DOI: 10.1590/1980-5497201500040007

ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

The independent effect of chronic diseases, sociodemographic and behavioral factors related to disability in older people living in Ribeirão Preto, SP, 2007 – The EPIDCV Project

Avaliação do efeito independente de doenças crônicas, fatores sociodemográficos e comportamentais sobre a incapacidade funcional em idosos residentes em Ribeirão Preto, SP, 2007 – Projeto EPIDCV

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ABSTRACT: ***Objectives:*** To investigate the prevalence and correlates of functional disability in elderly people living in Ribeirão Preto, SP. ***Methods:*** This is a cross-sectional population-based epidemiological study with multistage sampling. Design effect was corrected using a weighted sample composed by 536 elderly people. Disability based on daily living activities dependence (outcome) was assessed by using a validated questionnaire for population-based epidemiological studies. Points and 95% confidence intervals estimated crude and stratified prevalence rates of the outcome according to sociodemographic, behavioral, health-related, and self-reported morbidity variables. To identify the correlates, the crude and adjusted prevalence ratios were estimated using Poisson regression. ***Results:*** The crude prevalence of disability was 50.31%. In the multivariate models, after simultaneous intra-group adjustment (final models), the following variables remained independently associated with the outcome: sociodemographic (age, education, and contribution to familiar income); behavioral (daily mean of sitting time); health-related factors (hypertension, ischemic heart disease, medicines taken, and low cognitive performance); and self-reported morbidity (number of diseases and low hearing performance). ***Conclusions:*** The high prevalence of disability among elderly people in Ribeirão Preto and the presence of modifiable variables impose the need for specific health promotion and prevention measures, aiming a better quality of life for this population group, which is already well represented in the city's most recent population pyramids.

Keywords: Disability. Correlates. Aging. Cross-sectional studies. Epidemiology. Public health.

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Conflict of interests: nothing to declare – **Financial support:** The EPIDCV Projet was granted by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) – Process nº 2006/50495-2. Lopes DA – Graduate Scholarship–CAPES. Freitas ICM – Post-Doc Scholarship FAPESP (Process nº 12/51141-0).

RESUMO: ***Objetivos:*** Investigar a prevalência e os fatores associados à incapacidade funcional em idosos residentes em Ribeirão Preto, SP, em 2007. ***Métodos:*** Estudo transversal de base populacional, com amostra complexa selecionada em três estágios. Para correção do efeito de desenho amostral, utilizou-se amostra ponderada (nw) de 536 idosos. A dependência funcional para atividades da vida diária foi aferida mediante a utilização de questionário estruturado e validado para estudos epidemiológicos de base populacional. Prevalências brutas do desfecho e estratificadas segundo variáveis sociodemográficas, comportamentais, relacionadas à saúde e à morbidade referida foram calculadas por pontos e por intervalos com 95% de confiança. Razões de prevalências brutas e ajustadas foram estimadas por pontos e por intervalos, utilizando-se a regressão de Poisson. ***Resultados:*** A prevalência bruta de incapacidade foi 50,31%. Nos modelos multivariados, após ajustamento intragrupos (modelos finais), as seguintes variáveis permaneceram independentemente associadas ao desfecho: sociodemográficas (idade, escolaridade e contribuição com a renda familiar); comportamentais (média diária de tempo sentado); relacionadas à saúde (hipertensão, doença isquêmica do coração, uso de medicamentos e baixo desempenho cognitivo); morbidade referida (número de doenças referidas e baixa acuidade auditiva). ***Conclusão:*** A elevada prevalência de incapacidades em idosos de Ribeirão Preto, bem como a presença de associações entre variáveis potencialmente modificáveis e o desfecho, impõe a necessidade de medidas específicas de promoção e prevenção em saúde com vistas à melhora da qualidade de vida desse estrato populacional já bem representado nas últimas pirâmides populacionais do município.

Palavras-chave: Incapacidade funcional. Fatores de risco. Envelhecimento. Estudos transversais. Epidemiologia. Saúde pública.

INTRODUCTION

The demographic and epidemiological transition includes modifications in patterns of health and disease over time, resulting primarily from changes in the age structure of the population. This led to relative population aging and the replacement of infectious diseases by chronic degenerative diseases and external causes, which currently are the main causes of mortality[1].

With the increasing elderly population, functional capacity (FC) has emerged as a new concept of health, better suited to implement and perform health care of the elderly people, by reflecting the impact of disease/disability on their quality of life[2]. Different authors have identified the associations between disability and demographic factors, behavioral and health-related factors, although, in most studies, sociodemographic factors such as age, education, and income, along with chronic diseases and comorbidities, have shown consistent associations with disability[3-6].

Knowledge of the determinants of functional disability has been possible, thanks to epidemiological population-based studies. Although, in Brazil, these studies focus on the south and southeast regions and are limited largely to the capitals, little is known on the epidemiological reality of municipalities within the country. Considering that the factors associated with functional disability can undergo interactions with the environment, this study aimed to investigate the prevalence of functional disability in the

elderly people living in Ribeirão Preto, SP, and identify the factors independently associated with this outcome.

MATERIAL AND METHODS

This cross-sectional study is nested in the EPIDCV Project (Prevalence of cardiovascular diseases and identification of associated factors in adults living in Ribeirão Preto, SP); it is an epidemiological, population-based study in which data collection was conducted in Ribeirão Preto during 2007/2008.

The sampling process was developed in three stages, and the accuracy of estimates calculated on a sample of 1,205 individuals corresponded to sampling errors fixed around 2% (for prevalence below 15% or above 75%) and 3% (for prevalence between 20 and 80%). In the first stage, 81 census tracts were drawn, and as a result, 1,672 households and 1,395 participants were calculated, representing the second and third stages, respectively[7]. The response rate was 82.1%, corresponding to 1,133 adult participants. To correct the sample design effect, the weighted sample (*nw*) of 2,471 participants aged 30 years or older, living in the urban area of the municipality was used, among whom were identified 536 elderly people. The details on the sampling process were previously published[8].

DEPENDENT VARIABLE: FUNCTIONAL DISABILITY

For the assessment of functional disability, a structured and validated questionnaire[9] containing 17 questions about the activities of daily living (ADLs), ranging from 0 to 34 points was used. For each ADL, the elderly people were classified as fully independent (2 points), requiring partial assistance (1 point), or requiring total aid (0 points). Functional capacity was classified into two categories (0/1), considering as reference (category 0), the one that corresponded to total independence of the elderly people (34 points), while the category 1 (functional disability) corresponded to the need for partial or total help for one or more ADLs.

INDEPENDENT VARIABLES

Sociodemographic variables

Participants of both sexes and ≥ 60 years were included. Education was shared into four categories according to the number of completed years of formal schooling (0 – 3; 4 – 7; 8 – 11, and ≥ 12 years). The marital status was defined according to the presence or absence of partner, regardless of formal union. The elderly income contribution on family income

was classified as: no income, ≤ 75% contribution, and > 75% contribution. The Economic Indicator of Ribeirão Preto (EIRP)[10] was constructed, using variables related to the acquisition of consumer goods and education of the head of the family. The scores ranged between 67 and 1,086 points, and the variable was classified into four categories, according to the cutoff points defined by quartiles of the distribution.

Behavioral variables

Smoking defined according to pack-years was estimated by the formula: [(no. of cigarettes/day)/20 × no. of years smoking][11], and then classified into three categories: nonsmokers, ≤ 14 years of smoking 1 pack/day, and > 14 years smoking 1 pack/day, the last two classified according to the cutoff points established by the median of the distribution. Information on alcohol consumption were taken from the questionnaire Alcohol Use Disorder Identification Test (AUDIT)[12], considering two categories: without dependence (sum of scores of 0 – 7) and with dependence (sum of scores ≥ 8). Daily mean of sitting time in minutes/day was calculated using the short version of the International Physical Activity Questionnaire (IPAQ) [13].

Health-related variables

Hypertension was defined as a history of the condition diagnosed by a physician, regular use of antihypertensive medication, or the average of three consecutive measurements of blood pressure, assessed in portable sphygmomanometers (Geratherm, Medical AG, Geschwenda, Germany). Hypertensive patients presented measurements ≥ 140/90 mm Hg for the systolic and diastolic mean pressures, respectively[14]. Glucose intolerance was defined as a history of diabetes diagnosed by a physician and by oral glucose tolerance tests (OGTT), performed after a 12-hour fasting and 2 hours after 75 g glucose overload. The glycemia (mg/dL) was measured in capillary blood by the reflectance colorimetry method, using Accutrend portable devices (Roche Diagnostics GmbH, Mannheim, Germany), and for the definition of glucose intolerance, cutoffs recommended by WHO[15] were adopted. The variable was classified dichotomously (no/yes); those with normal glucose tolerance were considered as the reference, while those with diabetes and impaired fasting glycemia or impaired glucose tolerance were considered exposed. Ischemic heart disease (IHD), classified dichotomously (no/yes), was represented by the combination of angina and possible myocardial infarction, after application of the full version of the Rose questionnaire (Q-Rose)[16]. The number of medicines taken was defined as consumption in the 15 days preceding the interview (information obtained from the participant and confirmed by submitting prescriptions and/or packaging). The variable was classified into four categories: "none," "1 – 2," "3 – 4," and "≥ 5". Cognitive performance was assessed by applying the questionnaire Mini Mental State Examination (MMSE), developed by Folstein et al.[17]. The MMSE scores ranged

from 0 to 30 and, for the purpose of this study were treated in a dichotomous way: > 25 (reference category) and ≤ 25, according to the median of the distribution. Nutritional status was classified into three categories: eutrophic, overweight, and obese, according to the cutoffs for body mass index (BMI), recommended by the World Health Organization[18]. The weight in kilograms was measured in portable electronic scales from Tanita brand, model BF 680®, and height in stadiometers of SECA® brand. The measures were taken by trained and calibrated interviewers who used the techniques proposed by Habicht and Butz[19]. The conicity index (C index) was used as the central obesity index, defined according to the equation below[20] and classified dichotomously, using the cutoff point corresponding to the 25th percentile. As reference for waist circumference, measured in centimeters (cm), the lesser curvature located between the costal margin and the iliac crest was considered, adopting specific cutoffs according to sex, recommended by the International Diabetes Federation[21]. For weight, height, and waist circumference, three consecutive measurements were taken, considering the average of these three measurements.

$$\text{C index} = \frac{\text{waist circumference (meters)}}{0{,}109 \times \sqrt{\frac{\text{body weight (Kg)}}{\text{height (meters)}}}}$$

Morbidity-related variables

The number of diseases reported by the participants (arthritis, rheumatism or arthrosis, bronchitis, constipation, cataracts and back problems—comorbidities) has been classified into three categories (0 – 1, 2 – 3, and ≥ 4). Visual and hearing acuity were classified as "excellent/good" or "fair/poor." The self-reported health status was rated as "excellent/good" and "fair/poor."

Data processing

Data collection was executed by applying a structured questionnaire in the eligible households by a staff of trained interviewers. Before the final typing, processed with double data entry, quality control of the information was assessed by replicating 12.5% of the interviews. The reliability was estimated using Kappa statistics, which reached values superior than 0.80.

Statistical analysis

Besides the characterization of the sample, functional disability prevalence rates were estimated by points and 95% confidence intervals, according to sociodemographic, behavioral, and health- and morbidity-related variables. To identify factors associated with functional

disability, prevalence ratios were estimated by points and 95% confidence intervals, using the Poisson regression[22]. Firstly, univariate analyses were run, according to sociodemographic, behavioral, and health- and morbidity related variables, excluding those that presented p-values > 0.25 for Wald statistics. In sequence, final models were run and the variables with p-values < 0.05 for the Wald statistics were retained. All analyses were run using Stata 10.1. All estimates took into account the sample design effect (deff), using the Stata "svy" commands.

Ethical considerations

The EPIDCV Project was approved by the Ethics Research Committee of the School of Nursing of Ribeirão Preto, Universidade de São Paulo, and protocoled under no. 0725/2006. All the participants signed an informed consent, as per recommendations of the Resolution no. 196/96 of the National Health Council.

RESULTS

Table 1 shows that the sample was composed mainly by female participants; of those aged between 60 and 69 years; with schooling from 4 to 11 years; of those living with a partner, and those belonged to households classified in the last two quartiles of IERP. The crude prevalence of functional disability was high, and the sampling design effect (deff) corresponded to 1.71848.

In relation to sociodemographic factors (Table 2), the prevalence of functional disability was directly related to age and inversely related to education and the EIRP quartiles. The adjusted prevalence ratios — age (direct relationship), schooling, and income contribution of the elderly on family income (inverse relationship), were independently associated with the outcome.

With respect to behavioral factors (Table 3), the outcome prevalence stood out among those who consumed 1 pack of cigarettes/day for more than 14 years and those with the highest daily mean of sitting time. The prevalence ratios for the variable "sitting time" had direct relation and independent association with the outcome (3rd tertile).

With regard to health-related factors (Table 4), the functional disability prevalence stood out among those who were hypertensive, classified as IHD, those who consumed 5 or more medications in the last 15 days, and those who were classified with low cognitive performance or showed global or central obesity. After simultaneous adjustment, arterial hypertension, IHD, number of medicines taken, and low cognitive performance remained independently associated with the outcome.

As for factors related to morbidity (Table 5), higher outcome prevalence was observed among those who reported four or more diseases, lower visual or hearing acuity, and rated their health as fair/poor. After simultaneous adjustment, the number of reported diseases (linear gradient) and hearing acuity classified as fair/poor remained independently associated with the outcome.

Table 1. Study population characteristics (Ribeirão Preto, São Paulo, Brazil, 2007, EPIDCV Project).

	nw*	%	95%CI
Sex			
Male	195.2	36.24	30.99 – 41.83
Female	343.5	63.76	58.17 – 69.01
Age (years)			
60 – 69	332.7	61.77	55.45 – 67.70
70 – 79	164.8	30.59	24.82 – 37.03
≥ 80	41.2	07.65	04.96 – 11.63
Schooling (years)			
0 – 3	157.1	29.89	23.31 – 37.43
4 – 7	202.8	38.59	31.65 – 46.03
8 – 11	86.45	16.45	11.62 – 22.77
≥ 12	79.21	15.07	09.80 – 22.46
Marital status			
No partner	240.0	44.54	37.88 – 51.41
With partner	298.8	55.46	48.59 – 62.12
Elderly income contribution			
No income	359.1	67.18	60.35 – 73.35
≤ 75%	91.89	17.19	12.94 – 22.47
> 75%	83.55	15.63	10.84 – 22.01
EIRP			
1st tertile (≤ 389.0)	126.6	23.99	18.32 – 30.76
2nd tertile (389.1 – 525.0)	120.8	22.89	18.21 – 28.35
3rd tertile (525.1 – 676.0)	132.0	25.02	19.83 – 31.05
4th tertile (> 676.0)	148.3	28.10	20.17 – 37.67
Functional disability			
No	265.3	49.69	41.43 – 57.96
Yes	268.6	50.31	42.04 – 58.57

*Weighted n; 95%CI: 95% confidence interval.

DISCUSSION

In this study, the crude prevalence of functional disability was high. In multivariate models, sociodemographic variables (age, education, and elderly contribution to family income); behavioral variables (daily mean of sitting time); health-related variables (hypertension, IHD, consumption of five or more medications, and low cognitive performance);

Table 2. Prevalence and crude and adjusted prevalence ratios according to sociodemographic factors (Ribeirão Preto, SP, Brazil, 2007, EPIDCV Project).

	Prevalence (95%CI)	Crude PR (95%CI)	Adjusted PR (95%CI)
Sex			
Male	40.98 (30.39 – 52.47)	1	
Female	55.69 (46.13 – 64.85)	1.36 (1.03 – 1.79)	–
Age (years)			
60 – 69	34.11 (23.91 – 46.03)	1	1
70 – 79	73.07 (59.76 – 83.22)	2.14 (1.48 – 3.10)	1.79 (1.24 – 2.58)
≥ 80	90.81 (70.25 – 97.64)	2.66 (1.85 – 3.82)	2.03 (1.43 – 2.88)
Schooling (years)			
0 – 3	68.95 (55.02 – 80.13)	1	1
4 – 7	52.54 (41.95 – 62.91)	0.76 (0.60 – 0.96)	0.82 (0.66 – 1.03)
8 – 11	21.34 (10.12 – 39.51)	0.31 (0.15 – 0.63)	0.42 (0.22 – 0.81)
≥ 12	31.13 (16.35 – 51.11)	0.45 (0.25 – 0.80)	0.52 (0.32 – 0.85)
Marital status			
No partner	51.25 (40.42 – 61.96)	1	
With partner	49.56 (39.65 – 59.51)	0.97 (0.75 – 1.24)	–
Elderly income contribution			
No income	58.91 (49.25 – 67.93)	1	1
≤ 75%	32.17 (17.98 – 50.64)	0.55 (0.32 – 0.93)	0.70 (0.41 – 1.19)
> 75%	33.18 (20.68 – 48.61)	0.56 (0.36 – 0.88)	0.64 (0.44 – 0.94)
EIRP			
1st tertile (≤ 389.0)	71.97 (58.81 – 82.19)	1	
2nd tertile (389.1 – 525.0)	56.01 (42.73 – 68.48)	0.78 (0.60 – 1.00)	–
3rd tertile (525.1 – 676.0)	39.59 (25.42 – 55.75)	0.55 (0.37 – 0.81)	–
4th tertile (> 676.0)	34.22 (22.30 – 48.53)	0.47 (0.31 – 0.72)	–

PR: prevalence ratios; 95%CI: 95% confidence interval; (–) variables excluded from final model (p > 0.05).

and morbidity-related variables (number of reported diseases and hearing acuity) remained independently associated with the outcome.

These findings are consistent with the results from national studies[3,4,6,23-29]. Related to international studies, the results of Ribeirão Preto are similar to those presented by Tze-Pin et al. [30] in a cross-sectional study carried out in multiethnic sample (Chinese, Malay, and Indian). Moreover, the results are similar to the findings of the Rotterdam study[5,31] and German KORA-age study[25] and to results reported by Kelly-Hayes et al.[32] in the Framingham cohort.

The methodological rigor in conducting the sampling process of EPIDCV Project, the high response rate (82.1%), and the extensive training of interviewers, alongside with relevant statistical techniques for data analysis, strengthen the internal validity of the study.

In this work, the socioeconomic condition was determinant of functional dependence, as high levels of education and income remained associated with the outcome (protective factors). These findings, confirmed by different authors[24-26], are owing mainly to the increased access to health services and information related to prevention of disabilities, such as the adoption of healthy habits that contribute to the preservation of autonomy.

Considering behavioral factors, consumption of alcohol and cigarettes did not remain associated with the outcome, as also observed in the Rotterdam study[5] and in south of Brazil[6]. On the other hand, sedentary behavior, expressed by the sitting time > 355 minutes/day, was positively and independently associated with functional disability. The excessive sitting

Table 3. Prevalence and crude and adjusted prevalence ratios according to behavioral factors (Ribeirão Preto, SP, Brazil, 2007, EPIDCV Project).

	Prevalence (95%CI)	Crude PR (95%CI)	Adjusted PR (95%CI)
Pack-years			
Nonsmoker	51.43 (41.64 – 61.12)	1	
≤ 14	41.32 (26.87 – 57.42)	0.80 (0.55 – 1.18)	–
> 14	55.66 (39.84 – 70.40)	1.08 (0.78 – 1.50)	–
Alcohol consumption			
No dependence (0 – 7)	51.14 (42.35 – 59.86)	1	
With dependence (8 – 40)	45.80 (29.60 – 62.93)	0.89 (0.61 – 1.32)	–
Daily mean of sitting time (min/day)			
1st tertile (≤ 180.0)	37.99 (27.54 – 49.69)	1	1
2nd tertile (180.1 – 355.0)	43.91 (33.63 – 54.73)	1.15 (0.81 – 1.65)	1.14 (0.80 – 1.62)
3rd tertile (> 355.0)	69.97 (57.28 – 80.19)	1.84 (1.36 – 2.50)	1.83 (1.36 – 2.47)

PR: prevalence ratios; IC95%: 95% confidence interval; (–) variables excluded from final model (p > 0.05).

time contributes to excessive weight, decreased muscle strength, joint stiffness, increased cholesterol levels, insulin resistance, and the occurrence of cardiovascular diseases[27] that interfere with the functionality of the elderly people.

Table 4. Prevalence and crude and adjusted prevalence ratios according to health-related factors (Ribeirão Preto, SP, Brazil, 2007, EPIDCV Project).

	Prevalence (95%CI)	Crude PR (95%CI)	Adjusted PR (95%CI)
Hypertension			
No	33.63 (23.57 – 45.43)	1	1
Yes	59.11 (49.52 – 68.06)	1.76 (1.26 – 2.45)	1.38 (1.00 – 1.90)
Glucose intolerance			
No	48.49 (37.75 – 59.36)	1	
Yes	51.97 (41.70 – 62.08)	1.07 (0.82 – 1.40)	–
IHD			
No	45.52 (36.59 – 54.76)	1	1
Yes	79.25 (60.82 – 90.38)	1.74 (1.31 – 2.31)	1.39 (1.05 – 1.85)
No. of medicines taken			
None	30.71 (16.58 – 49.69)	1	1
1 – 2	34.10 (22.96 – 47.32)	1.11 (0.59 – 2.08)	1.04 (0.56 – 1.95)
3 – 4	46.66 (33.97 – 59.80)	1.52 (0.85 – 2.71)	1.36 (0.75 – 2.45)
≥ 5	75.86 (62.14 – 85.75)	2.47 (1.39 – 4.40)	1.88 (1.04 – 3.40)
MMSE			
> 25	39.52 (30.33 – 49.51)	1	1
≤ 25	62.70 (51.45 – 72.73)	1.59 (1.21 – 2.08)	1.43 (1.12 – 1.83)
Nutritonal status			
Eutrophic	47.84 (36.07 – 59.85)	1	
Overweight	47.73 (36.59 – 59.10)	1.00 (0.73 – 1.36)	–
Obese	56.69 (42.77 – 69.63)	1.18 (0.88 – 1.59)	–
Conicity index			
≤ 1.24	39.29 (26.13 – 54.22)	1	
> 1.24	54.07 (45.32 – 62.56)	1.38 (0.96 – 1.97)	–

PR: prevalence ratios; IHD: ischemic heart disease; MMSE: Mini Mental State Examination; IC95%: 95% confidence interval; (–) variables excluded from final model (p > 0.05).

Regarding health-related factors, the findings for the independent effect of hypertension and IHD on disability were consistent with those reported by Alves et al.[3] in a cross-sectional study conducted in São Paulo with data from the SABE Project. Symptoms of high blood pressure, such as fatigue, palpitations, tingling in arms and legs, headache, and blurred vision, affect the performance of daily activities. Furthermore, hypertension, if not controlled, is one of the most potent risk factors for coronary disease[8] and strokes whose sequelae hinder the individual to perform the usual activities.

Still regarding the variables related to health, adjusted prevalence ratios revealed that low cognitive performance was positively associated with functional disability, which was corroborated by other authors[33,34]. Boult et al.[33] constructed a simulation model for the development of functional disability in noninstitutionalized US population, based on the Longitudinal Study of Aging for the period between 2001 and 2049. In the final model, age, strokes, diabetes, arthritis, and frequent episodes of mental confusion remained independently associated with the risk of disability. Forecast analyses have identified that, during the period in question, a reduction of only 1% in every 2 years in the prevalence of these events would enable a significant increase in the number of elderly people free of functional disability.

With regard to the use of medication, there was a linear gradient for the adjusted prevalence ratios that progressively increased according to the number of medications consumed.

Table 5. Prevalence and crude and adjusted prevalence ratios according to self-reported morbidity (Ribeirão Preto, SP, Brazil, 2007, EPIDCV Project).

	Prevalence (95%CI)	Crude PR (95%CI)	Adjusted PR (95%CI)
No. of reported diseases			
0 – 1	27.78 (17.52 – 41.06)	1	1
2 – 3	46.92 (35.70 – 58.45)	1.69 (1.06 – 2.68)	1.77 (1.13 – 2.76)
≥ 4	65.76 (54.90 – 75.19)	2.37 (1.53 – 3.66)	2.30 (1.51 – 3.52)
Visual acuity			
Excellent/good	41.32 (31.08 – 52.37)	1	
Fair/poor	55.64 (45.30 – 65.51)	1.35 (1.02 – 1.78)	–
Hearing acuity			
Excellent/good	43.07 (34.00 – 52.63)	1	1
Fair/poor	65.36 (52.44 – 76.35)	1.52 (1.17 – 1.97)	1.46 (1.15 – 1.84)
Self-reported health status			
Excellent/good	41.49 (32.66 – 50.90)	1	
Fair/poor	60.84 (48.19 – 72.19)	1.47 (1.11 – 1.93)	–

PR: prevalence ratios; 95%CI: 95% confidence interval; (–) variables excluded from final model (p > 0.05).

Similar results to this study were also found by Giacomin et al.[28] in Bambuí Project, MG, and Nunes et al.[29] in a cross-sectional study conducted with elderly of Ubá, MG. High consumption of medications reflects poor health status and the presence of comorbidities that, together, impair the functional autonomy. Moreover, excess of medications can contribute to the prolonged sedation, increasing risk of falls and fractures and, thus, interfering with the ADLs.

It is important to mention that, although obesity and abdominal fat accumulation hinder the realization of some ADLs such as dressing up, lying down, getting up from the bed, and climbing stairs, among others, nutritional status and the conicity index did not remain in the final model. Potent effects of other chronic diseases such as hypertension, IHD, and comorbidities on functional disability may have removed the independent effect of global and central obesity on the outcome.

Regarding comorbidities, expressed by the number of reported diseases, there was a linear gradient indication of the outcome prevalence in their categories, as well as in the respective adjusted prevalence ratios, which was corroborated by Santos et al.[26] in the south of Brazil, who identified that the category corresponding to the highest number of these diseases remained positively and independently associated with functional disability.

Regarding the hearing acuity, results similar to those of this study were reported by Nourhashémi et al.[34] and Odding et al.[31] in cross-sectional studies conducted in France and the Netherlands, respectively, in which hearing impairment was positively and independently associated with functional disability. A plausible hypothesis for these findings may be based on the progressive loss of social interaction, isolation, and lack of motivation for recreational and social activities which, together, may contribute to the deterioration of functional independence.

In short, the findings of this study reproduced the results of national and international studies, with cross-sectional or cohort designs, which enhances their coherence and consistency. In addition, it is confirmed, in Ribeirão Preto, the advent of the fifth stage of the epidemiological transition postulated by Omran[1], called "paradoxical longevity." He says that the decline in mortality and fertility rates would result in increased survival, with consequent accumulation of chronic diseases and disability resulting from them.

Limitations inherent in the cross-sectional design can be exemplified by the lack of associations, related to the outcome, of exposures such as the tobacco load, expressed by the pack-years indicator, or alcohol dependence. It is plausible to assume that functional limitations may have contributed to the control of these exposures (reverse causality bias). Another limitation refers to the impossibility of stratifying models by gender, considering the loss of statistical power inherent to the sample dilution into the strata. However, testing for interaction between sex and other variables that remained in the final models were not statistically significant in relation to the outcome ($p > 0.05$).

Finally, it is considered appropriate to emphasize that ongoing studies, with data from EPIDCV Project in which multilevel structural equation models[35] are being applied, should clarify possible direct, indirect, or reciprocal effects between the covariates and

the outcome in question, elucidating relationships that still remain unclear, from the use of classical multivariate models.

CONCLUSION

The high prevalence of functional disability in the elderly people of Ribeirão Preto and the presence of associations between potentially modifiable variables and the outcome impose the need for specific measures of health promotion and prevention that result in improved quality of life for seniors, the stratum that is already well represented in the last population pyramids of the municipality[36].

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Received on: 11/26/2014
Accepted on: 05/09/2015