

Work Ability in Patients with COPD: Premature Retirement

Minov J*, Stoleski S, Mijakoski D, Atanasovska A, Panajotovic Radevska M, Bislimovska D, Zdraveski D

¹Institute for Occupational Health of R North Macedonia, Skopje

²Faculty of Medicine, Ss Cyril and Methodius University in Skopje

*Corresponding authors: Minov Jordan, Institute for Occupational Health of RN Macedonia, Medical Faculty, Ss Cyril and Methodius University in Skopje, RN Macedonia, Balkans

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Summary

Introduction: Existing evidence indicates that chronic obstructive pulmonary disease (COPD) can cause work disability in many patients with this condition.

Objective: To compare frequency of premature retirement and work life duration and its relation to sex and occupation during active period between retired patients with COPD and retired subjects in whom COPD was excluded.

Methods: We performed a cross-sectional study including 147 retired patients with COPD (87 males and 60 females, aged 64 to 74 years) and an equal number of retired persons in whom COPD was excluded, matched to COPD patients by sex, age and occupation group. In addition, all study subjects were classified in four occupation groups following the International Standard Classification of Occupations (ISCO-08). The study protocol included completion of an interviewer-led questionnaire and spirometry with bronchodilator test by indication.

Results: Frequency of premature retirement (age less than 64 years for men and 62 years for women) was significantly higher in COPD patients than in non-COPD controls (32.6% vs. 17.7%; $P = 0.022$). Mean age of retirement was significantly lower in COPD patients than in non-COPD controls (55.8 ± 5.9 yrs vs. 60.1 ± 3.1 yrs; $P = 0.000$). Mean duration of active work life was significantly lower in COPD patients than in non-COPD controls (26.1 ± 2.8 yrs vs. 32.7 ± 3.1 yrs; $P = 0.000$). There was not significant difference in the distribution of premature retirement by sex in both examined groups. Significantly higher frequency of premature retirement was found in COPD patients who worked as manual workers than in those who worked in non-manual jobs (42.8% vs. 21.3%; $P = 0.037$).

Conclusion: We found significant impact of COPD on work ability, i.e. significantly higher frequency of early retirement and significantly shortened work life in COPD patients than in subjects without COPD, indicating a need of improvement of the preventive measures and activities in order to maintain the work ability of these patients as long as possible.

Introduction

Although Chronic Obstructive Pulmonary Disease (COPD) is often considered as a disease of the elderly, a large proportion of patients with COPD are at working age and the disease significantly affects their work ability and work productivity leading to reduced working hours, absenteeism, presenteeism and early retirement. Disability due to COPD is a very important public health problem in the last decades at global level with a substantial impact on patients, their families, governments and the whole society. On the other side, up to now evidence for the impact of COPD on work ability and work productivity loss still is not sufficient [1-5].

According to the results of the Global Burden of Disease (GBD) study, the Disability Adjusted Life Years (DALY), i.e.,

the sum of years lost because of premature mortality and years of life lived with disability adjusted for its severity, from 1990 to 2019 COPD was the primary driver of increased DALY worldwide, especially in Low- and Middle-Income Countries (LMICs). Namely, the global health burden of COPD increased from 59.2 million DALY in 1990 to 74.4 million DALY in 2019 that was increase of 25.7% [6-8].

In the Dutch study investigating the economic impact of COPD in working age population on both patients and government, van Boven et al. indicated that direct medical costs for COPD patients of working age were €91 million, while the amount of income due to early retirement exceeded over two times their medical costs (€223 million). In addition, costs for the government were considerable because of lost tax revenues (€77 mil-

lion) and COPD related disability pensions paid (€180 million) [9].

According to the Law on Pension and Disability Insurance, the customary retirement age in RN Macedonia is 62 years for females and 64 years for males [10]. Prematurely retirement (early retirement or disability retirement), i.e., retirement at the age less than 62 years for females and 64 years for males, can be approved in the case of disability caused by disease or injury by the Commission for the assessment of work ability within the Fund of Pension and Disability of RN Macedonia following the criteria of the Rulebook on the organization, composition and way of working of the Commission for the assessment of work ability [11].

The aim of the present study was to compare frequency of disability retirement and its relation to sex and occupation during their work life between retired patients with COPD and retired subjects in whom COPD was excluded.

Methods

Study design and setting

A cross-sectional study (study of prevalence) was performed at the Institute for Occupational Health of RN Macedonia, Skopje, in the period December 2022 – December 2023. Premature retirement and duration of work life and its relation to sex and

occupation during their active period were compared between a group of retired patients with COPD and a group of retired non-COPD controls.

Study population

Study population included 294 retired subjects divided in two groups. The first group included 147 retired patients with COPD diagnosed by physician during their work life. The second group included an equal number of retired subjects in whom COPD was excluded, matched to the COPD patients by sex, age and occupation in their active period.

All study subjects were informed about study and their written consent was obtained.

Study protocol

Study protocol included completion of a questionnaire and lung function measurements.

An interview-led questionnaire was consisted of four parts.

The first part included questions regarding demography of the study subjects (sex, age and smoking status). Smoking status (active smoker, ex-smoker, and non-smoker) was defined by the World Health Organization (WHO) criteria [12].

The second part of the questionnaire included questions about occupation and work characteristics of the study subjects dur-

Table 1: Characteristics of the study subjects.

Variable	Patients with COPD (n = 147)	Non-COPD controls (n = 147)	P value
Sex			
Males	87 (59.2%)	85 (57.8%)	0.904
Females	60 (40.8%)	62 (42.2%)	0.879
Age (years)			
Range	64 – 74	64 – 75	
Mean age	68.1 ± 3.1	67.8 ± 3.8	0.516
Smoking status			
Active smoker	44 (29.9%)	52 (35.4%)	0.478
Ex-smoker	69 (46.9%)	46 (31.3%)	0.069
Non-smoker	34 (23.2%)	49 (33.3%)	0.146
Occupation			
Group 1	40 (27.2%)	37 (23.8%)	0.761
Group 2	37 (25.2%)	41 (27.9%)	0.687
Group 3	35 (23.8%)	34 (23.1%)	0.914
Group 4	35 (23.8%)	35 (23.8%)	1.000
Group 1+2	77 (52.4%)	78 (53.1%)	0.948
Group 3+4	70 (47.6%)	69 (46.9%)	0.944
Other chronic conditions diagnosed by physician			
Arterial hypertension	45 (30.6%)	41 (27.9%)	0.704
IHD	26 (17.7%)	21 (14.3%)	0.498
Metabolic syndrome	24 (16.3%)	25 (17.0%)	0.895
DM type 2	26 (17.7%)	24 (16.3%)	0.794
Osteoarticular disorders	56 (38.1%)	47 (31.9%)	0.445
Peptic ulcer	19 (12.9%)	15 (10.2%)	0.639
Spiro metric parameters (% pred.)			
FVC	69.4 ± 6.3	96.7 ± 12.8	0.000
FEV ₁	43.2 ± 4.1	84.1 ± 6.1	0.000
FEV ₁ /FVC ratio	0.62 ± 0.03	0.85 ± 0.07	0.000

COPD: chronic obstructive pulmonary disease; IHD: ischaemic heart disease; DM: diabetes mellitus; FEV₁: forced expiratory volume in 1 second; FVC: forced vital capacity; % pred.: % of the predicted value.

ing their active period. Occupations were classified in four groups following the International Standard Classification of Occupations (ISCO-08) based on the skill level, i.e., on the ability to carry out the tasks and duties of a given job, that is described elsewhere [13,14]. Additionally, study subjects were divided in two occupation groups, i.e., a group including subjects who performed dominantly physical and/or manual tasks during their work life, i.e., workers from manual jobs (Group 1+2), and a group of subjects working in non-manual jobs during their work life (Group 3+4).

The third part of the questionnaires included questions on chronic diseases of the study subjects diagnosed by physician and their treatment.

The fourth part of the questionnaire included questions on the retirement of the study subjects, i.e., customary or premature retirement, the leading condition for premature retirement, the age of retirement and the duration of their work life.

Lung function measurements included baseline (pre-bronchodilator) spirometry which was performed in all study subjects and post-bronchodilator spirometry, which was performed in subjects with value of the ratio between forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC) less than 0.70. Fixed airflow narrowing characteristic for COPD was considered if post-bronchodilator FEV1/FVC remained less than 0.70 [15,16].

Statistical analysis

All analyses were carried out using the Statistical Package for the Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean values with standard deviation (SD), and the nominal variables as numbers and percentages. Study variables were checked for normality by the Kolmogorov–Smirnov and Shapiro–Wilk W tests, and normal data distribution was detected. Due to the aim of the study for data analyses were used univariate statistical models for testing the differences in prevalence and comparison of the means. Chi-square test (or Fisher’s exact test where appropriate) was used for testing difference in the prevalence. Comparison of spirometric measurements was performed by independent-samples T-test. The level of significance was set at P value less than 0.05.

Results

Table 1 is shown the demographic and other characteristics of the study subjects.

Frequency of prematurely retired subjects was significantly higher in COPD patients than in non-COPD controls (32.6% vs. 17.7%; *P* = 0.022) (**Figure 1**).

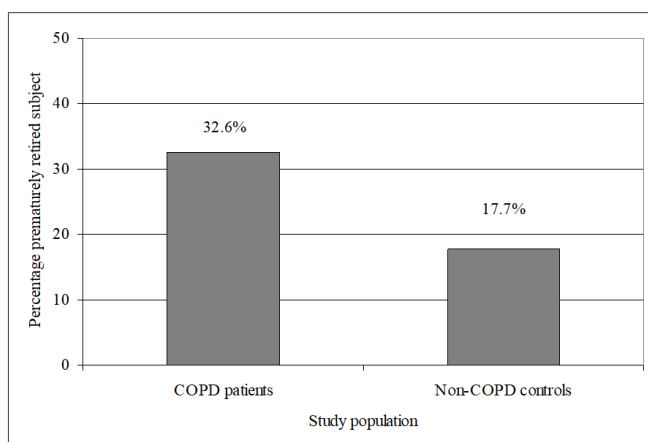
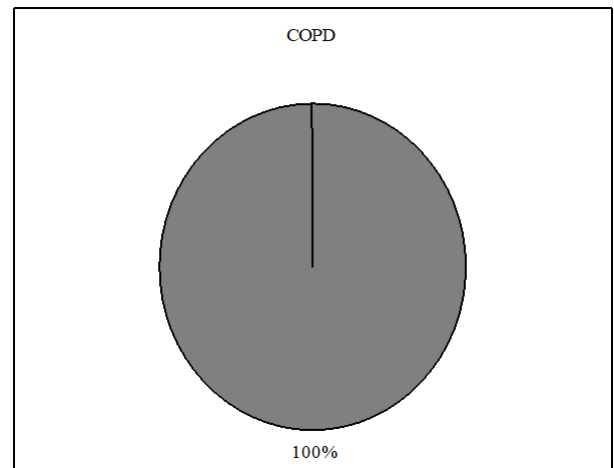
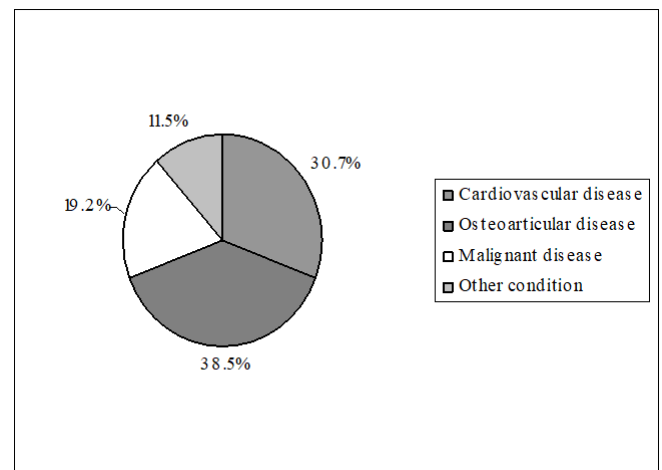


Figure 1: Frequency of prematurely retired subjects in the study population.

The leading condition for premature retirement in the first group was COPD, whereas the leading conditions of premature retirement in the second group were osteoarticular disease (38.5%), cardiovascular disease (30.7%), malignant disease (19.2%), and other condition (11.5%) (**Figure 2 a, b**).



a) COPD patients



b) non-COPD controls

Figure 2: Leading condition for premature retirement in the study population.

Mean age of retirement was significantly lower in the group of COPD patients than in the group of retired non-COPD controls (55.8 ± 5.9 years vs. 60.8 ± 4.1 years; *P* = 0.000) (**Figure 3**).

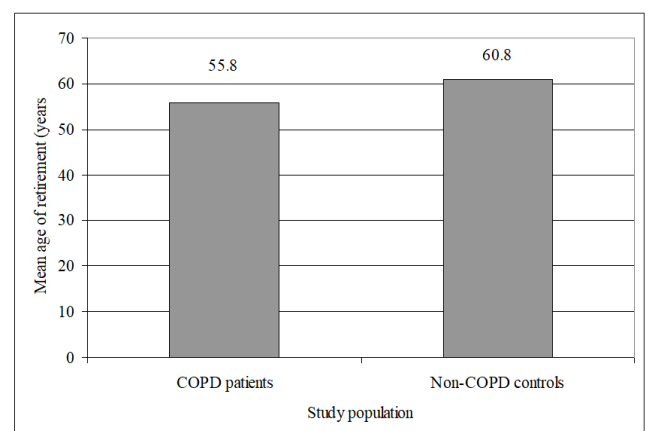


Figure 3: Mean age of retirement of the study population.

Mean duration of active work life was significantly lower in the group of COPD patients than in the group of non-COPD controls (26.1 ± 2.8 years vs. 32.7 ± 3.1 years; *P* = 0.000) (**Figure 4**).

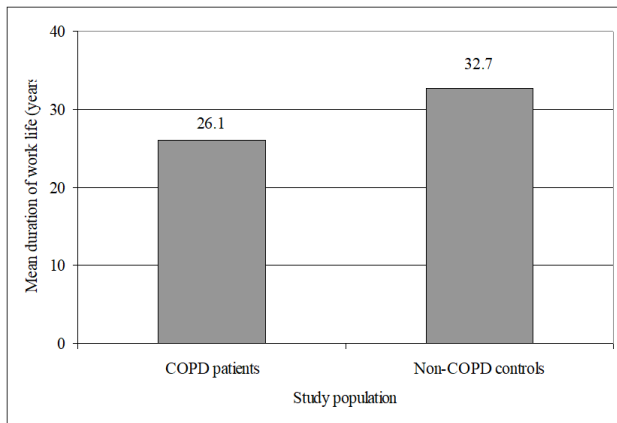


Figure 4: Mean duration of work life of the study population.

Frequency of prematurely retired males and females was significantly higher in COPD patients than in non-COPD controls (32.1% vs. 17.6%; $P = 0.039$ and 33.3% vs. 17.7%; $P = 0.047$, respectively). On the other hand, there was not significant difference between prematurely retired males and females neither within the COPD group nor within the group of non-COPD controls (32.1% vs. 33.3%; $P = 0.917$, and 17.6% vs. 17.7%; $P = 0.990$, respectively) (Figure 5).

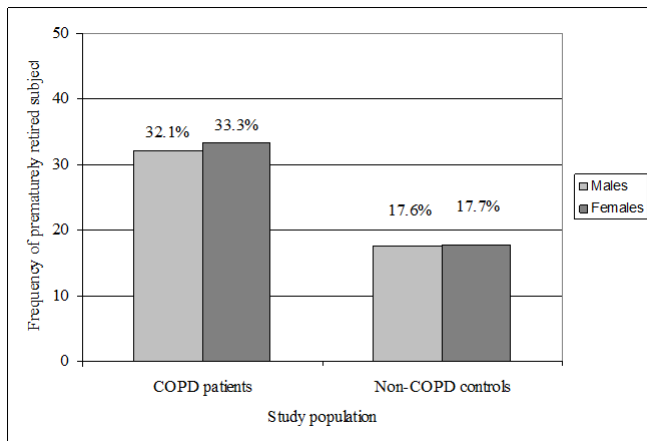


Figure 5: Distribution of prematurely retired subjects by sex.

Mean age of retirement in COPD patients was statistically higher in males than in females (54.3±2.9 vs. 56.6±3.4; $P = 0.000$). Similar finding was obtained in the group of non-COPD controls (58.9 ± 3.7 vs. 61.9 ± 3.2; $P = 0.000$) (Figure 6).

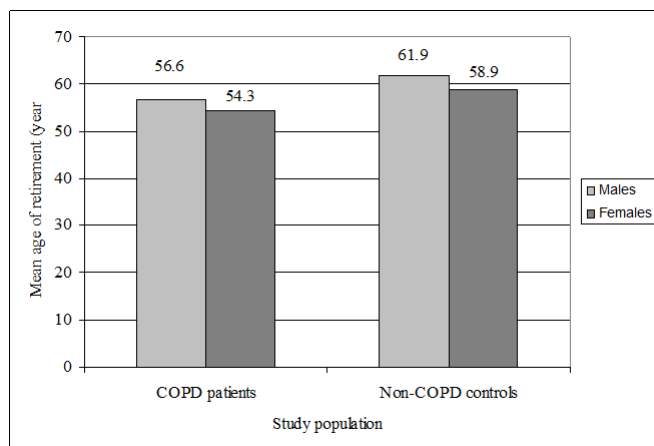


Figure 6: Mean age of the retired males and females.

Frequency of prematurely retired COPD patients was significantly higher in those who worked in manual jobs (Group 1+2) than in the subjects who worked in non-manual jobs (Group

3+4) (42.8% vs. 21.3%; $P = 0.037$). Frequency of prematurely retired non-COPD controls was higher in those who worked in manual jobs but the difference was not statistically significant (24.3% vs. 13.1%; $P = 0.159$) (Figure 7).

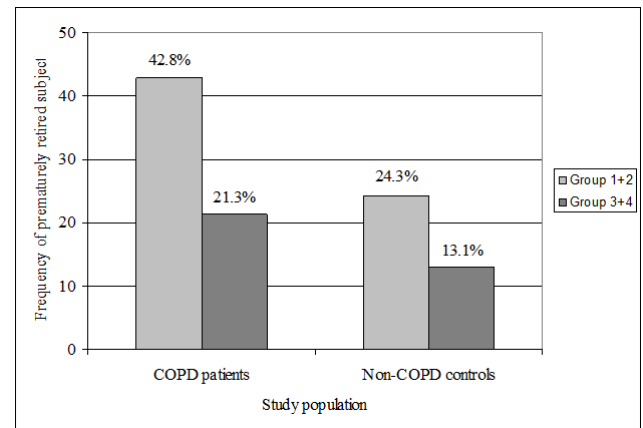


Figure 7: Distribution of prematurely retired subjects by occupation during their work life.

Mean age of retirement of the COPD patients was significantly lower in the subjects from the Group 1+2 (ex-manual workers) than in the subjects from the Group 3+4 (53.4 years ± 3.9 vs. 57.1 years ± 2.1; $P = 0.000$). Mean age of retirement in non-COPD controls was also significantly higher in the Group 1+2 than in the Group 3+4 (58.6 years ± 2.8 vs. 61.8 years ± 1.9; $P = 0.000$) (Figure 8).

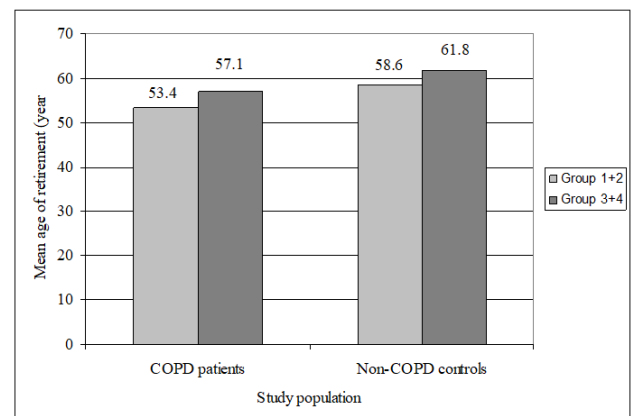


Figure 8: Mean age of the retired subjects from the Group 1+2 and Group 3+4.

Discussion

COPD is one of the leading causes of morbidity, mortality and disability at global level in the recent decades. In addition, the prevalence and burden of COPD are projected to increase in the coming decades due to combination of continued exposure to COPD risk factors, i.e., tobacco smoke, occupational pollutants, outdoor and indoor environmental pollutants, etc., and aging of the world population.

In our previous study on work ability in patients with COPD we investigated frequency and duration of work absence in these patients finding significantly higher frequency of sick leave episodes and their significantly higher duration in COPD patients than in non-COPD controls [14]. In the present study we compared frequency of premature retirement between a group of retired COPD patients and a group of retired non-COPD controls as a continuum of our investigation on the impact of COPD on work ability in the working age population. Both groups had similar sex distribution and included retired subjects at similar age.

In the 30-year follow-up Finnish study which included 24,043 adult Finnish twins (49.7% females) the authors found that smoking strongly predicted disability retirement due to COPD, i.e., in comparison to never-smokers age-adjusted hazard ratio for current smokers was 22.0 and for smokers for equal and more than 12 pack years was 27.3 [17]. Frequency of active smoking in our study was high, i.e., around a third of the study subjects of both examined groups were active smokers. Similar findings were obtained in our previous surveys indicating low effectiveness of anti-smoking strategies and activities and a need of greater emphasis for tobacco smoking and environmental and occupational exposure to other respiratory irritants [18,19].

All study subjects were classified in four occupation groups with similar size following the criteria of ISCO-08. This classification is based on the worker's skill level, i.e., on his ability to carry out the tasks and duties of a given job. Occupations at Skill Level 1 and 2 (Group 1 and 2) usually involve the performance of physical or manual tasks requiring hard or moderate muscular work. At the same time, work tasks in these occupations are often associated with exposure to variety respiratory irritants. Occupations at Skill Level 3 and 4 (Group 3 and 4) involve non-manual jobs, i.e., the performance of complex technical and practical tasks that require extensive body of factual, technical and procedural knowledge in specialized field [13].

In the study on comparison of prediction of health outcomes derived from work and work conditions of several classification schemes, Eyles et al. found that the ISCO scheme, i.e., classification specific to occupation or industry, was the most appropriate [20].

Frequency of prematurely subjects was two-fold higher in retired COPD patients than in retired non-COPD controls and mean age of retirement was significantly lower in retired COPD patients (around 56 years) than in retired non-COPD controls (around 61 years). In addition, mean duration of active work life was significantly lower in the group of retired COPD patients (around 26 years) than in the group of retired non-COPD controls (around 33 years). Consistent with our findings were findings of the international survey on the impact of COPD on a working age population, a cross-country (Brazil, China, Germany, Turkey, US, UK), cross-sectional survey which included 2,426 participants aged 45-67 years. The mean age of retired subjects was 58.3 and average time since retirement was 4 years that suggested the average time of retirement was around 54 and the authors indicated significant personal, economic and social burden of COPD on working age people [21].

In the past, most studies indicated higher COPD prevalence and mortality in men than in women, but later studies indicated similar COPD prevalence in both sexes, probably reflecting the changing patterns of tobacco smoking. On the other side, several studies on animal models and human specimens demonstrated higher susceptibility to harmful effects of smoking in women than in men and a greater burden of COPD in females compared with males [22-24]. Our results indicated non-significant gender-related difference in the frequency of prematurely retired COPD patients with significantly lower age of the retirement in males than in females.

We found significantly higher frequency of prematurely retired COPD patients in the groups including subjects who performed

physical and/or manual tasks during their work life than in the groups including subjects working in non-manual jobs during their active period. In addition, mean age of retirement in the retired COPD patients from the Group 1+2 was significantly lower than in the retired COPD patients from the Group 3+4. A number of studies indicated that occupational exposures, including vapors, gases, organic and inorganic dusts, and fumes, are an under-appreciated risk factor for the COPD development, as well as for the COPD progression [25-28].

According to the American Thoracic Society statement published in 2003, occupational exposures accounted for 10-20% of either symptoms or functional impairment consistent with COPD [29].

Results from the cross-sectional observational study conducted by Marchetti et al. demonstrated that self-reported exposure to workplace dust and fumes was associated with not only increased airflow obstruction and respiratory symptoms, but also more emphysema and gas trapping, as assessed by computed tomography scan, in both men and women [30]. By our experience, the COPD prevalence in non-smoking workers from "dusty" occupations, i.e., in bricklayers, cotton workers, grain workers, dairy farmers, and welders, was significantly higher than its prevalence in non-smoking administrative workers who served as controls [31].

Findings of the present study should be interpreted in the context of its limitations. Relatively small size of enrolled study participants, as well as cross-sectional analysis, could have implication on the results obtained and their interpretation.

In addition, consistent with our previous study on frequency and duration of sick leave episodes in COPD patients, classification of occupations was based on the skill level required for a given job, not on the workplace exposure, so the impact of certain workplace exposure on the prematurely retirement could not be assessed. Strengths of the study is random selection of retired COPD patients making it representative of the retired COPD population at large, as well as the inclusion of comparison group of retired non-COPD subjects that allowed better understanding of the magnitude of the difference in work ability loss in COPD patients.

Conclusion

Our findings proved the great impact of COPD on work ability of affected workers, i.e., we found significantly higher frequency of premature retirement and significantly lower work life duration in patients with COPD than in non-COPD controls. In addition, we found similar frequency of prematurely retired COPD patients of both sexes and its significantly higher frequency in COPD patients who worked in manual jobs during their work life.

The results obtained indicated a need of workplace interventions to reduce respiratory exposures, as well as medical preventive measures for early detection of lung impairment, aimed at improvement of work ability and work productivity among COPD patients.

Competing Interests: All authors hereby have declared that no competing interests exist.

Authors Participation: JM and SS participated in data collection, data analysis, and writing all versions of the manuscript. DM, AA, MPR, DB, and DZ participated in data collection. All authors read and approved the final version of the manuscript.

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