"DRUG USAGE PATTERN FOR LRTI IN PEDIATRICS AT TERTIARY CARE HOSPITAL"

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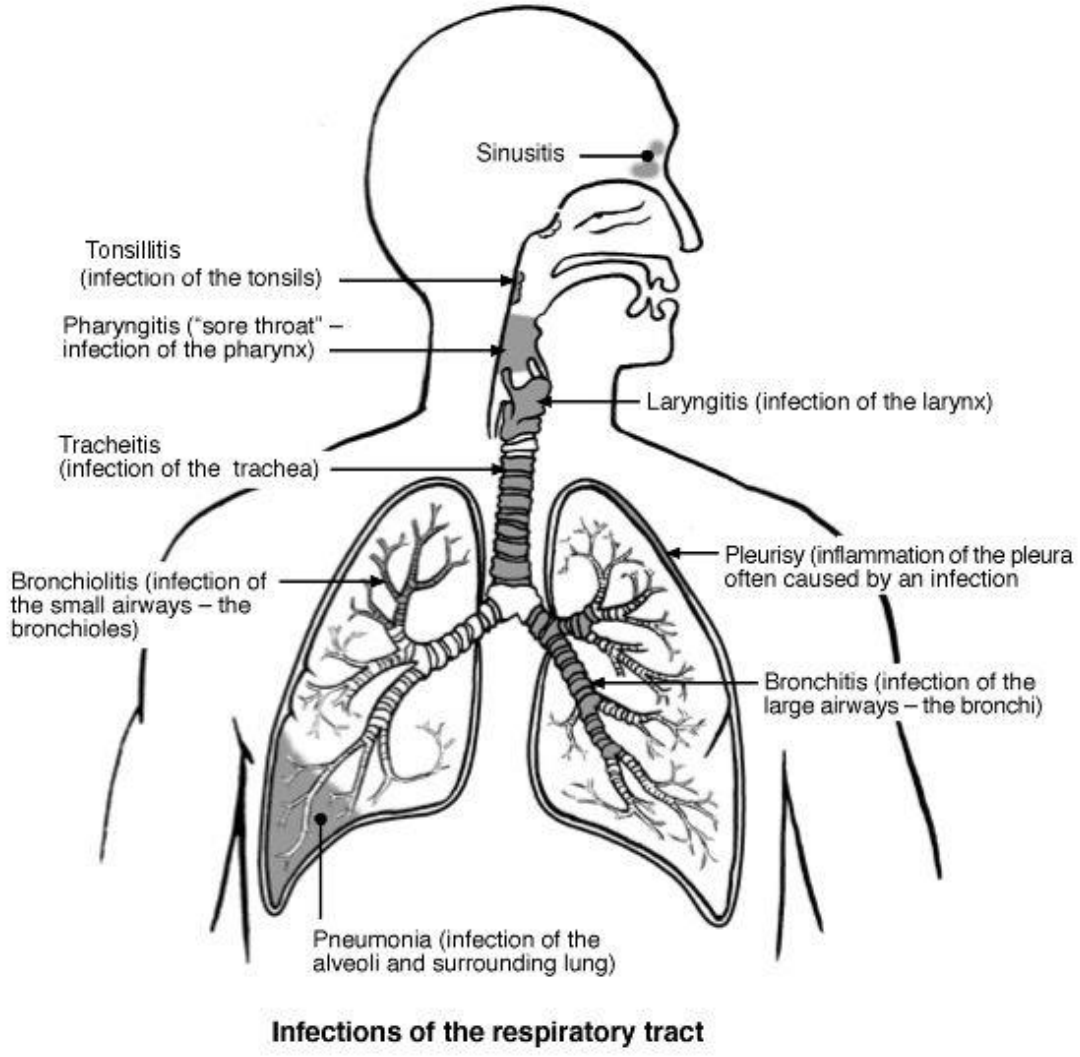
ABSTRACT:

The purpose of this study is to determine the treatment pattern for lower respiratory tract infections in paediatrics. This will allow us to identify any changing trends in physician prescribing patterns, and we will be able to investigate the reason for the changes in prescription patterns. To assess the rational use of medications using WHO indicators, Modified Kunin's rationality criteria. Prospective, observational study, over the period of 6 months (2021-22), at a tertiary care teaching hospital, Vadodara. The sample size is calculated using the RAOSOFT online software and statistical analysis is performed using Microsoft Excel version 2019. P value will be determined from Chi square method using GraphPad Prism 9 to determine the authenticity of the data. A total of 90 prescriptions were analyzed. 54 (60%) were male and 36 (40%) were female patients. The highest number of patients were seen in the 1-5 age group which is 62(67.7 %). 48(53.3%) patients were found to be suffering from WALRI as compared to 29(32.2%) suffering from pneumonia. On calculating the WHO indicators it was found that 39.6% of total drugs prescribed were prescribed by generic name and 33.6 % of the total drugs prescribed were IV preparations. Percent encounter with an antibiotic prescribed were 25.4%. Majority of the medications commonly used in our study site was antimicrobial agents.

KEYWORDS: Lower Respiratory tract infection, Pediatrics, Drug Utilization Evaluation, WHO prescribing indicators, Modified Kunin's Rationality Criteria.

1. INTRODUCTION:

Figure 1: Types of Respiratory tract infections



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It can be classified as Upper Respiratory Tract Infection (URTI) and Lower Respiratory Tract Infection (LRTI). Upper Respiratory Tract Infections (URTIs) include the common cold, laryngitis, pharyngitis/tonsilitis, acute rhinitis, acute rhinosinusitis, and acute otitis media,[1] Among all infectious diseases, LRTIs are the major cause of death globally. Lower respiratory

tract infections are the major cause of death compared to upper respiratory tract infections. Lower respiratory tract infections are any infections in the lungs or below the larynx. These include bronchitis, bronchiolitis, pneumonia, and pulmonary tuberculosis.[2] Viruses like respiratory syncytial virus and bacteria like streptococcus or staphylococcus aureus cause the majority of lower respiratory tract infections.[3] LRTI most commonly affects young children and older adults and worldwide it is a major cause of death. Of the 5.9 million deaths which occurred worldwide due to respiratory tract infections, 1.2 million deaths were in India.[4] The use of antibiotics has become a routine practice for the treatment of pediatric illnesses and antibiotics are the most commonly prescribed drugs in the pediatric population.[5] Every year, around 9 million children under the age of five die from respiratory illnesses, with pneumonia being the most common cause.[6]

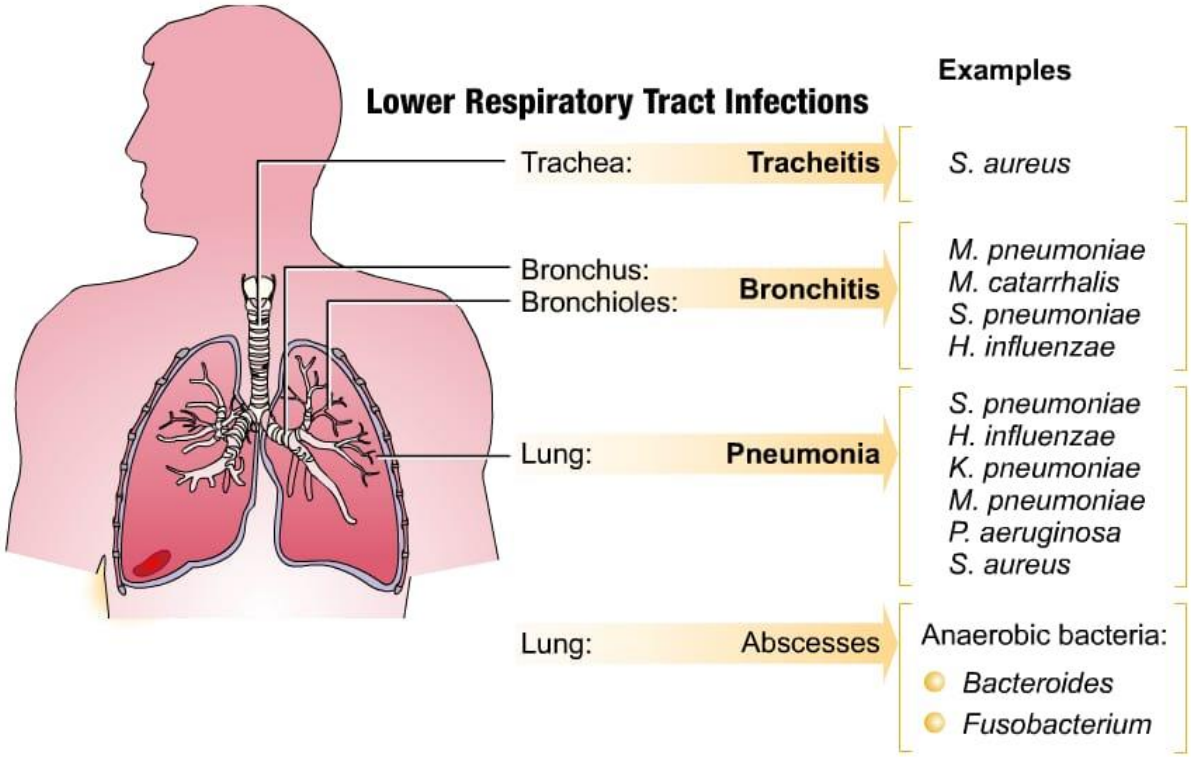

Figure 2: Types of Lower respiratory tract infections

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Viruses cause bronchitis, bronchiolitis, and pneumonia, which are all referred to as LRTI. Streptococcus pneumoniae, chlamydia spp., legionella, and Coxiella burnetii viruses are the most prevalent causes of community-acquired pneumonia. Gram-negative organisms, primarily staphylococci, cause nosocomial pneumonia. Organisms enter the

body through a different pathway, including inhaled air, aspiration, and hematogenous seeding. Pathogens multiply inside or on the surface of the epithelium after entering the body. In severe bronchiolitis, epithelial inflammation and necrosis can plug small airways, leading in airway obstruction.[7]

2. Experimental section:

2.1. Materials and methods:

2.1.1 Study Preparation:

The study on the drug usage pattern on LRTI in pediatrics is assessed through a prospective observational study, over a period of 6 months at a tertiary care hospital, Vadodara.

2.1.2 Data Collection:

The study was conducted in Parul Sevashram hospital with 90 sample size. The data were collected from the IPD and OPD of pediatric ward.

2.1.3 Sample Selection Criteria:

The study was conducted in English, Gujrati and Hindi language. One-to-one interview was done in vernacular language for people willing to participate in study. The survey was conducted during August 2021- February 2022.

2.1.4 Data Analysis and Statistical Application:

The data will be compiled and analyzed using Microsoft Excel 2019. Different types of graphs, figures and tables will be used to outline the data visually. P value will be determined from Chi square method using GraphPad Prism 9 to determine the authenticity of the data.

3. RESULT AND DISCUSSION:

3.1 RESULT:

A total of 90 patients were assessed and separated into two different groups based on their admission criteria. The data was collected from 90 patients, 9 of whom were recruited from an out-patient department and 81 from an in-patient department of a tertiary care hospital's Pediatric ward.

3.1.1 DEMOGRAPHIC DATA AND BASELINE CHARACTERISTICS OF THE RECRUITED PATIENTS:

Obtained patient demographic details were analyzed and baseline characteristics of the study population are summarised as follows:

1. Male patients were found to be 54(60%) of total population and Female patients were found to be 36(40%) of the total population.

2. Mean length of hospital stay in the patients admitted to the inpatient department was found to be 5-7 days.

3. There were 81 patients in the inpatient department and 9 patients in the outpatient department

3.1.2 PRESCRIBING PATTERN OF DRUGS IN PEDIATRICS:

3.1.2.1 CLASS-WISE DISTRIBUTION OF DRUGS PRESCRIBED:

Table 1: Class Wise distribution of drugs prescribed

Class	No. of drugs	Percentage (%)	(Chi-square) χ^2	P-value (total)
Bronchodilators	37	9.1	Total= 186.016	P value is <0.0001
Mucolytic agents	4	1		
Nasal decongestants	21	5.1		
Corticosteroids	15	3.71		
Antibiotics	99	25.4		
Antihistamines	15	3.71		
NSAIDs	44	10.8		
Supplements	69	17.07		
Others	44	10.8		
Combination medicines	56	13.8		

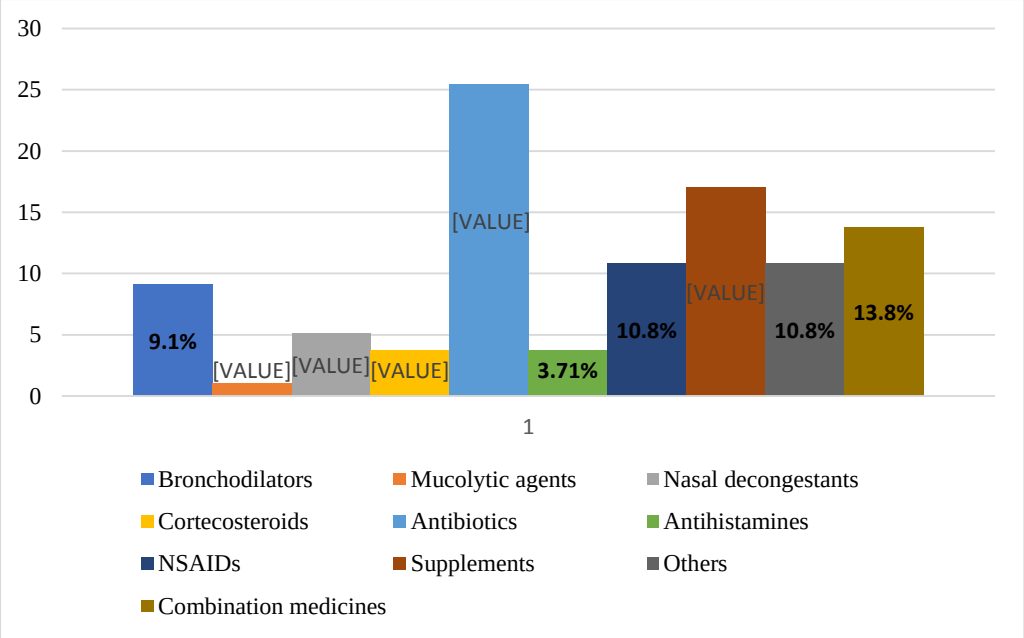

Figure 1: Percentage distribution of Drugs prescribed according to class

Out of 90 prescriptions, we have found that antibiotics were highly prescribed i.e. 99 (25.4 %) in number to the pediatric population followed by supplements 69 (17.07%) which were followed by combination medicines 56 (13.8%), NSAIDs, and others 44 (10.8%), bronchodilators 37 (9.1%), nasal decongestants 21 (5.1%), antihistamines 15 (3.71%), corticosteroids 15 (3.71%), and mucolytic agents 4 (1%) were found to be prescribed alike. 404 medications were estimated to be prescribed to the total patient population of 90 patients. P-value was determined by the Chi-square method which was found to be statistically significant i.e P-value is <0.0001. The result was significant at $p<0.05$

3.1.2.2 DISTRIBUTION OF DRUGS USED TO TREAT LOWER RESPIRATORY TRACT INFECTIONS:

Class	No. of drugs	Percentage (%)
Bronchodilators	37	14.9
Mucolytic agents	4	1.6
Nasal decongestants	21	8.5
Corticosteroids	15	6.07
Antibiotics	99	40
Antihistamines	15	6.07

Combination medicines	56	22.6

Table 2: Distribution of drugs used in LRTI

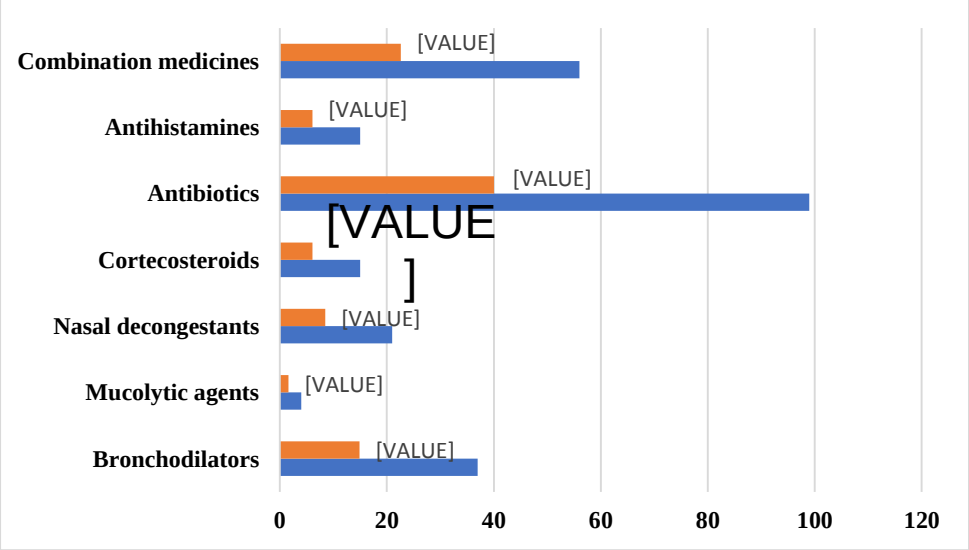

Figure 2: Percentage distribution drugs used in LRTI

A total of 247 medications were prescribed for treating lower respiratory tract infections. Out of the 247 prescribed, 56 were combination medicines which comprised 22.6% of the total prescribed medications to treat LRTI. Bronchodilators (Salbutamol, Ipratropium bromide) constituted 37 i.e. 14.9%, nasal decongestants (phenylephrine) constituted 8.5% i.e. 21 in number, 15 (6.07%) medications prescribed were antihistamines (levocetrizine). 15 corticosteroids (prednisolone) were prescribed (6.07%) and 4 medications belonged to mucolytic agents (Ambroxol) which constituted 1.6% of the total prescribed medications. The most used drugs were antibiotics which constituted 40% of the total prescribed medications.

3.1.2.3 DISTRIBUTION OF COMBINATION OF DRUGS PRESCRIBED:

Combination drugs	Content	No. of drugs	Percentage (%)
Syrup Solvin	Chlorpheniramine Maleate (2mg)+ Dextromethorphan Hydrobromide (10mg)	2	4.8
Syrup Solvin cold	Chlorpheniramine Maleate (2mg)+ Paracetamol (125mg)+phenylephrine (5 mg)	27	65.8
Syrup DPC	Bromhexine hydrochloride(4 mg), chlorpheniramine maleate (2 mg) and	5	12.1

	dextromethorphan hydrobromide (5 mg)		
Ambrodil-S /Mucolite	Ambroxol (15mg/5ml)+ Salbutamol (1mg/5ml)	2	4.8
Deriphylline-BM/M Solvin	Ambroxol 30mg/10 ml +Guaifenesin 100mg/10 ml +Terbutaline 1.25mg/ 10 ml	5	4.8

Table 3: Distribution of drugs prescribed in combination

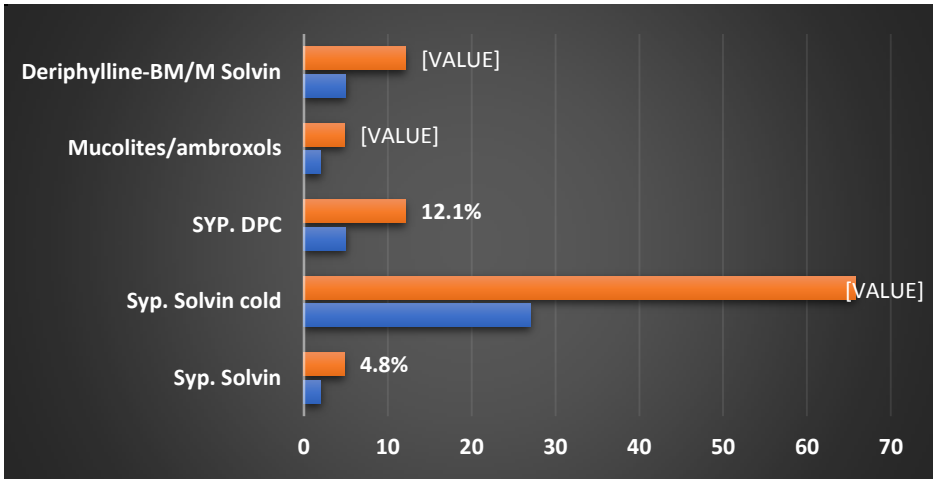

Figure 3: Percentage distribution of drugs prescribed in combination

Combination drugs accounted for 41 of the 90 prescriptions given. The syrup solvin cold (Chlorpheniramine, Paracetamol and Phenylephrine) made up the majority of the drugs prescribed among the 41 combinations, accounting for 27 (65.8%) of the total. Five times, DPC syrup (bromhexine, chlorpheniramine maleate, and dextromethorphan hydrobromide) and Deriphyllin-BM/ M Solvin were prescribed (12.1 percent). Mucolite/ambrodil-S were found to be the least commonly prescribed combination drug, accounting for only 2 (4.8 percent) of the total 41combinations.

3.1.2.4 DISTRIBUTION OF VARIOUS ANTIBIOTICS PRESCRIBED

Table 4: Distribution of various antibiotics prescribed

Classes	No. of drugs	Percentage (%)	(Chi-square) χ^2	P-value (total)
Penicillins	50	48.5		
Cephalosporins	24	23.3		
Aminoglycosides	14	13.5	Total= 156.64	P value is <0.0001
Macrolides	2	1.9		

Anti TB drugs	7	6.7		
Glycopeptides	2	1.9		
Oxazolidionones	3	2.9		
Fluoroquinolones	1	0.97		

Sr.no	**Parameters**	**Number**

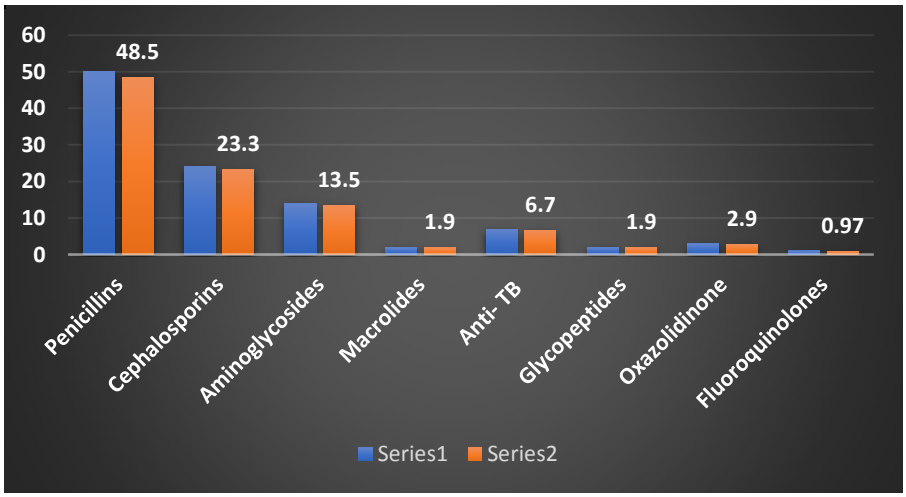

Figure 4: Percentage distribution of various antibiotics prescribed

103 antibiotics were prescribed in this study, with Amoxycillin plus clavulanic acid accounting for the majority of them (50 in total), accounting for 48.5 percent of all antibiotics administered. Vancomycin, levofloxacin, and azithromycin were found to be the least prescribed antibiotics, accounting for 1.9 percent of all antibiotics prescribed. P-value was determined by the Chi-square method which was found to be statistically significant i.e P-value is <0.0001. The result was significant at $p<0.05$

3.1.3 WHO PRESCRIBING INDICATORS ASSESSMENT:

Table 5: WHO indicators assessment

1	Average number of medicines prescribed per patient encounter	4.48
2	Percentage of drugs prescribed by generic name	39.6%
3	Percent encounter with an antibiotic prescribed	25.4%
4	Percent encounter with an injection prescribed	33.6%
5	Percentage of drugs prescribed from NLEM	96.3%

Kunin's Criteria	**n (%)**

WHO indicators are used to assess the rationality of the prescription. After assessing the prescription by WHO indicators it was found that average no. of drugs prescribed per patients encounter was 4.48. The percentage of medications prescribed by generic name was 39.6%, which is below the optimal level. The percentage of drugs prescribed from national list of essential medicines (NLEM) was found to be 96.3%.

3.1.4 MODIFIED KUNIN'S RATIONALITY CRITERIA:

Table 6: Modified Kunin's rationality criteria

Category I- Agree with the use of antimicrobial therapy, the protocol is appropriate	71, (68.93%)
Category II- Agree with the use of antimicrobial therapy, the protocol is appropriate, but a microbiology report is missing, to classify the protocol in another category	16, (15.53%)
Category III- Agree with the use of antimicrobial therapy but a different antimicrobial is preferred	9, (8.73%)
Category IV- Agree with the use of antimicrobial therapy but a modified dose, interval, duration or route od administration is preferred	5, (4.85%)
Category V- Disagree with the use of antimicrobial therapy, the administration is unjustified	2, (1.94%)

The rationality of the AMAs prescribed was analyzed by modified Kunin's rationality criteria (Table6). Appropriate therapy was given in 68.93% of patients, and 71 cases were classified under Criteria- I i.e agree with the use of antimicrobial therapy, the protocol is appropriate.

4. DISCUSSION:

The observational study was conducted in a tertiary care teaching hospital in Vadodara, Gujarat. A total of 90 prescriptions were analyzed from IPD and OPD of the pediatric department. It was found that male patients (54.60%) were higher than female patients (36.40%). A similar study by Ramani *et.al.*, observed a large number of boys than girls in their study.[8] Patients in the 1-5 age group had the highest number of patients (67.7%), followed by patients in the 6-10 age group (16.66%). These findings were similar to the study conducted by Jin yu *et.al.*,[9] The majority of the patients presenting to the pediatric department had symptoms of cough, cold, fever, and breathlessness combined along with one or more other symptoms like headache, vomiting, decreased oral intake, etc. Cough, cold, and fever were the most common clinical manifestation observed in our study. (37.7%), cough cold and breathlessness (26.6%), cough and cold (10%), and others (25.5%). This result was somewhat similar to the study conducted by Javadi *et.al.*,[10] in which it was observed that fever is the most common symptom in children. According to diagnosis majority of patients visiting the pediatric department were having Wheezing Associated Lower Respiratory tract

Infection (WALRI) (53.3%) followed by pneumonia (32.2%). Similar study results were found in a study by Lekhshminarayan *et.al.*,[11] where they observed that WALRI is the highest incidence followed by pneumonia. According to the length of stay majority of patients, stay was 5 to 7 days (61.7%) followed by 2 to 4 days (30.8%). This result was similar to Mirkarmi *et.al.*,[12], where the mean length of hospital stay was 5.5 to 7.2 days. In our study, Antibiotics were the most prescribed medication which was seen in (25.4%) of the total prescriptions. It was followed by supplements (17.07%), combination medicines (13.8%), Non Steroidal Anti-Inflammatory Drugs (NSAIDs) (10.8%), others (10.7%),bronchodilators (9.1%), nasal decongestants (5.1%), corticosteroids(3.71%), antihistamines (3.71%), mucolytic agents (1%). A study was done by Demoz *et.al.*,[13] also found that antibiotics are the most widely used medications for treating respiratory infections. Supplements were also prescribed to 69 patients. These medications must have been recommended because viral illness produces generalized weakness and anorexia. Bhasin *et.al.*,[14] conducted a survey-based investigation. They observed that multivitamins were provided to a substantial number of patients using medicines for respiratory tract infections. The reason for this was because taking antibiotics at the same time can disrupt gut bacterial flora and lead to vitamin B complex deficiency; supplements were suggested to avoid this. Among the total number of medications prescribed, oral(46.03%) dosage forms were higher than IV (33.6%), followed by IN (20.2%). This result was similar to Alehegn *et.al.*,[15] where the oral dosage form prescribed were (85.74%) followed by IV(14.26%). Antihistamines and a combination of nasal decongestants and analgesics (CPM+ phenylephrine +Paracetamol) were prescribed in 27 patients i.e, 65.8% followed by the combination of nasal decongestants, antihistaminics, and expectorants (phenylpropanolamine+ dextromethorphan hydrobromide) were prescribed in 5 patients i.e,12.1%, beta-agonist (Terbutaline)and combination of mucolytics and nasal decongestants(Ambroxol hydrochloride + guaifenesin) were prescribed in 5 patients i.e,12.1%, combination of bronchodilators and mucolytics(salbutamol+ambroxol) were prescribed in 2 patients i.e, 4.8%, combination of antihistaminics and expectorants (CPM+dextromethorphan hydrobromide) were prescribed in 2 patients i.e, 4.8%. A study conducted by Biswadeep *et.al.*,[16] found that antihistaminics were used in the majority of patients (41.8%). Antihistaminics were recommended to alleviate symptoms, but there is no evidence that they will decrease the disease's course. We found that medication specifically prescribed for treating LRTI, the majority of drugs were antibiotics (40.08%) followed by combination medicines (22.67%) such as the combination of anti-allergics, leukotriene

antagonists, mucolytics, analgesics, nasal decongestants. Other classes of medication used were bronchodilators(14.97%), nasal decongestants (8.50%), corticosteroids (6.07%), antihistamines (6.07%), mucolytic agents (1.61%) in the given order of most commonly prescribed to least commonly prescribed medication to treat the other symptoms that the patients presented. Antiemetics (Ondansetron) (2.31%) was most highly prescribed to treat complaints of vomiting. A similar study was conducted by Esposito *et.al.,*[17] where they observed that antibiotics are the core medication for treating LRTI. Amoxicillin plus clavulanic acid (48.5%), belonging to the class of beta-lactam antibiotics followed by cephalosporins (23.3%), were found to be the majorly prescribed antibiotic used in treating an LRTI. It was found that our results were similar to the study by Baidya *et.al.,*[18] the classes like macrolide antibiotics like azithromycin (1.9%) glycopeptides like vancomycin(1.9%) were among the least prescribed medicines along with oxazolidinones like linezolid(2.9%) and fluoroquinolones like levofloxacin (0.97%). Aminoglycosides were also prescribed in 14 patients i.e, 13.5%. Anti -TB medications like ethambutol, rifampicin, isoniazid, pyrazinamide were prescribed in 7 patients i.e, 6.7%. As a result of our study we determined that beta-lactam antimicrobials were preferred for lower respiratory tract infection in pediatrics. We found that 81 patients(90%) were not having any significant comorbidities and 9 patients (10%)were having significant comorbidities like Febrile seizures, Severe acute malnutrition, asthma, chronic lung disease, etc. A study done by Margaritopoulos *et.al.,*[19] stated that interstitial lung disease morbidity and death can be reduced by early identification and accurate therapy of comorbidities. 96.3% were prescribed from the National List of Essential Medicine (NLEM). 39.6% was prescribed by generic name and 33.6% of the total drugs prescribed were IV preparations. The average number of drugs per prescription was 4.48, which was higher than the WHO recommended value of 1.6-1.8 drugs per prescription**.** A similar study by Jadhav *et.al.,*[20] was studied which showed similar results with 4.1 drugs per prescription. The total number of drugs prescribed was found to be 404 in our study involving 90 patients. The number of prescriptions without antibiotics was lesser in number than the number of prescriptions with an antibiotic prescribed. Out of 404 drugs prescribed 103 of them were antibiotics. On calculating we found the average number of antibiotics per prescription was found to be 1.14%.Percent encounters with an antibiotic prescribed were found to be 25.4% which was normal according to WHO's recommended value of 20.0-26.8 %. The rationality of the AMAs prescribed was assessed by modified Kunin's criteria. Appropriate therapy was given in 68.93% of patients, and 71 cases were classified under

criteria 1. Criteria II cases (15.53%) got empirical therapy with the appropriate antibiotic age, but culture sensitivity test was not performed to confirm the diagnosis. Criteria III cases accounted for 8.73 %, as they received multiple antimicrobial agents at the same time. Criteria IV applies to 4.85 %. 1.94% of cases fall under Criteria V. According to Cochrane Database systemic review 2011, AMAs have restricted use in bronchiolitis[21]. Moreover, in our study some of the patients with bronchiolitis received AMAs. For a better and optimal effect of pharmacological management in patient care, rational drug utilization is a significant factor to be considered. In India, many factors are present due to which optimal health benefit is not achieved. Those factors include illiteracy, poverty, use of multiple health care systems, drug advertisements, prescribing a drug without a prescription and lack of drug information. Improper use of drugs also raises the expense of medical treatment, antimicrobial resistance, adverse effects of drug-related problems, and mortality. Appropriate antibiotic prescription based on the infecting pathogen is essential to avoid antibiotic resistance. Studies on the prescription pattern will aid in analyzing, monitoring, and suggesting modifications in the prescription pattern in order to improve the outcome for the patient and to provide better patient care.

5. CONCLUSION AND OUTLOOK:

A total of 90 prescriptions were analyzed, 54 (60%) of them were male and 36 (40%) were female patients. The majority of patients were seen in the 1-5 age group which was 61 (67.7%). Among the diagnosis of these patients, WALRI 48 (53.3%) was most commonly observed followed by Pneumonia 29(32.2%). The average number of drugs per prescription and an average number of antimicrobial agents per prescription were 4.48 and 1.14 respectively. The most commonly prescribed antimicrobial agents were amoxicillin+clavulanic acid (48.5% of patients) and ceftriaxone (23.3% of patients). Oral antimicrobial dosage forms were higher than intravenous dosage forms.

FUTURE SCOPE FROM THIS STUDY:

For a better and optimal effect of pharmacological management in patient care, rational drug utilization is a significant factor to be considered. In India, many factors are present due to which optimal health benefit is not achieved. Those factors include illiteracy, poverty, use of multiple health care systems, drug advertisements, prescribing a drug without a prescription and lack of drug information. Improper Use of drug also raises the expense of medical treatment, antimicrobial resistance, adverse effect of drug-related problems and mortality.

Appropriate antibiotic prescription based on the infecting pathogen is essential to avoid antibiotic resistance. Studies on the prescription pattern will aid in analyzing, monitoring and suggesting modification in the prescription pattern in order to improve the outcome for the patient and to provide better patient care.

STRENGTHS OF STUDY:

This study could assist health care professionals as well as government bodies to know the importance of appropriate prescribing in healthcare society.

FINANCIAL SUPPORT OR SPONSORSHIP:

No financial support was obtained from any person or firm.

CONFLICTS OF INTEREST:

There is no conflict of interest.

ACKNOWLEDGMENTS:

We acknowledge all participants who showed interest in the study and responded for study. We would also like to thank Dr Tousif Idrisi and Mr. Hemal Patel for their support throughout the study

Abbreviation	Terminology
RTIs	Respiratory Tract Infection
LRTIs	Lower Respiratory Tract Infection
DUE	Drug Utilization Evaluation
WHO	World Health Organization

TB	Tuberculosis
IV	Intra Venous
WALRI	Wheezing Associated Lower Respiratory Infection
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
IPD	In-Patient Department
OPD	Out Patient Department
AMAs	Anti-Microbial Agents
PICU	Pediatric Intensive Care Unit

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