



## Drug Utilization Study of Antibiotics in Respiratory illnesses Among Geriatric Patients in a Tertiary Care Hospital

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Conflicts of Interest: Nil

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### ABSTRACT

Lower Respiratory Tract Infections (LRTIs) refer to the inflammation of the trachea, bronchi, bronchioles and lung tissue. The two most common LRTIs are Bronchitis and Pneumonia. They occur frequently and are associated with significant morbidity and mortality. Geriatric patients are at an increased risk of developing LRTIs as compared to young adults. The prevalence of LRTIs in the elderly population is not only related to underlying disease and aging itself, but also to variety of clinical issues, such as a history of hospitalization, previous antibacterial therapy, mechanical ventilation and antibiotic resistance. Also, as age increases, frequent health related issues also arise and that include frailty, poly pharmacy, under-use of medications, inappropriate prescribing, medication errors, co-morbid conditions and the pharmacokinetic and pharmacodynamic changes. Antibiotics seem to be the corner stone of LRTI management in the elderly. Drug Utilization Review (DUR) is defined as an authorized, structured and ongoing review of prescribing, dispensing and use of medications. DUR studies have made it possible to study drug prescribing and drug usage in a scientific and formal manner. The DUR studies provide a view about the efficiency of drug use and help in setting up priorities for rational use of antibiotics and also of health care budgets. Very few studies on use of antibiotics in treatment of LRTIs in geriatric patients are available. Hence the present study has been undertaken, with the aim of analyzing the pattern of antibiotic use in geriatric patients suffering from LRTIs, in a tertiary care hospital.

**Keywords:** Lower respiratory tract infections, Antibiotics, Drug utilization study, Geriatric Patients.

### INTRODUCTION

**Acute Respiratory Infection** usually starts as a viral infection in the nose, trachea or lungs and interferes with a person's normal breathing. Acute respiratory infections account for 20 to 40% of outpatient and 12 to 35% of inpatient attendance in general hospitals.<sup>1</sup> In World Health Report of 2004, the WHO estimated that respiratory infection generated 94.6 Disability- Adjusted Life Years (DALY) lost worldwide and were the fourth major cause of mortality, responsible for four million deaths or 6.9% of a global number of deaths in 2002.<sup>2</sup> Respiratory infections are traditionally divided into: Upper Respiratory

Tract Infections (URTIs) and Lower Respiratory Tract Infections (LRTIs).<sup>3</sup> LRTIs are generally more serious than URTIs<sup>4</sup> and include diseases like: Acute Bronchitis, Pneumonia, Acute exacerbation of chronic lung disease such as COPD or Bronchiectasis<sup>5</sup>. LRTIs and Pneumonia are the **fourth** leading cause of death among all infectious diseases<sup>6</sup>. According to the GLOBAL BURDEN OF DISEASE 2015 (GBD 2015), COPD and LRTIs represent the 3<sup>rd</sup> and 4<sup>th</sup> most common causes of death, respectively<sup>5</sup>. In a systematic analysis conducted in 2015, LRTIs caused 2.74 million

deaths and 103 million Disability Adjusted Life Years (DALYs), making them the second leading cause of DALYs<sup>7</sup>.

**Geriatric patients** are at an increased risk of developing LRTIs as compared to young adults. According to the 2017 Global Burden of Disease (GBD), the burden of LRTIs in people older than 70 years is increasing<sup>7,8</sup>. The prevalence of LRTIs in the elderly population related to variety of clinical issues such as: history of hospitalization, previous antibacterial therapy, mechanical ventilation and Antibiotic resistance<sup>1</sup>. Also, as age increases, frequent health related issues also arise which includes frailty, poly pharmacy, under-use of medications, inappropriate prescribing, medication errors, co-morbid conditions and the pharmacokinetic and pharmacodynamic changes of drugs<sup>9</sup>. Inappropriate medication use in Geriatric patients may be due to decreased vision, memory loss, impaired cognition, low compliance and unsupervised care.<sup>1</sup> These factors have led to an increase in the prevalence and mortality due to respiratory illnesses in the elderly, and new medical strategies are urgently needed<sup>1</sup>.

**Antibiotics** seem to be the corner stone of management of respiratory illnesses in the elderly<sup>10</sup>. Antibiotics are the oldest class of drugs that fight against specific microorganisms like bacteria and fungi<sup>11</sup>. There are more than 100 million antibiotic prescriptions in an adult ambulatory care hospital set up per year, out of these 41% are for respiratory conditions<sup>12</sup>. Use of antibiotics in Respiratory illnesses remains controversial. On the one hand, they are usually bacterial in origin, are associated with high morbidity and mortality and need to be rapidly treated with antibiotics. On the other hand, most of the times they are self-limiting illnesses and prescription of antimicrobials may cause increased antimicrobial resistance<sup>13</sup>, resulting in increase in burden of respiratory illnesses<sup>1</sup>. Changes in antibiotic resistance patterns are a threat to its effective treatment. Hence, there is an **increasing concern** about antibiotic prescription in the community<sup>13</sup>.

**Drug Utilization Review (DUR)** is defined as an authorized, structured and ongoing review of prescribing, dispensing and use of medications<sup>14</sup>. The development of Drug Utilization Review (DUR) studies has made it possible to study drug prescribing pattern and drug usage in a scientific and formal manner<sup>15</sup>. The DUR studies provide a view about the efficiency of drug use and help in setting up priorities for rational use of antibiotics and also of health care budgets<sup>14</sup>.

## Objectives

### Primary objective:

- To study the pattern of antibiotic use in geriatric patients suffering from LRTIs, in a tertiary care hospital.

### Secondary objective:

- To determine the average number of antibiotics prescribed per prescription
- To identify the indication for which antibiotics were prescribed
- To determine the most commonly prescribed antibiotic in treatment of LRTIs in geriatric patients.

## Materials and Methods

**Study Site:** Medicine Department of Shree Krishna Hospital, Karamsad.

**Study Design:** Retrospective, Observational, Hospital based study.

**Study Period:** Study was carried out within 20 days after obtaining approval from Institutional Ethics Committee – 2 (IEC), Bhaikaka University, Karamsad, Anand.

### Inclusion criteria:

- Both male and female patients of age 60 years and above.
- Patients diagnosed with Lower Respiratory Tract Infections and receiving antibiotics for its treatment.
- Patients stable clinically, without acute exacerbations in the past 2 weeks.

### Exclusion Criteria:

- Patients under the age of 60 years.

- Patients diagnosed with Upper Respiratory Tract Infections.
- Patients with altered consciousness and accident cases
- Patients diagnosed with Pulmonary Malignancies and Occupational Lung Diseases.
- Patients with Mental illness.
- Patients taking corticosteroids regularly.
- Patients participating in other studies in the recent past.
- Patients receiving Antibiotics for any other infection.

**Source of Data:**

Data of Geriatric patients suffering from Lower Respiratory Tract Infections and admitted in the Medicine Department of Shree Krishna Hospital, Karamsad, during the period from February 2020 to March 2021 was collected from Hospital Case papers of the patients.

**Pilot study:**

A pilot study was carried out in which data of 5 patients was collected to evaluate the feasibility of method of data collection and to evaluate the effectiveness and design of data collection form. Based on the pilot study, the design of data collection form was modified to make it more practical before using it for subsequent data collection.

**Study Procedure:**

A Retro-prospective study on Utilization of Antibiotics for treatment of Lower Respiratory Tract Infections among Geriatric patients was conducted in the Medicine department of Shree Krishna Hospital, Karamsad.

Approval for the same was obtained from Institutional Ethics Committee-2.

**IEC Approval No. - IEC/BU/2021/ Ex.12/83 / 2021, dated 1/04/21**

A wellplanned structured data collection form was designed for collection of demographic data, presenting complaints, diagnosis, known co-morbidities, past medication history, data of clinical findings, data of drugs/antibiotics prescribed for treatment of LRTIs and co-morbid conditions, duration of treatment etc.

Data of 100 Geriatric patients suffering from Lower Respiratory Tract Infections(LRTIs) was collected from the case papers of patients admitted in the Medicine Department of Shree Krishna Hospital, Karamsad. Informed consent of patients was not obtained and Participant Information Sheet was not provided to patients since data collection was done from the case papers of patients.

**IEC also approved the project with waiver of consent for data collection.**

Data collected was analyzed for frequency distribution based on age, gender, signs and symptoms, type of LRTI, antibiotics prescribed, comorbid conditions, drugs prescribed for comorbidities, average number of antibiotics prescribed per prescription and most frequently prescribed antibiotic etc.

**Statistical Analysis:**

Scientific data so collected was subjected to Descriptive statistical analysis to determine the frequency distribution of various parameters using Microsoft Excel.

**Results**

Respiratory tract illnesses are common and perhaps the most frequently reported infection of human beings<sup>16</sup>.

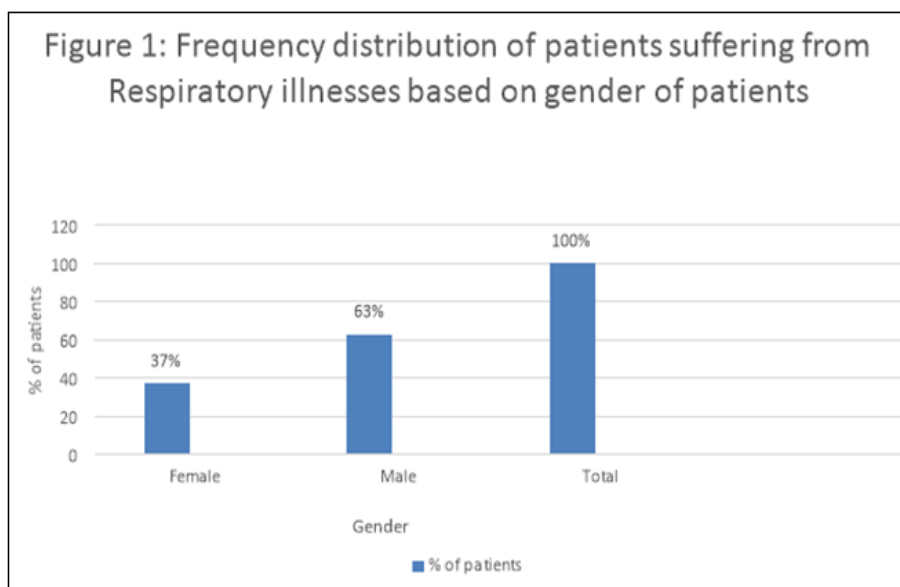
Lower respiratory tract infections (LRTIs) such as pneumonia and acute Bronchitis are among the most common infections occurring among elderly geriatric patients<sup>17</sup> and they are more likely to develop complications from LRTIs as compared to young patients<sup>18</sup>.

Bacterial infections account for 80-90% of these respiratory illnesses and are the most frequent indication for antibiotic treatment<sup>19</sup>.

The present study was undertaken with the aim of determining the pattern of antibiotic use in geriatric patients suffering from respiratory illnesses in a tertiary care hospital.

**1. Demographic characteristics of study population****1.1 Gender/Sex:**

**Result:** Of the 100 patients whose data was collected, 63% were Male and 37% were Female (Figure1). Thus, Male was the predominant gender.



### 1.2 Age:

All the patients whose data was collected were in the age range of 60-93 years. Patients were classified into 4 different age groups- 60-69 years, 70-79 years, 80-89 years, 90-100 years. Our results are in co-ordination with the results reported by SripuramCharave et al., who observed almost 75% of study population in the 60-79 years age group, though female was the predominant gender in their study<sup>20</sup>.

As is evident from Table 2, out of 100 patients whose data was collected, 47% belonged to age group 60-69 years, 33% were in the 70-79 years age group, 16% belonged to 80-89 years age group and only 4% were in the 90-100 years age group.

Thus, 80%patients in age group 60-79 years are more prone to develop lower respiratory tract infection.

**Table 2: Frequency distribution of patients suffering from Respiratory illnesses based on Age group (years)**

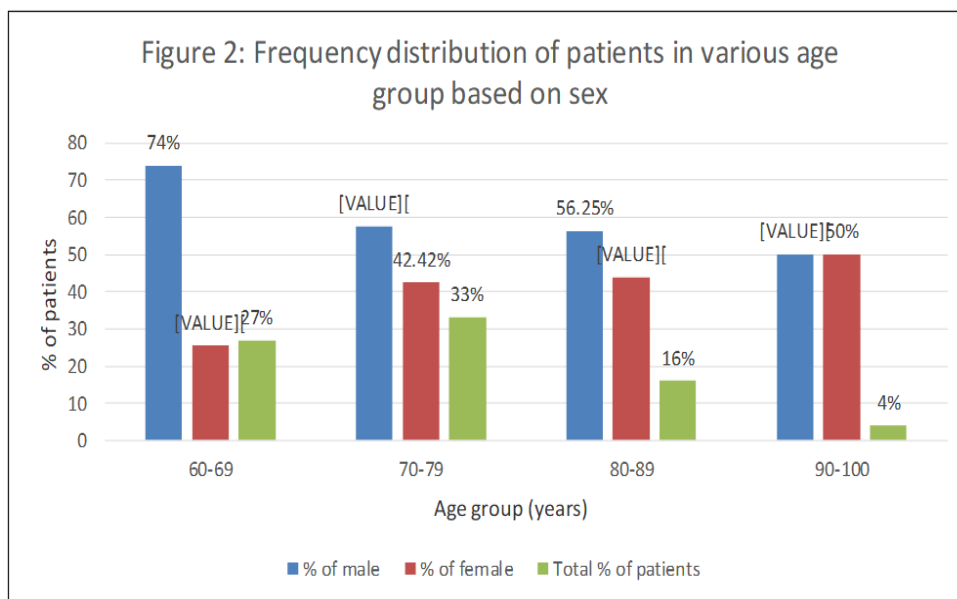
Age group (years)	%of patients (n=100)
60-69	47
70-79	33
80-89	16
90-100	4

### 1.3: Frequency distribution of patients in various age groups based on gender/sex

**Result:** Patients categorized into various age groups were further segregated based on their gender.

Of the total 47% patients in the 60-69 years age group, 74.5 % were male and 25.5 % were female. In the 70-79 years age group, of the

33% patients, 57.5% were male and 42.42 % were female. 16% of the total patients belonged to the 80-89 years age group, of which 56.25% were male and 43.75% were female. Only 2% patients were in the 90-100 years age group, with 50% patients being male and female. (Fig.2)



## 2. Categories of Respiratory Illness

### 2.1 Frequency/percentage distribution of patients based on the category of respiratory illness

**Result:** All 100 patients whose data was collected, were categorized into different categories based on the type of respiratory illness they were suffering from. Table 4 shows the categories of respiratory illnesses

along with their percentage distribution. As it is evident from Table 4, LRTI (which include cases of Bronchitis & Bronchiectasis also) is the most common form of respiratory illness with 56% patients. The other forms of Respiratory illnesses are Pneumonia (33%) and COPD (9%) and Bronchial Asthma (2%). (Table 2).

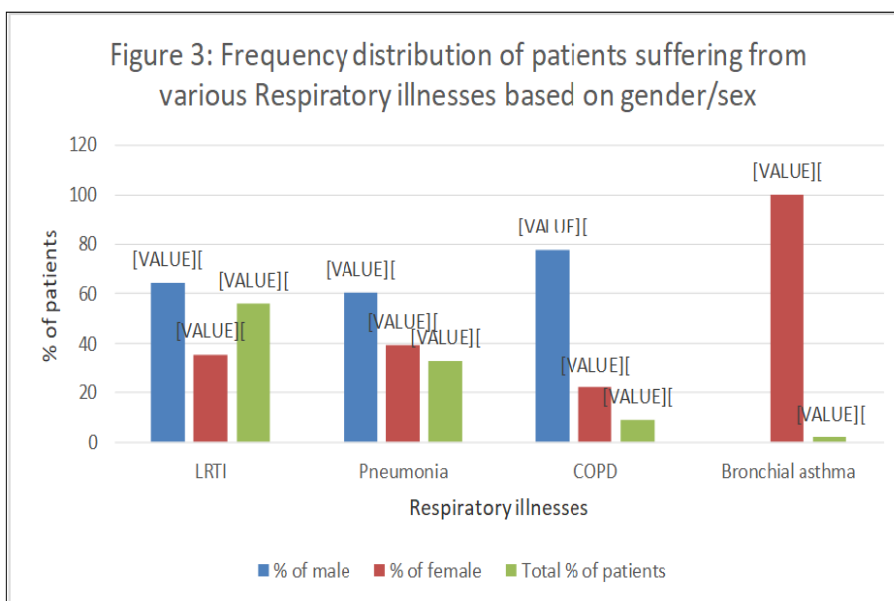
**Table 2: Frequency/percentage distribution of patients based on the category of respiratory illness**

Disease	No. of Patients	% of Patients
LRTIs	56	56
Pneumonia	33	33
COPD	9	9
Bronchial asthma	2	2

### 2.2 Frequency distribution of patients suffering from various types of Respiratory illness based on Gender

**Results:** Figure 3 shows the frequency distribution of patients suffering from various types of Respiratory illness based on gender. As it is evident from the Figure 5, of the total 56% patients suffering from LRTIs, 36

(64.28%) were male and 19(35.71%) were female. Similarly, of the 33% cases of Pneumonia, 20(60.6%) were male and 13(39.39%) were female. The cases of COPD were 9% of which 7(77.77%) were male and 2(22.22%) were female and the 2% cases of Bronchial Asthma were female (Fig.3)



## 2. Signs and Symptoms of Respiratory illness

**Result:** Table 3 represents the frequency/percentage distribution of different signs and symptoms observed in patients suffering from various types of respiratory illnesses.

As it is evident from the table, Breathlessness, observed in 70% patients, was the most

frequent/common symptom observed followed by 49% patients complaining of Fever. Other symptoms seen in these patients were Cough with expectoration in 33% patients and Cough in 32% patients. 31% patients complained of chest pain with 24% patients complaining of Anorexia and 20 % patients showed pedal edema.

**Table 3: Frequency distribution of patients suffering from Respiratory illness based on Signs & Symptoms**

Signs & symptoms	No. and % of patients
Breathlessness	70
Fever	49
Cough with expectoration	33
Cough	32
Chest pain	31
Anorexia	24
Pedal edema	20

## 4. Antibiotics prescribed

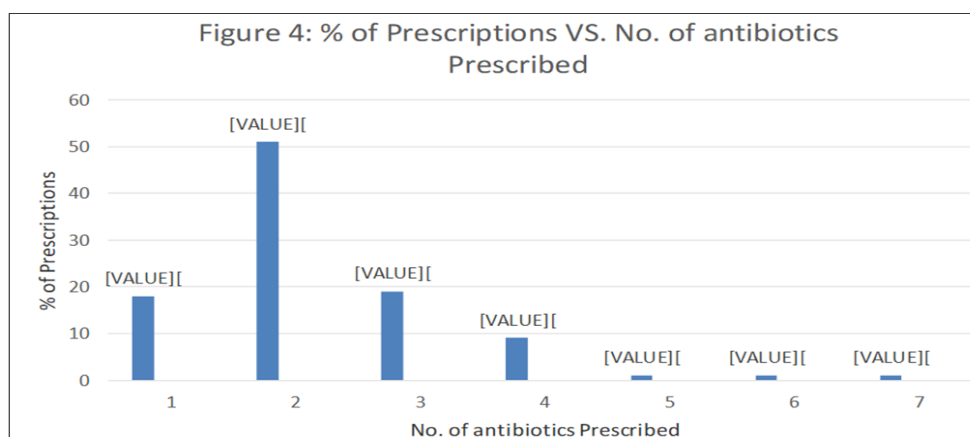
### 4.1 Number of Antibiotics per prescription

Respiratory illnesses are treated using antibiotics with the aim of improving clinical outcome, minimize the toxicity & prevent the emergence of resistant pathogens<sup>21,22</sup>.

**Result:**The number of antibiotics prescribed per prescription of Respiratory illness are shown in figure 7. As is evident from the figure, in majority of the prescriptions, i.e., 51% prescriptions, 2 antibiotics were

prescribed, followed by 1 and 3 antibiotics prescribed to the extent of 18% and 19% respectively. Surprisingly, 9% prescriptions had 4 antibiotics and 1% of the total 100 prescriptions had 5,6 and 7 antibiotics each. (Fig. 4)

Another study reported 34.37% prescriptions having single antibiotic and 65-625% prescriptions contained poly antibiotics. Thus poly antibiotic prescriptions are more preferred in treatment of respiratory illnesses



**4.2 Frequency distribution of commonly prescribed antibiotics to patients suffering from respiratory illnesses**

**Result:** The commonly prescribed antibiotics for the treatment of various forms of Respiratory illnesses was found out by counting the total number of antibiotics per prescription and classifying them into various classes like Macrolides (Azithromycin, Clarithromycin), Quinolones (Levofloxacin, Moxifloxacin), Beta lactum Antibiotics (Penicillin: Piperacillin, Amoxycillin, Benzathine Penicillin, Ampicillin/ Cephalsporins: Ceftriaxone, Cefixime, Cefotaxime, cefuroxime, Cefoperazone) with Beta lactmase Inhibitor drugs (Tazobactam, Sulbactam, Clavulanic acid), AG antibiotics (Amikacin, Gentamycin), Cotrimoxazole and Oxazolidinediones (Linezolid).

Table 4 reveals that Macrolide group of Antibiotics like Azithromycin and Clarithromycin were the most commonly prescribed antibiotics for the treatment of all 3 forms of respiratory illness, followed by beta lactam antibiotics like Penicillin and Cephalsporins in combination with

Clavulanic acid/ Sulbactam and Cephalsporins alone.

Hence dual therapy with a macrolide &  $\beta$  lactam antibiotic is preferred, we observed that  $\beta$  lactam antibiotics like Cephalsporins & Penicillins were prescribed to the extent of 52% and 12% respectively and  $\beta$  lactam antibiotics in combination with  $\beta$  lactam inhibitors drugs were prescribed to the extent of 54% and other researchers have reported use of combination of  $\beta$  lactam antibiotic with  $\beta$  lactamase inhibitors drugs as most commonly prescribed (35.45%). Guidelines recommend that Cephalsporins are also appropriate for treatment of respiratory illnesses as they are active against respiratory infections causing pathogens like H. influenza and Pneumococci. The Indian guidelines suggest to prefer Macrolides such as Azithromycin over Doxycycline as initial empiric therapy in patients with respiratory illnesses like Pneumonia. In patients with co-morbidities a combination therapy with  $\beta$  lactam or a fluoroquinolones plus a Macrolide or Amoxycillin- Clavulanic acid is preferred.

**Table 4: Frequency distribution of commonly prescribed antibiotics to patients suffering from respiratory illnesses**

Category of antibiotic Prescribed	No and % of Patients to whom Prescribed
Macrolide	57
$\beta$ lactam antibiotics+ $\beta$ lactamase inhibitors	54
Cephalsporins	52
Quinolones	26
Penicillin	12
Aminoglycoside	6
Oxazolidinone	2
Co-trimoxazole	1

### 4.3: Commonly prescribed antibiotics

**Result:** Of the total 57% patients who received Macrolide group of Antibiotics 54.38% were of LRTI, 33.33% were of Pneumonia and 12.28% were of COPD. Beta lactum Antibiotics were given in combination with beta lactmase inhibitor drugs like Clavulanic acid and Sulbactum to 54% of the total 100 patients whose data was collected, of which 53.70% were of LRTI, 37.04% were patients of Pneumonia and 9.26% were of COPD.

Similarly, 52% patients received Cephalosporins of which 50% were of LRTI, 40.38% were of Pneumonia and 9.61% of COPD.

Thus, these 3 categories of antibiotics were more commonly prescribed. Other categories of antibiotics prescribed include Quinolones to the extent of 26%, Penicillin alone to the extent of 12%, AGA to the extent of 6% (Table 5).

**Table 5: Commonly prescribed antibiotics**

Category of Antibiotics	Total no and % of Patients to whom Prescribed	NO of Patients of LRTI	% of Patients of LRTI	NO of Patients of Pneumonia	% of Patients of Pneumonia	No of Patients of COPD	% of Patients of COPD
Macrolide	57	31	54.38	19	33.33	7	12.28
B lactamase antibiotic + $\beta$ lactamase antibiotic	54	29	53.7	20	37.03	5	9.25
Cephalosporins	52	26	50	21	40.38	5	9.61
Quinolones	26	14	53.84	9	34.61	3	11.53
Penicillin	12	8	66.66	4	33.33	0	0
Aminoglycoside	6	3	50	2	33.33	1	16.66
Oxazolidinone	2	0	0	2	100	0	0
Co-trimoxazole	1	0	0	0	0	1	100

At least 90% of respiratory illness episodes are viral so anti-viral drugs are commonly prescribed simultaneously. In our study, Oseltamivir and Acyclovir were prescribed to the 2% and 1% patients, respectively.

Antiviral drugs	No. & % Prescription
Oseltamivir	2
Acyclovir	1

## 5. Comorbid conditions

### 5.1 Frequency/percentage distribution of patients with different forms of comorbid conditions

**Results:** With age all physiological processes decline and hence Geriatric patients may suffer from various disorders. Case papers of the 100 geriatric patients whose data were

collected, revealed that Hypertension (67%) was the most common comorbid condition followed by Diabetes Mellitus (39%), heart diseases (32%) and Dyslipidemia(33%). Other comorbid conditions observed were Hypothyroidism (10%), Renal disease (8%), Anaemia(5%), Tuberculosis(5%) .(Table 6)



**Table 6: Frequency Distribution of Comorbid conditions**

Comorbid conditions	No. and percentage of patients
Hypertension	67
Diabetes mellitus	39
Dyslipidemia	33
Cardiac disease	32
Thyroid (Hypothyroidism)	10
Renal disease	08
Anemia	05
Tuberculosis	05

### 5.2. Frequency distribution of patients of different

#### Respiratory Illnesses based on comorbid conditions

**Results:** Table 7 shows frequency distribution of patients of different Respiratory illnesses, based on co-morbid conditions.

Of the total 67% patients having Hypertension as co-morbid condition, 56.71% patients were of LRTI, 35.82% were of Pneumonia and

only 7.46% were of COPD. Similarly, 51.28%, 46.15% and 2.56% patients of the total 39% Diabetics, were of LRTI, Pneumonia and COPD respectively. Heart disease as a co-morbid condition was observed in 32% of all the patients whose data was collected, of which, patients of LRTI were 68.75% and patients of Pneumonia and COPD were 21.87% and 9.37% respectively.

**Table 7: Frequency distribution of patients suffering from different Forms of respiratory illnesses based on comorbid conditions**

Comorbid conditions	Patients suffering from different form of respiratory illnesses based on comorbid conditions					
	LRTIS		Pneumonia		COPD	
	No. of patients	%	No. of patients	%	No. of patients	%
Hypertension	38	56.71	24	35.82	5	7.46
Diabetes mellitus	20	51.28	18	46.15	1	2.56
Cardiac disease	22	68.75	07	21.87	03	9.37
Dyslipidemia	20	60.6	11	33.33	2	6.06
Thyroid	05	50	05	50	0	0
Renal disease	08	100	0	0	0	0
Anemia	05	100	0	0	0	0
Tuberculosis	03	60	0	0	02	40

### 5.3 Frequency distribution of drugs prescribed for comorbid conditions in patient with different forms of respiratory illness

**Result:** Since Hypertension, Diabetes and Cardiac diseases are the most frequent comorbid conditions observed, Anti hypertensives drugs(63%), Anti-diabetic drugs (39%), Anti-platelet agents (47%) and Anti

hyperlipidemic drugs (35%) were most commonly prescribed drugs for the treatment of comorbid conditions. Table 12 also reveals that bronchodilators were also prescribed to almost 60% of patients of various respiratory illnesses to relieve bronchoconstriction associated with all forms of respiratory illness-LRTI, COPD, Pneumonia and Asthma (Table 8)

**Table 8: Frequency Distribution of Drugs Prescribed for Comorbid conditions in patients suffering from respiratory illnesses**

Drugs prescribed for comorbid conditions in patients suffering from respiratory illness	No. of patients
Antihypertensive drugs	63
Bronchodilators	59
Result: Diuretics	54
Antiplatelet/Anticoagulant agents	47
Antidiabetic agents	39
Antihyperlipidemic drugs	35
Antithyroid drugs	10

### Conclusion

To conclude, observations made from the data collected reveal, that the most frequently occurring respiratory illnesses are LRTI & Pneumonia, observed more in 60-79 years age group male patients and that Macrolides &  $\beta$  lactam antibiotics in combination with  $\beta$  lactamase inhibitors drugs are most commonly prescribed for their treatment. Also poly antibiotic use is preferred to mono-antibiotic use. Thus the line of treatment of respiratory illnesses is as per Indian Guidelines which are adopted from the guidelines issued by American Thoracic Society (ATS) and Infectious Disease Society of America (IDSA).

### Limitation of the Study:

1. The period of study was short & so data collected was less.
2. Data could not be collected in a wider aspect (like drug interactions, mortality, duration of treatment, hospital antibiotic policy etc).

### Acknowledgment:

We wish to express our sincere gratitude and heartfelt thanks to **Dr. BhalenduVaishnav sir**, HOD, Medicine Department of Pramukh Swami Medical College and Shri Krishna Hospital, Karamsad for sparing his valuable time to guide us.

We are also thankful to **Dr. SomShekhar sir**, Head, Central Research Society (CRS), Pramukh Swami Medical College for his cooperation and support.

Their help, guidance, cooperation and support has helped us to complete this project successfully.

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