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A STUDY TO ASSESS THE EFFICACY AND PRESCRIBING PATTERN OF ANTIBIOTICS IN LOWER RESPIRATORY TRACT INFECTIONS AMONG INPATIENTS AND OUTPATIENTS

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ABSTRACT

Lower respiratory tract infections (LRTIs) remain a major cause of morbidity and hospitalisation worldwide, particularly among elderly individuals and patients with underlying comorbidities. Appropriate antibiotic therapy plays a crucial role in the management of LRTIs, as rational prescribing can improve clinical outcomes while minimising adverse drug reactions and antimicrobial resistance. Evaluating the prescribing pattern and therapeutic outcomes of antibiotics in LRTI patients is therefore essential to promote effective and safe clinical practice. Objectives: - The present study aimed to assess the efficacy and prescribing pattern of antibiotics in patients with Lower Respiratory Tract Infection among inpatients and outpatients, as well as to evaluate the occurrence of adverse drug reactions and treatment outcomes. A prospective observational study was conducted in a tertiary care hospital involving patients diagnosed with LRTIs. Demographic details, clinical diagnosis, antibiotic therapy, duration of treatment, and adverse drug reactions were recorded using a structured data collection form. The severity of pneumonia was assessed using the CURB-65 score. Clinical outcomes were evaluated based on improvement in symptoms, vital signs, laboratory parameters, and radiological findings. The majority of patients were elderly, with the highest proportion belonging to the 71–80 years age group, and a slight male predominance (56%) was observed. Among the LRTIs identified, Pneumonia (38%) was the most common condition, followed by Bronchitis (34%) and Chronic Obstructive Pulmonary Disease Exacerbation (28%). Empirical antibiotic therapy was used in 60% of patients, while culture-guided therapy was used in 40%. The most prescribed antibiotics included Azithromycin (25%), Levofloxacin (22%), Meropenem (20%), Piperacillin –Tazobactam (18%), and Ceftriaxone (15%). Adverse drug reactions were observed in 53% of patients, predominantly mild gastrointestinal disturbances and skin rash. Clinical outcomes showed that 40% of patients recovered completely, 25% improved, 15% remained unchanged, and 20% deteriorated.

Keywords: Lower Respiratory Tract Infection, Pneumonia, Azithromycin, Levofloxacin, Antibiotic prescribing pattern, Adverse drug reactions, CURB-65 Score, Clinical outcomes.

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INTRODUCTION

Respiratory tract infections (RTIs), particularly lower respiratory tract infections (LRTIs), continue to represent a major clinical and public health challenge worldwide due to their high prevalence, associated morbidity, and healthcare burden [1,2]. LRTIs such as acute bronchitis, chronic bronchitis exacerbations, pneumonia, COPD exacerbations, and ventilator-associated infections require accurate diagnosis and appropriate management strategies based on the underlying pathogen, disease severity, and patient comorbidities [3].Acute bronchitis is generally a self-limiting condition, and unnecessary antibiotic therapy should be avoided except in confirmed bacterial infections such as pertussis or in influenza requiring antiviral therapy [4]. In chronic bronchitis and COPD exacerbations, treatment aims to reduce mucus hypersecretion, improve airway clearance, and minimize inflammation, with antibiotic selection guided by patient risk factors and local resistance patterns [5]. Community-acquired pneumonia remains an important cause of hospitalization and mortality, particularly among patients with chronic illnesses, and appropriate empiric antimicrobial therapy is essential for effective management [6,8]. Severe respiratory failure

associated with ARDS may require advanced supportive measures such as venovenous ECMO in specialized centers [7].Hospital-acquired respiratory infections, including ventilator-associated pneumonia (VAP) and non-ventilator hospital-acquired pneumonia (NV-HAP), remain significant healthcare-associated infections requiring timely diagnosis, culture-guided treatment, and preventive strategies such as early patient mobilization and infection control practices [9,10]. COPD exacerbations are multifactorial events that significantly worsen patient outcomes and may overlap with other respiratory and non-respiratory conditions, making careful differential diagnosis essential [11,12].Asthma is a heterogeneous inflammatory airway disease influenced by environmental and infectious factors. Evidence suggests that prenatal and early-life antibiotic exposure may increase the risk of wheezing and asthma development in childhood [13]. Although biologic therapies and allergen immunotherapy provide significant long-term benefits in type 2 and allergic asthma, respiratory viral infections continue to be important triggers for severe exacerbations [14,15].The reviewed data strongly emphasise that antibiotics remain the cornerstone of treatment for bacterial LRTIs; however, irrational prescribing practices are highly prevalent and contribute significantly to antimicrobial resistance (AMR), adverse drug reactions, and increased healthcare costs [16,18]. Despite established clinical guidelines, inappropriate antibiotic use, including excessive prescribing and use of second-line agents, remains common in respiratory infections [17,19,21]. Monitoring prescribing patterns and evaluating treatment effectiveness are therefore essential to ensure rational drug use and improved patient outcomes [20].Furthermore, clinician-related factors such as overestimation of patient expectations for antibiotics may contribute to unnecessary prescribing practices [22,23]. Therefore, strengthening antimicrobial stewardship programs, improving adherence to evidence-based guidelines, promoting physician and patient education, and encouraging rational antibiotic use are crucial steps to reduce AMR and preserve antibiotic effectiveness for future generations [16–23]

MATERIALS AND METHODS

Study Design, Type, and Duration

The proposed research was an observational cohort study has been conducted at the Department of Pulmonology and General medicine of SVS Medical College and Hospital, located in Mahabubnagar. The study was anticipated for a period of six months. The collection and analysis of patient data has been conducted from inpatient wards, outpatient clinic, using appropriate statistical methodologies, and subsequent evaluation of the data has been performed.

Study Setting and Source of Data

Study has been conducted in the Department of Pulmonology and General medicine at SVS Medical College and Hospital, Mahbubnagar.

Sample Size Determination

A total of 100 LRTI patients were included in the study. The sample size was determined based on feasibility and the availability of eligible participants during the study period.

Sample Selection Criteria

Inclusion Criteria

- Patients visiting the Department of Pulmonology and General medicine and who are diagnosed with LRTI.
- Patients are willing to give their consent for the study.
- Age includes paediatric group, and all the adult's diagnosis with LRTI.
- Patients who have been prescribed at least one systemic antibiotic for current LRTI episode

Exclusion Criteria

- Patients receiving antibiotics for infections other than LRTI during the same admission.
- Patients with active pulmonary tuberculosis.
- Patients transferred from other hospitals where complete treatment data are unavailable.

Methodology

This is a hospital-based observational study conducted in the Department of Pulmonology and Medicine at SVS Medical college and hospital over a period of six months. The study aims to assess the efficacy and rationality of antibiotic prescribing patterns in patients diagnosed with lower respiratory tract infections (LRTIs). Patients meeting the inclusion criteria and receiving at least one systemic antibiotic has been enrolled. Data has been collected using a structured data collection form, including patient demographics, diagnosis, prescribed antibiotics, laboratory and culture findings, and clinical outcomes. Each antibiotic prescription has been evaluated for appropriateness according to standard treatment guidelines such as WHO. Statistical analysis has been carried out using Microsoft Excel/SPSS to assess prescribing trends and treatment outcomes.

Study Procedure

The study investigation an observational cohort study has been conducted in the Department of Medicine at SVS Medical college and hospital. Patients diagnosed with lower respiratory tract infections (such as bronchitis, pneumonia, or COPD exacerbations) and prescribed antibiotics has been identified through inpatient and outpatient records. Eligible patients have been enrolled after obtaining informed consent (for prospective studies). Data has been collected using a predesigned data collection form, which includes patient demographics, diagnosis, antibiotic details (drug, dose, route, duration), laboratory and microbiology findings, and treatment outcomes. Each prescription has been reviewed and evaluated for appropriateness, efficacy, and rationality according to standard treatment guidelines (e.g., WHO, IDSA, or National Guidelines). Collected data has been compiled and analyzed statistically using Microsoft Excel or SPSS software to determine prescribing trends, treatment outcomes, and adherence to rational antibiotic use principles. Patient confidentiality has been maintained throughout the study.

Materials, Investigations, and Interventions

No additional investigations, interventions, or procedures beyond routine clinical care were performed on study participants. Data collection was limited to surveys and interviews.

Anticipated Risks and Risk Minimization

The study posed no anticipated physical or psychological risks to participants. Confidentiality and anonymity were strictly maintained, and participation was entirely voluntary.

Data Analysis Procedure

All patients presenting to the Departments of Pulmonology and General Medicine were systematically screened for eligibility, and those meeting the inclusion criteria were enrolled in the study after obtaining informed consent. A structured patient data collection form was utilized to record demographic details, clinical assessments, chest X-ray findings, laboratory investigations, and quality of life parameters. Each prescription was critically evaluated for appropriateness according to World Health Organization (WHO) antibiotic prescribing guidelines and subsequently categorized as appropriate or inappropriate. The enrolled participants were further monitored through follow-up assessments to evaluate treatment progress and outcomes. Statistical analyses, including Chi-square and t-tests, were performed to identify associations between variables such as antibiotic selection and treatment outcomes. Following data analysis, the findings were presented using tables, charts, and graphs for clear interpretation.

Statistical Methods

The collected data has been entered and analyzed using Microsoft Excel and SPSS version 23. Descriptive statistics has been used to summarize the data; continuous variables such as age and duration of therapy have been expressed as mean, standard deviation, and range, while categorical variables 56 such as gender, diagnosis, and antibiotic class has been expressed as frequencies and percentages. Inferential statistical tests, including the Chi-square test, has been applied to assess associations between categorical variables, such as the type of antibiotic prescribed and clinical outcomes. t-tests or ANOVA has been used to compare mean values across groups where applicable. A p-value of less than 0.05 has been considered statistically significant. The results have been interpreted to evaluate the efficacy, appropriateness, and rationality of antibiotic prescribing patterns in patients with lower respiratory tract infections.

Statistical Software

The statistical analysis has been done with the help of the Statistical Package for the Social Sciences (SPSS) software with version 23 and GraphPad Prism with version.

Ethical Considerations

The ethical committee clearance was obtained from SVS MEDICAL COLLEGE HOSPITAL before initiating the study. Reference number: IEC/DHR-03/(04/04)/2025

RESULTS AND DISCUSSION

Distribution of Patients Based on Age

The age-wise distribution of patients included in the study is presented in Table 01 and Figure 01. The majority of the patients belonged to the age group of 71–80 years (28%), followed by 61–70 years (19%) and 51–60 years (17%). The least number of patients were observed in the 41–50 years age group (9%). The mean age of the study population was found to be 63.5 ± 15.4 years, indicating that elderly patients were more commonly affected with lower respiratory tract infections (LRTIs).

Table 1: Distribution of Patients Based on Age

Age Group (Years)	Frequency	Percentage
30–40	12	12%
41–50	9	9%
51–60	17	17%
61–70	19	19%
71–80	28	28%
81–90	15	15%
Total	**100**	**100%**

Mean ± SD: 63.5 ± 15.4

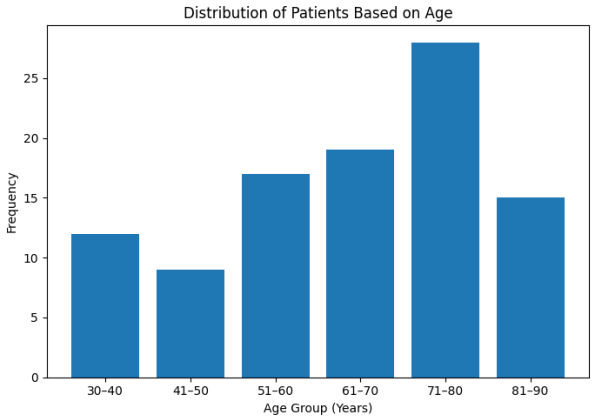

Figure 01: Distribution of Patients Based on Age

Distribution of Patients Based on Gender

The gender-wise distribution of patients is summarised in Table 02. Among the total study population, male patients constituted 56%, while female patients accounted for 44%. The findings indicate a slightly higher prevalence of LRTIs among male patients compared to females.

Table 02: Distribution of Patients Based on Gender

Gender	Frequency	Percentage
Male	56	56%
Female	44	44%
Total	**100**	**100%**

Distribution of Patients Based on Type of LRTI

The distribution of patients according to the type of lower respiratory tract infection is shown in Table 03. Pneumonia was the most commonly observed condition, accounting for 38% of cases, followed by bronchitis (34%) and COPD exacerbation (28%). These findings suggest that pneumonia represents the major clinical presentation among hospitalised LRTI patients.

Table 03: Distribution of Patients Based on Type of LRTI

Type of LRTI	Frequency	Percent
Pneumonia	38	38%
Bronchitis	34	34%
COPD Exacerbation	28	28%
Total	**100**	**100%**

Distribution of Patients Based on Risk Category (CURB-65)

The risk stratification of patients based on CURB-65 scoring is depicted in Table 04. More than half of the patients (52%) were categorised under low risk, while 30% and 18% were classified as moderate and high risk, respectively. The findings indicate that the majority of patients presented with less severe disease conditions at the time of assessment.

Table 04: Distribution of Patients Based on Risk Category (CURB-65)

Risk Category	Frequency	Percent
Low Risk	52	52%
Moderate Risk	30	30%
High Risk	18	18%
Total	**100**	**100%**

Distribution of Patients Based on Antibiotic Therapy Pattern

The pattern of antibiotic therapy administered to patients is summarised in Table 05. Empirical therapy was prescribed in 60% of the patients, whereas culture-guided therapy was utilised in 40% of cases. The higher use of empirical therapy may be attributed to the urgent need for early treatment initiation in LRTI patients before microbiological confirmation.

Table 05: Distribution of Patients Based on Antibiotic Therapy Pattern

Therapy Type	Frequency	Percent
Empirical	60	60%
Culture-guided	40	40%
Total	**100**	**100%**

Antibiotics Prescribed According to Clinical Indication

The antibiotics prescribed according to different clinical indications are presented in Table 06. Azithromycin, levofloxacin, and ceftriaxone were commonly prescribed for pneumonia, while azithromycin and levofloxacin were frequently used for bronchitis. COPD exacerbation cases were mainly treated with levofloxacin and piperacillin–tazobactam, whereas severe pneumonia patients received meropenem therapy. The selection of antibiotics was based on disease severity and clinical presentation.

Table 06: Antibiotics Prescribed According to Clinical Indication

Clinical Condition	Common Antibiotics Used	Typical Dose & Frequency
Pneumonia	Azithromycin, Levofloxacin, Ceftriaxone	Azithromycin 500 mg OD; Levofloxacin 500 mg OD; Ceftriaxone 1–2 g IV OD
Bronchitis	Azithromycin, Levofloxacin	Azithromycin 500 mg OD; Levofloxacin 500 mg OD
COPD Exacerbation	Levofloxacin, Piperacillin–Tazobactam	Levofloxacin 500 mg OD; Piperacillin–Tazobactam 4.5 g IV q8h
Severe Pneumonia	Meropenem	Meropenem 1 g IV q8h

Antibiotics According to Indication, Dose, and Duration

The detailed distribution of antibiotics based on indication, dose, frequency, and average duration of therapy is shown in Table 07. Most antibiotics were administered once daily, while broad-spectrum intravenous antibiotics such as piperacillin–tazobactam and meropenem were administered every 8 hours. The average duration of therapy ranged from 3 to 10 days, depending on the severity of infection and the clinical response of the patient.

Table 07: Antibiotics According to Indication, Dose, and Duration

Clinical Condition	Antibiotic	Dose	Frequency	Average Duration
Pneumonia	Azithromycin	500 mg	Once daily	3–5 days
Pneumonia	Levofloxacin	500 mg	Once daily	5–7 days
Pneumonia	Ceftriaxone	1–2 g	IV once daily	5–7 days
Bronchitis	Azithromycin	500 mg	Once daily	3–5 days
COPD Exacerbation	Levofloxacin	500 mg	Once daily	5–7 days
COPD Exacerbation	Piperacillin–Tazobactam	4.5 g	IV every 8 hours	5–7 days
Severe Pneumonia	Meropenem	1 g	IV every 8 hours	7–10 days

Adverse Drug Reactions Observed with Antibiotics and Their Management

The adverse drug reactions (ADRs) observed during antibiotic therapy are summarized in Table 08 and Figure 03. Gastrointestinal disturbances such as nausea, abdominal discomfort, and diarrhoea were the most commonly reported ADRs, particularly with azithromycin and meropenem therapy. Skin rashes were frequently associated with piperacillin–tazobactam and ceftriaxone administration. Most ADRs were mild in nature and managed effectively with symptomatic treatment, antihistamines, antiemetics, hydration therapy, and close monitoring. In a few cases, substitution or discontinuation of the suspected antibiotic was required when symptoms persisted.

Table 08: Adverse Drug Reactions Observed with Antibiotics and Their Management

Antibiotic	Dose & Frequency	Type of ADR Observed	No. of Cases	Management of ADR
Azithromycin	500 mg PO once daily	Nausea, abdominal discomfort, diarrhoea	14	Symptomatic treatment with antiemetics and oral rehydration; monitoring of symptoms
Levofloxacin	750 mg IV once daily	Mild GI symptoms, occasional rash	11	Antiemetics for GI symptoms; antihistamines for rash; monitoring and continuation if mild
Piperacillin – Tazobactam	4.5 g IV three times daily	Skin rash	10	Administration of antihistamines; discontinuation or substitution of antibiotic if rash persisted
Ceftriaxone	1 g IV twice daily	Skin rash	9	Antihistamines and symptomatic treatment; switching to an alternative antibiotic when required
Meropenem	1 g IV three times daily	Nausea, diarrhoea	9	Supportive therapy including antiemetics and monitoring of gastrointestinal symptoms

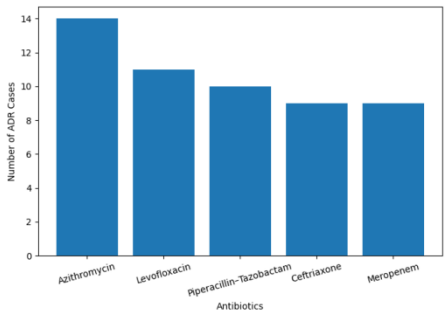

Figure 03: Adverse Drug Reactions Observed with Antibiotics and Their Management

Clinical Outcomes of Patients with LRTI

The clinical outcomes of patients with lower respiratory tract infections are presented in Table 09 and Figure 04. Among the total study population, 40% of patients completely recovered following treatment, while 25% showed clinical improvement. However, 15% of patients remained unchanged and 20% experienced deterioration in their clinical condition. The findings indicate that the majority of patients responded positively to the prescribed antibiotic therapy and supportive management.

Table 09: Clinical Outcomes of Patients with LRTI

Outcome	Frequency	Percentage
Recovered	40	40%
Improved	25	25%
Unchanged	15	15%
Deteriorated	20	20%
Total	**100**	**100%**

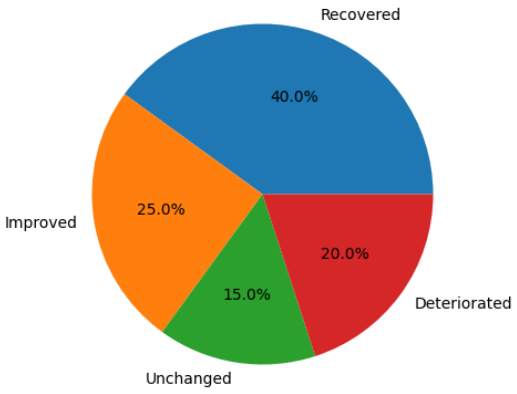

Figure 04: Clinical Outcomes of Patients with LRTI

CONCLUSION

The study findings revealed that elderly individuals were more frequently affected, with the highest proportion of patients belonging to the 71–80 years age group, and the mean age of the study population being 63.5 ± 15.4 years. A slight male predominance was also observed, indicating that males were somewhat more susceptible to LRTIs in the study population. Among the different types of LRTIs identified, Pneumonia was the most common condition, followed by Bronchitis and Chronic Obstructive Pulmonary Disease Exacerbation. Severity assessment using the CURB-65 Score indicated that the majority of patients belonged to the low-risk category.

Regarding antibiotic therapy, empirical treatment was more commonly used than culture-guided therapy. Among the antibiotics prescribed, Azithromycin was the most frequently utilized drug, followed by Levofloxacin, Meropenem, Piperacillin–Tazobactam, and Ceftriaxone. Adverse drug reactions were reported in 53% of patients, predominantly mild gastrointestinal disturbances and skin rash, which were manageable with supportive care. Clinical outcome evaluation showed that 40% of patients recovered completely and 25% showed improvement, indicating the effectiveness of antibiotic therapy in managing LRTIs. Overall, the study highlights the importance of rational antibiotic prescribing and appropriate clinical monitoring to improve patient outcomes.

LIMITATIONS AND RECOMMENDATIONS

- Larger multicenter studies should be conducted to obtain more representative data on LRTIs, antibiotic prescribing patterns, and antimicrobial resistance trends.
- Implementation of antimicrobial stewardship programs is recommended to promote rational antibiotic prescribing and minimize the emergence of antimicrobial resistance.
- Continuous education and training of healthcare professionals regarding evidence-based antibiotic use and infection management should be encouraged.
- Public health measures focusing on prevention of respiratory infections, including vaccination, smoking cessation, and environmental control, may help reduce the overall burden of LRTIs.
- The study was conducted with a relatively small sample size of 100 patients, which may limit the generalizability of the findings to larger populations.
- The study was performed in a single hospital setting, and therefore the results may not represent the overall pattern of Lower Respiratory Tract Infections (LRTIs) and antibiotic utilization in other healthcare settings.
- Some clinical and lifestyle risk factors such as smoking status, environmental exposure, and detailed comorbidity assessment were not extensively evaluated in this study.
- The assessment of antibiotic appropriateness was based mainly on available clinical information and guidelines, which may introduce some degree of subjectivity.

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Nil

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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AUTHOR CONTRIBUTIONS

Paspula Soumya conceived and designed the study, supervised the research work, and drafted the manuscript. Shazaa, Saniya naaz, N Madhumitha and Saniya sultana contributed to data collection, analysis, and manuscript preparation. All authors reviewed and approved the final version of the manuscript.

ETHICAL STATEMENT

The ethical committee clearance was obtained from SVS Medical College Hospital before initiating the study. Reference number: IEC/DHR-03/ (04/04)/2025

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