



## ORIGINAL ARTICLE

# Assessment of the Medication Adherence Among Chronic Obstructive Pulmonary Disease Patients in ALSha'ab Teaching Hospital, Sudan

Muna Ahmed Ibrahim<sup>1\*</sup>, Fath Elrahman Mohamed Idris<sup>2</sup>

<sup>1</sup>Department of Internal Medicine, Sudan Medical Specialization Board, East Riffa, Bahrain

<sup>2</sup>Department of Pulmonology, Bahri Teaching Hospital, Sudan

### \*Corresponding author:

Dr. Muna Ahmed Ibrahim, Department of Internal Medicine, Bahrain Defence Force Hospital East Riffa, Bahrain; Email: [munamunmun@hotmail.com](mailto:munamunmun@hotmail.com)

Received date: May 06, 2023; Accepted date: June 08, 2023; Published date: September 30, 2023

### Abstract

**Background:** Adherence to therapy is one of the basic predilections to successfully treating chronic obstructive pulmonary disease (COPD). Unfortunately, predictors of medication adherence are not well-known in chronic obstructive pulmonary disease (COPD) in Sudan.

**Objective:** To assess the medication adherence in the patients treated for COPD in ALSha'ab Teaching Hospital.

**Methods:** An observational, hospital-based cross-sectional study conducted on a sample of COPD outpatients. The following information was obtained: adherence to COPD therapy (Morisky Medication Adherence Scale - 4 items), age, gender, smoking status, treatment regimen for COPD, and COPD medication costs per month paid by the patients. Data was analyzed by using SPSS version 21.0.

**Results:** Among 100 COPD patients, 73 (73%) were males, and (47%) belonged to the age group 40-60 years. Regarding adherence, 47 (47%) reported as medium adherent, 38 (38%) as low adherents, and 15 (15%) patients as high adherent. High Adherence to COPD therapy was associated with older age (27%), married (16.5%), literate (23.3%), drugs with less frequent dosing (50%), oral medications (75%), aware of the inhaler usage (22.7%), a smaller number of drugs (41.4%), and affordable drugs (28.8%).

**Conclusion:** The level of adherence to COPD therapy is low. Understanding factors associated with medication adherence could help enhance health outcomes in COPD. Non-adherence was associated with middle age, unmarried patients, number of respiratory drugs and daily COPD drug doses, Low knowledge and increased difficulties in inhaler technique, and non-affordability of drugs.

**Keywords:** COPD, Patients, Sudan, Adherence.

### Introduction

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity worldwide. The impact of COPD is expected to increase, resulting

in more economic burden. (25.5%). The annual per capita healthcare expenditure on people with COPD is more than two times higher than those without respiratory disease.<sup>1,2</sup> Assessing treatment

adherence is complex, and many methods have been proposed for COPD (clinician estimates, patient self-reporting, pharmacy records, and electronic monitoring). Patient self-report methods and inhaler technique assessment are considered the most suitable for measuring adherence to medication in clinical practice, even though patients tend to overestimate adherence.

The 4-item Morisky and 8-item Morisky Medication Adherence Scales are generic self-reported medication-taking behavior scales considered the most used self-reporting method to determine adherence in chronic diseases; however, it was designed for inhaled medication. In contrast, Plaza et al. have recently developed a self-reporting “Test of Adherence to Inhalers (TAI)” questionnaire for assessing inhaler adherence in patients with COPD or asthma. The authors indicate that this is a reliable and homogeneous questionnaire that can be used to identify non-adherence and classify the barriers to using inhalers in asthma and COPD from a clinical perspective.<sup>3,4</sup>

Suboptimal adherence to treatment decreases the clinical effect of the therapy and accounts for many of the observed differences between the efficacy (works under experimental conditions) and the real-world effectiveness of the drug treatment. Although the adherence rates have been estimated to be 70–90% among COPD patients in clinical trials, these rates are around 20–60% in clinical practice. This reflects that under real-life conditions, non-adherence to medication regimens poses a significant barrier to the optimal management of COPD patients. Medication discontinuation may increase the frequency of exacerbations, the number of hospitalizations, and the mortality rate. Non-adherence to long-term therapies can result in poor health and increased healthcare costs.<sup>5</sup>

Non-adherence is a multidimensional phenomenon; it frequently occurs for various reasons. These include factors related to the patient’s characteristics, the disease, the therapies, and the doctor-patient relationship. Factors influencing medication adherence in COPD patients have yet to be thoroughly investigated. Identifying factors related to adherence is necessary to develop more

effective strategies to improve medication-taking behavior.

## Materials & methods

**Study design:** This is an observational, hospital-based cross-sectional study of medication adherence assessment among Sudanese COPD patients in AlSha’ab Teaching Hospital. It was conducted among 100 COPD patients in AlSha’ab Teaching Hospital, one of Sudan’s largest referral centers for pulmonary medicine. The study is conducted from February – May 2019.

**Study population:** Patients diagnosed with chronic obstructive pulmonary disease (COPD) for one year or more and attending the outpatient clinic in AlSha'ab Teaching Hospital. A total of 100 COPD patients who fulfilled the study criteria and were recruited from the study area within the study period were included in the study.

### Technique used

The Morisky Medication Adherence Scale (MMAS)<sup>6</sup> was used to evaluate medication adherence to respiratory therapy. The MMAS is a self-reported, well-validated instrument. The scale consists of 4 items: (A) forgetting, (B) carelessness, (C) stopping the drug when the patients feel better, or (D) stopping the drug because they believe it makes them feel worse. All the questions on the scale referred only to the medication given for COPD. The scoring scheme of ‘Yes’ = 1 and ‘No’ = 0 was employed.

**Table 1:** Interpretation of Morisky Medication Adherence Scale- 4 items (MMAS-4)<sup>6</sup>

| Adherence        | MMAS-4 Score |
|------------------|--------------|
| High Adherence   | 0            |
| Medium Adherence | 1-2          |
| Low Adherence    | 3-4          |

**Data collection:** The questionnaires comprised demographic data, smoking status, disease duration, medication information, support, cost, and adherence level. Data collection was carried out by the principal investigator. After recruiting the study subjects, structured questionnaires were used to collect data. Data was analyzed using the computer program Statistical Package for Social Sciences (SPSS V. 21.0). Chi-square test was used

in bivariate analysis to identify the independent factors of adherence. The P-value was considered significant at level 0.05.

**Ethical consideration:** Ethical approval was obtained from the Sudan Medical Specialization Board (SMAB) ethics review committee. Written consent was taken from all participants, and they were aware of their rights throughout the study; participation in the study was voluntary and confidential.

## Result

### *Descriptive Statistics and Patients Characteristics*

A total of 100 COPD patients were included in the study. The male-to-female ratio was 2.7:1. Almost half were 40-60 years old; 40% were illiterate. The majority were married (85%).

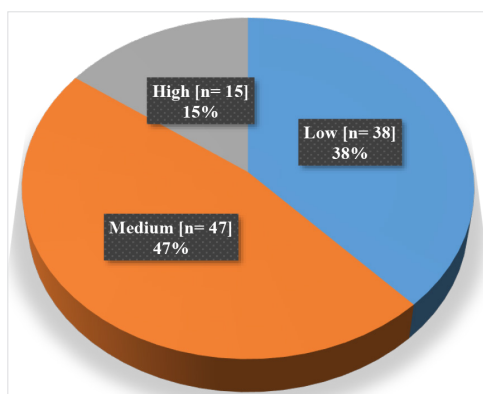
**Patients' characteristics:** Socio-demographics and medication information are summarized in Table 2. In the occupation distribution, 37 (37%) of the patients were employed, 28 (28%) were retired, 25 (25%) were homemakers, and 10 (10%) were unemployed. About one-half (54%) of the patients with COPD were non-smokers, 26 (26%) were ex-smokers, and 20 (20%) patients were currently smokers. Regarding the existence of comorbidities, 29 (29%) patients had hypertension, 27 (27%) had diabetes mellitus (DM), and 4 (4%) patients had cardiovascular disease. Among our study group, almost half of the patients had COPD duration from 5-10 years (Table 2). Regarding the dose of the medications per day, 41(41%) of the patients were taking two daily doses; this is shown in (Table 2).

More than half of the patients (57%) were taking medication by the inhalation route, only 4% by oral way, and 39% patients by both methods; 66% reported that they have proper knowledge of inhaler technique, and 72% said that they don't face any difficulties in inhaler technique. Most of the patients (71%) had more than two drugs per day. Most patients (84%) never experienced side effects of COPD medication. Concerning type of support, 73% of the patients had family support and self-support, in 27% and 48% described the cost of COPD drugs as not affordable (Table 2).

**Table 2:** Patients Characteristics: Socio-demographics and Medication info (N=100)

| Variable                                  | Categories     | N (%)    |
|---|----------------|----------|
| Gender                                    | Male           | 73 (73%) |
|   | Female         | 27 (27%) |
| Age                                       | <40            | 16 (16%) |
|   | 40-60          | 47 (47%) |
|   | >60            | 37 (37%) |
| Education                                 | Literate       | 60 (60%) |
|   | Illiterate     | 40 (40%) |
| Marital Status                            | Married        | 85 (85%) |
|   | Unmarried      | 15 (15%) |
| Occupation                                | Employed       | 37 (37%) |
|   | Retired        | 28 (28%) |
|   | Housewife      | 25 (25%) |
|   | Unemployed     | 10 (10%) |
| Smoking Status                            | Non-smoker     | 54 (54%) |
|   | Ex-smoker      | 26 (26%) |
|   | Current moker  | 20 (20%) |
| Concurrent Disease                        | HTN            | 29 (29%) |
|   | DM             | 27 (27%) |
|   | CVD            | 4 (4%)   |
| COPD Duration (Years)                     | <5             | 33 (33%) |
|   | 5-10           | 49 (49%) |
|   | >10            | 18 (18%) |
| Medication Dose Per Day                   | 1 per day      | 24 (24%) |
|   | 2 per day      | 41 (41%) |
|   | 3 per day      | 16 (16%) |
|   | >3 per day     | 19 (19%) |
| Administration Route                      | Inhaler        | 57 (57%) |
|   | Oral           | 4 (4%)   |
|   | Both           | 39 (39%) |
| Proper Knowledge of the Inhaler Technique | Yes            | 66 (66%) |
|   | No             | 34 (34%) |
| Difficulty In Inhaler Technique           | Yes            | 28 (28%) |
|   | No             | 72 (72%) |
| Number of other Medications               | One            | 29 (29%) |
|   | > One          | 71 (71%) |
| Side Effects of COPD Medication           | Yes            | 16 (16%) |
|   | No             | 84 (84%) |
| Support Type in COPD Patients             | Family Support | 73 (73%) |
|   | Self-Support   | 27 (27%) |
| Medication Costs                          | Affordable     | 52 (52%) |
|   | Not affordable | 48 (48%) |

Using Morisky Medication-Adherence Scale-MMAS (4-item) for the medication adherence assessment yielded: 38% low adherence, 47% medium adherence, and 15% high adherence (Figure 1).



**Figure 1:** Distribution of the adherence levels regarding MMAS-4 among the patients with COPD (N= 100)

### Factors Affecting Medication Adherence Level

Adherence level was associated significantly with age, education, and marital status (Table 3).

The association between the level of adherence and the gender of participants showed that the level of medication adherence was not significantly affected by the gender of COPD patients. The age of the COPD patients was significantly associated with the level of commitment in which the patients with age more than 60 years; 27% were found to be highly adherents to the medication, while the patients in the age group from 40-60 years were found to be lower adherent to the drug (53.2%) (Table 3).

The marital status of the COPD patients was significantly affecting the level of adherence as; the married patients tended to be highly adherent when compared to the unmarried patients (16.5% vs. 6.7%) (Table 3). Likewise, the educational level of

**Table 3:** Socio-demographics association with adherence level (N=100)

|                           | N  | Low Adherence<br>N = 38 | Medium Adherence<br>N = 47 | High Adherence<br>N = 15 | P-value           |
|---------------------------|----|-------------------------|----------------------------|--------------------------|-------------------|
| <b>Gender</b>             |    |                         |                            |                          |                   |
| Male                      | 73 | 27 (37%)                | 35 (47.9%)                 | 11 (15.1%)               | 0.939             |
| Female                    | 27 | 11 (40.7%)              | 12 (44.4%)                 | 4 (14.8%)                |                   |
| <b>Age</b>                |    |                         |                            |                          |                   |
| <40                       | 16 | 4 (25%)                 | 10 (62.5%)                 | 2 (12.5%)                | <b>0.013*</b>     |
| 40-60                     | 47 | 25 (53.2%)              | 19 (40.4%)                 | 3 (6.4%)                 |                   |
| >60                       | 37 | 9 (24.3%)               | 18 (48.6%)                 | 10 (27%)                 |                   |
| <b>Education</b>          |    |                         |                            |                          |                   |
| Literate                  | 60 | 13 (21.7%)              | 33 (55%)                   | 14 (23.3%)               | <b>&lt;0.01**</b> |
| Illiterate                | 40 | 25 (62.5%)              | 14 (35%)                   | 1 (2.5%)                 |                   |
| <b>Marital Status</b>     |    |                         |                            |                          |                   |
| Married                   | 85 | 32 (37.6%)              | 39 (45.9%)                 | 14 (16.5%)               | <b>0.031*</b>     |
| Unmarried                 | 15 | 6 (40%)                 | 8 (53.3%)                  | 1 (6.7%)                 |                   |
| <b>Occupation</b>         |    |                         |                            |                          |                   |
| Employed                  | 37 | 17 (45.9%)              | 18 (48.6%)                 | 2 (5.4%)                 | <b>0.065</b>      |
| Retired                   | 28 | 7 (25%)                 | 12 (42.9%)                 | 9 (32.1%)                |                   |
| Housewife                 | 25 | 12 (48%)                | 9 (36%)                    | 4 (16%)                  |                   |
| Unemployed                | 10 | 2 (20%)                 | 8 (80%)                    | 0 (0%)                   |                   |
| <b>Smoking Status</b>     |    |                         |                            |                          |                   |
| Non-smoker                | 54 | 20 (37%)                | 25 (46.3%)                 | 9 (16.7%)                | 0.906             |
| Ex-smoker                 | 26 | 11 (42.3%)              | 11 (42.3%)                 | 4 (15.4%)                |                   |
| Current smoker            | 20 | 7 (35%)                 | 11 (55%)                   | 2 (10%)                  |                   |
| <b>Concurrent disease</b> |    |                         |                            |                          |                   |
| HTN                       | 29 | 7 (24.1%)               | 16 (55.2%)                 | 6 (20.7%)                | 0.171             |
| DM                        | 27 | 8 (29.6%)               | 10 (37%)                   | 9 (33.3%)                | 0.843             |
| CVD                       | 4  | 2 (50%)                 | 2 (50%)                    | 0 (0%)                   | 0.998             |

\* Significant at the 0.05 level \*\*Significant at the 0.01 level



the COPD patients was significantly associated with the level of adherence; the literate patients tended to be highly adherent compared to the illiterate patients (23.3% vs. 2.5%). The association between the level of adherence and the occupations of participants showed that the level of medication adherence was not significantly affected by the occupations of COPD patients. Also, smoking status was not particularly related to the medication adherence levels among patients with COPD. Similarly, the duration of COPD was not significantly associated with the medication adherence levels among the patients with COPD. The presences of comorbidities such as hypertension, DM, and cardiovascular disease were not significantly related to the levels of medication adherence among the patients with COPD (Table 3).

One-half (50%) of the patients taking one daily drug dose tended to be highly adherent to the medication, while the patients with more than three daily drug doses (73.7%) were found to be less adherent to the medication. The drug administration routes of the COPD patients were significantly associated with

the level of adherence, in which the patients with the oral route (75%) tended to be highly adherent to the medication. In the same manner, the knowledge of inhaler usage was significantly associated with the level of adherence, as; the patients who were aware of using inhalers more tended to be highly adherent compared to the unaware patients (22.7% vs. 0.0%). Moreover, the difficulty in inhaler use was significantly associated with the level of adherence; the patients who did not face difficulty in inhaler usage tended to be highly adherent compared to those who faced difficulty (19.5% vs. 3.6%). In the association between the level of adherence and the number of daily drugs, the patients with one drug showed a high level of adherence compared to those with more than two drugs (41.4% vs. 4.2%). The association between the level of adherence and the side effects showed that the level of medication adherence was not significantly affected by the side effects among COPD patients. In the association between the level of adherence and medication cost, the patients who thought the drug cost was affordable showed a high level of adherence compared to those

**Table 4:** Adherence level association with factors related to medication

|  | N  | Low Adherence<br>N = 38 | Medium Adherence<br>N = 47 | High Adherence<br>N = 15 | P-value        |
|--|----|-------------------------|----------------------------|--------------------------|----------------|
| <b>COPD duration (years)</b>                 |    |                         |                            |                          |                |
| <5   | 33 | 10 (30.3%)              | 19 (57.6%)                 | 4 (12.1%)                | 0.514          |
| 5-10   | 49 | 22 (44.9%)              | 20 (40.8%)                 | 7 (14.3%)                |                |
| >10  | 18 | 6 (33.3%)               | 8 (44.4%)                  | 4 (22.2%)                |                |
| <b>Medication dose per day</b>               |    |                         |                            |                          |                |
| 1 per day                                    | 24 | 2 (8.3%)                | 10 (41.7%)                 | 12 (50%)                 | <b>0.001**</b> |
| 2 per day                                    | 41 | 12 (29.3%)              | 26 (63.4%)                 | 3 (7.3%)                 |                |
| 3 per day                                    | 16 | 10 (62.5%)              | 6 (37.5%)                  | 0 (0%)                   |                |
| >3 per day                                   | 19 | 14 (73.7%)              | 5 (26.3%)                  | 0 (0%)                   |                |
| <b>Administration route</b>                  |    |                         |                            |                          |                |
| Inhaler                                      | 57 | 27 (47.4%)              | 23 (40.4%)                 | 7 (12.2%)                | <b>0.002**</b> |
| Oral   | 4  | 0 (0%)                  | 1 (25%)                    | 3 (75%)                  |                |
| Both   | 39 | 11 (28.2%)              | 22 (56.4%)                 | 6 (15.4%)                |                |
| <b>Proper knowledge of inhaler technique</b> |    |                         |                            |                          |                |
| Yes  | 66 | 20 (30.3%)              | 31 (47%)                   | 15 (22.7%)               | <b>0.028*</b>  |
| No   | 34 | 18 (53%)                | 16 (47%)                   | 0 (0%)                   |                |

| <b>Difficulty in inhaler technique</b> |    |            |            |            |                   |
|--|----|------------|------------|------------|-------------------|
| Yes                                    | 28 | 13 (46.4%) | 14 (50%)   | 1 (3.6%)   | <b>0.042*</b>     |
| No                                     | 72 | 25 (34.7%) | 33 (45.8%) | 14 (19.5%) |                   |
| <b>Number of other medications</b>     |    |            |            |            |                   |
| One                                    | 29 | 9 (31%)    | 8 (27.6%)  | 12 (41.4%) | <b>0.008**</b>    |
| > One                                  | 71 | 29 (40.8%) | 39 (54.9%) | 3 (4.2%)   |                   |
| <b>Side effects of COPD medication</b> |    |            |            |            |                   |
| Yes                                    | 16 | 4 (25%)    | 10 (62.5%) | 2 (12.5%)  | 0.387             |
| No                                     | 84 | 34 (40.5%) | 37 (44%)   | 13 (15.5%) |                   |
| <b>Support type in COPD patients</b>   |    |            |            |            |                   |
| Family Support                         | 73 | 32 (43.8%) | 31 (42.5%) | 10 (13.7%) | 0.141             |
| Self-Support                           | 27 | 6 (22.2%)  | 16 (59.3%) | 5 (18.5%)  |                   |
| <b>Medication costs</b>                |    |            |            |            |                   |
| Affordable                             | 52 | 13 (25%)   | 24 (46.2%) | 15 (28.8%) | <b>&lt;0.01**</b> |
| Not affordable                         | 48 | 25 (52.1%) | 23 (47.9%) | 0 (0%)     |                   |

\* Significant at the 0.05 level \*\*Significant at the 0.01 level

who described the price as non-affordable (28.8% vs. 0.0%) (Table 4).

## Discussion

Our study aimed to evaluate medication adherence in COPD patients simply because low adherence was associated with defects in disease control, increased exacerbation rate, and increased healthcare utilization and costs. Many factors led to poor adherence to COPD treatment, including medication side effects, running out of medication, and multiple medications with complex dosing regimens. The polypharmacy of numerous daily doses involved in treating COPD alone leads to complex dosing regimens. Furthermore, older patients also face difficulties in adherence to medications.

The study's results indicate that the level of adherence to COPD therapy is considerably low. The adherence rate of 62% (47% as medium, and 15% as high adherence) identified in this study is similar to the results of the previous study by Agh T. et al., which evaluated self-reported adherence in COPD to be 58.2%.<sup>5</sup> Our finding was lower than the study of Maria M. et al., who reported 80.1%.<sup>7</sup> Medication adherence by patients with COPD is generally poor, with reports indicating adherence

rates to various treatment regimens of approximately 50%.<sup>8,9</sup> Although adherence rates in clinical trials may be as high as 70–90%<sup>10,11</sup>, in clinical practice, it is in the range of 10–40%<sup>12–14</sup>.

According to our study, gender was not significantly affecting adherence among COPD patients. In most prior studies, gender is not a predictor of medication adherence.<sup>5, 7, 15–17</sup> And, group differences between the adherence levels of men and women reported in the literature may be caused by different predictors of adherence. One possible factor might be depression, as women with COPD tend to be more depressed than men.<sup>18</sup> Furthermore, the results revealed that patients of advanced age (> 60 years) and married patients are more adherent, consistent with previous findings. Agh T et al. reported that older patients were more adherent to medication than younger COPD patients (68.6±10.8 years vs. 57.1±8.0 years).<sup>5</sup>

In the study of Turner J et al., in the USA, older age was a significant predictor for adherence in COPD patients (OR=P=0.000). Likewise, Maria M. et al. reported that older patients were more adherent to medication than younger COPD patients (69.8±8.4 years vs. 52.3±17.1 years; P= 0.000). And similarly, Iman H et al. reported that age was positively correlated to adherence (P= 0.000).<sup>7,15,19</sup>

In the study of Turner J et al., in the USA, older age was a significant predictor for adherence in COPD patients ( $P = 0.000$ ).<sup>19</sup> Likewise, Maria M et al. reported that younger patients were less adherent to medication than older COPD patients ( $69.8 \pm 8.4$  years vs.  $52.3 \pm 17.1$  years;  $P = 0.000$ ).<sup>7</sup> Similarly, Iman H et al. reported that age was positively correlated to adherence ( $P = 0.000$ ).<sup>15</sup>

Education was associated with more adherence to medication among COPD patients. These were similar to the results reported by Maria M. et al., who noticed that higher educational levels were related to more levels of adherence.<sup>15</sup> And, in a systemic review by Jamie B et al., smoking was the main factor of low adherence in COPD patients.<sup>20</sup> Moreover, Turner J et al. mentioned that smoking was a significant predictor for nonadherence in COPD patients in the USA ( $P = 0.000$ ). At the same time, Iman H et al. reported low adherence scores in smokers,  $P = 0.000$ .<sup>15,19</sup>

We observed that education was related to increased medication adherence among COPD patients. These findings were inconsistent with the results reported by Maria M. et al., who noticed higher educational levels associated with more adherence.<sup>7</sup> Education was associated with more adherence to medication in COPD patients; these were similar to the results reported by Maria M et al., who noticed higher educational levels were related to increased levels of adherence.<sup>7</sup>

Education was related to more adherence to medication in COPD patients; these were similar to the results reported by Maria M et al., who noticed that higher educational levels were related to increased levels of adherence.<sup>7</sup>

This study demonstrated that the increased prescribed number of drugs and daily doses were reversely related to adherence. Treatment for COPD is based on the present health status of the patient. Patients with moderate to severe COPD are treated with combination therapy; therefore, in many cases, the number of drug substances cannot be reduced. These results agreed with the other study conducted by Agh T. et al., five who reported that patients with more than two daily drugs seem nonadherent

compared to those with less than two drugs (93% vs. 7%;  $P = 0.000$ ). Also, Iman H et al. reported number of drugs ( $> 2$  drugs) ( $P = 0.000$ ) and the number of daily drug doses ( $P = 0.000$ ) were associated with low medication adherence levels among COPD patients in Egypt.<sup>15</sup> Unsurprising, the present study showed patient who were knew the inhaler using ( $P = 0.028$ ), and those who were not facing difficulties in dealing with inhaler ( $P = 0.042$ ) were more likely to be adherent. These findings were consistent with the review presented by Jamie B. et al.<sup>20</sup> In a study conducted by Garcia-Aymerich J et al., among 150 Spanish patients with COPD admitted to the hospital because of an exacerbation, 43% of them had inadequate inhaler technique.<sup>21</sup>

This study showed that patients using oral were more adherent to the medication than other administration routes. Garcia-Aymerich J. et al. also reported that; in Spain, adherence is higher to oral forms of medication than to inhaled drugs of the same class (e.g.,  $\beta_2$  agonists or corticosteroids). This is an issue, particularly for patients with asthma or COPD, where inhaled medications are desirable.<sup>21</sup> The current study demonstrated a significant association between cost and adherence; for no doubt, drug cost seems to be an independent predictor controlling the achievement of optimal medication adherence. These findings go in the same line with Sumerian SB. et al., who recognized that in some healthcare systems, inability to buy or reduced access through government programs may contribute to both primary and secondary non-adherence.<sup>22</sup>

## Conclusion

The study indicates that the level of adherence to COPD therapy is low. Understanding factors associated with medication adherence could help enhance treatment outcomes in COPD. In our study, non-adherence was associated with middle age, unmarried patients, number of respiratory drugs, number of daily respiratory drug doses, Low knowledge, and increased difficulties with inhaler use, administration, and non-affordability of drugs.

Consideration of medication adherence within routine clinical practice is needed to optimize the

management of COPD patients, which would lead to a decrease in disease burden in the long run. Raising the awareness of medication adherence and medication use in patients is recommended to optimize the management of this disease.

## References

1. Viegli G, Scognamiglio A, Baldacci S, Pistelli F, Carrozzi L: Epidemiology of chronic obstructive pulmonary disease (COPD). *Respiration* 2001;68:4–19.
2. Rabe KF, Hurd S, Anzueto A, Barnes PJ, Buist SA, Calverley P, Fukuchi Y, Jenkins C, Rodriguez-Roisin R, van Weel C, Zielinski J: Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *Am J Respir Crit Care Med* 2007;176:532–555.
3. Plaza V, Fernandez-Rodriguez C, Melero C, Cosi 'o BG, Entrenas LM, de Llano LP, et al. Validation of the 'Test of the Adherence to Inhalers'(TAI) for Asthma and COPD Patients. *J Aerosol Med Pulm Drug Deliv.* 2015; 28: 2–11.
4. Morisky DE, Ang A, Krousel-Wood M, Ward HJ. Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens (Greenwich).* 2008; 10: 348–354.
5. Agh T. Inotai A. Meszaros A. Factors Associated with Medication Adherence in Patients with Chronic Obstructive Pulmonary Disease. *Respiration.* 2011;82:328–334.
6. Morisky DE, Ang A, Krousel-Wood M, Ward HJ. Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens(Greenwich).*2008;10:348-54.
7. Maria M., Menezes A, Wehrmeister FC, Lopez Varela MV, Casas A, Ugalde L, et al. Adherence to inhaled therapies of COPD patients from seven Latin American countries: The LASSYC study. *PLoS ONE.* 2017; 12(11): e0186777.
8. Bourbeau J., Bartlett S.J. Patient adherence in COPD. *Thorax.* 2008 Sep; 63(9): 831–838.
9. Dolce JJ, Crisp C, Manzella B, et al. Medication adherence patterns in chronic obstructive pulmonary disease. *Chest.* 1991;99:837–841.
10. Kesten S, Flanders J, Serby C. Compliance with tiotropium, a once daily dry powder inhaled bronchodilator, in one year COPD trials. *Chest.* 2000;118:191S–192S.
11. van Grunsven PM, van Schayck CP, van Deuveren M, et al. Compliance during long-term treatment with fluticasone propionate in subjects with early signs of asthma or chronic obstructive pulmonary disease (COPD): results of the Detection, Intervention, and Monitoring Program of COPD and Asthma (DIMCA) Study. *J Asthma.* 2000;37:225–234.
12. Bender BG, Pedan A, Varasteh LT. Adherence and persistence with fluticasone propionate/salmeterol combination therapy. *J Allergy Clin Immunol.* 2006;118:899–904.
13. Breekveldt-Postma NS, Gerrits CM, Lammers JW, et al. Persistence with inhaled corticosteroid therapy in daily practice. *Respir Med.* 2004;98:752–759.
14. Krigsman K, Nilsson JL, Ring L. Refill adherence for patients with asthma and COPD: comparison of a pharmacy record database with manually collected repeat prescriptions. *Pharmacoepidemiol Drug Saf.* 2007;16:441–448.
15. Iman H., Yasser M., Abeer A., Yosra E . Medication adherence and treatment satisfaction in some Egyptian patients with chronic obstructive pulmonary disease and bronchial asthma. *Egypt J Bronchol* 2018;12:33-40.
16. Corden ZM, Bosley CM, Rees PJ, Cochrane GM: Home nebulized therapy for patients with COPD: patient compliance with treatment and its relation to quality of life. *Chest.* 1997;112:1278–1282.
17. Apter AJ, Reisine ST, Affleck G, Barrows E, ZuWallack RL: Adherence with twice-daily dosing of inhaled steroids. Socioeconomic and health-belief differences. *Am J Respir Crit Care Med* 1998;157:1810–1817.



18. Laforest L, Denis F, Van Ganse E, Ritleng C, Saussier C, Passante N, Devouassoux G, Chatte G, Freymond N, Pacheco Y: Correlates of adherence to respiratory drugs in COPD patients. *Prim Care Respir J* 2010;19:148–154.
19. Turner J, Wright E, Mendella L, et al. Predictors of patient adherence to long-term home nebulizer therapy for COPD. The IPPB Study Group. *Intermittent Positive Pressure Breathing*. *Chest*. 1995;108:394–400.
20. Jamie B., Vanessa M., Allison B., Rob S., Christine P., Jessica M. Improving medication adherence in chronic obstructive pulmonary disease: a systematic review. *Respiratory Research*. 2013;14:109.
21. Garcia-Aymerich J, Barreiro E, Farrero E, et al. Patients hospitalized for COPD have a high prevalence of modifiable risk factors for exacerbation (EFRAM study) *Eur Respir J*. 2000;16:1037–1042.
22. Soumerai SB, Ross-Degnan D, Avorn J, et al. Effects of Medicaid drug-payment limits on admission to hospitals and nursing homes. *N Engl J Med*. 1991;325:1072–1077.