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Prevalence of chronic obstructive pulmonary disease and risk factors in São Paulo, Brazil, 2008–2009

ABSTRACT

OBJECTIVE: To assess the prevalence of chronic obstructive pulmonary disease and related risk factors.

METHODS: A population-based cross-sectional study with 1,441 individuals of both sexes aged 40 years or more was conducted in the city of São Paulo, Brazil, between 2008 and 2009. A two-stage (census tract, household) cluster random sampling stratified by sex and age was used and data was collected through home interviews. Multiple Poisson regression was used in the adjusted analysis.

RESULTS: Of all respondents, 4.2% (95%CI: 3.1;5.4) reported chronic obstructive pulmonary disease. After adjustment the following factors were found independently associated with self-reported chronic obstructive pulmonary disease: number of cigarettes smoked in their lifetime (>1,500 vs. none) (PR=3.85; 95%CI: 1.87;7.94); easily fatigued (yes vs. no) (PR=2.61; 95%CI: 1.39;4.90); age (60;69 vs. 50;59) (PR 3.27; 95%CI: 1.01;11.24); age (70 and over vs. 50;59) (PR 4.29; 95%CI: 1.30;11.29); health conditions in the last 15 days (yes vs. no) (PR=1.31; 95%CI: 1.02;1.77); leisure-time physical activity (yes vs. no) (PR=0.57; 95%CI: 0.26;0.97).

CONCLUSIONS: The prevalence of chronic obstructive pulmonary disease is high in the population studied and is associated with smoking and age over 60. Frequent health conditions and low leisure-time physical activity are a consequence of the disease.

DESCRIPTORS: Pulmonary Disease, Chronic Obstructive, Epidemiology. Risk Factors. Life Style. Cross-Sectional Studies.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is characterized by airflow limitation that is usually not fully reversible, progressive and associated with abnormal inflammatory response in the lungs to inhaled harmful particles or gases. The main risk factors for COPD include cigarette smoking, inhalation of occupational dusts, chemical irritants, and environmental pollution, low socioeconomic condition and severe respiratory infections during childhood.[2]

Chronic inflammation of the lungs can result in damage to the bronchi (chronic bronchitis) and cause lung parenchyma destruction (emphysema) with consequent reduced elasticity. Lung damage varies among individuals as well as symptom presentation. COPD symptoms include chronic cough, sputum

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production and dyspnea on exertion. Although COPD mainly affects the lungs, it also has significant systemic cardiovascular and musculoskeletal consequences. COPD changes are characterized by inflammation, mucus hypersecretion, smooth muscle contraction of the airways, bronchial wall thickening, loss of elastic recoil and alveolar destruction, leading to airflow limitation, inadequate ventilation-perfusion ratio and pulmonary hyperinflation. COPD comprises chronic bronchitis and emphysema but not asthma. These two conditions are individually defined: chronic bronchitis refers to the presence of cough and sputum production for at least three months during two consecutive years, and emphysema is defined by alveolar destruction.[2]

COPD is a major cause of morbidity and mortality worldwide and imparts substantial economic burden on individuals and health systems. Direct costs include medical (drugs, tests, consultations and hospital services) and non-medical expenses (transportation and rental/purchase of home equipment). Indirect costs are caused by reduced or lost productivity due to the disease or early death. Given COPD prevalence and its impact, the estimated disease-related cost is US$ 1,522.00 per patient per year, almost three times the cost per asthma patient.[5] Data from a prospective cohort of 1,510 patients with COPD followed up in Spain during the year of 2000 showed that the annual costs were US$ 2,911 for severe, US$ 2047 for moderate and US$ 1,484 for mild patients. [20]

Halbert et al[10] (2003) assessed the prevalence of COPD in 17 cities in Europe and North America after reviewing 32 articles published between 1961 and 2001. The prevalences ranged from 4% to 10% and they were estimated based on spirometry results, respiratory symptoms and self-reported disease.

The prevalence of COPD was between 6% and 15.8% in São Paulo in 2003 based on spirometry diagnostic criteria.[18] In Latin America, the prevalence ranged from 7.8% in Mexico City, Mexico, to 19.7 % in Montevideo, Uruguay.[19]

There is great scarcity of information on COPD prevalence and associated factors. The major risk factor for COPD is cigarette smoking. Pipe and cigar smoking and other popular forms of tobacco consumption are also factors associated with COPD. Other factors include occupational dusts and chemicals; indoor air pollution from wood stoves used for cooking and heating in poorly ventilated dwellings; outdoor pollution, which adds to the overall effects of inhaled particles on the lungs, though its role in COPD is not yet understood; and passive smoking, which can also contribute to respiratory symptoms and COPD.[2,17]

In the United States, COPD is the fourth leading cause of death and a leading cause of morbidity and disability. There were about 715,000 hospitalizations due to COPD in 2005.[1] According to the most recent consensus on COPD in Brazil,[2] it was the fifth leading cause of hospitalization in the public health system in people over 40 in 2003, with 196,698 hospitalizations and a cost of approximately R$ 72 million. The number of deaths from COPD in Brazil was 38,000 people per year, ranking between the fifth and sixth leading cause of death (excluding violent deaths). Between 1997 and 2007 mortality from COPD increased by 24.3%.[a]

Given the importance of this condition in Brazil, the present study aimed to assess the prevalence of COPD and factors associated.

METHODS

A cross-sectional population-based study was conducted using data from the 2008 Health Survey of the City of São Paulo (ISA-Capital 2008) between 2008 and 2009. A total of 3,271 adults of both sexes aged 40 years or more were selected and the final sample consisted of 1,441 individuals.

A two-stage (census tract, household) cluster random sampling stratified by sex and age was used. Seventy census tracts were randomly selected from the 267 urban census tracts in the city of São Paulo sampled in the Brazilian Household Survey (*Pesquisa Nacional por Amostra de Domicílios,* PNAD-2002).[b]

Data was collected through a structured questionnaire comprising 21 thematic groups with mostly closed questions.[c] All interviews were conducted by trained staff that was supervised throughout the study. Interviews by phone or at home were performed in a random sample of 5% of the respondents to ensure quality of data collection. The non-response rate was 22.5%; in 7.3% of the selected households no dweller was found or they refused to inform whether any of the dwellers was in the age group of interest.

The dependent variable was self-reported COPD (yes/no). The independent variables selected for the analysis were:

demographic and socioeconomic characteristics: gender; age; race/skin color; marital status; schooling;

[a] Ministério da Saúde. Departamento de Informática do SUS – DATASUS. Informações de saúde: estatísticas vitais - mortalidade [cited 2010 Sep 20]. Available from: http://www2.datasus.gov.br/DATASUS/index.php?area=0205

[b] Alves MCGP, Escuder MML. Plano de amostragem do ISA-Capital 2008. São Paulo; 2009 [cited 2010 Nov 2]. Available from: http://www.fsp.usp.br/isa-sp/pdf/planoamostral2008.pdf

[c] Universidade de São Paulo, Faculdade de Saúde Pública. Inquérito de Saúde no Município de São Paulo - ISA Capital 2008: questionário completo. São Paulo; 2008 [cited 2010 Nov 2]. Available from: http://www.fsp.usp.br/isa-sp/pdf/questionarioisa2008.pdf.

family income; housing conditions; type of housing; number of rooms in the household and sewage disposal;

Lifestyle variables included: smoking; number of cigarettes smoked per day; years of smoking; number of cigarettes smoked in their lifetime, calculated by the average number of cigarettes smoked per day and the number of years of smoking; alcohol dependence evaluated using the Cut-down, Annoyed by Criticism, Guilty and Eye Opener (CAGE) questionnaire; and leisure-time physical activity;

Health-related variables included: body mass index (BMI) calculated based on weight and height information provided; sleep, assessed through the items "sleeps badly" / "feel tired all the time" / "get easily tired" of the Self-Report Questionnaire (SRQ-20); hospitalization in the 12 months prior to interview; length of hospital stay; health problems in the 15 days preceding the interview; and self-reported medical conditions such as hypertension, diabetes, allergies, rhinitis, anemia, back pain, arthritis/ rheumatic disease, chronic kidney disease, stroke, depression/anxiety/mental problems, osteoporosis and heart disease.

The association between independent variables and COPD was assessed in the bivariate analysis with the use of χ^2 test at a 5% significance level. Prevalence ratios (PR) and related 95% confidence intervals (95%CI) were estimated and an adjusted Poisson multiple regression analysis was performed. The multiple regression model included the variables with $p<0.20$ in the bivariate analysis and only those with $p<0.05$ remained in the model. Interactions between the variables in the final model were also examined. The design effects for the analysis of complex survey data were also examined.

The analyses were carried out in SPSS 16.0 that allows to analyzing observations of different weights.

The study was approved by the Research Ethics Committee of the Universidade de São Paulo School of Public Health (protocol #381/2001). All respondents signed a consent form informing the purposes of the study and information requested and ensuring confidentiality of all information provided.

RESULTS

Of the 1,441 respondents aged 40 years or more, 55.6% were female, 66.3% were white and 69.4% had a partner. Of all, 44% elementary education and 27.9% middle/ high school education. Sixty-eight percent reported living in a house, 73.7% were home owners and 71.7% lived in households with four or more rooms (Table 1).

The estimated prevalence of self-reported COPD was 4.2% (95%CI 3.1;5.4). The variables associated with COPD in the crude analysis were: age ($p<0.030$); number of cigarettes smoked in their lifetime ($p<0.001$); feel tired all the time ($p=0.011$); get easily tired ($p<0.001$); leisure-time physical activity ($p=0.047$); health problems in the 15 days prior to the interview ($p=0.046$); rhinitis ($p=0.030$); and osteoporosis ($p=0.031$) (Tables 1, 2 and 3).

The independent variables associated with self-reported COPD in the multiple regression model were: number of cigarettes smoked in their lifetime (>1500 / none) (PR = 3.85, 95%CI 1.87;7.94); get easily tired (yes / no) (PR = 2.61, 95%CI 1.39;4.90); age (60 to 69 / 50 to 59 years) (PR = 3.27, 95%CI 1.01;11.24), age (70 years and more / 50 to 59 years) (PR = 4.29, 95%CI 1.30;14.29); health problems in the 15 days prior to the interview (yes / no) (PR = 1.31, 95%CI 1.02;1.77), and leisure-time physical activity (yes / no) (PR = 0.57, 95%CI 0.26;0.97) (Table 4).

There was no interaction between number of cigarettes smoked in their lifetime and get easily tired ($p=0.279$). Leisure-time physical activity did not change the association with health problems in the 15 days preceding the interview ($p=0.747$) and get easily tired ($p=0.101$). There was no interaction between get easily tired and health problems in the 15 days preceding the interview ($p=0.401$). Age did not change the association with any variables except for the number of cigarettes smoked in their lifetime ($p<0.001$).

DISCUSSION

The estimated prevalence of self-reported COPD was 4.2% (95%CI 3.1;5.4%). Data on the prevalence of COPD in Latin America is relatively scarce. The only study published in Brazil until 2004 was carried out in Pelotas, southern Brazil.[17] It was a cross-sectional study with a random sample of 1,053 people over 40 years that estimated the prevalence of chronic bronchitis diagnosed based on the classical clinical criteria. It was found a prevalence of 12.7% of chronic bronchitis in this sample. Although it was an important study on the epidemiology of chronic bronchitis in Brazil, emphysema was not investigated and thus the prevalence of COPD was not assessed.

The Platino Project was a cross-sectional population-based study that assessed the prevalence of COPD in 2003. São Paulo was the first city studied and, based on the diagnostic spirometry criteria used, the prevalence ranged between 6%[17] and 19.7%[18] in Latin America.

According to Halbert et al[11] (2006), the prevalence of COPD diagnosed by spirometry was 9.2% (95%CI 7.7;11.0) in 37 studies and the prevalence of self-reported COPD was 4.9 (95%CI 2.8;8.3) in seven studies, consistent with that found in the present study.

Table 1. Sample distribution and prevalence of self-reported chronic obstructive pulmonary disease in individuals aged 40 years or more according to demographic and socioeconomic variables. São Paulo, Southeastern Brazil, 2008–2009.

Variable	n	%	Prevalence (%)	p-value*	PR (95%CI)
Gender				0.698	
Male	574	44.4	3.5		1
Female	867	55.6	4.0		1.13 (0.61;2.09)
Age (years)				0.030	
40–49	295	39.3	3.4		2.10 (0.65;6.76)
50–59	222	29.6	1.7		1
60–69	443	15.1	5.3		3.27 (1.08;9.90)
70 or more	481	15.9	7.1		4.46 (1.50;13.33)
Race/skin color				0.230	
White	955	66.3	3.3		1
Black/mixed	446	33.7	4.8		1.47 (0.78;2.75)
Marital status				0.748	
No partner	532	69.4	3.5		1
Partner	895	30.6	3.8		1.10 (0.62;1.94)
Schooling				0.681	
None	115	5.0	2.7		1
Elementary/Middle school	836	44.2	3.5		1.30 (0.46;3.72)
High school	281	27.9	4.7		1.77 (0.58;5.41)
College	195	22.9	3.1		1.13 (0.33;3.94)
Family income (minimum wages)[a]				0.625	
>4	291	34.7	2.4		1
>2.5–4	410	33.7	4.2		1.78 (0.72;4.39)
>1–2.5	467	26.4	4.0		1.68 (0.66;4.31)
≤1	154	5.3	3.2		1.32 (0.35;4.98)
Type of housing				0.798	
Apartment	171	14.1	3.4		1
House	1264	85.9	3.8		1.12 (0.45;2.78)
Housing status				0.063	
Not owned	313	26.3	2.0		1
Owned	1112	73.7	4.4		2.22 (0.95;5.18)
Number of rooms in the household				0.774	
1–3	388	28.3	4.0		1
4 or more	1050	71.7	3.6		0.90 (0.42;1.91)
Sanitation				0.806	
Sewage system	1330	93.6	3.7		1
Other	107	6.4	3.3		0.87 (0.28;2.71)

[a] Family income in minimum wages (1 monthly minimum wage: R$ 510.00).
* Chi-square test

The interaction between exposure to environmental risk factors such as cigarette smoking, and individual factors is key for the development of COPD.[14] Individual factors include alpha-1 antitrypsin deficiency, bronchial hyperresponsiveness, malnutrition, prematurity and recurrent respiratory infections.[2] Alpha-1 antitrypsin deficiency is a genetic disorder that occurs in 3% to 10% of the Caucasian population and is associated with COPD.[14] In 1963,[15] Laurell & Eriksson showed that individuals with deficiency of this lung-protective protein had an increased prevalence of emphysema as they were unable to inhibit neutrophil elastase action allowing it to destroy lung parenchyma. Although there is no evidence of the role of genetic variation in the development of COPD,

Table 2. Sample distribution and prevalence of self-reported chronic obstructive pulmonary disease in people aged 40 years or more according to lifestyle. São Paulo, Southeastern Brazil, 2008–2009.

Variable	n	%	Prevalence (%)	p-value*	PR (95%CI)
Smoking				0,109	
Current smoker	267	25.0	2.9		1
Never smoked	781	49.8	3.2		1.10 (0.45;2.66)
Former smoker	393	25.2	5.9		2.11 (0.90;4.93)
Number of cigarettes per day				0.303	
None	1182	75.5	4.0		1.91 (0.68;5.32)
≤20	215	20.3	2.2		1
>20	44	4.2	6.7		3.24 (0.69;15.15)
Years of smoking[a]				0.582	
≤40	295	70.8	1.8		1
>40	360	29.2	10.7		1.73 (0.22;13.84)
Number of cigarettes smoked in their lifetime				<0.001	
None	797	50.6	3.1		1
≤ 1500	536	44.0	3.6		1.16 (0.55;2.45)
> 1500	108	5.4	11.6		4.12 (1.90;8.93)
Alcohol dependence				0.760	
No	598	89.4	3.6		1
Yes	69	10.6	2.9		0.81 (0.20;3.28)
Leisure-time physical activity				0.047	
No	1080	72.5	4.3		1
Yes	359	27.5	2.4		0.54 (0.27;0.96)

[a] Age-adjusted
* Chi-square test

some authors claim that genetic inheritance may be involved in up to 40% of cases of chronic bronchitis.[9]

The most important risk factor for COPD is cigarette smoking. Pipe and cigar smoking and other forms of tobacco consumption are also risk factors. In the present study, the PR of the number of cigarettes smoked in their lifetime (>1,500) was 3.9 times greater among those with COPD compared to those who never smoked. The Platino Project showed that smokers had a PR of 2.04 (95%CI: 1.41;2.95) for COPD compared with nonsmokers in São Paulo in 2003.[18] The Second Brazilian Consensus on COPD[2] reported that approximately 15 % of smokers develop COPD, and this proportion is likely to be underestimated. A cohort study[16] with 8,045 individuals followed up for 25 years in the city of Copenhagen, Denmark, estimated that 25% of smokers developed COPD during this follow-up period.

The highest prevalence of COPD are found between the sixth and seventh decade of life.[17,18] The present study showed that, regardless of the number of cigarettes smoked in their lifetime, individuals aged ≥60 years had a significantly higher prevalence of COPD. The natural history of chronic airflow obstruction shows that even individuals who have never smoked or are not susceptible to the harmful effects of smoking have an average decline of 25% in their lung function between 40 and 80 years of age.[6] The prevalence of COPD was a 1.3 times higher in individuals who reported health problems in the 15 days preceding the interview compared with those who did not. The prevalence ratio for COPD was 2.6 times higher among those who reported getting easily tired compared to those who did not. COPD compromises lung mechanics, peripheral muscles and cardiovascular system, which may explain their dyspnea and perception of fatigue with exertion.[8, 22,23]

Changes in lung mechanics result from bronchial obstruction and air trapping in the lungs. This pathophysiological process leads to lung hyperinflation over time, which progressively reduces one's ability to physical exertion. The pathophysiological changes aggravate as COPD progresses and patients develop limiting symptoms such as dyspnea. They have reduced ability to perform daily life activities and consequently it creates a vicious cycle as they limit their activities to mitigate the symptoms.[22] Excessive resting make these patients decrease their physical fitness, which is a main factor for muscle mass loss in COPD patients.[8,23]

Table 3. Sample distribution and prevalence of self-reported chronic obstructive pulmonary disease in people aged 40 years or more according to health conditions. São Paulo, Southeastern Brazil, 2008–2009.

Variable	n	%	Prevalence (%)	p-value*	PR (95%CI)
Body mass index (kg/m^2)				0,264	
<25	568	41.9	4.4		1
≥25	829	58.1	3.1		0.71 (0.38;1.31)
Sleeps badly				0.533	
No	879	66.8	3.3		1
Yes	499	33.2	4.0		1.21 (0.66;2.20)
Feels tired all the time[a]				0.011	
No	1104	81.5	2.8		1
Yes	274	18.5	6.6		2.41 (1.21;4.81)
Get easily tired[a]				<0.001	
No	967	74.8	2.4		1
Yes	411	25.2	7.0		4.70 (2.30;9.62)
Hospitalization in the last 12 months				0.067	
No	1309	91.4	3.5		1
Yes	132	8.6	6.8		2.03 (0.94;4.40)
Length of hospital stay (days)				0.861	
≤3	68	57.1	6.1		1
4–7	28	16.7	7.0		1.24 (0.23;2.59)
>7	36	26.1	8.4		1.42 (0.32;6.31)
Health problems in the last 15 days				0.046	
No	1109	79.6	3.2		1
Yes	332	20.4	5.9		1.87 (1.05;3.49)
Self-reported medical conditions					
Hypertension	657	35.0	4.8	0.192	1.52 (0.81;2.85)
Diabetes	238	11.5	2.0	0.101	1.99 (0.86;4.64)
Allergy	252	17.0	5.2	0.306	1.53 (0.67;3.47)
Rhinitis	196	17.3	6.9	0.030	2.36 (1.06;5.24)
Anemia	62	4.3	8.6	0.112	2.45 (0.80;7.48)
Back pain	372	20.6	5.8	0.069	1.85 (0.95;3.61)
Arthritis / rheumatic disease	316	15.3	4.5	0.445	1.25 (0.70;2.21)
Chronic kidney disease	57	3.4	9.7	0.093	2.92 (0.83;10.30)
Stroke	68	3.2	6.9	0.287	1.94 (0.56;6.67)
Depression / anxiety / mental condition	366	22.7	5.5	0.100	1.73 (0.90;3.35)
Osteoporosis[a]	160	6.1	8.5	0.031	1.74 (1.04;2.88)
Heart disease	186	8.4	5.7	0.154	1.62 (0.83;3.15)

[a] Age-adjusted
* Chi-square test

COPD patients have higher risk of cardiovascular death regardless of tobacco use. This phenomenon may be explained by a common genetic predisposition to atherosclerosis and emphysema because both are systemic inflammatory diseases.[23] Comorbidities associated with systemic inflammation such as cardiovascular disease and diabetes mellitus are usually seen in COPD patients. A recent study conducted in England based on primary care records of 1,204,100 patients aged 35 and more found that physician-diagnosed COPD was associated with increased risk of cardiovascular disease (OR = 4.98, 95%CI 4.85;5.81), stroke (OR = 3.34, 95%CI 3.21;3.48) and diabetes mellitus (OR = 2.04, 95%CI 1.97;2.12).[4]

Respondents with COPD showed lower levels of leisure-time physical activity (PR = 0.57, 95%CI 0.26;0.97). Because of physical inability caused by

Table 4. Poisson multiple regression model for self-reported chronic obstructive pulmonary disease in people aged 40 years or more. São Paulo, Southeastern Brazil, 2008–2009.

Variable	PR (95%CI)	Standard error	p-value	Design effect
Number of cigarettes smoked in their lifetime			<0,001	
None	1			
≤1500	1.27 (0.55;2.92)	0.36		1.45
>1500	3.85 (1.87;7.94)	0.41		0.74
Get easily tired (yes / no)	2.61 (1.39;4.90)	0.32	0.003	1.08
Age (years)			0.049	
40–49	2.77 (0.66;11.63)	0.60		1.90
50–59	1			
60–69	3.27 (1.01;11.24)	0.31		1.37
70 or more	4.29 (1.30;14.29)	0.45		1.52
Health problems in the last 15 days (yes / no)	1.31 (1.02;1.77)	0.38	0.044	1.14
Leisure-time physical activity (yes / no)	0.57 (0.26;0.97)	0.40	0.046	1.03

the disease and reduced daily activities to mitigate the symptoms, COPD patients tend to spend most of the day in the sitting position. Shortness of breath and early muscle fatigue during any physical exertion may explain excessive resting in these patients.[22]

Contrary to common belief, it is highly recommended supervised exercise training at any stage of the disease, and pulmonary rehabilitation aims to optimize the patient's physical and social performance and autonomy. Pulmonary rehabilitation care has four main components: drug treatment; respiratory muscle training; education program with psychosocial and behavioral interventions; and exercise training. Pulmonary rehabilitation in COPD patients can improve exercise ability and health-related quality of life; reduce the perceived shortness of breath; reduce the number of hospitalizations and days of hospital stay, and exercise training of upper limb muscles can reduce the perceived shortness of breath.[2]

Physical activity can reduce the risk of developing COPD. A case-control study carried out in Japan with 278 cases and 335 controls aged between 50 and 75 years concluded that those who remained active throughout their life had better lung function when compared to sedentary people. An adjusted OR = 0.59 (95%CI 0.36, 0.97) for COPD and OR = 0.56 for dyspnea (95%CI 0.36,0.88) was found among those physically active compared to those inactive.[13]

The American College of Sports Medicine (ACSM) and American Heart Association (AHA) guidelines on physical activity for adults recommend at least 30 minutes of moderate physical activity (e.g., walking) five times a week or 20 minutes of vigorous physical activity (e.g., brisk walking or running) three times a week for health maintenance and promotion. Given the dose-response relationship between exercise and health, individuals who wish to improve their physical fitness, reduce their risk of chronic diseases and disabilities or prevent weight gain may benefit from exceeding the minimum recommended level of physical activity.[12]

Garcia-Aymerich et al[7] (2005) followed up 6,790 adults for 10 years to assess the association between physical activity and lung function decline and COPD risk among smokers and nonsmokers. Among those individuals (smokers and nonsmokers) who engaged in moderate to high levels of physical activity, the relative risk for developing COPD was 0.80 (95%CI 0.65;0.98) compared with those with low levels of physical activity. There was also seen a protective effect against the development of COPD among current smokers who engaged in moderate to high levels of physical activity with a relative risk of 0.77 (95%CI 0.61;0.97) compared to those with low levels of physical activity.

Physical activity can prevent COPD regardless of smoking. The biological plausibility of the influence of physical activity on lung function decline relies on the anti-inflammatory effects of physical activity. Exercise training can reduce the levels of proinflammatory cytokines (IL-6, TNF-α and C-reactive protein), increase the levels of anti-inflammatory cytokines (IL-4, IL-10 and TGF-β) when compared to controls.[3]

One of the study limitations is the use of self-reported morbidity data because it can underestimate the prevalence of respiratory conditions due to recall bias and/or undiagnosed conditions. However, Mullerova et al[21] (2004) back the validity of self-reports in epidemiological studies on respiratory diseases because data has shown adequate sensitivity and specificity in population-based surveys, as it may reflect indirectly the actual disease prevalence and constitute an indirect indicator with good reliability. From an epidemiological perspective, estimating the prevalence of

self-reported respiratory disease in a population is an easy, straightforward approach to obtain information on health status and shows good agreement, reproducibility and cost-effective when considering the results of clinical evaluations.

Cross-sectional studies with complex sampling design are widely used in epidemiology. The use of clusters leads to less accurate estimates of the variance than simple random sampling, which in turn leads to less accurate results than a stratified sample. Studies with complex sampling should provide accurate estimates of the parameters studied and the design effect (Deff) assesses how well it was obtained considering the variance between simple and complex random sampling. Besides being used in the study planning for estimating the sample size, the Deff is used to assess the error made when ignoring the complex sampling and analyzing the data as if they were drawn by simple random sampling. The Deff is the "price" paid by the researchers for having their task facilitated by investigating only randomly selected clusters, which results in increased inaccuracy of the results due to potential correlations of the sampling units within and between clusters.[24]

The present study highlights the significant association of COPD with tobacco use and age over 60. Frequent health problems and reduced leisure-time physical activity can be regarded as outcomes of this disease. In the light of the increasing trend of COPD due to increasing longevity, early diagnosis and an education approach to smoking cessation and physical activity promotion are extremely important for improving health-related quality of life in these individuals and reducing the economic impact of COPD to the health system.

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