



UNIVERSIDADE FEDERAL DE SANTA CATARINA
CAMPUS ARARANGUÁ
CENTRO DE CIÊNCIAS, TECNOLOGIA E SAÚDE
CURSO DE MEDICINA

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Associação entre características individuais e contextuais com a prevalência de multimorbidade em idosos: evidências de uma pesquisa nacional

Araranguá
2023

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Trabalho de Conclusão de Curso de Graduação em Medicina do Centro de Ciências, Tecnologia e Saúde da Universidade Federal de Santa Catarina como requisito para a obtenção do título de Bacharel em Medicina.

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Araranguá

2023

Ficha de identificação da obra elaborada pelo autor,
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Rodrigues, João Vitor

Associação entre características individuais e contextuais
com a prevalência de multimorbidade em idosos : evidências de
uma pesquisa nacional / João Vitor Rodrigues ; orientador, Maruí
Weber Corseuil Giehl, 2023.

50 p.

Trabalho de Conclusão de Curso (graduação) - Universidade
Federal de Santa Catarina, Campus Araranguá, Graduação em
Medicina, Araranguá, 2023.

Inclui referências.

1. Medicina. 2. Medicina. 3. Idosos. 4. Multimorbidade. 5.
Brasil. I. Giehl, Maruí Weber Corseuil. II. Universidade Federal
de Santa Catarina. Graduação em Medicina. III. Título.

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Este Trabalho de Conclusão de Curso foi julgado adequado para obtenção do título de “Bacharel em Medicina” e aprovado em sua forma final pelo Curso de Graduação em Medicina do Centro de Ciências, Tecnologias e Saúde da Universidade Federal de Santa Catarina

Araranguá, 30 de junho de 2023.

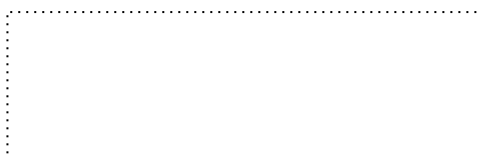


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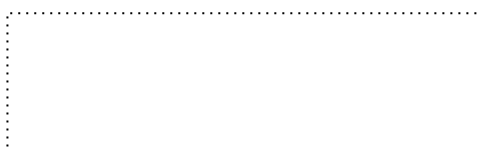
Banca examinadora



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Araranguá, 2023.

Este trabalho é dedicado aos meus amigos, aos meus professores, aos meus pais e à toda minha família.

AGRADECIMENTOS

Primeiramente, agradeço a Deus, fonte de toda sabedoria e força que me acompanharam ao longo desta jornada. Agradeço por me conceder discernimento e por me sustentar em momentos de desafio.

Agradeço também à minha orientadora, Dra. Maruí Weber Corseuil Giehl, com quem contei com apoio e dedicação imensuráveis ao longo do desenvolvimento deste trabalho. Sou imensamente grato por toda a inspiração, paciência e confiança que depositou em mim.

Aos meus amados familiares, em especial aos meus pais Zélia e Marcelo, meu agradecimento mais profundo. Vocês foram meu alicerce em todas as etapas da minha caminhada. Obrigado por todo o apoio, sacrifícios e encorajamento constantes. Este trabalho é dedicado a vocês, pois são a razão pela qual sou quem sou.

Finalmente, agradeço aos meus queridos amigos que, desde que nossos caminhos se cruzaram, sempre estiveram ao meu lado, compartilhando risadas, desafios e momentos de descontração, tornando essa jornada acadêmica mais leve e, com certeza, mais prazerosa. Vocês são parte fundamental da minha jornada.

RESUMO

Introdução: Nas últimas décadas, a população global de idosos (indivíduos com 60 anos de idade ou mais) tem crescido significativamente. No entanto, é importante ressaltar que uma sociedade com maior expectativa de vida não implica necessariamente em um contexto que proporcione envelhecimento saudável e livre de acometimento por múltiplas doenças crônicas não transmissíveis. **Objetivo:** estimar a prevalência de multimorbidade na população idosa brasileira e analisar sua associação com os fatores socioeconômicos individuais e contextuais. **Métodos:** Trata-se de um estudo observacional do tipo transversal com dados provenientes da segunda edição da Pesquisa Nacional de Saúde, realizada em 2019. Foram utilizadas as informações dos indivíduos de 60 anos ou mais de ambos os sexos, que responderam ao questionário individual, totalizando 22.728 indivíduos na amostra final. O ponto de corte para definir a multimorbidade foi de ≥ 2 doenças crônicas. **Resultados:** Os fatores individuais associados com uma maior chance de multimorbidade na população idosa foram: sexo feminino, idade avançada, estar casado, poucos anos de estudo, inatividade física e não-tabagismo. Foi observado que, entre os idosos que vivem em áreas com IDH elevado, a chance de multimorbidade foi 24% maior. **Conclusão:** Os achados indicam que idosos residentes em áreas mais desenvolvidas têm mais chance de serem diagnosticado com múltiplas doenças crônicas não transmissíveis. Por esse motivo, mesmo com níveis elevados de diagnóstico médico, se faz necessário que políticas de prevenção primária sejam implementadas nestes locais para garantir a qualidade de vida da população idosa residente.

Palavras-chave: Idoso; Multimorbidade; Doença Crônica; Ambiente Social.

ABSTRACT

Introduction: In recent years, a significant increase in the global elderly population (individuals aged 60 years or older) can be noticed. However, it is important to emphasize that a society with a longer life expectancy does not necessarily mean a context that provides healthy aging or free multiple non-communicable chronic diseases ambient. **Objective:** To estimate the frequency of multimorbidity in the Brazilian elderly population and measure its association with individual and contextual socioeconomic factors in the urban context. **Methods:** This is an observational cross-sectional study that uses data from the second edition of the Brazilian National Health Survey conducted in 2019. Information from individuals aged 60 years and older of both sexes who responded to the individual questionnaire was used, totaling 22,728 individuals in the final sample. The cutoff point to define multimorbidity was ≥ 2 chronic diseases. **Results:** The individual factors associated with higher odds of multimorbidity in the elderly population were: female gender, older age, being married, less years of education, physical inactivity, and non-smoking. It was observed that among older adults living in areas with high HDI, the odds of multimorbidity were 24% higher. **Conclusion:** The findings indicate that elderly individuals residing in more developed areas have higher odds of being diagnosed with multiple chronic non-communicable diseases. Therefore, even with high levels of medical diagnosis, it is necessary to implement primary prevention policies in these locations to ensure the quality of life for the resident elderly population.

Keywords: Aged; Multimorbidity; Chronic disease; Social Environment.

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LISTA DE ABREVIATURAS E SIGLAS

95%CI	95% Confidence Intervals
AIC	Akaike's Information Criteria
BIC	Bayesian Information Criteria
FU	Federation Units
HDI	Human Development Index
ICC	Intraclass Correlation
MHDI	Municipal Human Development Index
MW	Minimum Wage
NCD	Noncommunicable diseases
OR	Odds Ratio
PNS	Brazilian National Health Survey
PR	Prevalence Ratio
PSU	Primary Sample Units
SD	Standard Deviation
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
WHO	World Health Organization

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1 ARTIGO

Individual and contextual socioeconomic status factors associated with prevalence of multimorbidity among Brazilian older population: evidence from a national survey

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Highlights

- Approximately 3 out of 5 elderly Brazilians present multimorbidity.
- Living in more developed areas leads to greater odds of multimorbidity.
- Promoting more directed policies of primary prevention is needed in Brazil.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of interest: none

ABSTRACT

This cross-sectional study aimed to investigate the prevalence of multimorbidity in Brazilian elderly and its association with individual and contextual factors with data from 2019 National Health Survey. Individual factors associated with greater odds of multimorbidity were: female gender, advanced age, being married, lower educational level, physical inactivity, and non-smoking status. It was observed that among elderly living in more developed areas, the odds of multimorbidity were 24% higher. These findings imply that despite the presence of enhanced diagnostic and treatment resources in more developed areas, there remains a need for preventive programs to promote healthier aging.

KEYWORDS: Aged. Multimorbidity. Chronic disease. Social Environment.

1.1 INTRODUCTION

In recent years, a significant increase in the global elderly population (individuals aged 60 years or older) can be noticed. According to global estimates, the number of older individuals is projected to double by 2050, reaching approximately 2 billion individuals. It is noteworthy that about four out of five of these will live in middle-income countries (World Health Organization, 2015). In Brazil, this process has been even more accentuated, with estimates indicating that the proportion will increase from the actual 11.7% to 29.3% of the population by 2050 (United Nations and Department of Economic and Social Affairs, 2015). The aging process of the Brazilian population began in the 1960s, driven by increased life expectancy and improved basic health conditions (Camargos et al., 2019), despite significant inequalities, mainly in the environmental and socioeconomic contexts, which are inherent to the different geographic regions of the country (Ramos et al., 1987).

However, it is important to emphasize that a society with a longer life expectancy does not necessarily represent a context that provides healthy aging or free of multiple non-communicable chronic diseases (NCD). Age is a fundamental factor in this scope, since the prevalence of health problems tends to increase, in addition to getting worse with advancing age and, therefore, multimorbidity (2 or more simultaneous NCD) becomes progressively more present and impacts the quality of life (Zimmer and Amornsirisomboon, 2001).

According to World Health Organization (WHO) (2015), the health level of the elderly is directly influenced by three main factors: the individual's intrinsic capacity (both mental and physical); the characteristics of the surrounding environment, and the interaction between them.

It is widely acknowledged that the factors related to the place where the elder lived reflect the position of these individuals in society and are influenced by historical and social construction, which results in inequalities. Contextual factors affect health events, regardless of individual characteristics, in addition to being able to modify how individual characteristics influence the health of populations (Díaz-Perera et al., 2013). Socioeconomic status is the reflection of a macrostructure that is responsible for determining the economic and political characteristics, the general living conditions of the population, and the basic principles of social organization (Santos et al., 2010).

With regard to individual characteristics, prior research has shown that women are more susceptible to multimorbidity when compared to men, possibly due to inherent biological and hormonal differences (Violan et al., 2014). Furthermore, unhealthy lifestyle habits including obesity, physical inactivity, and excessive alcohol consumption were also associated with a higher risk of multimorbidity development (France et al., 2012; Mounce et al., 2018).

The presence of multimorbidity is correlated with other factors that negatively affect the quality of life, such as physical and mental disabilities, premature mortality, and greater relative use of health system resources (Costa et al., 2012). Caring for individuals with multimorbidity is complex and costly both for the health system and for the patient and his family when compared to those who have only one NCD (Sallis et al., 2008).

Given this scenario, when considering the challenges arising from the rapid demographic and epidemiological transition that has occurred in recent years, in addition to fact that health and lifestyle habits are not randomly distributed among regions and populations, understanding the occurrence and patterns of multimorbidity in the country may be relevant for the management of financial and human resources in the nationwide Unified Health System.

In this sense, identifying and understanding contextual and individual differences around the prevalence of multimorbidity helps policymakers to prioritize and promote health actions and interventions related to the management of multimorbidity (Nunes et al., 2017).

Thus, the aim of the present study was to investigate the prevalence of multimorbidity in Brazilian elderly and its association with individual and contextual socioeconomic factors in urban context based on data from the 2019 National Health Survey (Pesquisa Nacional de Saúde [PNS]).

1.2 METHODS

A cross-sectional observational study was conducted, following the steps recommended by the STROBE protocol (Strengthening the Reporting of Observational Studies in Epidemiology). The data used was derived from the second edition of the PNS, carried out in 2019 by *Instituto Brasileiro de Geografia e Estatística* in partnership with the Ministry of Health.

The 2019 PNS is a population-based survey with individuals aged 15 or over, living in permanent private households in Brazil (Stopa et al., 2020). The population located in special census tracts were excluded from the research sample, namely: subnormal clusters; barracks, military bases, etc.; accommodation, camps, etc.; vessels, boats, ships, etc.; indigenous villages; penitentiaries, penal colonies, prisons, jails, etc.; asylums, orphanages, convents, hospitals, etc.; and rural settlements (Souza-Júnior et al., 2015; Stopa et al., 2020).

The 2019 PNS sample consisted of conglomerates in three stages of selection: (1) selection of primary sample units (PSU) consisting of census tracts or sets of sectors; (2) selection of households in each census tract drawn; (3) and finally, in the third stage, in each household, a resident aged 15 years or older was randomly selected by simple random sampling (Souza-Júnior et al., 2015; Stopa et al., 2020).

The sampled total of PSU was 8,036; that of households was 108,525, with a final sample of 94,114 with interviews carried out. The non-response rate was 6.4% (Stopa et al., 2020).

In the present study, information was used from individuals aged 60 or over of both sexes, who answered the individual questionnaire for the selected resident, thus, the final sample of this study was 22,728 individuals. More information on the 2019 PNS methodology can be accessed in a previous publication (Stopa et al., 2020).

1.2.1 Outcome Variable

The outcome variable was multimorbidity, which was evaluated considering 14 morbidities within the list questioned in the survey. Of these, 11 morbidities were

identified in the “Module Q - Chronic Diseases” through the following question: “Has a doctor ever diagnosed you with...”. Such diseases are high blood pressure; diabetes; hypercholesterolemia; heart problems; cerebrovascular accidents; asthma; arthritis or rheumatism; work-related muscle-skeletal disorders; lung diseases; chronic kidney disease and cancer. Among women, episodes of hypertension and diabetes during pregnancy were excluded.

In cases of depression or other mental illnesses, the question was: “Has any doctor or mental health professional (psychiatrist or psychologist) ever diagnosed you with...”. To identify spinal column problems, the question was: “Do you have any chronic spinal column problems, such as chronic back or neck pain, low back pain, sciatica, vertebrae, or disc problems?” As suggested by WHO (2016), the cutoff point to define multimorbidity was ≥ 2 chronic diseases.

1.2.2 Exploratory variables at the individual level

To analyze the associations between the outcome and individual exposure variables in the present study, studies in the literature (Bento, 2020; Francisco et al., 2018; Freedman et al., 2011) that identified complexity of the variables associated with the presence of multimorbidity in elderly were considered, and the most frequently associated were sociodemographic characteristics (age and sex), precarious socioeconomic conditions, unhealthy lifestyle, among others (Andrade et al., 2022; Carvalho et al., 2017; Jantsch et al., 2018; Pabayo et al., 2015).

Thus, the variables investigated in this research are presented below. The sociodemographic variables measured included gender (male and female); age range (60 to 69, 70 to 79, and 80 years or older), race/skin color (white and black/brown); education (no education, or incomplete primary education: 0-8 years; complete primary or incomplete secondary: 8-12 years; complete secondary or incomplete higher education: ≥ 12 years; complete higher education); per capita family income, classified in minimum wages (MW), considering the MW to be approximately US\$253 in 2019 (up to 1 MW: US\$0-US\$253, more than 1 to 3 MW: US\$253-US\$759, more than 3 MW: \geq US\$759); marital status (married, divorced/single or widowed).

The selected health-related behaviors were: sufficient leisure-time physical activity (yes and no). Those who performed 150 weekly minutes of exercises with light or moderate intensity, or 75 minutes weekly of vigorous intensity, regardless of the number of days of practice per week were considered active (Bull et al., 2020); current

smoker (yes and no); excessive alcohol consumption, which is defined as the weekly consumption of 15 or more alcoholic drinks for men and 8 or more for women (Centers for Disease Control and Prevention, 2022).

1.2.3 Contextual exploratory variables

To assess the contextual level, considered as aggregation by Federation Units (FU), the Municipal Human Development Index (MHDI) was used, made available by the Atlas of Human Development in Brazil (United Nations Development Programme, 2021). The data were incorporated into the PNS database to carry out the analyses. The Brazilian FU were chosen because they represent the maximum level of aggregation that the PNS data allowed, maintaining the entire sample.

The MHDI is a summary measure of long-term progress, considering three basic components related to human development (education, income, and longevity), and ranges from 0 to 1, with higher values indicating better human development in the municipality (United Nations Development Programme, 2021). This index represents a methodological adjustment to the Human Development Index (HDI), considering the same three dimensions: health, education, and income, but adapting to the availability of national indicators. In this study, the 2021 MHDI – the last available update of the index – of the 27 FU in Brazil was considered, and calculated by extracting a geometric mean: the cube root of the multiplication of the HDI longevity, HDI education, and HDI income, considering the database of the Continuous National Household Sample Survey (Instituto de Pesquisa Econômica Aplicada, 2022). For this calculation, the three components have the same weight. The MHDI was categorized according to its tertiles, meaning that the first tertile corresponds to the FU that present the lowest MHDI and the third tertile to the highest.

1.2.4 Data analysis

Descriptive statistics were calculated for individual and contextual variables. Multilevel Logistic Regression with random intercepts was fitted to investigate the association between multimorbidity and contextual characteristics, represented by the FU MHDI, with the individuals as the first level and the FU of residence as the second level. The empty model was tested (with random intercept and without covariates) to estimate the proportion of the total variance of multimorbidity that can be attributed to

the differences between the FU context (MHDI) (level 2). The effects of level 2 (FU) on the outcome were determined by calculating the intraclass correlation (ICC). Second, mixed-effects multilevel models were created. The variables were gradually included in the multivariable regression models (Victora et al., 1997), which were three in total. First, unadjusted associations of multimorbidity and MHDI were tested (Model 1). Second, demographic variables (sex, age, and marital status) were included, followed by socioeconomic (schooling), and lifestyle and health status variables (leisure time physical activity and smoking status) (Model 2), to analyze the association among individual characteristics and the outcome. Following, the final adjusted model was performed, in which the association of outcome and contextual factor were tested controlling for the individual variables (Model 3). All analyses were performed in Stata 14.0 software, and sample weightings and sampling design were taken into account in all analyses. Results are expressed as odds ratios (OR) or prevalence ratios (PR) with their respective 95% confidence intervals (95%CI) and p-values <0.05 were considered indicative of statistical significance.

The PNS was approved by the National Research Ethics Commission (process No. 3.529.376, of August 23, 2019). All respondents signed a free and informed consent statement form. The PNS 2019 database and questionnaire modules are available for public access and use on the survey website (<https://www.pns.icict.fiocruz.br>).

1.3 RESULTS

The final sample of the study comprised 22,728 elderly people. The overall prevalence of multimorbidity among the elderly was 58.12% (95%CI 57.00-59.23). The FU where older adults had the highest prevalence of multimorbidity were Rio Grande do Sul (63.50%), Minas Gerais (60.33%), and Goiás (59.85%) ($p < 0.001$) (data not shown). Table 1 presents the individual and contextual characteristics of the participants, considering the sample weights. Most of the sample consisted of women (56.68%) and self-declared white individuals (51.45%). The mean age was 70.05 years (SD=8.08), ranging from 60 to 112 completed years. Approximately half of the respondents were married. As for education, most of elderly had no education or had only completed elementary school (63.27%), while 11.30% had completed higher education. The per capita household income of 42.67% of the studied population was between 1 and 3 MW. As for healthy behaviors, approximately 4 out of 5 seniors were

classified as physically inactive in their leisure time, 88.56% denied current smoking, and alcohol consumption was considered normal in about half of the sample.

Tabela 1 – Sociodemographic and economic characteristics of Brazilian elderly. National Health Survey Brazil, 2019 (n= 22728).

Variables	n	(%)	95%CI
Individual Level			
Sex	22728		
Male	10193	43.32	42.25, 44.39
Female	12535	56.68	55.60, 57.74
Age range (in years)	22728		
60-69	12555	56.30	55.21, 57.39
70-79	7157	30.14	29.17, 31.13
≥80	3016	13.56	18.82, 14.33
Ethnicity	22357		
White	9901	51.45	50.27, 52.61
Brown/black	12456	48.55	47.38, 49.72
Marital status	22728		
Married	9946	50.65	49.55, 51.76
Divorced/single	6698	24.30	23.40, 25.22
Widower	6084	25.05	24.14, 25.99
Education level	22728		
No education/incomplete primary education	14987	63.27	62.09, 64.44
Complete primary/incomplete secondary education	2011	9.53	8.88, 10.21
Complete secondary/incomplete higher education	3322	15.90	15.05, 16.78
Complete higher education	2408	11.30	10.52, 12.13
Per capita family income (in MW)	22725		
≤1	10250	41.73	40.56, 42.92
1-3	8904	42.67	41.55, 43.79
≥ 3	3571	15.60	14.68, 16.55
Leisure physical activity	22728		
Insufficiently active	18517	80.54	79.60, 81.44
Physically active	4211	19.46	18.56, 20.40
Current smoking	22728		
Yes	2680	11.44	10.76, 12.14
No	20048	88.56	87.86, 89.23
Alcohol consumption	3755		
Normal	3119	83.97	81.84, 85.82
High	636	16.03	14.18, 18.06
Multimorbidity	21725		
< 2 NCD	9682	41.88	40.77, 43.00
≥ 2 NCD	12043	58.12	57.00, 59.23
Contextual Level			
MHDI tertile	22728		
1 (lower)	7703	23.91	23.15, 24.69
2 (middle)	7359	26.89	26.10, 27.70

3 (higher) 7666 49.20 48.18, 50.22

Fonte: elaborado pelos autores

Legenda: 95CI%: 95% confidence interval; MHDI: Municipal Human Development Index; MW: minimal wages; NCD: Noncommunicable Diseases

The mean number of simultaneous morbidities was 3.13 (SD=1.30). The most reported morbidities were high blood pressure (56.42%), spinal column problems (31.06%), and hypercholesterolemia (27.97%) (Table 2). Table 3 describes the prevalence of the outcome according to the individual characteristics and context of the participants. The following were associated with a higher prevalence of multimorbidity: female gender, age greater than 70 years, widowhood, few or no years of study, low income, physical inactivity, and non-smoking. No significant associations were found with alcohol consumption or skin color. As for the contextual characteristics, represented by the MHDI, it was observed that there was a higher prevalence of the outcome in those elderly individuals who lived in FU with higher MHDI tertiles.

Tabela 2 – Individual prevalence of morbidities in Brazilian elderly. National Health Survey Brazil, 2019 (n= 21725).

Noncommunicable Disease	(%)	95%CI
High blood pressure	56.42	55.35, 57.48
Spinal column problem	31.06	29.97, 32.18
Hypercholesterolemia	27.97	26.92, 29.04
Diabetes	20.84	19.95, 21.75
Arthritis/rheumatism	18.17	17.24, 19.12
Heart problem	13.15	12.41, 13.92
Depression	11.82	11.10, 15.57
Cancer	6.78	6.23, 7.38
Cerebrovascular accident	5.60	5.14, 6.10
Other mental diseases	4.68	4.21, 5.20
Asthma	4.56	4.10, 5.06
Other lung diseases	2.90	2.50, 3.36
Chronic kidney disease	2.55	2.23, 2.92
Work-related muscle-skeletal disorder	2.21	1.83, 2.66

Fonte: elaborado pelos autores

Legenda: 95%CI: 95% confidence interval

Table 4 shows the results of the multilevel analysis. Significant variability in multimorbidity was found between Brazilian FU in the null model (Model 1), so the variation explained by the difference between FU for the outcome was approximately 1.0% (ICC=0.007, $p<0.001$). A positive association was identified between multimorbidity and the MHDI of the FU. There was a reduction in the intraclass

correlation value when the contextual variable was inserted into the model. There were subsequent minor changes in this measure when the model with only individual variables was analyzed (Model 2) and the final model (Model 3), where individual and contextual variables were considered.

Tabela 3 – Prevalence of multimorbidity according to individual characteristics and context in Brazilian elderly. National Health Survey Brazil, 2019 (n= 21725).

Variables	Prevalence of multimorbidity% (95%CI)	p-value*
Individual Level		
Sex		0.00
Male	49.06 (47.42, 50.70)	
Female	64.86 (63.37, 66.31)	
Age range (in years)		0.00
60-69	55.42 (53.91, 56.92)	
70-79	61.66 (59.76, 63.52)	
≥80	61.48 (58.57, 64,31)	
Ethnicity		0.9930
White	58.00 (56.39, 59.58)	
Brown/black	57.99 (56.43, 59.53)	
Marital status		0.00
Married	56.72 (55.15, 58.27)	
Divorced/single	55.66 (53.53, 57.78)	
Widower	63.30 (61.19, 65.35)	
Education level		0.00
No education/incomplete primary education	60.15 (58.81, 61.48)	
Complete primary/incomplete secondary education	55.70 (52.20, 59.15)	
Complete secondary/incomplete higher education	55.72 (52.94, 58.47)	
Complete higher education	52.47 (49.02, 55.90)	
Per capita family income (in MW)		0.0234
≤1	58.87 (57.19, 60.53)	
1-3	58.71 (56.99, 60.41)	
≥ 3	54.56 (51.68, 57.41)	
Leisure physical activity		0.0012
Insufficiently active	59.07 (57.82, 60.32)	
Physically active	54.25 (51.62, 56.86)	
Current smoking		0.00
Yes	49.59 (46.33, 52.85)	
No	59.16 (57.99, 60.33)	
Alcohol consumption		0.5972
Normal	49.88 (46.94, 52.83)	
High	47.84 (40.85, 54.91)	
Contextual Level		0.00
MHDI tertile		
1 (lower)	54.85 (52.79, 56.89)	

2 (middle)	55.79 (54.06, 57.51)
3 (higher)	60.93 (59.13, 62.70)

Fonte: elaborado pelos autores

Legenda: * p<0,001;

**p<0,05;

95CI%: 95% confidence interval; MHDI: Municipal Human Development Index; MW: minimal wage;

Finally, considering the final multilevel model (Model 3), the individual variables associated with greater odds of multimorbidity in the elderly population were: female gender (OR: 2.01, 95%CI 1.89 – 2.13) and older age (OR: 1.25, 95%CI 1.18 – 1.33 and PR: 1.14, 95%CI 1.05 – 1.25). On the other hand, the odds of multimorbidity were lower in those individuals who were single or divorced (OR: 0.85, 95%CI 0.79 – 0.91), in those with more education (OR: 0.86, 95%CI 0.78 – 0.95; PR: 0.91, 95%CI 0.85 – 0.99 and PR: 0.88, 95%CI 0.81 – 0.97), in physically active elderly (OR: 0.92, 95%CI 0.86 – 0.99) and in smokers (OR: 0.73, 95%CI 0.66 – 0.80). As regard the association between contextual variables and multimorbidity, it was observed that among elderly who lived in the upper terciles of MHDI, the odds of multimorbidity were 24% higher (95%CI 1.07-1.44) when compared to those who lived in FU with lower MHDI.

When evaluating the fit of the models, a reduction in the Akaike's Information Criteria (AIC) and Bayesian Information Criteria (BIC) values was observed after the inclusion of the contextual level variables, indicating an improvement in the fit of the model.

Tabela 4 – Association between characteristics of the context (MHDI) and multimorbidity in elderly residents of Brazilian Federation Units. National Health Survey Brazil, 2019.

Variable	Empty model	Model 1* OR (95%CI)	Model 2** OR (95%CI)	Model 3*** OR (95%CI)
Individual level				
Sex				
Male			1	1
Female			2,04 (1,92 – 2,16)	2,01 (1,89 – 2,13)
Age range (in years)				
60-69			1	1
70-79			1,24 (1,15 – 1,34)	1,25 (1,18 – 1,33)
≥80			1,40 (1,32 – 1,50)	1,14 (1,05 – 1,25)
Marital status				

Married		1	1	
Divorced/single		0,83 (0,78 – 0,89)	0,85 (0,79 – 0,91)	
Widower		0,95 (0,88 – 1,03)	0,97 (0,90 – 1,05)	
Education level				
No education/incomplete primary education		1	1	
Complete primary/incomplete secondary education		0,88 (0,80 – 0,97)	0,86 (0,78 – 0,95)	
Complete secondary/incomplete higher education		0,93 (0,86 – 1,01)	0,91 (0,85 – 0,99)	
Complete higher education		0,89 (0,81 – 0,98)	0,88 (0,81 – 0,97)	
Leisure physical activity				
Insufficiently active		1	1	
Physically active		0,93 (0,86 – 0,99)	0,92 (0,86 – 0,99)	
Current smoking				
No		1	1	
Yes		0,73 (0,67 – 0,80)	0,73 (0,66 – 0,80)	
Contextual Level				
MHDI tertile				
1 (lower)		1	1	
2 (middle)		1,07 (0,94 – 1,23)	1,08 (0,93 – 1,24)	
3 (higher)		1,23 (1,06 – 1,41)	1,24 (1,07 – 1,44)	
Variance components				
Level 2 variance (95%CI)	0,02	0,02	0,03	0,02
ICC%	0,007	0,005	0,008	0,006
AIC	29.781,1	29.778,2	28.997,29	28.994,35
BIC	29.797,1	29.810,15	29.093,13	29.106,16

Fonte: elaborado pelos autores

Legenda: * Model 1 includes only the contextual level variables;

** Model 2 includes only the individual level variables (age range, ethnicity, marital status and education level);

*** Model 3 includes both contextual and individual variables.

OR: Odds Ratio; CI95%: 95% Confidence Interval; AIC: Akaike's Information Criteria; BIC: Bayesian Information Criteria; ICC: Intraclass correlation; MHDI: Municipal Human Development Index

1.4 DISCUSSION

Contextual correlates associated with multimorbidity have not been extensively studied in older adults, especially in low and middle-income countries (Machado et al., 2013; Nunes et al., 2015; Romano et al., 2021). This study revealed

that individual and contextual factors were associated with multimorbidity among elderly living in Brazilian FU. Regarding the contextual factors, higher tertiles of MHDl by the FU were associated with a higher prevalence of multimorbidity.

In the present study, the prevalence of multimorbidity in Brazilian elderly was considerable and follows the average of other low and middle-income countries such as China, India, Ghana, Mexico, Russia, and South Africa (58.4%) (Romano et al., 2021), since about 3 out of 5 individuals of this group present the condition. Compared to the previous edition of the PNS, carried out in 2013, the prevalence (56.5%) showed a slight increase (Andrade et al., 2022).

Concerning individual characteristics, a positive association between multimorbidity and female gender has been identified. The higher prevalence of multimorbidity among females in this study suggests a greater sensitivity among them toward their health condition and can be attributed to their greater demand for health services, resulting in increased exposure to receiving diagnoses for multiple chronic diseases (Pache et al., 2015). According to previous studies that analyzed data from 2019 PNS, 80,6% of Brazilian women had a medical appointment in the 12 months before the interview, against 66,6% among men (Palmeira et al., 2022). Furthermore, according to WHO (2022), compared to women, men are more likely to die prematurely due to NCD, which consequently contributes to a higher prevalence of chronic diseases among women. This finding showed potential gender disparities in healthcare utilization and disease burden (Perelman et al., 2012).

Regarding marital status, divorced and single individuals were less likely to have multimorbidity. Although the mechanism is still poorly understood, it is assumed that it includes cultural assessment and its impact on NCD development and diagnosis. A possible reason for this is that married older adults access more health services due to their partner's encouragement and, for this reason, are more commonly diagnosed (Amiresmaili et al., 2019).

The prevalence of multimorbidity was also related to age increasing. This association meets the biological logic that the human aging process leads to physical, cardiometabolic, and mental changes (Ministério da Saúde Brasil and Secretaria de Atenção à Saúde, 2006). Similar findings related to specific morbidities have been proposed in other population-based studies in Brazil (Guimarães and Andrade, 2020; Szwarcwald et al., 2022).

Regarding health behaviors, physical activity was related to lower odds of multimorbidity, reaffirming the protective character of this practice in respect of biological risk factors for NCD, such as obesity, inflammation, sarcopenia, and decreased cardiorespiratory capacity (Diez Roux, 2003). Contrary to expectations, smokers showed lower odds of presenting the outcome. Significant and inverse associations between smoking and morbidity were also verified in other studies with the Brazilian elderly (Costa et al., 2009; Keomma et al., 2022). The main explanation described is based on the lower life expectancy of this subgroup since active smoking is the main risk factor for mortality from NCD (Oberg et al., 2011). Another partial explanation is that when the diagnosis of an NCD is confirmed, the individual tends to seek the health service more and is encouraged to stop smoking (Costa et al., 2009).

Relating to socioeconomic characteristics at the individual level, both a lower level of education and low income have been associated with multimorbidity. A meta-analysis conducted by Pathirana and Jackson (2018) revealed a 64% increased likelihood of multimorbidity among individuals with lower educational attainment compared to those with higher levels of education. Better socioeconomic indicators are indicative of reduced challenges in identifying health needs, enhanced access to medical services, care, and treatment, as well as greater availability of health-related information. Consequently, individuals with better socioeconomic status are more likely to adopt healthy practices and behaviors. (Magrini and Martini, 2012).

Based on a multilevel analysis, our findings indicated a positive association between residing in FU belonging to the highest tertiles of the MHDl and higher odds of multimorbidity among the elderly population in Brazil. This observation is consistent with previous research that has examined specific NCD (Bento, 2020; Francisco et al., 2018). This result provides further evidence of the relationship between contextual factors, especially socioeconomic characteristics, and multimorbidity. However, it is important to note that the complex nature of this relationship necessitates a comprehensive understanding of the underlying mechanisms.

Several potential explanations can be considered to elucidate the observed association between MHDl and multimorbidity. One plausible explanation is the presence of a survival bias. It is conceivable that individuals residing in areas with higher MHDl scores may have better access to healthcare resources, leading to improved disease management and longer survival rates. Consequently, these individuals would have a greater opportunity to accumulate multiple chronic conditions

over time, thus contributing to the higher prevalence of multimorbidity in these areas (Bento, 2020).

Furthermore, it is essential to acknowledge the multifactorial nature of multimorbidity. The development and progression of multiple chronic conditions are influenced by various individual, social, and environmental factors. Contextual socioeconomic characteristics captured by the MHDl, such as education, income, and living conditions, can shape the health behaviors, access to healthcare, and overall well-being of individuals. Therefore, it is plausible that areas with higher MHDl scores are more likely to exhibit a convergence of factors that increase longevity among older adults, and consequently, as discussed before, the odds of developing multiple chronic conditions (Szwarcwald et al., 2022).

An important additional factor that is interconnected within the relationship between multimorbidity and MHDl is the unequal access to medical diagnostic resources across various contexts in Brazil. This disparity arises from the fact that diagnosis of morbidity relies on ensuring adequate access to healthcare, particularly primary care, and the comprehensive utilization of medical services (Barros et al., 2011). Data from the 2013 PNS conducted in Brazil, show that individuals residing in the Southeast and South regions, which have significantly higher MHDl, exhibited greater rates of healthcare service accessibility in comparison to residents of other regions (Stopa et al., 2017).

Providing appropriate care for elderly people with multimorbidity represent a significant challenge for healthcare systems, especially in middle-income countries that experience fast population aging. In Brazil, despite the presence of a public health system that emphasizes comprehensive care as one of its fundamental principles, with a strong focus on primary healthcare, there remains an observable inclination towards a model centered on medical diagnosis and treatment, rather than primary prevention of illnesses and health promotion. This approach may contribute to the high prevalence of individuals affected by multimorbidity (Rzewuska et al., 2017). Some measures, such as: monitoring areas with more susceptible populations, expansion of primary care policies, and the implementation of preventive programs relative to morbidities, can have a positive impact on quality of life and minimize functional limitations, in addition to minimizing the costs related to repetitive hospitalizations and other complications resulting from multimorbidity.

This study is one of the few conducted in Brazil that investigated the association between multimorbidity and contextual characteristics, represented by the Municipal Human Development Index, in the elderly population, showing significant associations between these factors. These results are important for several reasons: older adults represent the fastest-growing age group, particularly in middle-income countries such as Brazil, and tend to have a higher prevalence of multimorbidity in comparison to younger individuals. Additionally, this target population is more susceptible to the context in which they living.

Some limitations must be considered when interpreting the results of this study. First, the use of a cross-sectional design limits the identification of a causal link between individual and contextual variables and multimorbidity but indicates the magnitude of associations, which may bring new approaches to development of the study area. Second, the use of self-reported measures may overestimate prevalence of the outcome. Also, in this study, the total variance of multimorbidity was not substantially explained by the contextual level, but it is emphasized that there was a statistically significant association between contextual factors and multimorbidity, even after considering individual characteristics.

1.5 CONCLUSIONS

The findings of the present study indicate that both individual and contextual characteristics are significantly associated with multimorbidity among elderly population in Brazil. In terms of contextual factors, the research reveals that older adults residing in areas with higher MHDI were more likely to present multimorbidity. This study opposes the currently prevailing approach focused on older adults with a single noncommunicable disease, which currently dominates the majority of healthcare guidelines in Brazil. The results underscore the tendency of the Brazilian national healthcare system to prioritize a model of attention centered on medical diagnosis and treatment, rather than placing greater emphasis on primary prevention and health promotion. In order to address the healthcare needs of the diverse Brazilian population facing prevalent multimorbidity, several interventions hold potential to positively impact quality of life and mitigate functional limitations. These include the implementation of a preventive programs aimed at specific morbidities, expansion of primary care policies and monitoring regions with higher contextual vulnerability.

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2 CONCLUSÕES E CONSIDERAÇÕES FINAIS

Este estudo se opõe à abordagem predominante focada em idosos com uma única doença não transmissível, que atualmente domina a maioria das diretrizes de saúde no Brasil. Nossos achados demonstram que o sistema de saúde nacional brasileiro apresenta uma tendência para um modelo centrado no diagnóstico médico e tratamento, em vez de priorizar a prevenção primária e a promoção da saúde. A fim de atender às necessidades de saúde da diversa população brasileira que enfrenta uma alta prevalência de multimorbidade, algumas intervenções têm o potencial de influenciar positivamente a qualidade de vida e mitigar limitações funcionais, como: monitorar áreas com maior vulnerabilidade, expandir as políticas de atenção primária e estabelecer programas preventivos direcionados às morbidades específicas.

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