1

Depressive symptoms among Brazilian elderly people: a study based on the National Health Survey – 2019

Vinicius dos Santos Sguerri https://orcid.org/0000-0002-3239-2825 [1]; Érico de Castro-Costa http://orcid.org/0000-0003-0792-5439 [2];
Antônio Ignácio de Loyola Filho https://orcid.org/0000-0002-7317-3477 [2,3]

Abstract *The aim is to investigate the prevalence and identify sociodemographic factors and health conditions associated with depressive symptoms among Brazilian elderly people. Data collected from 21,965 elderly people participating in the National Health Survey – 2019 were used. The Patient Health Questionnaire-9 (PHQ-9) was used to track depressive symptoms, considering the cutoff point ≥ 9. The Poisson regression model was used to detect associated factors, at a significance level of p < 0.05. The prevalence of depressive symptoms was 13.2%. After adjustment, female sex, negative self-rated health (fair or bad/very bad) and having two or more chronic diseases were positively associated with the presence of depressive symptoms. Negative associations were detected for ages between 70 and 79 years and living in rural areas and in the Northeast and North regions. Considering the frequency with which depressive symptoms occur among elderly people, and the consequences for the quality of life of this population segment, health services must organize themselves to monitor them and provide or refer appropriate care.*

Key words *Depression, Older adults, Aging, PHQ-9, Health surveys*

[1] Programa de Pós-Graduação em Saúde Pública, Instituto René Rachou – Fiocruz Minas, Fundação Oswaldo Cruz. Av. Augusto de Lima, 1520, sl. 214. 30190-003 Belo Horizonte MG Brasil. vinicius.sguerri@uftm.edu.br
[2] Núcleo de Estudos em Saúde Pública e Envelhecimento, Instituto René Rachou – Fiocruz Minas, Fundação Oswaldo Cruz. Belo Horizonte MG Brasil.
[3] Departamento de Gestão de Serviços de Saúde, Universidade Federal de Minas Gerais. Belo Horizonte MG Brasil.

Introduction

Population aging, characterized by the proportional increase of the older adult segment within the population, is a global phenomenon, though it has occurred or is occurring at different rates across countries[1]. In Brazil, population aging began in the 1970s, completely transforming the country's demographic profile. At that time, the population was still relatively young, with older adults representing 4.3% of the total population. By 2010, this percentage had risen to 10.8%[2]. According to the latest census conducted in 2022, the older adult population in Brazil now exceeds 32 million, accounting for 15.8% of the total population[3].

Population aging is accompanied by a shift in patterns of morbidity, mortality, and functionality, with a progressive increase in the prevalence of chronic non-communicable diseases (NCDs). These diseases are non-infectious and result from a combination of genetic, physiological, behavioral, and environmental factors. They tend to have a prolonged course, require long-term treatment, and include conditions such as cardiovascular diseases, chronic respiratory diseases, cancers, and diabetes mellitus (DM), among others[4]. The predominance of NCDs in the morbidity and mortality profile of aging populations underscores the importance of addressing mental health issues, as many of these diseases are associated with depressive disorders. This association may result from specific diseases or the presence of multimorbidity[5-7].

Depressive disorders are characterized by symptoms such as sadness, loss of interest or pleasure, feelings of guilt or reduced self-esteem, sleep or appetite disturbances, fatigue, and difficulty concentrating. They can manifest as major depressive disorder, depressive episodes (which can be mild, moderate, or severe), or dysthymia (a chronic form of mild depressive disorder, similar to a depressive episode but less intense and more enduring)[8]. In large epidemiological studies, various sets of questions are used to detect clinically relevant symptoms of depressive disorders, known as screening scales[9]. This approach is preferred because using psychiatric interviews for diagnosing depressive disorders in such studies is extremely challenging due to their high cost and the time required for administration[10].

The determinants of depressive disorders encompass a broad spectrum of factors, ranging genetic predisposition to NCDs (as previously mentioned), as well as sociodemographic and psychosocial factors[11-13]. In addition to their impact on physical health, depressive disorders impose a significant social cost by impairing work, domestic, and social activities. They lead to recurrent work absences, prolonged periods away from work, decreased productivity, increased social exclusion, and earlier retirement due to health issues[14]. Among older adults, depressive disorders contribute to a diminished quality of life, as economic and emotional losses are compounded by health-related issues such as comorbidities, functional impairment, and dementia[15].

Depressive disorder is the most commonly observed mental disorder. In 2015, 322 million people (4.4% of the global population) were affected by depressive disorders, with prevalence increasing by 18.4% from 2005 to 2015[8]. In Brazil, the 2019 National Health Survey revealed that one in ten (10.9%) Brazilian adults aged 18-59 suffered from major depressive disorder[6]. Among older adults, the 2013 National Health Survey reported a prevalence of depressive disorders of 5.0% in the 60-79 age group and 6.8% in those aged 80 and older[16].

The National Health Survey is a comprehensive health assessment that continues the work of the Health Supplement of the National Household Sample Survey (*Suplemento Saúde da Pesquisa Nacional por Amostra de Domicílio – PNAD*), with similar objectives, focus, and periodicity. It provides results for a situational diagnosis of the health of the Brazilian population, identifying at-risk subgroups and detailing access to and use of health services. The survey offers a detailed overview of health across different population levels, including regional, state, and capital city levels, to guide public health policies. In its two most recent editions (2013 and 2019), it includes a screening tool for depressive symptoms, allowing for a robust assessment of the prevalence of this issue in the Brazilian population[17]. However, we were unable to find any studies in major electronic bibliographic databases that specifically investigated the prevalence and associated factors of depressive symptoms among a representative sample of the Brazilian older adult population.

In this regard, the present study used data from the 2019 National Health Survey to investigate the prevalence of depressive symptoms and identify the sociodemographic characteristics and health conditions associated with these symptoms in the Brazilian older adult population (aged 60 and older).

Methodology

Study design, context, and population

This cross-sectional study utilized data from the 2019 National Health Survey. The survey aimed to understand the determinants, conditions, and health needs of Brazilians to support the development of public policies and enhance the effectiveness of the Brazilian health system through targeted health interventions[17].

The National Health Survey was conducted with a representative sample of the Brazilian population across all age groups, totaling 279,382 individuals. The sampling design used in the survey included cluster sampling in three stages: (1) census sectors or sets of census sectors formed the primary sampling units, (2) households were selected as the units of the second stage, and (3) adult residents defined the units of the third stage. Census sectors and households were chosen through simple random sampling, and participants (household residents) were selected with equal probability. Questionnaires were completed by residents aged 18 and older[17]. For the present study, all participants aged 60 years or older (n = 22,728) who responded to the selected resident's questions in the 2019 National Health Survey were eligible.

Variables and data collection

Data were collected through household interviews using a structured questionnaire. All data collectors, supervisors, and coordinators involved in the National Health Survey were trained and qualified. The interviews were conducted using Personal Digital Assistants (PDAs) – handheld computers programmed for the process of criticizing variables[17].

The dependent variable was the presence of depressive symptoms, screened using the Patient Health Questionnaire-9 (PHQ-9)[18], which has been validated in Brazil[12]. This screening tool consists of nine questions that assess depressive symptoms as outlined in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders[19]. It evaluates the following symptoms: depressed mood, fatigue or lack of energy, anhedonia, difficulty sleeping, changes in appetite or weight, feelings of guilt or worthlessness, difficulty concentrating, restlessness or lethargy, and suicidal thoughts.

For each question, the frequency of symptoms experienced in the past two weeks was assessed. The instrument assigns points based on the frequency of symptoms, ranging from zero (not at all) to three (nearly every day). The scores for each question are summed to obtain a final score with a maximum possible value of 27 points. Clinically relevant depressive symptoms were identified in participants who scored nine or more points, a threshold that maximizes the sensitivity and specificity of the test as validated in Brazil[12].

Sociodemographic variables and health condition descriptors were considered in the investigation of associated factors. The sociodemographic variables included sex (male; female), age (60-69 years, 70-79 years, and 80 years or older), education level (no formal education; primary education; secondary education; higher education), marital status (married; divorced; widowed; single), per capita household income in national minimum wages (NMW) (up to 1 NMW; between > 1 and 2 NMW; between > 2 and 5 NMW; and > 5 NMW), area of residence (urban; rural), and geographic region of residence (Southeast, South, Northeast, Central-West, North).

The health condition variables included the number of chronic diseases and self-rated health (very good/good; fair; poor/very poor). The first category corresponded to a positive health assessment, while the other categories indicated a negative one. The "number of chronic conditions" variable considered the sum of reported medical diagnoses for the following NCDs: hypertension (HTN), DM, heart disease, stroke, asthma, arthritis, chronic obstructive pulmonary disease (COPD), cancer, and chronic kidney disease (CKD). These variables were dichotomous (no; yes), and positive responses (yes) for each disease were summed to assign a numerical value to the variable, which was later categorized (none; 1; 2 or more NCDs) for analytical procedures.

Data analysis

The characterization of the study population based on explanatory variables was based on absolute and relative frequencies. The prevalence of depressive symptoms (overall and by explanatory variables) was calculated proportionally by relating the number of participants with depressive symptoms (score ≥ 9) to the total number of study participants. Confidence intervals (95%CI) were also calculated for the prevalence estimates.

Regarding explanatory variables, the comparison between participants with and without

depressive symptoms was conducted using univariate analyses based on Pearson's chi-square test with Rao-Scott correction. This adjustment was made to account for the effects of the complex sampling design.

Univariate and multivariate analyses were based on the Poisson regression model, which provides estimates of prevalence ratios and their corresponding 95% confidence intervals. All variables were included in the initial multivariate model (full model), regardless of the results from the univariate analyses. Selective deletion of variables (backward elimination) was then performed for those not associated with depressive symptoms in the presence of other variables. Variables independently associated with the outcome were retained in the final model. A significance level of p<0.05 was adopted for both the selective deletion of variables in the intermediate models and for identifying variables independently associated with the outcome in the final model.

The analyses in this study were conducted using STATA statistical software, version 14.0, with the survey module, which is suitable for handling data from population surveys with complex samples.

Ethical aspects

In compliance with Resolution 196/96 of the National Health Council, the 2019 National Health Survey received approval from the National Research Ethics Commission (*Comissão Nacional de* Ética *em Pesquisa* – CONEP) in August 2019, under number 3.529.376. The study ensured participants' voluntary participation, anonymity, and the right to withdraw from the study at any time.

Results

The study included 21,965 older adults with complete data for all analyzed variables (response rate = 96.6%), excluding those with missing information on any variable. The losses (n = 763, or 3.4%) were not significantly different with respect to the event under investigation (p = 0.268).

The study population was predominantly female (57.2%), aged between 60 and 69 years (56.4%), with education equivalent to elementary school (53.4%), and with a per capita household income of up to 2 NMW (73.3%). Most were married (50.8%) and resided in urban ar-

eas (86.0%), with nearly half (46.9%) living in the Southeast region. Regarding health conditions, 11.3% rated their health as poor or very poor, and 37.7% reported a medical diagnosis of two or more chronic diseases. Table 1 provides a complete description of the study population.

The prevalence of depressive symptoms was 13.2% (95%CI: 12.4%-14.0%) according to PHQ-9 ≥ 9. Table 1 also shows the distribution of depressive symptoms by explanatory variables. The prevalence was significantly (p < 0.05) higher among females and individuals aged 80 or older and lower among those who were married. Depressive symptoms decreased with increasing education and per capita household income and were higher among urban residents. No significant differences were observed with respect to geographic region.

Depressive symptoms were more frequent among participants in poorer health conditions, both subjectively and objectively. The prevalence of depressive symptoms was 43.6% among those who rated their health as poor or very poor, compared to 4.3% among those who rated their health as good or very good. Approximately one-fifth (20.9%) of respondents with two or more chronic diseases reported depressive symptoms, compared to 6.8% among those with none of the assessed conditions (Table 1).

Table 2 presents the results of univariate and multivariate analyses of factors associated with depressive symptoms using the Poisson regression model. In the univariate analysis, all variables were associated with depressive symptoms (p < 0.05). After adjusting in the multivariate model, the factors independently associated with higher probabilities of depressive symptoms were female sex (PR = 1.69; 95%CI: 1.50-1.92), self-rated health as fair (PR = 3.25; 95%CI: 2.69-3.93) and poor/very poor (PR = 8.65; 95%CI: 7.06-10.61), and having two or more chronic diseases (PR = 1.64; 95%CI: 1.37-1.97). Factors associated with lower probabilities of depressive symptoms included being in the age group of 70-79 years (PR = 0.83; 95%CI: 0.74-0.94), living in a rural area (PR = 0.82; 95%CI: 0.71-0.94), and residing in the Northeast (PR = 0.79; 95%CI: 0.69-0.90) and North (PR = 0.68; 95%CI: 0.57-0.82) regions.

Discussion

The present investigation revealed that approximately 13% of the older adult Brazilian population had a PHQ-9 score ≥ 9, compatible with the

Table 1. Proportional distribution (%) of depressive symptoms[a] among Brazilian older adults (n = 21,965) by sociodemographic characteristics; National Health Survey, 2019.

Characteristics	Total population	Depressive symptoms		p-value[c]
		%	CI95%	
Sex				
Male	42.8	8.3	7.4-9.4	
Female	57.2	16.8	15.7-18.0	< 0.001
Age (in years)				
60-69	56.4	13.0	12.0-14.2	
70-79	30.1	12.2	11.0-13.5	
80 or older	13.5	15.8	13.7-18.3	0.015
Education				
No education	16.3	16.3	14.5-18.3	
Primary	53.5	14.4	13.2-15.6	
Secondary	17.3	10.7	9.0-12.7	
Higher	13.0	7.4	5.9-9.2	< 0.001
Marital status				
Married	50.8	11.5	10.4-12.6	
Divorced	9.1	15.1	12.6-18.0	
Widowed	25.1	15.6	14.1-17.2	
Single	15.0	13.6	11.5-16.0	< 0.001
Per capita household income (in NMW)d				
up to 1	41.1	15.7	14.4-17.0	
> 1 to 2	32.2	13.3	11.9-14.9	
> 2 to 5	19.1	9.1	7.9-10.5	
> 5	7.5	9.2	6.9-12.2	< 0.001
Area of residence				
Urban	86.0	13.5	12,6-14.4	
Rural	14.0	11.2	9,8-12.9	< 0.001
Geographic region				
Southeast	46.9	13.5	12.1-15.1	
South	15.8	12.8	11.2-14.5	
Northeast	25.0	13.4	12.3-14.7	
Central-West	6.4	13.2	11.4-15.2	
North	5.9	10.4	8.8-12.1	0.247
Self-rated health				
Very good/good	47.0	4.3	3.6 – 5.1	
Fair	41.7	14.9	13.7-16.3	
Poor/very poor	11.3	43.6	40.4-46.8	< 0.001
Number of chronic diseasese				
0	26.4	6.8	5.8 – 8.0	
1	35.9	9.7	8.7-10.9	
2 or more	37.7	20.9	19.3-22.5	< 0.001

[a] PHQ-9 ≥ 9; [b] weighted values; significant when < 0.05; [c] obtained using Pearson's chi-square test with Rao-Scott correction; [d] national minimum wage at the time = R$998.00; [e] hypertension; diabetes mellitus; cardiovascular comorbidity; stroke; asthma; arthritis; chronic pulmonary disease; cancer; chronic kidney failure.

Source: Authors.

presence of clinically relevant depressive symptoms. It also showed that depressive symptoms were more common among older women and less frequent among those aged 70-79, residing in rural areas, and living in the Northeast and North regions. Additionally, the prevalence of depressive symptoms was significantly higher among participants in poorer health conditions

Table 2. Results of factors associated with depressive symptomsa among Brazilian older Adults, using the Poisson regression model; National Health Survey, 2019.

Variables	Unadjusted PR[b]	CI95%[c]	Adjusted PR[b]	CI95%[c]
Sociodemographic				
Sex (ref: male)				
Female	2.02	(1.77-2.30)*	1.69	(1.50-1.92)*
Age (ref: 60-69 years)				
70-79 years	0.94	(0.82-1.06)	0.83	(0.74-0.94)*
80 or older	1.22	(1.03-2.44)**	1.02	(0.88-1.19)
Education (ref: no education)				
Primary	0.88	(0.77-1.02)	-	-
Secondary	0.66	(0.54-0.81)*	-	-
Higher	0.45	(0.35-0.58)*	-	-
Marital status (ref: married)				
Divorced	1.31	(1.07-1.61)**	-	-
Widowed	1.36	(1.19-1.55)*	-	-
Single	1.19	(0.98-1.44)	-	-
Per capita household income (ref: up to 1 NMW)d				
> 1 to 2	0.85	(0.74-0.98)**	-	-
> 2 to 5	0.58	(0.49-0.63)*	-	-
> 5	0.59	(0.44-0.79)*	-	-
Area of residence (ref: urban)				
Rural	0.83	(0.71-0.97)**	0.82	(0.71-0.94)*
Geographic region (ref: Southeast)				
South	0.94	(0.80-1.12)	0.93	(0.80-1.08)
Northeast	0.99	(0.86-1.15)	0.79	(0.69-0.90)*
Central-West	0,97	(0.81-1.17)	0.90	(0.76-1.07)
North	0.77	(0.63-0.93)*	0/68	(0.57-0.82)*
Health conditions				
Self-Rated Health (ref: Very good/good)				
Fair	3.48	(2.89-4.18)*	3.25	(2.69-3.93)*
Poor/very poor	10.15	(8.41-10.24)*	8.65	(7.06-10.61)*
Number of chronic diseases (ref: none)				
1	1.43	(1.18-1.74)*	1.17	(0.98-1.41)
2 or more	3.06	(2.57-3.66)*	1.64	(1.37-1.97)*

[a] PHQ-9 ≥ 9; [b] PR = prevalence ratio; [c] CI95% = 95% confidence interval; [d] NMW = national minimum wage; * $p < 0.01$; ** $p < 0.05$.

Source: Authors.

(negative self-assessment of health and with two or more NCDs). All these differences remained as independent associations after multivariate analysis.

The prevalence of depressive symptoms detected in the present study was lower than the average prevalence (28.4%) found in a systematic review and meta-analysis based on 48 studies involving approximately 73,000 older adults from various continents, predominantly Asian[20]. It was nearly the same (13.3%) as that observed in another meta-analysis aggregating 18,953 older adults from countries across all continents[15]. It was also lower than the prevalences observed among Canadians aged 50 or older (27.0%)[21] and among older adults in India (29,0%)[22], Chile (28.3%)[23], and China (15,9%)[24] – all of which were national studies.

Regarding studies conducted in Brazil, our results fall within the range of prevalence val-

ues for depressive symptoms (between 7.1% and 39.6%, mean = 21.0%), as estimated in a systematic review and meta-analysis encompassing 33 articles (n = 39,431 older adults), nearly all of which were published between 2000 and 2017. Several studies conducted in Brazilian cities of varying population sizes (Caeté-MG[26], São Paulo-SP[27], Pelotas-RS[28], and Florianópolis-SC[29]) found prevalences between 14.2% and 25.6%, which are higher than the estimate from our study.

Explaining the variation in prevalence rates of depressive symptoms among different populations is challenging. These variations can arise from a variety of factors, primarily related to the characteristics of the population and socio-environmental context. Methodological issues, especially concerning the screening instruments used, also play a significant role.

Regarding population and contextual characteristics, depressive symptoms are more prevalent in populations experiencing worse health conditions, particularly those with debilitating illnesses[30]. Studies that exclude individuals with severe illnesses or disabilities often report lower prevalence estimates[31]. Similarly, populations facing greater socioeconomic deprivation and/or stigma related to depression tend to have higher prevalences of depressive symptoms, as they are more frequently exposed to stressful events and may be less likely to seek health services for treatment. Conversely, governments in regions with higher socioeconomic and human development can implement health policies that provide greater support and mental health benefits, resulting in lower prevalence rates[20]. In Brazil, municipalities with higher Human Development Index (HDI) scores have exhibited lower frequencies of depressive symptoms[25].

Prevalence estimates can also be influenced by the tests used to identify depressive symptoms. Tests with higher sensitivity tend to yield higher prevalence rates, while those with higher specificity may result in lower estimates. Among Brazilians, the Geriatric Depression Scale (GDS-15) has shown greater sensitivity compared to specificity[32]. In the validation study of the PHQ-9 with the Brazilian adult population, the cut-off point of ≥ 9 provided greater specificity (86.7%) than sensitivity (77.5%)[12]. Consequently, the PHQ-9 showed lower sensitivity compared to the GDS-15. Studies conducted in Brazil that reported higher prevalence rates than ours used the GDS-15 for screening depressive symptoms.

Similarly, lower cut-off points confer greater sensitivity to the test, while higher cut-off points increase specificity. For instance, a trend study based on data from the National Health Survey 2019 found prevalence rates of 10.5% and 11.1% for the age groups 60-69 years and 70 years or older, respectively[33]. These prevalences are lower than those detected in our study, which used the same database. The likely reason for this difference is the discrepancy in the cut-off point adopted for detecting depressive symptoms: Lopes et al. (2022)[33] used a cut-off of ≥ 10, which is more specific than the cut-off of ≥ 9 used in our study.

Among the sociodemographic characteristics, depressive symptoms were positively associated with the female sex and negatively associated with the intermediate age group (60-79 years), as well as residents in the North and Northeast regions and rural areas. The association between female sex and depression is well-documented in both international and national scientific literature. In various countries[21,24,31,34], older women experience more depressive symptoms than their male counterparts, a pattern also observed among older adults in Brazil[16,27,28,35].

The higher frequency of depressive symptoms among older women may stem from both biological and socioeconomic factors. Biologically, the pathophysiology of depression differs between men and women, with variations in the behavior of biomarkers related to neurotransmission, neuroplasticity, and the immune system. These mechanisms are intricately linked with sex hormones, making women more susceptible to depressive symptoms[15,36]. Socioeconomically, women may experience depression due to greater exposure to stressors related to sexual discrimination, their roles within family and society, and economic dependence on their partners[34,35].

Scientific literature is not unanimous regarding the influence of age on the occurrence of depressive symptoms among older adults. Several studies from various countries show a positive association between age and depressive symptoms[11,15,24,34,36], while others indicate no such association[27,31,35]. We observed a lower frequency of depressive symptoms with increasing age, (restricted to the 70-79 age group, which aligns with findings from older adults of Chile[23,38] and Southern Brazil[29].

The increase in depression with advancing age may be linked to chronic diseases, memory and vision impairments, functional disability, and other events common in later life, which contribute to dependency and a decline in qual-

ity of life[27,34]. Therefore, the negative association between age and depressive symptoms observed in our study might seem counterintuitive. In older Chileans, this association was attributed to the exclusion of the oldest individuals with cognitive problems or dementia from the study population[23]. In our study, however, physical or cognitive dysfunction was not an exclusion criterion, and data losses due to missing information were not differentiated by health conditions (results not shown). Another plausible explanation could be psychological immunity, a term referring to greater resilience to adverse life events due to repeated exposure, which might make older adults less susceptible to depression[39].

Similar to the present study, a lower prevalence of depressive symptoms among older adults living in rural areas and the North and Northeast macro-regions was also detected in the 2013 National Health Survey in studies involving the general population (18 years or older)[16,33]. Specifically regarding residence area, the results in other countries are controversial and may vary depending on the socioeconomic context. Some studies have associated depression with urban residence[24,40], while others have found no such association[41,42].

The environment can be a risk factor for developing depressive symptoms. In urban areas, higher population density, excessive noise, frequent sleep disturbances, insecurity, and fear can permeate daily life. Social inequality is often more pronounced, all contributing to a lower quality of life and increasing the risk of depression for those living in such environments[35].

In turn, the lower prevalence of depressive symptoms among older adults in the North and Northeast regions, compared to those in the Southeast, could be attributed to differences in the distribution of determinants of depressive symptoms across these population strata and the intensity of the relationship between exposures and the outcome. For instance, the likelihood of living in rural areas was higher in both the North and Northeast regions, whereas the frequency of having two or more chronic diseases was lower in the North. In our study population, living in rural areas was negatively associated with depressive symptoms, while the presence of two or more chronic diseases was positively associated with depressive symptoms, supporting this explanatory hypothesis. However, this pattern was not observed for other variables associated with depressive symptoms, such as sex, which did not differ by macro-geo-graphic region. Additionally, similar to the general population, older adults in the North and Northeast regions rated their own health worse, contradicting the speculated explanation.

Among Brazilian older adults, poorer health conditions, such as the presence of chronic disease and a negative self-assessment of health, were associated with depressive symptoms. The association between worse self-perceived health and depressive symptoms has been documented in various older populations[5,27,28,30,35,38].

Self-assessment of health is a widely used variable in epidemiological studies due to its robustness and comprehensiveness in explaining health events and ease of implementation, as it relies on a single question. This measure offers valuable insights into the individual's health and life context, capturing symptoms of undiagnosed illnesses and reflecting their perceived progression. Its measurement power stems from its ability to assess both physical and psychological factors that threaten an individual's health, incorporating biological and psychological aspects of well-being[43].

In addition to reflecting the individual's judgment of their own health, this variable can signal internal motivations, the social resources available for coping with illness, and their propensity for managing it[44,45]. Given the extensive and comprehensive information it encompasses, a poorer self-perception of health undoubtedly affects an individual's well-being and mental health, potentially contributing to the occurrence of depression. Consequently, healthcare professionals should be attentive to their patient's health perceptions, as a simple question during a consultation can reveal not only the presence of depressive symptoms but also the individual's readiness to address them. The bidirectional nature of this association[43,46] does not invalidate this approach.

The association between chronic diseases and depression is well-established in the literature. Some studies have investigated specific diseases, linking depression to conditions such as heart disease, arthritis, and rheumatism[5]; HTN and DM[16]; stroke; COPD; asthma; and chronic spine problems[6,47]. Others, like our study, have addressed chronic diseases collectively, without individualizing them, and associated depression with the number of chronic conditions present[6,24,34,35,38,48].

From a broader perspective, the presence of pain and inflammatory processes links NCDs to depression. The biological connections between these diseases include vascular changes (such as

endothelial dysfunction), neurochemical alterations, and disruptions in nervous system metabolism. NCDs cause discomfort due to their symptom burden and persistent complications, leading to functional decline and dependency. Additionally, the psychological impact of losing control over important life activities, coupled with the negative feelings associated with NCDs – stemming from the unpredictability of their course and past experiences – contributes to a decline in quality of life and acts as a trigger for the development of depression[7,47,49].

Similar to the case with self-rated health, it is important to highlight the bidirectional nature of the association between NCDs and depression[7]. Depression can impact adherence to treatment for NCDs and promote the adoption of health-damaging behaviors (such as smoking, physical inactivity, and poor diet), which are risk factors for NCDs[50]. This mutual determination should receive special attention from healthcare services and professionals due to its implications for the therapeutic management of these diseases.

The main limitation of this study arises from its cross-sectional design. Cross-sectional studies cannot establish causal relationships between exposure and outcome, as they do not allow for temporal separation of measures. Thus, the presence of reverse causation bias cannot be ruled out, especially regarding associations with variables describing health conditions. Another limitation pertains to the measurement process of the investigated event. While screening instruments can identify clinically relevant depressive symptoms, they are insufficient for diagnosing depression. However, they are valuable for identifying segments of the population at risk of developing depressive symptoms, who should undergo further evaluation by healthcare services.

On the other hand, the strength of our work lies in the size of the sample (study population) used and its representativeness across different levels of aggregation (national, macro-regions, federal states, and their capitals). This aspect allows for the full potential of statistical analyses, producing robust and reliable results that can be generalized to the older adult population in Brazil. Finally, the choice of the PHQ-9 as a screening tool maximizes sensitivity and specificity for detecting clinically relevant depressive symptoms. The PHQ-9 is particularly suitable for the older adult population and has been validated in Brazil.

In summary, the present investigation revealed that depressive symptoms among older adults in Brazil are associated with sociodemographic characteristics and health conditions, corroborating findings from other population-based epidemiological studies. It also demonstrated that, within this population, both objectively and subjectively measured health conditions – particularly the latter – were the factors most strongly associated with depressive symptoms. Given the frequency of depressive symptoms among older adults and their impact on the quality of life of this population segment, healthcare services should be organized to monitor, identify, and provide appropriate care for these symptoms.

In light of the connections between NCDs and depression and the frequent use of healthcare services, medical consultations represent a valuable opportunity to investigate depression among older adults, even in non-specialized settings. This can be achieved through depression screening tests or by incorporating selected questions from these instruments during routine medical consultations, aiming to refer patients for specialized care when necessary. Additionally, considering that depressive symptoms in older adults are potentially modifiable and preventable, our findings support the implementation of early multidisciplinary intervention strategies. These strategies should involve healthcare professionals beyond specialists and include guidance and psychoeducation for family members to promote better self-assessment of the older adult's health.

Collaborations

VS Sguerri, Castro-Costa E and Loyola Filho AI contributed equally to all stages of the article's construction: project design, data analysis and interpretation, writing of the article, critical review, and approval of the final version.

References

1. United Nations (UN). *World population prospects 2022: summary of results*. New York: UN; 2022.

2. Vasconcelos AMN, Gomes MMF. Transição demográfica: a experiência brasileira, *Epidemiol Serv Saude* 2012; 21(4):539-548.

3. Instituto Brasileiro de Geografia e Estatística (IBGE). Censo Demográfico 2022: População por idade e sexo, pessoas de 60 anos ou mais de idade [Internet]. 2023 [acessado 2023 dez 20]. Disponível em: https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=2102038

4. World Health Organization (WHO). Non Comunicable Diseases. Fact sheets [Internet]. 2022 [cited 2023 jan 29]. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases.

5. Maier A, Riedel-Heller SG, Pabst A, Luppa M. Risk factors and protective factors of depression in older people 65+. A systematic review. *PloS One* 2021; 16(5):e0251326.

6. Sousa NFDS, Barros MBDA, Medina LDPB, Malta DC, Szwarcwald CL. Association of major depressive disorder with chronic diseases and multimorbidity in Brazilian adults, stratified by gender: 2019 National Health Survey. *Rev Bras Epidemiol* 2021; 24(Suppl. 2):e210015.

7. Zhang Y, Chen Y, MA L. Depression and cardiovascular disease in elderly: current understanding. *J Clin Neurosc* 2018; 47:1-5.

8. World Health Organization (WHO). Depression and other common mental disorders: global health estimates [Internet]. 2017 [cited 2023 jun 7]. Available from: https://apps.who.int/iris/bitstream/10665/254610/1/WHO-MSD-MER-2017.2-eng.pdf

9. Gelenberg AJ. Using assessment tools to screen for, diagnose, and treat major depressive disorder in clinical practice. *J Clin Psychiatry* 2010; 71(Suppl. 1):e01.

10. Kessler RC. Psychiatric epidemiology: challenges and opportunities. *Int Rev Psychiatry* 2007; 19(5):509-521.

11. Sinha P, Hussain T, Boora NK, Rao GN, Varghese M, Gururaj G, Benegal V; NMHS India Collaborators Group. Prevalence of common mental disorders in older adults: results from the National Mental Health Survey of India. *Asian J Psychiatry* 2021; 55:102463.

12. Santos IS, Tavares BF, Munhoz TN, Almeida LS, Silva NT, Tams BD, Patella AM, Matijasevich A. Sensibilidade e especificidade do Patient Health Questionnaire-9 (PHQ-9) entre adultos da população geral. *Cad Saude Publica* 2013; 29:1533-1543.

13. Qin X, Wang S, Hsieh C. The prevalence of depression and depressive symptoms among adults in China: estimation based on a national household survey. *China Econ Rev* 2018; 51:271-282.

14. Maske EU, Buttery AK, Beesdo-Baum K, Riedel-Heller S, Hapke U, Busch MA. Prevalence and correlates of DSM-IV-TR major depressive disorder, self-reported diagnosed depression and current depressive symptoms among adults in Germany. *J Affect Disord* 2016; 190:167-177.

15. Abdoli N, Salari N, Darvishi N, Jafarpour S, Solaymani M, Mohammadi M, Shohaimi S. The global prevalence of major depressive disorder (MDD) among the elderly: a systematic review and meta-analysis. *Neurosci Biobehav Rev* 2022; 132:1067-1073.

16. Munhoz TN, Nunes BP, Wehrmeister FC, Santos IS, Matijasevich A. A nationwide population-based study of depression in Brazil. *J Affect Disord* 2016; 192:226-233.

17. Stopa SR, Szwarcwald CL, Oliveira MD, Gouvea ECDP, Vieira MLFP, Freitas MD. Pesquisa Nacional de Saúde 2019: histórico, métodos e perspectivas. *Epidemiol Serv Saude* 2020; 29(5):e2020315.

18. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001; 16(9):606-613.

19. American Psychiatric Association (APA). *Diagnostic and statistical manual of mental disorders: DSM-IV*. Washington: APA; 2000.

20. Hu T, Zhao X, Wu M, Li Z, Luo L, Yang C, Yang F. Prevalence of depression in older adults: a systematic review and meta-analysis. *Psychiatry Res* 2022; 311:114511.

21. MacNeil A, Birk S, Villeneuve PJ, Jiang Y, Groh M, Fuller-Thomson E. Incident and recurrent depression among adults aged 50 years and older during the COVID-19 pandemic: a longitudinal analysis of the Canadian Longitudinal Study on Aging. *Int J Environ Res Public Health* 2022; 19(22):15032.

22. Ansari S, Anand A, Hossain B. Multimorbidity and depression among older adults in India: mediating role of functional and behavioural health. *PLoS One* 2022; 17(6):e0269646.

23. Aravena JM, Saguez R, Lera L, Moya MO, Albala C. Factors related to depressive symptoms and self-reported diagnosis of depression in community-dwelling older Chileans: a national cross-sectional analysis. *Int J Geriatr Psychiatry* 2020; 35(7):749-758.

24. Tang X, Qi S, Zhang H, Wang Z. Prevalence of depressive symptoms and its related factors among China's older adults in 2016. *J Affect Disord* 2021; 292:95-101.

25. Meneguci J, Meneguci CAG, Moreira MM, Pereira KR, Tribess S, Sasaki JE, Virtuoso Júnir JS. Prevalência de sintomatologia depressiva em idosos brasileiros: uma revisão sistemática com metanálise. *J Bras Psiquiatr* 2019; 68(4):221-230.

26. Dias FLC, Teixeira AL, Guimarães HC, Santos APB, Ritter SRF, Machado JCB, Barbosa MT, Caramelli P. Prevalence of late-life depression and its correlates in a community-dwelling low-educated population aged 75+ years: the Pietà study. *J Affect Disord* 2019; 242:173-179.

27. Mendes-Chiloff CL, Lima MCP, Torres AR, Santos JLF, Duarte YO, Lebrão ML, Cerqueira ATAR. Depressive symptoms among the elderly in São Paulo city, Brazil: prevalence and associated factors (SABE Study). *Rev Bras Epidemiol* 2019; 21(Suppl. 2):e180014.

28. Hellwig N, Munhoz TN, Tomasi E. Sintomas depressivos em idosos: estudo transversal de base populacional. *Cien Saude Colet* 2016; 21(11):3575-3584.

SguerrIVS *et al.*

29. Borges LJ, Benedetti TRB, Xavier AJ, d'Orsi E. Fatores associados aos sintomas depressivos em idosos: estudo EpiFloripa. *Rev Saude Publica* 2013; 47(4):701-710.

30. Park JI, Park TW, Yang JC, Chung SK. Factors associated with depression among elderly Koreans: the role of chronic illness, subjective health status, and cognitive impairment. *Psychogeriatrics* 2016; 16(1):62-69.

31. Wu CS, Yu SH, Lee CY, Tseng HY, Chiu YF, Hsiung CA. Prevalence of and risk factors for minor and major depression among community-dwelling older adults in Taiwan. *Int Psychogeriatr* 2017; 29(7):1113-1121.

32. Almeida OP, Almeida SA. Short versions of the geriatric depression scale: a study of their validity for the diagnosis of a major depressive episode according to ICD-10 and DSM-IV. *Int J Geriatr Psychiatry* 1999; 14(10):858-865.

33. Lopes CDS, Gomes NL, Junger WL, Menezes PR. Trend in the prevalence of depressive symptoms in Brazil: results from the Brazilian National Health Survey 2013 and 2019. *Cad Saude Publica* 2022; 38(Suppl. 1):e00123421.

34. Mulat N, Gutema H, Wassie GT. Prevalence of depression and associated factors among elderly people in Womberma District, north-west, Ethiopia. *BMC Psychiatry* 2021; 21(1):136.

35. Corrêa ML, Carpena MX, Meucci RD, Neiva-Silva L. Depressão em idosos de uma região rural do Sul do Brasil. *Cien Saude Colet* 2020; 25(6):2083-2092.

36. Labaka A, Goñi-Balentziaga O, Lebeña A, Pérez-Tejada J. Biological sex differences in depression: a systematic review. *Biol Res Nurs* 2018; 20(4):383-392.

37. Lotfaliany M, Hoare E, Jacka FN, Kowal P, Berk M, Mohebbi M. Variation in the prevalence of depression and patterns of association, sociodemographic and lifestyle factors in community-dwelling older adults in six low-and middle-income countries. *J Affect Disord* 2019; 251:218-226.

38. Moreno X, Gajardo J, Monsalves MJ. Gender differences in positive screen for depression and diagnosis among older adults in Chile. *BMC Geriatr* 2022; 22(1):54.

39. Jorm AF. Does old age reduce the risk of anxiety and depression? A review of epidemiological studies across the adult life span. *Psychol Med* 2000; 30(1):11-22.

40. Purtle J, Nelson KL, Yang Y, Langellier B, Stankov I, Roux AVD. Urban–rural differences in older adult depression: a systematic review and meta-analysis of comparative studies. *Am J Prev Med* 2019; 56(4):603-613.

41. Adjaye-Gbewonyo D, Rebok GW, Gallo JJ, Gross AL, Underwood CR. Residence in urban and rural areas over the life course and depression among Ghanaian and South African older adults. *Health Place* 2020; 63:102349.

42. Fujise N, Abe Y, Fukunaga R, Nakagawa Y, Nishi Y, Koyama A, Matsumoto S, Otsuka T. Comparisons of prevalence and related factors of depression in middle-aged adults between urban and rural populations in Japan. *J Affect Disord* 2016; 190:772-776.

43. Peleg S, Nudelman G. Associations between self-rated health and depressive symptoms among older adults: does age matter? *Soc Sci Med* 2021; 280:114024.

44. Benyamini Y, Leventhal EA, Leventhal H. Elderly people's ratings of the importance of health-related factors to their self-assessments of health. *Soc Sci Med* 2003; 56(8):1661-1667.

45. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav* 1997; 38(1):21-37.

46. Bustos-Vázquez E, Fernández-Niño JA, Astudillo-García CI. Self-rated health, multimorbidity and depression in older adults: proposal and evaluation of a simple conceptual model. *Biomedica* 2016; 37(Supl. 1):92-103.

47. Jiang C, Zhu F, Qin T. Relationships between chronic diseases and depression among middle-aged and elderly people in China: a prospective study from CHARLS. *Curr Med Sci* 2020; 40(5):858-870.

48. Zhang L, Shooshtari S, St. John P, Menec VH. Multimorbidity and depressive symptoms in older adults and the role of social support: evidence using Canadian Longitudinal Study on Aging (CLSA) data. *PLoS One* 2022; 17(11):e0276279.

49. Patten SB, Williams JVA, Lavorato DH, Wang JL, Jetté N, Sajobi TT, El-Gabalawy R, Bulloch AGM. Patterns of association of chronic medical conditions and major depression. *Epidemiol Psychiatr Sci* 2018; 27(1):42-50.

50. Read JR, Sharpe L, Modini M, Dear BF. Multimorbidity and depression: a systematic review and meta-analysis. *J Affect Disord* 2017; 221:36-46.