

Associations of social isolation with sociodemographic aspects and health indicators in Brazilian middle-aged and older adults: ELSI-Brazil

Isolamento social e suas associações com indicadores sociodemográficos e de saúde em adultos e idosos brasileiros: ELSI-Brasil

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Abstract

Objectives: To investigate the prevalence of social isolation and its associations with sociodemographic and health indicators in Brazilian middle-aged and older adults recruited from households.

Methods: A cross-sectional study of baseline data (2015–2016) of 7886 Brazilian adults aged 50 years and older from the Brazilian Longitudinal Study of Aging (ELSI-Brazil) was conducted. Social isolation was the dependent variable, as defined by living arrangement, frequency of contact with children, relatives, and friends, and degree of participation in social activities within the community. The independent variables were sociodemographic aspects, health-related behaviors, and health status. Associations between social isolation and independent variables were estimated using Poisson regression analysis.

Results: The prevalence ratio (PR) of high level of social isolation was 23.13%. Significant positive associations were observed between high level of social isolation and male sex (PR 1.27; 95%CI 1.16–1.40); being 70 to 79 years old (PR 1.22; 95%CI 1.07–1.39) or 80 years or older (PR 1.56; 95%CI 1.32–1.85); having no formal education (PR 3.15; 95%CI 2.69–3.68) or having a maximum of 4 years (PR 2.11; 95%CI 1.82–2.46) or 5 to 8 years of formal education (PR 1.54; 95%CI 1.30–1.84); fair self-rated health (PR 1.25; 95%CI 1.12–1.39); depressive symptoms (PR 1.22; 95%CI 1.07–1.40); and poor-quality diet (PR 1.37; 95%CI 1.19–1.58). Fair sleep quality was negatively associated with social isolation (PR 0.87; 95%CI 0.78–0.98).

Conclusions: The group most at risk for social isolation comprises men, aged 70 or older, with low educational attainment, fair self-rated health, and an unhealthy diet. Future research should use longitudinal study designs to investigate causal relationships and develop interventions for older adults who are socially isolated.

Keywords: social isolation; self-care; aging; health behavior; sociodemographic factors.

INTRODUCTION

The role of social connections as determinants of health in aging is increasingly recognized, and social isolation in older adults is considered a public health problem in several parts of the world.¹ Social isolation is defined as the objective state of having few or infrequent social connections and is often associated with living alone, widowhood, low frequency of contact with family and friends, and low social participation.² It differs from loneliness, which is a subjective state characterized by negative or painful feelings arising from dissatisfaction with social relationships.¹

Normative events with a high probability of occurrence in old age, such as retirement, widowhood, death of friends, and deterioration of health, contribute to the reduction of one's social network and increase the risk of social isolation.³ According to the Socioemotional Selectivity Theory,⁴ upon realizing that one's time remaining in life is probably shorter than the time already lived, older adults prefer to optimize closer social interactions capable of providing them with greater emotional reward — such as those that occur with children, spouses, and friends — instead of engaging in the search for new or more distant social relationships with uncertain emotional return.

The negative effects of social isolation on the health of older adults can reach magnitudes comparable to those of risk factors such as smoking and obesity.⁵ International studies have shown associations between social isolation and various physical and mental health conditions,^{1,2} which can be explained by physiological and psychological mechanisms and by the link between social isolation and health-damaging behaviors.⁶ A deficit in social relationships can be perceived as a threat by the central nervous system, leading to activation of the sympathetic nervous system and hypothalamic-pituitary-adrenal axis and having a direct influence on inflammation, which increases the risk of developing or exacerbating diseases.^{6,7} Additionally, isolated individuals tend to have negative expectations regarding social relationships and remember more negative social experiences than positive ones, which can adversely affect their mental health and lead them to distance themselves from social contacts that could promote the adoption of positive health behaviors.⁷

In the Brazilian population, evidence is lacking on the relationships between social isolation, behaviors, and health conditions. Thus, the aim of this study is to investigate the prevalence of social isolation and its associations with socio-demographic variables (sex, age, and education), health-related behaviors (diet quality and regular physical activity), and health conditions (self-rated health, depressive symptoms, and

sleep quality) in a nationally representative sample of Brazilian middle-aged and older adults recruited from households.

METHODS

A cross-sectional study was conducted on data from the first wave of the Brazilian Longitudinal Study of Aging (ELSI-Brazil), collected in 2015-16. ELSI-Brazil is a population-based study involving a nationally representative sample of non-institutionalized Brazilians aged 50 years and older from all five geographic macroregions of Brazil. The sample design of the ELSI-Brazil is complex, entailing stratification of primary sampling units (cities), census sectors, and households, drawing on the geographic database held by the Brazilian Institute of Geography and Statistics (IBGE). Further details are available on the study website (<https://elsi.cpqrr.fiocruz.br/>) and have been previously published elsewhere.⁸ Participants eligible for this study were those who answered the questions related to the variables of interest without assistance from a mediator. Out of the 9412 baseline participants, we excluded individuals for whom data were missing on social isolation ($n = 363$), sleep ($n = 151$), self-rated health ($n = 13$), and depressive symptoms ($n = 999$), resulting in a final sample of 7886 individuals (Figure 1).

Social isolation was the dependent variable. As no standard scale measuring social connectedness was applied in the ELSI-Brazil, the present study used the social isolation instrument and index employed in the English Longitudinal Study of Ageing (ELSA),^{9,10} which included 5 items on living arrangement, frequency of social contact, and participation in social activities. Living arrangements were assessed with the question “In total, how many people live in this household?”.

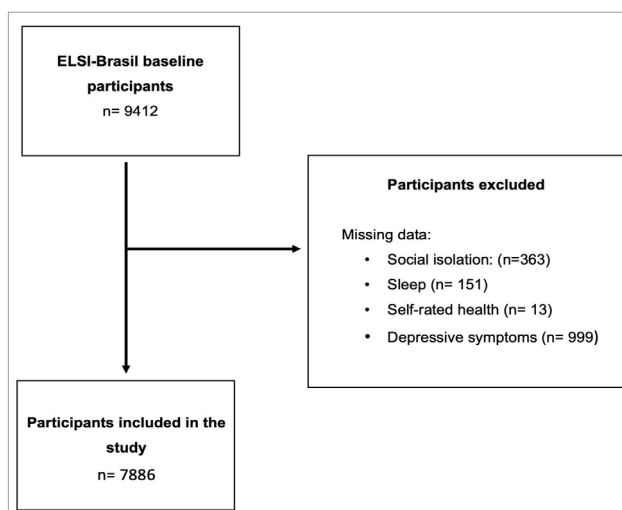


FIGURE 1. Flow diagram of study participants.

Individuals who reported living alone scored 1 point, zero otherwise. The frequency of social contacts with children, relatives, and friends, excluding those living in the same household, was assessed by asking a three-part question: “How often do you meet in person or talk on the phone, Skype, WhatsApp, or Facebook with any of your children? With any of your relatives? With any of your friends?”. One point was scored for each part if contacts occurred less than once a month. No points were given if contacts occurred once or more times a month. Lack of participation in social activities was assessed with yes vs. no questions about involvement in activities in clubs, community or religious groups, community centers for older people, university of the third age, civil societies, boards, community leadership, cooperatives, political parties, and voluntary work. One point was assigned to those who reported not having participated in any of these social activities in the last 12 months, zero otherwise. The total score ranged from zero to five points. The higher the score, the higher the level of social isolation presumed. As previously published,⁹ scores were dichotomized into two categories: high or low levels of social isolation. Participants whose total scores were higher than the cutoff value defined by the upper quintile threshold (≥ 4 points) were defined as having a high level of social isolation.

The independent variables were sociodemographic indicators (sex, age, education), health-related behaviors (diet quality, level of physical activity), and health conditions (sleep quality, depressive symptoms, and self-rated health).

The self-reported sociodemographic indicators assessed were sex (male or female), chronological age (subsequently stratified by age group into 50–59, 60–69, 70–79, or ≥ 80 years), and educational attainment (number of years of formal education or no formal education).

Diet quality was assessed using an instrument applied in a previous study¹¹ based on weekly intake of four food items, one of which (red meat) was related to the risk of developing chronic diseases, while the other three (fruits, vegetables, and chicken) were related to health benefits. Each of the four items was scored according to frequency of consumption:

- 7 days a week = 4 points;
- 5–6 days a week = 3 points;
- 3–4 days a week = 2 points;
- 1–2 days a week = 1 point; and
- almost never or never = 0 points.

The score was reversed for red meat consumption. The sum of points could range from 0 to 16. The higher the score, the better the diet quality. The new variable was categorized according to the tertiles of distribution: good-quality diet

or healthy eating (top tertile), fair-quality diet (intermediate tertile), and poor-quality diet or unhealthy eating (bottom tertile).¹¹

Physical activity level was measured using the short form of the International Physical Activity Questionnaire (IPAQ), as translated and validated for Brazil.¹² According to World Health Organization (WHO) recommendations, individuals who engaged in at least 150 minutes of moderate physical activity or 75 minutes of vigorous physical activity per week were considered active.¹³

Sleep quality was assessed with the question “How do you rate the quality of your sleep: very good, good, fair, poor, or very poor?”. The variable was categorized as good/very good (3 points), fair (2 points), and poor/very poor (1 point).

Depressive symptoms were assessed using the Portuguese-translated version of the eight-item Center for Epidemiological Studies Depression Scale (CES-D8).¹⁴ Affirmative responses to items describing depressive symptoms received 1 point each. The points were summed, and depressive symptoms were considered present for total scores ≥ 4 .¹⁵

Self-rated health was measured by the question “Overall, how do you rate your health: very good, good, fair, poor, or very poor?”.^{16,17} Scores of 3, 2, and 1 were assigned to very good/good, fair, and poor/very poor, respectively.¹⁸

A descriptive analysis of participant characteristics overall and according to level of social isolation (high vs. low) was performed. Pearson’s χ^2 test was used to obtain frequency measurements and their respective 95% confidence intervals (95%CI), as well as measures of comparison between frequencies according to level of social isolation.

Modified Poisson regression analysis was performed to analyze associations between independent variables and the dependent variable, expressed by prevalence ratios (PR) and respective 95%CIs. Independent variables that, in bivariate analysis, showed association with the dependent variable with statistical significance ($p < 0.20$) were included in the regression model. Initially, all candidate variables were included simultaneously. A backward selection process was used to refine the model, aiming to prevent overfitting and minimize collinearity. Variables were then sequentially removed based on their statistical significance, with the model being re-estimated after each removal. Only those variables with a p-value of less than 0.05 were kept in the final model.

The authors used the svy commands in Stata version 15.0 (<https://www.stata.com>) to account for the complex survey design and unequal probability of participant selection, applying the sampling weights provided by ELSI-Brazil and utilizing a robust standard error estimator.

RESULTS

Among the 7886 participants, the majority were women (55.74%), aged 50 to 69 years (76.72%), had 1 to 4 years of education or no formal education (52.21%), had a good- or fair-quality diet (66.52%), did not engage in physical activity

(73.79%), reported good or very good sleep quality (54.12%), did not score for depressive symptoms (65.25%), and rated their own health as very good, good, or fair (88.34%). Most participants (76.87%) were categorized as having a low level of social isolation (Table 1).

TABLE 1. Characteristics of sample, stratified by level of social isolation. The Brazilian Longitudinal Study of Aging (ELSI-Brazil), 2015–2016.

	Total (95%CI)	Low social isolation (95%CI)	High social isolation (95%CI)	p-value
Sex				
Male	3490 (44.26)	76.60 (74.03 – 78.99)	23.40 (21.01 – 25.97)	p < 0.001*
Female	4396 (55.74)	81.28 (79.00 – 83.36)	18.72 (16.64 – 21.00)	
Age (years)				
50 – 59	3568 (45.24)	81.70 (79.32 – 83.87)	18.30 (16.13 – 20.68)	p < 0.001*
60 – 69	2482 (31.48)	79.86 (77.32 – 82.18)	20.14 (17.82 – 22.68)	
70 – 79	1388 (17.60)	72.92 (69.70 – 75.91)	27.08 (24.09 – 30.30)	
≥ 80	448 (5.68)	64.91 (58.79 – 70.57)	35.09 (29.43 – 41.21)	
Education (years)				
≥ 9	2135 (27.07)	89.77 (88.24 – 91.12)	10.23 (8.88 – 11.76)	p < 0.001*
5 – 8	1634 (20.72)	82.67 (79.90 – 85.12)	17.33 (14.88 – 20.10)	
1 – 4	3013 (38.21)	74.34 (71.77 – 76.75)	25.66 (23.25 – 28.23)	
No formal education	1104 (14.00)	59.56 (55.59 – 63.41)	40.44 (36.59 – 44.41)	
Self-rated health				
Good or very good	3396 (43.06)	83.61 (81.38 – 85.63)	16.39 (14.37 – 18.62)	p < 0.001*
Fair	3571 (45.28)	76.23 (73.78 – 78.52)	23.77 (21.48 – 26.22)	
Poor or very poor	919 (11.66)	72.13 (67.53 – 76.31)	27.87 (23.69 – 32.47)	
Depressive symptoms				
No (CES-D8 < 4)	5146 (65.25)	81.33 (79.06 – 83.41)	18.67 (16.59 – 20.94)	p < 0.001*
Yes (CES-D8 ≥ 4)	2740 (34.75)	74.64 (71.59 – 77.47)	25.36 (22.53 – 28.41)	
Sleep quality				
Good or very good	4268 (54.12)	79.53 (77.13 – 81.74)	20.47 (18.26 – 22.87)	p = 0.001*
Fair	2160 (27.39)	80.96 (78.30 – 83.36)	19.04 (16.64 – 21.70)	
Poor or very poor	1458 (18.49)	74.86 (71.56 – 77.89)	25.14 (22.11 – 28.44)	
Diet quality				
Healthy or good	2477 (31.41)	83.70 (81.02 – 86.06)	16.30 (13.94 – 18.98)	p < 0.001*
Fair	2769 (35.11)	81.77 (79.52 – 83.83)	18.23 (16.27 – 20.48)	
Unhealthy or poor	2640 (33.48)	71.96 (69.04 – 74.70)	28.04 (25.30 – 30.96)	
Physical activity				
Active	2067 (26.21)	80.54 (78.24 – 82.65)	19.46 (17.35 – 21.76)	p = 0.097
Inactive	5819 (73.79)	78.56 (76.22 – 80.74)	21.44 (19.26 – 23.78)	
Social isolation				
High	1824 (23.13)	-	-	
Low	6062 (76.87)	-	-	

95%CI: 95% confidence interval; CES-D8: 8-item version of the Center for Epidemiological Studies Depression Scale.

*Statistically significant differences ($p < 0.05$) using the Pearson χ^2 test.

Considering social connections, most participants lived with one or more housemates (87.59%); met with friends at least once a month (53.01%) and with children (51.47%) less than once a month; and did not participate in organized social activities (50.72%), civil associations (89.70%), or volunteer work (82.48%) (Figure 2).

High levels of social isolation were significantly more frequent among men, those 60 years of age and older, those who had studied for 8 years or less or had never attended school, those with fair or poor/very poor self-rated health, those with scores above the cutoff for depressive symptoms, those who had poor/very poor sleep quality, and those who had a fair- or poor-quality diet. No statistically significant differences in social isolation were observed considering the variable physical activity level (Table 1).

All independent variables showed a $p < 0.20$ in bivariate analysis and were included in the regression model. In the unadjusted model, sex, age, education, self-rated health, depressive symptoms, sleep quality, and diet quality had $p < 0.05$ and therefore were retained in the final model. Physical activity, with a $p > 0.05$, was excluded. In the multivariate regression model, high levels of social isolation were

associated with being male (PR 1.27; 95%CI 1.16–1.40), being 70 to 79 years old (PR 1.22; 95%CI 1.07–1.39) or 80 years or older (PR 1.56; 95%CI 1.32–1.85), having no formal education (PR 3.15; 95%CI 2.69–3.68) or having attended school for a maximum of 4 years (PR 2.11; 95%CI 1.82–2.46) or 5 to 8 years (PR 1.54; 95%CI 1.30–1.84), fair self-rated health (PR 1.25; 95%CI 1.12–1.39), depressive symptoms (PR 1.22; 95%CI 1.07–1.40), fair sleep quality (PR 0.87; 95%CI 0.78–0.98), and poor-quality diet (PR 1.37; 95%CI 1.19–1.58) (Table 2).

DISCUSSION

In a nationally representative sample of non-institutionalized middle-aged and older adults in Brazil, the majority of respondents had low levels of social isolation. Groups with a higher likelihood of being more socially isolated included men, individuals who were 70 years and older, those who had never attended school or had up to 8 years of education, individuals who rated their health as fair, those with depressive symptoms, and those who consumed an unhealthy diet.

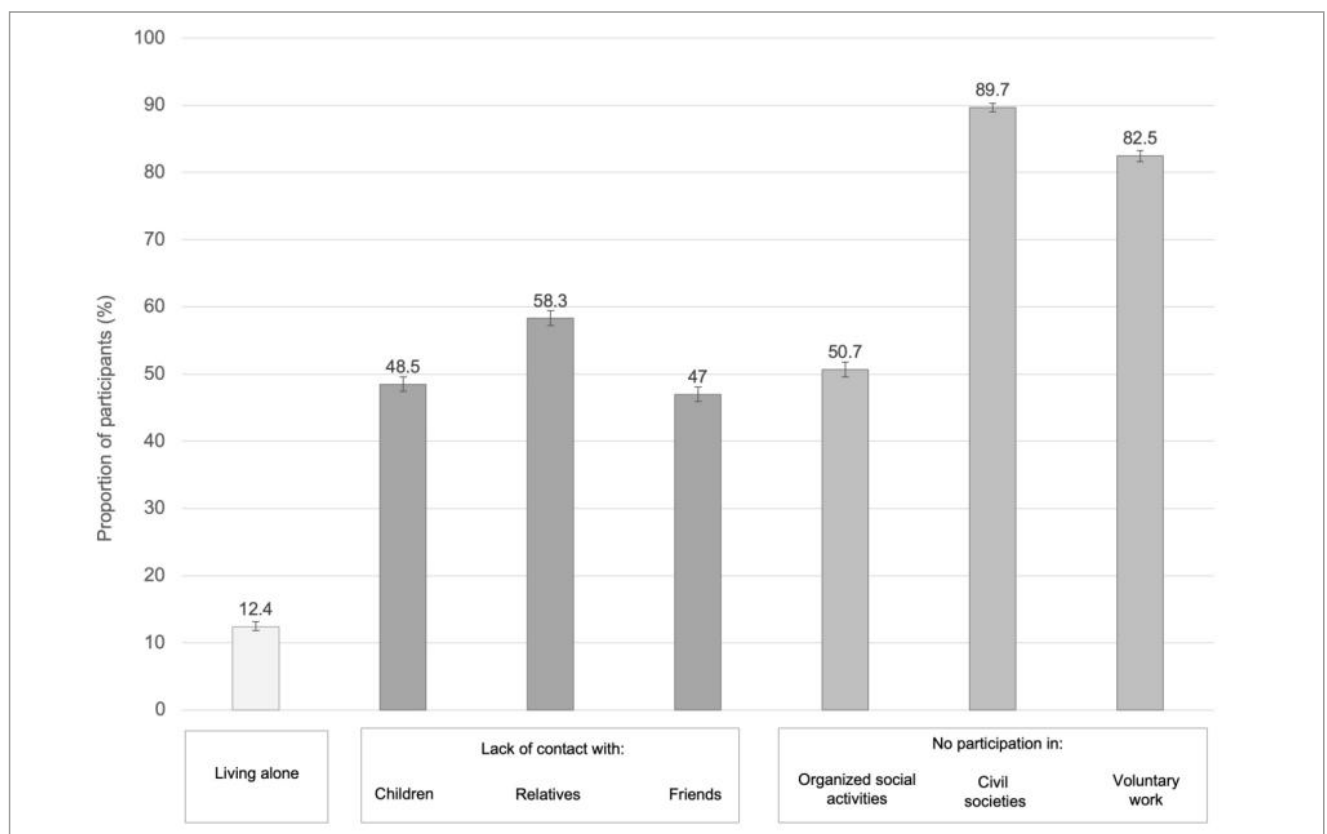


FIGURE 2. Proportion of participants stratified by items of the social isolation indicator. Brazilian Longitudinal Study of Aging (ELSI-Brazil), 2015–2016.

TABLE 2. Prevalence ratios of social isolation, crude and adjusted for sociodemographic indicators, health-related behaviors, and health status. The Brazilian Longitudinal Study of Aging (ELSI-Brazil), 2015–2016.

	Unadjusted analysis			Multivariate analysis*		
	PR	95%CI	p-value	PR	95%CI	p-value
Sex						
Female	1			1		
Male	1.25	1.12 – 1.40	< 0.001	1.27	(1.16 – 1.40)	< 0.001
Age (years)						
50 – 59	1			1		
60 – 69	1.10	0.97 – 1.25	0.141	1.0	0.89 – 1.13	0.946
70 – 79	1.48	1.27 – 1.72	< 0.001	1.22	1.07 – 1.39	0.004
≥ 80	1.91	1.61 – 2.29	< 0.001	1.56	1.32 – 1.85	< 0.001
Education (years)						
≥ 9	1			1		
5 – 8	1.69	1.42 – 2.02	< 0.001	1.54	1.30 – 1.84	< 0.001
1 – 4	2.51	2.15 – 2.92	< 0.001	2.11	1.82 – 2.46	< 0.001
No formal education	3.95	3.40 – 4.60	< 0.001	3.15	2.69 – 3.68	< 0.001
Self-rated health						
Good or very good	1			1		
Fair	1.45	1.28 – 1.64	< 0.001	1.5	1.12 – 1.39	< 0.001
Poor or very poor	1.70	1.40 – 2.06	< 0.001	1.18	0.98 – 1.43	0.078
Depressive symptoms						
No (CES-D8 < 4)	1			1		
Yes (CES-D8 ≥ 4)	1.36	1.18 – 1.56	< 0.001	1.22	1.07 – 1.40	0.003
Sleep quality						
Good or very good	1			1		
Fair	0.93	0.82 – 1.06	0.270	0.87	0.78 – 0.98	0.019
Poor or very poor	1.23	1.07 – 1.40	0.003	1.07	0.95 – 1.22	0.265
Diet quality						
Healthy or good	1			1		
Fair	1.11	0.97 – 1.28	0.112	1.02	0.89 – 1.16	0.796
Unhealthy or poor	1.72	1.48 – 2.0	< 0.001	1.37	1.19 – 1.58	< 0.001
Physical activity						
Active	1					
Inactive	1.10	0.98 – 1.23	0.098			

PR: Prevalence ratios; 95%CI: 95% confidence interval; CES-D8: 8-item version of the Center for Epidemiological Studies Depression Scale. *Model adjusted for sex, age, education, self-rated health, depressive symptoms, sleep quality, and diet quality.

The prevalence of high levels of social isolation was like that found in international studies conducted in representative samples of the same age groups using a similar measure of social isolation as was adopted in this study. For example, studies with subsamples from the United States Health and Retirement Study and the ELSA showed that the prevalence of high social isolation among middle-aged and older adults

was 21.00% in the United States¹⁹ and 18.50 to 28.00% in England.^{9,10} However, in international research using other measurement tools, the prevalence of social isolation in this age group has varied: 19.70% among Indians,²⁰ 30.26% among Chinese,²¹ and 53.00% among Mexicans.²²

Compared to being 50 to 59 years old, being 70 years or older was associated with higher levels of social isolation.

In a study conducted with German participants, the prevalence of social isolation in individuals 70 years of age and older was almost four times higher than that found in young adults.²³ With aging, the reduction and reorganization of the social network become more likely, due to events common in this stage of life such as widowhood, death of relatives and friends, children leaving home, retirement, and the need to care for grandchildren or a sick spouse.³ In addition, the reduction in social connections among older individuals, especially more distal ones, can also occur voluntarily.⁴ Selectivity in choosing social contacts, normative events of old age, increased likelihood of worsening health conditions, mobility limitations, and functional losses can explain the association between advanced age and social isolation. On the other hand, a study conducted with a sample residing in the United States showed that social isolation did not vary between young-old and old-old individuals.²⁴ However, it is important to note that the characteristics of the measurement tool and the cultural and socioeconomic conditions of the sample may have favored the maintenance of social connections in aging, contributing to the result.

In this study, a high level of social isolation was positively associated with being male, a finding also present in other studies.^{3,23} Throughout life, men usually build their social relationships especially in the work environment, often patronize less diverse environments than women do, and tend to limit them to those more related to their interests (e.g., sports-related environments such as soccer).^{25,26} For men, retirement can result in a sudden cutoff from social connections, and the relationship with one's wife or partner becomes the main source of emotional support.²⁶ When widowed, men may be more dependent on relationships with family members than women are. In addition to building stronger ties with children and relatives throughout life, women generally maintain a larger and more diversified social network — the size and functions of which do not depend solely on the family environment — than men.²⁵

Although most participants in this study did not score for high social isolation, the low level of participation in more distal and complex social activities is noteworthy. Results from a study conducted with middle-aged and older Americans showed that less than half participated in religious groups and less than a quarter participated in community groups or associations.⁶ Conversely, about 70% of older people in Japan and England reported participating in organized social activities, civil associations, or volunteer work.²⁷ These are more complex activities that require not only interaction with other people but also provide a sense of purpose of helping and

contributing to society (social engagement), a cultural value cultivated in different ways by different groups.^{19,27}

There is evidence in the literature of an association between social isolation and poverty^{19,23} and of the direct relationship between poverty and education.²⁸ As observed in other studies,^{3,23} low education was significantly associated with social isolation. From a life-course perspective, educational level is considered one of the fundamental causes of health inequalities and their consequences. In addition to exerting early influence on access to health services and the adoption of healthy lifestyles, social inequality affects job opportunities, income levels, and social and leisure activities during adulthood and old age.²³ The greater the number of years of education, combined with higher income, the larger and more diverse one's social network throughout life.

Corroborating previous evidence that social isolation is a determinant of health and may be associated with negative indicators of physical and mental health,¹ in this study, fair self-rated health scores and depressive symptoms were more common among those living in a situation of high social isolation. Social isolation is associated with a biological stress state and promotes the emergence of emotional stress linked to the perception of a lack of social support. This can lead to negative feelings such as discontentment and rejection, which are also associated with loneliness and depression.⁷ These, in turn, may mediate associations of social isolation with negative self-rated health and poor sleep quality.^{16,17} It is possible that the loss of statistical significance of the association between poor/very poor self-rated health and social isolation in the multivariable analysis of this study was due to the presence of more depressive symptoms in those who rated their health more negatively. The negative association between fair sleep quality and higher levels of social isolation may have been spurious, as no validated rationale was identified to explain this finding.

The adoption of negative health behaviors is one of the mechanisms that can explain the higher prevalence of diseases in socially isolated older adults.⁶ As observed in previous studies,^{29,30} a lack of social connections was associated with consumption of a poor-quality diet in our sample. Social relationships can also influence health by encouraging the adoption of healthy behaviors and inhibiting the practice of behaviors detrimental to health.²⁹ Positive social relationships contribute to the consumption of higher-quality diets by older adults, as they can provide motivation, reminders, and instrumental support for healthy eating, as well as companionship during meals.³⁰ Conversely, older persons who live alone and have no social connections in the neighborhood are more likely to have reduced appetite, take fewer

meals, and consume insufficient quantities and varieties of foods each day.^{29,30}

This study has limitations. First, the cross-sectional design precludes any assertions regarding the direction of the observed associations. Second, because the ELSI-Brazil did not have a valid measure of social isolation for the Brazilian population, the authors adopted the social isolation indicator applied in ELSA. Cultural and socioeconomic differences between the English and Brazilian samples may have determined differences in the understanding of the items, and thus in the directions of the observed associations. Furthermore, replicating procedures from previous studies, and due to the lack of consensus on the best way to categorize this variable, we used the upper quintile as the cutoff point for social isolation. The third limitation to be mentioned is that the prevalence of social isolation may have been underestimated due to the social desirability

of responses that highlight the frequency of contacts with children, relatives, and friends.

CONCLUSION

This is the first study of its kind to examine the associations of social isolation with sociodemographic variables and health conditions and behaviors in Brazilian adults 50 years of age and older. In terms of informing health policies, the most relevant results of the study are that the population most at risk of social isolation comprises men who are aged 70 years or older, have low education, fair self-rated health, and consume an unhealthy diet. Based on the findings of this study and addressing its limitations, future research should explore longitudinal designs to further understand causal relationships and develop effective interventions to reduce unwanted social isolation among Brazilian middle-aged and older adults.

DECLARATIONS

Conflict of Interest

The authors declare no conflicts of interest.

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Authors' Contribution

Paulo Afonso Sandy Júnior: conceptualization, investigation, methodology, writing – original draft, writing – review & editing. Flávia Silva Arbex Borim: conceptualization, formal analysis, investigation, methodology. Daniela de Assumpção: investigation, methodology. Anita Liberalesso Neri: conceptualization, investigation, methodology, project administration, supervision, validation, writing – review & editing

Ethical approval

ELSI-Brazil was approved by the Ethics Committee of the Oswaldo Cruz Foundation – Minas Gerais and registered on Plataforma Brasil (CAAE: 34649814.3.0000.5091). Participants signed separate informed consent forms for each of the research procedures and authorized access to corresponding secondary databases.

Data availability statement

The database is located in a repository maintained by the Oswaldo Cruz Foundation (Fiocruz) and made available to interested researchers via password access on the website <http://elsi.cpqrr.fiocruz.br/data-access/>.

Users registered with ELSI-Brazil are not permitted to make data available to third parties or allow third parties access to data files. This means that each person in a specific scientific project using ELSI-Brazil data must register and download the data individually.

Reporting standards guidelines

This manuscript has been prepared following the STROBE Statement guidelines for reporting observational studies.

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