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Factors associated with pulmonary disease among the elderly

ABSTRACT

OBJECTIVE: To investigate the prevalence of reported pulmonary disease among elderly subjects, according to sociodemographic and economic characteristics, lifestyle, physical mobility, and health status.

METHODS: This was a cross-sectional population-based study that included 1,957 elderly subjects (aged 60 and over). Information was collected by means of interviews. Subjects were selected using a two-stage probabilistic, stratified, cluster sampling strategy in six municipalities in the State of São Paulo between 2001 and 2002. Descriptive statistics, chi-squared association tests, prevalence ratios, and 95% confidence intervals were utilized. Adjusted analysis was carried out by Poisson regression.

RESULTS: Among the interviewees, around 7% reported pulmonary disease. There was no association between pulmonary disease and influenza vaccination. Adjusted analysis identified the following factors that were independently associated with reported disease: smoking (PR: 2.03; 95% CI: 1.39-2.97); medication use (PR: 2.05; 95% CI: 1.11-3.79); health status self-assessed as poor or very poor (PR: 1.89; 95% CI: 1.20-2.96); and depression, anxiety, or emotional problems (PR: 1.86; 95% CI: 1.11-3.10).

CONCLUSIONS: The findings from the present study reinforce the importance of respiratory diseases among the elderly, particularly in more vulnerable groups. Preventive measures and specific care for such groups are therefore justified.

KEYWORDS: Lung diseases, epidemiology. Aging health. Prevalence. Cross-sectional studies.

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INTRODUCTION

At the end of the twentieth century, there was large growth in the elderly population in Brazil, and it was the group aged 60 and over that grew most in proportional terms, reaching 14 million in 2002.¹⁶ According to projections by the World Health Organization, the growth of the elderly population in Brazil between 1950 and 2025 will be around three times greater than that of the whole population over this period. This can be considered to be one of the fastest growth rates in the world.

Important information for determining the health status of the elderly has been obtained from population-based epidemiological studies. This information can be used for planning public policies aimed at this population segment.^{17,22}

In addition to the higher prevalence of chronic-degenerative diseases that are associated with the aging process, other conditions with different etiologies are expressed more severely in the elderly. This is due to their greater physiological and immunological susceptibility, particularly to infections,⁹ which contributes towards reducing their physical and biological capabilities and decreasing their autonomy.

Among the causes of disease and death among the elderly, chronic obstructive pulmonary disease (COPD) is highlighted because of its high prevalence and progressive nature. It consists of two entities: chronic bronchitis and pulmonary emphysema; tobacco use is its main cause. Chronic obstructive pulmonary disease is still underdiagnosed in Brazil and epidemiological data regarding the disease are still sparse.¹⁴

Respiratory infection has also been pointed out as one of the main causes of morbidity-mortality among the elderly,²¹ and it may be associated with clinical exacerbation of chronic obstructive pulmonary disease. From an anatomical and functional point of view, aging reduces mobility of the thoracic box, pulmonary elasticity and maximum inspiratory and expiratory pressures. Consequently, the efficiency of coughing decreases, as does the mobility of the respiratory epithelial cilia.⁹

The incidence of acute respiratory infections and their complications has increased worldwide over the last few decades. Likewise, the annual incidence rates for pneumonia affecting individuals over the age of 65 years have grown in many countries. Furthermore, acute respiratory diseases are the main cause of hospitalization among patients with chronic medical conditions.¹⁰

Data from the Mortality Information System (SIM/SUS) show that, in Brazil, the proportion of deaths due to respiratory diseases has been growing among the population aged over 60 years over the last few decades. The same trend can be seen in the State of São Paulo: in 1980, deaths due to such affections represented 8.6% of all causes of deaths among this age group, which increased to 13.2% and 15% in 1990 and 2002, respectively.

With regard to morbidity due to such affections in this country, according to the Hospital Information System (SIH/SUS), there were 65,194 hospitalizations due to respiratory disease in the State of São Paulo in the year 2000; 26,456 of them were due to pneumonia and, out of these, 18,240 (68.95%) were among the elderly.

Studies on the temporal trends of mortality rates due to respiratory disease, standardized by age and gender, have shown that this increased over the last decade, particularly among those aged over 75 years. The elderly are living longer and are at greater risk of becoming ill and dying due to pneumonia and other respiratory conditions.^{7,8}

In the State of São Paulo in 2001, respiratory diseases were the second most important cause of hospitalization among the population aged 60 years and over. Among the main causes of such diseases, pneumonia, bronchitis, emphysema, chronic obstructive pulmonary disease, other diseases of the respiratory apparatus and acute infections of the higher respiratory tract can be highlighted, in decreasing order of importance.

Sociodemographic, economic and behavioral variables (particularly smoking), as well as comorbidities, may predispose the elderly to pulmonary disease, in addition to the altered immune status related to age itself.¹⁸ Therefore, it is important to identify these factors, since morbidity reduction is essential for maintaining functional capability and autonomy among the elderly.

The present study had the aim of investigating the prevalence of pulmonary disease reported by non-institutionalized elderly people, according to their sociodemographic and economic characteristics, lifestyle, physical mobility and health status.

METHODS

This was a cross-sectional population-based study that included 1,957 non-institutionalized elderly individuals (aged 60 years and over), between 2001

and 2002. The participants lived in the urban areas of the municipalities of Itapeperica da Serra, Embu, Taboão da Serra, Campinas and Botucatu and in the Butantã district of the municipality of São Paulo. The data came from a multicenter study:³ "Population based health inquiry in municipalities of the State of São Paulo" (ISA-SP), which was carried out in collaboration between public universities in the State of São Paulo and the State Health Department.

The participants in the study were selected by means of stratified probabilistic sampling by clusters that was done in two stages. From data made available by the Brazilian Institute for Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística - IBGE*) in 1996, the census tracts were classified and grouped in three strata according the schooling level of the heads of households. Ten census tracts were sampled from each stratum, from which a simple systematic sample of homes was selected.

Information was obtained by means of a questionnaire containing closed, semi-open and open questions that were organized in thematic groups.

The dependent variable utilized was reported pulmonary disease (yes or no). The independent socio-demographic and economic variables selected were: gender, age, marital status, schooling, occupational activity, number of individuals including children living in the home and *per capita* income (in minimum salaries). The independent lifestyle variables selected were: alcohol dependency assessed by means of the "Cut down, Annoyed by criticism, Guilty and Eye-opener" (CAGE) test,⁵ smoking, body mass index (BMI) calculated using reported weight and height, and physical mobility in terms of the degree of difficulty in performing of daily activities presented. The health status variable selected were: the individual's perception of his own health at the time of the interview and in comparison with one year earlier, reported morbidity, hospitalization within the last 12 months, use of medications during the three days prior to the interview, number of chronic diseases, and influenza vaccination status. The presence of the following diseases was taken into consideration: arterial hypertension, diabetes, anemia, spine and back diseases, arthritis/rheumatism/arthrosis, chronic kidney disease, stroke, depression/anxiety/emotional problems, osteoporosis and heart disease.

Associations between the variables and reported pulmonary disease were assessed by means of bivariate analysis using the χ^2 test, with a significance level of 5%. Prevalence ratios and 95% confidence intervals

were used, and the adjusted analysis was performed using Poisson regression. In the multiple model, variables with p-values lower than 0.20 in the bivariate analysis were taken into consideration, and only those with $p < 0.05$ remained in the model.

The effect of the sample design on the analysis of surveys based on complex delineations was considered in all the analyses. The Stata 7.0 program was utilized, which enabled incorporation of different weights for the observations.

The project was approved by the Research Ethics Committee of the School of Medical Sciences of UNICAMP, with the evaluation number 369/2000.

RESULTS

The responses were given by the elderly individuals themselves in 1,916 (97.7%) of the interviews. With regard to gender, 1,028 (57.3%) were female. The mean age was 69.7 years (95% CI: 69.0-70.4), and 1,092 (55.9%) were less than 70 years old (Table 1). The estimate prevalence of self-reported pulmonary disease was 6.9% (95% CI: 5.2-8.7%). Among the diseases mentioned that were included in the composition of the response variable were bronchitis (52.6%), pulmonary emphysema (15.8%), asthma (12.8%), pneumonia (4.2%), chronic obstructive pulmonary disease (2.6%) and unspecified lung and respiratory disorders (2.4%).

There was no statistically significant association between the sociodemographic and economic variables and reported pulmonary disease. However, the greatest proportion of this disease occurred among individuals of more advanced age, men, individuals living alone, those with less schooling, and those who were not working at all at that time, either with or without payment. (Table 1).

With regard to the variables related to lifestyle and physical mobility that are presented in Table 2, only present or past smoking habit presented a statistically significant association with pulmonary disease.

With regard to health status, the prevalence of pulmonary disease was shown to be significantly higher among the elderly individuals who considered their own health to be poor or very poor; and among those who reported some other symptom and the use of medication within 15 and three days prior to the interview. Likewise, a higher prevalence of pulmonary disease was registered among those who reported the presence of one or more comorbidities, and also among those reporting the following

Table 1 - Prevalence of self-reported pulmonary disease among elderly people (aged 60 and over), according to sociodemographic and economic variables. State of São Paulo, 2001-2002.

| Variables and categories | N | Prevalence (%) | p* | PR (95% CI) |
|-------------------------------------|-------|----------------|------|------------------|
| Gender | | | | |
| Male | 929 | 8.0 | | 1 |
| Female | 1,028 | 6.2 | 0.22 | 0.77 (0.51-1.17) |
| Age group | | | | |
| 60 to 69 | 1,092 | 6.7 | | 1 |
| 70 to 79 | 644 | 7.1 | | 1.05 (0.66-1.71) |
| 80 and over | 221 | 8.2 | 0.82 | 1.23 (0.64-2.35) |
| Marital status | | | | |
| With partner | 1,159 | 6.4 | | 1 |
| Without partner | 794 | 7.6 | 0.50 | 1.17 (0.74-1.87) |
| Schooling | | | | |
| Up to four years of schooling | 1,410 | 7.2 | | 1.15 (0.70-1.88) |
| Five or more years of schooling | 539 | 6.3 | 0.58 | 1 |
| Occupational activity | | | | |
| Yes | 502 | 4.7 | | 1 |
| No | 1,455 | 7.7 | 0.10 | 1.63 (0.90-2.95) |
| Number of people living in the home | | | | |
| 1 to 2 people | 892 | 6.7 | | 1 |
| 3 to 4 people | 665 | 6.6 | | 0.98 (0.52-1.84) |
| 5 or more people | 400 | 8.0 | 0.77 | 1.19 (0.75-1.91) |
| Number of children in the home | | | | |
| None | 1,754 | 6.8 | | 1 |
| One or more | 203 | 8.2 | 0.62 | 1.20 (0.59-2.44) |
| Per capita income (MS) | | | | |
| ≤1 MS | 621 | 7.7 | | 1.58 (0.89-2.81) |
| >1 to 2.5 MS | 622 | 6.9 | | 1.42 (0.72-2.81) |
| >2.5 to 4 MS | 305 | 8.6 | | 1.77 (0.79-3.99) |
| >4 MS | 409 | 4.9 | 0.49 | 1 |

N: number of individuals in the non-weighted sample

*p-value from χ^2 test

PR: Prevalence ratio

MS: Minimum salary in force at the time of the survey: March to April 2001 =R\$151.00; May 2001 to March 2002 =R\$180.00; and April to September 2002 =R\$200.00.

chronic diseases: anemia, kidney disease and depression, anxiety or emotional problems. There was no statistically significant association between reported pulmonary disease and vaccination against influenza (Table 3).

From the Poisson multiple regression analysis, the factors that were independently associated with pulmonary disease were: smoking, consumption of medications, worse self-perception of health and self-reported depression (Table 4).

DISCUSSION

Among the limitations to the present study, it needs to be considered that self-reported morbidity may underestimate the prevalence of the disease or chronic condition, due to memory problems and/or absence of a diagnosis.¹⁷ However, some authors^{11,19,20} have drawn attention to the validity of self-reporting of respiratory symptoms, asthma and chronic obstructive pulmonary disease in surveys. They have stated that such data present adequate sensitivity and

Table 2 - Prevalence of self-reported pulmonary disease among elderly people (aged 60 and over), according to lifestyle and physical mobility. State of São Paulo, 2001-2002.

| Variables and categories | N | Prevalence (%) | p* | PR (95% CI) |
|--|-------|----------------|-------|------------------|
| Dependency on alcoholic drinks (CAGE) | | | | |
| Non-dependent | 1,853 | 6.8 | | 1 |
| Dependent | 66 | 10.1 | 0.38 | 1.48 (0.61-3.59) |
| Smoking | | | | |
| Non-smoker | 1,044 | 4.7 | | 1 |
| Former smoker and smoker | 909 | 9.7 | <0.01 | 2.05 (1.35-3.10) |
| Body mass index (BMI) | | | | |
| <25 kg/m ² | 788 | 8.4 | | 1.41 (0.94-2.10) |
| ≥25 kg/m ² | 1,169 | 6.0 | 0.09 | 1 |
| Difficulty in performing activities** | | | | |
| Lifting up or carrying groceries | 749 | 8.5 | 0.05 | 1.46 (1.00-2.16) |
| Going up a flight of stairs | 479 | 8.9 | 0.10 | 1.43 (0.93-2.21) |
| Bending over, kneeling down or doubling up | 965 | 7.7 | 0.25 | 1.28 (0.84-1.95) |
| Walking one block | 350 | 6.6 | 0.07 | 1.44(0.98-2.12) |
| Having a bath or getting dressed | 176 | 10.3 | 0.14 | 1.55(0.86-2.79) |

N: number of individuals in the non-weighted sample

RP: Prevalence ratio

*p-value from χ^2 test

CAGE test: "Cut down, Annoyed by criticism, Guilty and Eye-opener"

**Percentage of subjects who said yes (reference class: negative response)

Table 3 - Prevalence of self-reported pulmonary disease among elderly people (aged 60 and over), according to health status. State of São Paulo, 2001-2002.

| Variables and categories | N | Prevalence (%) | p* | PR (95% CI) |
|---|-------|----------------|-------|------------------|
| Self-perception of health | | | | |
| Excellent/very good | 462 | 4.4 | | 1 |
| Good | 1,170 | 6.4 | | 1.44 (0.75-2.77) |
| Poor/very poor | 275 | 14.6 | <0.01 | 3.30 (1.73-6.29) |
| Health status one year earlier | | | | |
| Much better/a little better | 426 | 6.8 | | 1 |
| The same | 1,065 | 6.3 | | 0.92 (0.56-1.51) |
| A little worse/much worse | 419 | 8.8 | 0.38 | 1.28 (0.70-2.36) |
| Morbidity over the last 15 days | | | | |
| No | 1,411 | 6.1 | | 1 |
| Yes | 546 | 9.6 | 0.03 | 1.57 (1.05-2.35) |
| Hospitalization within the last 12 months | | | | |
| None | 1,725 | 6.6 | | 1 |
| One or more | 231 | 9.5 | 0.20 | 1.43 (0.83-2.49) |
| Use of medication over the last three days | | | | |
| No | 512 | 3.5 | | 1 |
| Yes | 1,442 | 7.9 | <0.01 | 2.25 (1.26-4.00) |
| Number of chronic diseases | | | | |
| None | 231 | 2.7 | | 1 |
| One or more | 1,603 | 7.5 | 0.01 | 2.78 (1.20-6.44) |
| Influenza vaccination | | | | |
| No | 680 | 6.6 | | 1 |
| Yes | 1,227 | 7.2 | 0.71 | 1.09 (0.70-1.69) |
| Report of the following diseases/chronic conditions** | | | | |
| Hypertension | 940 | 7.2 | 0.78 | 1.07 (0.66-1.73) |
| Diabetes | 292 | 7.0 | 0.99 | 1.00 (0.57-1.78) |
| Anemia | 92 | 15.3 | <0.01 | 2.31 (1.28-4.15) |
| Spine/back pain | 620 | 8.8 | 0.12 | 1.41 (0.91-2.19) |
| Arthritis/rheumatism/arthrosis | 505 | 8.6 | 0.17 | 1.36 (0.87-2.13) |
| Chronic kidney disease | 119 | 14.3 | 0.02 | 2.17 (1.14-4.12) |
| Stroke | 93 | 12.1 | 0.13 | 1.80 (0.84-3.90) |
| Depression/anxiety/emotional problems | 475 | 12.2 | <0.01 | 2.31 (1.42-3.74) |
| Osteoporosis | 266 | 10.9 | 0.09 | 1.71 (0.92-3.19) |
| Heart disease | 297 | 10.1 | 0.12 | 1.58 (0.88-2.84) |

N: number of individuals in the non-weighted sample

RP: Prevalence ratio

*p-value from χ^2 test

**Percentage of subjects who said yes (reference class: negative response for the disease/chronic condition)

specificity in population screening, and may indirectly reflect the real prevalence in the community.

Moreover, in a study⁴ involving cluster selection, the estimated proportions tended to be less precise than those obtained from simple randomized sampling. The effects of the design (Table 4) that were greater than one indicated that more information would be necessary in order to ensure the same precision that could be obtained by means of a draw for simple randomized sampling with reposi-

Despite the widespread use of logistic regression in the analysis of cross-sectional studies with binary outcomes, in the present study the Poisson regression was used. Through this analysis, prevalence ratios can be directly estimated, thereby providing a meas-

urement that is more conservative and easier to interpret than odds ratios.²

The results showed that the prevalence of reported pulmonary disease among the elderly was 6.9%, which is similar to the rate of 7.8% for the presence of asthma and bronchitis reported by elderly individuals in a national study.¹⁷ In the United States, the prevalence of reported chronic bronchitis was 2.1 to 3%, and that of asthma¹³ was 4.5 to 8.2%. Data from a Finnish city showed prevalences of 4.2% for chronic obstructive pulmonary disease (chronic bronchitis, pulmonary emphysema, chronic interstitial pulmonary disease, tuberculosis sequelae, severe bronchiectasis and lung cancer) and 3.5% for bronchial asthma.¹²

In the present study, there was no statistically signifi-

Table 4 - Multivariate Poisson regression model for self-reported pulmonary disease among elderly people (aged 60 and over). State of São Paulo, 2001-2002.

| Variable | PR | Standard error | p | 95% CI | Effect of the design |
|---|------|----------------|------|-------------|----------------------|
| Smoker and former smoker | 2.03 | 0.39 | 0.00 | (1.39-2.97) | 1.30 |
| Use of medication over the three days preceding the interview | 2.05 | 0.64 | 0.02 | (1.11-3.79) | 1.41 |
| Self-assessment of health as poor or very poor | 1.89 | 0.43 | 0.01 | (1.20-2.96) | 1.54 |
| Depression, anxiety or emotional problems | 1.86 | 0.48 | 0.02 | (1.11-3.10) | 2.30 |

PR: Prevalence ratio

cant association between sociodemographic and economic characteristics and reported pulmonary disease, as shown by other authors.¹ The composition of the variable "chronic pulmonary disease" may include a collection of pulmonary diseases and, furthermore, the perception of the disease may be different between genders and the social strata of the study population, thus making it difficult to interpret the responses obtained. A study carried out in Pelotas (southern Brazil), by Menezes et al¹⁸ (1994) identified a prevalence of 12.7% for chronic bronchitis among adults aged 40 years and over, and found an association between chronic bronchitis and male gender in the bivariate analysis. However, only low family income, poor schooling levels, smoking and reported bronchitis as the main childhood disease were significantly associated with chronic bronchitis in the multiple logistic regression model.

With regard to the lifestyle and physical mobility variables, there was higher prevalence of disease among those who reported difficulties in performing daily activities. However, only smoking was statistically associated with the condition and remained as an independent factor associated with the disease in the final model. Smoking has been shown to be the main cause of chronic bronchitis and pulmonary emphysema.^{1,13} Meyer¹⁹ (2001) highlighted declining immune response with increasing age as a factor for increasing the susceptibility to pulmonary infection.

Chronic respiratory diseases are completely reversible if the person stops smoking before the airways start to become obstructed.¹ Educational campaigns against smoking have an important impact on the progression of these diseases.

There was no statistically significant association between influenza vaccination status and pulmonary disease. Both bronchitis and asthma, or other lung conditions that are reported by the elderly may present exacerbations due to viral or bacterial infections. A study carried out in Melbourne, Australia,²⁵ reported a strong association between recent infection of the respiratory tract and acute severe exacerbation of asthma in adults that required hospitalization. Furthermore, 79% of the infections were viral and the incidence of infection by influenza was 19%, thus supporting the indication of vaccination for people with asthma.

Primary viral and secondary bacterial pneumonia are the main complications resulting from influenza infection in elderly individuals with chronic clinical conditions,¹⁰ and therefore vaccination is formally recommended for this at-risk group. Vaccination is beneficial for prevention of severe influenza, pneu-

monia, exacerbated chronic conditions and death among individuals in high-risk groups, such as those with chronic pulmonary disease.^{9,10} Anti-pneumococcal polysaccharide vaccine has also been indicated for individuals with chronic diseases in order to prevent invasive disease caused by *Streptococcus pneumoniae*.⁶

Smoking, use of medications, self-assessment of health status as poor or very poor, and depression, anxiety and emotional problems remained in the multivariate model. Data from the National Home Sampling Survey (PNAD-1998) showed higher levels of reported and observed morbidity and worse self-assessment of health status among the elderly, as well as a greater proportion of restrictions on daily activities due to health reasons over the 15 days preceding the interview, in relation to other age groups.²⁶

In this age group, the majority of individuals present multiple chronic morbidities. In addition, self-perception of health has been shown to be a robust indicator for health status and a consistent predictor of survival in the elderly population.¹⁵

Smoking was shown to be an important cause and/or aggravating factor of pulmonary disease in the elderly. These individuals form part of a cohort that has survived a variety of exposures over the course of their life cycles, and among these was the smoking habit, which was common in that generation.

Although the cross-sectional design does not allow clarification of the cause-effect relationship, physical illness and disability are known risk factors for psychological problems.²⁴ Depression, anxiety and/or emotional problems among those reporting pulmonary disease may derive from limitations to the individual's life that are brought about by the disease. The limitations increase proportionally as the symptoms intensify and become more frequent. Furthermore, unexpected exacerbations may contribute towards the patients' insecurity and anxiety.

People with chronic pulmonary disease highlight their difficulties in keeping up their daily activities. According to Silva et al²³ (2005), these difficulties influence the gradual decline in physical activities, thereby leading to irritation and frustration. In these authors' opinion, individuals who are unable to look after themselves have their self-esteem and confidence shaken.

The findings from the present study point out the importance of respiratory diseases in this at-risk group, which are associated with psychological problems,

self-perception of poor health and use of medications. Considering the trend for chronic-degenerative diseases to increase among the elderly, because of the growing longevity among the population, early diagnosis of such cases and adoption of a psychosocial approach towards patients are extremely important

for their quality of life. Health promotion and disease prevention measures among the elderly may have an impact on the quality of life and survival of this age group, with the aim of reducing the complications from pulmonary disease and preventing common viral and bacterial infections.

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