Quality of life indicators associated with the functionality of older people in Brazilian amazon: a network analysis approach

Indicadores de calidad de vida asociados con la funcionalidad de personas mayores en la Amazonía brasileña: un enfoque de análisis de redes

Authors

Cleidson Colares Batista [1]
Talita Cezareti da Silva [2]
Elaine Cristina Costa Lopes [1]
Renato Augusto Mariotto [1]
Tania Maria Gomes da Silva [1]
Aliny de Lima Santos [1]
Aline Diniz Gehren [1]
José Roberto Andrade do Nascimento Júnior [3]
Daniel Vicentini de Oliveira [1]

[1] Cesumar University (Brazil)
[2] Cardiology National Institute (Brazil)
[3] Federal University of the Sao Francisco Valley (Brazil)

Corresponding author:
Daniel Vicentini de Oliveira
d.vicentini@hotmail.com

How to cite in APA

Colares Batista, C., Cezareti da Silva, T., Costa Lopes, E. C., Mariotto, R. A., Gomes da Silva, T. M., Lima Santos, A., Diniz Gehren, A., Andrade do Nascimento Júnior, J. R., & Vicentini de Oliveira, D. (2025). Quality of life indicators associated with the functionality of older people in Brazilian amazon: a network analysis approach. *Retos*, *65*, 623–633. https://doi.org/10.47197/retos.v65.111414

Abstract

Introduction: The relationship between quality of life (QoL) and functionality is a critical aspect of healthy aging, reflecting the interconnectedness of physical, psychological, and cognitive health.
Objective: to analyze the associations between the domains and facets of QoL and the functionality components of older participants in a social project in a municipality in the Brazilian Amazon.
Methodology: This is a quantitative, analytical, observational, and cross-sectional study realized with 122 older individuals. The WHOQOL-Bref, WHOQOL-OLD, and WHODAS 2.0 were used. The data were analyzed using the Kolmogorov-Smirnov test, Spearman's correlation, and Network Analysis (p<0,05).
Results: The analysis showed moderate correlations (r > 0.40, p < 0.05) among QoL domains and weak to moderate negative correlations (r between -0.18 and -0.46) between functionality and QoL domains. The physical domain emerged as the primary indicator of better functionality in mobility (r = -0.05), ADLs (r = -0.15), and social participation (r = -0.13). Sensory functioning was also relevant for cognition, mobility, and interpersonal relationships (r = -0.06 for each). Centrality analysis highlighted the physical domain as the most influential, followed by psychological and cognitive functionality, emphasizing the integration of physical and mental health for healthy aging.
Conclusion: The physical domain is key to better functionality, especially in mobility, daily activities, and social participation. The psychological QoL domain and cognitive functionality also emphasize the need for a holistic approach to healthy aging.

Keywords

Aged; quality of life; social determinants of health; functional status; Brazil.

Resumen

Introducción: La relación entre la calidad de vida (QoL) y la funcionalidad es un aspecto crucial del envejecimiento saludable, evidenciando la conexión entre la salud física, psicológica y cognitiva.
Objetivo: Analizar las asociaciones entre los dominios y facetas de la QoL y los componentes de funcionalidad de personas mayores participantes en un proyecto social en la Amazonia brasileña.
Metodología: Estudio cuantitativo, observacional y transversal realizado con 122 personas mayores. Se emplearon los instrumentos WHOQOL-Bref, WHOQOL-OLD y WHODAS 2.0. Los datos fueron analizados con la prueba de Kolmogorov-Smirnov, correlación de Spearman y Análisis de Redes (p < 0,05).
Resultados: Se encontraron correlaciones moderadas (r > 0,40, p < 0,05) entre los dominios de QoL y correlaciones negativas débiles a moderadas (r entre -0,18 y -0,46) entre la funcionalidad y los dominios de QoL. El dominio físico destacó como principal indicador de funcionalidad en la movilidad (r = -0,05), actividades diarias (r = -0,15) y participación social (r = -0,13). El funcionamiento sensorial también fue relevante para la cognición, la movilidad y las relaciones interpersonales (r = -0,06 en cada caso). El análisis de centralidad identificó al dominio físico como el más influyente, seguido por el psicológico y la funcionalidad cognitiva, resaltando la importancia de integrar la salud física y mental para el envejecimiento saludable.
Conclusión: El dominio físico es fundamental para una funcionalidad óptima, especialmente en movilidad y actividades diarias. Los dominios psicológicos y cognitivos también destacan la necesidad de un enfoque holístico en el envejecimiento.

Palabras clave

Personas mayores; calidad de vida; determinantes sociales de la salud; estado funcional; Brasil.

Introduction

In contemporary times, population aging stands out as one of the main topics of global discussion, mainly due to its impact on various social sectors (United Nations, 2023). The significant increase in the population aged 60 and over is a global phenomenon that demands adaptation and planning in areas such as health, public policies, economy, and well-being, aiming to provide quality of life (QoL) for this growing demographic (Steinbeisser et al. 2021).

This reality is even more challenging in the Brazilian context due to regional inequalities, where factors such as access to healthcare services, socioeconomic conditions, and social support networks vary widely (Andrade et al., 2013). In regions like the Amazon, geographical conditions and limited infrastructure hinder the implementation of adequate public health policies for the older population (Garnelo, 2019). These challenges make the QoL and functionality indicators of older adults in these areas deserving of more detailed investigation to understand how these individuals experience aging in a context marked by specific structural and cultural limitations (Garbacco et al., 2018).

The QoL of an older adult is a multifaceted concept encompassing various domains, such as physical, psychological, social, and environmental well-being (Băjenaru et al., 2022). Moreover, functionality is another essential aspect of healthy aging (Tavares et al., 2017). Studies (Souza Júnior et al., 2022; Martin et al., 2015) indicate higher functionality is associated with better QoL, but this relationship can vary depending on the social context and available resources. Understanding the interrelations between QoL and functionality is crucial for developing interventions that address the older population's needs in regions with specific challenges, such as the Brazilian Amazon.

The network analysis approach has proven to be a valuable tool for exploring these complex and interdependent associations. Network analysis allows for mapping the connections between variables, revealing direct associations and interrelations that provide a holistic view of older adults' living conditions and functionality (Borgatti, Everett, & Johnson, 2013). By employing this methodology, it is possible to understand how the different domains and facets of QoL relate to functionality components, highlighting the factors that significantly impact older adults' lives.

In this context, the present study aims to analyze the associations between the domains and facets of QoL and the functionality components of older participants in a social project in a municipality in the Brazilian Amazon. Through this analysis, it is expected to identify the most relevant QoL indicators for the functionality of this population, considering the specificities and challenges of the Amazonian context. By investigating these associations, this research seeks to contribute to developing public policies and intervention strategies that promote healthy aging and improve the QoL of older adults in remote and socially vulnerable regions, such as the Brazilian Amazon.

Method

Type of Study and Ethical Aspects

This is a quantitative, analytical, observational, and cross-sectional study, approved by the Ethics Committee of Cesumar University (Unicesumar), under opinion number 6.080.372, and developed based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.
All procedures were conducted by the standards established by Resolution No. 466/2012 of the National Research Ethics Council, which defines the essential scientific requirements for studies involving human subjects.

Participants

The municipality of Itaituba is located in the Southwest Pará mesoregion and the Tapajós region. The municipal seat is 891 km straight from the capital, Belém, making it the fifth most distant municipal seat from the state's capital. Its geographical coordinates are 04º 16' 24'' S and 55º 59' 09'' W Gr. It has an altitude of 45 meters above sea level, covering an area of 62,111.60 km^2, and is geographically bordered to the north by the municipality of Aveiro; to the south by the municipality of Jacareacanga; to the east by the municipalities of Altamira, Rurópolis, Novo Progresso, and Trairão; and to the west by the city of Jacareacanga and the State of Amazonas. According to the 2022 Demographic Census, Itaituba has a population of 123.314 (IBGE, 2023).

In 2023, the participants of the "Social Project for Physical Activities for the Older Adults of the Municipal Department of Development and Social Assistance (SEMDAS)" consisted of 208 individuals of both sexes, aged 60 years or older, residing in various neighborhoods of Itaituba/PA, in the state of Pará, located in the Brazilian Amazon region.

Based on this population, a probabilistic sample was selected non-intentionally. The sample size was calculated using the finite population sampling formula (Richardson et al., 2012), adopting a 95% confidence level, a 5% margin of error, and an expected ratio of 50%. Considering the estimated population of 208 older participants in the project, a sample of 150 individuals would be required to account for possible losses. In the end, 122 older individuals responded to the data collection instruments and were included in the study.

The inclusion criteria were as follows: men or women aged 60 years or older, residents of various neighborhoods in the municipality who had regularly participated in the project's activities for at least one year, and with preserved cognitive, speech, and hearing abilities. Exclusion criteria included participants with debilitating neurological diseases (e.g., Alzheimer's, Parkinson's, or plugins) or reduced intellectual capacity.

Instruments

Five data collection instruments were used. The first instrument gathered sociodemographic and health data, including questions about age, sex, marital status, race, education level, income, employment, health perception, medication use, history of falls in recent months, and the duration of participation in the social project.

The WHO Quality of Life Bref (WHOQOL-Bref) assessed caregivers' QoL. This is a shortened version of the World Health Organization's QoL assessment questionnaire. It consists of 26 questions, two of which address individual perceptions of QoL and health, while the remaining are divided into four domains: physical, psychological, social relationships, and environment. Each domain is scored from 4 to 20 points, with scores closer to 20 indicating better QoL in the evaluated domain (Fleck et al., 2000).

The WHOQOL-OLD was also employed for QoL assessment. This tool comprises 24 items assigned to six facets: sensory functioning, autonomy, past, present, and future activities, death and dying, and intimacy. It is designed to measure QoL in older adults and should be applied alongside the WHOQOL-Bref. Scores are calculated using syntax and range from 0 to 100, with higher scores indicating better QoL in the evaluated facet (Fleck, Chachamovich, & Trentini, 2006).

Functionality was assessed using the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0). This instrument evaluates functionality in six activity domains: cognition, mobility, self-care, interpersonal relationships, daily activities, and participation, based on 12 questions. Each WHODAS 2.0 item measures the difficulty the older adult experienced performing activities during the past month. Responses are scored on a Likert scale from 0 (no difficulty) to 4 (extreme difficulty). A final score is obtained by summing the two questions in each domain, ranging from 0 to 8, with higher scores indicating greater difficulty (disability) in the evaluated domain (Castro, & Leite, 2017).

Procedures

We met with the participants, during which a lecture titled "Quality of Life and Functionality in Aging" was presented. Following the lecture, the research and the Informed Consent Form (ICF) were thoroughly explained, and attendees were invited to participate in the study. Those who agreed signed the ICF.

Subsequently, sessions were scheduled to complete the questionnaires and conduct interviews. All these stages took place within the SEMDAS Social Project facilities, according to the official schedule or specific convocations.

The selected participants were recruited, and data was collected at the SEMDAS Social Project site. This location was chosen for its suitable conditions to interact with the target audience, who gather three times a week to participate in various activities, such as stretching, aerobic exercises, and dance. For data collection, the researcher was assisted by 10 volunteer undergraduate Nursing students from the Itaituba Faculty, who were previously selected and trained to administer the questionnaires. Data collection occurred from October 2023 to February 2024.

Data Analysis

The data were analyzed using descriptive and inferential statistics with the JASP software. Data normality was verified using the Kolmogorov-Smirnov test, which revealed a non-parametric univariate distribution. Spearman's correlation assessed the relationship between variables, with values considered significant when $p < 0.05$. A network analysis technique was applied to study the complex interaction between the study variables. A Least Absolute Shrinkage and Selection Operator (LASSO) network was produced, which calculates a network of partial correlations among all variables, promoting pairwise associations while controlling for the influence of other variables. The LASSO network reduces trivially small correlations to zero, outlining a network with only the strongest associations and eliminating potentially spurious correlations (Wang et al., 2018).

Networks are composed of "nodes" (circles) that represent variables and "edges" connecting variables. The edge colors indicate the direction of the relationship, and the edge width represents the strength of the association. The positioning of the nodes within the network reflects the calculated associations (Silva et al., 2006).

In the present network, blue edges represented positive associations, while red edges indicated an inverse (negative) relationship. Beyond the visual inspection of the network, the following centrality indices were used to identify the most influential nodes: strength of connections, which measures the direct connections of a node; closeness centrality, which measures the distance between nodes, indicating how easily information from one node travels across the network; betweenness centrality, which describes the number of times a node acts as a bridge in the shortest path between two nodes, showing the potential of a node to influence other variables in the network; and expected influence, which indicates the importance of a node in activating or deactivating other nodes in a network with opposing edges (Dalege et al., 2017).

Results

A total of 122 older adults (116 women and six men) aged between 60 and 79 participated in the study ($M = 66.30$; $SD = 4.29$). Most participants were aged between 60 and 69 (84.4%), had a partner (50.8%), reported a monthly income of one to two minimum wages (82.0%), and were illiterate or had incomplete primary education (54.9%).

Table 1 presents the descriptive statistics and correlation between the functionality domains, QoL domains, and facets of older adults. Overall, participants showed low scores in all functionality domains, indicating satisfactory functionality. Regarding the QoL domains, the highest means were found in the psychological domain ($M = 15.97$; $SD = 2.43$), social relationships domain ($M = 15.17$; $SD = 2.59$), and self-assessment domain ($M = 15.11$; $SD = 3.04$). Finally, the highest means among the QoL facets were observed in social participation ($M = 71.46$; $SD = 16.74$) and past, present, and future activities ($M = 70.13$; $SD = 17.90$).

The analysis of the correlation matrix for the investigated variables (Table 1) reveals significant ($p < 0.05$), positive, and moderate correlations ($r > 0.40$) among the QoL domains and facets. The functionality domains of cognition and mobility showed negative correlations of weak to moderate intensity (r between -0.18 and -0.40) with the physical, psychological, and social relationships, self-assessment QoL domains, sensory functioning, and death and dying facets. The self-care domain exhibited weak negative correlations (r between -0.19 and -0.25) with the physical, psychological, and environmental domains. The interpersonal relationships domain showed weak negative correlations (r between -0.22 and -0.35) with all QoL domains, sensory functioning, and death and dying facets. The ADL domain negatively correlated with weak intensity (r between -0.20 and -0.36) with the physical and social relationships, self-assessment domains, and death and dying facets. Lastly, the social participation domain was negatively associated with weak to moderate intensity (r between -0.21 and -0.46) with the physical, psychological, and social relationships domains, sensory functioning, and death and dying facets

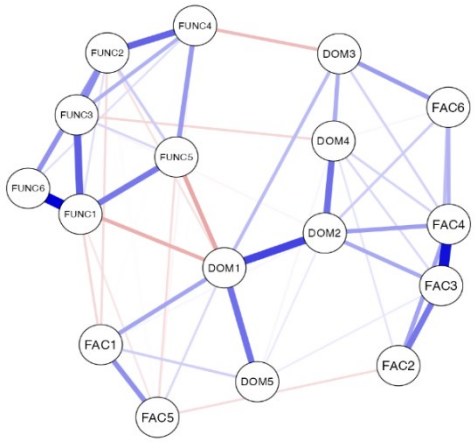
Table 1. Descriptive Statistics and Correlation Between Functionality Domains and QoL Domains and Facets of Older Adults.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Cognition (func.)	-																
2. Mobility (func.)	0.55	-															
3. Self-Care (func.)	0.44	0.54*	-														
4.I. Relationships (func.)	0.46	0.57*	0.57**	-													
5.ADLs (func.)	0.52	0.49*	0.26**	0.57**	-												
6.S. Participation (func.)	0.75	0.55*	0.34**	0.43**	0.44**	-											
7. Physical (dom.)	-0.39	-0.40	-0.25**	-0.32**	-0.36**	-0.46**	-										
8. Psychological (dom.)	-0.2	-0.29	-0.23**	-0.25**	-0.11	-0.31**	0.61**	-									
9.S. Relationships (dom.)	-0.1	-0.21	-0.07	-0.35**	-0.22*	-0.25**	0.42**	0.46**	-								
10. Enviromental (dom.)	-0.1	-0.1	-0.19*	-0.22*	-0.16	-0.16	0.34**	0.56**	0.43**	-							
11. Self-Assess. (dom.)	-0.2	-0.23	-0.12	-0.22*	-0.20*	-0.13	0.49**	0.36**	0.18*	0.27**	-						
12. Sensory Funct. (fac.)	-0.34	-0.33	-0.10	-0.27*	-0.17	-0.21*	0.44**	0.31**	0.10	-0.01	0.33**	-					
13. Autonomy (fac.)	-0.1	-0.0	-0.05	-0.01	0.02	-0.10	0.01	0.26**	0.21*	0.33**	0.22*	0.08	-				
14.PPFA (fac.)	-0.0	-0.0	-0.07	-0.05	-0.12	-0.09	0.26**	0.55**	0.34**	0.44**	0.38**	0.11	0.54**	-			
15.S. Participation (fac.)	-0.0	-0.0	-0.09	-0.07	-0.08	-0.15	0.33**	0.57**	0.41**	0.45**	0.24**	0.12	0.50**	0.73**	-		
16. Death / Dying (fac.)	-0.25	-0.26	-0.12	-0.25*	-0.22*	-0.23**	0.32**	0.21*	0.07	0.06	0.18*	0.40**	-0.22*	-0.02	0.05	-	
17. Intimacy (fac.)	-0.0	-0.0	-0.15	-0.05	0.09	-0.16	0.24**	0.43**	0.43**	0.34**	0.05	0.01	0.30**	0.45**	0.47**	-0.0	-
Média	3.0	3.02	2.33	2.69	2.64	3.36	14.73	15.97	15.17	14.16	15.11	68.70	60.14	70.13	71.46	65.6	69.67
Desvio Padrão	1.4	1.63	1.03	1.37	1.23	1.67	2.63	2.43	3.27	2.59	3.04	19.36	23.81	17.90	16.74	30.4	21.93

Spearman Correlation. *Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level. func.: functionality; dom.: domain; fac.: facet; I.: Interpersonal; S.: Social; ADLs: Activities of Daily Living; Assess.: Assessment; Funct.: Functioning; PPFA: Past, Present, and Future Activities.

The resulting network (Figure 1) demonstrated notable clustering and separation of variables, with the QoL domains and facets on one side and the functionality domains on the other. The QoL domains and facets were positively associated with each other, indicating a positive interaction among these variables. A similar result was observed among the functionality domains.

Figure 1. Network Structure (n = 122): Functionality Domains and QoL Domains and Facets



Note: FUNC: functionality; DOM: domain; FAC: facet. The size and density of the edges between nodes represent the strength of connectivity; FUNC1 = Cognition; FUNC2 = Mobility; FUNC3 = Self-Care; FUNC4 = Interpersonal Relationships; FUNC5 = Activities of Daily Living; FUNC6 = Social Participation; DOM1 = Physical; DOM2 = Psychological; DOM3 = Social Relationships; DOM4 = Environment; DOM5 = Self-Assessment; FAC1 = Sensory Functioning; FAC2 = Autonomy; FAC3 = Past, Present, and Future Activities; FAC4 = Social Participation (Facet); FAC5 = Death and Dying; FAC6 = Intimacy.

Figure 1 highlights that the physical, psychological, social relationships, and environment QoL domains, along with the sensory functioning facet, were positioned at the center of the network, establishing the primary positive connections with other QoL domains and facets, and the primary negative connections with the functionality domains. Notably, the physical QoL domain exhibited negative connections with the functionality domains of cognition and activities of daily living (ADLs). The social relationships QoL

domain showed a negative connection with the functionality domain of interpersonal relationships, while the environment domain was negatively connected with self-care. Sensory functioning was negatively associated with the cognition and mobility domains, whereas the death and dying facet was negatively linked with the cognition and ADLs domains.

Table 2 presents the weight of all associations within the network. A closer examination of the interaction between QoL domains and facets with functionality domains reveals that the physical domain was the most relevant indicator of better (lower score) functionality in the mobility (r = -0.05), ADLs (r = -0.15), and social participation (r = -0.13) domains. The sensory functioning facet also emerged as a relevant indicator of better (lower score) functionality in the cognition (r = -0.06), mobility (r = -0.06), and interpersonal relationships (r = -0.06) domains. The death and dying facet was another indicator of better (lower score) functionality in cognition (r = -0.04), mobility (r = -0.01), interpersonal relationships (r = -0.02), and ADLs (r = -0.05) domains. The psychological and environmental domains were also negatively associated with self-care (r = -0.02 and r = -0.06, respectively). In contrast, the QoL domain of social relationships was negatively associated (indicating better functionality) with the functionality domain of interpersonal relationships (r = -0.11).

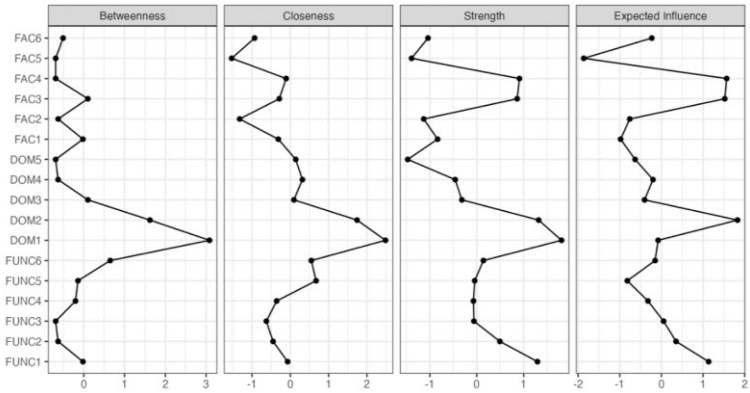
Table 2. Weight of Associations in the Network Analysis.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Cognition (func.)	-																
2. Mobility (func.)	0.05	-															
3. Self-Care (func.)	0.27	0.19	-														
4.I. Relationships (func.)		0.26	0.13	-													
5.ADLs (func.)	0.22	0.08	0.07	0.17	-												
6.S. Participation (func.)	0.42	0.18		0.05		-											
7. Physical (dom.)		-0.05			-0.15	-0.13	-										
8. Psychological (dom.)			-0.02				0.31	-									
9.S. Relationships (dom.)				-0.11			0.11	0.08	-								
10. Enviromental (dom.)			-0.06					0.24	0.14	-							
11. Self-Assess. (dom.)							0.23	0.03		0.01	-						
12. Sensory Funct. (fac.)	-0.06	-0.06		-0.01			0.15	0.01			0.08	-					
13. Autonomy (fac.)										0.04			-				
14. PPFA (fac.)								0.14		0.06	0.03		0.22	-			
15.S. Participation (fac.)								0.16		0.07			0.15	0.39	-		
16. Death / Dying (fac.)	-0.04	-0.01		-0.02	-0.05		0.06					0.18	-0.06			-	
17. Intimacy (fac.)								0.08	0.16	0.01				0.11	0.13		-

Note: func.: functionality; dom.: domain; fac.: facet; I.: Interpersonal; S.: Social; ADLs: Activities of Daily Living; Assess.: Assessment; Funct.: Functioning; PPFA: Past, Present, and Future Activities.

Analyzing the centrality indices of the network (Figure 2), it is observed that the physical QoL domain had the highest betweenness value, highlighting it as the most influential node in the network. The physical and psychological QoL domains showed the highest closeness values. They were also the most strongly connected variables within the network, followed by the cognition functionality domain and the QoL facets of past, present, and future activities and social participation. Regarding expected influence, the psychological domain had the highest expected impact in the network, followed by past, present, and future activities, social participation, and the cognition functionality domain. This finding suggests that if the goal were to activate this network, the psychological domain node would be the primary target for activation.

Figure 2. Betweenness, Closeness, Strength of Connections, and Expected Influence of Network Variables.



FUNC: functionality; DOM: domain; FAC: facet. FUNC1 = Cognition; FUNC2 = Mobility; FUNC3 = Self-Care; FUNC4 = Interpersonal Relationships; FUNC5 = Activities of Daily Living; FUNC6 = Social Participation; DOM1 = Physical; DOM2 = Psychological; DOM3 = Social Relationships; DOM4 = Environment; DOM5 = Self-Assessment; FAC1 = Sensory Functioning; FAC2 = Autonomy; FAC3 = Past, Present, and Future Activities; FAC4 = Social Participation; FAC5 = Death and Dying; FAC6 = Intimacy.

Discussion

The QoL variables demonstrated a positive interaction among themselves, as did the functionality domains, indicating internal cohesion within these variables. At the center of the network, the physical, psychological, social relationships, and environment QoL domains, along with the sensory functioning facet, stood out as the primary connection points, establishing positive associations with other QoL domains and negative associations with functionality domains. It was also noted that the physical QoL domain was the primary indicator of better functionality, particularly in mobility, ADLs, and social participation. Centrality analyses identified the physical QoL domain as the most influential node, followed by the psychological domain and cognitive functionality, highlighting their central position and capacity to influence other variables in the network.

The results, which emphasized the physical, psychological, social relationships, and environment QoL domains, as well as the sensory functioning facet, as the primary connection points in the analyzed network, reflect the importance of these dimensions for the well-being and functionality of older adults. In the context of aging, especially in regions with geographical and structural challenges such as the Brazilian Amazon, these QoL dimensions tend to be fundamental, as they influence both the individual perception of health and the ability to maintain independence and social participation (Sampaio et al., 2024; Costa et al., 2021).

According to Marzo et al. (2023), the physical domain, for example, is a crucial aspect of the independence of older adults, as its preservation is directly linked to the ability to perform daily activities and maintain mobility—essential factors for preventing dependency. The psychological domain, being strongly associated with QoL, can be understood through mental health's impact on overall well-being, influencing motivation, social engagement, and coping with the challenges of aging (Steptoe, Deaton, & Stone, 2015). Literature suggests that older adults with better psychological health tend to demonstrate greater resilience and adaptability, which becomes especially relevant in challenging socioeconomic and environmental contexts (Risal et al., 2020; Cosco, Howse, & Brayne, 2017). The social relationships domain of QoL also emerged as a significant factor, which can be attributed to the importance of social support for the health and well-being of older adults. Guedes et al. (2017) noted that social interaction becomes a vital resource for emotional and practical support in vulnerable environments, contributing to a sense of belonging and social integration. Similarly, the environment domain proves to be central to QoL, as it reflects the infrastructure and resources of the surrounding area, which influence access to healthcare services, safety, and the quality of public spaces available for older adults (Vagetti et al., 2013). This relationship is particularly relevant in the Amazon, where access to such resources may be limited and require adaptations (Sampaio et al., 2024).

The sensory functioning facet, in turn, stood out as a relevant dimension of QoL for functionality. Bestetti (2014) noted that preserving sensory capacities, such as vision and hearing, is essential for older adults'

interaction with their environment and the people around them. In geographic isolation, such as the Amazon, sensory functionality may have an even more significant impact, either facilitating or limiting access to resources and social interaction.

These negative associations with functionality domains reinforce that, while QoL aspects remain positively integrated, the functionality of older adults presents demands and vulnerabilities that may not be fully addressed solely by maintaining good QoL. These findings suggest that interventions must be holistic and tailored to the specific context, recognizing that promoting healthy aging for this population requires strategies integrating physical health, social support, and adequate environmental conditions.

The results identifying the physical QoL domain as the primary indicator associated with better functionality, particularly in mobility, ADLs, and social participation, reflect the importance of this domain for the autonomy and independence of older adults. Functional capacity, especially in mobility and performing daily activities, is essential for older adults to maintain an active and independent life, fostering healthy aging and preserving QoL (Lima et al., 2022). The centrality of the physical domain as the most influential node in the network suggests that physical health is the foundational element supporting and enhancing other dimensions of functionality and QoL.

The intrinsic relationship between physical functionality and independence can also explain this central position of the physical domain. According to Marzetti (2022), aging tends to significantly impact muscle strength, flexibility, and endurance, directly influencing the ability to perform ADLs and social participation. Older adults in good physical condition find it easier to maintain mobility and independence, enabling them to interact with their environment, participate in group activities, and access available community resources (Cotterell, Buffel, & Phillipson, 2018). In vulnerable contexts, such as the Brazilian Amazon, where access to services and infrastructure is more challenging, preserving physical functionality can be a crucial protective factor for maintaining good QoL.

The second position of the psychological domain as an influential factor in the network further emphasizes the importance of mental health in supporting functionality and the overall well-being of older adults. Psychological health promotes coping with the challenges of aging and fosters resilience, which is essential for adapting to physical limitations that arise over time (Carpenter, Gatz, & Smyer, 2022). Thus, the psychological domain is a supporting pillar for the physical domain, creating an emotional well-being foundation that strengthens motivation and engagement in daily and social activities.

Cognitive functionality, also identified as an influential factor, suggests that cognition is a crucial enabler of autonomy for older adults. Maintaining cognitive functions allows them to plan, organize, and execute their daily activities safely and independently, particularly relevant for active aging (Pettigrew & Soldan, 2019). These findings indicate that when combined with preserved mental and cognitive states, physical functionality enhances QoL and provides older adults with a solid foundation for maintaining their abilities.

The study presents some significant limitations. Firstly, the cross-sectional design prevents determining causal relationships between QoL domains and functionality aspects. Although the associations observed in the network analysis suggest connections between these variables, it is impossible to confirm whether improvements in a specific QoL domain would lead to corresponding changes in functionality or vice versa. Longitudinal studies are needed to verify whether these associations persist over time. Additionally, the geographic and cultural specificity of the research, conducted with older adults participating in a social project in a municipality of the Brazilian Amazon, limits the generalization of the results to other regions and populations with different socioeconomic characteristics.

Another limitation is the reliance on self-reported measures of QoL and functionality, which may introduce response biases, particularly in older adults, due to factors such as cognition and comprehension. Future studies using objective measures and multiple data sources could help mitigate these biases.

The low number of men in the sample, compared to the high number of women, represents a significant limitation of this study. This disparity may influence the generalization of the results, particularly regarding gender differences in the variables analyzed. We acknowledge that a more balanced sample could provide a more representative and comprehensive perspective, and this limitation has been thoroughly discussed in the text as an aspect to be considered in interpreting the findings.

Finally, while network analysis provides a detailed view of the interrelations among variables, the lack of longitudinal data restricts understanding these relationships' evolution over time. Therefore, the findings should be interpreted cautiously and complemented by further research addressing these limitations, broadening the knowledge of the relationship between QoL and functionality in older adults.

Conclusions

It is concluded that the physical domain stands out as the primary factor associated with better functionality, particularly in mobility, ADLs, and social participation. Additionally, the centrality of the psychological QoL domain and cognitive functionality highlights the importance of a holistic approach that integrates physical, mental, and cognitive health for healthy aging.

The network structure enabled an in-depth analysis of the interrelations between QoL and functionality domains, revealing positive and negative connections. These findings suggest that promoting QoL for older adults in regions with geographical challenges and limited resources, such as the Amazon, should consider local specificities and prioritize the maintenance of physical functionality, support for mental health, and preserving cognitive capacities.

This study contributes to understanding the health needs of the older population in the Amazon region and can guide the formulation of targeted public policies and interventions. By prioritizing strategies that strengthen functionality and promote QoL in an integrated manner, it is possible to advance the promotion of active and independent aging. Future research could further explore the contextual and cultural variables that influence the relationship between functionality and QoL in other vulnerable populations, expanding the knowledge base and practical application of these findings in diverse settings.

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Authors' and translators' details:

Cleidson Colares Batista	cleidsoncolares@hotmail.com	Author
Talita Cezareti da Silva	tcezareti@gmail.com	Author
Elaine Cristina Costa Lopes	lopesfisioterapia23@gmail.com	Author
Renato Augusto Mariotto	renatomariotto88@icloud.com	Author
Tania Maria Gomes da Silva	tania.silva@unicesumar.edu.br	Author
Aliny de Lima Santos	aliny.santos@unicesumar.edu.br	Author
Aline Diniz Gehren	aline.gehren@unicesumar.edu.br	Author
José Roberto Andrade do Nascimento Júnior	Jroberto.jrs01@gmail.com	Author
Daniel Vicentini de Oliveira	d.vicentini@hotmail.com	Author/Translator