Review Article

Chronic Obstructive Pulmonary Disease: Lifestyle Impact

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Abstract

Respiratory infections, a global health priority according to the World Health Organization, cause around 7.5 million deaths annually, constituting 14% of global mortality. Beyond severe health implications, these diseases exacerbate social disparities and impose a substantial economic burden. Chronic obstructive pulmonary disease (COPD) combines chronic bronchitis (airway inflammation) and emphysema (air sac destruction) caused by prolonged exposure to irritants, and poor lifestyle choices lead to airway blockage and breathing difficulties. Lifestyle choices significantly influence health trajectories, evidenced by a consistent increase in "positive comfort" over time. A Chinese study highlights the correlation between adopting a healthy lifestyle and increased life expectancy. European health initiatives address these challenges, emphasizing early detection through large-scale health camps to identify new cases and assess severity. Exacerbation and infections are primary triggers, with bacteria and viruses requiring antibiotic interventions. Awareness campaigns targeting causes, symptoms, and prevention, including childhood infection initiatives with influenza and pneumococcal vaccinations, are crucial. Motivating smoking cessation and encouraging whole grain, fruit, and vegetable consumption mitigate lung oxidative damage. Promoting physical activity and addressing environmental pollution contribute to overall lung health. Timely nutritional evaluations for newly diagnosed cases manage obesity and malnutrition and prevent further lung function deterioration. There is growing attention toward the influence of poor lifestyle choices like sedentary lifestyle, environmental exposure, and unhealthy dietary patterns on the increased risk of COPD development besides smoking. This essay explores these factors, recognizing the intricate interplay between lifestyle and COPD prevention and management.

Keywords: *Air pollution, chronic respiratory disease, fiber, lung capacity, smoking, vaccination*

Introduction

Chronic obstructive pulmonary disease (COPD) comprises chronic bronchitis (airway inflammation) and emphysema (tiny air sac destruction).[1,2] Major risk factors for COPD include cigarette smoking, exposure to ambient air pollution, being underweight, experiencing chronic cough during childhood, having a parental history of respiratory diseases, and lower levels of education.[3]

There is a growing focus on lifestyle factors, like sedentary living, environmental exposure, and so on contributing to COPD risk.[4]

A comprehensive systematic literature search was undertaken to investigate the effects of lifestyle modification on COPD cases. A variety of electronic databases, such as PubMed Central, CINAHL Plus, Cochrane Library, Embase, and Google Scholar, were employed. Effective search terms and keywords were devised to ensure thorough coverage. Important details, including methodology, main findings, data analysis, and other relevant information, were carefully extracted from pertinent studies. The review specifically targeted articles published in English between 2010 and 2023.

Huber's comprehensive COPD definition includes diseases like asthma and lung infections, often starting in childhood and worsening with age, influenced by ecological risk factors, family behavior, and individual choices.[5,6] Efforts to combat COPD include smoking bans, early detection, vaccination, risk factor reduction, exercise promotion, and individualized nutrition plans [Figure 1]. These strategies enhance COPD management, reduce hospitalizations, and improve patients' quality of life.[7,8] Systematic review explores lifestyle changes in COPD management as patients grapple with

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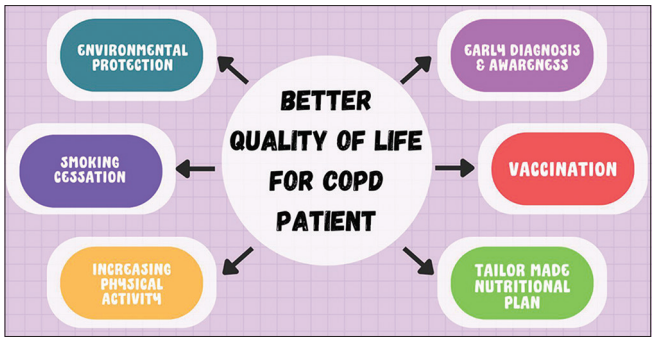

Figure 1: Lifestyle modifications by enhancing the living environment, early detection and raising disease awareness, advocating for vaccinations, adhering to personalized diet plans, boosting physical activity, and quitting smoking for improving health-related quality of life (HRQoL)

worsening symptoms like cough and breathlessness, signaling a need for lifestyle changes.[7]

Early Detection of Disease

Any reasonable body of infection begins with a rational and early discovery.[9] Despite the importance of a thorough physical examination, the foundation for identifying and observing COPD is the evaluation of lung capability.[10] Unfortunately, not all pulmonologists recognize the value of their extremely important spirometry test, in the same way that cardiologists recognize the value of an electrocardiogram (ECG).[11] This test plays a crucial role in the detection and assessing the severity of the condition. It determines the results by calculating the ratio of FEV1/FVC; less than 0.70 confirms the presence of COPD. As per GOLD (Global Initiative for Obstructive Lung Disease) revised guidelines with spirometry test, other assessment tools like mMRC (Modified British Medical Research Council) and CAT (COPD assessment test) must be included to assess the symptoms and history of exacerbation during mass screening campaigns to uncover new cases of COPD and stage of severity.[12] In a similar vein, an early detection may influence the patient's motivation to quit smoking.[13]

Prevention of Infections

The main causes of exacerbation in COPD are lower respiratory tract infections. Evidence proved the positive role of bacteria and viruses in lung inflammation under stable conditions or during acute exacerbation in COPD. One of the primary goals of the organization is to ensure that escalations are handled with respect and anticipation, with antibiotics and vaccination playing crucial roles in achieving this objective.[14,15]

Antibiotics

Several studies indicate that approximately 50% of COPD exacerbations are caused by bacteria and viruses when they find their way into the lungs. The most commonly identified bacteria are Haemophilus influenzae, Streptococcus pneumonia, and Moraxella catharralis according to GOLD.[16] Antibiotics are used to treat these lung infections.[14] Antimicrobial treatment may benefit COPD patients with increased dyspnea (breathlessness) and severe sputum production. Nebulized administration of a few antimicrobials has been developed to treat and prevent severe rises.[17]

Vaccination

Vaccines play a very important role in the prevention and management of lung infections. Vaccination in childhood can prevent the onset of COPD in adulthood who come under high-risk categories. Specific bacteria and viruses can cause severe lung infections and are also responsible for acute exacerbations in COPD. The Centre for Disease Control (CDC) recommends a flu and pneumonia shot as routine vaccination for adults.[18]

Influenza vaccination

Research establishes a connection between influenza and the development of COPD, leading to acute exacerbation and an elevated incidence of hospitalizations.[19] Vaccination must be included as a part of treatment for newly diagnosed cases of COPD as early as possible. The H3N2, H1N1, and flu B strains are included in the injectable trivalent, inactivated flu vaccine, which is offered annually as a component.[20] In light of the fact that "web-based medication" has led to a decline in immunization participation and a decrease in trust in evidence-based medicine, health professionals and the media should emphasize the long-term benefits of flu vaccinations rather than their year-to-year variability.[21,22] A few studies have shown that inactivated vaccinations reduce flu-related rises that occur at least 3 weeks after inoculation in COPD patients. Both GOLD and GesEPOC guidelines (The Spanish COPD Guideline) advocate for the administration of an annual influenza vaccine for individuals with COPD.[23]

Pneumococcal vaccine

According to limited evidence from randomized controlled preliminary studies, injectable polyvalent pneumococcal immunizations may provide some protection against morbidity for people with COPD. The adult pneumococcal vaccine (PPSV23) is a 23-valent polysaccharide antibody that guards against the most prevalent adult illness-associated serotypes. However, PPSV23's clinical viability typically deteriorates with age and eventually vanishes: It might not work for people over 65.[24,25] In any case, the list does not include all serotypes associated with obtrusive illness. Pneumococcal vaccination has been included for CRD on a large scale for public proposals, while PCV13 is used for national recommendation patients.[26] Currently, the US Advisory Committee on Immunization Practices recommends PVC13, followed by PPSV23 for individuals over 19 who are at high risk for pneumococcal disease and for all adults over 65 who have not been immunized recently.[27]

Smoking Cessation

Tobacco use, primarily cigarette smoking, is the leading cause of preventable disease and death. It is well established that smoking increases the risk of respiratory diseases like COPD. The most important tip for a COPD patient who smokes is to quit smoking immediately to protect the lungs for further deterioration and development of other smoke-related illnesses like cardiac diseases, hypertension, and stroke. A 5-year study conducted on severe cases of COPD in China proved that there is a remarkable increase in survival rate for those who quit smoking as compared to those who do not leave smoking.[28] Recurring exacerbation in COPD due to oxidative stress caused by cigarette smoking is not only responsible for frequent hospitalization, but it also deteriorates the quality of life. Smoking causes respiratory diseases and contributes to a 10-year decline in future mortality.[29,30] Because of the developing number of smokers, all out tobacco-related passings, including those brought about by COPD, are supposed to ascend from 5.4 million out of 2005 to 8.3 million by 2030. As the effects of smoking manifest slowly over a long period of time, smokers are unable to quit before it occurs.[31] Even though smoking cessation events are costly and time-consuming; they have the potential to reduce a person's risk of disease by as much as 25% over time.[32] A study on a South Korean man done in 2023 revealed that individuals who ceased smoking within 2 years following a COPD diagnosis experienced both reduced risks of all causes and mortality compared to those who continued smoking persistently.[33] These days, there are several effective aids available, like electronic cigarettes or e-cigarettes, medicines, and nicotine-containing products such as nicotine patches, gum, lozenges, and inhalers. Law-enforced smoking bans, one-to-one counseling sessions, and group interactions are also effective in quitting smoking [number of ways to quit smoking is shown in Figure 2].

E-cigarettes/electronic cigarettes

Electronic cigarettes or e-cigarettes are devices that help smokers quit or reduce their tendency to smoke by breaking down nicotine. In low-quality polls, there is a positive correlation between using an e-cigarette and quitting smoking. The potential benefits of e-cigarettes for a single smoker should be compared to the potential harm they could cause to a larger group of people who are more socially valuable.[34] Electronic devices should be restricted or prohibited until more information about their effects on health is available, and when permitted, they should be used in the same way as drugs or tobacco products are used.[35,36]

Pharmacological interventions

Cistine, bupropion, varenicline, and nicotine replacement therapy (NRT) enhance the cessation success rate. Moreover, combining varenicline and nortriptyline with

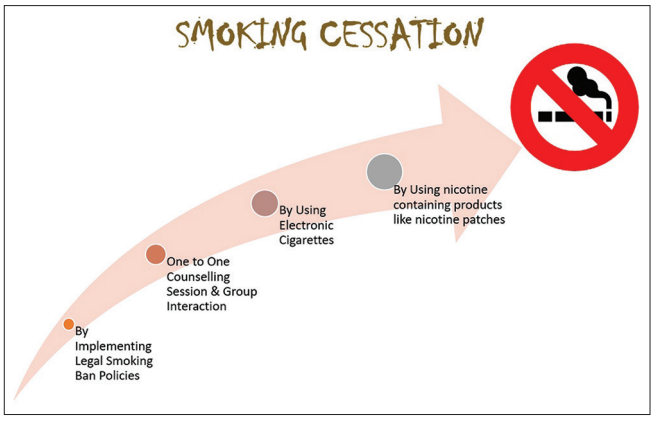

Figure 2: Different methods for quitting smoking, including the use of e-cigarettes and nicotine-based products such as chewing gums, patches, or lozenges. Also includes options like individual counseling, group sessions, and the implementation of smoking bans through legal measures

NRT proves effective. There are no adverse conditions restricting the use of any approach. Interventions that integrate pharmacotherapy with social support exhibit a lower success rate in cessation compared to focused mediation or consistent attention.[37,38]

Legal smoking bans

Mandatory smoking bans can potentially decrease secondhand smoke exposure, leading to better health outcomes, though they are not mandatory. A Swiss study confirmed a reduction in respiratory issues, like cough, within a year of implementing a public ban, and long-term exposure to recycled smoke was diminishing. While their impact on perinatal health may vary, public smoking restrictions seem to positively influence cardiac health and reduce mortality from smoking-related infections.[39,40]

Behavioral Approach

A clinical investigation investigating the behavioral risk factors in obstructive lung disease linked with metabolic syndrome revealed that a significant proportion of patients had detrimental lifestyle behaviors. The results emphasize the harmful effects of behavioral variables, such as unhealthy eating habits, lack of physical activity, and smoking, on lung health in persons with metabolic syndrome. It is essential to address these abnormalities in lifestyle in order to properly manage obstructive lung disorders and enhance overall health outcomes.[41] Conduct therapy is recommended for individuals attempting to quit smoking because it identifies and adjusts behaviors that have the potential to influence smoking habits. With treatment force, individual, group, and telephone analysis mediations gain power. Currently, there is no sign to support any behavior or medication.[42,43]

Food and Nutrition

Nutrition plays a crucial role in modulating the immune response during infectious diseases, impacting the

progression and management of COPD. It provides essential substrates for synthesizing regulatory molecules involved in immune responses, thus influencing lung health. Key nutrients including vitamins (A, C, D, and E), minerals (zinc, selenium, iron, and magnesium), flavonoids, and fatty acids contribute significantly to reducing the susceptibility to chronic pulmonary diseases and viral infections. Their antioxidant and anti-inflammatory properties are associated with improved lung function and decreased risks of complications by mitigating the harmful effects of the immune system during inflammatory responses.[44]

In one of the studies, no association was observed between the risk of COPD and the intake of vegetables, n-3 fatty acids, vitamin E, and β-carotene; however, it was associated with n-6 fatty acids, 1.06 (95% CI: 0.87–1.30). The results suggested that a higher intake of fruits, probably dietary fiber, and fish reduce the risk of COPD.[45]

Individuals in the group with a high polygenic risk score (PRS) had a 2.2-fold increased chance of developing COPD. The interaction between the PRS, w-3 fatty acid consumption, and exercise has an impact on the risk of developing COPD, particularly those with poor consumption of omega-3 fatty acids and high levels of activity. Adjusting their intake of w-3 fatty acids and levels of activity might possibly reduce this risk of developing COPD.[46]

A comprehensive review of the available literature suggests that consuming fruits is correlated with enhanced lung function and decreased COPD mortality and respiratory symptoms. Moreover, a higher intake of vegetables is associated with a reduced risk of COPD, while increased fish consumption contributes positively to lung function. Conversely, excessive consumption of meat may raise the risk of COPD and respiratory symptoms, leading to a decline in lung function. The impact of whole grains, however, exhibits inconsistency. Further research is necessary to gain a better understanding of the role of dietary factors in light of emerging evidence from epidemiological studies.[45]

In this study, the participants who were underweight exhibited a significantly elevated risk of death (HR, 1.88; 95% CI, 1.62-2.20; $P < 0.0001$) and severe exacerbations (HR, 1.31; 95% CI, 1.16-1.47; $P < 0.0001$) compared to those with normal weight. Conversely, overweight and obese participants showed either lower or no additional risk. These findings underscore a strong correlation between body weight, occurrences of COPD events, and mortality risk.[13]

While oxygen is essential for life, excessive concentrations can pose risks to cells beyond physiological limits. Given that the lungs are directly exposed to high oxygen levels, it is crucial for this organ to possess defenses against potential oxidative stress. Lungs are equipped with a range of endogenous agents known as antioxidants, which help combat the harmful effects of various oxidants and reactive oxygen species, which are produced internally and sometimes encountered from environmental exposure. One of the primary non-enzymatic antioxidants is vitamins C, acting as the first line of defense against the deleterious effects of various oxidants, protecting the lungs.[47]

Increasing total fruit and vegetable intake by one serving per day was found to significantly decrease the risk of COPD, with a reduction of 8% (95% CI 4% to 11%) in current smokers and 4% (95% CI 0% to 7%) in ex-smokers but not in individuals who have never smoked.[11,47]

Studies have also associated vitamins with reduced symptoms, respiratory infections, and exacerbation.[45,48] The dietary fiber content shapes the gut microbiota composition, influencing both metabolic functions and immune responses in the body. Metabolites generated by indigestible dietary fiber not only regulate gastrointestinal immunity but also impact lung immune responses. Certain probiotics currently available demonstrate positive effects on lung health. Consuming high fiber from sources like whole grains, vegetables, and fruits has been associated with a reduction in COPD-related symptoms and death, improving lung functions, scavenging free radicals, and reducing oxidative damage. Dietary fibers also regulate the immune system through the gut–liver–lung connection.[49,50]

Weight support is crucial as unintentional weight loss is associated with reduced survival. Muscle waste and decreased muscle oxidative metabolism significantly impact COPD patients' physical performance and mortality. Dietary quality plays a central role in COPD risk and progression, making dietary awareness essential from prevention to chronic respiratory failure.[20]

A judiciously planned high-protein, high-fiber, and calorie-dense balanced diet can aid in gaining weight and muscle, especially in malnourished individuals.[51] However, there is insufficient evidence supporting the claim that supplementation can enhance exercise efficacy in the COPD population. The Western diet is linked to increased asthma exacerbation, while the Mediterranean diet is associated with asthma control and improvement in fatigue during their daily activities. Recent research suggests that agriculture-based food security programs enhance dietary guidelines in low- and middle-income nations.[52,53]

Therefore, adopting a nutritious balanced diet, including fruits, vegetables, fish, and whole-grain products, contrasts favorably with a Western diet and can positively impact immune function and overall lung health, influencing the progression and treatment outcomes of chronic respiratory conditions.[44,54] The dietary fiber content shapes the gut microbiota composition, influencing both

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Environmental Protection

A well-known risk factor for COPD and other chronic respiratory diseases (CRDs) is poor indoor and outdoor air quality, particularly from biomass fills, particulate matter, carbon monoxide, and so on. Improved ventilation, cooking ovens or radiators, avoiding burning leaves, trash, and use of cleaner power sources may all contribute to lowering this risk. The most recent WHO report states that 7 million people regularly inhale polluted air, which exposes them to fine particles and accounts for 43% of harmful lung infections and 29% of cellular breakdown in the lungs. Children who suffer from asthma are more likely to be exposed to traffic-related air pollution.[56,57]

Family exposure to air pollution is a major factor in the worldwide decrease in life expectancy, resulting in fundamental health effects that are obvious from birth to old age. Indoor smoking; the use of building materials; power sources for cooking, heating, and lighting; pesticides; and cleaning products made of synthetic compounds are among the many factors that contribute to family air pollution.[58,59] The frequency of interstitial and harmful lung illnesses remains unacceptable due to a lack of control measures or new openings. With the development of inventive advancements, workplaces are constantly exposed to new threats.[60,61]

Even though natural and word-related lung disease rates have decreased in many Western nations, these conditions continue to be associated with high disease rates in rapidly developing nations with expanding populations. For instance, COPD affects 8.6% of Chinese adults on an average. Significant risk factors include family history of respiratory illness, lack of awareness, low education, and smoking.[3]

Physical Activity

Physical inactivity and systemic inflammation were found to be associated with both COPD and chronic bronchitis.[62] The recent emphasis on physical exercise in people with COPD arises from its robust association with mortality associated to COPD. This study analyzes clinical evidence on the definition, related characteristics, advantages, and biological processes of physical exercise in the context of COPD. Additionally, it investigates the connections between sedentary behavior and health outcomes in both the general population and those with COPD. Gaining a comprehensive understanding of these effects may provide valuable insights for future intervention research aimed at developing successful management solutions.[63] A sedentary lifestyle increases the risk of illness if we do not engage in any form of physical labor.[64] Physical exercise not only increases the energy level and builds muscle mass but also boosts the mood and helps us to regain the confidence of independency. Engaging in these exercises improves physical fitness, thereby decreasing the likelihood of exacerbating COPD symptoms [Figure 3]. Individuals who exercise regularly are more prone to maintaining good health over an extended period.[65-67] Disparities in physical activity levels are expected to emerge among nations, driven by factors like female inactivity and environmental considerations such as the walkability of urban areas. Public intervention proposes that enhancing the walkability or cyclability of cities would enhance overall well-being.[67,68]

COPD patients' daily actual work decreases in the early stages of the illness and eventually disappears, with significant clinical outcomes, when compared to healthy, age-matched controls. Higher adult lung volumes are linked to high-impact health work during puberty but not the type of flight.[67,69] Reduced lung capacity decline and intensification in COPD patients are linked to normal levels of physical activity,[70] as is a lower risk of developing COPD in smokers. Family might also be involved. COPD patients are more latent and inactive than their friends and family, despite having somewhat comparable activity inspiration. In any case, dynamic patients are more likely to have a functioning loved one and are more likely to be dynamic.[71-73] Exercise preparation should be given to most patients, according to COPD executives' guidelines.[74-76]

To encourage patients to move around more, it might be beneficial to perform light work. Mediation with low power may only be beneficial to patients with moderate aviation route block. Work can help smokers quit smoking more

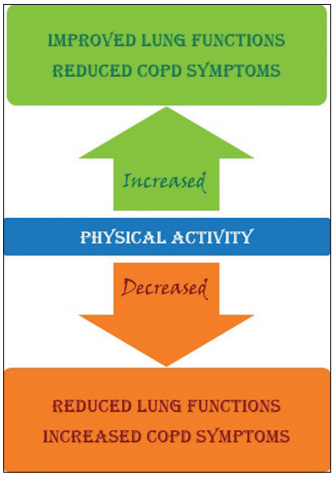

Figure 3: The influence of physical activity on lung function: Reduced physical activity exacerbates COPD symptoms, while an escalation in physical activity improves COPD symptoms

effectively. An ex-smoker's HRQoL may be comparable to that of a non-smoker if they are truly dynamic.[4,77,78]

Numerous countries face challenges in implementing clinic-based supervised exercise training programs due to factors such as a high volume of patients, transportation issues, program expenses, and geographical limitations. Home-based programs could serve as a practical and comparable alternative to the brief programs conducted in medical clinics.[79,80] Tele-rehabilitation could offer valuable potential in delivering and sustaining the advantages of pulmonary rehabilitation, especially in challenging or remote locations.[32,81] The daily step count and action time are the most accurate sizes of actual work, and they may help patients complete effective daily actual work. However, caution should be exercised when recommending actual work to older people who have difficulty moving around.[73,82,83]

Education and Self-Management

In the long-term running of COPD, a significant factor is how patients respond to their illnesses.[64] Cooperative self-management projects have been planned to maintain patients' prosperity, boost their sense of self-worth, and improve their health outcomes. These projects enhance patients' knowledge of their illness, use of medication, devices, managing the side effects, and intensification.[74] The findings indicated that individuals in the intervention group exhibited an increased walking distance, less dyspnea, and higher weight reduction in comparison to the control group.[46] Self-administration projects have been shown to significantly improve HRQoL, practice limit, and a few aspects of COPD patients' self-viability, according to a meta-analysis.[27]

Conclusion

Research has identified various approaches to reduce or prevent COPD; however, there is a substantial gap between population-based interventions and scientific knowledge. The timely detection of COPD cases through mass-scale initiatives is a crucial step in lifestyle modification to prevent, control, and manage the disease. Spirometry tests evaluate disease severity. There is extensive distribution of flu and pneumococcal vaccinations, at either no cost or low cost, for those falling into high-risk categories, enhancing accessible and effective treatments to manage chest infections in children.

Tobacco use is a confirmed primary factor in the onset of the disease and is closely tied to the severity of its progression. Encouraging individuals to quit smoking involves raising awareness of its detrimental health effects and providing support and guidance at both social and governmental levels, with implementation of stringent government smoking ban policies, group interactions, and counseling sessions.

Boost your lung health by upping your intake of antioxidants, including a variety of colorful fruits and green leafy vegetables, and maintain ideal body weight. Replace refined cereals with whole grains and millet to increase fiber intake.

Overcoming the challenge of enhancing COPD patients' engagement in physical activity requires healthcare providers to emphasize the significance of physical fitness and strength. Encouraging comparisons to past health conditions can serve as a motivational strategy for promoting leisure-time physical activity among COPD patients.[64] Engaging in regular physical exercise not only elevates energy level but also enhances their confidence. Advocating light physical activities under therapeutic guidance for sick COPD cases. These exercises make you physically fit, which reduces the severity of COPD symptoms and frequent episodes of hospitalization.

It is imperative to enhance the number of impactful, evidence-based strategies and interventions. This involves diminishing tobacco use and environmental pollution, addressing respiratory diseases early on, promoting vaccination program, and increasing awareness regarding nutrition knowledge and the consumption of nutritious foods.

Various studies proved the vital role of physical activity in maintaining health. Overcoming the challenge of enhancing COPD patients' engagement in physical activity requires healthcare providers to emphasize the significance of physical fitness and strength. Encouraging comparisons to past health conditions can serve as a motivational strategy for promoting leisure-time physical activity among COPD patients, advocating light physical activities under therapeutic guidance for sick COPD cases.

Abbreviations

- COPD Chronic obstructive pulmonary disease
- HRQoL Healthrelated quality of life.
- ECG Electrocardiogram
- FEV 1 - Forced Expiratory Volume in 1 second
- FVC- Forced Vital Capacity
- GOLD Global initiative for chronic obstructive lung
- CAT - Chronic Obstructive Pulmonary Disease Assessment Test
- CRD Chronic Renal Disease
- BMI Body mass index
- TB Tuberculosis
- H1N1 - Hemagglutinin type 1 and neuraminidases type 1
- PCV13 - Pneumococcal conjugate vaccine (13-valent)
- PPSV-23 - Pneumococcal polysaccharides vaccine (23-valent)
- NRT Nicotine replacement therapy
- CRDs Chronic respiratory diseases
- WHO World Health Organization

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