibiotic use across the healthcare system.

7 Limitations and Future Directions

This review has some limitations. The included studies varied in **study design, healthcare setting, population, assessment methods and definitions of appropriate prescribing**, making direct comparisons difficult. Some studies assessed general treatment guidelines or stewardship practices rather than specifically evaluating adherence to ICMR recommendations. In addition, most studies were observational, limiting the ability to establish causal relationships.

Future research should use **standardised measures of guideline adherence**, specifically assess compliance with current ICMR treatment recommendations and evaluate the long-term impact of antimicrobial stewardship interventions. Further evidence from primary and secondary healthcare settings is also needed.

8. CONCLUSION

This narrative review indicates that **antibiotic prescribing and adherence to ICMR treatment recommendations remain variable across Indian healthcare settings**. Although appropriate prescribing was reported in several studies, important gaps remain in antibiotic selection, treatment duration, de-escalation, monitoring and overall guideline adherence.¹⁻¹⁸

The evidence shows that **guidelines alone are not enough** to ensure rational antibiotic use. Prescription audits, antimicrobial-use monitoring, feedback, diagnostic support, continuing education and multidisciplinary antimicrobial stewardship programmes are important for translating ICMR recommendations into routine clinical practice.

Overall, **strengthening the implementation of ICMR treatment guidelines through sustainable, institution-based antimicrobial stewardship programmes** can improve prescribing practices, reduce unnecessary antibiotic exposure and contribute to efforts to control antimicrobial resistance in India.

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