A Systematic Review On Drug Utilization And Prescribing Patterns Of Antibiotics In Pulmonology Department Of Tertiary Care Hospital

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ABSTRACT

Background: Respiratory tract infections (RTIs) continue to be a primary cause of illness and death globally, especially in low- and middle-income nations. They account for a substantial proportion of outpatient visits and hospital admissions in pulmonology departments. Due to overlapping clinical features of viral and bacterial infections, empirical antibiotic therapy is frequently initiated without microbiological confirmation. This practice significantly contributes to antimicrobial resistance (AMR), posing substantial challenges to public health. Objectives: To systematically review literature on antibiotic prescribing trends and drug utilization patterns in pulmonology departments of tertiary care hospitals, focusing on irrational prescribing, stewardship implementation, and guideline adherence. Methods: A comprehensive search of PubMed, Scopus, and Google Scholar (2015–2024) was conducted using predefined keywords. Four peer-reviewed studies that met eligibility criteria were selected. A narrative synthesis was used. Results: The review found high empirical use of broad-spectrum antibiotics—especially third-generation cephalosporins, macrolides, and fluoroquinolones. Adherence to guidelines was poor, and microbiological testing was infrequent. Studies implementing Antimicrobial Stewardship Programs (ASPs) reported improvements in prescribing behavior. Conclusion: Empirical antibiotic use is prevalent in pulmonology settings. Implementation of ASPs, improved diagnostics, and training are essential for optimizing antibiotic use and preventing AMR.

INTRODUCTION

Respiratory tract infections (RTIs) are among the most frequently encountered conditions in clinical practice, accounting for a significant proportion of outpatient consultations, emergency room visits, and hospital admissions worldwide. [1] [3] These infections range from self-limiting upper respiratory tract infections (URTIs), such as the common cold and pharyngitis, to more severe lower respiratory tract infections (LRTIs) like bronchitis, pneumonia, and exacerbations of chronic obstructive pulmonary disease (COPD).[2]

Particularly in developing countries, RTIs contribute heavily to morbidity and mortality across all age groups, placing a considerable burden on healthcare systems. Antibiotics are the cornerstone of treatment for bacterial RTIs, and they are among the most commonly prescribed drugs in both community and hospital settings. However, their irrational and indiscriminate use—especially in tertiary care pulmonology departments—has led to a rise in antimicrobial resistance (AMR), an urgent global health threat. The overprescription of broad-spectrum antibiotics, often administered empirically without appropriate diagnostic evaluation, is a driving factor behind the development of resistant strains of respiratory pathogens such as Streptococcus pneumoniae, Haemophilus influenzae, and Klebsiella pneumoniae. [3]

Challenges in Prescribing for RTIs

The high incidence of RTIs in tertiary care hospitals has led to widespread empirical prescribing practices. Several challenges hinder rational antibiotic use:

 Delayed availability of culture reports, forcing physicians to treat based on symptoms, Pressure to treat quickly, especially in acutely ill patients, Lack of local antibiograms or institutional guidelines, Inadequate physician awareness of treatment recommendations or AMR data

As a result, third-generation cephalosporins, fluoroquinolones, and macrolides are frequently overprescribed. Fixed-dose combinations (FDCs) are also commonly used, sometimes without strong clinical justification. These issues not only contribute to rising resistance but also increase treatment costs, hospital stays, and adverse drug reactions. [4] [5] [6]

Role of Antimicrobial Stewardship

In response to the alarming rise in Antimicrobial Stewardship Programs (ASPs), the concept of ASPs has gained prominence. Antibiotic Stewardship Programs consist of coordinated efforts aimed at enhancing and assessing the proper utilization of antibiotics. These include:

- Guideline-based prescribing
- Streamlining antibiotic therapy based on culture results
- Limiting the use of broad-spectrum agents
- Monitoring and feedback systems

In pulmonology departments, where antibiotic use is particularly high due to complex respiratory cases, ASPs can have a profound impact. Studies have shown that ASPs can reduce inappropriate prescriptions by up to 30–40%, improve patient outcomes, and curb the spread of multidrug-resistant organisms. [12]

Current Gaps in Practice

Despite the known benefits of ASPs and guideline-based treatment, several gaps persist:

- Microbiological diagnostics are underutilized; few patients undergo sputum culture or Gram staining
- Documentation of indication and duration is often missing in case files
- Over-reliance on empirical therapy, with very little de-escalation based on test results
- No regular prescription audits in many tertiary hospitals [9]

These practices reflect a need for systemic change in how antibiotics are prescribed, monitored, and regulated within tertiary care pulmonology units.

The WHO's Global Action Plan on Antimicrobial Resistance advocates for evidence-based antibiotic stewardship, improved surveillance, and strengthened regulatory mechanisms. Despite these initiatives, many tertiary care hospitals lack formal stewardship policies, especially in resource-constrained settings. Consequently, there is a need to systematically evaluate existing prescribing patterns, assess adherence to standard treatment guidelines, and identify interventions that improve rational prescribing in pulmonology departments. [11]

This systematic review aims to assess and synthesize the current literature related to drug utilization and prescribing patterns of antibiotics in pulmonology departments of tertiary care hospitals. Specifically, it focuses on:

- The most commonly prescribed antibiotic classes and agents
- The prevalence of empirical vs. culture-guided prescribing
- Adherence to national or international treatment guidelines [11]
- The role and impact of antimicrobial stewardship interventions

Through this review, we intend to highlight key areas where interventions are required to improve antibiotic use in pulmonology care and suggest policy changes for effective implementation of stewardship principles in clinical practice.

Justification for the Present Review

To address these issues, a systematic review of current antibiotic prescribing trends and drug utilization in pulmonology departments is essential. Such a review helps to:

- Identify common patterns of irrational use
- Evaluate the implementation and effectiveness of ASPs
- Highlight areas needing intervention and policy improvement

This review aims to analyze evidence from recent studies to understand how antibiotics are prescribed in tertiary care pulmonology departments, assess adherence to treatment guidelines, evaluate the impact of ASPs, and propose strategies for improvement. [11]

Objectives of the Study

- This systematic review was conducted with the following objectives:
- To identify the most commonly prescribed antibiotics for RTIs in pulmonology departments
- To assess the prevalence of empirical versus culture-based prescribing

- To assess compliance with both national and international guidelines
- To understand the impact of ASPs on prescribing trends and resistance patterns
- To recommend strategies for rationalizing antibiotic use in tertiary care pulmonology practice

MATERIALS AND METHODS

This study is a systematic review designed to analyze and synthesize the current literature regarding drug utilization and prescribing patterns of antibiotics in pulmonology departments of tertiary care hospitals. The primary objective was to evaluate current prescribing trends, assess the extent of irrational antibiotic use, and examine the role and effectiveness of antimicrobial stewardship programs (ASPs) in improving rational drug use. The research was carried out following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. [7]

Search Strategy

A comprehensive and systematic search of the literature was conducted using electronic databases such as PubMed, Scopus, and Google Scholar. The search covered the period from January 2015 to May 2024, and included only studies published in English. The search strategy involved combinations of the following keywords and Boolean operators:

("antibiotic prescribing" OR "antibiotic utilization" OR "antibiotic use") AND

("pulmonology" OR "respiratory tract infections" OR "RTIs") AND

("tertiary care hospital" OR "inpatient care") AND

("drug utilization evaluation" OR "antimicrobial stewardship")

Medical Subject Headings (MeSH) terms such as "Anti-Bacterial Agents," "Respiratory Tract Infections," and "Drug Prescriptions" were also used to refine the search on PubMed.

Inclusion Criteria:

- Original research articles (observational or interventional studies)
- Studies published between 2015 and 2024
- Conducted in pulmonology departments of tertiary care hospitals
- Reporting data on antibiotic usage, prescribing patterns, or antimicrobial stewardship

Exclusion Criteria:

- Editorials, reviews, case reports, and conference abstracts
- Studies not specific to pulmonology or respiratory infections
- Pediatric or surgical department studies
- Studies not involving tertiary care hospital settings

Study Selection Process

The preliminary search resulted in 64 articles in total. Following the elimination of duplicates, 42 articles were left. The titles and abstracts were evaluated for their relevance to antibiotic prescribing in respiratory tract infections (RTIs) within pulmonology departments. Out of these, 21 full-text articles were assessed for eligibility.

Ultimately, four studies met all the inclusion criteria and were included in the final systematic review. The study selection process followed the PRISMA flow diagram methodology, including identification, screening, eligibility, and inclusion phases. Disagreements during article selection were resolved by consensus among the reviewers.

Data Extraction

A standardized data extraction form was developed and used to collect relevant information from the included studies. The data fields included:

- Study title and year of publication
- Study location and setting (hospital type, country)
- Study design (cross-sectional, retrospective, interventional)
- Sample size and patient demographics
- Type of RTI and diagnosis methods
- Antibiotic classes and agents prescribed
- Route of administration and duration of therapy
- Empirical vs. culture-guided therapy [13]
- Documentation of indications and follow-up
- Presence and impact of antimicrobial stewardship interventions
- Synthesis and Analysis

Due to the heterogeneity in study designs, outcome measures, and antibiotic classification systems used, meta-analysis was not conducted. Instead, a narrative synthesis approach was employed. The included studies were grouped based on thematic similarity, such as:

- Types of RTIs treated
- Common antibiotic classes used
- Diagnostic support and culture testing practices
- ASP implementation and outcomes

The findings were compared qualitatively, and patterns were described in a tabulated format where applicable.

Quality Assessment

STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist used to analyses the methodological quality for observational studies

Cochrane Risk of Bias Tool for interventional trial

Although most studies were found to be of moderate-to-good quality, certain limitations were noted:

Single-center studies, Small sample sizes, Retrospective data without control groups, Incomplete reporting of stewardship components

These limitations were taken into account when interpreting the results.

Ethical Considerations

Since this was a systematic review of data that had been published previously, ethical approval was not required. However, ethical standards were maintained by giving due credit to all sources and ensuring transparency in data handling, interpretation, and reporting.

RESULTS

A total of four studies were included in this systematic review after meeting the predefined inclusion criteria. All studies were conducted in the pulmonology or respiratory medicine departments of tertiary care hospitals, focusing on antibiotic prescribing patterns for respiratory tract infections (RTIs).

1. Prescribing Trends

All studies reported widespread empirical use of broad-spectrum antibiotics, often initiated before microbiological test results were available. The maximum frequently prescribed classes of antibiotics were: [1]

- Third-generation cephalosporins (e.g., ceftriaxone, cefpodoxime)
- Macrolides (e.g., azithromycin, clarithromycin)
- Fluoroquinolones (e.g., levofloxacin, ciprofloxacin)

In some settings, combinations such as beta-lactam + beta-lactamase inhibitors were also popular.

Inappropriate use of fixed-dose combinations (FDCs) and duplicate therapy (e.g., combining two antibiotics of the same class) was noted in two studies.

2. Empirical vs. Culture-Guided Therapy

The majority of prescriptions—ranging from 70% to 85% across studies—were empirical in nature. Microbiological testing (sputum culture, blood culture, Gram staining) was ordered in fewer than 30% of patients. In one study, only 26% of cases underwent culture testing prior to initiating antibiotics. The absence of therapy guided by cultural considerations was ascribed to: [13]

Diagnostic delays

Unavailability of rapid tests

Pressure to treat critically ill patients without delay

3. Adherence to Guidelines: Adherence to national and international standard treatment guidelines (such as ICMR, IDSA, or NICE) was found to be suboptimal, reported in only 40–50% of prescriptions. Reasons included: [11]

- Lack of awareness among prescribers
- Absence of hospital-specific antibiograms
- Poor documentation of indication, dose, or duration

Only one study incorporated prescription audits as part of its assessment, highlighting the need for regular review mechanisms. [9]

4. Impact of Antimicrobial Stewardship Programs (ASPs): One study conducted after ASP implementation reported:

- A 30% reduction in inappropriate prescriptions
- Improved documentation of indication and stop dates
- Increased use of diagnostic tools
- Better adherence to guidelines

These findings underscore the role of ASPs in improving antibiotic prescribing behavior, especially in high-volume departments like pulmonology.

5. Summary Table

These results emphasize the pressing need for diagnostic support, prescriber training, and stewardship protocols to ensure rational antibiotic use in pulmonology departments. [10]

DISCUSSION

This systematic review highlights significant concerns regarding antibiotic prescribing practices in pulmonology departments of tertiary care hospitals. Across all four studies reviewed, a consistent pattern of empirical and broad-spectrum antibiotic use was observed, often initiated without appropriate microbiological confirmation. While empirical treatment is sometimes necessary in acute clinical scenarios, the overwhelming reliance on it—even in non-critical cases—raises concerns about rationality and long-term implications.

The frequent use of third-generation cephalosporins, macrolides, and fluoroquinolones suggests a preference for agents with broad activity, potentially driven by prescriber uncertainty or fear of treatment failure. However, such practices inadvertently promote antimicrobial resistance (AMR), especially when not accompanied by timely culture tests or de-escalation strategies. The underutilization of diagnostic tools such as sputum cultures and Gram stains across all studies reflects both infrastructural limitations and clinician inertia. [3] [4] [5] [6]

Moreover, adherence to standard treatment guidelines was notably poor in the majority of cases. This gap could stem from the lack of locally adapted protocols, unawareness among practitioners, or the absence of routine audits. Notably, in the one study where an Antimicrobial Stewardship Program (ASP) was active, a significant improvement in rational prescribing, documentation, and

guideline compliance was reported. This suggests that stewardship interventions, even when basic, can yield substantial benefits in pulmonology settings. [11]

Overall, the findings of this review mirror broader global concerns about irrational antibiotic use and reinforce the call for integrated stewardship, enhanced diagnostics, and regular prescriber education.

CONCLUSION

This systematic review underscores the urgent need to improve antibiotic prescribing practices in pulmonology departments of tertiary care hospitals. Despite the availability of clinical guidelines and awareness of the dangers of antimicrobial resistance (AMR), empirical and broad-spectrum antibiotic use remains widespread. The findings indicate that physicians frequently resort to empirical therapy without adequate microbiological support due to diagnostic uncertainty, institutional pressures, and systemic barriers such as insufficient lab facilities or delayed test results. [3]

Hospitals that implemented Antimicrobial Stewardship Programs (ASPs) demonstrated significant improvements in prescribing patterns. These programs not only reduced the use of unnecessary antibiotics but also promoted documentation, adherence to protocols, and multidisciplinary collaboration. However, the review also highlights the inconsistent implementation of these programs across hospitals, particularly in low-resource settings.

To address these challenges, tertiary care hospitals must prioritize the establishment of robust ASPs, improve access to diagnostics, and enforce accountability in antibiotic use. Continued medical education (CME) for prescribers, integration of microbiology labs with clinical decision-making, and national-level policy enforcement will be vital in achieving rational antibiotic use. Given the growing threat of AMR, these interventions are not optional but essential to safeguard public health and preserve the efficacy of existing antibiotics.

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