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A Prospective Study on the Role of Pharmacist in Improving the Knowledge and Medication Adherence of Pulmonary Disease Patients

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ABSTRACT

Introduction: COPD is characterized by the airflow limitation which is not fully reversible. Medication adherence is degree to which the person's behaviour corresponds with recommendations from a health care provider.

In this study, medication adherence and patient knowledge were examined

Aim: The aim of the study is to assess the role of Pharmacist in improving knowledge and Medication adherence of pulmonary disease patients

Methods : It was a prospective observational study. COPD &Asthma patients who fulfill the inclusion criteria were enrolled and divided to control and intervention group. During two follow-up, improvement in patient knowledge &medication adherence was observed by using MMAS-8& BCKQ questionnaire. Data was analyzed using MS Excel 2010 and SPSS statistical software.

Results: A total of 150 patients were enrolled in the study. Control and intervention group contain 75 patients. By comparing MMAS-8 score of both the groups, the intervention group shown an improvement in medication adherence after the two follows up. From the independent t-test analysis, BCKQ mean of 2nd follow up of intervention group was 54.19. The mean of 2nd follow up of control group was 46.62. B y comparing BCKQ score of both the groups, the intervention group showed an improvement in medication adherence after 2 follow up.

Conclusion: From the study it was concluded that, patient knowledge and medication adherence was improved significantly by the pharmacist care.

Key words: COPD,ASTHMA, BCKQ, MMAS-8

I. INTRODUCTION

ASTHMA

The National Asthma Education and Prevention Program (NAEPP) defined asthma as a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. In some susceptible individuals, inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and coughing. These episodes are usually associated with airflow obstruction that may often reversible either spontaneously or with treatment. The inflammation also causes an increase in bronchial hyper responsiveness (BHR) to variety of those stimuli.

Studies have shown that higher adherence is associated with better symptom control in patients with asthma, whereas suboptimal adherence is a modifiable independent risk factors contributing to suboptimal adherence in asthma and COPD. The factors that contribute to suboptimal adherence in asthma and COPD are grouped into 3 major categories.[1]

Factor for asthma exacerbations Specifically, high adherence to asthma controller therapy, such as ICS, has been associated with significantly reduced risk of exacerbation, reduced OCS use, and positive impacts on asthma-related mortality.3,8,38,39 A study in paediatric patients with moderate persistent asthma showed that medication adherence was also a strong determinant of asthma control (as defined by the 2018 GINA report). Given that poor asthma control can be a result of suboptimal adherence, it is important to distinguish between a patient with asthma who is not adhering to his or her current therapy and a patient with asthma who requires progression to a higher GINA treatment step to control his or her symptoms. For these reasons, it is important to assess both adherence and inhaler technique before stepping up asthma therapy so as to avoid unnecessary medications. The use of

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electronic monitoring devices has been proposed to better identify paediatric patients with severe disease who require step-up therapy despite reportedly high adherence.[2]

SIGNS &SYMPTOMS

Chronic asthma

- Coughing (particularly at Night),
- Episodic dyspnoea associated with wheezing chest tightness,
- Wheezing or a whistling sound when breathing. (often occurs with exercise but may occur spontaneously or in association with known allergens)
- Expiratory wheezing on auscultation,
- Dry hacking cough,
- Allergic rhinitis or eczema.

Severe Acute Asthma

- Inflammation,
- Airway oedema,
- Excessive mucus accumulation,
- Severe bronchospasm
- Airway narrowing
- Tachypnea,
- Tachycardia,
- weakness
- Pallor or cyanosis,
- Hyper inflated chest with intercostal and supraclavicular retractions.
- Breath sounds may be diminished with very severe obstruction

RISK FACTORS

- Allergens
- Air pollution
- Environmental chemicals.
- Traffic pollution and high ozone level
- Volatile organic compounds
- The history of atopic disease.
- The eczema or hay fever.
- Genetics

DIAGNOSIS

- Primarily done by a history of recurrent episodes of coughing, wheezing, chest tightness, or shortness of breath and confirmatory spirometry.
- Spirometry demonstrates obstruction (forced expiratory volume in 1 second (FEV1)/forced vital capacity less than 80%)
- If baseline spirometry is normal, challenge testing with exercise, histamine, or methacholine can be used to elicit BHR.
- Arterial blood gases may reveal metabolic acidosis and a low PaO2.
- A history of previous asthma exacerbations(e.g., hospitalizations, intubations) and complicating illnesses (e.g., cardiac Disease, diabetes) should be obtained.
- The patient should be examined to assessment of hydration status; use of accessory muscles of respiration; and the presence of cyanosis, pneumonia, pneumothorax, pneumomediastinum, &upper airway obstruction.
- A complete blood count may be appropriate for patients with fever or purulent sputum.[2]

COPD- DEFINITION

Chronic obstructive pulmonary disease (COPD) is characterized by the airflow limitation which is not fully reversible. The airflow limitation is progressive and associated with an abnormal inflammatory response of lungs to noxious particles or gases[6]

Most common conditions comprising COPD are chronic bronchitis & emphysema.

- Chronic bronchitis is associated with recurrent excess mucus secretion into the bronchial tree with cough that occurs on most days for at least least 3 months of the year for at least 2 consecutive years when other causes of cough have been excluded.
- Emphysema is defined as abnormal, permanent enlargement of the airspaces distal to the terminal bronchioles, accompanied by destruction of walls without obvious fibrosis.[6]

The WHO predicts that COPD will become the fourth leading cause of death worldwide by 2030. The burden of COPD assessed by disability-adjusted life years (DALYs) ranks 10th worldwide. Total deaths from COPD are projected to increase by more than 30% in the next 10 years unless urgent preventive measures are in place. Although COPD cannot be cured, optimal management provides symptom control, slows progression of the disease, and may improve the quality of life. Management of COPD becomes suboptimal when physicians fail to prescribe appropriate therapies, due to poor adherence to evidence based guidelines and underdiagnosed or when patients fail to adhere to prescribed treatment regimens. There are a limited number of studies on the physician knowledge and practice patterns for individuals with COPD that may result in suboptimal management and adversely affect patient outcomes Adherence is defined as “the extent to which a person’s behaviour (in terms of taking medications, following diets, or executing

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lifestyle changes) coincides with medical or health advice". Adherence to medication regimens is often suboptimal when patients are on long-term pharmacotherapy using repeat prescriptions. A study published by the WHO estimated 50% adherence or less for patients on long-term pharmacotherapy.[11]

Adhering to inhaled medications is of paramount importance in the management of patients with COPD in both clinical and ambulatory settings. These pharmacologic agents include bronchodilators and corticosteroids used in a variety of aerosol devices that include small volume nebulizers (SVNs), pressurized metered-dose inhalers (pMDIs), and dry powder inhalers (DPIs). Selection of the medication and the device typically depends on the efficacy of the different inhaled medications and the devices. However, this selection is often limited by the availability of a match between the medication prescribed and the aerosol device. While it is desirable that the medications prescribed to a patient are delivered through the same or similar devices, adherence to the right medication – device combination may be influenced by commercial availability. The medication – device availability problem will be compounded by the phasing-out of CFC-propelled pMDIs at the end of 2009 as proposed by the Federal register ruling. Replacement of CFC propelled pMDIs by hydrofluoroalkane (HFA)-propelled pMDIs has been more difficult than expected since it has resulted in a redesign of the entire pMDI metering-valve system at a higher cost than simply replacing the propellant. This transitioning will initially restrict the list of available agents and could have considerable financal implications in the routine management of patients with COPD .Medication regimens for patients with COPD are particularly vulnerable to adherence problems because of the chronic nature of the disease, the use of multiple medications or poly pharmacy, and the periods of symptom remission. Patients with COPD are often prescribed aerosolized medications to use from 2 to 6 times daily plus concurrent therapy for other comorbidities that may include diabetes, hypertension, and coronary artery disease.[8]

Clinical efficacy of major classes of medications and combinations:

Determination of clinical efficacy involves evaluation of outcomes such as lung function, rate of exacerbations, and mortality. However, these outcome parameters need to be a reflection of the clinical efficacy perceived by the patient. A combination of objective and subjective clinical efficacy is a critical determinant of adherence to therapy. Inhaled corticosteroids (ICS), long-acting β2-agonists (LABAs), and anti-cholinergics have been recommended for the treatment of COPD. LABAs are recommended by GOLD (2007) when patients continue to experience problems on short-acting bronchodilators (SABAs). The most obvious benefit of combination therapy is in terms of patient convenience that may lead to greater treatment adherence.

Lung function Current evidence indicates that there is statistically significant difference in FEV1 and in health status measurements in favour of LABAs (Appleton et al 2006) and ICS (Yang et al 2007). Several randomized controlled trials have found that a LABA – ICS combination therapy is associated with a significant increase over the baseline FEV1 when compared with the groups receiving placebo, LABA alone, or ICS alone. Addition of tiotropium to the LABA – ICS combination significantly improves lung function. The combination of ipratropium bromide and albuterol in patients with COPD results in significant improvement in peak FEV1 compared with albuterol or ipratropium alone. Tashkin et al (2007) reported no significant difference in lung function measured by FEV1 in a group of patients with COPD randomized to SVN, pMDI, and concomitant treatment involving SVN (morning and night) plus pMDI (afternoon and evening) using a combination of albuterol and ipratropium bromide.[26]

Rate of exacerbations, hospitalizations, and mortality Using LABA :

ICS is associated with a significant reduction in the rate of exacerbation, admission rates, and mortality. Combination therapy may reduce 1 exacerbation of COPD every 2–4 years. Patients with COPD at any stage may perceive the lower health resource utilization as a motivator to adhere more rigorously to medications. However, this correlation has not been determined. Trials of short-acting anticholinergic and SABA combinations have shown a significant reduction in exacerbations compared with mono therapy, but no difference in mortality [7]

Use of rescue medication:

The use of rescue medications during COPD exacerbations may seem to be the most feasible explanation for overuse. During an exacerbation, an average of 1 additional puff during

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the day and half a puff during the night is seen two weeks prior and after an exacerbation regardless of COPD stage. However, changes in rescue medication intake poorly correlate with exacerbations. The use of LABA – ICS has been associated with a significant reduction in mean puffs per day of SABA, significant increases in the percentage of nights with no awakenings requiring SABA versus placebo, and a significant difference in median percentage of days without use of relief medication .

Safety and tolerability of major classes of medications and combinations adverse events to medications are reported by 90% of the patients with COPD. The presence of serious side effects negatively affects adherence. An increase in the risk of pneumonia in patients with COPD using a combination of ICS and LABA has been reported in several studies.. The most frequently reported adverse event was an exacerbation of COPD. Although there is no significant difference in the occurrence of overall reported adverse events between LABA – ICS and placebo, pneumonia, candidiasis, naso-pharyngitis, hoarseness, and upper respiratory tract infections (URTI) occurred more frequently when treated with a LABA – ICS combination. [7]

PATHOPHYSIOLOGY

- The exposure to environmental tobacco smoke and other chronic inhalational exposures can lead to COPD.
- Inhalation of noxious particles and gases stimulates the activation of neutrophils, macrophages, and CD8+ lymphocytes, which release a variety of chemical mediators, including tumour necrosis factor- , interleukin-8, & leukotriene B4.
- These inflammatory cells and mediators lead to widespread destructive changes in the airways, pulmonary vasculature and lung parenchyma.[2]

SIGNS &SYMPTOMS

Chronic cough and sputum production;

Patients may have these symptoms for several years before dyspnoea appears

- Cyanosis of mucosal membranes,
- Development of Barrel chest due to hyperinflation of the lungs, an increased resting respiratory rate,
- Shallow breathing,
- Pursing of the lips during expiration.
- Worsening dyspnoea
- Chest tightness
- Malaise, fatigue
- Decreased exercise tolerance.[2]

RISK FACTORS

- Exposure to tobacco smoke. The most significant risk factor for COPD is long-term cigarette smoking.
- Exposure to air pollution.
- Asthmatic history.
- Breathing second hand smoke.
- Working with chemicals, dust and fumes.
- A genetic condition called Alpha-1 deficiency.
- A history of childhood respiratory infection.
- Occupational exposure to dusts and chemicals.
- Exposure to fumes from burning fuel.
- Genetics.

DIAGNOSIS

- **PULMONARY FUNCTION TESTS**
- Assessment of airflow limitation through spirometry is the standard for diagnosing and monitoring COPD. The forced expiratory volume after 1 second (FEV1) is generally reduced except in very mild disease.
- The forced vital capacity (FVC) may also be decreased.
- The hallmark of COPD is a reduced FEV1: FVC ratio to less than 70%.
- A post bronchodilator FEV1 that is less than 80% of predicted confirms the presence of airflow limitation which is not fully reversible.
- An improvement in FEV1 of less than 12% after inhalation of a rapid acting bronchodilator is considered to be evidence of irreversible airflow obstruction.
- Peak expiratory flow measurements are not adequate for diagnosis of COPD because of low specificity and a high degree of effort dependence. However, a low peak expiratory flow is consistent with COPD.

- **ARTERIALS BLOOD GASES**
- Significant changes in arterial blood gases are not usually present until theFEV1 is less than 1 L. At this stage, hypoxemia and hypercapnia may become chronic problems.
- Hypoxemia usually occurs initially with exercise but develops at rest as the disease progresses. Patients with severe COPD can have a low arterial oxygen tension (PaO2 45to 60 mm Hg) and an elevated arterial carbon dioxide tension (PaCO2 50 to 60 mm Hg).

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- Hypoxemia results from hypoventilation (V) of lung tissue relative to perfusion (Q) of the area. The low V: Q ratio progresses over several years, resulting in a consistent decline in the PaO2.[2]

- **DIAGNOSIS OF ACUTE RESPIRATORY FAILURE IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE**

• The diagnosis of acute respiratory failure in COPD is made on the basis of acute drop in PaO2 of 10 to 15 mm Hg or any acute increase in PaCO2 which decreases the serum pH to 7.3 or less.

• Additional acute clinical manifestations include restlessness, confusion, tachycardia, diaphoresis, cyanosis, hypotension, irregular breathing, miosis, and unconsciousness.

• The most common cause of acute respiratory failure in COPD is acute exacerbation of bronchitis with an increase in sputum volume and viscosity. This serves to worsen obstruction and further impair alveolar ventilation, resulting in worsening hypoxemia and hypercapnia. Additional causes are pneumonia, pulmonary embolism, left ventricular failure, pneumothorax, and CNS depressants.[2

NONP-HARMACOLOGIC THERAPY

- Smoking cessation is the most known effective strategy to reduce the risk of developing COPD
- This intervention proven to affect the long-term decline in FEV1 and slow the progression of COPD.
- Pulmonary rehabilitation programs include exercise training along with smoking cessation, breathing exercises, optimal medical treatment, psychosocial support, and health education. Supplemental oxygen, nutritional support, and psychoeducational care (e.g., relaxation) are important adjuncts in the treatment
- Annual vaccination with the inactivated intramuscular influenza vaccine is to be recommended.
- One dose of the polyvalent pneumococcal vaccine is indicated for patients at any age of COPD; revaccination is recommended for patients who are older than 65 years if the first vaccination was more than 5 years earlier and the patient was younger than 65 years.

PHARMACOLOGICAL TREATMENT

β2 selective sympathomimetics	Long acting β 2 agonists (LABA): Formetorol Salmetorol Short acting β2 agonists(SABA): Albuterol Levalbuterol Terbutaline
Anticholinergic	Ipratropium bromide Tiotropium bromide
Combination of anticholinergics and sympathomimetic drugs	Albuterol+Ipratropium (Combivent)
Methyl xanthines	Theophylline Aminophylline

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Antimicrobials	Amoxicillin Clavulanate Levofloxacin Moxifloxacin Gemifloxacin
Corticosteroids	Prednisolone, methyl prednisolone

MEDICATION ADHERENCE

Medication adherence is defined by the World Health Organization as the degree to which the person's behaviour corresponds with the agreed recommendations from a health care provider.

Adherence is a multifactorial problem that can be influenced by various factors. The factors can be roughly divided in the following five dimensions: Social and economic, health care system, health condition, therapy and patient[36]

Poor adherence to prescribed regimens can result in serious health consequence. Medication adherence is important for controlling chronic conditions, treating temporary conditions, and overall long-term health and well-being. A personal connection with health-care provider or pharmacist is an important part of medication adherence. Medication adherence usually refers to whether patients take their medications as prescribed as well as whether they continue to take a prescribed medication.[19]

Medication non adherence is a growing concern to clinicians, healthcare systems, and other stakeholder because of mounting evidence that it is prevalent and associated with adverse outcomes and higher costs of care. To date, measurement of patient medication adherence and use of interventions to improve adherence are rare in routine clinical practice. Medication non adherence occurs when patients don't take their medications as prescribed and it is unfortunately fairly common, especially among patients with chronic disease. When this is the case, it is important for physicians and other health professionals to understand why patients don't take their medications. This will help teams identify and improve patients' adherence to their medications. To overcome this, check that the drug you're prescribing is on the patient's insurance formulary. Selecting and prescribing a medication known to be on a discount list can decrease the cost regardless of insurance.[19]

If a patient is concerned about becoming dependent on a medicine, it can also lead to non-adherence. One way to overcome this is to improve patient-physician communication. Inadequate communication can account for 55% of medication non-adherence, making it important to understand the patient's rationale for non-adherence.

Previous research has indicated that adherence is influenced by a number of issues, including side effects, cost of the medication, dosing frequency, and routes of administration. Other factors include patient beliefs, demographics and comorbidities.

Taking your medicine as prescribed or medication adherence is important for controlling chronic conditions, treating temporary conditions, and overall long-term health and well-being. A personal connection with your health-care provider or pharmacist is an important part of medication adherence.[36]

Adherence to therapy in COPD is complex. Patients with COPD require adequate education on the disease process, comorbidities, and also on the use of different medications and devices.. They often need to make important behavioural and lifestyle changes such as starting a smoking cessation program, adhering to an exercise program, and wearing oxygen. Several methods are used to measure adherence: refill adherence based on pharmacy records of dispensed prescription or manual recording of collected prescriptions, and self-reports of compliance using medication adherence report scales (MARS) .Although adherence should ideally be measured upon ingestion or administration of the medication, this is not practical for large groups. Most studies rely on a mixture of refill adherence and self-report. Since the most commonly used method to measure is the self-report ,this review focuses only on this technique. Numerous factors predispose patients with COPD to poor adherence. Recognition of the type of non-adherence in patients with COPD must be the first step in this complicated process of improving adherence. Prescription of an inhaled medication requires knowledge of different groups

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of medications and the potential clinical efficacy of combinations. It also requires being familiar with several aerosol delivery devices. Newer medications and devices improve clinical outcomes and ease of use but typically mean a higher out-of-pocket expense for patients. Patient's perceptions of their illness, their understanding of the treatment, and their relationship with the primary care provider are critical to adherence to therapy. It is the aim of this manuscript is to review some of these important aspects affecting adherence to medication and to identify some predictors of poor adherence in patients with COPD.[36]

Types of Non-adherence to therapy:

There are three classic types of non-adherence to therapy: underuse, overuse, and improper use. Underuse is defined as a reduction of the apparent daily use versus a standard dose of a medication that is indicated for the treatment or prevention of a disease or condition.[7]

Improper use or inappropriate use is confirmed by determining whether a drug is ineffective, not indicated, or if there is unnecessary duplication of therapy. Although these three factors have been well defined in the literature, there is limited evidence that links specific factors to each form of non-adherence in patients with COPD. The most common type of non-adherence in patients with COPD is underuse al 1997. By contrast, improper use is the most frequent type of non-adherence in patients older than 65 years with poly pharmacy (taking 2 or more medications) . Factors with tendency for association with unnecessary drug use include white race, income US$30,000/year, more than 6.8 (±2) of prescription medications, and lack of patient's health belief .In older adults, higher levels of independence and self-reliance have been associated with lower adherence to a medication regimen .The two most common reasons for a medication to be considered inappropriate are lack of effectiveness and lack of indication. Inhaled medications are not on the top 5 medications that are inappropriately used in patients older than 65 years. In patients with COPD, underuse is followed in frequency by overuse and improper use of the medication delivering device. Underuse could be sporadic or systematic. From forgetting an occasional dose to changing dosing schedule, patients with underuse are at a higher risk for adherence related morbidity. A recent evaluation of the use of ICS in primary care patients revealed that up to 30% of the patients did not have a clear indication for this medication. Although improper use and underuse often coexist in the same patient, improper use may not correlate with underuse .There is evidence of overuse of short-acting beta agonists in patients with asthma, but little is known about the real incidence of overuse in patients with COPD. During respiratory distress, approximately half of the patients report using more than the prescribed amount of medications.[7]

Adherence to individual medications and combinations:

Type of medication Patients with COPD have the lowest adherence to a regimen that included inhaled anticholinergic agents followed in order by the inhaled sympathomimetic, theophylline, corticosteroids, and antibiotics. The ability to produce quick relief of symptoms or the safety profiles could explain class differences. It has been suggested that compliance to corticosteroids should be lower than to bronchodilators, because of the lack of direct symptom-relieving effect of the corticosteroids. However,

Patients may adhere to regimens that include oral corticosteroids and antibiotics more frequently because these medications are typically prescribed for short periods of time. Since they are prescribed to deal with acute symptoms, the patients' perception is that these medications are more urgent and necessary.

Complexity of medication regimens It has been previously reported that overall, the average number of time-contingent and as needed medications per patient may be as high as 6.26 (range, 1–16) (Dolce et al 1991). Up to 77% of patients with COPD may receive 2 or more oral-contingent medications. One-third typically receive 2 or more inhaled time-contingent medications, 45% receive 1 inhaled time-contingent medication, and 23% receive no inhaled time-contingent medications. The average of prescribed oral time-contingent and inhaled time-contingent medications are 3.53 and 1.17, respectively. Thirty percentage of patients with COPD are prescribed oral P.R.N. medications and 17% had inhaled P.R.N. medications. Many of these medications have different dosing schedules. Thus, it is quite common for patients to be prescribed a combination of 5–8 oral and inhaled medications, with many medications requiring different dosing patterns. Use of ipratropium bromide and albuterol in one inhaler is associated with a significantly lower risk of an emergency department visit or

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hospitalization, lower mean monthly health charges, shorter hospital stays, and greater likelihood of compliance than if used in two separate inhalers.[7]

Therapy adherence for asthma & COPD; similarities & differences.

Standard treatment regimens for both asthma and chronic obstructive pulmonary disease (COPD) require patients to use several daily inhaled medications, delivered by either pressurised metered-dose inhalers (pMDIs), dry powder inhalers or nebulisers, COPD and its therapies differ markedly from asthma and its therapies in a number of ways. Asthma is an episodic, rarely life-threatening disease with effective controller and reliever therapies available that can generally allow patients to achieve total control of their disease. COPD, on the other hand, is a progressive, debilitating and often fatal disease with treatment options that can improve quality of life and reduce exacerbations, but cannot fully reverse or control disease symptoms. The nature of the disease, the treatment, and patient beliefs and expectations about therapy all combine to influence patient adherence to therapy.

As with other chronic treatment regimens, non-adherence with asthma and COPD therapy is widespread and, as such, is a significant risk factor for morbidity and mortality. Conservative estimates indicate that almost half of the prescription medications dispensed each year for these conditions are not taken as prescribed. Non-adherence can take many forms: it can be a failure to collect the initial prescription (primary non-adherence), under-use of therapy (secondary non-adherence) or premature discontinuation of therapy. Primary non-adherence in patients with asthma by matching prescriptions written to those collected over a 3-month period. The study included both new and repeat prescriptions for asthma medication. Of 359 documented prescriptions written, only 251 (,70%) were collected. The adherence rate for inhaled corticosteroids (ICS) among adult patients was 57% of prescribed. Since these adherence estimates are based on refill rates, they represent the maximum possible levels of adherence and do not provide any information on the day-to-day patterns of medication use in the home.[18]

Even when patients collected prescriptions for medication, studies of secondary non-adherence (rates of medication use) suggest that long-term rates of adherence to preventive therapies (e.g. controller or preventer medications) among adult patients are low. By using sed electronic monitoring of pMDI dispensing, suggest that average adherence to asthma and COPD regimens is ,50% of prescribed, and may dip much lower. Studies in both asthma and COPD also suggest that, while patients tend to under-use controller or maintenance therapies, symptom-relieving drugs such as bronchodilators are often overused.

Only a limited number of studies have specifically examined patient adherence with COPD therapy. One of the earliest, a small study conducted examined self-reported adherence in 78 outpatients being treated at a medical centre in the south-eastern region of the USA. Patients reported that they were prescribed on average six medications, requiring different dosing regimens and modes of administration. Poor pMDI technique was common (31%) and .50% of patients reported regularly under-using prescribed medications. The study's authors did not find that prescription patterns or patient demographic variables were associated with adherence; however, patients did report that they were more likely to overuse rescue medications when they were experiencing respiratory distress.[23]

Medication adherence measurement tool:

The eight-item Morisky Medication Adherence Scale (MMAS-8):

MMAS-8 is a structured self-report measure of medication-taking behaviour that has been widely used in various cultures.

The scale showed adequate construct validity and results pointed to a one-factor solution in which all the items contributed to the final index of adherence. The MMAS-8 exhibited significant correlation coefficients with the 10-item Drug Attitude Inventory, Form C of the Multidimensional Health Locus of Control scale, and the Hong Psychological Reactance Scale. Moreover, the MMAS-8 was able to differentiate between various mental disorder diagnosis groups. The findings of this study suggest that the Spanish version of the MMAS-8 is a reliable and valid measure of medication adherence that can be used in outpatient setting.[36]

Medication Adherence Scale (MMAS-8) Questions are formulated to avoid a ''yes-saying'' bias (i.e., the wording of Item 5 is reversed to prevent the tendency to respond the same way to a series of questions regardless of their content). Response choices ''yes'' or ''no'' for items 1 through 7 and Item 8 has a five-point Likert

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response scale. Each ‘‘no’’ response is rated as 1 and each ‘‘yes’’ response is rated as 0 except for item 5,in which each ‘‘yes’’ response is rated as 1 and each ‘‘no’ response is rated as 0. For Item 8, the code (0-4) has to be response is rated as 0. For Item 8, the code (0-4) has to be standardized by dividing the result by 4 to calculate a summated score. Total scores on the MMAS-8 range from 0 to 8,with scores of 8 reflecting high adherence, 7 or 6 reflecting medium adherence, and <6 reflecting low adherence. [36]

Permission to use the scale was granted by Donald Morisky, the copyright holder of the instrument. Four self-report questionnaires were used as validity criteria in the study: the Hong Psychological Reactance Scale (HPRS), Form C of the Multidimensional Health Locus of Control scale (MHLC-C), the General Self-Efficacy Scale (GSE), and the 10-item Drug Attitude Inventory.

Patient knowledge assessment tools:

Bristol COPD Knowledge Questionnaire:

Studies of the effects of education on patients with chronic obstructive lung disease have shown no uniformity in the results of this intervention. For example, there have been no consistent findings with regard to its cost effectiveness and its effect on health status of patients.1–6. The reasons for the inconsistency are unclear, but they may include variation in the form and content of the education, and variation in the knowledge gained. In addition there has been a lack of uniformity in the type of patient studied. For example one study showed a reduction in consumption of health services following education but over one-third of their patients were asthmatics, and so the results may not be applicable to chronic obstructive pulmonary disease (COPD).Six Whilst acknowledging the importance of education, none of the studies has produced any good data measuring knowledge and change in knowledge. In order to interpret the effects of education, it is of particular importance that the education should be appropriate to the patient’s needs and that there should be a satisfactory method of assessing the knowledge attained. Asthma questionnaires exploring knowledge of disease have been designed, and some of these have been applied to patients with both asthma and COPD. However, these conditions are sufficiently different to make it important for COPD to be looked at separately. A review of previous questionnaires has revealed that none of them are satisfactory, for a number of reasons, as shown in the following examples[31]

As with other chronic treatment regimens, non-adherence with asthma and COPD therapy is widespread and, as such, is a significant risk factor for morbidity and mortality. Conservative estimates indicate that almost half of the prescription medications dispensed each year for these conditions are not taken as prescribed. Non-adherence can take many forms: it can be a failure to collect the initial prescription (primary non-adherence), under-use of therapy (secondary non-adherence) or premature discontinuation of therapy. Primary non-adherence in patients with asthma by matching prescriptions written to those collected over a 3- month period. The study included both new and repeat prescriptions for asthma medication. Of 359 documented prescriptions written, only 251 (,70%) were collected. The adherence rate for inhaled corticosteroids (ICS) among adult patients was 57% of prescribed. Since these adherence estimates are based on refill rates, they represent the maximum possible levels of adherence and do not provide any information on the day-to-day patterns of medication use in the home.[18]

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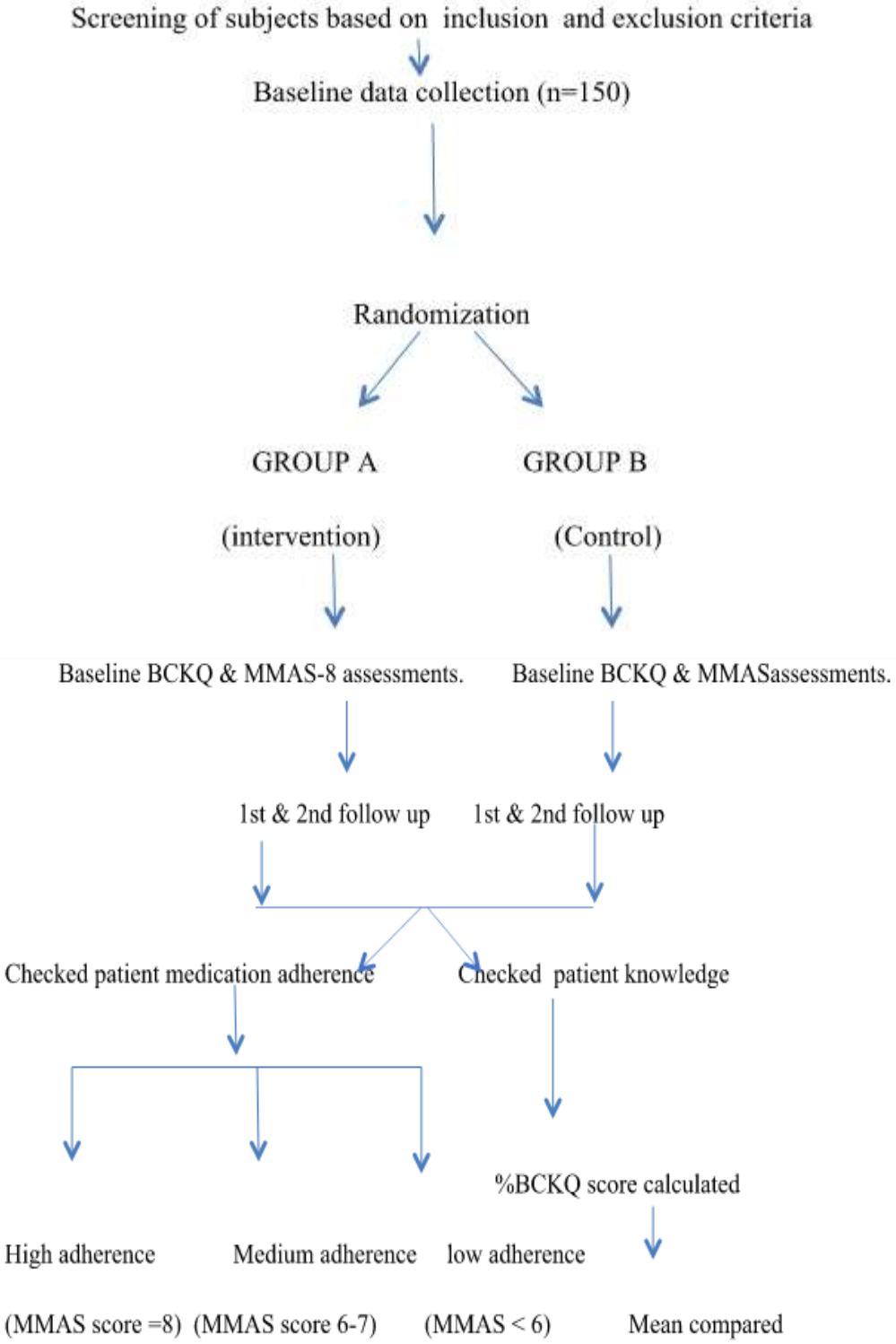
II. METHODOLOGY



This prospective study was conducted on a tertiary care hospital. Prior permissions to conduct the study were obtained from medical superintendent of hospital. COPD & Asthma patients who met the inclusion criteria and who were willing to participate were included in the study. Approval from the Institutional Ethics Committee was obtained and all the participants

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filled their informed consent to participate in the study. The subjects in the study are included based in inclusion and exclusion criteria

Data collection: A pre designed Patient data collection form used to collect Demographic details such as age, gender, marital status, employment status and smoking behaviour and all these details recorded in the data collection form.

The subjects divided into intervention and control group by using simple randomization technique.

Each follow up was conducted in 3 months interval, Patient education provided along with in intervention group.

Patient education: Pharmacist care provided to the patient to obtain more information about their treatment. Advices regarding smoking cessation and diet control, information about use of inhalers are included in those sessions.

Subjects were studied on each follow up, and patient medication adherence and knowledge assessment score were recorded.

Patient knowledge assessment: Bristol COPD Knowledge Questionnaire was used here as Patient knowledge assessment tool. Bristol COPD knowledge assessment questionnaire is provided with each follow up to assess the patient knowledge. Bristol score out of 65 is calculated and mean is found.

Med ication adherence assessment: It is done by Morisky Medication Adherence scale.MMAS-8 score can ranges from 0 to 8 and categorized in to three levels of adherence ie, score 8 shows high adherence, score of 6 to 8 shows medium adherence, and score less than 6 shows low adherence.

III. RESULTS

This prospective study was conducted in the Pulmonology Department of Valluvanad Hospital, ottapalam. A total of 150 pulmonary disease patients were enrolled in the study based on the inclusion and exclusion criteria.

- **AGE WISE DISTRIBUTION**

Patients were categorized according to their age. Mainly five groups of patients were there. Most of the patients (62) were in the age group 61-80 (45.3%).42 patients(28%) were >80 age category, followed by 20 patients (13.3%) in 51-60 years, 12(8%) patients in 31-50 years, 8(5.3%) in 18-30 years of age group.

Table 1: Age wise (%) distribution

Sl.No	Age Group (Year)	Groups	
		Intervention Group (n=75)	Control Group (n=75)
•	18-30	5 (6.7%)	3(4%)
•	31-50	8(10.7%)	4(5.3%)
•	51-60	9(12%)	11(14.7%)
•	61-80	36(48%)	32(42.7%)
•	>80	17(22.7%)	25(33.3%)

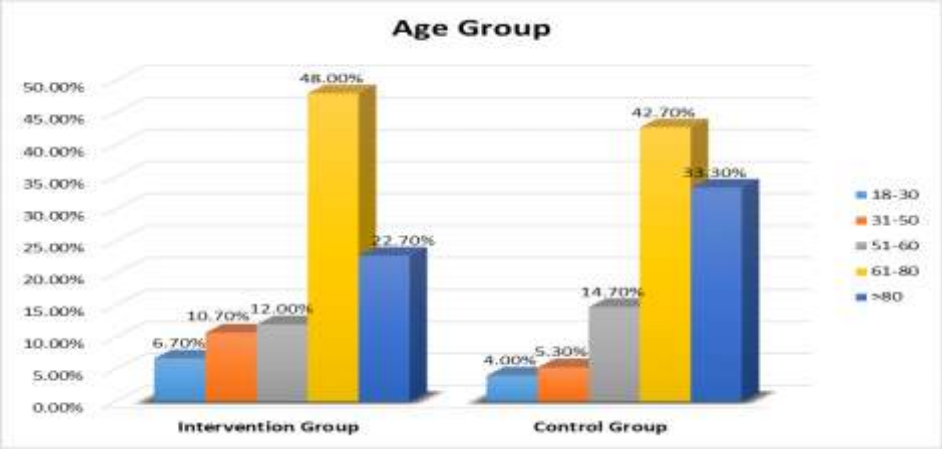

Fig1: Age wise (%) distribution

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- **GENDER WISE DISTRIBUTION**

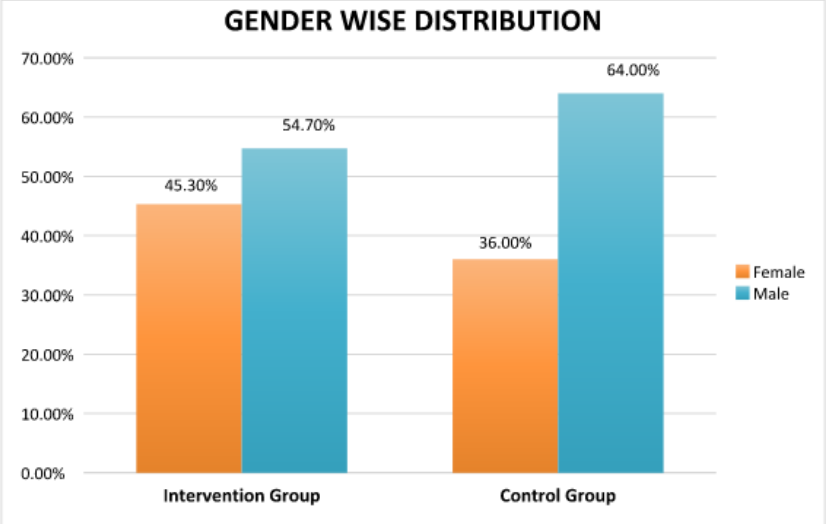
	Intervention group (n-75)	Control group (n=75)
Female	34(45.3%)	27(36%)
Male	41(54.7%)	48(64%)

The study groups were categorized based on gender. Out of 150 patients,67 (44.7%) were female and 83(55.33%) were male .

Table no.2 : Gender wise distribution

	Intervention group (n-75)	Control group (n=75)
Female	34(45.3%)	27(36%)
Male	41(54.7%)	48(64%)

Fig.2 : Gender wise distribution



- **EMPLOYMENT STATUS WISE DISTRIBUTION**

Table no.3: Percentage distribution of employment status

	Intervention Group (n=75)	Control Group (n=75)
Employed	27 (30%)	25 (33.3%)
Un employed	43 (57.3%)	50 (66.7)%)

Out of 75 patients on intervention group,27(30%) were employed and 43(57.3%) were unemployed. In control group, 25 out of 75(33.3%) were employed and 50(66.7%) were unemployed.

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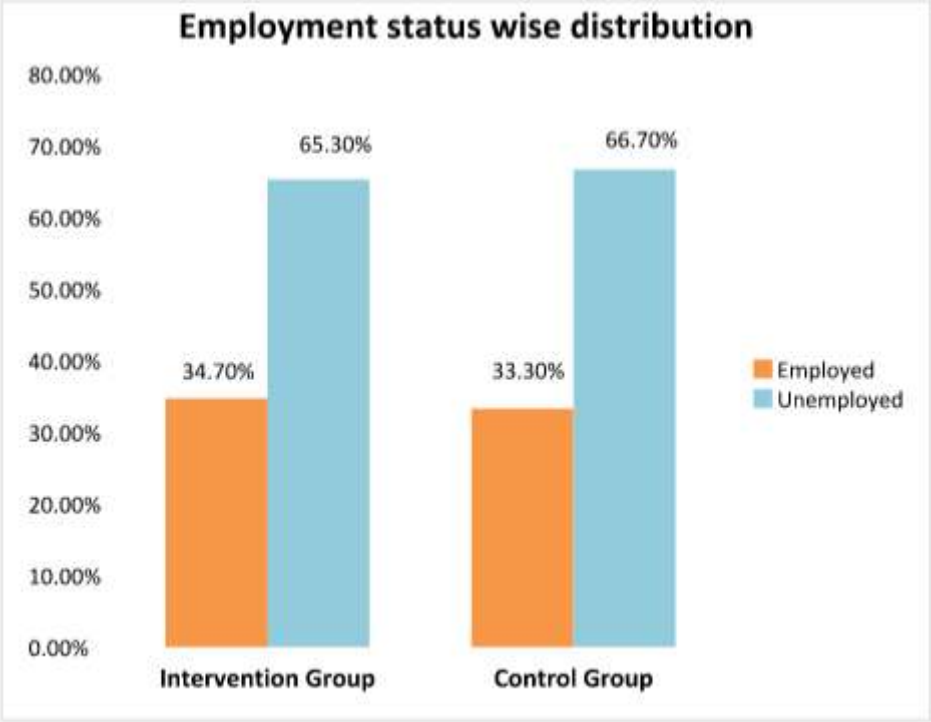

Fig.3: Distribution based on employment status

- **DISTRIBUTION OF PATIENTS BASED ON MARITAL STATUS**

Table no. 4: Percentage distribution Based on marital status

Marital status	**Intervention group (n=75)**	**Control group (n=75)**
Married	61(81.3%)	60(80%)
Un-married	3(4%)	4(5.3%)
Widow	5(6.7%)	1(1.3%)
Widower	6(8%)	10(13.3%)

Out of 75 of intervention group, 61(81.3%) were married ,3(4%) were un married,5(6.7%)were widows and 6(8%)were widower. In control group, 60(80%) were married, 4(5.3%) were unmarried, 1(1.3%) were widow and 10(13.3%) were Widower

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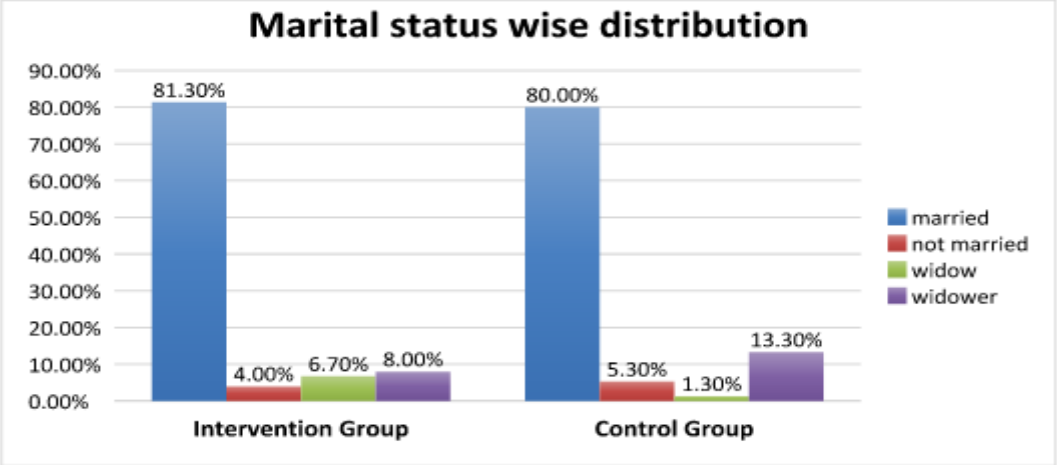

Fig.4 : Distribution of patients based on marital status

5.5 BASED ON SMOKING HISTORY

Table no. 5: Distribution based on smoking behaviour

Smoking history	Intervention group (n=75)	Control group (n=75)
Ex- smoker	16(21.3%)	16(21.3%)
Non- smoker	36(48%)	29(38.7%)
Smoker	23(30.7%)	30(40%)

Out of 75 of intervention group,16(21.3%) were ex-smokers,36(48%) were non-smokers and 23(30.7%) were smokers.
In control group, out of 75 patients, 16(21.3%) wereex-smokers,29938.7%) were non-smokers and 30(40%) were smokers.

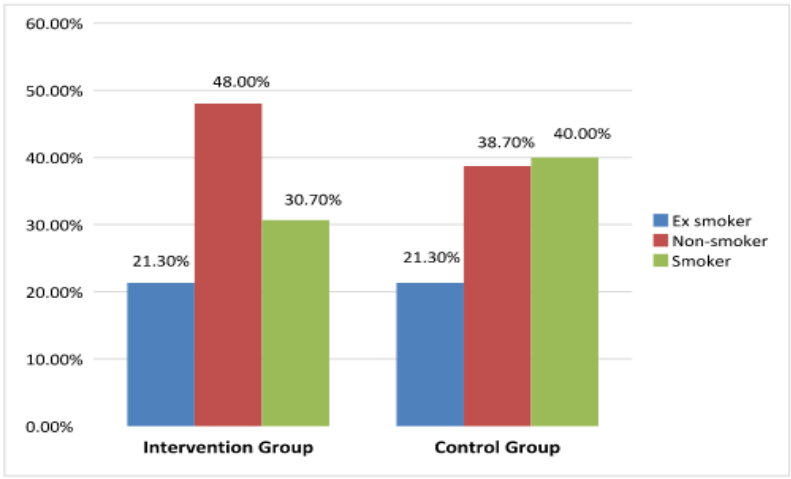

Fig.5: Distribution based on smoking behavior

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5.6. Distribution of patients based on medication adherence level

Table no.6: Distribution of patients based on medication adherence level

MMAS 8 Adherence level		Group		
		Intervention Group (n=75)	Control Group (n=75)	Total (n=150)
Baseline	High Adherence	3(4%)	5(6.7%)	8(5.3%)
	Medium Adherence	9(12%)	10(13.3%)	19(12.7%)
	Low Adherence	63(84%)	60(80%)	123(82%)
First follow up	High Adherence	28(37.3%)	23(30.7%)	51(34%)
	Medium Adherence	13(17.3%)	9(12%)	22(14.7%)
	Low Adherence	34(45.3%)	43(57.3%)	77(51.3%)
Second follow up	High Adherence	58(77.3%)	40(53.3%)	98(65.3%)
	Medium Adherence	24(32%)	11(14.7%)	35(23.3%)
	Low Adherence	6(8%)	11(14.7%)	17(11.3%)

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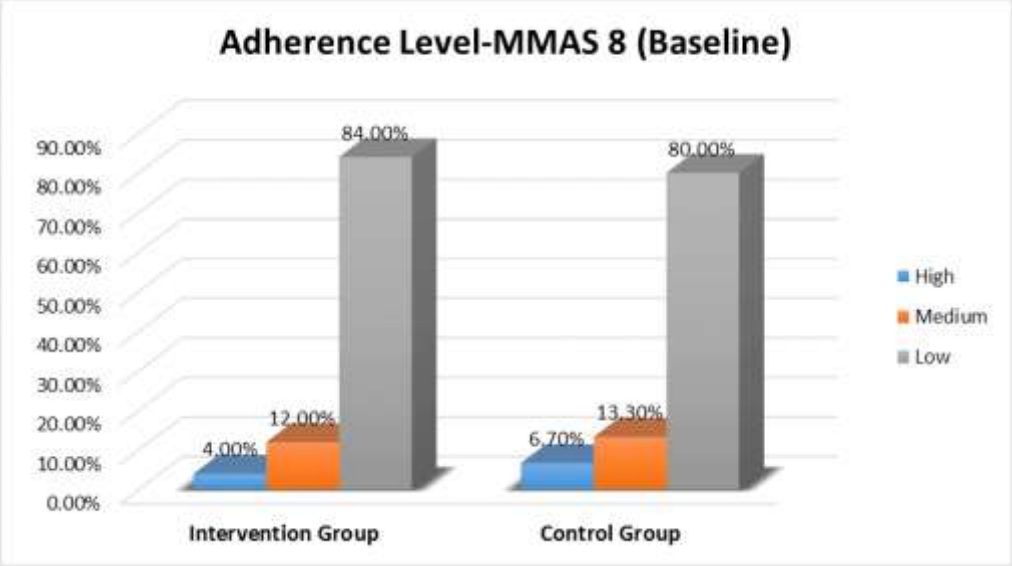

Fig6.Adherence level of baseline MMAS 8 baseline

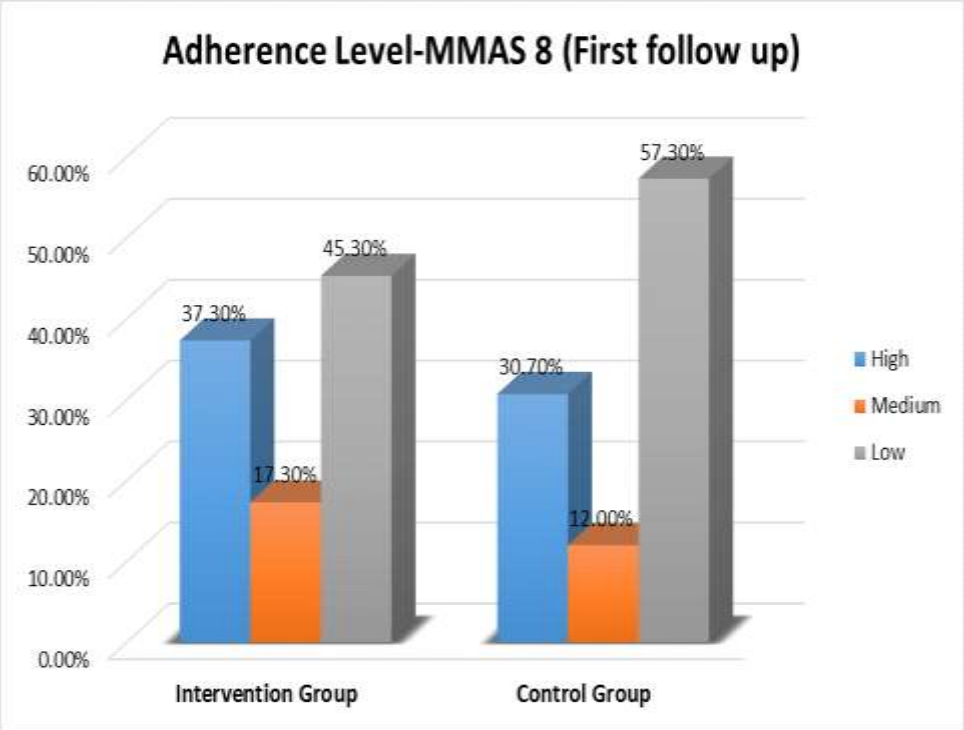

Fig.7:Adherence level of MMAS 8 first follow up

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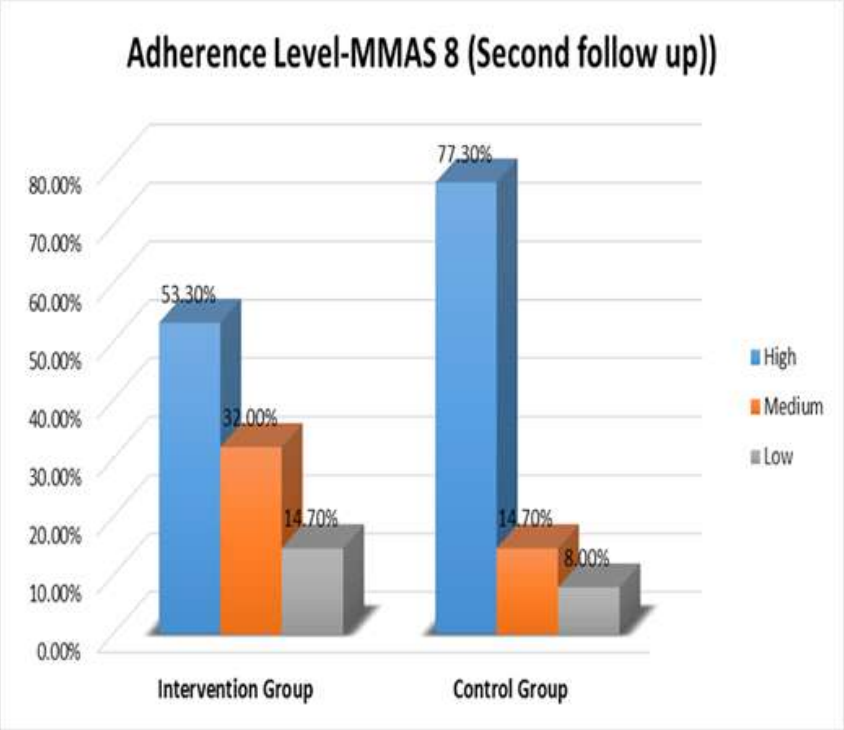

Fig.8: Adherence level of MMAS-8 second follow up

5.7. Distribution of reason for non- adherence.

Tab.no:7 Distribution of patient based on reason for non- adherence

Table no.6 : Reasons for non-adherence

Reason For Non-adherence	Intervention (n=63)	Control Group(n=60)	Total(n=123)
Fear of addiction	8(12.7%)	11(18.3%)	19(15.4%)
Feeling better	25(39.7%)	19(31.7%)	44(35.8%)
Financial reasons	9(14.3%)	5(8.3%)	14(11.4%)
Forgetfullness	15(23.8%)	18(30%)	33(26.8%)
Lack of family support	6(9.5%)	7(11.7%)	13(10.6%)

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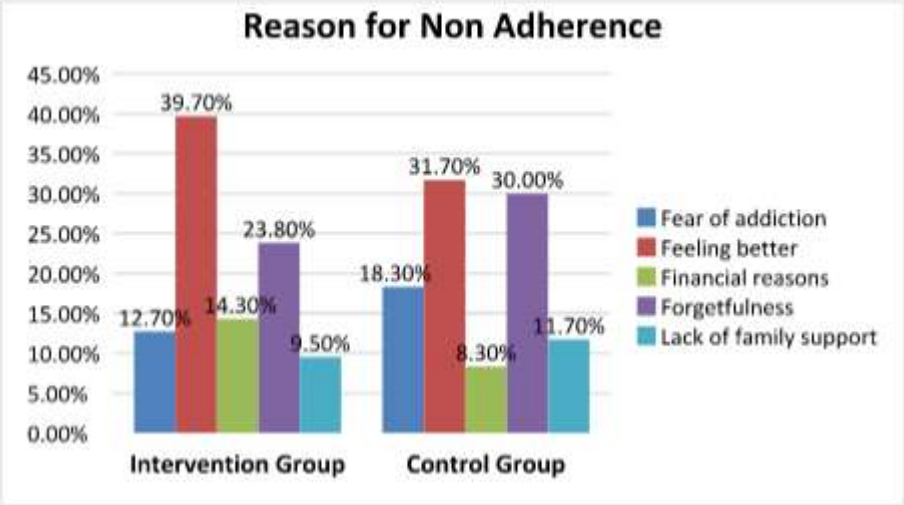

Fig.9: Distribution of reasons for non-adherence.

After baseline data collection, its obtained that- total of 93 persons shows high adherence to therapy Remaining patients, 60 out of 75 in control group and 63 out 0f 75 in intervention group shows non-adherence or medium adherence to the treatment.

Out of these 93, 25(39.6%) in intervention and 19(3.17%) in control group were stopped their medications because they felt better on their clinical condition.

15(23.8%) persons in intervention and 18(30%) in control group shows non- adherence due to forgetfullness. 9 patients (14.2%) in intervention group and 5patients (8.3%) in control; group stopped their medications due to some financial reasons.

6 people (9.5%) in intervention and 7 people (11.7%) in control withdrawn their treatment plan because of lack of their family support.

The remaining 8 in the intervention group (12.7%) and 11 in the control group (13.7%) stopped medication due to their fear for addiction of medicines.

5.6.2 BCKQ SCORING

Table no:9 – BCKQ Means of control and intervention group.

BCKQ Score	Intervention Group (n=75) (Mean)	Control Group(n=75) (Mean)
Baseline	35.2	33.9
First Follow up	47.2	40.7
Second follow up	54.2	46.6

In table no.8 average (fig.10) BCKQ score of control and intervention is given.From this results, it indicates that, intervention group shows an increase in knowledge level due to the pharmacist intervention.

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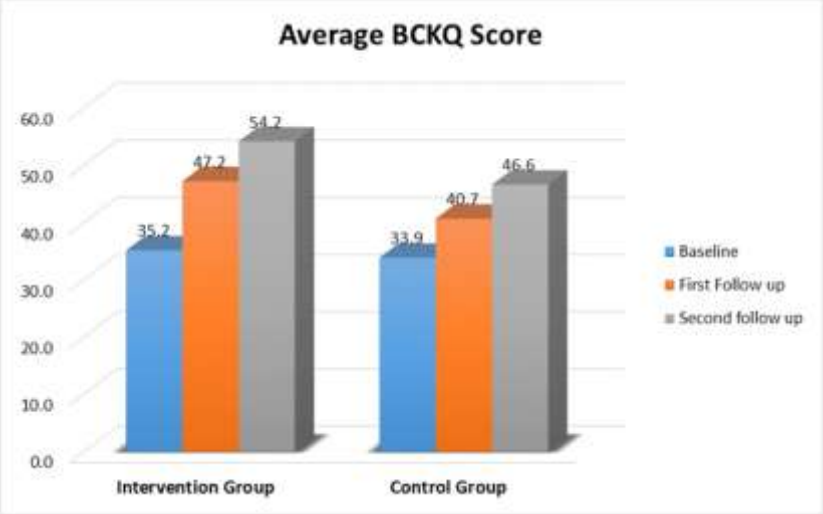

Fig.10: Average BCKQ score of control and intervention group

5.9.Paired t-test analysis of MMAS-8 score of intervention group.

Paired t-test analysis of baseline mean of MMAS-8 score is 4.210. After the second follow up, mean of MMAS-8 score were 7.11. It shows that there is an improvement in medication adherence of intervention group after second follow up.

Tab.no 10: Paired t-test analysis of MMAS-8 score of intervention group

MMAS-8	Mean	Standard Deviation	t value	P value
Baseline	4.210	1.623	-15.620	0.001
First follow up	6.23	1.540		
First follow up	6.23	1.540	-8.441	0.001
Second followup	7.11	7.11		
Baseline	4.210	1.623	-10.78	0.001
Second follow up	7.11	7.11		

5.10.Paired t-test analysis of MMAS-8 score of control group.

Paired t-test analysis of baseline mean of MMAS-8 score of control group was 4.32..The second follow up shows mean value of MMAS-8 score were 5.132. It shows that, there is an improvement in medication adherence of intervention group after second follow up

Tab.no.11: Paired t-test analysis of MMAS-8 score of control group.

MMAS-8	Mean	Std Deviation	T	P value

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Baseline	4.32	1.871	-8.73	0.001
First follow up	5.81	1.726		
First follow up	5.81	1.726	-4.42	0.001
Second follow up	5.132	1.362		
Baseline	4.32	1.871	-6.50	0.001
Second follow up	5.132	1.362		

5.11.Comparison of MMAS-8 score of intervention and control group by independent t-test

Tab.12: Comparison of MMAS-8 score of intervention and control group by independent t-test

MMAS-8	**Mean**	**Std. deviation**	**t value**	**P value**
2nd follow up of intervention	7.11	1.431	6.387	0.001
2nd follow up of control	5.132	1.262	6.378	0.001

From the independent t-test analysis, mean of 2nd follow up of intervention group was 7.11. The mean of 2nd follow up of control group was 5.132. B y comparing MMAS-8 score of both the groups, the intervention group shown an improvement in medication adherence.

5.12.Paired sample t-test of BCKQ score of control group

Paired t-test analysis of baseline mean of BCKQ score of control group was 33.89 .The second follow up shows mean value of BCKQ score was 46.64. It shows that, there is an improvement in medication adherence of intervention group after second follow up

Tab.no;13 Paired sample t-test of BCKQ score of control group

BCKQ	**Mean**	**Std. deviation**	**t**	**p- value**
Baseline	33.89	16.651	-18.321	0.001
1st follow up	37.16	15.891		
1st follow up	37.16	15.891	-10.127	0.001
2nd follow up	46.64	13.843		

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Baseline	33.89	16.651	-13.212	0.001
2nd follow up	46.64	13.843		

5.13.Paired t-test of BCKQ score of intervention group

From the Paired t-test analysis, baseline mean of BCKQ score of intervention group was35.16 .The second follow up shows mean value of BCKQ score was 54.19. It shows that, there is an improvement in medication adherence of intervention group after second follow up

Tab.no.14: Paired t-test of BCKQ score of intervention group

BCKQ	Mean	Std. deviation	T	p- value
Baseline	35.16	17.203	-12.341	0.001
1st follow up	42.02	10.116		
1st follow up	42.02	10.116	-9.672	0.001
2nd follow up	54.19	13.207		
Baseline	33.16	17.203	-15.427	0.001
2nd follow up	54.19	13.207		

5.14.Comparison of BCKQ score of intervention and control by independent t-test analysis

From the independent t-test analysis, mean of 2nd follow up of intervention group was 7.54.19. The mean of 2nd follow up of control group was 46.62. B y comparing BCKQ score of both the groups, the intervention group shown an improvement in medication adherence.

Tab.no:15 Comparison of BCKQ score of intervention and control by independent t-test analysis

BCKQ	Mean	Std.deviation	T	p-value
2nd follow up of intervention group	54.19	13.207	7.083	0.001
2nd follow up of control group	46.62	14.843	7.083	0.001

IV. DISCUSSION

Medication adherence is defined by the World Health Organization as the degree to which the person‘s behaviour corresponds with the agreed recommendations from a health care provider.

Poor adherence to prescribed regimens can result in serious health consequence. Medication adherence is important for controlling chronic conditions, treating temporary conditions, and overall long-term health and well-being.

This study aimed is to assess the role of Pharmacist in improving knowledge and medication adherence of pulmonary disease patients.

Out of 250 patients, 150 were included in the study according to inclusion and exclusion criteria.

As per the methodological guidance, data collection and 2 follow up of selected subjects undergone in requested time duration.

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In Table no.1, Patients were categorized according to their age. Mainly five groups of patients were there. Most of the patients (62) were in the age group 61-80 (45.3%).42 patients(28%) were >80 age category, followed by 20 patients (13.3%) in 51-60 years, 12(8%) patients in

31-50 years, 8(5.3%) in 18-30 years of age group.

The study groups were categorized based on gende are shown in Table no.2. Out of 150 patients,67 (44.7%) were female and 83(55.33%) were male .Employment status wise distribution is shown in Table no.4. Out of 75 patients on intervention group,27(30%) were employed and 43(57.3%) were unemployed. In control group, 25 out of 75(33.3%) were employed and 50(66.7%) were unemployed.

In table no 4, marital status wise distribution is shown.Out of 75 of intervention group, 61(81.3%) were married ,3(4%) were un married,5(6.7%)were widows and 6(8%)were widower. In control group, 60(80%) were married, 4(5.3%) were unmarried ,1(1.3%) were widow and 10(13.3%) were widower.

Table no 5,Out of 75 of intervention group,16(21.3%) were ex-smokers,36(48%) were non- smokers and 23(30.7%) were smokers.

In control group, out of 75 patients, 16(21.3%) wereex-smokers,29(38.7%) were non-smokers and 30(40%) were smokers.

Table no10 shows that Paired t-test analysis of baseline mean of MMAS-8 score is 4.210. After the second follow up, mean of MMAS-8 score were 7.11. It shows that there is an improvement in medication adherence of intervention group after second follow up.

Paired t-test analysis of baseline mean of MMAS-8 score of control group was 4.32..The second follow up shows mean value of MMAS-8 score were 5.132. It shows that, there is an improvement in medication adherence of intervention group after second follow up.

Paired t-test analysis of baseline mean of BCKQ score of control group was 33.89 .The second follow up shows mean value of BCKQ score was 46.64. It shows that, there is an improvement in medication adherence of intervention group after second follow up.

From the Paired t-test analysis, baseline mean of BCKQ score of intervention group was35.16 .The second follow up shows mean value of BCKQ score was 54.19. It shows that, there is an improvement in medication adherence of intervention group after second follow up. From the independent t-test analysis, mean of 2nd follow up of intervention group was 7.54.19. The mean of 2nd follow up of control group was 46.62. B y comparing BCKQ score of both the groups, the intervention group shown an improvement in medication adherence.

The study reveals that, medication adherene and patient knowledge as a result of pharmacist care and patient counselling in intervention group by comparing it with control group. This is an accordance with results obtained from previous study of Jackin R. Moses,Neena Priyamalar et al.,2020 in which shows 33.45% increment in patient knowledge & 83.67 % change in medication adherence improvement after intervention. This results correlated with my study that about 38.7% shows improvement in medication adherence and 19% increment in patient knowledge after intervention.

V. CONCLUSION

COPD is one of major leading cause of total disease burden, and Asthma is very common in current population. So that, this prospective study on the role of pharmacist in improving patient knowledge and medication adherence is of prime importance.

Specific measurement of medication adherence and knowledge assessment of a person is not possible at all. Still, I calculated their scores and found their range of adherence and knowledge level.

This study shows significe of pharmacist care in improvement of medication adherence measurement and patient knowledge assessment.

In each cases, final follow up results shows satisfactory reports of this study.

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I am proud to dedicate my deep sense of gratitude to our beloved founder, (Late)

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