



Chronic non-communicable diseases considering sociodemographic determinants in a cohort of older adults

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Abstract

Objective: To analyze the differences between the proportions of chronic non-communicable diseases (CNCDs) at two time periods, in a cohort of older adults, based on sociodemographic determinants. **Method:** This is a retrospective longitudinal study with baseline data obtained in 2008-2009 and follow-up in 2016-2017, from the FIBRA Study. The McNemar test was used to compare the frequencies of CNCDs according to sex, age, and education, with a significance level of 5% ($p < 0.05$). **Results:** The sample consisted of 453 older adults (mean age 72 ± 5.2 years old; 69.4% women). There was an increase in the proportions of arterial hypertension (64.4% versus 71.1%) and diabetes mellitus (21.9% versus 27.5%) in the periods studied, and a reduction in rheumatologic disease (43.6% versus 35.8%) and depression (21.7% versus 15.7%). Hypertension increased in older women, in those aged 65-74 years old and those with low education levels. Diabetes increased in older men, in those over 65 years of age and those with low education levels. A reduction in the proportions of rheumatologic diseases and depression was observed in women, in those aged 65-74 years old and those with low education levels. **Conclusion:** The data reflect the need to understand the sociodemographic health determinants involved in the health-disease-care process to reduce social inequities and the burden of CNCDs in the most vulnerable population segments, especially in the older adult population with multimorbidity.

Keywords: Chronic Disease; Health of the Elderly; Epidemiology; Noncommunicable Diseases; Elderly.

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The authors declare there are no conflicts of interest in relation to the present study.

Funding: Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Edital MCT-CNPq/MS-SCTIE-DECIT, Processo 17/2006, projeto nº 555082/2006-7; Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Convênio CAPES/Procad 2972/2014-01, projeto nº 88881.068447/2014-01; Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), projeto temático nº 2016/00084-8, e ao CNPq, auxílio à pesquisa nº 424789/2016-7.

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Received: October 5, 2021
Approved: December 22, 2021

INTRODUCTION

Chronic non-communicable diseases (CNCDs) are the leading cause of disability and premature mortality in the world, responsible for the death of 41 million people each year, equivalent to 71% of all deaths.¹ The advance of CNCDs is due to the gradual aging of the population associated with the epidemiological transition process, characterized by the increase in chronic-degenerative diseases and the reduction of acute infectious diseases. Among the CNCDs, cardiovascular diseases, diabetes, cancer and chronic respiratory disease are those that most contribute to the burden of morbidity and mortality, causing worsening quality of life, permanent clinical complications, loss of autonomy and functional disability, especially in the older adult population.²⁻⁴

CNCDs are a global public health problem, more serious in tropical, middle- and low-income countries like Brazil, which have age-standardized mortality rates higher than those of high-income countries.^{4,5} This condition reflects the socioeconomic and political context marked by structural problems, such as low education, inadequate nutrition, worse living conditions, infectious diseases, insufficient regulation of tobacco and alcohol, and health care subject to precarious and inaccessible resources.^{2,3,5} Evidence shows that most of the burden of CNCDs and health inequities occur due to social determinants of health, a term used to encompass social, economic, political, cultural and environmental determinants of health.^{6,7}

In recent decades, the study of social determinants of health has gained prominence around the world, given the need to combat inequities that hinder access and the right to health.⁸ In Brazil, the Ministry of Health has implemented measures to control CNCDs, with emphasis on the “Plan of Strategic Actions to Combat CNCDs.” Launched in 2011, the plan aims to develop goals and promote policies that guarantee reductions in morbidity, mortality and disabilities caused by CNCDs, through highly cost-effective actions, such as health promotion, early detection, treatment of CNCDs and the reorganization of health services.²

According to data from the *Pesquisa Nacional de Saúde* (National Health Survey) (PNS, 2013), the prevalence of CNCDs is high in Brazil (45.1%), with

a predominance of systemic arterial hypertension, chronic back problems, depression, arthritis and diabetes mellitus.⁹ CNCDs affect all socioeconomic strata, though are more intense in vulnerable groups, especially older adults and those on low income and who have low education levels.² The highest prevalence of CNCDs is observed with increasing age² and among women, who use health services more (both consultations and hospitalizations), and report more limitations due to CNCDs.¹⁰

Comprehensive care for the older adult population assumes an essential role in the control of CNCDs and the possibility of longitudinal observation of the occurrence of CNCDs in the older adult population should enable us to understand the magnitude and behavior of these diseases. In this context, sociodemographic determinants can influence the illness profile of the older adult population, given the complexity of the health-disease binomial. Therefore, the purpose of the study was to analyze the differences between the proportions of CNCDs, at two time points, in a cohort of older adults, based on sociodemographic determinants.

METHODS

This is a retrospective longitudinal study with community-dwelling older adults. Data were obtained from the FIBRA (Frailty Profile of Elderly Brazilians) Study conducted at two time periods: baseline (2008-2009)¹¹ and during follow-up (2016-2017), in Campinas and in Ermelino Matarazzo, a sub-district of the city of São Paulo.

At baseline, minimum sample sizes were estimated for each of the locations of 4 to 5 percentage points. To achieve the sample size, 90 urban census sectors in Campinas and 62 in Ermelino Matarazzo were randomly selected and, for each sample, proportional quotas of men and women by age group were estimated (65-69, 70-74, 75-79 and ≥ 80 years old), according to the census distribution of these segments in the population. The households of the selected census tracts were visited by recruiters trained to identify the presence of older adults eligible for the study: 65 years of age or older, who understood instructions to answer the questionnaire, who agreed to participate in the

survey, and who were permanent residents in the household and within the census sector.

The older adults who met the eligibility criteria were invited to attend public locations with easy access for data collection, which began with the administration of the Mini-Mental State Examination (MMSE), sociodemographic, anthropometric and clinical variables (blood pressure and oral health) and testing for frailty. The score obtained on the MMSE determined the continuity of the interview, taking into account that impairments in cognitive skills could make it impossible to answer self-report questions on CNCDS, the use of medical services, and other subjects. The cutoff scores used in the MMSE were 17 for illiterates, 22 for individuals with 1 to 4 years of education, 24 for those with 5 to 8 years, and 26 for those with 9 years or more of education.¹²

In all, 1,284 older adults were interviewed at baseline (900 in Campinas and 384 in Ermelino

Matarazzo), with a mean age of 72.6 ± 5.8 years old and 68.7% women. In 2016-2017, addresses recorded in the baseline database were traversed to locate older adults for a follow-up study. Recruiters made up to three attempts per participant. Of the original sample, 549 older adults were located, 192 had died since baseline, and a further 543 older adults were lost because they could not be located, the application of exclusion criteria, refusal to participate, interruption of the interview by a family member or the older adult, and presence of risk to the physical and psychological integrity of the interviewers. Among the 549 located, 96 were excluded because they did not have complete records of all the variables of interest.

Figure 1 presents the flowchart of the decision-making process for the composition of the sample for this study. The interviews were conducted in the households by a pair of trained recruiters, with a family member or other companion who was available at the time.

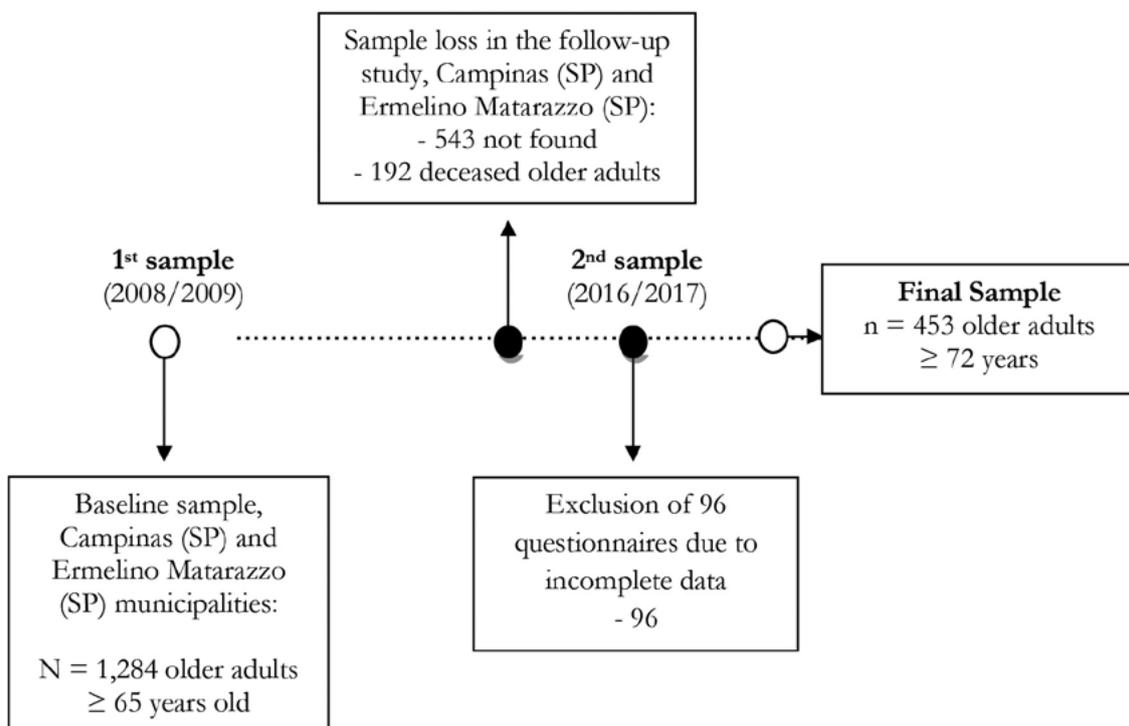


Figure 1. Sample composition flowchart. FIBRA Study, Older Adults, Campinas and Ermelino Matarazzo, SP, Brasil, 2008-2009 and 2016-2017.

The variables of interest in this study were chronic diseases contained on a checklist that, according to the older adults, had been diagnosed by a physician during the last year. The checklist contained nine dichotomous items (yes x no): heart disease (such as angina, myocardial infarction, or heart attack); systemic arterial hypertension (SAH); stroke; diabetes mellitus (DM); neoplasm/cancer; and rheumatologic disease (arthritis/rheumatism). The variables sex (male or female), age (65 to 74 years old or 75 years old and over) and education (0-4 or above 5 years of education) – taken from the baseline study – were considered to assess their relationship with the occurrence of diseases during the period.

Absolute and relative frequency values were computed for each chronic disease recorded at baseline and at follow-up. The proportions of occurrence were estimated according to sociodemographic variables. The McNemar statistical test was used to compare the proportions of chronic diseases in the two time periods. A critical *p* value of less than 0.05 was considered.

This study was approved by the Research Ethics Committee (REC) of the State University of Campinas (CAAE 37597220.7.0000.5404), following expert report no. 4,356,611, October 23, 2020. The baseline FIBRA Study projects (CAAE 39547014.0.1001.5404) and follow-up (CAAE 49987615.3.0000.5404 and 92684517.5.1001.5404) were also approved following expert reports, no.

907.575 of December 15, 2014, no. 1.332.651 of November 23, 2015, and no. 2.847.829 of November 23, 2015, and no. 2.847.829 of August 27, 2018, by above mentioned ethics committee. All participants signed a term of free, informed consent regarding the objectives, procedures, rights and duties of the participants and ethical commitments of the researchers.

RESULTS

The sample consisted of 453 older adults. At baseline, the mean age was 72.0 ± 5.2 years old, the majority were women (69.4%) and had between 0 and 4 years of education (71.8%). Table 1 presents the data resulting from the comparison of CNCD proportions at baseline and follow-up. A statistically significant increase was observed in the occurrence of SAH (64.4% versus 71.1%; $p = 0.001$) and DM (21.9% versus 27.5%; $p = 0.001$). Decreases were observed in the accumulated proportions of rheumatologic disease (43.6% versus 35.8%; $p = 0.003$) and depression (21.7% versus 15.7%; $p = 0.004$).

When evaluating the occurrence of chronic diseases according to sex, an increase in the proportion of DM was observed among men (21.5% versus 30.5%; $p = 0.010$) and of SAH in women (68.6% versus 75.1%; $p = 0.010$). Neoplasms, rheumatologic diseases and depression were less frequent at follow-up compared with baseline for women (Table 2).

Table 1. Comparison of the frequency of occurrence of CNCD in older adults over time. FIBRA Study, Older Adults, Campinas and Ermelino Matarazzo, SP, Brazil, 2008-2009 and 2016-2017.

CNCD	BL n (%)	FU n (%)	<i>p</i> value*
Heart Disease	100 (22.4)	100 (22.4)	1.000
SAH	290 (64.4)	320 (71.1)	0.001
Stroke	40 (8.9)	39 (8.7)	1.000
DM	98 (21.9)	123 (27.5)	0.001
Neoplasms	44 (9.8)	31 (6.9)	0.085
Rheumatologic Disease	195 (43.6)	160 (35.8)	0.003
Pulmonary Disease	45 (10.2)	41 (9.3)	0.689
Depression	97 (21.7)	70 (15.7)	0.004
Osteoporosis	127 (28.5)	118 (26.5)	0.463

BL: baseline; FU: follow-up; SAH: systemic arterial hypertension; DM: diabetes *mellitus*.

* McNemar test: $p < 0.05$.

Table 2. Comparison of the frequency of occurrence of CNCDs in older adults over time, according to sex. FIBRA Study, Older Adults, Campinas and Ermelino Matarazzo, SP, Brazil, 2008-2009 and 2016-2017.

CNCND	MALE			FEMALE		
	BL n (%)	FU n (%)	<i>p value</i> *	BL n (%)	FU n (%)	<i>p value</i> *
Heart Disease	28 (19.4)	28 (19.4)	1.000	72 (23.7)	72 (23.7)	1.000
SAH	80 (55.6)	90 (62.5)	0.075	210 (68.6)	230 (75.1)	0.010
Stroke	18 (12.5)	17 (11.8)	1.000	22 (7.2)	22 (7.2)	1.000
DM	31 (21.5)	44 (30.5)	0.010	67 (22.0)	79 (26.0)	0.057
Neoplasms	17 (11.9)	16 (11.2)	1.000	27 (8.9)	15 (4.9)	0.042
Rheumatologic Disease	38 (26.4)	28 (19.4)	0.121	157 (51.8)	132 (43.5)	0.015
Pulmonary Disease	15 (10.5)	7 (4.9)	0.076	30 (10.0)	34 (11.3)	0.635
Depression	18 (12.6)	14 (9.8)	0.503	79 (26.0)	56 (18.5)	0.005
Osteoporosis	12 (8.3)	8 (5.5)	0.480	115 (38.1)	110 (36.4)	0.690

BL: baseline; FU: follow-up; SAH: systemic arterial hypertension; DM: diabetes *mellitus*.

* McNemar test: $p < 0.05$.

The analyzes stratified by age group show that, among older adults aged between 65 and 74 years old, the occurrence of SAH and DM increased, while those of rheumatologic diseases and depression decreased during the course of the study ($p < 0.05$). For the oldest age group, a statistically significant increase in the occurrence of DM was observed (Table 3).

Among older adults with low education levels, an increase in the occurrence of SAH and DM and a reduction in the occurrence of neoplasms, rheumatologic diseases and depression was observed over the period. Among the most educated, there was stability regarding the the conditions evaluated ($p > 0.05$), except for depression, which showed a reduction (20.4% versus 12.0%; $p = 0.049$), when comparing the two periods (Table 4).

Table 3. Comparison of the frequency of occurrence of CNCND in older adults over time, according to age group. FIBRA Study, Older Adults, Campinas and Ermelino Matarazzo, SP, Brazil, 2008-2009 and 2016-2017.

CNCND	65 - 74 YRS OLD			75 YRS OLD & OVER		
	BL n (%)	FU n (%)	<i>p value</i> *	BL n (%)	FU n (%)	<i>p value</i> *
Heart Disease	75 (22.4)	80 (23.9)	0.660	25 (22.1)	20 (17.7)	0.458
SAH	218 (64.9)	242 (72.0)	0.003	72 (63.1)	78 (68.4)	0.237
Stroke	31 (9.3)	32 (9.6)	1.000	9 (7.9)	7 (6.1)	0.726
DM	79 (23.6)	95 (28.4)	0.025	19 (16.6)	28 (24.5)	0.011
Neoplasms	29 (8.7)	21 (6.3)	0.229	15 (13.3)	10 (8.9)	0.301
Rheumatologic Disease	149 (44.7)	124 (37.2)	0.017	46 (40.3)	36 (31.6)	0.098
Pulmonary Disease	31 (9.4)	31 (9.4)	1.000	14 (12.3)	10 (8.8)	0.424
Depression	81 (24.2)	50 (15.0)	0.001	16 (14.1)	20 (17.7)	0.503
Osteoporosis	88 (26.3)	83 (24.8)	0.657	39 (34.8)	35 (31.2)	0.627

BL: baseline; FU: follow-up; SAH: systemic arterial hypertension; DM: diabetes *mellitus*.

* McNemar test: $p < 0.05$.

Table 4. Comparison of the frequency of occurrence of CNCD in older adults over time, according to education. FIBRA Study, Older Adults, Campinas and Ermelino Matarazzo, SP, Brazil, 2008-2009 and 2016-2017.

CNCD	0 - 4 YEARS			5 YEARS OR MORE		
	BL n (%)	FU n (%)	<i>p value*</i>	BL n (%)	FU n (%)	<i>p value*</i>
Heart disease	74 (21.9)	70 (20.7)	0.752	25 (23.1)	29 (26.8)	0.523
SAH	221 (65.0)	245 (72.0)	0.003	68 (62.4)	74 (67.9)	0.263
Stroke	33 (9.7)	28 (8.3)	0.458	7 (6.4)	10 (9.2)	0.548
DM	77 (22.8)	96 (28.4)	0.005	20 (18.3)	26 (23.8)	0.179
Neoplasms	30 (8.9)	17 (5.0)	0.024	14 (12.8)	14 (12.8)	1.000
Rheumatologic disease	144 (42.7)	120 (35.6)	0.025	50 (45.9)	40 (36.7)	0.075
Pulmonary disease	35 (10.4)	29 (8.6)	0.440	10 (9.35)	12 (11.2)	0.790
Depression	75 (22.2)	57 (16.8)	0.038	22 (20.4)	13 (12.0)	0.049
Osteoporosis	98 (29.2)	87 (25.9)	0.294	28 (25.7)	30 (27.5)	0.850

BL: baseline; FU: follow-up; SAH: systemic arterial hypertension; DM: diabetes *mellitus*.

* McNemar test: $p < 0.05$.

DISCUSSION

The results obtained in the study show the proportions of self-reported CNCDs in older adults living in the community at two time points, considering the variables of sex, age and education. The natural aging process promotes organic changes that can cause increased vulnerability to the development of CNCDs.¹³ In this study, an increase in the occurrence of SAH and DM was observed among older adults, a finding that is consistent with those of other studies.^{14,15} These diseases show high prevalence and stand out among the public health problems and the main causes of morbidity and mortality in the older adult population.^{16,17}

SAH is the most prevalent chronic disease in the Brazilian geriatric population and its prevalence increases with age¹⁶; it represents a risk factor for cognitive decline, stroke, Alzheimer's dementia and loss of functionality.^{18,19} The global prevalence of SAH in older adults aged 60-69 years old is estimated at 57.0% in men and 61.6% in women. Over 70 years of age, this increases to 68.6% in men and 75.8% in women,²⁰ data also observed in this study.

There was an increase in the occurrence of SAH in women. Women's greater demand for health services and their greater sensitivity to health status predispose them to frequent reporting of diseases,

high rates of diagnosis²¹ and, probably, higher rates of survival. This process leads to an increase in the proportion of older adult women in the population, a phenomenon known as the feminization of old age.²² It is also worth noting that premenopausal women experience a decline in estrogen levels, which can trigger vasomotor symptoms (hot flashes, sweating, palpitations) and psychological symptoms (nervousness, irritability, insomnia and depression), in addition to being associated with increased risk of cardiovascular diseases and osteoporosis.²³

Education is an important determinant of health status and illness, especially in old age. Brazilian older adults with low education levels show a higher prevalence of SAH and DM, which denotes poor living conditions and health behaviors, which have an important impact on the health of older adults.²⁴ A systematic review found that low levels of education increased the probability of multimorbidity by 64% (OR: 1.64, 95%CI 1.41-1.91), and that this association is stronger in aging populations than in younger ones.²⁵ Bento et al.²⁶ investigated the association between contextual and individual variables and SAH in Brazilian older adults and observed an inverse association between hypertension and education. This result likely reflects the greater difficulty that older adults with low education levels experience in recognizing their health needs and adhering to treatments, as well as a reflection of poor medical

care, poorer functional literacy and difficulties in accessing health services.^{25,26}

DM is another very important CNCD, since it is associated with functional disability, multisystem complications (cardiovascular, renal and neurological), high rates of hospitalization and premature mortality.²⁷ Estimates indicate that between 2010 and 2030 there will be a 69% increase in the number of adults with DM in developing countries and a 20% increase in developed countries.²⁸ In Brazil, according to data from the 2013 PNS, the prevalence of DM was 6.2%; an estimated 9.2 million Brazilians have the disease. Among older adults, the prevalence reached 14.5% (60-64 years old) and around 20.0% (65 years old and over).²⁹ The prevalence of DM in older Brazilians increased from 22.2% to 25.9% ($p = 0.001$) between 2012 and 2016, according to data from a telephone survey conducted by the Ministry of Health.³⁰

For Brazilian adults of advanced age (75 years old or over), an increase in the occurrence of DM ($p=0.011$) was observed similar to that reported in the national and international literature.^{17,31} This increase may be influenced by greater access to health services and understanding of the diagnosis, the adherence to free treatment and interventions for improved disease control, such as the Hiperdia program, which reduces mortality and increases the incidence (accumulation of treated patients) and, consequently, the survival of older adults living with DM.

A reduction in the frequencies of depression and rheumatologic diseases was observed from baseline to follow-up, in this present study, possibly related to losses in follow-up or to the selective survival bias – following diagnosis, the patient changes habits, adopting healthier practices and behaviors. Depression is a frequent condition in the older adult population, associated with chronic diseases, functional limitation in daily activities and cognitive deficit.³² Reynolds et al.³³ conducted a study on psychiatric disorders in a representative sample of 12,312 older adults in the United States and observed a decrease in the rates of psychiatric disorders with increasing age. The authors reported that the limited perception of time by older adults, together with the search for the fulfillment of emotionally significant

goals, reduces stressful social situations and increases the probability of experiencing positive emotions.³³ Our results seem to replicate this finding.

The occurrence of neoplasms decreased in follow-up compared with baseline, suggesting a higher probability of death for part of the cohort that presented chronic disease. In a study using data from the 2013 PNS, the prevalence of cancer diagnosis was identified in 5.6% of older adults, and was higher in men (7.1%) than in women (4.7%; $p<0.001$),³⁴ similar to this study, which showed a higher occurrence of neoplasms in older men. Older adults with cancer who participated in the 2013 PNS showed an even higher prevalence of arterial hypertension, heart diseases, depression and chronic respiratory diseases, which reflects the association between CNCDs (multimorbidity), their clinical implications and in oncogeriatric care.³⁴

Several measures have been implemented in recent years to control CNCDs in Brazil, with free access to drug treatment forming an essential strategy for health policies. Matta et al.³⁵ identified the pharmacy of the Unified Health System as the main source of obtaining medicines in Brazil. However, relevant regional differences in drug dispensing were identified, particularly in the North and Northeast regions of the country. The accreditation of pharmacies and commercial drugstores through the *Programa Farmácia Popular* (a low-price drugstore program) in Brazil is an alternative to ensure access for the population to essential medicines for the treatment of chronic diseases, such as SAH, DM and asthma.³⁵

Although the baseline of the FIBRA Study did not adopt a perfect sampling design, this investigation represents a relevant contribution to the study of old age in Brazil, since it is a pioneer in the study of frailty, it involves adults aged 65 years old and over, because of its multicentric nature, and because it presents an acceptable level of sample randomization. The composition of the sample may have been affected by the selection of the fittest survivors, through the exclusion of those who did not meet the cognitive performance criteria established to respond to the complete protocol.

After an average of nine years since the baseline study, locating the oldest adults posed a challenge and a major obstacle to recruitment, as much as moving residence among part of the older adults to a child's home or to an institution, their children imposing a ban on further participation in the study, and the fear some older adults present about having strangers in their home. Self-reported data may have been hampered by memory biases or social desirability. The fact that simple or multiple imputation techniques were not used to calculate the estimates of proportions should also be taken into consideration, a factor that requires further studies on the subject. Thus, estimates may be low for some of the indicators presented.

CONCLUSION

The study presented changes in the proportion of older adults with CNCDS, considering sociodemographic determinants of the health-disease process. An increase in the occurrence of SAH and DM was observed in the older adult

population, together with a decrease in the prevalence of rheumatologic disease and depression after an average of nine years since the baseline measurements were taken. Differences in the prevalence of CNCDS according to sex, age and education were also identified. These data can contribute to the elaboration of health promotion actions among older adults, given the need to reduce the incidence and prevalence of CNCDS in old age.

Organic alterations secondary to the aging process determine greater vulnerability among older adults to the development of CNCDS, which implies the need for a better understanding of the social determinants of health. Educational measures, treatment, the control of risk factors (smoking, alcoholism, etc.), the promotion of healthy behaviors (healthy eating, physical activity) and management of CNCDS are a challenge for public health. Collaborative efforts are urgently needed to tackle the burden of chronic disease and multimorbidity in the most vulnerable population segments, especially the older adult population.

Edited by: Marquiony Marques dos Santos

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