

AN OBSERVATIONAL STUDY ON DRUG UTILIZATION IN ASTHMA & COPD AT RESPIRATORY DEPARTMENT OF A TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT

Background: A reduced ability to move air through the conducting airways and out of the lungs is the definition of obstructive airway disorders, which include asthma and COPD.

Goal: Examine the medication use patterns associated with asthma and chronic obstructive pulmonary disease. Find out which drugs are used irrationally—that is, when they are not taken as directed by a prescription—and if the prescriptions were written in accordance with accepted treatment protocols.

Techniques: The research comprised 150 individuals with asthma and/or COPD who were of either sex and older than 18 years. Information was noted and patients' medical records were examined. Patterns of drug use were examined in the prescriptions. After a month, the newly diagnosed patients were monitored and their drug adherence was assessed. **Findings:** Of the 150 patients, 103 were men and 47 were women. There were 54 individuals with asthma, 89 with COPD, and 7 with overlap between asthma and COPD. Most patients received prescriptions for one to three medications each. Drugs administered at the greatest level were inhaled corticosteroids. Budesonide with formoterol was the most often

given medication combination. Most patients have not followed their treatment plan very well. **Conclusion:** The study's data shows that there aren't many known drug interactions between prescription drugs. The GOLD (Global Initiative for Chronic Obstructive Lung Disease) and GINA (Global Initiative for Asthma) standard standards were followed in prescribing the medications and their combinations.

Keywords: asthma; chronic obstructive lung disease; assessment of medication use.

I. INTRODUCTION

Chronic lung diseases are divided into two categories (1) obstructive and (2) restrictive. The symptoms of obstructive and restrictive lung disease might be similar but they affect the lungs in different ways. For example, asthma, chronic obstructive pulmonary disease (COPD) are obstructive lung diseases [1,2]. Obstructive airway disease can be diagnosed by spirometry and other type of lung function test. Spirometry and the calculation of FEV1/FVC allow the identification of obstructive or restrictive ventilatory defects [3]. Annually there are approximately 489,000 deaths due to asthma. The majority of deaths occur in low and middleincome countries like Oceania, South Asia, Middle East, and Africa. As per a recent

study in India on the epidemiology of asthma, the prevalence of asthma in India is 2.05% among those aged > 15 years. The estimated national burden is 18 million asthmatics [4]. General goals for asthma management are achieving symptom control, maintaining normal physical performance, minimizing the risk of exacerbations, fixed airway obstructions, and side effects of the therapy. Inhalation therapy is preferred in asthma as it provides high local concentrations, fewer side effects, and good tolerance [5]. Many epidemiological studies have shown that asthma and COPD may coexist, or at least one condition may evolve into the other making a condition known as Asthma and COPD Overlap Syndrome (ACOS). It is a syndrome in which older adults with a significant smoking history have features of asthma along with their COPD [6]. COPD is responsible for early mortality, high death rates, and significant cost to the health care system. COPD is estimated to be the third leading cause of death in the world by 2020 [7]. India contributes very significantly to mortality from COPD 102.3/100,000 and 6,740,000 disability-adjusted life years out of a world total of 27,756,000 disability-adjusted life years; thus, significantly affecting health-related quality of life in the country. Multiple studies from 1994 to 2010 show an increasing number of COPD morbidity and mortality [8]. Drug Utilization Evaluation (DUE), also known as Drug Utilization Review (DUR) and Medication Utilization Review (MUR) is an ongoing, systematic, criteria-based program of medical evaluation that will help ensure appropriate medicine use. The DUE will help to define appropriate medicine use, auditing criteria against what is being prescribed, providing feedback to prescribers on all identified problems, monitoring to see if criteria are followed, and prescribing is improved. There are many medicine use problems such as,

polypharmacy, choosing incorrect medicines, prescribing the incorrect dose, prescribing medicines that cause adverse drug reactions (ADRs) or medicine interactions, and using more expensive medicines when less expensive medicines would be equally or more effective. The DUE is needed to control this irrational medicine use [9]. Medication adherence is a key factor in determining the therapeutic outcomes of medications, especially in patients suffering from chronic illness. Whatever the efficacy of a drug, it cannot act unless the patient takes as prescribed. Low medication adherence is an important factor as it seriously undermines the benefits of current medical care and imposes a significant financial burden on individual patients and the whole health care system [10]. As per a study by Gillissen A. nonadherence in asthma treatment results in an increased rate of mortality and morbidity. It is also associated with increased costs of treatment. Nonadherence might be either intentional or unintentional. The reasons for intentional non-adherence might be anxiety (regarding side-effects, dependence, or overdose), the awkwardness of taking medication, an embarrassment of having diseases especially in children, youth, and young adults, inconvenience of treatment (higher with inhalation therapy), forgetfulness, laziness, and unwillingness to change lifestyle (e.g., many patients continue smoking regardless of their asthma or COPD). Some unintentional reasons for nonadherence are complicated or timeconsuming treatment, inadequate training in the inhalation technique, and lack of understanding about the disease and the need of continuing the treatment [11]. Medication adherence can be improved by providing the patients with adequate knowledge about the disease, the need for continuing the therapy even in a symptoms-free period, and techniques of using inhaler devices. Various methods of improving adherence should be used by health

care practitioners. We aimed to study the drug utilization pattern in asthma and chronic obstructive pulmonary disease, determine irrationally (does not comply with prescription) drug usage, and whether they were prescribed following the standard treatment guidelines.

II. METHODOLOGY

It was a prospective observational cross-sectional and cohort study conducted for 6 months at the Department of Respiratory Medicine, Dhiraj General Hospital, Vadodara, Gujarat, India. All patients of either sex aged 18 years and above diagnosed as suffering from asthma and/or COPD with or without comorbidities who were included in a study after explaining to the patients, the details of the study, the Informed consent form was taken. The patient's medical records were checked and the following information was noted in the Patient Medical Record sheet: Patient's demographic details, Patient Medical History, Diagnosis and duration, family history, presence of other comorbidities, Past Medication history, Prescribed drugs including (Frequency, Dose, Route of administration and Duration) was also collected, Drug interaction, Cost of drugs, Lab investigations reports (which are already mentioned inpatient medical records). All the relevant data was obtained from the patients' medical records and through counseling the patients who visited the Out-Patient Department (OPD) or In-Patient Department (IPD). Morisky's adherence scale was used to assess the adherence of patients to prescribed drugs. Drug interactions between prescribed medications were determined using a Micromedex drug interaction checker. After the data collection, all the data were exported to statistical software for statistical analysis. All the quantitative data were represented in percentage (%) and mean \pm standard deviation. Comparative statistical differences were calculated using appropriate parametric tests. The categorical data were

represented in the median and comparative statistical differences were calculated by using appropriate non-parametric statistical tests (Chisquare test and independent t-test). The graphical representative was used for a better understanding of the data. A p-value of ≤ 0.05 was considered significant.

III. RESULTS

A total of 150 prescriptions of asthma and/or COPD were collected from the department of respiratory medicine. Out of all 150 patients, 103 (68.67%) patients were males and 47 (31.33%) patients were females. Among asthma patients there were 44% (N=24) male (mean age \pm SD 36.17 \pm 13.46) and 56% (N=30) female patients (mean age \pm SD 39.07 \pm 13.3). In COPD patients there were 82% (N=73) male (mean age \pm SD 58.78 \pm 15.18) and 18% (N=16) female patients (mean age \pm SD 55.15 \pm 14.06). 86% (N=6) (mean age \pm SD 53.83 \pm 15.65) male and 14% (N=1) female patients were having asthma COPD overlap syndrome (ACOS). In the age group 18-40 years, there were 69.57% (N=32) patients of asthma (mean age \pm SD 29 \pm 6.44) followed by 26.09% (N=12) patients of COPD (mean age \pm SD 34.42 \pm 4.99) and 4% (N=2) patients with both diseases (mean age \pm SD 28.5 \pm 6.36). In the age group 41-60 years, there were more patients with COPD (64.41%) (N=38) (mean age \pm SD 51.92 \pm 5.61) compared to asthma (32.2%) (N=19) (mean age \pm SD 48.11 \pm 4.48). This pattern was followed by the age group 61-90 years with 86.67% (N=39) (mean age \pm SD 70.28 \pm 6.44) patients of COPD and 6.67% (N=3) patients of asthma (mean age \pm SD 70 \pm 7).

The most common comorbid condition among all patients was hypertension in a total of 33 patients (22%), followed by type 2 Diabetes in 13 patients (9%). Allergic rhinitis, bronchiectasis, and lower respiratory tract infections were present in 5% (N=7), 2% (N=3), and 3% (N=4) patients respectively. Other

cardiovascular conditions such as ischemic heart disease, myocardial infarction, rheumatic heart disease, cardiovascular accident, coronary artery disease was also seen as a comorbidity in 9 patients (6%). There were other comorbid conditions present including UTI, hyperthyroidism, deficiency dermatosis, psoriasis Vulgaris, neuralgia, haemorrhoids, chronic lung disease, etc. in 10 patients (7%) [as shown in Fig. 1].

Table 1. Patient distribution based on gender and disease

Disease	Asthma (N=54)	COPD (N=69)	Asthma + COPD (N=7)
Male	24 (44%)	73 (82%)	6 (86%)
Mean age±SD	(36.17±13.46)	(58.78±15.18)	(53.63±15.66)
Female	30 (56%)	16 (18%)	1 (14%)
Mean age±SD	(39.07±13.31)	(55.15±14.06)	1 (14%)

Table 2. Patient distribution based on age

Age (years)	Asthma	COPD	Asthma + COPD
18-40	32 (70%)	12 (26%)	2 (4%)
Mean age±SD	(29±6.44)	(34.42±4.99)	(28.5±6.36)
41-60	19 (32%)	36 (65%)	2 (3%)
Mean age±SD	(48.11±4.48)	(51.92±5.61)	(44±2.83)
61-90	3 (6%)	36 (67%)	3 (7%)
Mean age±SD	(70±7)	(70.28±6.44)	(67.33±6.62)

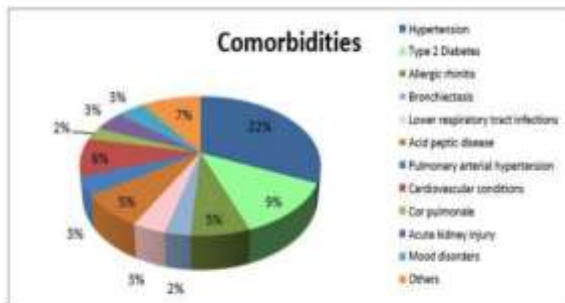


Fig. 1. Percentage of comorbid conditions

A total of 54 patients were either homemakers or students or not working at all. They all fall in the unemployed category. In the group of working people, 72% (N=71) patients were working as occupation class 3 (persons engaged in occupations requiring manual labour or heavy machinery or exposure to certain hazardous conditions) which includes farmers, construction site workers, factory workers, sweeper, labours, drivers, carpenters, cooks, etc. 15% patients (N=14) were working as occupation class 2 (persons engaged in skilled and semi-skilled work and not exposed to hazardous conditions) such as barber, tailor, salesman, etc. 10% patients (N=10) were working as occupation class 1 (professionals and persons engaged in executive, administrative or clerical duties) such

as teachers, company employees, etc. Among asthma patients, the majority of the patients (88.89%) (N=48) were non-smokers, whereas very few patients (5.56%) (N=3) were current smokers and an equal number of patients left smoking in past. Out of all the COPD patients, the count of current smokers (40.44%) (N=36) and non-smokers (38.2%) (N=34) was almost equal. 21.34% (N=19) of COPD patients were ex-smokers. Among the patients having both asthma and COPD 14.28% (N= 1) patients never smoked in their lifetime, whereas the ratio of current smokers and ex-smokers was exactly similar with 42.85% (N=3).

Inhaled corticosteroids (25.19%) (N=129) were prescribed the highest out of all the drug classes. This was followed by long-acting beta-2 agonists (LABA) (17.77%) (N=91) and antibiotics (16.6%) (N=85). Anticholinergics were prescribed in 14.06% (N=72) patients. Anticholinergics were followed by short-acting beta-2 agonists (SABA) (11.32%) (N=58) and methylxanthines (8.2%) (N=42). Systemic corticosteroids (3.51%) (N=17) and leukotriene modifiers (3.32%) (N=17) were prescribed in very few patients. Among asthma patients' corticosteroids (42%) (N=52) were the highest prescribed drugs followed by LABA (37%) (N=46), anticholinergics (8%) (N=10), SABA (7%) (N=9), and methylxanthines (6%) (N=8). In COPD patients' corticosteroids (34%) (N=89) were again the highest prescribed drugs among all followed by anticholinergics (21%) (N=55), LABA (17%) (N=44), SABA (16%) (N=42), and methylxanthines (13%) (N=33). In patients having both asthma and COPD SABA (33%) (N=7) and anticholinergics (33%) were the highest prescribed drugs with the p-value < 0.05. This is statistically significant.

Drugs prescribed in different dosage forms: Out of all the drugs prescribed for asthma and COPD, the majority of the drugs (55.73%) (N=204) were prescribed in the inhalation

dosage form. 36.61% (N=134) drugs were prescribed in oral dosage form and only 7.65% (N=28) drugs were prescribed parenteral dosage form. Among asthma patients, 39% (N=39) of drugs were prescribed in oral dosage form and 61% (N=61) drugs were prescribed in the inhalation dosage form. In COPD patients 53% (N= 132) drugs were prescribed in inhalation dosage form followed by oral (36%) (N=91) and parenteral (11%) (N=27) dosage form [Figs. 2 and 3].

Antibiotics prescribed: Among antibiotics Doxycycline was the choice of drug in the majority of the patients (33%) (N=27) followed by amoxicillin and potassium clavulanate (25%) (N=20). Azithromycin (22%) (N=18) stands next in the line. Azithromycin is followed by cephalosporins (ceftriaxone, cefadroxil, and cefoperazone) (14%) (N=11), clarithromycin (4%) (N=3), and levofloxacin (2%) (N=2). Azithromycin (47.37%) (N=9) was the most preferred antibiotic in asthma patients followed by amoxicillin and potassium clavulanate (26.32%) (N=5), doxycycline (21.05%) (N=4), and levofloxacin (5.26%) (N=1), whereas in COPD patient's doxycycline (37.93%) (N=22) was the highest prescribed antibiotic followed by amoxicillin and potassium clavulanate (25.86%) (N=15), cephalosporins (15.52%) (N=9), azithromycin (13.79%) (N=8), clarithromycin (5.17%) (N=3), and levofloxacin (1.72%) (N=1). Among patients with both diseases cephalosporins (50%) (N=2), doxycycline (25%) (N=1), and azithromycin (25%) (N=1) were the choice of antibiotics.

Table 3. Drugs prescribed by class

Class of drugs	Number of patients	Percentage
Systemic corticosteroids	17	3.32%
Inhaled corticosteroids	129	25.19%
SABA (Short-Acting Beta Agonists)	58	11.32%
LABA (Long-Acting Beta Agonists)	91	17.77%
Antibiotics	85	16.6%
Anticholinergics	72	14.06%
Methylxanthines	42	8.2%
Leukotriene modifiers	17	3.32%

Table 4. Drugs prescribed by class

Class	Asthma	COPD	Asthma + COPD
Corticosteroids	52 (42%)	85(34%)	5(24%)
SABA (Short-Acting Beta Agonists)	9 (7%)	42(16%)	7(33%)
LABA (Long-Acting Beta Agonists)	48 (37%)	44(17%)	1(5%)
Methylxanthines	8 (6%)	33(13%)	1(5%)
Anticholinergics	10 (8%)	55(21%)	7(33%)
Total	125 (100%)	253 (100%)	21 (100%)

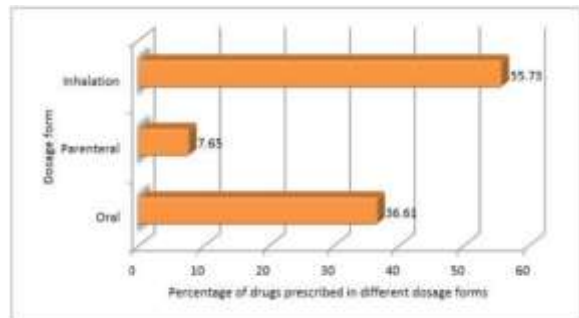


Fig. 2. Percentage of drugs prescribed in different dosage forms

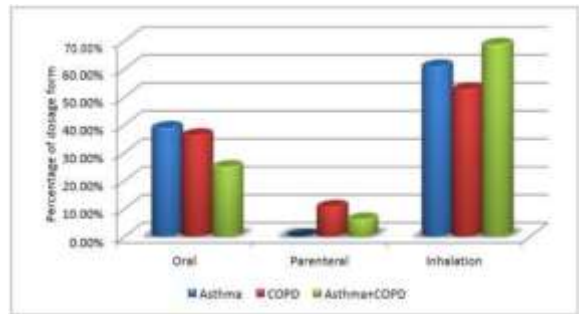


Fig. 3. Percentage of drugs prescribed in different dosage forms by disease

Table 5. Antibiotics prescribed by disease

Antibiotics	Asthma	COPD	Asthma + COPD
Amoxicillin + Potassium clavulanate	5 (26.32%)	15 (25.86%)	0 (0%)
Cephalosporins	0 (0%)	9 (15.52%)	2 (50%)
Clarithromycin	0 (0%)	3 (5.17%)	0 (0%)
Doxycycline	4 (21.05%)	22 (37.93%)	1 (25%)
Levofloxacin	1 (5.26%)	1 (1.72%)	0 (0%)
Azithromycin	9 (47.37%)	8 (13.79%)	1 (25%)

Table 6. Drugs prescribed as adjuvant therapy

Drugs	Percentage
Multivitamins	34 (19.10%)
Calcium + Vitamin D3	13 (7.30%)
Calcium	16 (8.99%)
Pantoprazole	42 (23.60%)
Famotidine	16 (8.99%)
Domperidone + Esomeprazole	30 (16.86%)
Acetylcysteine	19 (10.67%)
Diclofenac + Paracetamol	3 (1.68%)
Paracetamol	3 (1.68%)
Dechlorpheniramine	2 (1.12%)

Drugs prescribed as Inhalation: Budesonide and formoterol were given in the majority of the patient (44.12%) (N=90) as inhalation therapy followed by salbutamol + ipratropium bromide (26.96%) (N=55). Other drugs prescribed as inhalation were budesonide (18.13%) (N=37), ipratropium bromide (4.41%) (N=9), tiotropium bromide (3.92%) (N=8), salbutamol (1.47%) (N=3), and fluticasone (0.98%) (N=2).

Drugs used as fixed drug combinations: Majority of patients were prescribed with fixed drug combinations. Budesonide + formoterol (39.47%) (N=90), salbutamol+ ipratropium bromide (24.12%) (N=55), domperidone + esomeprazole (13.16%) (N=30), levocetirizine + montelukast (7.02%) (N=16), acebrophylline + acetylcysteine (6.14%) (N=14), bromhexine + guaifenesin + terbutaline (1.75%) (N=4), and etophylline + theophylline (8.33%) (N=19). The drug combination of budesonide + formoterol (62%) (N=46) was prescribed the highest times in asthma patients followed by the combination of levocetirizine + montelukast (16%) (N=12), salbutamol + ipratropium bromide (11%) (N=8), acebrophylline + acetylcysteine (9%) (N=7) and etophylline + theophylline (1%) (N=1). In COPD patients the drug combinations of budesonide + formoterol (39%) (N=43) and salbutamol + ipratropium bromide (36%) (N=40) were prescribed in almost similar number of patients followed by etophylline + theophylline (16%) (N=18), acebrophylline + acetylcysteine (6%) (N=7), levocetirizine + montelukast (3%) (N=3). Drugs prescribed as adjuvant therapy: Many drugs were prescribed as adjuvant therapy including multivitamins, antacids, calcium, antihistamines, analgesics etc. Pantoprazole (23.60%), multivitamins (19.10%), domperidone and esomeprazole (16.85%), acetylcysteine (10.67%), famotidine (8.99%), calcium (8.99%), calcium and vitamin D3 (7.30%), diclofenac and paracetamol (1.68%), dexchlorpheniramine (1.12%). Drugs prescribed in brand name or generic name: Out of 150 prescriptions 45% (N=168) drugs were prescribed in brand name and 55% (N=202) drugs were prescribed in Generic name.

Drug interactions: There were 14 drug interactions found between medications prescribed for asthma and COPD. The highest number of drug interactions were between the drugs theophylline + Azithromycin (N=5),

followed by budesonide + diclofenac (N=3), budesonide + clarithromycin (N=2), doxofylline + formoterol (N=1), doxofylline + furosemide (N=1), doxofylline + ranitidine (N=1), levofloxacin + theophylline (N=1).

Inhaler device technique: Out of 150 patients 64 % (N=96) of patients used the proper technique of using the inhaler device properly and 36% (N=54) patients were not using inhaler devices properly [as shown in figure 5.18]. This was recorded from the patient's medical data. Medication adherence: Out of 150 patients, 53 patients were newly diagnosed with either asthma or COPD. The medication adherence was checked in newly diagnosed patients. Medication adherence was determined by the Morisky medication adherence scale (MMAS-8). There was 15.09% (N=8) high adherence, 37.74% (N=20) medium adherence, and 47.16% (N=25) low adherence among newly diagnosed patients prescribed with the medications for asthma and COPD with the p-value < 0.05 which is statistically significant.

IV. DISCUSSION

In our study, it was observed that there were a greater number of male patients (68.67%) than female patients (38.33%). This is similar to a previous study by Niffy et al. in which male patients (75.2%) were more compared to female patients (24.8%) [12]. Out of 150 patients, there were 54 patients with asthma, 89 patients with COPD, and 7 patients with asthma + COPD overlap syndrome. Among asthma patients, there were 44% male and 56% female patients. In COPD patients there were 82% male and 18% female patients. 86% male and 14% female patients were having ACOS. The patients were distributed into 3 age groups: 18-40 years, 41-60 years, and 61-90 years. Among asthma patient's majority of the patients (69.57%) were from the age group 18-40 years and very few patients (6.67%) from the age group 61-90 years. These results were nearly similar to the study by

Laxminarayan Kamath et al. where the majority of asthma patients (50%) were between the age between 18 and 38 years and only a few patients (11.3%) of age above 59 years [13].

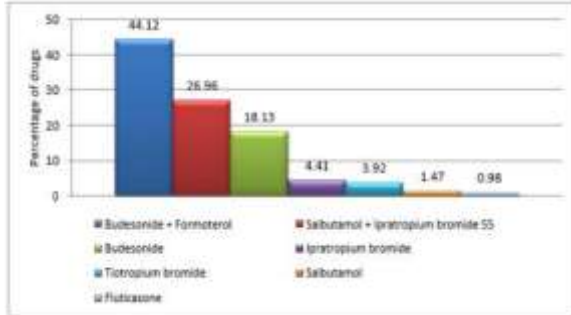


Fig. 4. Percentage of drugs prescribed as inhalation

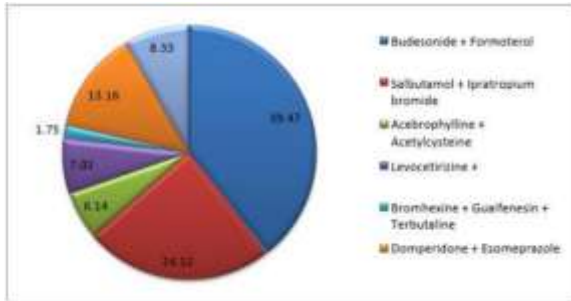


Fig.5: Percentage of drugs used as fixed drug combinations

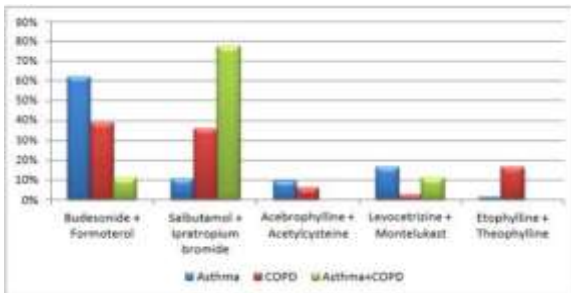


Fig. 6. Percentage of drugs used as fixed drug combinations

Table 7. Drug interactions

Drug Interactions	Number of patients	Severity	Effect	Management
Budesonide+ Clarithromycin	2	Moderate	Clarithromycin inhibits the metabolism and increase the exposure of budesonide	Use with caution
Budesonide + Diclofenac	3	Major	May increase the risk of gastrointestinal ulcer and bleeding	Monitor for signs of bleeding
Doxofylline+ Formoterol	1	Moderate	May result in increased risk or severity of adverse effects	Use with caution
Doxofylline + Furosemide	1	Minor	May result in hypokalemia	Use with caution
Doxofylline	1	Minor	May result in increased serum concentrations of doxofylline	Careful monitoring of serum doxofylline concentrations
Levofloxacin+ Theophylline	1	Major	May result in theophylline toxicity (nausea, vomiting, palpitations, seizures)	Monitor theophylline level closely and make appropriate dosage adjustments
Theophylline+ Azithromycin	5	Moderate	May result in increased serum concentrations	Careful monitoring of plasma theophylline concentrations

V. CONCLUSION

An observational research was carried out to examine the drug use patterns of medications recommended for COPD and asthma. We noticed that there were more male patients in our research than female ones. Male patients had a higher prevalence of COPD, whereas female patients had a higher incidence of asthma. When it came to asthmatics, most of them were between the ages of 18 and 40, while more COPD patients were shown to be older than 40. Along with their illness, several of the patients also had co-morbid illnesses such diabetes, bronchiectasis, allergic rhinitis, hypertension, and cor-pulmonale. The majority of patients had class 3 occupations as their profession. While the majority of COPD patients smoked, the majority of asthmatics did not smoke. Most patients who visited the outpatient department were given one or two medications, while patients who were inpatient were administered three or four medications. This may be due to the need of giving patients comfort more quickly while their illness is becoming worse. Patients with COPD and asthma tended to choose corticosteroids as their medication of choice. Prescriptions for inhaled corticosteroids were the most common. The most often given antibiotic was doxycycline. Whereas the majority of COPD patients were taken Doxycycline, the majority of asthma patients were prescribed azithromycin. The underlying bacterial infections that caused asthma or COPD episodes were the reason for the prescriptions for the medicines. The method that was most favored was inhalation.

As to the recommendations, the primary option for treating obstructive lung illnesses ought to be inhalation treatment. The most often recommended combination for inhalation treatment was budesonide with formoterol. The most often prescribed fixed medication combinations were salbutamol and ipratropium

bromide, budesonide and formoterol, and salbutamol and formoterol. The GOLD and GINA criteria were followed in the prescription of each medication.

As adjuvant treatment, multivitamin B-complex, calcium, and medications to control acidity were administered. Medicines with both brand and generic labels were prescribed. There were few prescriptions where medication interactions were found. Even though most patients understood how to use inhaler devices correctly, the largest percentage of patients did not follow their treatment plan as prescribed.

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