RESEARCH ARTICLE

©2023 The Academy of Environmental Biology, India

Journal of Ecophysiology and Occupational Health, *Vol 25(2), DOI: 10.18311/jeoh/2025/46150, 339-345, June 2025*

ISSN (Online) : 0972-4397
ISSN (Online) : 0974-0805

Assessment of Microbial Profile and Drug Utilization Pattern in Lower Respiratory Tract Infectious Patients

E. Chitrabanu, R. Sharagesh, M. Mohana Krishna, S. Anand and Priyadharshini Ananthathandavan*

Department of Pharmacy Practice, SRM College of Pharmacy, SRM Institute of Science and Technology, Kattankulathur - 603203, Tamil Nadu, India; priyathandavan93@gmail.com

Abstract

Background: Lower Respiratory Tract Infections (LRTIs), including bronchitis, bronchiolitis, and pneumonia, are significant contributors to global morbidity and mortality, particularly affecting pediatric and geriatric populations. The genetic diversity of pathogens, such as human rhinoviruses and drug-resistant strains like Klebsiella pneumoniae, complicates diagnosis and treatment, highlighting the need for targeted antimicrobial therapy. Understanding regional microbial profiles and antibiotic resistance patterns is crucial for effective management and improving patient outcomes. **Aim and Objectives:** The study aims to analyze the most common bacterial etiologies and evaluate drug use patterns in LRTI patients. **Methodology:** A retrospective observational study with the data of 100 LRTI patients at a tertiary care teaching hospital was collected and the prescription analysis was done according to the WHO guidelines for rational use of drugs. **Results and Discussion:** The study found a higher prevalence of LRTI in males (60%) compared to females (40%), with those over 60 years most affected (29%). Key lifestyle factors included smoking (34%), and alcohol consumption (18%). Bronchiectasis and pneumonia were the most common diagnoses (37% each), with hypertension (29%) and diabetes mellitus (26%) as major comorbidities. The average hospital stay was 1–5 days (58%). Drug utilization revealed an average of 5.1 drugs per prescription, with bronchodilators and antibiotics most frequently prescribed. Staphylococcus aureus was the predominant pathogen (81.25%), underscoring the need for targeted antibiotic therapy. The study highlights the importance of standardized therapeutic protocols and rational antibiotic use to combat resistance. Further research is recommended to refine treatment protocols and address emerging resistance patterns and comorbidities in LRTI patients. **Conclusion:** There is a need for developing and implementing standard therapeutic approaches and treatment guidelines for managing LRTIs.

Major Findings: The study revealed that *Staphylococcus aureus* was the predominant pathogen in LRTIs, with **penicillins** and **azithromycin** being the most prominently used antibiotics alongside bronchodilators. It emphasized the need for standardized therapeutic protocols, rational antibiotic use, and increased adoption of generic drugs to improve patient outcomes and combat resistance.

Keywords: Antibiotics, Drug Resistance, Empirical Therapy, Retrospective Observational Study

1. Introduction

LRTIs encompass a range of infections that affect the airways below the voice box (larynx), including bronchitis, bronchiolitis, and pneumonia. The assessment of these dimensions in the context of LRTIs has undergone significant advancements, with recent studies contributing valuable insights[1]. This facilitates a more targeted approach to antimicrobial therapy, potentially reducing the misuse of antibiotics and improving patient

*Author for correspondence

Article Received on: 28.09.2024 Revised on: 27.11.2024 Accepted on: 04.12.2024

outcomes. Understanding the microbial landscape in specific geo-demographic contexts is crucial for effective LRTI management[2].

Human rhinoviruses, for instance, demonstrate pronounced genetic diversity, with no specific correlation between RV species and clinical presentations in adult patients[3,4]. This diversity complicates the clinical management of LRTIs, as it challenges the development of universal vaccines or targeted therapies. Similarly, *Klebsiella pneumoniae*, a common cause of bacterial LRTI, has shown varying strains with drug-resistant mechanisms, particularly concerning the elderly population[5,6]. For instance, Respiratory Syncytial Virus (RSV) infections are a major cause of LRTIs in children, leading to significant respiratory distress and failure in severe cases[7].

Assessing the microbial profile and drug utilization patterns in patients suffering from LRTIs is crucial for devising effective treatment strategies and antimicrobial stewardship. The previous studies highlight the significance of understanding both microbial profiles and antibiotic susceptibility patterns within specific geographic and demographic contexts[8]. Similarly, research conducted in Southern Ethiopia provides complementary insights, reinforcing the high prevalence of community-acquired lower respiratory tract infection and the challenges posed by antibiotic resistance[9]. These regional studies are further supported by broad assessments of antimicrobial agent utilization patterns, as evidenced by research evaluating prescribing patterns in hospitalized patients with infectious diseases[10]. They underscore the critical need for localized microbial and drug resistance surveillance to inform therapeutic choices, alongside broader research into antimicrobial usage patterns to ensure optimal and sustainable treatment strategies.

2. Methodology

Study Design: A retrospective observational study.
Study Duration: 6 months
Study Site:

- Department of Respiratory Medicine, SRM Medical College Hospital and Research Centre, SRMIST, Kattankulathur, Chengalpattu District, Tamilnadu, 603203.
- Medical Record Department (MRD), SRM Medical College Hospital and Research Centre, SRMIST, Kattankulathur, Chengalpattu District, Tamilnadu, 603203.

Sample Size: 100 patients
Inclusion Criteria:

- Patients above the age of 18 years diagnosed with LRTI.
- Patient case sheets with details of Complete Blood Count (CBC), and culture test will be included in the study.

Exclusion Criteria:

- Patients below the age of 18 years.
- Patients who voluntarily discharged and case sheet with incomplete information.
- Case sheets lacking data on Complete Blood Count (CBC) and Culture Sensitivity Test.

Ethical Clearance:

The study was carried out after receiving ethical clearance from the Ethical Committee of SRM Medical College and Research Institute (SRMIEC-ST0922-178)

3. Results

The study entitled "Assessment of Microbial Profile and Antimicrobial Susceptibility Pattern of Pathogens Isolated from Lower Respiratory Tract Infectious Patients" was conducted for 6 months. A total of 100 patient cases were collected from the respiratory ward, General medicine ward and Medical Record Department (MRD) at SRM Medical College Hospital and Research Centre based on the inclusion and exclusion criteria and analysed.

According to the study, there was a higher occurrence of LRTI in males (60%) compared to females (40%). In addition, there was a higher occurrence of respiratory infections observed in males. Based on the age distribution, it can be observed that LRTI is more common among patients over 60 years old (29%), followed by the 51-60 age group (21%), and least common among individuals aged 18-30 (14%). LRTI had a higher prevalence among males who were 60 years old or older.

The chart represents the duration of hospitalization for LRTI patients divided into three categories. Red (1–5 Days): The majority of patients (over 60%) had short hospital stays. Yellow (6–10 Days) and Green (Above 10 Days): Moderate (30%) and extended stays (below 10%), respectively.

Table 1 presents the social history of the study population, categorizing patients as alcoholic (18%), smokers (34%), or having no history of these habits (48%).

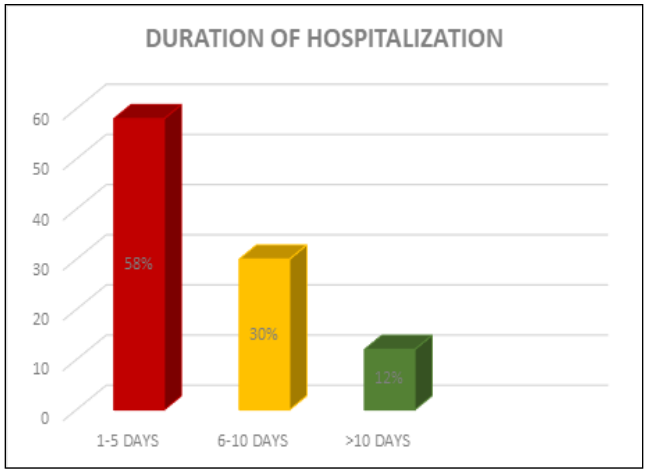


Figure 1. Duration of hospitalization of LRTI patients.

Table 1. Social history of the study population

Social history	Number of Patients (n=100)	Percentage (%)
Alcoholic	18	18
Smoking	34	34
None	48	48

Table 2. Diagnostic conditions in the study population

Major diagnosis	No of Patient(n=100)	Percentage%
Bronchiectasis	37	37
Pneumonia	37	37
Bronchitis	26	26

Table 2 summarizes the major diagnoses in the study population, with bronchiectasis and pneumonia each accounting for 37% of cases, and bronchitis contributing 26%.

Table 3 presents the distribution of comorbidities among 100 patients with LRTI, highlighting the prevalence of conditions such as hypertension, diabetes mellitus, COPD, and others, along with their respective percentages.

Figure 2 illustrates the general prescribing pattern among a study population of 531 patients, showing the percentage distribution of various drug categories, including bronchodilators, antibiotics, corticosteroids, and others.

Table 3. Comorbidities of LRTI patients

Co-morbidities	Number of Patients (n=100)	Percentage (%)
Hypertension	29	29
Diabetes mellitus	26	26
COPD	13	13
Diabetes mellitus + hypertension	9	9
Tuberculosis	8	8
Anemia	8	8
None	7	7

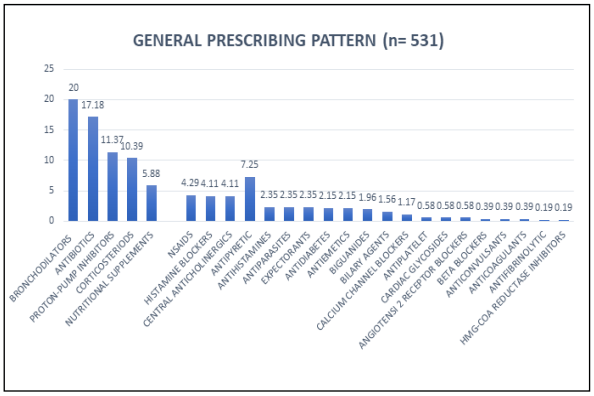


Figure 2. The general prescribing pattern in the study population.

Table 4 summarizes the prescribing patterns of drugs for LRTI based on 243 drugs, including antibiotics, bronchodilators, and corticosteroids, with their respective percentages. Additionally, it details the distribution of microorganisms (n=32) identified, categorized as Gram-positive and Gram-negative.

Table 5 shows the microbial profile of LRTI patients (n=32), highlighting the prevalence of Gram-positive bacteria, predominantly *Staphylococcus aureus*, and Gram-negative bacteria such as *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, along with their respective percentages.

Table 6 presents the Frequency of drug prescriptions categorized by generic vs. brand names for a total of 510 drugs.

Table 7 represents the WHO prescribing indicators for LRTI patients, highlighting the average number of drugs per prescription, the proportion of drugs prescribed by generic names, and the frequency of antibiotics and injections in prescriptions.

Table 4. Prescribing pattern of drugs for lower respiratory tract infection

Drugs	No. of Drugs (n= 243)	Percentage%
	ANTIBIOTICS	
Penicillins		
Amoxicillin	21	23.86
Piperacillin (Parenteral)	5	5.68
Macrolides		
Azithromycin	20	22.72
Cephalosporins		
Cefoperazone (Parenteral)	13	14.77
Cefixime	4	4.54
Fluoroquinolones		
Ciprofloxacin	12	13.66
Levofloxacin	3	3.41
Tetracycline		
Doxycycline	10	11.36
	BRONCHODILATORS	
Acebrophylline	54	52.94
Ipratropium bromide and levosalbutamol (Inhalation)	34	33.33
Theophylline	14	13.72
	CORTICOSTEROIDS	
Budesonide (Inhalation)	21	39.62
Prednisolone	14	26.41
Dexamethasone (Parenteral)	13	24.52
Hydrocortisone (Parenteral)	5	9.43

4. Discussion

The current retrospective observational study aimed to evaluate the microbial profile and drug utilization patterns in patients diagnosed with LRTI over six months. The analysis encompassed 100 patients from the Department of Respiratory Medicine at SRM Medical College Hospital and Research Centre.

According to the study, there was a higher occurrence of LRTI in males (60%) compared to females (40%). In addition, there was a higher occurrence of respiratory infections observed in males. Based on the age distribution, it can be observed that LRTI is more common among patients over 60 years old (29%), followed by the 51-60 age group (21%), and least common among individuals aged 18-30 (14%). LRTI had a higher prevalence among males who were 60 years old or older[11]. This research implies the same result as Mitra, Kar, *et al.*

Reviewing the duration of hospital stays for patients with LRTIs provides valuable information about the management and severity of the disease. A significant number of patients (58%) noticed stays of 1-5 days, suggesting that the initial treatment was effective and their recovery was swift. A considerable percentage (30%) took 5-10 days, possibly because of the moderate severity or the necessity for thorough diagnostic and therapeutic procedures[12,13]. A smaller percentage of individuals experienced longer stays, which can be attributed to more

Table 5. Microbial profile in LRTI patients

Drugs	No of Drugs (n=510)	Percentage
Number of drugs prescribed by generic name	52	10.2
Number of drugs prescribed by brand	458	89.8

Table 6. Frequency of medication prescription

Microorganisms	Total no (n=32)	Average (%)
Gram-positive		
Staphylococcus aureus	26	81.25
Gram-negative		
Klebsiella pneumonia	2	6.25
Pseudomonos aeruginosa	4	12.5

Table 7. Who prescribing indicators in LRTI patients

Prescribing Indicators	Percentage
Average number of drugs per prescription	100
Percentage of drugs prescribed by generic name	2.75
Percentage of prescriptions with an antibiotic prescribed	17.18 %
Percentage of prescriptions with an injection prescribed	8.62%

severe cases that were further complicated by additional health conditions or infections that were difficult to treat.

These findings emphasise the range of severity in LRTI and the significance of personalised care. (Figure 1) Shorter stays indicate effective treatment protocols, while longer durations highlight the necessity for comprehensive management in more intricate cases. This study highlights the importance of identifying issues early on and implementing personalised interventions to enhance results and make the most efficient use of healthcare resources. Future research should prioritise the improvement of treatment protocols to better cater to the requirements of patients with severe LRTI.

Between the patient population, a notable proportion of individuals, specifically 18%, were found to have a history of alcoholism. (Table 1) Additionally, 34% of the patients were identified as smokers, whereas the majority, accounting for 48%, did not engage in either of these behaviours. These lifestyle factors play a crucial role, as smoking and alcohol consumption have been linked to respiratory infections, which may explain the higher prevalence in these groups[14].

The most common diagnoses were Bronchiectasis and Pneumonia, (Table 2) each accounting for 37% of cases, followed by Bronchitis at 26%. This distribution underscores the diversity of LRTI presentations. Hypertension (29%) and Diabetes Mellitus (26%) were the predominant comorbidities (Table 3), indicating a significant overlap between chronic conditions and respiratory infections. Additionally, 13% of patients had COPD, 9% had both diabetes and hypertension, and 8% had tuberculosis or anaemia, highlighting the complex medical profiles often associated with LRTI[15].

The distribution of prescribed drugs among LRTI patients highlights the variety of therapeutic approaches used in managing the condition. (Figure 2) Bronchodilators were the most commonly prescribed, accounting for 20% of the total drugs, reflecting their importance in relieving respiratory symptoms. Antibiotics constituted 17.18%, indicating a significant bacterial component in LRTI cases and the need for targeted antimicrobial therapy (Table 4). Proton-pump inhibitors (11.37%) and corticosteroids (10.39%) were also frequently prescribed, likely for managing gastroesophageal reflux and inflammation, respectively.

Other notable categories included nutritional supplements (5.88%), NSAIDs (4.29%), and histamine blockers (4.11%), which were used to support overall patient health and manage symptoms[16]. Using different types of drugs, like antipyretics, antihistamines, and central anticholinergics, shows that treating LRTI is complex because it involves treating both the main and secondary symptoms.

Pseudomonas aeruginosa (12.5%) and *Klebsiella pneumoniae* (6.25%) were the next most frequently isolated microorganisms after *Staphylococcus aureus* (81.25%). (Table 5) The predominance of S. aureus is consistent with other studies on respiratory infections, underlining its significant role in LRTI aetiology. These findings highlight the importance of appropriate microbial identification and targeted antibiotic therapy in managing LRTI[17-19].

The data reveals a notable disparity in prescription practices for LRTI patients, with a significant preference for brand-name drugs over generic ones. (Table 6) Only 52 (10.2%) of the 510 drugs prescribed had their generic names; the vast majority, 458 (89.8%), had their brand names[20]. This trend suggests a potential influence of brand recognition or patient and physician preferences for specific branded formulations. The lower rate of generic drug prescriptions may have implications for the overall cost of treatment, as generics are typically less expensive than their branded counterparts.

The predominance of brand-name prescriptions over generic alternatives highlights a critical area for improvement in prescribing practices. Promoting the use of generic drugs could significantly reduce healthcare costs while maintaining therapeutic efficacy. This shift would require increased awareness and confidence in generic medications among both healthcare providers and patients. The findings underscore the need for strategies to encourage the use of generic names in prescriptions, aligning with cost-effective healthcare delivery without compromising the quality of patient care.

The analysis of prescribing indicators provides insight into the prescribing habits and medication use patterns in the study. (Table 7) The average number of medicines prescribed per patient encounter was notably high, with every patient receiving multiple medications. This polypharmacy trend suggests a comprehensive approach to managing lower respiratory tract infections, often involving a combination of therapeutic agents.

Only 2.75% of the medications had their generic names prescribed, indicating a strong preference for brand-name medications. This low percentage of generic prescriptions may reflect a lack of emphasis on cost-

effective prescribing practices, potentially leading to higher treatment costs.

Antibiotics were prescribed in 17.18% of encounters, highlighting their crucial role in the management of bacterial infections[21]. This percentage also raises concerns about the potential overuse or misuse of antibiotics, which can contribute to antibiotic resistance.

Injectables accounted for 8.62% of the prescribed medications, indicating a reliance on parenteral routes of administration in certain clinical scenarios. This could be due to the severity of the condition, requiring rapid drug action, or instances where oral administration was not feasible.

The findings emphasize the need to promote generic prescribing to reduce healthcare costs and ensure rational drug use. Additionally, careful consideration is necessary to prevent unnecessary antibiotic and injectable use, thereby minimizing the risk of resistance and adverse effects[22,23]. These insights can inform the development of guidelines and interventions aimed at optimizing prescribing practices and improving patient outcomes in the treatment of lower respiratory tract infections. The findings of this study are crucial for healthcare providers to consider when determining the best course of treatment for their patients.

5. Conclusion

In conclusion, this study underscores the importance of establishing standardized therapeutic protocols for LRTIs, given the high prevalence of *Staphylococcus aureus* and significant comorbidities among patients. The findings emphasize the critical need for rational antibiotic use to combat resistance and the importance of addressing lifestyle factors like smoking and alcohol consumption. Further research is recommended to refine treatment approaches and tackle emerging resistance patterns and comorbidities, ultimately improving LRTI management and patient outcomes in the healthcare setting.

6. References

1. Murphy CN, Fowler R, Balada-Llasat JM, Carroll A, Stone H, Akerele O, *et al*. Multicenter evaluation of the biofire film array pneumonia/pneumonia plus panel for detection and quantification of agents of lower respiratory tract infection. J Clin Microbiol. 2020; 58(7):e00128-20. https://doi.org/10.1128/JCM.00128-20 PMid:32350043 PMCid:PMC7315029
2. Egbe CA, Ndiokwere C, Omoregie R. Microbiology of lower respiratory tract infections in Benin City, Nigeria. Malays J Med Sci. 2011; 18(2):27-31. PMID:22135583 PMCid: PMC3216205
3. Verwey C, Madhi SA. Review and update of active and passive immunisation against respiratory syncytial virus. BioDrugs. 2023; 37(3):295-309. https://doi.org/10.1007/s40259-023-00596-4 PMid:37097594 PMCid:PMC10127166
4. Golke P, Hönemann M, Bergs S, Liebert UG. Human rhinoviruses in adult patients in a tertiary care hospital in Germany: Molecular epidemiology and clinical significance. Viruses. 2021; 13(10):2027. https://doi.org/10.3390/v13102027 PMid:34696457 PMCid:PMC8539166
5. Shao C, Wang W, Liu S, Zhang Z, Jiang M, Zhang F. Molecular epidemiology and drug-resistant mechanism of carbapenem-resistant *Klebsiella pneumoniae* in elderly patients with lower respiratory tract infection. Front Public Health. 2021; 9:669173. https://doi.org/10.3389/fpubh.2021.669173 PMid:34095072 PMCid:PMC8172620
6. Long MB, Howden AJM, Keir HR, Rollings CM, Giam YH, Pembridge T, *et al*. Extensive acute and sustained changes to neutrophil proteomes post-SARS-CoV-2 infection. Eur Respir J. 2024; 63(3):2300787. https://doi.org/10.1183/13993003.00787-2023 PMid:38097207 PMCid:PMC10918319
7. Javouhey E, Pouyau R, Massenavette B. Pathophysiology of acute respiratory failure in children with bronchiolitis and effect of CPAP. Noninvasive Ventilation in High-Risk Infections and Mass Casualty Events. 2013; 233-249. https://doi.org/10.1007/978-3-7091-1496-4_27 PMCid:PMC7120685
8. Egbe CA, Ndiokwere C, Omoregie R. Microbiology of lower respiratory tract infections in Benin City, Nigeria. Malays J Med Sci. 2011; 18(2):27-31. PMID:22135583 PMCid: PMC3216205
9. Gebre AB, Begashaw TA, Ormago MD. Bacterial profile and drug susceptibility among adult patients with community-acquired lower respiratory tract infection at tertiary hospital, Southern Ethiopia. BMC Infect Dis. 2021; 21(1):440. https://doi.org/10.1186/s12879-021-06151-2 PMid:33985445 PMCid:PMC8120775
10. Nawa AIA, Shareef J, Rao PGM, Rashid AU. Assessment of drug utilisation pattern of antimicrobial agents in hospitalised patients with infectious diseases: A cross-sectional study in the United Arab Emirates. J Adv Pharm Technol Res. 2023; 14(4):299-305. https://doi.org/10.4103/japtr.japtr_79_23 PMid:38107453 PMCid: PMC10723168

11. Mitra K, Dubey A, Singh R, Jamwal A, Tejan N, Sahu C. Microbiological and clinical characteristics of lower respiratory tract infections in patients from the pediatric ward, adult respiratory ward, and medicine intensive care unit at a university hospital in Northern India. J Appl Sci Clin Pract. 2024. https://doi.org/10.4103/jascp.jascp_32_23
12. Dinh A, Crémieux AC, Guillemot D. Short treatment duration for community-acquired pneumonia. Curr Opin Infect Dis. 2023; 36:140-145. https://doi.org/10.1097/QCO.0000000000000908 PMid:36718940
13. Dossou PE. Short treatment duration for community-acquired pneumonia. Curr Opin Infect Dis. 2023; Publish Ahead of Print. https://doi.org/10.1097/qco.0000000000000908 PMid:36718940
14. Shah P, Desai B, Jagani K, Pipalava A, Savaliya P. Sociodemographic profile of patients using other substances in patients of alcohol use disorder. Int J Sci Res. 2022; 34-36. https://doi.org/10.36106/ijsr/2501083
15. Hyams C, Begier EA, Southern J, King J, Morley A, Szasz-Benczur Z, *et al*. Acute lower respiratory tract disease is a complex clinical syndrome causing significant disease burden in a prospective cohort study. Epidemiology. 2022. https://doi.org/10.1183/13993003.congress-2022.428
16. Vishwasrao S, Vishwasrao S, Kumar A. Drug prescribing pattern in obstructive airway disorders in a tertiary care hospital, Chengalpattu, Tamil Nadu: A cross-sectional and observational study. Natl J Physiol Pharm Pharmacol. 2022. https://doi.org/10.5455/njppp.2022.12.08387202214082022
17. Ravi M, Krishnasamy L, Krishnakumar S. Antimicrobial susceptibility pattern of bacterial isolates in patients with lower respiratory tract infections. Int J Life Sci Pharm Res. 2023. https://doi.org/10.22376/ijlpr.2023.13.5.L371-L376
18. Chai S, Wang C, Liu Y, Xia J, Wang X, Shi J. Distribution patterns of pathogens causing lower respiratory tract infection based on metagenomic next-generation sequencing. Infect Drug Resist. 2023; 16:6635-6645. https://doi.org/10.2147/idr.s421383 PMid:37840830 PMCid:PMC10576460
19. Ratnakar S. Aerobic bacterial profile and antibiogram of bronchoalveolar lavages in pulmonary infections at a tertiary care hospital. Int J Curr Pharm Res. 2023. https://doi.org/10.22159/ijcpr.2023v15i4.3016
20. Patients choices of generic and branded medicines: A comparative study. J Inform Educ Res. 2023. https://doi.org/10.52783/jier.v3i2.52
21. Agede OA, Ogunmodede JA, Ole JO, Bojuwoye DS, Oyedepo NS, Aiyedun SA. Assessment of medication prescribing indicators using the World Health Organization standard indices in a tertiary hospital in Ilorin, Nigeria. Pan Afr J Life Sci. 2023. https://doi.org/10.36108/pajols/3202/70.0360 PMid:38665847
22. Hishmath M, Zaheema AP, Francis SP, Veigas GJ, Ravikumar R. Prescribing pattern of antimicrobials for respiratory tract infections among the pediatric population in a multi-speciality teaching hospital. Res J Pharm Technol. 2023; 5972-5977. https://doi.org/10.52711/0974-360X.2023.00969
23. Razdan D, Yadav S, Gudibanda KR, Dudhraj V, Anand S, Kaur S, *et al*. Assessing prescribing practices in Indian health facilities: A comprehensive review. Int J Community Med Public Health. 2023. https://doi.org/10.18203/2394-6040.ijcmph20233814

Access this journal online	
	Quick Response Code
Website: www.informaticsjournals.co.in/index.php/JEOH/index	