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Original Article

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Evaluation of Antibiotic Usage in Pediatric Respiratory Tract Infections in a Tertiary Care Hospital: An Observational Study

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ABSTRACT

Background: Inappropriate antibiotic use in pediatric respiratory tract infections (RTIs) contributes to antimicrobial resistance, necessitating evaluation of prescribing practices. This study assessed antibiotic usage for pediatric RTIs using WHO prescribing indicators at a tertiary care hospital in Delhi, NCR, India.

Methods: A prospective observational study was conducted from December 2023 to December 2024 at Santosh Medical College, Ghaziabad. Prescriptions for pediatric patients with RTIs were analyzed for WHO indicators, including medication count, antibiotic use, generic prescribing, and adherence to the 2022 National List of Essential Medicines (NLEM).

Results: Out of 372 prescriptions, 88.17% included antibiotics (mean: 0.88 antibiotics/prescription), with a mean of 3.37 medications per prescription. Fixed-dose combinations (FDCs) accounted for 37.63% of prescriptions, and 54.57% used generic names. All antibiotics adhered to NLEM, with 60% classified as Access and 39% as Watch per WHO AWaRe. Antibiotic use (88.17% vs. 20–26.8%) and medications per prescription (3.37 vs. <2) exceeded WHO standards, while injectable use (16.13%) and NLEM adherence (100%) met guidelines.

Conclusion: High antibiotic use and polypharmacy suggest overuse, highlighting the need for antimicrobial stewardship programs (ASPs) to promote rational prescribing in pediatric RTIs; targeted interventions, physician training, and prescription audits are essential to curb resistance and ensure safe, evidence-based care.

Key-words: Drug Utilization Evaluation, Pediatric Respiratory Tract Infections, WHO Prescribing Indicators, Antibiotics, Rational Drug Uses

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INTRODUCTION

Drug Utilization Research (DUR), as defined by the World Health Organization (WHO), examines the marketing, distribution, prescription, and use of pharmaceuticals within a healthcare system, focusing on their social, medical, and economic impacts [1]. WHO prescribing indicators are critical tools for assessing polypharmacy, inappropriate antibiotic use, parenteral medication use, generic prescribing, and adherence to essential drug lists

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[2]. DUR provides insights into medication use patterns and identifies areas for improvement in prescribing practices. WHO reports suggest that nearly half of all medications are prescribed or administered inappropriately, leading to suboptimal therapeutic outcomes [3]. Investigating prescription patterns is essential to promote rational prescribing practices.

Antibiotics are among the most prescribed medications in pediatrics, particularly for respiratory tract infections (RTIs), which are a leading cause of morbidity in children under five globally [4]. Rational prescribing requires judicious, safe, effective, and cost-effective use of medications to minimize risks, such as antibiotic resistance, while respecting patient preferences [5]. Overuse of antibiotics contributes to the emergence of resistant pathogens, necessitating prudent use to manage resistance [1,6]. Factors such as patient demand, time constraints, and diagnostic uncertainty often drive overprescribing [7,8]. RTIs, particularly upper respiratory tract infections (URTIs), are the most prevalent infections in children, with preschoolers experiencing six to eight episodes annually [9]. URTIs, primarily viral (e.g., the common cold), cause symptoms such as nasal congestion, fever, and irritability, leading to increased healthcare visits and absenteeism [9].

Bacterial complications, such as acute otitis media (70% of children by age 2) and sinusitis, are common [10,11]. Community-acquired pneumonia (CAP) affects 0.2–0.6% of children annually, contributing to 3.5 million deaths from lower respiratory tract infections (LRTIs) globally [12,6]. LRTIs, including bronchitis and bronchiolitis, are caused by viral or bacterial pathogens affecting the lungs [12]. Few studies in India have explored prescribing patterns for pediatric RTIs [13]. This study aimed to evaluate antibiotic usage and prescribing patterns in pediatric RTIs at a tertiary care hospital in Delhi, NCR, using WHO prescribing indicators.

MATERIALS AND METHODS

Study Design and Setting- This hospital-based, observational, prospective study was conducted at Santosh Medical College and Hospital, Ghaziabad, India, from December 2023 to December 2024. The study analyzed prescription trends in pediatric patients (newborn to 18 years) diagnosed with RTIs in outpatient departments (OPD) or admitted to wards/ICUs.

Sample Size and Selection- A sample size of 372 prescriptions was determined using a confidence level of 95% and a margin of error of 5%, based on an estimated prevalence of antibiotic use in pediatric RTIs from prior studies [14].

Inclusion criteria

- Patients diagnosed with RTIs
- Aged ≤18 years
- Informed consent obtained from guardians

Exclusion Criteria

- Prescriptions with errors
- Incomplete/missing data
- Patients >18 years

Data Collection- Data on patient demographics, RTI diagnoses, and antibiotic use were collected from prescriptions or legal guardians after informed consent. Prescribing patterns were analyzed using WHO core prescribing indicators, including the average number of medications per prescription, antibiotic use, use of fixed-dose combinations (FDCs), generic prescribing, and adherence to the 2022 National List of Essential Medicines (NLEM) [3]. Antibiotics were categorized using the WHO AWaRe classification (Access, Watch, Reserve) [2].

Statistical Analysis- Data were analyzed using IBM SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequency, percentage, and mean, were used to summarize patient characteristics and prescribing patterns.

RESULTS

A total of 372 prescriptions were analyzed, representing patients with a mean age of 7.25 years (range: 1–18 years). The majority (53.23%) were male, and 46.77% were female. Patients aged 6–10 years were most affected (46.77%), followed by those aged 1–5 years (34.68%), 11–15 years (16.94%), and 15–18 years (1.61%). The mean patient weight was 23.41 kg. The common cold was the predominant RTI (17.74%), followed by bronchitis (13.44%), asthma (12.90%), pneumonia (8.60%), and other RTIs. (Fig. 1,2) Comorbidities or concurrent symptoms, primarily fever (55.95%) and allergic rhinitis (12.86%), affected 83.6% of patients.

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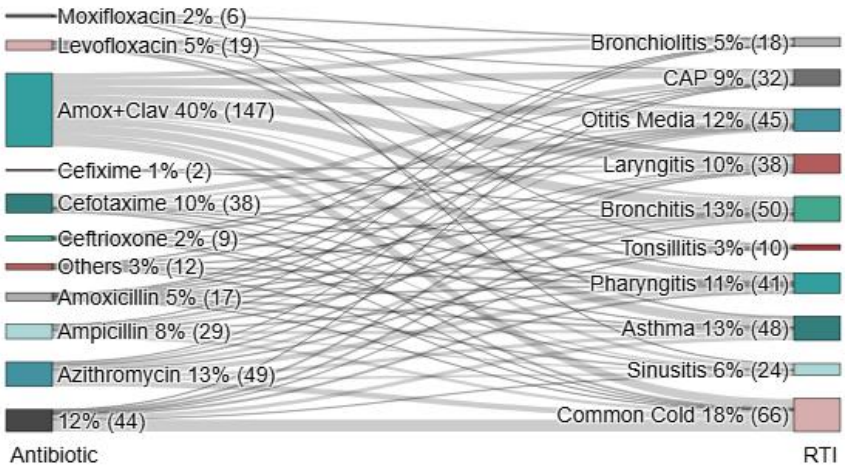

Fig. 1: Antibiotic usage pattern for different RTI symptoms in pediatric patients.

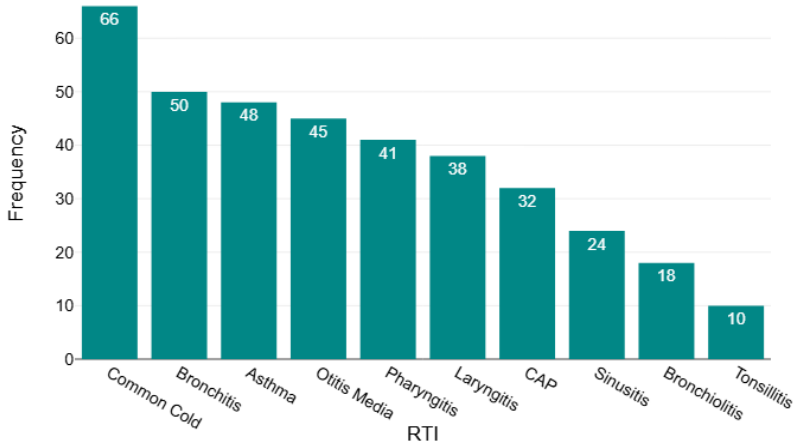

Fig 2: RTI pattern in pediatric department (n=372)

A total of 1,254 medications were prescribed, with a mean of 3.37 medications per prescription. Antibiotics were prescribed in 328 (88.17%) prescriptions, averaging 0.88 antibiotics per prescription. Amoxicillin/Clavulanic acid was the most frequently prescribed antibiotic (39.52%), followed by azithromycin (13.17%), cefotaxime (10.22%), and cephalosporins. (Fig. 3) Most antibiotics belonged to the Access (60%) or Watch (39%) groups per the WHO AWaRe classification. Medications were administered orally (83.87%) or via injection (16.13%).

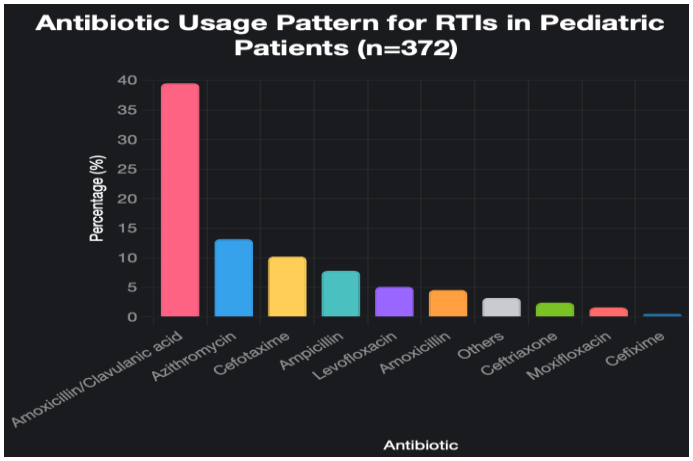

Fig. 3: Antibiotic usage pattern for RTI's in pediatric patients (n=372**)**

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All prescriptions included drug dosage forms and adhered to the 2022 NLEM. Generic names were used in 203 (54.57%) prescriptions, and FDCs accounted for 140 (37.63%) prescriptions. (Table 1) Compared to WHO standards, the study showed higher medication use (3.37 vs. <2) and antibiotic prescribing (88.17% vs. 20–26.8%), but injectable antibiotic use (16.13%) and NLEM adherence (100%) met WHO guidelines (Table 2).

Table 1: Analysis of antibiotic prescriptions for RTI in pediatric patient based on WHO core prescribing indicators

Drug use indicators	Results of analysis
Total number of Prescription analyzed (n=372) Total number of drugs prescribed (n=1254) Total number of antibiotic medications prescribed, (n=328) The averages of medicines per prescription studied	3.37
Average number of antibiotic medicines per prescription	0.88
Prescription containing FDC in the study	140 (37.63%)
Percentage of prescriptions with drug dosage form	100%
Percentage of prescriptions prescribed from NLEM (2022)	100%
Percentage of prescription written with generic name	203 (54.57%)

Table 2: Comparison of antibiotic prescriptions for RTI in pediatric patient based on WHO core prescribing indicators with standard indicators

Indicators	Study Result	Who Standard (%)
Average medications/prescription	3.37 (1254)	<2
Percentage of antibiotics prescribed	88.17 % (328)	20-26.8
Percentage of injectable antibiotics	16.13 % (60)	13.4-24.1
Percentage of antibiotics with generic name	54.57% (203)	100
Percentage of antibiotics from NLEM	100%	100

DISCUSSION

Rational prescribing ensures medications meet clinical needs, are dosed appropriately, used for a sufficient duration, and are cost-effective for patients and communities [7]. However, WHO estimates suggest over half of prescriptions are irrational, leading to drug interactions, resistance, and non-compliance [5]. This study analyzed 372 pediatric RTI prescriptions, with a mean patient age of 7.25 years and a slight male predominance (53.23%). The common cold, followed by bronchitis and asthma, was the most common RTI, with 83.6% of patients experiencing comorbidities or concurrent symptoms like fever (55.95%) and allergic rhinitis (12.86%) [9,11].

Amoxicillin/Clavulanic acid was the most prescribed antibiotic (39.52%), followed by azithromycin and cefotaxime [12,13]. These findings align with studies reporting frequent use of Amoxicillin/Clavulanic acid in pediatric RTIs [14].

The combination of Ampicillin and Cloxacillin, prescribed to approximately 10 patients, lacks synergistic effects, as Cloxacillin is ineffective against gram-negative bacteria and does not inhibit beta-lactamase, potentially increasing costs and adverse effects [13]. Similarly, a study in Moradabad, India, reported the use of antibiotic combinations such as Cefpodoxime with Amikacin and Ceftriaxone with Vancomycin, which may also contribute to suboptimal treatment outcomes [13].

Antipyretics, bronchodilators, and expectorants were commonly prescribed alongside antibiotics, consistent with fever and respiratory symptoms in RTIs [15]. Oral administration (83.87%) was predominant, followed by injectables (16.13%), reflecting the need for intravenous antibiotics in severe cases [12]. The high antibiotic prescribing rate (88.17%) exceeds WHO standards (20–26.8%), suggesting potential overuse, possibly due to diagnostic uncertainty or patient expectations [8].

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Antimicrobial stewardship programs (ASPs) can promote rational antibiotic use by encouraging narrower-spectrum antibiotics and shorter treatment durations [4]. A systematic review of pediatric ASPs for respiratory infections supports their efficacy in reducing inappropriate prescribing [4]. Variations in prescribing practices may reflect differences in hospital protocols and clinical settings [16]. Interventions such as pharmacotherapy training, hospital formularies, and antibiotic guidelines can enhance rational prescribing [3]. The study's findings of high antibiotic use and polypharmacy suggest a need for targeted interventions to address overuse and promote adherence to WHO standards [17].

CONCLUSIONS

This study identified higher-than-recommended antibiotic use (88.17%) and medications per prescription (3.37) compared to WHO standards, likely due to the prevalence of fever and other symptoms in RTI patients. However, the use of injectable antibiotics (16.13%) and adherence to the NLEM (100%) met the WHO guidelines. Generic prescribing (54.57%) fell short of the WHO target (100%). These findings suggest that appropriate antibiotic selection is often possible, but highlight the need for ASPs to reduce overuse and promote rational prescribing. Medical professionals should be trained in cost-effective prescribing, and national conferences should advocate for responsible practices to address antibiotic resistance.

CONTRIBUTION OF AUTHORS

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Data collection– Rajni Kumari Rai, Vishal Kapoor
Data analysis and interpretation– Jyotsna Sharma, Sumit Singhal
Literature search– Alka Agrawal, Rajni Kumari Rai, Ajay Kestwal
Writing article– Prabhjot Kaur, Shaktibala Dutta
Critical review– Jyotsna Sharma, Srihari Dutta
Article editing– Amit Singhal, Rajni Kumari Rai, Vishal Kapoor
Final approval– Srihari Dutta, Amit Singhal

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