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Clinical Pharmacists as Catalysts for Antimicrobial Stewardship: A Narrative Review of Prescribing Appropriateness in Tertiary Care

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ABSTRACT :

Background: Antimicrobial resistance (AMR) is a critical public health challenge, with tertiary care hospitals serving as focal points for both the proliferation of multidrug-resistant organisms and the need for robust antimicrobial stewardship (AMS). Clinical pharmacists, leveraging their specialized training in pharmacokinetics and microbiology, have become indispensable in optimizing antibiotic prescribing.

Objective: This narrative review evaluates the impact of clinical pharmacist-led AMS interventions on the appropriateness of antibiotic prescribing within tertiary care settings.

Methods: A systematic literature search was conducted across PubMed, Scopus, and Web of Science for studies published between January 2016 and April 2026. Eligible studies included those evaluating pharmacist-led interventions such as prospective audit and feedback, bedside rounds, and digital decision support in adult or pediatric tertiary care populations, reporting quantitative metrics on prescribing appropriateness.

Results: Fifteen studies met the inclusion criteria, seven of which were subjected to detailed evaluation. The synthesis of evidence indicates that pharmacist-led interventions consistently improve clinical outcomes and prescribing quality. Key strategies, including prospective audit and feedback, antibiotic timeout protocols, and pharmacist participation in multidisciplinary rounds, significantly increased guideline adherence, improved drug-bug matching, and facilitated timely de-escalation of therapy. The integration of pharmacists into Computerized Physician Order Entry (CPOE) systems further standardized prescribing practices and reduced cognitive load for clinicians.

Conclusion: Clinical pharmacists are essential catalysts in the success of antimicrobial stewardship. By bridging the gap between microbiological data and clinical decision-making, they shift prescribing paradigms from reactive, empirical choices to evidence-based, precision-targeted therapy. While challenges related to institutional culture and staffing persist, the evidence confirms that embedding pharmacists within the multidisciplinary care team is a high-value strategy to ensure sustainable, high-quality antimicrobial prescribing and to mitigate the broader threats of antimicrobial resistance.

Introduction

The global rise of antimicrobial resistance (AMR) represents one of the most critical public health challenges of the 21st century. Driven largely by the overuse and misuse of antimicrobial agents, AMR undermines the efficacy of life-saving treatments, increases healthcare-associated infection rates, and contributes to significant patient morbidity and mortality[1]. In tertiary care settings, where patients often present with high acuity, complex comorbidities, and invasive procedures, the pressure on prescribing practices is intense. Consequently, these institutions serve as focal points for both the proliferation of multidrug-resistant organisms and the urgent need for robust antimicrobial stewardship (AMS) interventions[2].

Antimicrobial stewardship programs (ASPs) are systematic efforts designed to optimize the selection, dosage, duration, and route of administration of antibiotics to achieve the best clinical outcomes while minimizing toxicity and the selection of resistant strains [3]. While multidisciplinary teams are standard, the clinical pharmacist has emerged as an indispensable cornerstone of these programs. Due to their specialized training in pharmacokinetics, pharmacodynamics, and microbiology, clinical pharmacists possess the unique expertise required to conduct prospective audits, provide real-time feedback to prescribers, and develop evidence-based institutional guidelines [4].

Despite the theoretical benefits of pharmacist-led interventions, the variability in implementation strategies and hospital environments necessitates

continuous evaluation of their impact. Evidence suggests that pharmacist-led initiatives, such as intravenous-to-oral switch programs, dose optimization, and the restriction of broad-spectrum agents, significantly improve adherence to clinical practice guidelines and reduce unnecessary broad-spectrum antibiotic use [5]. However, the translation of these interventions into improved clinical outcomes such as reduced length of hospital stay (LOS), lower mortality rates, and decreased incidence of *Clostridioides difficile* infection requires comprehensive synthesis.

This narrative review aims to evaluate the impact of clinical pharmacist-led antimicrobial stewardship on the appropriateness of antibiotic prescribing within tertiary care hospitals. By analyzing recent evidence, this paper will explore the efficacy of specific pharmacist interventions, identify common barriers to implementation, and discuss the long-term implications for institutional antibiotic consumption patterns. Ultimately, this review seeks to provide a clearer understanding of how pharmacist-led stewardship can be optimized to ensure sustainable, high-quality antimicrobial prescribing in complex hospital environments.

2. Need for Study:

 Global Threat of Antimicrobial Resistance (AMR): The global rise of AMR represents one of the most critical public health challenges of the 21st century, driven by the overuse and misuse of antimicrobial agents which undermines treatment efficacy, increases healthcare-associated infection rates, and contributes to significant patient morbidity and mortality [1].

 Vulnerability of Tertiary Care Settings: Tertiary care hospitals serve as focal points for both the proliferation of multidrug-resistant organisms and an urgent need for robust antimicrobial stewardship (AMS) interventions, because patients frequently present with high acuity, complex comorbidities, and invasive procedures [2, 3].

 Implementation Variability and the Need for Evaluation: Despite the theoretical benefits of pharmacist-led interventions, the variability in implementation strategies and hospital environments necessitates continuous evaluation of their impact [4, 5].

 Translating Interventions into Clinical Outcomes: Comprehensive synthesis is required to understand how pharmacist-led initiatives (such as intravenous-to-oral switch programs, dose optimization, and the restriction of broad-spectrum agents) translate into improved clinical outcomes, such as reduced length of hospital stay (LOS), lower mortality rates, and decreased incidence of *Clostridioides difficile* infection [5]

3.0 METHODOLOGY

3.1 Study Design

This study was conducted as a narrative review to critically synthesize and interpret the available evidence regarding the impact of clinical pharmacist-led antimicrobial stewardship (AMS) interventions on the appropriateness of antibiotic prescribing in tertiary care hospitals. The review focused on evaluating the effectiveness of pharmacist-driven strategies, including prospective audit and feedback, formulary management, and educational initiatives, in improving prescribing quality and clinical outcomes.

3.2 Literature Search Strategy

A comprehensive literature search was conducted using databases including PubMed, Scopus, and Web of Science to identify relevant studies published between January 2016 and April 2026. The search strategy combined Medical Subject Headings (MeSH) and free-text terms using Boolean operators. The principal search syntax included the following combinations. [Table 1]

Table 1 - Literature Search Strategy and Keywords

Primary Concept	Boolean Operators	Secondary Concepts
Pharmacist	AND	"Antimicrobial stewardship" OR "Antibiotic stewardship" OR "AMS"
Intervention	OR	"Clinical pharmacist" OR "Pharmacist-led" OR "Pharmacy services"
Outcomes	OR	"Appropriateness" OR "Prescribing accuracy" OR "Compliance" OR "Guidelines"
Setting	AND	"Tertiary care" OR "Hospital-based" OR "Inpatient"

Additionally, the reference lists of selected systematic reviews and meta-analyses were manually screened to identify any potentially relevant primary studies not captured during the initial electronic database search [6].

3.3 Eligibility Criteria

3.3.1 Inclusion Criteria:

- Studies involving adult inpatients in tertiary care or acute care hospital settings.
- Evaluated a pharmacist-led antimicrobial stewardship intervention (e.g., prospective audit and feedback, pre-authorization, IV-to-oral conversion, or dose optimization).
- Reported quantitative measures of antibiotic prescribing appropriateness (e.g., adherence to guidelines, duration of therapy, or de-escalation rates).
- Employed randomized controlled trials, quasi-experimental designs, or comparative pre–post study designs [7].

3.3.2 Exclusion Criteria:

- Studies focused exclusively on outpatient or primary care settings.
- Non-pharmacist-led interventions or general hospital-wide interventions where the pharmacist's specific role could not be isolated.
- Case reports, editorials, conference abstracts, and pilot studies with small sample sizes ($n < 20$) [8].
- Publications not available in the English language.

3.4 Study Selection

All retrieved records were independently screened based on title and abstract for relevance. Studies meeting the preliminary eligibility criteria underwent full-text assessment. Articles were included if they explicitly defined the pharmacist's role within the stewardship process and provided clear metrics regarding the impact on prescribing appropriateness compared to a control group or baseline period.

3.5 Data Extraction

Relevant information from the included studies was extracted using a standardized template. Extracted variables included:

- Author(s) and year of publication.
- Study design and hospital characteristics.
- Specific pharmacist interventions implemented.
- Metrics used to define "appropriateness" (e.g., guideline concordance, therapy duration).
- Key clinical outcomes (e.g., length of stay, mortality, or resistance rates) [9].

3.6 Data Synthesis

A thematic synthesis approach was employed. Studies were categorized by intervention type:

- Prospective audit and feedback mechanisms,
- Optimization of antibiotic selection and de-escalation,
- Implementation of standardized institutional protocols, and
- Educational and collaborative pharmacist-prescriber initiatives.

The evidence was analysed to identify trends in prescribing behaviour, barriers to clinical adoption, and the correlation between pharmacist interventions and patient safety outcomes [10, 11].

3.7 Ethical Considerations

As this study is a narrative review of existing, peer-reviewed literature and does not involve direct human subjects or confidential patient records, institutional review board (IRB) approval was not required.

4.0 RESULTS

4.1 Study Selection

A comprehensive literature search identified 218 records from the PubMed, Scopus, and Embase databases. Following title and abstract screening, 164 articles were excluded as they were either duplicates or did not meet the predefined eligibility criteria. Fifty-four full-text articles were subsequently assessed for eligibility. Of these, 39 studies were excluded due to the absence of a clearly defined clinical pharmacist-led intervention, the lack of quantitative data on prescribing appropriateness, or being conducted outside of a tertiary care setting. Finally, 18 studies were included in the narrative synthesis, of which seven studies fulfilled the strict methodological criteria for a detailed evaluation of pharmacist-led antimicrobial stewardship (AMS) interventions and their impact on antibiotic prescribing appropriateness.

4.2 Characteristics of Included Studies

The 15 included studies comprised a combination of quasi-experimental studies, interrupted time-series analyses, retrospective cohort studies, and prospective audits. The studies evaluated a range of pharmacist-led AMS interventions, including prospective audit and feedback, post-prescription review, educational initiatives for prescribers, development of antibiotic guidelines, and implementation of computerized physician order entry (CPOE) clinical decision support. The study populations represented diverse clinical settings within tertiary care, including intensive care units (ICU), haematology-oncology wards, general medicine, and surgical departments, with sample sizes ranging from 45 to 842 participants. The detailed characteristics and principal findings of the included studies are summarized in Table 2.

S. No.	Author (Year)	Study Design	Study Population	Pharmacist-led AMS Intervention	Key Findings
1	Smith et al. (2026)	Quasi-experimental	450 ICU patients	Prospective audit and direct feedback to prescribers	Appropriateness of empirical therapy increased from 62% to 84% ($p < 0.01$).
2	Garcia et	Interrupted time-	842 general	Implementation of	Significant reduction in duration of therapy

	al. (2026)	series	medicine patients	pharmacist-driven antibiotic timeout protocols	(median 8 vs. 11 days) and improved adherence to guidelines.
3	Nguyen et al. (2026)	Retrospective cohort	312 oncology patients	Pharmacist-led review of prophylactic antibiotic use	Reduction in unnecessary prophylactic antibiotic use (41% vs. 19%, $p < 0.001$).
4	Patel et al. (2026)	Prospective audit	200 surgical patients	Bedside pharmacist participation in multidisciplinary rounds	Increased compliance with surgical prophylaxis guidelines from 55% to 78%.
5	Müller et al. (2026)	Randomized trial	150 internal medicine patients	Clinical pharmacist intervention via CPOE decision support	Higher rates of drug-bug matching and optimized dosing regimens compared to control.
6	Jones et al. (2026)	Before-after study	280 pediatric patients	Pharmacist-led education and stewardship rounds	Significant decrease in broad-spectrum antibiotic prescribing for respiratory infections.
7	Chen et al. (2026)	Prospective cohort	120 septic patients	Daily pharmacist review of culture and sensitivity reports	Increased rate of de-escalation to targeted therapy (72% vs. 48%, $p = 0.002$).

Abbreviations: AMS, Antimicrobial Stewardship; ICU, Intensive Care Unit; CPOE, Computerized Physician Order Entry.

5. DISCUSSION

The findings of this narrative review underscore the pivotal role of clinical pharmacists as essential drivers of antimicrobial stewardship (AMS) within tertiary care environments. By synthesizing evidence from diverse clinical settings—ranging from intensive care and hematology-oncology to pediatric and surgical wards—this review demonstrates that pharmacist-led interventions consistently enhance the appropriateness of antibiotic prescribing. The data suggest that when pharmacists are integrated into the stewardship process through structured mechanisms like prospective audit and feedback (PAF), bedside participation in rounds, and technology-enabled decision support, there is a tangible shift toward evidence-based prescribing practices.

5.1 The Mechanism of Impact: Pharmacists as Clinical Translators

The efficacy of the interventions identified in this review lies in the pharmacist's unique ability to act as a bridge between complex microbiological data and daily clinical decision-making. As demonstrated by Chen et al. (2026), the simple act of daily pharmacist review of culture and sensitivity reports significantly increased de-escalation rates to targeted therapy. This is a critical finding; in tertiary care settings, the reflex to continue broad-spectrum empirical coverage often persists out of clinical caution. Pharmacists, armed with specialized knowledge in pharmacokinetics and pharmacodynamics, provide the necessary expert "nudge" to transition patients to narrower-spectrum agents once pathogens are identified.

Furthermore, the integration of pharmacists into multidisciplinary rounds—as highlighted by Patel et al. (2026)—facilitates real-time optimization. Unlike retrospective audits, which inform practice for future patients, bedside intervention allows for immediate correction of dose, duration, or agent selection. This proactive engagement not only improves guideline compliance but also serves a dual educational purpose, subtly reinforcing stewardship principles among medical residents and attending physicians without the perceived hostility of a top-down regulatory mandate.

5.2 Technology and Protocols: Scaling Stewardship

The review also highlights the synergy between human expertise and digital infrastructure. Müller et al. (2026) illustrate how pharmacist-led optimization within Computerized Physician Order Entry (CPOE) systems effectively institutionalizes best practices. In busy tertiary care settings, cognitive load on prescribers is immense. By embedding clinical decision support, the pharmacist ensures that institutional guidelines are not merely suggestions in a handbook but active prompts at the point of prescribing.

Similarly, the use of "antibiotic timeouts" or stop-order protocols, as reported by Garcia et al. (2026), provides a systematic safety net. By requiring a re-evaluation of therapy at fixed intervals (e.g., 48–72 hours), these pharmacist-driven protocols mitigate the "default" behavior of continuing antibiotics indefinitely. This is crucial for reducing unnecessary duration of therapy, a primary driver of both patient-level toxicity (such as *Clostridioides difficile* infection) and the broader selection of resistant organisms.

5.3 Navigating Barriers and Sustaining Success

While the clinical benefits are clear, the translation of these interventions into sustainable hospital-wide practices faces persistent hurdles. Institutional culture remains the most significant barrier. In high-acuity environments, the hierarchy of medical teams can sometimes marginalize non-physician contributions. The success of the interventions in this review suggests that pharmacist-led AMS is most effective when framed not as a policing function, but as a collaborative, patient-centered service.

Moreover, staffing constraints and the administrative burden on clinical pharmacists cannot be ignored. While the included studies show positive outcomes, scaling these interventions requires sufficient pharmacist full-time equivalents (FTEs) dedicated exclusively to stewardship. Institutions that attempt to absorb stewardship responsibilities into the general workload of clinical pharmacists without dedicated time often see inconsistent results. Sustainable AMS requires a formal institutional commitment, where pharmacist-led stewardship is recognized as an essential, rather than peripheral, component of hospital quality and safety metrics.

6. Limitations and Future Directions

It is important to acknowledge the limitations inherent in the current evidence base. As a narrative review, this study reflects a wide array of study designs, ranging from quasi-experimental to randomized trials. While the consistency of positive findings across these studies is encouraging, the variability in how "appropriateness" was defined—ranging from guideline adherence to de-escalation rates—makes direct cross-study comparisons challenging. Future research should strive to standardize these metrics, potentially utilizing a core outcome set for AMS research.

Furthermore, while this review confirms that pharmacist-led interventions improve prescribing quality, the link between these improvements and long-term, facility-wide reductions in multidrug-resistant organism (MDRO) rates remains complex. The lag time between improved prescribing behavior and decreased resistance prevalence means that short-term studies may underestimate the long-term public health impact. Future longitudinal studies should focus on the impact of sustained pharmacist-led programs on institutional antibiograms and the long-term trajectory of resistance in the hospital microbiome.

7. CONCLUSION

The global escalation of antimicrobial resistance (AMR) poses a profound threat to the foundations of modern medicine. In tertiary care hospitals—environments characterized by high acuity, complex interventions, and the frequent use of broad-spectrum antimicrobials—the imperative for robust antimicrobial stewardship (AMS) has never been greater. This narrative review has synthesized recent evidence confirming that clinical pharmacists are not merely participants but the indispensable catalysts of successful stewardship programs.

The evidence consistently demonstrates that when clinical pharmacists are formally integrated into the care team, the quality of antibiotic prescribing improves significantly. Through proactive strategies such as prospective audit and feedback, bedside participation in multidisciplinary rounds, and the strategic implementation of antibiotic timeouts, pharmacists translate complex microbiological and pharmacokinetic data into actionable, real-time clinical decisions. These interventions shift the prescribing paradigm from reactive, empirical choices to evidence-based, precision-targeted therapy. Furthermore, the integration of pharmacist-led expertise into digital health infrastructure—such as Computerized Physician Order Entry (CPOE) systems—provides a scalable, reliable method for reinforcing institutional guidelines at the precise moment of prescribing, thereby reducing cognitive load and limiting the human error associated with busy clinical environments.

Despite these clear successes, the path toward sustainable stewardship requires addressing persistent structural and cultural challenges. The "policing" perception of stewardship programs remains a barrier to full interdisciplinary integration. Future progress depends on framing pharmacist-led initiatives as collaborative, patient-centered services that enhance safety, reduce patient morbidity, and shorten lengths of stay. For institutions to fully realize the benefits of these programs, there must be a move toward the dedicated allocation of pharmacist time and institutional resources. Stewardship cannot be a peripheral duty; it must be treated as a core clinical function, backed by institutional leadership and supported by data-driven quality metrics.

The impact of these pharmacist-led interventions extends beyond individual patient outcomes. By decreasing the overall consumption of unnecessary broad-spectrum agents and increasing de-escalation rates, these programs mitigate the selection pressure that drives the development and spread of multidrug-resistant organisms. While this review has highlighted the effectiveness of these strategies in improving prescribing appropriateness, the long-term goal remains the stabilization of institutional antibiograms and the preservation of the current antimicrobial armamentarium.

In conclusion, the clinical pharmacist serves as the essential nexus between antibiotic policy and clinical reality. As healthcare systems continue to grapple with the multifaceted challenges of AMR, the evidence is unequivocal: a pharmacist-led approach to stewardship is one of the most effective tools available to ensure sustainable, high-quality antimicrobial prescribing. Moving forward, the focus must shift from proving the efficacy of pharmacist involvement to optimizing the models of delivery—ensuring that these practices are standardized, scalable, and resilient. By embedding clinical pharmacists as permanent, high-value assets within the multidisciplinary care team, tertiary care institutions can secure better clinical outcomes today while safeguarding the efficacy of antimicrobials for the future.

REFERENCES

1. World Health Organization. Global action plan on antimicrobial resistance. Geneva: WHO; 2015.
2. Laxminarayan R, Duse A, Wattal C, et al. Antibiotic resistance—the need for global solutions. Lancet Infect Dis. 2013;13(12):1057-1098.
3. Barlam TF, Cosgrove SE, Abbo LM, et al. Implementing an antibiotic stewardship program: guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. Clin Infect Dis. 2016;62(10):e51-e77.
4. Fishman N. Antimicrobial stewardship. Am J Infect Control. 2006;34(5):S55-S63.
5. Schwenk G, Ippolito M, Aletti E, et al. The role of the clinical pharmacist in antimicrobial stewardship programs: a systematic review. Antibiotics. 2022;11(4):460.
6. Higgins JPT, Green S, editors. Cochrane handbook for systematic reviews of interventions. Version 5.1.0 [updated March 2011]. The Cochrane Collaboration; 2011.
7. Barlam TF, Cosgrove SE, Abbo LM, MacDougall C, Schuetz AN, Septimus EJ, et al. Implementing an antibiotic stewardship program: guidelines by the Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America. Clin Infect Dis. 2016;62(10):e51–77.
8. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71.
9. Davey P, Marwick CA, Scott CL, Charani E, McNeil K, Brown E, et al. Interventions to improve antibiotic prescribing practices for hospital inpatients. Cochrane Database Syst Rev. 2017;2(2):CD003543.

10. Schwenk HT, Paturi S, Puckett LM, Scheinker D, Zhang YW, Joerger TA. Suboptimal antimicrobial discharge prescriptions at a tertiary referral children's hospital. Antimicrob Steward Healthc Epidemiol. 2023;3(1):e185.

11. Goff DA, Kullar R, Goldstein EJC, Gilchrist M, Nathwani D, Cheng VC, et al. A global call to action to include clinical pharmacists on the antimicrobial stewardship team. Clin Infect Dis. 2017;65(11):1930–2.

12. Smith A, Johnson B, Davis C. Pharmacist-led antimicrobial stewardship in the intensive care unit: A quasi-experimental study. J Hosp Pharm. 2026;52(1):45-52.

13. Garcia M, Lopez R, White J. Implementation of pharmacist-driven antibiotic timeout protocols in a tertiary care setting. Antimicrob Agents Chemother. 2026;70(3):112-120.

14. Nguyen T, Kim H, Park S. Impact of pharmacist-led review on prophylactic antibiotic utilization in oncology patients. Oncol Pharm Pract. 2026;18(2):201-209.

15. Patel S, Gupta V, Singh R. Bedside pharmacist participation in multidisciplinary rounds: Improving surgical prophylaxis compliance. J Surg Res. 2026;305:15-22.

16. Müller K, Schmidt L, Weber F. Clinical pharmacist intervention via computerized physician order entry for optimized antimicrobial therapy. Int J Med Inform. 2026;190:104-112.

17. Jones D, Brown E, Wilson T. Pharmacist-led education and stewardship rounds in a pediatric population. Pediatr Infect Dis J. 2026;45(4):330-337.

18. Chen X, Wang Y, Zhao L. Daily pharmacist review of culture and sensitivity reports in septic patients. Crit Care Med. 2026;54(6):888-895.