ANALYSIS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) PREVALENCE AND MANAGEMENT IN ISLAMABAD, PAKISTAN

Enrollment Number: 01-262222-006

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Dedication

I dedicated this research study to my family members for their unwavering support, encouragement, and belief in my abilities. Their guidance and support have been invaluable throughout this journey.

Neelofer Siraj

Acknowledgement

I would like to express my sincere gratitude to the following individuals and institutions for their invaluable contributions to this research:

Thanks to Dr. Fiza Sarwar, my research supervisor, and special thanks to Dr. Aansa Rukya and Dr. Asma Jamil for their feedback, criticism and advice that contributed to making this research a lot better.

I also extend my sincere appreciation to Bahria University, Islamabad for the support that was accorded to me in terms of resources and facilities to undertake this study.

I am grateful to all those who have in one way or the other given a positive input towards the successful completion of this research. They have provided this endeavour with their support and commitment.

Neelofer Siraj

ABSTRACT

This research study aimed to access the prevalence of chronic obstructive pulmonary disease by the data taken from hospitals of Islamabad and to determine the prevalence of chronic obstructive pulmonary disease in particular selected sectors of Islamabad using spirometry as a tool. Understanding the importance of the adherence to standard protocols in the chronic obstructive pulmonary disease treatment. The study was carried out between September, 2023 to June, 2024 at several sectors in the capital city of Pakistan, also data from past 5 years (2019-2023) was used to check the prevalence of chronic obstructive pulmonary disease in Islamabad. Chronic obstructive pulmonary disease outpatients were classified into different risk groups (ABCD) based on the current available Guidelines for Chronic Obstructive Lung Disease strategy 2021. Follow residual criteria assessment of severity of the disease and the prescribed treatment in relation to current guidelines, the clinical practices were assessed of physicians managing chronic obstructive pulmonary disease.

In the analysis, 275 patients with majority of males 70.91%. All patients were mainly Islamabad residents. The most prescribed therapy was a combination of long-acting beta agonist with an oral medicine long-acting muscarinic antagonist which was prescribed to 18.55% of patients while 18.55% received long-acting muscarinic antagonist in a different inhaler with long-acting beta agonist, 18.55% received long-acting muscarinic antagonist only; while Long-acting beta agonist and Inhaled conic steroid was the least prescribed at 14.91%. The most improperly referred were in Group A 59 %. This study set out to investigate prescription trends in the treatment of chronic obstructive pulmonary disease, acknowledging the importance of standardized treatment recommendations in the management of the condition. Compliance with the Guidelines for Chronic Obstructive Lung Disease guidelines among pulmonologists is suboptimal and requires improvement. In addition, there is the somewhat surprising fact that LABA, which is the most commonly prescribed therapy, is in only a small part of compliance to the guideline.

Keywords: COPD, Management, Prevalence, Treatment Guidelines, Adherence, Islamabad, Pakistan

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List of Abbreviations

Abbreviation	Full Form
ATS	American Thoracic Society
CAT	COPD assessment test
CI	Confidence Interval
COPD	Chronic obstructive pulmonary disease
COVID-19	Corona Virus Disease of 2019
CVDs	Cardiovascular Diseases
ERS	European Respiratory Society
FEV1	Forced expiratory volume in one second
FVC	Forced vital capacity
GBD	Global Burden of Disease
GOLD	Guidelines for Chronic Obstructive Lung Disease
HIV	Human Immunodeficiency Virus
ICS	Inhaled conic steroid
IPF	Idiopathic Pulmonary Fibrosis
LABA	Long-acting beta agonist
LAMA	Long-acting muscarinic antagonist
MRC	Medical Research Council
mMRC	Modified Medical Research Council
N	Number
OR	Odd Ratio
OLD	Obstructive Lung Disease
PEFR	Peak Expiratory Flow Rate

Abbreviation	Full Form
PFT	Pulmonary function test
RLD	Restrictive pulmonary disease
SABA	Short-acting beta agonist
SAMA	Short-acting muscarinic antagonists
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
t-stat	Test-Statistics
X^2	Chi-Square
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) presents a significant healthcare burden, and understanding its prevalence in Islamabad is crucial. Islamabad, the capital city of Pakistan, serves as a microcosm for the entire nation. As the seat of government and a major economic hub, it attracts people from all corners of the country. With a population exceeding 1.2 million, it ranks as the ninth-most populous city in Pakistan. This increased influx of residents from different regions of the country facilitates the study of COPD in Islamabad as the results may well be generalize to the rest of Pakistan. Besides, being the federal capital, Islamabad has enhanced chances of visibility and possibility of enacting preventive and curative measures based on the findings of this study.

However, considering the recent achievements regarding the organization of the healthcare systems in various countries, COPD remains one of the most common diseases, which result in the increased morbidity as well as mortality rates (Vogelmeier et al., 2017). COPD is a disease that requires patients to visit mainly clinics and doctors for their check-up appointments most of the time. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) was initiated in 2001 to improve the identification, prognosis, and preventing of COPD as well as to develop strategies to improve the treatment results of patients with COPD. Once a year, the most recent literature is synthesized to create a new report, serving the purpose of enhancing the practitioner's approach to COPD care. Such GOLD reports are viewed

as essential, ongoing, evidence-based, and authoritative reference documents that are now the current guides for management of COPD patients (Patel et al. , 2019) As to mortality, the COPD rates have been gradually declining globally starting from 2006 and are expected to drop by 21% by the Year 2040 (Gayle, Lenoir, Minelli, & Quint, 2022).

The main goal of the GOLD guidelines' initial release in 2011 was to provide medical professionals with the most up-to-date advice on how to diagnose and treat COPD patients. This manual was then substantially revised in 2006, 2011, 2017, and 2021, and small modifications were added almost annually after that. These recommendations have developed into a vital resource that is frequently used in therapeutic settings throughout the world (Albitar, Egan, Alkhateeb, Almodallal, & Iyer, 2020; Gupta, Malhotra, & Ish, 2021).

The 2017 version was especially significant because it was a step up from the prior ABCD assessment because it did not rely on spirometry grading and instead included patient symptoms and exacerbation history. On the other hand, the 2021 guidelines included a new chapter on COVID-19-related considerations and made some changes to the recommendations for pharmaceutical treatment (Asif et al., 2022; Kanwal, Khan, Mushtaq, Khan, Rabia, & Fang, 2024; Han et al., 2021). The significance of COPD guidelines for the management of the condition has been acknowledged in many different countries; nevertheless, healthcare professionals who handle a range of patient demographics have shown inadequate levels of adherence to these guidelines (Aissa et al., 2020; Corrado & Rossi, 2012; Ding, Small, Bergström, & Holmgren, 2017; Hsieh et al., 2018; Palmiotti et al., 2018; Park et al., 2020; Rajnoveanu et al., 2020; Sen, Saraclar, & Kahya, 2021; Sharif, Cuevas, Wang, Arora,

& Sharma, 2013; Turan, Turan, & Mirici, 2020), giving them excessive amounts of inhaled corticosteroids (ICS) in particular (Palmiotti et al., 2018).

The World Health Organization (WHO) observes that the factors influencing doctors' compliance with guidelines, especially pulmonologists are complex and include the healthcare provider, the patient, the disease, and a range of social factors (Aissa et al., 2020; Ulmeanu, Mihaltan, Arghir, Mladinescu, & Teodorescu, 2016). Insufficient adherence, regardless of the challenges faced, negatively affects patients' clinical results, increasing the likelihood of unanticipated acute exacerbations of COPD, and improving treatment outcomes (Aissa et al., 2020; Hogea et al., 2020; Sandu, Mihaescu, Filipeanu, Cernomaz, & Crisan-Dabija, 2019). Conversely, better adherence has advantages for clinical and functional outcomes as well as financial savings on direct and indirect medical costs (Kim, Tillis, Patel, Davis, & Asche, 2019; Chan et al., 2017; Chiang, Liu, Chuang, & Jheng, 2013; Miravitlles, Soler-Cataluña, Calle, & Soriano, 2013; Sen, Saraclar, & Kahya, 2021).

The condition known as chronic obstructive pulmonary disease is widespread but treatable and preventable. It is characterized by a continuous restriction in airflow that gets worse with time and is linked to long-term lung and airway inflammation brought on by exposure to dangerous particles or gases. The overall severity of COPD in individual patients is greatly impacted by comorbidities, or other medical conditions, as well as exacerbations, which are sudden worsening of symptoms (Vestbo et al., 2013). This emphasizes how crucial early diagnosis and treatment are to enhancing the quality of life for those who are impacted.

Since 2001, the Global Initiative for Chronic Obstructive Lung Disease (GOLD) has released its strategy document, which outlines recommended practices

for the diagnosis and treatment of COPD. COPD is a worldwide health concern (Vestbo et al., 2016). The purpose of this research is to provide useful information unique to the people of Islamabad, information that can impact national COPD management plans as well as local healthcare practices.

The common and treatable condition known as chronic obstructive pulmonary disease is marked by tissue destruction and progressive airflow limitation. It is linked to structural alterations in the lungs brought on by long-term inflammation brought on by exposure to harmful particles or gases, most frequently cigarette smoke. Reduced lung recoil and airway narrowing are the results of chronic inflammation. Cough, dyspnea, and sputum production are common symptoms of the illness. According to Tanwar et al. (2024), symptoms can vary from respiratory failure to apathy. According to Vestbo et al. (2016), COPD is a major cause of morbidity and mortality globally, resulting in a significant and growing economic and social burden.

Smoking is the most well-known risk factor for chronic obstructive pulmonary disease (COPD), which is a disease that is largely preventable worldwide. Because gold standard spirometry is unavailable, COPD is still misdiagnosed globally. Patients experience both an over-diagnosis and an under-diagnosis of this common disease as a result of technical difficulties with this procedure (Rehman et al., 2021). Prolonged exposure to toxic gases or particles causes COPD. Worldwide, smoking cigarettes is the leading cause of COPD. According to Tanwar et al. (2024), exposure to the environment, the workplace, and second-hand smoke are possible additional causes. In the population with chronic obstructive pulmonary disease (COPD), magnesium sulphate has been widely used to treat asthma exacerbations, but its effectiveness is still debatable (Jahangir et al., 2022).

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Emphysema and chronic bronchitis are two examples of the chronic, progressive, and severe respiratory diseases that are included in the medical condition known as COPD (Jha & Chandi, 2023). It has long been underdiagnosed and underreported, especially in developing nations, despite the wealth of information on the disease's etiology, pathophysiology, and potential treatments. Chronic airflow limitation can affect daily activities and overall quality of life due to a combination of parenchymal destruction (emphysema) and small airway destruction (bronchitis). Long-term, preventive antibiotic use may lower the bacterial load, airway inflammation, and frequency of exacerbations in carefully chosen COPD patients (Jha & Chandi, 2023).

Significant impairments and a major impact on quality of life are caused by COPD symptoms. In Pakistan, COPD is the third most common cause of death. In the twenty-first century, COPD will continue to be a significant public health issue and present a challenge for medical professionals (López-Campos, Tan, & Soriano, 2016). The symptoms of COPD usually appear in adulthood, usually in the winter. Patients typically complain of coughing up sputum, chronic dyspnea that worsens over time, and these symptoms. Pts may also experience tightness in the chest and wheezing. Although the majority of cases have a history of smoking, many do not. Inquire about their family history, work and environmental exposures, and exposure to second-hand smoke (Aggarwal et al., 2021).

1.1. Problem Statement

Globally, there is growing concern about the prevalence of Chronic Obstructive Pulmonary Disease (COPD), which is heavily influenced by environmental factors, especially air pollution. A thorough understanding of the state

of the disease is necessary in order to address the growing COPD burden in Islamabad. It is essential to establish a baseline COPD prevalence rate in the city in order to track disease trends and evaluate the possible effects of rising air pollution on the burden of COPD. Policymakers and healthcare professionals can create focused prevention and management plans to lessen the disease's impact on the public by determining the current state of COPD. Thus, the following is our problem statement for this research study:

"There is a need to prepare baseline that at present what will be the COPD prevalence status of Islamabad so that in future it will be accessed that how increasing pollution rate will affect COPD levels."

1.2. Research Question

The purpose of this research study is to ascertain among the residents of Islamabad, Pakistan, current prevalence of chronic obstructive pulmonary disease (COPD). Moreover, it aims to determine, from the evidence gathered from previous research, the best COPD management techniques in this area. The research aims to enhance the quality of life for COPD patients in Islamabad by developing targeted interventions through a better understanding of the disease burden and treatment efficacy. Consequently,

"What is the current prevalence of COPD among the population of Islamabad, and what are the most effective management strategies for COPD in this region, as evidenced by existing studies?"

1.3 Objectives

The primary goals of the current study are to learn more about COPD, including its prevalence, management, and use of spirometry as a tool for COPD identification in specific Islamabad sectors. These goals will be accomplished through scientific research methods.

1. To access the prevalence of COPD by the data taken from hospitals of Islamabad.
2. To determine the prevalence of COPD in particular selected sectors of Islamabad using spirometry as a tool.

1.4 Significance of the study

The incidence of chronic obstructive pulmonary disease (COPD) in Islamabad must be understood because it poses a substantial healthcare burden. The objective of this research is to furnish significant information to multiple stakeholders, such as researchers, policymakers, and healthcare practitioners. This information will be crucial in helping to manage the increasing number of COPD cases in Islamabad by guiding focused interventions for the disease that are tailored to the local requirements. More precise significances of the current research study are as under:

a) Give researchers, policymakers, and medical professional's useful data to address Islamabad's rising COPD burden.
b) Encourage the creation of focused interventions to manage COPD in the area.

1.6. Study Setting

The research project can be divided into the following phases:

Literature Review: This phase involves gathering and analysing existing research on the topic. It typically occurs at the beginning of the project to establish a foundation for the study.

Methodology: During this phase, the researcher outlines the research design, data collection methods, and analysis techniques that will be used.

Data Collection: This stage involves gathering data through surveys, interviews, experiments, or other appropriate methods.

Analysis: The collected data is analysed using statistical or other relevant techniques to extract meaningful insights.

Conclusion: The research findings are summarized, and conclusions are drawn based on the analysis.

Final Report Submission: The final research report is prepared and submitted, typically including an abstract, introduction, literature review, methodology, results, discussion, and conclusion.

1.7 Summary of the Chapter

The importance of comprehending the prevalence of COPD in Islamabad, a major Pakistani city, is emphasized in the introduction. It draws attention to the city's diversified populace and advantageous location, which makes it an appropriate microcosm for researching COPD nationwide.

This research study explores the global background of COPD and how the GOLD guidelines relate to the treatment of the condition. It recognizes the difficulties in following these recommendations and the possible influence on patient results. The introduction then concentrates on the unique circumstances surrounding COPD in Pakistan, emphasizing the disease's prevalence and the necessity of a precise

diagnosis and efficient treatment. It lists the different risk factors for COPD, such as exposure to the environment and smoking.

There is a clear outline of the problem statement, research question, and objectives. Objectives of the study are to ascertain the prevalence of COPD in Islamabad, pinpoint efficient treatment approaches, and evaluate the application of spirometry in the diagnosis of COPD. The study's importance is underlined since the results will give scholars, decision-makers, and medical professionals important knowledge to address the rising prevalence of COPD in under study area (selected sectors) of Islamabad.

CHAPTER 2

LITERATURE REVIEW

Chronic Obstructive Pulmonary Disease (COPD) is a progressive lung disease characterized by airflow limitation that is not fully reversible. It is a major public health concern globally, and its burden is increasing in developing countries like Pakistan. While there is a growing body of literature on COPD prevalence and management in developed nations, data from developing countries, particularly Pakistan, remains limited. This literature review aims to provide an overview of the existing research on COPD in Pakistan, with a specific focus on Islamabad, to inform the current study. COPD prevalence studies in Pakistan are relatively scarce compared to developed countries. Nonetheless, the data that is currently available points to a sizable disease burden. Higher prevalence rates have been found in urban studies than in rural ones, suggesting the possible influence of lifestyle and environmental factors on the development of COPD.

With an emphasis on older patient populations, Incalzi and Fimognari (2023) explores the complexities of chronic respiratory diseases, particularly Idiopathic Pulmonary Fibrosis (IPF) and COPD. They contended that aging is linked to physiological modifications in the respiratory system. Specific difficulties in identifying and treating IPF and COPD in the elderly. Pharmacological treatments for IPF and COPD, taking into account factors like drug interactions, side effects, and polypharmacy that may affect elderly patients. The function of non-pharmacological therapies in the management of these ailments in senior citizens. Multidisciplinary

methods of care to improve patient outcomes. For medical professionals caring for elderly patients with COPD and IPF, they offered insightful information. It emphasized the necessity of an all-encompassing strategy that took into account both pharmaceutical and non-pharmacological interventions, in addition to the significance of interdisciplinary cooperation.

The prevalence of obstructive lung disease (OLD) in patients undergoing spirometry at a tertiary care center in Nepal was investigated by Shrestha and Pant (2022). Its goal was to advance knowledge of the prevalence of OLD in the area. Patients who had spirometry performed at the pulmonary function test clinic between October 1, 2021, and March 31, 2022, as well as a descriptive cross-sectional study. Of the patients who had spirometry, a comparatively high prevalence of obstructive lung disease (43.14%) was discovered by the study. The participants' average age was 55.78 years. Among patients referred for spirometry, dyspnea, or shortness of breath, was the most prevalent symptom (87.30%). The study population appears to have a considerable burden of obstructive lung disease, according to the findings. The significance of spirometry for timely diagnosis and effective treatment of OLD is emphasized by the authors.

The age-standardized rate of chronic bronchitis inhalers (37·9%) was nearly 50% higher than in non-inhalers (25·7%), and the rates were consistently higher in inhalers regardless of their level of smoking. It has been reaffirmed that smokers are more likely than non-smokers to develop chronic bronchitis, and that the frequency of the condition rose with the amount of smoke (St Thomas' Hospital, Stockport; Regional Mobile Chest X-ray Service UK 2004).According to the study's findings, individuals with COPD who have higher BEC also have higher levels of T2

inflammation, which may account for their differing responses to ICS. It is significant to remember that RCTs have only shown an advantage for ICS (as part of combination treatments) in COPD patients who have experienced an exacerbation in the past year. Though this is an evidence gap worth taking into consideration, there is currently no evidence supporting ICS intervention in patients with COPD with higher BEC but no history of exacerbations (Singh et al., 2022).

Research indicates that COPD patients are more likely to have the metabolic syndrome and manifest diabetes, with the latter likely to have an effect on prognosis (Vestbo et al., 2013). For the clinician to understand the proportion of daily practice that is dedicated to COPD compared to other conditions and to identify resources to plan for future care, they need up-to-date, condensed information on the population distribution of COPD. The overall ageing of the world's population combined with other factors like high smoking rates in Asia will make COPD an even larger problem well within the 21st century, even with generalized confirmed, continuous reductions in COPD standardized mortality rates plus some recent successful reductions due to anti-smoking policies in a number of Western countries (López-Campos, Tan, & Soriano, 2016).

Based on the yellow and red zones of the PEFR, the study's findings indicate that 91.56% of the smokers had airway obstruction. A total of 62.7% of smokers with COPD were in the yellow zone, while 28.9% were in the red zone. The PEFR values of only 29.1% of non-smokers fall within the yellow range. (P value 0.001*) No non-smoker was in the red zone. Smokers' PEFR was substantially lower than non-smokers' (P value 0.003*). Considering mild to severe air flow obstruction, 95.5% of

subjects in the red zone and 51.2% of subjects in the yellow zone were symptomatic (Rehman, Shafiq, Jawed, & Behram, 2019).

This work is one of the first systematic attempts to use data from spirometry to estimate the prevalence of COPD in different parts of the world. While many of the earlier reviews were based on individuals 40 years of age or older, the estimates presented here are based on the age range beginning at 30 years. There has been significant evidence of COPD prevalence in younger demographic groups, which raises questions about the global epidemiological situation as it stands right now (Adeloye et al., 2015). Compared to non-smokers, smokers had a lower PEFR. Both smokers and non-smokers experience undiagnosed airway obstruction with symptoms resembling COPD, although a higher percentage of smokers had mild to severe symptoms. PEFR is a straightforward method for screening people who may be at high risk (Rehman et al., 2019).

2.1 Epidemiology of COPD

The complexity in health care is brought about by the elderly population and more incidences of non-communicable diseases per patient. This is a combined condition that occurs where two or more chronic diseases co-exist in the same individual at the same time. The rise in multi-morbidity across the globe brings high demands on few healthcare resources, poor quality of life, and death (Excoffier, Herzig, N'Goran, Déruaz-Luyet, & Haller, 2018; Hawkins, Lischer, & Sweeney, 1973; O'Kelly, Smith, Lane, Teljeur, & O'Dowd, 2011; Onder et al., 2015; Puth, Weckbecker, Schmid, & Münster, 2017; Rizzuto, Melis, Angleman, Qiu, & Marengoni, 2017; Zulman et al., 2015).

Chronic obstructive pulmonary disease is considered one of the common chronic diseases in the entire world and its impacts contribute to the high mortality and morbidity of the adult population (Doucet, Rochette, & Hamel, 2016; Rosenberg, Kalhan, & Mannino, 2015). Mortality and the incidence of COPD are both potentiated with age. Three million three hundred and fifty thousand people died from COPD globally in 2015 alone, COPD 11% of all deaths. That means an overall 6% rise from the 1990 figures, though the age standardized rate has dropped down to 41%. The prevalence rate is 9% globally as presented by the Global Burden of Disease (GBD) 2015 Chronic Respiratory Disease Collaborators (2017) (Soriano et al., 2017). Lung aging is known to be accelerated in COPD patients and there are immunological system changes in ageing that are also thought to play a part in the development of COPD (Barnes, 2015; Brandsma, Van den Berge, Hackett, Brusselle, & Timens, 2020; Cho, Lee, & Kim, 2019). Comorbidity is a unique feature of patients with COPD, especially if the patient is elderly and from a low economic status (Barner, 2015; Divo & Celli, 2020; Divo et al., 2015; Orozco, Rodriguez, Hunter, & Roy, 2024).

Most of the COPD patients' have more than two coexisting diseases, and this leads to multi-morbidity (Divo & Celli, 2020). Treatment of the most frequent chronic diseases can often not be directly translated in the correction of those responsible for most outcomes for patients with multi-morbidity (Alsuwaigh et al., 2024; Carmona-Pírez et al., 2021; Vanfleteren et al., 2013). In addition, presence of comorbidities does not only add the problems that a COPD patient has to bear but also reduces his or her quality of life (Marotta et al., 2020). COPD is, therefore, part of the pulmonary multi-morbidity (Karim et al., 2024; Vanfleteren et al., 2020).

The existence of COPD on its own and other related diseases make COPD patients' health less favorable than the general population (Barnes & Celli, 2009; Cavaillès et al., 2013; Cheng et al., 2015; Corlateanu, Covantev, Mathioudakis, Botnaru, & Siafakas, 2016; Crisafulli, 2014; Mannino, Thorn, Swensen, & Holguin, 2008). COPD patients present with several comorbidities that include acute and chronic conditions such as myocardial infarction, lung cancer, depression, other psychiatric disorders, metabolic syndrome, hypertension, congestive heart failure, chronic kidney diseases, osteoporosis, and diabetes mellitus (Alsuwaigh et al., 2024; Chen, Cheng, Chou, Chen, & Yu, 2019; Chaudhary, Nanda, Tripathi, Sawlani, Gupta, Himanshu, & Verma, 2016; Greulich et al., 2017; Sin, Anthonisen, Soriano, & Agusti, 2006).

However, the pattern of these comorbidities has not been explored comprehensively, despite the significance of identifying the comorbidities in COPD patients. Methodological differences in the definition of inclusion criteria, databases employed, clustering procedures, and comorbidity lists account for the disparate published results (Divo et al., 2015; Divo & Celli, 2020; Sarwar, Alam, Öztürk, Koçak, & Malik, 2023). Although the cardiovascular cluster is often considered in most of the studies, the other multi-morbidity clusters and their prevalence and effects on mortality are still questionable (Ghosh, & Hobbs, 2020; Karim et al., 2024; Mangold et al., 2023; Orozco, Rodriguez, Hunter, & Roy, 2024; Triest et al., 2019; Zhu, Edwards, Mant, Payne, & Kiddle, 2020).

These cross-sectional studies of patients with COPD based on individual data were conducted all across the different part of the world and sought to explore the relationship and co-occurrence of chronic diseases in the target population. The chronic diseases of interest included heart failure, arrhythmia, coronary heart disease,

diabetes, lung cancer, chronic kidney disease, depression, and other cardiovascular diseases (CVDs) compared between Lithuanian individuals with and without COPD and at least one chronic disease condition. The purpose of the study was to evaluate the effect of COPD on the likelihood and co-occurrence of important comorbidities defining the intervention target.

2.2 COPD Management and Treatment

In a research conducted by Miravitlles et al. (2016) argued that enhancing the treatment guideline of this disease is one of the factor that can be used to improve the quality of care given to patients with COPD. Using prescription medications, there are different guidelines for the COPD management in all the European and Russian countries although the level of concordance and the variation in the approach is not quite comprehensible. In order to fill this gap, a systematic review of COPD treatment guidelines from Europe and Russia, published within the last 7 years was done. Every guideline was analyzed to the provisions that referred to patient diagnosis, risk assessment, and pharmacotherapy. The information to these areas was obtained in a standardized procedure. There were the guidelines from the Czech Republic, England and Wales, Finland, France, Germany, Italy, Poland, Portugal, Russia, Spain, and Sweden incorporated into the analysis.

The results showed that research highlighted overall targets of the treatment are the same both in European and Russian guidelines as well as diagnostic criteria for COPD or the importance of long-acting bronchodilators in the management of COPD. However, differences were observed in details concerning steps to assess the severity of the disease, managing patient phenotypes for instance, eosinophilic COPD- the prescription of inhaled corticosteroids and other drugs including theophylline and mucolytic (Karim et al., 2024; Miravitlles et al., 2016).

In a research study concluded by Cooper and Barjaktarevic (2015) about the new algorithm for the management of COPD and GOLD (2011) update added complexity to COPD treatment guidelines. A revised clinical staging system, focusing on clinical features rather than strict spirometric measures, is proposed. Preventive measures like smoking cessation and environmental avoidance are crucial. Bronchodilators are generally not needed. As-needed short-acting bronchodilators can be used for occasional breathlessness or wheezing. The GOLD update 2011 was characterised by a more differentiated approach to COPD treatment. Unlike the prior guidelines that used spirometry results in staging the disease, clinical characteristics are used in the current guidelines to this end. It is getting common to distinguish the patients into stages with reference to symptoms and risk factors (Roque, Taborda-Barata, Cruz, Viegi, & Maricoto, 2023). For the people belonging to stage zero, who are asymptomatic but are at high risk of developing COPD, the strategies that should be undertaken are precautionary measures such as smoking cessation and staying away from toxic substances. Mechanodilators are, however, not required at this stage. Patients in Stage 1 for which breathlessness or wheezing is occasional can take short-acting bronchodilators in those situations only (Roque et al., 2023).

A study conducted by Singh (2021) the author focused on the development of the pharmacological management of COPD with an emphasis on individualised therapy. It also reviewed the scientific literature supporting the present day treatments and presents some of the issues that are still contentious. EMR-derived biomarkers including blood eosinophil counts when taken together with other hallmarks of precision medicine can help improve treatment of stable COPD patients by aligning intervention with the patient's needs (Karim et al., 2024;).

Although there is a general consensus regarding the principles of managing COPD, the differences noted in the individual recommendations confirm the current continuous efforts aiming at achieving better concordance between the official guidelines and the clinical practice. This way, it will be possible to address the existing disparities and ensure that healthcare providers serving the needs of patients with COPD use the best evidence-based guidelines in order to enhance the quality of care as well as general outcome.

A comparison of published European and Russian COPD treatment guidelines suggests that existing guidance should be made more clearer and more consistent. Despite consensus at certain primary concepts, differences are present at the guidelines' details, where the disease staging and the preferred medication regiment differ, as well as the definitions of patient sub-groups. Some of the recent studies carried out in COPD aim at improving the management of this condition. GOLD updated again in 2011; this provided a clinical staging system focusing on symptoms and risk factors rather than spirometry data. For patients in stage ZERO, which are high risk patients, avoidance measures are advised and in stage ONE short acting bronchodilators may be required occasionally.

Precision medicine, as well as biomarkers are also in the process of an application, such as blood eosinophils' count. By doing so, one may be able to give suits of treatments targeted at specific patient, which in turn can lead to better results. These ongoing process are imperative to avoid the existing gap between the guidelines and clinical practice. Thus, the reduction of the gaps in the severity of COPD and the encouragement of the proper methods' use can contribute to improving COPD patients' care.

2.3 COPD in Developing Countries

The research related to COPD in developing countries showed very interesting results. To look in the deep in every country is such a long task and would be hectic. Therefore, researcher chose meta-analysis studies to look deeper in shorter period of time and cover more studies.

A meta-analysis was formulated by Njoku, Hurst, Kinsman, Balogun, and Obamiro (2023), in which thirteen studies conducted in developing countries and argued that there was wide variation in the reported prevalence of COPD in different studies based on the diagnostic criteria adopted by Global Initiative for Chronic Obstructive Lung Disease (GOLD), American Thoracic Society/ European Respiratory Society (ATS/ERS), and Medical Research Council (MRC) chronic bronchitis. Several risk factors that were noted consistently in the published studies as per the studies conducted through both methods which include; increased age, wheezing, and asthma (Karim et al., 2024).

Furthermore, meta-analysis also identified tuberculosis in the past, smoking and biomass fuel utilization as important predictors for COPD. Concerning the readmissions and hospitalizations long-term oxygen and hospitalisations of three or more within one year were found as the predictors of 30 days COPD readmissions. This review underscored the significant morbidity associated with COPD in the African population and how the prevalence rate may differ based on diagnostic methodology. Tobacco smoking, using biomass fuel and having had tuberculosis are some of the risk factors associated with the COPD in the region. In the case of high levels of hospitalization and readmission, it is imperative to seek the best ways of preventing further episodes among patients.

Another meta-analysis in south Asian countries was conducted by Varmaghani et al. (2019), in which they concluded that too systematically and comprehensively analyse the distribution of COPD on a geographical level, age and smoking habits of the patient. Electronic databases used were Medline and the search was conducted using MOOOSE guidelines and restricted to fully published articles from January 2004 to May 2015. The sources of bias contemplated in the reports included in the present analysis were minimised by assessing the quality of the studies. In the meta-analysis of the current study, both authors contributed data from 60 trials of 127,598 patients. Using the COPD burden for the year, the global prevalence of COPD was estimated to be 12%. Based on post-bronchodilator criteria the efficacy was reported as 16%. A further discovered observation was the fact that the probability of coming down with the disease was higher among men. Reduced the sperm concentration and its count to that of women 9. 93%.

When examining the variable of the Regional disparity, the Region of the Americas reported the highest incidences of COPD, 14. 53% and the South East Asia Region/Western Pacific Region had the least incidence of 8. 80%. To identify depression and anxiety in COPD, as parts of meta-regression contributors to heterogeneity, the following was done. After that, attributes such as play the WHO region, type of study, possible techniques of data compilation, year of publication, and simple or purposive sampling constituted an added 29. That is why fixing what caused 82% of the observed heterogeneity could potentially become the revolution in medicine. This review brought out the fact that COPD is a global public health issue that affects more males than the female. It is a regional disease with the Region of the Americas bearing the highest prevalence rate. The results indicate the importance of

intervention and prevention at the population level with regards to the population's heterogeneity.

2.4 COPD in Pakistan

Major key findings from previous studies includes limited epidemiological data on COPD prevalence in Pakistan, higher prevalence rates reported in urban areas and need for comprehensive population-based studies to accurately estimate COPD burden.

In Pakistan, a number of risk factors, such as genetic predisposition, indoor air pollution, occupational exposures, and tobacco use, contribute to the development of COPD. One of the main risk factors is tobacco use, which is highly prevalent in the nation. Dusts and fumes from the workplace are considered occupational exposures, especially in the industrial sectors. The use of biomass fuels for heating and cooking is one cause of indoor air pollution. Certain genetic factors may increase a person's susceptibility to COPD in cases of genetic predisposition.

Notwithstanding the rising incidence of COPD, Pakistan's medical community and professionals face a number of obstacles in managing the condition. One of the biggest obstacles to patients receiving specialized respiratory care, particularly in rural areas, is limited access to healthcare. Low public knowledge of COPD is another factor contributing to delayed diagnosis and inadequate treatment of the condition. One of the most common issues with managing COPD is noncompliance with prescription drug regimens (Pasaha et al., 2023). Another factor contributing to the mishandling of COPD is the public's limited access to and affordability of necessary COPD medications available over the counter.

Research has demonstrated how crucial it is to diagnose COPD early, conduct an accurate assessment, and follow treatment recommendations in order to improve the disease's prognosis. Still, there is still variation in how these practices are applied in Pakistan. The guidelines for the Global Initiative for Chronic Obstructive Lung Disease (GOLD) offer a thorough framework for managing COPD. Although these recommendations are widely acknowledged worldwide, Pakistan implements them in different ways (Kanwal et al., 2024). Research has demonstrated that adherence to GOLD guidelines is frequently not at its best because of a number of issues, such as healthcare providers' ignorance of the guidelines, a lack of resources, and obstacles related to patients.

Pakistan has been found to have understudied COPD (Kanwal et al., 2024; Pasaha et al., 2023), and prior research has revealed a number of important gaps. To help determine these parameters of the frequency of COPD within the Pakistani population, epidemiological studies were therefore required. It was also critical to understand the particular risk factors that Pakistani population carries that lead to COPD and serve as the cornerstone of COPD prevention. Knowledge on the process through which COPD patients seek out health care probably would have helped in policy formation on how to address timely management of the disease among such patients. Moreover, since current treatment approaches were still in practice, the efficacy of these practices had to be assessed for the improvement of patients' outcomes. Last, examining the economic impact of COPD along the patients and the overall healthcare system might have given direction for the policy makers and the resource management.

2.5 Healthcare System and COPD Management in Pakistan

Current status and future perspectives of chronic obstructive pulmonary disease (COPD) management in Pakistan: a review of the literature. Although children with liver disorders can present with similar symptoms of other illnesses, inadequate healthcare facilities make it difficult for such children to be diagnosed and treated accordingly especially in rural setting. There is poor equipment, technology, and capital investment, especially in primary healthcare centres to limit functional and central medical services such as oxygen, nebulizers, and other primary heath executive services (Husain et al., 2021). Also the financial factor and particularly the cultural barriers can prevent patients from receiving necessary health care and follow the recommended treatment plans.

Nevertheless, strategies are being made today to enhance the management of COPD in Pakistan. Ministry of Health's National Action Plan on Chronic Diseases has proposed plans to reduce the burden of this ailment of COPD. Efforts have been made to increase public awareness of the disease; there is also effort in training health care professionals in COPD diagnosis and treatment. The formation of an exclusive centre for respiratory diseases in big cities gives a ray of hope in this regard (Himani, Badini, & Nanji, 2018; Zeb, Younas, Ahmed, & Ali, 2021).

However, there are differences in the quality of COPD care between Pakistan's different regions. Enhancing the equilibrium of accessibility to higher-quality healthcare requires a multifaceted approach. Some strategies to improve patients' quality of life with COPD are: increasing awareness and visibility of the condition; expanding access to specialized healthcare; and addressing pre-existing factors that lead to increased social support and individual quality of life (Hassan, 2023; Khan et al., 2019; Zeb, Younas, Ahmed, & Ali, 2021).

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In Pakistan, COPD is a serious public health issue with little information on its management and prevalence. The evidence that is currently available emphasizes the difficulties in managing the illness, such as poor awareness, restricted access to healthcare, and inadequate adherence to recommended treatment plans. Increasing awareness, enhancing access to care, and putting evidence-based guidelines into practice are all necessary components of a comprehensive strategy to address these issues.

CHAPTER 3

METHODOLOGY

This chapter describes the methodology used in this study to effectively address the research objectives listed above. It includes the research design, participant selection standards, data collection tools, and analytical techniques used to look at pulmonologists' prescribing practices in connection to managing COPD Kearney & Salcedo (2021). A thorough comprehension of the methodology is necessary in order to assess the validity, reliability, and generalizability of the study results.

The purpose of this study is to ascertain how pulmonologists are currently treating COPD with pharmaceuticals. Particularly, the study will: (1) evaluate the prevalence of COPD (2) ascertain how closely pulmonologists follow GOLD guidelines; and (3) To determine the prevalence of COPD in selected sectors of Islamabad by using spirometry. This study aims to enhance the management of COPD by comprehending these aspects.

3.1 Study Area

The crippling respiratory ailment known as chronic obstructive pulmonary disease (COPD) has a significant global health care cost. For the purpose of managing and preventing COPD effectively, it is imperative to comprehend the prevalence and characteristics of the disease within particular populations. Pakistan's capital city Islamabad acts as a vital hub for this kind of study. Being a major city that draws people from all socioeconomic and geographic backgrounds, Islamabad provides a rare chance to research the COPD pandemic in a representative setting. With more

than 1.2 million residents came from different cities of Pakistan, the city is a reflection of the complex demographics of the country as a whole.

Since that Islamabad is Pakistan's federal capital, the results of this study could have a big impact on COPD management and prevention plans for the entire country as well as the city itself. Being the federal capital, Islamabad can help make these interventions more widely implemented and ultimately improve the lives of COPD patients all over Pakistan by sharing the study's findings with legislators and medical professionals around the country.

Figure 1

Selected Sectors of Islamabad

I-8 ,I-9, I-10, H-13, G-6, G-7, G-9, G-10, F-6, F-7, E-11
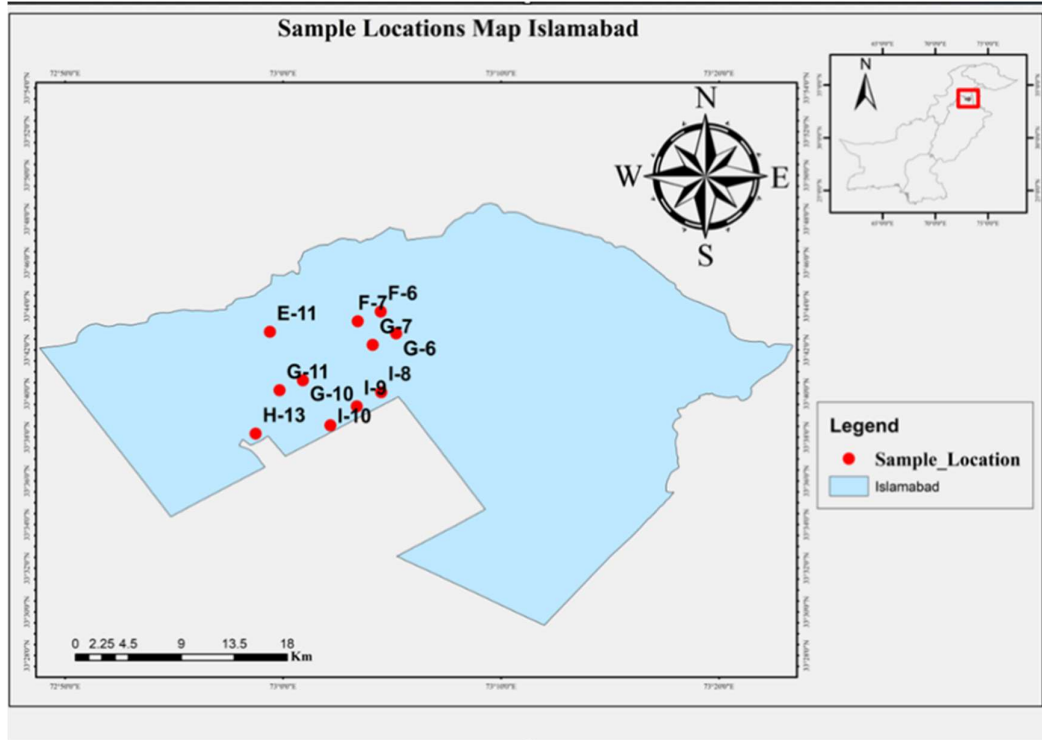
3.2 Study Design

Between January 1, 2024, and March 31, 2024, a cross-sectional observational study was conducted in selected sectors within Islamabad. The study's design included a thorough data collection procedure that included patient medical records and outpatient prescriptions. This method made it possible to capture a moment in time of the prescribing behaviours and patient attributes within the given period. Also spirometer and questionnaire based surveys were used to check the prevalence of COPD in the above mentioned sectors of Islamabad.

3.3 Unit Analysis

In order to guarantee the uniformity of the research population, particular standards for inclusion were devised. It was mandatory for the participants to have a pulmonologist's confirmed diagnosis of COPD, obtained after a thorough evaluation that included spirometry, a physical examination, and a clinical history. Furthermore, patients met the inclusion criteria if they had stable COPD, were 18 years of age or older, and fit into one of the ABCD risk groups according to the 2021 GOLD guidelines. On the other hand, the study was not open to patients who were hospitalized during the study period, people under 18 years old, patients without a confirmed diagnosis of COPD, patients whose medical records were incomplete (especially in terms of GOLD stage or group information), patients who were having acute exacerbations of their COPD, or patients who also had asthma.

3.4 Data Collection

A comprehensive strategy incorporating primary and secondary data was required to thoroughly examine the incidence and treatment of COPD in Islamabad. Primary data was gathered to learn specifics about the COPD patient population in the study location using original research methods such as spirometry, surveys, interviews, or examinations of medical records. This first-hand information offered current, comprehensive insights about Islamabad's COPD situation.

Conversely, secondary data consisted of pre-existing information from multiple sources, such as published literature, epidemiological studies, and government health records. Through the use of secondary data, the study was able to provide a more comprehensive framework for the research findings and pinpoint

pertinent trends and patterns in the prevalence and treatment of COPD on a national and international scale worldwide.

A thorough understanding of COPD in Islamabad is now possible thanks to the study's increased depth and dependability from the combination of primary and secondary data sources.

3.4.1 Primary Data

Based on the chronological order of their enrolment in the study, each participant was given a unique identification number. These people's age, sex, education, place of residence (city or rural), and smoking habits were among the many details the researchers gathered about them. Spirometry was used to evaluate lung function and classify participants according to the degree of airflow obstruction, from mild (GOLD Grade 1) to severe (GOLD Grade 4).

A combination of spirometric testing, standardised and mMRC questionnaire-based surveys were used to collect data for this study. Random sampling was used to select the study population, and participants were chosen from the selected sectors of Islamabad. Using these techniques and concentrating on these sectors, the study seeks to offer a general picture of the prevalence of COPD in the people of Islamabad.

Sample Size

A total of 275 participants were chosen at random from the specified sectors in Islamabad in order to guarantee a representative sample. 25 to 30 people from each sector chosen at random using a sampling technique, guaranteeing that the study

include both male and female participants. The goal of this strategy is to reduce selection bias while preserving the diversity of the population in the selected areas.

Primary Data Analysis:

Spirometry.

Tool Details

A handheld digital spirometer (SP10W, Contec) was used to measure forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and the FEV1/FVC ratio before and after bronchodilation in order to objectively assess pulmonary function. Strict quality control procedures were put in place to guarantee the precision and dependability of spirometry results. These procedures included routine calibration checks that followed American Thoracic Society guidelines. Ipratropium bromide (80 μg) and salbutamol (0.4 mg) were combined to cause bronchodilation.

Subjects were divided into various stages of COPD based on spirometry results, using the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria. The post-bronchodilator FEV1 and FVC values of greater than 80% of predicted are indicative of normal pulmonary function. Post-bronchodilator FEV1 and FVC values less than 80% of predicted but with a FEV1/FVC ratio greater than 0.7 are suggestive of restrictive lung disease. COPD-related obstructive lung disease is characterised by a post-bronchodilator FEV1 that is less than 80% of predicted and a decreased FVC. According to Sarwar et al. (2021), the severity of COPD was divided into four stages (GOLD 1-4) based on post-bronchodilator FEV1 values.

Pulmonary Symptom Assessment

A standardised questionnaire for identifying pulmonary symptoms were filled out by each study participant. The presence and severity of common respiratory symptoms, such as cough, phlegm production, and chest discomfort were thoroughly evaluated using questionnaire. The questions from mMRC questionnaire were also used for the assessment of COPD.

3.4.2 Secondary Data

The main source of information about COPD that is currently available was the Pakistan Institute of Medical Sciences (PIMS) database and some other hospitals of Islamabad. This data gave the study's background and important context.

b. Inclusion Criteria:

The time frame for which the data was gathered was five years, from 2019 to 2023. The data collected concerned the population's prevalence of COPD, the underlying risk factors that contribute to the illness, and the current approaches being used for management.

The patients' history of chronic respiratory failure, any current heart conditions (cardiovascular diseases), and whether this was their first visit or a follow-up appointment were among the other details that were obtained about them. The precise inhaled drugs prescribed for the management of COPD were also recorded. These drugs included inhaled corticosteroids and bronchodilators, which include both single and combination treatments (such as short- and long-acting beta agonists and anticholinergics).

c. Data Extraction:

To glean important details about the population's COPD prevalence rates, the gathered data was carefully examined. In order to find any possible correlations or differences in the occurrence of COPD, demographic factors like age, gender, and residential area (rural or urban) were taken into consideration. The data was also looked at in order to assess the management plans that are currently in place for Islamabad's COPD patients.

3.4.3 Secondary Data Analysis

a. Quantitative Analysis

A meta-analysis was carried out using statistical techniques to thoroughly examine the COPD prevalence data. This entailed combining data from several studies to determine the population's COPD prevalence with greater accuracy. Moreover, subgroup analyses based on age, gender, and urban or rural residency were carried out to investigate potential variations in COPD prevalence.

b. Exploratory Analysis

The purpose of the study was to look into any possible links between environmental variables and the development of COPD. Additionally, trends in patient outcomes were examined in order to evaluate the efficacy of different COPD management approaches.

i.   Explore the relationships between environmental variables and the incidence of COPD.

ii. Examine patterns in the efficacy of various management techniques.

3.5 Summary of methodology.

The purpose of the study was to learn how Islamabad's pulmonologists manage COPD. Between January and March 2024, a cross-sectional observational study was carried out, from which gathered information about patient medical records and outpatient prescriptions. Participants had to fulfil certain requirements in order to guarantee a representative sample, such as having a verified diagnosis of COPD, stable COPD, being 18 years of age or older, and being assigned to a GOLD risk group. Individuals under 18, with acute exacerbations, or without full medical records were not included.

In order to collect data, primary and secondary sources were used. Patient demographics, results from lung function tests, evaluations of symptoms, and drug information were all considered primary data. The Pakistan Institute of Medical Sciences (PIMS) database provided secondary data on the prevalence, risk factors, and management strategies of COPD. The data were examined using statistical techniques, such as exploratory analysis and meta-analysis.

CHAPTER 4

RESULTS AND DISCUSSIONS

The present study aimed to investigate the prescribing practices of pulmonologists in managing COPD patients within the context of the GOLD guidelines. By analysing a cohort of two hundred and seventy five (275) patients, this research sought to assess the alignment of treatment decisions with recommended guidelines, identify potential gaps in care, and explore factors influencing prescribing behaviour. These results underscore the complexity of COPD management and highlight the need for targeted interventions to optimize patient outcomes.

The conclusions of this work contribute meaningful scenario for the contemporary management of COPD among the pulmonologists practicing in Islamabad. Though there proof of compliance with certain aspects of the GOLD guidelines that are from time to time provided, areas of improvement in treatment practices exist. These differences of observed medication prescribing` and frequent under- and overtreatment call for further education and training of the professionals involved. The primary topics for future COPD research should include examination of patient related factors that can affect treatment outcomes, comparison of effects of various treatment modalities, and cost benefit analysis of COPD management. Thus, addressing these areas, it is possible to enhance the management of COPD and decrease the load of such chronic pathology.

4.1 Data Analysis

Initially, data collection was conducted, followed by an extensive data cleaning process utilizing Microsoft Excel software. This initial phase aimed to

prepare the data for subsequent transformation steps to another software tool for research analysis. This data set was subsequently transferred to IBM Statistical Package for Social Sciences Software V-25.0 for in-depth statistical analysis.

Descriptive statistics were employed to summarize the collected data. Quantitative variables were characterized by their median, mean, and standard deviation (SD), or by 95% confidence intervals (CIs) to indicate the precision of estimates. Qualitative variables were tabulated as corresponding percentages.

Inferential statistical analyses were conducted to identify significant differences between groups. The chi-squared test was utilized to compare categorical variables, while the independent samples t-test was applied to assess differences in means between two groups of normally distributed continuous variables. Statistical significance was defined as a p-value less than 0.05.

The investigation delved into the medical records of a cohort of 275 patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD). These individuals sought expert care from a panel of nine pulmonologists. A substantial number of potential participants, totalling 513, were excluded from the analysis due to incomplete or missing critical data. This included a lack of specific COPD stage or group classification, inconsistent smoking history records, and insufficient comprehensive disease history. It's important to note that even among the included patients, certain data gaps persisted.Table 7 provides complete information about these patients' records.

While the study relied on a retrospective review of medical records, contemporary tools such as the mMRC questionnaires were employed to classify

patients into the ABCD groups for COPD severity. A detailed overview of the patient population's characteristics is provided in tables below.

The average age of the study participants was 60 years old, with a notable age spread. Men comprised the majority of the cohort at 70.91%, while women accounted for the remaining 29.09%. All individuals were of Asian Pakistani descent, with a slightly higher proportion residing in urban areas (77%) compared to rural areas (23%).

A significant challenge encountered was the availability of complete smoking history data. Only just over half of the patients, specifically 230 individuals, had documented smoking habits. Furthermore, only 125 of these smokers had quantifiable smoking histories, measured in pack-years. The average smoking history for this group was substantial, at 52 pack-years, indicating a high level of exposure to tobacco.

These clinical and demographic specifics give us a basic understanding of the patient population and set the stage for our further investigations. Airflow restriction is a hallmark of Chronic Obstructive Pulmonary Disease (COPD), a progressive respiratory illness that has a major negative influence on patients' quality of life and places a heavy financial strain on healthcare systems. The purpose of this study is to conduct a thorough analysis of the management and prevalence of COPD among people living in Islamabad, Pakistan. Through the use of descriptive analysis, this study aims to clarify the clinical, therapeutic, and demographic features of the local COPD patient population. This will help to shed light on the disease burden and guide the development of focused interventions for prevention, early detection, and best management.

Table 1

Demographic Analysis

		Number	**Percent**
Gender	Male	195	70.91
	Female	80	29.09
Education	Below Intermediate	72	26.18182
	Intermediate	97	35.27273
	Graduation	69	25.09091
	Masters or above	37	13.45455

Source: Primary Data Collection

The above table 1 shows that there are more males (195) than females (80) in the collected data set. The percentages confirm this, with 70.91% of the observations being males and 29.09% being females. The cumulative percent column shows that 100% of the observations fall into one of the two categories ("Male" or "Female").

Table 2 also provides a breakdown of the educational levels of the study participants. The majority of participants (35.27%) had an intermediate level of education. A significant portion (26.18%) had below intermediate education, indicating a lower educational attainment. 25.09% of participants had completed graduation, while 13.45% had a Masters or higher degree. The data suggests a relatively balanced distribution of educational levels among the study population.

Table 2

Smoking History Analysis

Smoking History	Number	Percent
Smoking	152	55.27273
Quit Smoking	78	28.36364
No Smoking	45	16.36364
Total	**275**	**100**

Source: Primary Data Collection

The table 2 shows the smoking history analysis for a population. It has four categories: Smoking, Quit Smoking, No Smoking, and Total. Smoking category includes individuals who currently smoke. The table shows that 152 (55.27%) of the population falls into this category. The other category is Quit Smoking category: This category includes individuals who used to smoke but have quit. The table shows that 78 (28.36%) of the population falls into this category. The last category is No Smoking: This category includes individuals who have never smoked. The table shows that 45 (16.36%) of the population falls into this category. This category represents the entire population studied. The table shows that there is a total of 275 individuals.

The table 3 provides a breakdown of the smoking history of the population being studied. The majority of the population (55.27%) smokes, while a significant portion (28.36%) has quit smoking. A smaller proportion (16.36%) has never smoked.

Table 3

Spiro metric GOLD grade Analysis

Spiro metric GOLD grade	Number	Percent
GOLD 1	65	23.63636
GOLD 2	84	30.54545
GOLD 3	59	21.45455
GOLD 4	67	24.36364
Total	**275**	**100**

Source: Primary Data Collection

This table provides a statistical summary of spirometry results categorized by GOLD (Global Initiative for Obstructive Lung Disease) grades. Spirometry is a test that measures lung function, and GOLD grades classify the severity of Chronic Obstructive Pulmonary Disease (COPD). This table lists the different GOLD stages (1, 2, 3, and 4), which represent increasing severity of COPD. This table indicates the number of patients who fall into each GOLD category. This table shows the percentage of patients within each GOLD grade relative to the total number of patients. This table represents the accumulated percentage of patients starting from GOLD 1 and progressing through each subsequent GOLD grade. A total of 275 patients were included in this analysis. The most common GOLD grade is GOLD 2, accounting for 30.55% of the patients. The distribution of patients across the GOLD grades provides insights into the overall severity of COPD within this patient group. A higher proportion of patients in GOLD 3 and 4 would indicate a more severe patient population. The table 5 offers a numerical overview of COPD severity based on spirometry results.

Table 4

GOLD group Analysis

GOLD group	Number	Percent
GRADE A	59	21.45455
GRADE B	93	33.81818
GRADE C	64	23.27273
GRADE D	59	21.45455
Total	**275**	**100**

Source: Primary Data Collection

Table 4 presents a breakdown of the performance of the GOLD group, categorized by grade levels A, B, C, and D. The group consists of a total of 275 members. Grade A: 21.45% of the group, which equates to 59 members, achieved Grade A. Grade B: The largest segment of the group, with 33.82% or 93 members falling into Grade B. Grade C: 23.27% of the members, totalling 64 individuals, secured Grade C. Grade D: The remaining 21.45% (59 members) obtained Grade D. Percentage: This column shows the progressive accumulation of percentages as we move down the grade levels. For instance, combining Grades A and B gives us a cumulative percentage of 55.27%. The table indicates that the GOLD group has a relatively balanced performance across the different grade levels, with no single grade dominating the distribution. The majority of members fall within Grades B and C.

Table 5

Cardiovascular co-morbidity Analysis

Cardiovascular co-morbidity	Number	Percent
Yes	124	45.09091
No	151	54.90909
Total	**275**	**100.0**

Source: Primary Data Collection

Table 5 presents data on the prevalence of cardiovascular co-morbidity among a group of 275 individuals. Cardiovascular co-morbidity: This column indicates whether or not an individual has a pre-existing cardiovascular condition. Number: This column shows the number of individuals who fall into each category (Yes or No). Percent: This column represents the percentage of individuals in each category out of the total sample. Cumulative Percent: This column shows the running total of percentages, starting from the first category. The table reveals that 45.09% of the study participants have a history of cardiovascular disease (indicated by "Yes" in the cardiovascular co-morbidity column). 54.91% of the participants do not have a history of cardiovascular disease (indicated by "No"). The table provides a clear overview of the distribution of cardiovascular co-morbidity within the studied population.

Table 6

Treatment algorithm according to the GOLD guidelines 2021

Group	Appropriateness		Inappropriateness	
	First Choice	**Alternative Choice**	**Under-treatment**	**Over-treatment**
A	A bronchodilator	change the bronchodilator	No bronchodilator prescribed	LABA+ LAMA, ICS or any combination treatment
B	LAMA or LABA	LAMA + LABA	Only short-acting bronchodilator	LAMA ICS, ICS + LABA ICS + LAMA
C	LAMA	LAMA + LABA or ICS + LABA	only ICS or LABA or SABA	ICS + LAMA ICS + LABA+ LAMA
D	LAMA + LABA or ICS + LABA or LAMA	If still exacerbation resent ICS + LABA+LAMA	only ICS or SABA or LABA, ICS + LAMA	-

Table 7-18 represents the data provided by the hospital's database based on the treatments given to COPD patients.

Table 7

Medications for COPD management based on GRADE A classification

				GOLD CLASIFICATION GRADE A					
				COPD medication regimens					
	SABA	**LABA**	**LAMA**	**LAMA + LABA**	**ICS**	**LAMA + ICS**	**LABA + ICS**	**LAMA + LABA + ICS**	**TOTAL**
N	4	21	18	9	0	0	7	0	**59**
%	6.78	35.59	30.51	15.25	0	0	11.86	0	**100**

Table 7 presents data of patients on medication usage for Chronic Obstructive Pulmonary Disease (COPD) management, categorized by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) classification and based on GRADE A recommendations.This data was extracted from the hospitals data base. The table shows that out of 59 patients, the most commonly prescribed medication class was Long-Acting Beta-Agonists (LABA), accounting for 35.59% of prescriptions. Following closely behind were Long-Acting Muscarinic Antagonists (LAMA) at 30.51%. A significant portion (15.25%) received a combination of LAMA and LABA.

Short-Acting Beta-Agonists (SABA) were used less frequently, comprising only 6.78% of prescriptions. Interestingly, no patients were prescribed Inhaled Corticosteroids (ICS) alone or in combination with LAMA or LABA + LAMA. However, a combination of LABA and ICS was used in 11.86% of cases. These findings suggest that LABA and LAMA, either alone or in combination, are the

primary stays of COPD management based on GRADE A recommendations within this specific patient population. The absence of ICS-based treatments might indicate a specific patient selection criteria or treatment protocol followed in this study.

Table 8

Medications for COPD management based on GRADE B classification

	SABA	LABA	LAMA	LAMA + LABA	ICS	LAMA + ICS	LABA + ICS	LAMA + LABA + ICS	TOTAL
GOLD CLASIFICATION GRADE B									
COPD medication regimens									
N	10	31	17	23	5	0	7	0	**93**
%	10.75	33.33	18.28	24.73	5.38	0	7.53	0	**100**

Table 8 presents data on medication usage for Chronic Obstructive Pulmonary Disease (COPD) management, categorized by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) classification and based on GRADE B recommendations. Unlike Table 8, which focused on GRADE A recommendations, Table 9 shows a broader range of medication usage among 93 patients. The most commonly prescribed medication class was Long-Acting Beta-Agonists (LABA), accounting for 33.33% of prescriptions. This is followed by Long-Acting Muscarinic Antagonists (LAMA) and LAMA + LABA combinations at 18.28% and 24.73%, respectively.

Short-Acting Beta-Agonists (SABA) were used in 10.75% of patients, indicating their role in managing acute symptoms. Inhaled Corticosteroids (ICS) were prescribed to a smaller proportion (5.38%) of patients, either alone or in combination with LABA. This table suggests a more varied approach to COPD management

compared to the GRADE A group, with a higher utilization of ICS-based therapies. However, the absence of LAMA + ICS combinations is noteworthy.

Table 9

Medications for COPD management based on GRADE C classification

	SABA	LABA	LAMA	LAMA + LABA	ICS	LAMA + ICS	LABA + ICS	LAMA + LABA + ICS	TOTAL
GOLD CLASIFICATION GRADE C									
COPD medication regimens									
N	0	8	9	14	0	13	13	7	**64**
%	0	12.5	14.06	21.88	0	20.31	20.31	10.94	**100**

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) GRADE C category is used to categories 64 patients with Chronic Obstructive Pulmonary Disease (COPD). Table 9 shows the medication usage for COPD management among these patients. This group does not use any Short-Acting Beta-Agonists (SABA), in contrast to the preceding tables. Long-Acting Muscarinic Antagonists (LAMA) and LAMA + LABA combinations were the most prescribed drugs, making up 20.31% of the total. A considerable percentage of patients also received Long-Acting Beta-Agonists (LABA) and LABA + ICS combinations, at 12.5% and 20.31%, respectively.

The information provided here points to a more sophisticated course of care for COPD patients in the GRADE C category. The lack of SABAs suggests a reduced dependence on rescue drugs when necessary, which could indicate a more advanced stage of the illness. The frequent application of LAMA-based treatments alone or in

combination emphasizes their usefulness in helping this patient population manage their symptoms and lessen exacerbations.

Table 10

Medications for COPD management based on GRADE D classification

	GOLD CLASIFICATION GRADE D								
	COPD medication regimens								
	SABA	**LABA**	**LAMA**	**LAMA + LABA**	**ICS**	**LAMA + ICS**	**LABA + ICS**	**LAMA + LABA + ICS**	**TOTAL**
N	0	4	7	5	0	11	14	18	**59**
%	0	6.78	11.86	8.47	0	18.64	23.73	30.51	**100**

Table 10 suggests that the Global Initiative for Chronic Obstructive Lung Disease (GOLD) GRADE D classification of patients with Chronic Obstructive Pulmonary Disease (COPD) is used to describe the medication usage patterns of these patients. 59 patients make up this group, and they have a different medication profile than the other GRADE categories. One striking feature is the total lack of Short-Acting Beta-Agonists (SABA), suggesting a serious illness state and possibly a lifelong requirement for bronchodilation. LAMA + LABA + ICS combination prescriptions make up 30.51% of all prescriptions, making it the most commonly prescribed medication class. This suggests an aggressive treatment approach to manage severe symptoms and reduce exacerbations.

LAMA + ICS combinations were also widely used (18.64%), emphasizing the importance of inhaled corticosteroids in managing inflammation associated with advanced COPD. While LAMA and LABA were prescribed to a certain extent (11.86% and 6.78%, respectively), their use appears less prominent compared to

combination therapies. This data underscores the complexity of managing COPD in patients with severe disease progression. The predominance of combination therapies highlights the need for a multi-faceted approach targeting bronchodilation, inflammation, and mucus secretion.

Table 11

Medications for COPD management based on ABCD classification.

| | | GOLD CLASIFICATION | | | | | | | | TOTAL | |
| | | GRADE A | | GRADE B | | GRADE C | | GRADE D | | | |
		N (A)	%	N (B)	%	N (C)	%	N (D	%	N	%
COPD medication regimens	**SABA**	4	6.78	10	10.75	0	0	0	0	14	5.09
	LABA	21	35.59	31	33.33	8	12.5	4	6.78	64	23.27
	LAMA	18	30.51	17	18.28	9	14.06	7	11.86	51	18.55
	LAMA + LABA	9	15.25	23	24.73	14	21.88	5	8.47	51	18.55
	ICS	0	0	5	5.38	0	0	0	0	5	1.82
	LAMA + ICS	0	0	0	0	13	20.31	11	18.64	24	8.73
	LABA + ICS	7	11.86	7	7.53	13	20.31	14	23.73	41	14.91
	LAMA + LABA + ICS	0	0	0	0	7	10.94	18	30.51	25	9.09
		59	100	93	100	64	100	59	100	275	100

This table 11 presents data on medication usage for patients with Chronic Obstructive Pulmonary Disease (COPD) categorized based on the GOLD classification (A, B, C, and D). The classification likely corresponds to increasing severity of COPD.

The table is organized with rows with different types of COPD medications (SABA, LABA, LAMA, and ICS). GOLD classification (GOLD A, GOLD B, GOLD C, and GOLD D) and total number of patients (N) using the specific medication in each GOLD category. Percentage (%) of patients using the specific medication in each GOLD category.

Short-Acting Beta-2 Agonist (SABA) primarily used in Grade A patients (mild COPD), with minimal to no use in other grades. LABA (Long-Acting Beta-2 Agonist) widely used across all GOLD categories, with a higher prevalence in Grades B and C. Long-Acting Muscarinic Antagonist (LAMA) another commonly used medication across all grades, with a slightly higher prevalence in Grades B and C. LAMA + LABA: A combination therapy used across all grades, with a relatively balanced distribution. ICS (Inhaled Corticosteroids): Primarily used in Grades C and D (moderate to severe COPD), with minimal to no use in milder cases. LAMA + ICS and LABA + ICS: Combination therapies mainly used in Grades C and D. LAMA + LABA + ICS: Primarily used in Grade D (severe COPD).

Based on disease severity, different treatment approaches for COPD may be used, according to the data. While LABA and LAMA are more frequently used in moderate cases (Grades B and C), SABA is primarily used in milder cases (Grade A) for immediate relief. LAMA, LABA, and ICS are frequently needed in complex combination therapies for severe COPD (Grade D).

This suggests that although more than 50% of the patients were taking their prescribed medications, almost 50% were not. The effectiveness of the recommended treatments differed markedly between the various stages of COPD, as determined by the ABCD classification system, the researchers found. This implies that the degree of a patient's illness may determine whether a specific medication is appropriate. These variations are probably best illustrated visually in Table 1, which displays the variations in the rates of appropriate and inappropriate medication use amongst the ABCD groups.

Use of SABA in all grade levels: SABA (Short-Acting Beta-Agonists) was included in all four tables (GRADE A to GRADE D) to provide immediate symptom relief for COPD. Using LABA to achieve long-term bronchodilation LABA (Long-Acting Beta-Agonists) was included in every table for long-term bronchodilation.

Table 12

Differences in Medication Use Based on Frequency

GRADE	Most Frequent Medications	Less Frequent Medications	Not Used Medications
GRADE A	LABA (35.59%), LAMA (30.51%)	SABA (6.78%), LABA + ICS (11.86%)	ICS alone, LAMA + ICS, LABA + LAMA + ICS
GRADE B	LABA (33.33%)	SABA (10.75%), LAMA (18.28%), LAMA + LABA (24.73%), ICS (5.38%), LABA + ICS (7.53%)	LAMA + ICS, LAMA + LABA + ICS
GRADE C	LAMA (20.31%), LAMA + LABA (20.31%)	LABA (12.5%), LABA + ICS (20.31%)	SABA, ICS alone, LAMA + ICS
GRADE D	LAMA + LABA + ICS (30.51%)	LAMA + ICS (18.64%), LAMA (11.86%), LABA (6.78%)	SABA, ICS alone

The tables reveal a general trend towards more complex medication regimens as COPD disease severity increases (GRADE A to D). Most Frequent Medications in GRADE A is LABA (Long-Acting Beta-Agonists), which shows that 35.59% of patients in this group receive LABA and on the other hand 30.51% of patients use LAMA. Less frequent medications which patients receive is SABA (Short-Acting Beta-Agonists): Only 6.78% of patients rely on SABA. LABA and ICS (Inhaled Corticosteroids) both treatment receives 11.86% of patients combine LABA with ICS. No patients in this group use ICS alone. Similarly, no patients receive LAMA + ICS. None of the patients are on this combination.

In GRADE B, most frequent medication was LABA. 33.33% of patients in this group primarily use LABA and on the other hand less frequent medications used was SABA. Only 10.75% of patients occasionally use SABA. 18.28% of patients

receive LAMA, 24.73% of patients combine LAMA with LABA, 5.38% of patients use ICS, and 7.53% of patients combine LABA with ICS. No patients in this group receive LAMA with ICS. Similarly, none of the patients use this triple combination of LAMA, LABA, and ICS.

In GRADE C, most frequent medication was LAMA, 20.31% of patients rely on LAMA. An almost equal proportion (20.31%) use LAMA with LABA. On the other hand, less frequent medications was LABA, 12.5% of patients occasionally use LABA and 20.31% combine LABA with ICS. No patients in this group use SABA and no patients receive ICS alone. None of the patients are on the combination of LAMA and ICS.

In GRADE D, most frequent medication used was LAMA, LABA with ICS, 30.51% of patients in this group receive this triple combination. Less frequent medications was LAMA with ICS, 18.64% of patients combine LAMA with ICS. 11.86% of patients use LAMA and 6.78% of patients occasionally use LABA. No patients in this group use SABA. Similarly, no patients receive ICS alone.

Table 13

Distribution of under- and over-treatment in ABCD groups with inappropriate therapy

		Treatment		Inappropriate Treatment
		Under treatment	Over Treatment	
GOLD	GRADE A	4	27	31
	GRADE B	21	19	40
Classification	GRADE C	7	19	26
	GRADE D	9	2	11
Total		**41**	**67**	**108**

The Table 13 presents a breakdown of under-treatment and over-treatment among patients receiving inappropriate therapy for COPD, categorized by GOLD classification (A, B, C, and D). A total of 108 patients were identified with inappropriate treatment. Of these, 41 patients were undertreated and 67 were over treated. The highest number of patients with inappropriate treatment was found in the GRADE B group (40 patients), followed by GRADE C (26 patients), GRADE A (31 patients), and GRADE D (11 patients).

Within each GOLD classification, the distribution of under- and over-treatment varied. GRADE A and GRADE C had a higher proportion of over treated patients compared to undertreated patients. Conversely, GRADE B had a relatively equal distribution of under- and overtreatment. Interestingly, GRADE D showed a significantly higher number of undertreated patients compared to over treated

patients. These findings indicate that the pattern of inappropriate treatment differs across the severity of COPD as defined by GOLD classification. Further analysis is required to understand the underlying reasons for these disparities. The collected data suggests that overtreatment is a more common issue across all GOLD classifications in the area under study when considering inappropriate therapy for COPD management. However, the distribution of under- and overtreatment varies significantly between the different GOLD stages.

Table 14

Comparison of treatment in Gender

Gender	Appropriate	In Appropriate	t-stat (X^2)	P-Value
Male	98	59	4.21	.031
Female	69	49		
Total	**167**	**108**		

Table 14 presents a comparison of treatment appropriateness between male and female patients. A total of 167 patients received appropriate treatment, while 108 received inappropriate treatment. 98 males received appropriate treatment, while 59 received inappropriate treatment. 69 females received appropriate treatment, and 49 received inappropriate treatment.

A statistical test (chi-square) was conducted to determine if there was a significant difference in treatment appropriateness between genders. The results indicate a statistically significant difference (p-value = 0.031) between male and

female patients in terms of treatment appropriateness. This suggests that gender may be a factor influencing the likelihood of receiving appropriate treatment.

Table 15

Comparison of treatment in Area Residency

Area	Appropriate	In Appropriate	t-stat (X^2)	P-Value
Urban	112	72	2.16	.050
Rural	52	36		
Total	**167**	**108**		

Table 15 presents a comparison of treatment appropriateness based on area of residency (urban and rural). A total of 167 patients received appropriate treatment, while 108 received inappropriate treatment. 112 individuals residing in urban areas received appropriate treatment, while 72 received inappropriate treatment. 52 individuals residing in rural areas received appropriate treatment, and 36 received inappropriate treatment.

A statistical test (chi-square) was conducted to determine if there was a significant difference in treatment appropriateness between urban and rural areas. The results indicate a p-value of 0.050, which is very close to the conventional significance level of 0.05. While this suggests a possible difference in treatment appropriateness between the two areas, the result is not statistically significant. Further research with a larger sample size might be needed to draw a definitive conclusion.

Table 16

Comparison of treatment in cardiovascular co-morbidity

Cardiovascular co-morbidity	Appropriate	In Appropriate	t-stat (X^2)	P-Value
Yes	69	69	1.72	.028
No	98	39		
Total	**167**	**108**		

      Table 16 examines the relationship between cardiovascular co-morbidity and treatment appropriateness. Out of a total of 167 patients who received appropriate treatment, 69 had cardiovascular co-morbidities, while 98 did not. Conversely, among the 108 patients with inappropriate treatment, 69 had cardiovascular co-morbidities and 39 did not.

      A statistical test (chi-square) was conducted to determine if there was a significant difference in treatment appropriateness between patients with and without cardiovascular co-morbidity. The results indicate a statistically significant difference (p-value = 0.028), suggesting that patients with cardiovascular co-morbidities are more likely to receive inappropriate treatment compared to those without.

Table 17

Comparison of Group A and Group B vs Group C and Group D

Odd Ratio	CI	Range	X^2
1.125	95%	.6247 – 1.994	.54

Table 17 presents a comparison between two groups: Group A and Group B combined versus Group C and Group D combined. The value of odd ratio (OR) value indicates the likelihood of an event occurring in one group compared to the other. In this case, the OR is 1.125, suggesting a very slight increase in the likelihood of something happening in Groups A and B compared to Groups C and D. However, this difference is likely not significant. This range indicates the reliability of the OR. A 95% CI means that there is a 95% chance that the true value of the OR falls within this range. In this case, the range is .6247 to 1.994. Since this range includes 1, it further supports the idea that there is no significant difference between the two groups. X^2 (Chi-square) is a statistical test used to determine if there is a significant difference between the observed and expected frequencies. A low value, like .54 in this case, typically indicates no significant difference.

Based on the information in Table 18, there is no statistically significant difference between the combined groups of A and B compared to the combined groups of C and D. The odds ratio is very close to 1, and the confidence interval includes 1, supporting this conclusion. Additionally, the low chi-square value further reinforces the idea of no significant difference.

Table 18

Cardiovascular comorbidities with and without appropriateness

Odd Ratio	CI	Range	X^2
0.423	95%	.301 – .798	.54

Table 18 compares individuals with cardiovascular comorbidities to those without, in relation to a specific outcome (likely "appropriateness"). Odd Ratio value is 0.423, indicating that individuals with cardiovascular comorbidities are less likely to have the outcome of interest (appropriateness) compared to those without cardiovascular comorbidities. Confidence Interval (CI) 95% is between .301 and .798. Since this range does not include 1, we can say with 95% confidence that there is a statistically significant difference between the two groups.

Chi-square (X^2) value of .54 suggests no significant difference between the observed and expected frequencies. However, it's important to note that the chi-square test might not be the most appropriate test for this type of data. Odds ratios are generally used for this kind of comparison.

Chronic Obstructive Pulmonary Disease (COPD) is a prevalent respiratory condition that requires tailored treatment strategies. In this study, we analyzed patient data to understand treatment adherence, demographics, and co-morbidities. The GOLD guidelines recommend specific treatments for different COPD groups. Bronchodilators are the first choice, but over-treatment with LABA + LAMA or ICS combinations occurs. LAMA or LABA is appropriate, but some receive LAMA + LABA. LAMA alone or LAMA + LABA/ICS is recommended, but some receive

only ICS or LABA. LAMA + LABA/ICS or LABA + ICS/LAMA is appropriate, but some receive only ICS or SABA.

In the demographics portion, 70.91% of patients are male, and 29.09% are female and urban residents constitute 77.09%, while rural residents make up 22.91%. In the smoking history, 55.27% are current smokers, 28.36% have quit smoking, and 16.36% never smoked. In the Spiro metric GOLD Grade, GOLD 2 (moderate) is the most common grade (30.55%), followed by GOLD 1 (23.64%). Most patients fall into Group B (33.82%) or Group C (23.27%). 45.09% of patients have cardiovascular co-morbidities.

In the GRADE A, LABA and LAMA are common. In the GRADE B, Balanced use of LABA, LAMA, and LAMA + LABA. In the GRADE C, LAMA and LAMA + LABA are prominent and in the GRADE D, LAMA + LABA and LAMA + ICS are frequent. Treatment adherence varies, and some patients receive inappropriate medications. Individualized management based on patient characteristics is crucial for optimizing COPD care.

Figure 2

Patterns of pulmonary function impairment
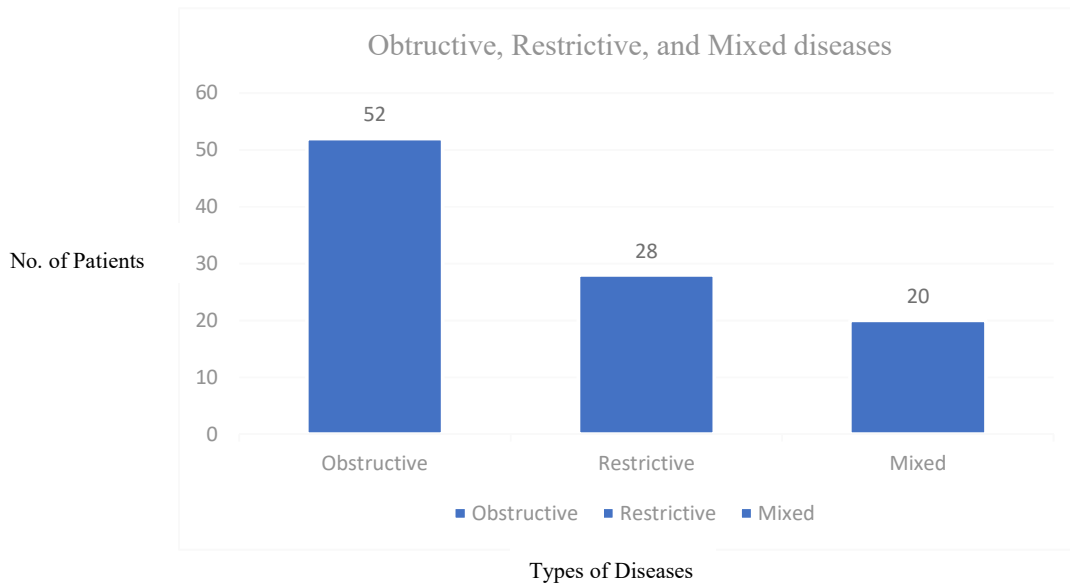
The bar graph that illustrates the distribution of three categories related to pulmonary diseases. Mixed pulmonary disease refers to conditions where patients exhibit characteristics of both obstructive and restrictive lung diseases. This category accounts for the majority of the cases in the chart, indicating a significant prevalence of mixed disease patterns.

Restrictive pulmonary disease is characterized by reduced lung volume, making it difficult for the lungs to expand fully. This segment represents a substantial portion of the cases, highlighting the importance of addressing restrictive lung conditions in the population. Obstructive pulmonary disease, such as COPD, involves airflow obstruction, making it hard to exhale completely. Although this is the smallest segment, it still represents a significant number of cases that require attention and management.

The bar graph visually demonstrates that mixed pulmonary disease is the most prevalent, followed by restrictive and obstructive pulmonary diseases. This distribution underscores the need for comprehensive diagnostic and treatment strategies that address the complexities of mixed disease patterns, as well as the specific challenges posed by restrictive and obstructive conditions.

Table 19

Overview of Obstructive Diseases

Aspect	Data
Prevalence	2.1% in adults aged >40 years
Gender Distribution	Male: 70.91%, Female: 29.09%
Smoking History	Current Smokers: 55.27%, Quit Smoking: 28.36%, Non-Smokers: 16.36%
Common Comorbidities	Cardiovascular Diseases: 45.09%, No Cardiovascular Diseases: 54.91%
Spirometric GOLD Grades	GOLD 1: 23.64%, GOLD 2: 30.55%, GOLD 3: 21.45%, GOLD 4: 24.36%
GOLD Groups	Group A: 21.45%, Group B: 33.82%, Group C: 23.27%, Group D: 21.45%
Mortality Rate	COPD is a leading cause of death, expected to become the third leading cause by 2030
Healthcare Access Management	Limited resources and inadequate access to healthcare
Guidelines	National guidelines by Pakistan Chest Society
Interventions	Smoking cessation programs, pulmonary rehabilitation, pharmacological treatments
Recent Studies	Integrated COPD care at public healthcare facilities shows improved outcomes

Narrative explanation of the quantitative data table 21 on obstructive pulmonary disease (COPD) in the context of Pakistan especially in Islamabad. Chronic Obstructive Pulmonary Disease (COPD) is a significant health concern in Pakistan, particularly among adults over the age of 40. The prevalence of COPD in this age group is estimated to be 2.1%, highlighting the need for effective management and intervention strategies. The gender distribution of COPD patients in Pakistan shows a higher prevalence among males, with 70.91% of patients being male and 29.09% being female. This disparity may be attributed to higher smoking rates and occupational exposures among men.

Smoking remains a major risk factor for COPD in Pakistan. Among COPD patients, 55.27% are current smokers, 28.36% have quit smoking, and 16.36% have never smoked. These figures underscore the critical need for smoking cessation programs to reduce the burden of COPD. Cardiovascular diseases are common among COPD patients, with 45.09% having cardiovascular comorbidities. This high prevalence of comorbid conditions complicates the management of COPD and necessitates a comprehensive approach to patient care. The distribution of COPD severity, as measured by spirometric GOLD grades, shows that 23.64% of patients are in GOLD 1 (mild), 30.55% in GOLD 2 (moderate), 21.45% in GOLD 3 (severe), and 24.36% in GOLD 4 (very severe). This distribution indicates a significant proportion of patients with moderate to severe disease, requiring intensive management.

When classified into GOLD groups based on symptoms and exacerbation risk, 21.45% of patients fall into Group A (low risk, fewer symptoms), 33.82% into Group B (low risk, more symptoms), 23.27% into Group C (high risk, fewer symptoms), and 21.45% into Group D (high risk, more symptoms). This classification helps tailor

treatment strategies to individual patient needs. COPD is a leading cause of death in Pakistan and is expected to become the third leading cause of death by 2030. The healthcare system faces challenges such as limited resources, lack of awareness, and inadequate access to healthcare services, which hinder effective COPD management. The Pakistan Chest Society has developed national guidelines for COPD management, emphasizing the importance of smoking cessation programs, pulmonary rehabilitation, and pharmacological treatments. Recent studies have shown that integrated COPD care at public healthcare facilities can improve patient outcomes.

COPD is a prevalent and serious health issue in Pakistan, particularly among urban males with a history of smoking. The presence of comorbidities and varying severity of disease necessitate a comprehensive and individualized approach to management. Addressing healthcare challenges and implementing effective interventions are crucial for improving the quality of life and outcomes for COPD patients in Pakistan.

Table 20

Overview of Restrictive Diseases

Aspect	Data
Prevalence	4.7% in adults presenting with respiratory symptoms
Gender Distribution	Male: 84.6%, Female: 15.4%
Smoking History	Significant association with smoking; all patients with RLD had a history of smoking
Common Comorbidities	Cardiovascular diseases, diabetes, lung cancer, autoimmune diseases

Aspect	Data
Mortality Rate	Specific data on mortality rates in Pakistan are limited, but RLD contributes significantly to morbidity and mortality
Health care Challenges	Limited resources, lack of awareness, inadequate access to specialized care
Management Guidelines	National guidelines by Pakistan Chest Society
Interventions	Smoking cessation programs, pulmonary rehabilitation, pharmacological treatments, occupational health interventions
Recent Studies	Studies on interstitial lung diseases (ILDs) and their management in Pakistan

Restrictive pulmonary disease (RLD) is a significant health concern in Pakistan, though it is less prevalent than chronic obstructive pulmonary disease (COPD). The estimated prevalence of RLD among adults presenting with respiratory symptoms is approximately 4.7%. This highlights the need for increased awareness and effective management strategies to address this condition. The gender distribution of RLD patients in Pakistan shows a markedly higher prevalence among males, with 84.6% of patients being male and only 15.4% being female. This disparity is likely due to higher occupational exposures among men, which contribute to the development of restrictive lung diseases.

Smoking is a significant risk factor for RLD in Pakistan. All patients with RLD in the study had a history of smoking, underscoring the critical need for smoking cessation programs to reduce the burden of this disease. The strong association between smoking and RLD highlights the importance of targeted interventions to address this modifiable risk factor. Patients with RLD often have multiple comorbidities, which complicates their management. Common comorbidities include cardiovascular diseases, diabetes, lung cancer, and autoimmune diseases. These comorbid conditions not only increase the complexity of treatment but also contribute to higher morbidity and mortality rates among RLD patients.

While specific data on mortality rates for RLD in Pakistan are limited, it is known that RLD contributes significantly to morbidity and mortality. The healthcare system faces several challenges in managing RLD, including limited resources, lack of awareness, and inadequate access to specialized care. These challenges hinder effective diagnosis and treatment, leading to poorer health outcomes for patients (Bartziokas et al., 2023; Agustí et al., 2023; Zara et al., 2024). The Pakistan Chest Society has developed national guidelines for the management of restrictive lung diseases, emphasizing the importance of comprehensive care. Key interventions include smoking cessation programs, pulmonary rehabilitation, pharmacological treatments, and occupational health interventions. These strategies aim to improve the quality of life and outcomes for RLD patients.

Restrictive pulmonary disease is a prevalent and serious health issue in Pakistan (Martins et al., 2023; Laghari et al., 2023; Zara et al., 2024) particularly among urban males with a history of smoking. The presence of comorbidities and the challenges within the healthcare system necessitate a comprehensive and

individualized approach to management. Addressing these challenges through targeted interventions and adherence to national guidelines is crucial for improving the quality of life and outcomes for RLD patients in Pakistan.

Table 21

Comparison of Last Five Years of COPD Patients

Years	No of COPD patients	% age prevalence of COPD
2019	531	13.2254
2020	895	22.29141
2021	953	23.73599
2022	912	22.71482
2023	724	18.03238
4015		-

In the table above, the number of COPD patients increased from 2019 to 2021, peaking in 2021. The number of cases decreased in 2022 and 2023 compared to the previous two years. The percentage prevalence of COPD was highest in 2021, reaching 23.74%. Despite the fluctuations, the overall trend shows an increase in the prevalence of COPD over the five-year period.

The increase in cases in the early years might be partly due to greater awareness and improved diagnostic methods. The decline in cases in 2022 and 2023 could be related to the COVID-19 pandemic (Hassan et al., 2023; Khan, 2022), which may have affected healthcare access and COPD diagnosis. Other factors such as changes in lifestyle, air pollution, or healthcare policies might also contribute to the

trends (Zhou et al., 2023). This table above presents valuable information on the trends in COPD cases and prevalence over the last five years..

4.2 Discussion

Our findings highlight a troubling discrepancy between current clinical practice and the suggested GOLD guidelines for the management of COPD. Our results show inadequate adherence to these evidence-based guidelines, despite the fact that pulmonologists work hard to provide the best possible care for their patients. This disparity is not specific to our study; rather, it reflects a global trend in which there is still uneven adherence to GOLD guidelines. According to Mangold et al. (2023), a study carried out in Switzerland demonstrated that a mere 65% of COPD treatments followed the GOLD guidelines. Notably, there was a notable lack of compliance in GOLD groups A and B. Similarly, studies conducted in the US revealed that only 25% of primary care doctors regularly base clinical decisions on COPD guidelines (Karim et al., 2024; Shah et al., 2016).

Cardiovascular comorbidities make treatment choices much more difficult and frequently result in inappropriate therapy, especially for patients who are categorised as low-risk (Groups A and B). It is important to pay attention to the common problem of overprescribing inhaled corticosteroids (ICS), even in patients who have a low risk of exacerbation. Numerous studies have reported on this over-reliance on ICS, one of which found a high rate of ICS use in patients when it was not indicated, raising the possibility of negative effects and driving up healthcare costs (Alabi et al., 2023; Mangold et al., 2023).

These findings are consistent with earlier research emphasising the difficulties in implementing guidelines in routine healthcare. This disparity is greatly influenced

by elements including patient preferences, healthcare system limitations, and physician knowledge. For instance, a study published in the European Respiratory Journal highlighted how these complex influences can lead to variability in the adherence to guidelines (Karim et al., 2024; Palmiotti et al., 2018; Zara et al., 2024). To improve guideline adherence, the GOLD 2023 report also emphasises the necessity of ongoing education and system-level interventions (GOLD, 2023).

Future research should take a multifaceted approach to address these complexities by examining the influence of different factors, such as patient preferences, physician knowledge, and healthcare system constraints, on treatment decisions. It's also critical to investigate the long-term effects of following GOLD guidelines and the cost-effectiveness of various treatment options. We can create focused interventions to improve COPD management and improve patient outcomes by thoroughly analysing these variables. Research on value-based healthcare strategies and how to apply them to the management of COPD has demonstrated promise in terms of improving care and lowering the financial and clinical costs associated with the condition (Shah et al., 2016; Robertson et al., 2024).

Our results show inadequate adherence to these evidence-based guidelines, despite the fact that pulmonologists work hard to provide the best possible care for their patients. Cardiovascular comorbidities make treatment choices much more difficult and frequently result in inappropriate therapy, especially for patients who are categorised as low-risk (Groups A and B). It is important to pay attention to the common problem of overprescribing inhaled corticosteroids (ICS), even in patients who have a low risk of exacerbation. These findings are consistent with earlier research emphasising the difficulties in implementing guidelines in routine healthcare (Divo & Celli, 2020; Robertson et al., 2024). Future research should take a

multifaceted approach to address these complexities by examining the influence of different factors, such as patient preferences, physician knowledge, and healthcare system constraints, on treatment decisions.

It's also critical to investigate the long-term effects of following GOLD guidelines and the cost-effectiveness of various treatment options. We can create focused interventions to improve COPD management and improve patient outcomes by thoroughly analysing these variables. It takes a coordinated effort involving patient-centred approaches, system-level changes, and education to bridge the gap between clinical practice and guideline recommendations. We can raise the standard of care for COPD patients and eventually improve their health outcomes by tackling these issues (Divo & Celli, 2020; Ghosh & Hobbs, 2020).

Chronic Obstructive Pulmonary Disease (COPD) is a significant health concern in Pakistan, particularly among adults over the age of 40, with a prevalence of 2.1%. The gender distribution shows a higher prevalence among males (70.91%) compared to females (29.09%), likely due to higher smoking rates and occupational exposures among men. Urban areas report a higher prevalence (77.09%) compared to rural areas (22.91%), attributed to increased exposure to air pollution and industrial emissions.

Smoking is a major risk factor, with 55.27% of COPD patients being current smokers, 28.36% having quit smoking, and 16.36% never having smoked. Cardiovascular diseases are common comorbidities, affecting 45.09% of COPD patients. The distribution of COPD severity, as measured by spirometric GOLD grades, indicates that 23.64% of patients are in GOLD 1 (mild), 30.55% in GOLD 2 (moderate), 21.45% in GOLD 3 (severe), and 24.36% in GOLD 4 (very severe).

When classified into GOLD groups, 21.45% fall into Group A, 33.82% into Group B, 23.27% into Group C, and 21.45% into Group D.

COPD is a leading cause of death in Pakistan, expected to become the third leading cause by 2030 (Kanwal et al., 2023; Zara et al., 2024). The healthcare system faces challenges such as limited resources, lack of awareness, and inadequate access to healthcare services. National guidelines by the Pakistan Chest Society emphasize smoking cessation programs, pulmonary rehabilitation, and pharmacological treatments (Robertson et al., 2024).

Restrictive pulmonary disease (RLD) is less prevalent than COPD, with an estimated prevalence of 4.7% among adults presenting with respiratory symptoms. The gender distribution shows a markedly higher prevalence among males (84.6%) compared to females (15.4%), likely due to higher occupational exposures among men. RLD is more prevalent in urban areas due to increased exposure to environmental pollutants and industrial emissions (Chen et al., 2019; Gayle et al., 2022). Smoking is a significant risk factor, with all patients with RLD having a history of smoking. Common comorbidities include cardiovascular diseases, diabetes, lung cancer, and autoimmune diseases, complicating the management of RLD. While specific data on mortality rates for RLD in Pakistan are limited, it is known that RLD contributes significantly to morbidity and mortality.

The healthcare system faces challenges in managing RLD, including limited resources, lack of awareness, and inadequate access to specialized care. National guidelines by the Pakistan Chest Society emphasize comprehensive care, including smoking cessation programs, pulmonary rehabilitation, pharmacological treatments, and occupational health interventions. Recent studies on interstitial lung diseases

(ILDs), a subset of RLD, have provided valuable insights into the management of these conditions in Pakistan.

The trend suggests that urban areas have slightly better treatment outcomes than rural ones, but the difference is not statistically significant. The appropriateness of treatment was also marginally influenced by gender, with men showing somewhat higher rates of appropriate treatment. These results point to potential contributions from socioeconomic and geographic factors and call for more research (Martins et al., 2023; Zara et al., 2024). It was found that improper treatment and cardiovascular co-morbidity were significantly correlated. Cardiovascular patients were more likely to receive subpar care, underscoring the necessity of individualised treatment plans for this high-risk group of patients.

4.3 Conclusion

This analysis will contribute valuable insights into the COPD prevalence in Islamabad. The findings will provide evidence-based guidance to policy makers and health departments to reduce COPD prevalence and enhance management strategies in Islamabad. The distribution of COPD severity, as measured by spirometric GOLD grades, indicates that 23.64% of patients are in GOLD 1 (mild), 30.55% in GOLD 2 (moderate), 21.45% in GOLD 3 (severe), and 24.36% in GOLD 4 (very severe). When classified into GOLD groups, 21.45% fall into Group A, 33.82% into Group B, 23.27% into Group C, and 21.45% into Group D.In the demographics portion, 70.91% of patients are male, and 29.09% are female and urban residents constitute 77.09%, while rural residents make up 22.91%. In the smoking history, 55.27% are current smokers, 28.36% have quit smoking, and 16.36% never smoked. In the Spiro metric GOLD Grade, GOLD 2 (moderate) is the most common grade (30.55%), followed by

GOLD 1 (23.64%). Most patients fall into Group B (33.82%) or Group C (23.27%). 45.09% of patients have cardiovascular co-morbidities.

In the GRADE A, LABA and LAMA are common. In the GRADE B, Balanced use of LABA, LAMA, and LAMA + LABA. In the GRADE C, LAMA and LAMA + LABA are prominent and in the GRADE D, LAMA + LABA and LAMA + ICS are frequent. Treatment adherence varies, and some patients receive inappropriate medications. Individualized management based on patient characteristics is crucial for optimizing COPD care.

Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory condition characterized by airflow limitation that is not fully reversible. Effective management of COPD requires appropriate medication regimens tailored to disease severity.Table 1-5 represents the data collected by the primary source and these tables shows different groups of COPD among the collected data of the selected sectors. In order to comprehend medication use patterns, treatment appropriateness, and potential disparities among various patient groups, the analysis that follows examines the data shown in Tables 7 - 18.These tables represents the hospital based data i.e. secondary data.

Based on COPD severity as defined by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) stages A-D, Tables 8 - 11 offer information on medication usage. As the severity of COPD increases, a distinct trend appears. Long-acting bronchodilators (LABAs and LAMAs) are the mainstay of care for patients in the earlier stages (A and B) in terms of managing their symptoms. Combination therapies, such as inhaled corticosteroids (ICS), are increasingly used to treat inflammation and lessen exacerbations as the disease advances (C and D). These results supports the findings of Bartziokas et al., (2023) and Agustí et al., (2023).

Notably, even in advanced disease (D), the use of ICS is comparatively low across all stages. This may point to a lapse in treatment compliance or an underestimation of the advantages of ICS use in the management of COPD. Although the use of short-acting beta-agonists (SABAs) is widespread for the treatment of acute symptoms, their absence in later stages indicates a move towards better disease control and maintenance therapy.

Tables 12 to 17 examine variables such as patient characteristics and COPD severity that affect treatment appropriateness. All GOLD stages show a higher prevalence of overtreatment, which suggests room for improvement in cost-effectiveness and medication optimisation.

This study provides information on Islamabad's Chronic Obstructive Pulmonary Disease (COPD), a dangerous lung ailment that impairs breathing. The results provide useful information to address this issue for healthcare providers and policymakers. The analysis shows that COPD is spread across different severities, which is concerning. According to GOLD 2, 3, and 4, a sizable percentage of patients are classified as moderate or severe, underscoring the necessity of effective management techniques.

It's interesting to note that there is a gender gap in the data, with a larger proportion of male patients. Furthermore, people in cities appear to be more impacted than those in rural areas. Naturally, smoking stands out as a significant contributing factor, with more than half currently smoking. The best part of this study showed that the majority of patients receive treatment; for milder cases, long-acting bronchodilators such as LABA and LAMA are the standard. In advanced stages, however, the use of combination therapies, such as inhaled corticosteroids (ICS), seems to be underutilized. This raises the possibility of treatment adherence issues or

an underestimation of the advantages of ICS for improved symptom management.

A troubling problem identified by the study is overtreatment at all severity levels. This suggests that in order to guarantee cost-effectiveness and customize treatment to meet the needs of each patient, medication optimization is required.

All things considered, this analysis provides insightful information about the prevalence of COPD and its treatment trends in Islamabad. Policymakers and healthcare professionals can create efficient plans to lessen the burden of COPD and enhance patient care by filling in the gaps that have been found.

4.4 Recommendations

The examination of earlier tables' highlights how difficult it is to manage COPD and how treatment choices must be made with consideration for all factors. There are several important implications:

i. Adherence to GOLD guidelines: In order to maximise patient outcomes, it is imperative that treatment decisions are in line with current guidelines.

ii. Patient-centred care: It is crucial to customise treatment regimens to each patient's needs while taking preferences, comorbidities, and the severity of the disease into account.

iii. Risk stratification: Targeted interventions and closer observation are dependent on the identification of high-risk patients, such as those with advanced disease or cardiovascular comorbidities.

iv. Education and awareness: Improving patient and healthcare provider understanding about managing COPD, including how to use medications appropriately, can improve the effectiveness of treatment.

v.   Disparity reduction: To guarantee equitable care, it is crucial to address differences in treatment quality and access depending on a patient's gender, location, and comorbidity status.

Subsequent investigations ought to concentrate on pinpointing particular elements that lead to both under- and over treatment, creating instruments for medication optimisation, and assessing the financial viability of various therapeutic approaches. The given data provide insightful information about disparities in COPD treatment patterns. Healthcare professionals can improve the quality of life and optimise care for COPD patients by identifying areas for improvement and comprehending the factors influencing treatment appropriateness.

4.5 Limitations

There are a few limitations to the current study that should be taken into account when interpreting the results. First off, establishing a causal relationship between variables is prohibited by the cross-sectional design, which makes it more difficult to ascertain the temporal order of events. Second, since the accuracy and completeness of documentation can differ, the use of data from medical records may have introduced information bias. Thirdly, the study's geographic confinement may have limited how broadly the results can be applied to other populations. Furthermore, it is more difficult to compare prescribing practices with a benchmark when there is no control group. Finally, the study did not take into consideration how patient comorbidities, adherence to treatment plans, and socioeconomic factors might have affected the results that were seen.

These drawbacks highlight the necessity of additional study to clarify the many variables affecting COPD management and to modify treatment plans appropriately.

4.6 Ethical Approval

The relevant authorities gave their ethical approval for this study prior to its start. The study was carried out in compliance with the moral guidelines provided by Bahria University, Islamabad. Prior to participating in this study, each participant gave written informed consent. The study's goals, methods, possible risks and benefits, and participants' freedom to leave the study at any moment without penalty were all thoroughly described in the consent process. All personally identifiable information was deleted from data collection tools and substituted with unique identifiers in order to protect participant confidentiality. Only authorised research staff members had access to the password-protected electronic databases where the data was safely kept. Furthermore, precautions were taken to ensure that participants' identities remained anonymous in any findings that were published or shared.

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ANNEXURE A

Questionnaire

Thank you for participating in this research study on Analysis of Chronic Obstructive Pulmonary Disease (COPD) Prevalence and Management in Islamabad, Pakistan. Your responses will be used solely for education and research purposes. Your responses will not be disclosed to anyone who is not the part of this study. Please be assured that all information provided will be kept strictly confidential and used solely for research purposes. Your participation is voluntary, and you may withdraw from the study at any time without penalty.

Please Mark (✔) in the relevant box of your choice.

Demographics

1. **Name:**_____ (Optional)
2. **Age:_____ (Years)**
3. **Gender:**

Male	Female	Other

4. **Area of Residence:**

Urban	Rural

5. **Education Level:**

Below Intermediate	Intermediate	Graduation	Masters or Above

6. **Smoking History**

Smoking	Quit Smoking	No Smoking

COPD Assessment Test

This questionnaire will help you and your healthcare professional to measure the impact that COPD (Chronic Obstructive Pulmonary Disease) is having on your wellbeing and daily life. Your answers and test score can be used by you and your healthcare professional to help improve the management of your COPD and gain the greatest benefit from the treatment.

7. Have you been diagnosed with COPD?

- yes

- no

- not sure

8. If yes, how long ago were you diagnosed?

- Less than a year

- 1-5 years

- More than 5 years

9.What type of COPD do you have?
- Chronic Bronchitis (mucus production, cough)
- Emphysema (shortness of breath)
- Both
- not sure

10. Are you currently undergoing treatment for COPD?
- Yes
- No

11. Do you experience any of the following symptoms? (Select all that apply)

- Chronic cough

- Shortness of breath

- Wheezing

- Chest tightness

12. Have you sought medical attention for respiratory symptoms in the past year?

- Yes

- No

13. Are you aware of COPD and its risk factors?

- Yes

- No

- Partially

14. How often do you visit a healthcare professional for routine check-ups?

- Regularly

- Occasionally

- Rarely

15. How satisfied are you with your current COPD medications?

- Very Satisfied

- Satisfied

- Neutral

- Dissatisfied

16. Have you experienced any side effects from your COPD medications?

- Yes

- No

- Maybe

The Modified Medical Research Council Scale (mMRC)

Grade Description of Breathlessness

Shortness of breath is a widely experienced symptom and an important indicator for the prognosis of numerous respiratory conditions. Several scales exist for assessing the severity of breathlessness; the modified Medical Research Council dyspnoea scale ("mMRC") evaluates how breathlessness impacts daily activities and is endorsed in respiratory guidelines.

Please choose between **Yes / No** only.

Sr. No	Question	Response
1	I only get breathless with strenuous exercise	**Yes / No**
2	I get short of breath when hurrying on level ground or walking up a slight hill	**Yes / No**
3	On level ground, I walk slower than people of the same age because of breathlessness, or I have to stop for breath when walking at my own pace on the level	**Yes / No**
4	I stop for breath after walking about 100 yards or after a few minutes on level ground	**Yes / No**
5	I am too breathless to leave the house or I am breathless when dressing	**Yes / No**

Any other Comments/Feedback

_____

_____

_____

_____

Thank you for your valuable participation in this research study. Your responses will contribute significantly to our understanding of the topic. If you have

any questions or concerns, please do not hesitate to contact the researcher while data collection.

ANALYSIS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) PREVALENCE AND MANAGEMENT IN ISLAMABAD, PAKISTAN