

EFFECTS OF SOCIOECONOMIC AND CLINICAL FACTORS ON TREATMENT ADHERENCE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASES PATIENT: FOCUS ON INHALATION THERAPY

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ABSTRACT

Objective: Chronic obstructive pulmonary disease (COPD) refers to a persistent blockage of airflow that requires bronchodilator medication for the rest of one's life. The goal of the treatment can only be met when the patient is adhering to the prescribed medicine. This study identifies and analyzes how clinical and socioeconomic factors affect COPD patients' drug adherence to given therapy. The impact of our findings will reduce socioeconomic inequality in COPD management which will improve adherence to drugs and overall physical well-being.

Methods: The hospital-based cross-sectional studies were conducted at the Department of TB and CD for 6 months in a tertiary care hospital. A total of 55 patients diagnosed with COPD participated in the study after signing the informed constant. The individual patients were interviewed using MMAS-8 and Kuppuswamy scale questionnaires. The data were analyzed by Chi-square test to determine the correlation between medication adherence and socioeconomic status in patients with COPD.

Results: Among 55 COPD patients included in the study, their mean age was 62.2(+10.76) years. Out of the total participants: Significant associations between the medication adherence scale (MMAS-8) scores and the Kuppuswamy scale were found as $p < 0.0001$, indicating that medication adherence was influenced by the patient's socioeconomic status. In addition, the BORG scale which is used to measure exercise tolerance in COPD that found to have a significant correlation with an MMAS-8 score of $p = 0.03$.

Conclusion: Our study found that a person with low socioeconomic levels will have poor adherence to inhaler therapy, leading to poor health outcomes like exacerbation and low physical activity due to shortness of breath.

Keywords: COPD, Medication adherence, inhaler device, Socioeconomic condition, lung chronic condition.

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INTRODUCTION

Non-communicable chronic respiratory disease is the major cause of death worldwideresultingin4.1 million deaths annually [1]. Due to over pollution, it become a prevalent issue and unfortunately, people seem to be less concerned about nature and the consequences of their daily habits. One of the main detrimental habits that have been contributing to a significant rise in chronic obstructive pulmonary disease (COPD) cases is smoking habit [2]. The inhalation of harmful substances present in cigarettes will cause irreversible damage to the lungs. It was estimated that the 55 million population of India is suffering from COPD [3]. The effectiveness of the treatment can be met only when the patient is adhering to both pharmacological and non-pharmacological [4].

Although supportive treatment can slow the progression and exacerbation, there is currently no known permanent cure for COPD is available. Inhalers with a single or combination dose of long and short-acting bronchodilators as well as inhalers containing corticosteroids are frequently prescribed as treatments because they assist easy breathing by dilating the respiratory tract [5]. However, certain factors such as the high cost of medication, ignorance of inhaler usage techniques, and lack of education might lead to non-adherence to the prescribed course of action [6].

Inhalers are available in various types each with unique characteristics and advantages. The most common types are metered-dose inhalers, dry powder inhalers, and simple compress inhalers. The choice of inhaler depends on the patient's condition and doctors carefully

consider which type will best suit their condition [7]. After patients receive their inhalers, health-care providers demonstrate them with comprehensive instructions on how to use the device correctly and ensure they understand the process clearly. Physicians also test the patient's confidence in using the inhaler at home asking them to repeat the procedure in front of them [8].

Medication is an important aspect of patient treatment a single dose of a fixed-dose combination of inhalers either bronchodilator or corticosteroids is used to reduce the symptoms; Monitoring adherence is essential to ensure the medication's effectiveness in preventing exacerbation and managing the condition optimally [9].

To assess patient adherence, the Morisky adherence scale was applied which involves a series of questionnaires. Where the total score ranges from 0 to 8, here yes is counted as 1 and no is counted as 0. Based on the score, they were divided into low, medium, and high adherence. We also introduced an additional questionnaire that allows patients to demonstrate the procedure of taking inhalers [10]. However, several factors such as clinical and socioeconomic status affect adherence. The Kuppuswamy Scale was employed to determine the patient's socioeconomic status. This scale includes the questionnaires that will help to determine the patient educational background, their monthly income, and which profession they are involved in [11].

Our study focused on COPD outpatients attending the TB-CD OPD and their adherence to inhaler medication, among them 54.5% of patients have full adherence to the therapy. To gain deeper insights into the

factors influencing medication adherence, we compared patients with poor adherence to those with high adherence. For clinical evaluation, we utilized the modified medical research council (MMRC) grade, BORG scale with a 6-min walk test to assess the level of respiratory difficulty experienced by the patient despite medication use along with an evaluation of non-adherence clinical conditions [12]. We also assessed the severity of COPD using the Pulmonary Function Test (PFT) (spirometry) and categorized patients based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) classification (GOLD-1 to GOLD-4) [13]. This classification allowed us to distinguish the varying degrees of medication adherence, socioeconomic status, and clinical severity of symptoms [14].

Every patient's demographic information, including age, sex, history of smoking, and others, was also analyzed based on patient adherence and socioeconomic status. Our comprehensive study of each of the factors will improve our knowledge of COPD severity and its treatment [15,16].

COPD severity inter connection Fig. 1.

METHODS

Study design

The prospective cross-sectional studies were conducted at the Department of TB and CD for 6 months from November 2023 to April 2024 in a tertiary care teaching hospital. Conventional sampling methods were applied due to less time availability to collect the data. Interviews were conducted with all eligible patients who agreed with the informed consent of the study. Inquiries focused on the patients' inhalation patterns, adherence to treatment, and disease severity which was determined by PFT results, COPD severity was classified using the Global Initiative for Chronic Obstructive Lung Disease GOLD spirometry definition.

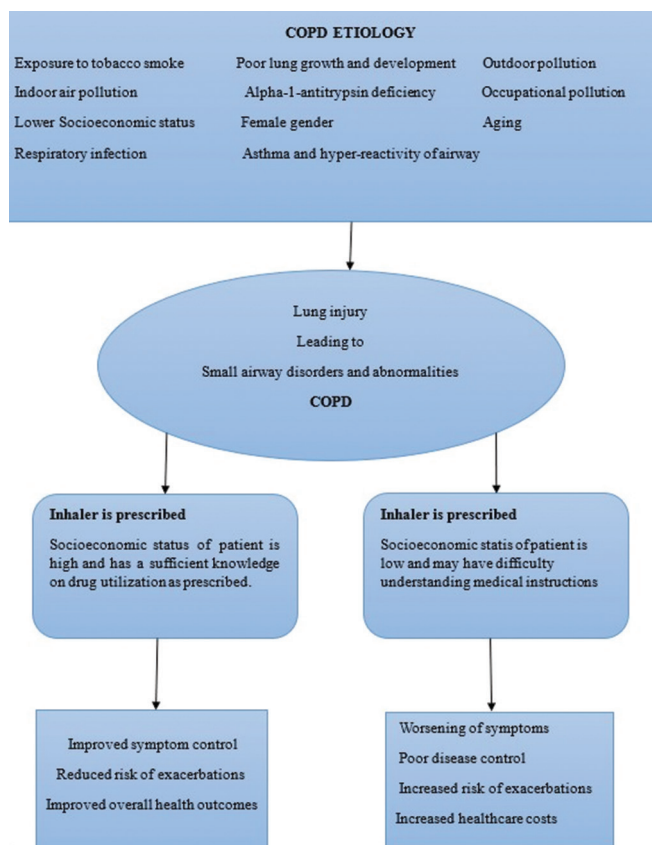


Fig. 1: Interconnection between Low Socioeconomic Condition and COPD severity and Severe exacerbation

Based on our inclusion and exclusion criteria, patients with cardiovascular disease, those unable to give informed consent to perform spirometry, and those with critical illness were excluded from the study and the patients who are taking inhalers without cardiovascular disease and agree to participate in the study were included in the study. Following the survey questionnaire, the basic information about patient demography, treatment data, and symptoms was collected from the patient case sheet, and other information on the dyspnea scale, blood pressure, temperature, pulse, and respiratory rate was examined and exercise tolerance test was also performed following 6-min walk test and graded based on BORG scale and PFT was performed in the present of the respiratory technician. Patients' Medical Research Council dyspnea scale was determined to evaluate breath lessness and inability to perform regular activities.

Data collection

Basic information

Demographic information includes age, gender, height, weight, and location. Clinical information, such as disease course, history of exacerbations, smoking history, present symptoms, follow-up, inhaler

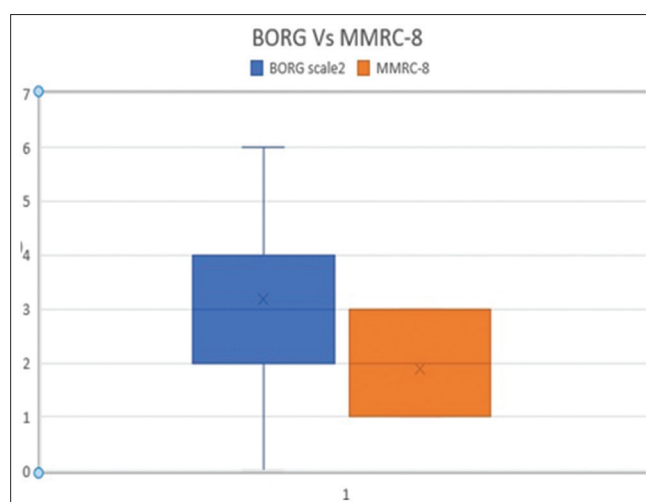


Fig. 2: Explain: MMAS-8 and Kuppuswamy scale (p<0.001) Indicating: That Socioeconomic Conditions of COPD patients could affect the Adherence to Inhaler drugs

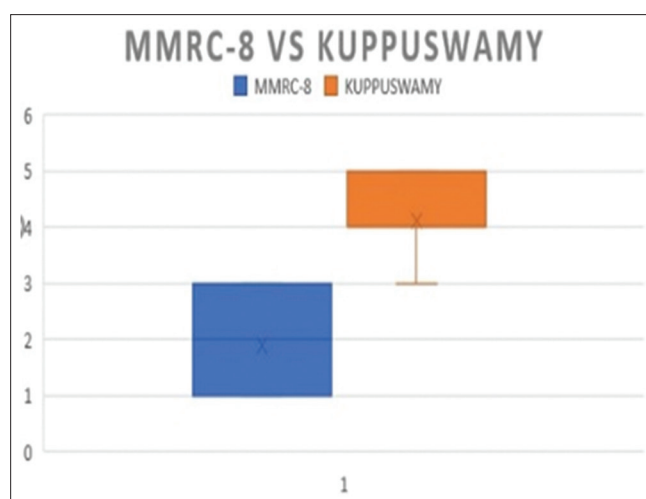


Fig. 3: Explain: BORG scale and MMAS-8 have a significant correlation with each other with a significant of 0.03 level, indicating: patients with low adherence to inhaler medication experienced a higher level of dyspnea, which had a significant impact on their daily activities and quality of life

Table 1: Distribution of participant characteristics according to different variables with Pearson correlation with MMAS

Characteristics	Frequency	Percentage	p-value
Gender			
Male	45	81.82	
Female	10	18.18	
Age Distribution			0.35
30–40	3	5.45	
41–60	14	25.45	
61–80	34	61.82	
81–90	4	7.28	
MMAS-8 scale			1
High adherence	24	43.64	
Medium adherence	13	23.63	
Low adherence	18	32.73	
Gold classification			0.4
Gold 1	12	21.8	
Gold 2	17	30.9	
Gold 3	20	36.4	
Gold 4	6	10.9	
Kuppuswamy scale			0.6**
Upper	0	0	
Upper middle	0	0	
Lower middle	10	18.18	
Upper lower	29	52.73	
Lower	16	29.09	
Pre-BORG scale			0.04
0–2(easy)	4	7.27	
3–4(moderate)	38	69.09	
5–6(hard)	12	21.82	
7–8(rarely hard)	1	1.82	
9–10(severely hard)	0	0	
BMI index			–0.93
<18.5	3	5.45	
18.5–25	34	61.82	
25–30	10	18.18	
30–35	2	3.64	
35–45	6	10.91	
MMRC grade			0.02
Grade I	8	14.55	
Grade II	20	36.36	
Grade III	20	36.36	
Grade IV	7	12.73	

type, and medication combination were collected from the hospital case sheet.

Medication adherence

After signing an informed consent form, 55 participants were interviewed and physically examined as described in Table 2. We assess individual levels of adherence using the Morisky Medication Adherence questionnaire. These questionnaires are scored on a scale of 1–8 with 8 representing high adherence, 6–8 representing moderate adherence, and a score <6 denoting poor adherence.

Socioeconomic status

Low socioeconomic status increases the risk for exacerbation of COPD symptoms because of low adherence to the drug due to its high cost. For this, we collect the information using Kuppuswamy scale 2022 questioners. Interviewing the patient based on the questioners their educational qualification, monthly income, and skill to carry out daily life. Based on the above information we classified the patients in upper class (26–29 score), upper middle class (16–25 score), lower middle class (11–15 score), upper lower class (5–10 score), lower class (<5 score) [17].

Outcomes

Medication adherence was measured using the updated version of the eight-item Morisky medication adherence scale (MMAS-8 item) for inhaler use by the patient for COPD treatment, such as Long-Acting Beta

Table 2: Patient distribution based on knowledge of inhaler use

Drug utilization by patient		
Patient evaluation	Number	Percentage
A patient who knows how to use an inhaler	33	60
Patients who do not know how to use an inhaler	22	40

Agonists (LABA), Inhaler corticosteroids (ICS), and ICS/LABA [18]. The total score on MMAS-8 ranges from 0 to 8 resulting from the sum of all answer points and has been categorized into high adherence (score=8), medium adherence ($6 \leq \text{score} < 8$), and low adherence (score < 6). British MMRC and PFT instruments were applied to measure breathlessness and health status impairment, respectively [19]. The MMRC scale consists of five descriptive items to estimate the severity of dyspnea in subjects, in which grade ≥ 2 shows not only greater severity of dyspnea but also poor health-related quality of life (HR-QoL). Every patient had an interview process to meet the study requirement of MMAS-8, MMRC, and Kuppuswamy socioeconomic scale. In addition, PFT was done on the TBCD department to measure the forced expiratory volume in the first second in every case and a 6-min walking test was conducted to support the BORG scale in determining the functional severity of the illness [20].

Statistical analysis

Statistical analysis was carried out on variables, such as the BORG scale, the MMRC scale, the GOLD severity grade, and demographic data. An ordinal logistic regression model was used to determine the predictors of medication adherence. The outcome variable was the categorical degrees of medication adherence (high, medium, low). It was also investigated whether socioeconomic status would have an impact on non-adherence and then the severity of the illness. The limit below which results became significant was set at $p < 0.05$. We evaluate the associations between medication adherence, socioeconomic status, and disease severity by using this Chi-square analytical procedure in SPSS 20.0 software and MS Excel.

RESULTS

Out of the 70 patients that were included in the trial, 15 were excluded because they did not meet the inclusion criteria. Every participant had a good response rate, and they were all physically examined, with blood pressure, breathing rate, a 6-min walk test, and a PFT. In the survey, 82% of respondents were men and 18% were women. The participants ranged in age from 30 to 90 years old, with an average age of 62.2 ± 10.76 years. Of these, 6.8% had a history of severe COPD (Table 1). They were taking maintenance treatment of inhaler alone (long-acting anticholinergic agents, LABA, or inhaled corticosteroids [ICS] with long-acting β_2 agonists [ICS+LABA]); combined inhalation preparations (ICS+LABA).

In the present study, the MMAS-8 scale served as a major assessment tool to determine the medication adherence of COPD patients. The average mean of MMAS-8 was found to be 5.8 and the standard deviation was found to be 2.46. On analysis, the MMAS scale revealed that 32.73% of patients had low adherence, 23.63% of patients had medium adherence, and 43.64% of subjects exhibited high adherence to the prescribed inhaler drug. We use the PFT to determine the severity of each patient and then classify them using the GOLD classification system. 21.8% of patients had mild COPD, 30.9% had moderate COPD, 36.3% had severe COPD, and 10.9% had extremely severe COPD according to the statistical report. These severe cases result from pharmaceutical nonadherence; of which 44% show high medication adherence, 23% show medium medication adherence, and 33% show low medication adherence. On the other hand, the participant was classified based on MMRC grades, where 15% had grade I, 36% had grade II and grade III, and 13% had grade IV breathlessness (Table 1).

Contradictory results from our study have been observed with other correspondents, such as age ($p=-0.31$), BMI ($p=-0.93$), and MMRC ($p=-0.88$), suggesting that those clinical and demographic factors are not significantly connected with the medication adherence.

Chi-square tests were conducted for each variable. Medication adherence has a significant association with the Kuppaswamy socioeconomic scale ($p<0.001$) and the BORG scale ($p=0.031$). This indicates that people with a low socioeconomic status have low adherence to inhalation therapy compared with a higher socioeconomic status as shown in Fig. 2 and that those low-adherence people are directly associated with poor health outcomes as shown in Fig. 3 by cross-evaluation with the MMRC scale and BORG scale. This result supports our hypothesis that socioeconomic and clinical factors will affect medical adherence in COPD patients.

Pearson correlations added further important relationships that were included in further research. The MMRC scores showed a moderate positive connection ($r=0.34$, $p=0.01$) between age and reported breathlessness, indicating that older people felt more breathless when engaging in certain activities. Notably, the MMAS-8 scores for medication adherence (Kuppaswamy scale; $r=0.638$, $p<0.001$) indicated a substantial positive association with socioeconomic level, suggesting that those with lower socioeconomic status were more likely to adhere to their prescription.

On evaluating the patient prescription, we found that 60% of patients were taking the formoterol + budesonide combination whose price ranges from 150 to 850 INR which suggests that selection of an affordable brand is possible in the treatment of COPD and the other 40% of prescriptions have other drug combination mention in Table 3.

DISCUSSION

It is estimated that a 55 million population is living with COPD in India of which 2 million die every year. Those morbidity can be delayed simply by adhering to the inhaler therapy. In our study, we are looking over the factors that cause non-adherence in the individual [21].

Low socioeconomic conditions may adversely impact adherence to drug therapy. In our study, we found out that there is a significant relation between low socioeconomic factors affecting the adherence to inhalation therapy with a significant rate of $p<0.001$, a similar study was done by Sandra Sogaarf Tottenborg, reported that significant association with socioeconomic inequalities in COPD treatment adherence [22]. They studied the adherence of individuals to the treatment based on individual status; high-income, low-income candidates, and unemployed immigrants, and found that low-income and unemployed patient has low adherence to the drug (aRR=1.17, 95% CI 1.11–1.24) study conducted in Denmark. Those statuses show that developed countries are also lacking policies for health weal fear of chronic disease patients [23].

Furthermore, the research conducted by Aizhamal Tabyshova in Kyrgyzstan found that low and middle-income country patients with asthma around 80% poorly adhere to medication, and non-adherence was directly or indirectly related to financial barriers to patients highlighting the association of other medical conditions like low BMI [21]. On COPD patients QOL is directly concerned with the lowering of exacerbation episodes and difficulties on breathing days, by adherence to prescribed inhalers. Boyuk Moradkhani surveyed over 100 patients and discovered that those with a higher quality of life adhered to their medication regimens more frequently than those with polypharmacy [24]. Similarly, highly educated individuals adhered to their medication regimens more frequently than those with uneducated people.

In our research, the well-educated and upper-class individuals with higher socioeconomic positions are more adherent to the prescribed drug therapy. This may be due to their knowledge/understanding of people and their ability to afford medication regularly despite the cost. Those people with a low adherence have been showing low exercise tolerance reporting they get shortness of breath after short-term work compared to the patient taking medication regularly. However, there is no significant correlation was found between age, BMI, smoking history, and comorbidity with drug adherence. A significant association between medication adherence and exercise tolerance, as measured by the BORG scale, sheds light on the importance of physical activity in the management of COPD. Emphasizing the need for designed interventions is optional considering socioeconomic factors and exercise tolerance to improve clinical outcomes in patients with COPD. In our research we found out that 40% of patients do not know how to use an inhaler properly and 60% of patients know how to use an inhaler properly this indicates that still there is a lack of patient knowledge about inhaler administration similar study was done by MV itcca where they reported that patient does not have sufficient knowledge about their disease and inhaler device and conclude that educating the patient irrespective to the device can help to improve the adherence.

Moreover, the vast correlation between medication adherence and exercise tolerance highlights the nature of COPD care, in which addressing now not only scientific aspects but also socioeconomic and lifestyle elements is vital. These insights emphasize the need for healthcare carriers to undertake a complete and affected person-centered approach in handling COPD with patient education and cost-effective drug therapy. Government policy should also be designed with consideration of health and treatment of chronic diseases people.

CONCLUSION

Those findings that address low socioeconomic status have shown a significant impact on treatment adherence and those patients have struggled with breathlessness during physical activity: Finding an address that identifying socioeconomic status is a crucial factor of COPD management on drug adherence and health outcomes so, to overcome this issue: Treatment should include an awareness program, counseling sessions, a patient-specific intervention, and access to an affordable inhaler will be provided to improve the adherence of patient with low SES that will help to improve the respiratory function. At the same time, we hope to shed light on the priorities of government agencies and healthcare professionals when it comes to adjusting policies and treatment plans for patients with chronic medical conditions.

Limitation

There are certain limitations to our study. Because of the short study period, we examine the relationship between medication adherence and clinical factors related to socioeconomic status using cross-sectional research; however, long-term research can be undertaken after a focus on customized treatment for every participant.

Another limitation we encountered was an inadequate sample size. The lack of a significant correlation between mMRC, co-morbidity (polypharmacy), and BMI may be the result of our study's small sample size.

Table 3: Distribution of drug utilization patron by the patient

Inhaler with drug combination		
Drugs	Number of patients taking a specific drug	Percentage
Formoterol+budesonide	33	60
Glycopyrrolate+formoterol+budesonide	8	14.55
Salmeterol+fluticasone	4	7.27
Tiotropium+formoterol+ipratropium	4	7.27
Fluticasone+vilanterol	3	5.45
Formoterol+glycopyrrolate	1	1.82
Indacaterol+monetasone	1	1.82
Salbutamol	1	1.82

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CONFLICTS OF INTEREST

There is no conflict of interest.

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