Intrinsic capacity and mortality among older adults living in a health microregion of Minas Gerais

Vinício Soares Cabral[1]
Érica Midori Ikegami[2]
Nayara Gomes Nunes Oliveira[3]
Neilzo Nunes Oliveira[3]
Darlene Mara dos Santos Tavares[4]

Abstract

Objective: To analyze intrinsic capacity and its ability to predict all-cause mortality in older adults living in a health microregion of Minas Gerais state, Brazil. *Method*: A household survey study with a quantitative approach was conducted. Data were collected at homes using instruments validated for use in Brazil. *Results*: Mean intrinsic capacity score was 5.8 (±1.63) points. During the follow-up period, with a mean follow-up time of 58.0 (±13.1) months, 142 deaths (16.4%) occurred. For each 1 point increase in intrinsic capacity score, there was a 21% reduction in the risk of mortality (p<0.001). *Conclusion*: Intrinsic capacity served as a predictor of mortality in older adults.

Keywords: Aged. Healthy Aging. Mortality. Mortality Registries.

[1] Universidade Federal do Triângulo Mineiro, Curso de Enfermagem. Uberaba, MG, Brasil.

[2] Universidade Federal do Triângulo Mineiro, Programa de Pós-Graduação *stricto sensu* em Atenção à Saúde. Uberaba, MG, Brasil.

[3] Universidade Federal de Uberlândia, Hospital de Clínicas da Universidade Federal de Uberlândia. Uberlândia, MG, Brasil.

[4] Universidade Federal do Triângulo Mineiro, Departamento de Enfermagem em Educação e Saúde Comunitária. Uberaba, MG, Brasil.

Funding: Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq). Under process no.: 303907/2022-3.

The authors declare that there is no conflict in the conception of this work.

Correspondence
Darlene Mara dos Santos Tavares
darlene.tavares@uftm.edu.br

Received: December 04, 2023
Approved: April 29, 2024

http://dx.doi.org/10.1590/1981-22562023026.230272en

INTRODUCTION

In the field of epidemiology, quantitative indicators for describing health outcomes and their respective risk factors are indispensable, also helping to plan actions and designate public health resources[1]. Mortality is one of the most commonly used measures in practice [2,3] and expresses the total number of deaths resulting from the health event assessed[2].

Mortality can be expressed in terms of proportions, rates or absolute numbers, and can provide not only demographic and geographic information, but also cause of death[3]. These data are useful because the age structure of the population is still undergoing a process of change[1] and indicators are needed to help characterize the evolution and intensity of repercussions of health events[2] in specific age groups, such as older adults.

One of the main lines of investigation in studies on mortality is cause of death by age group[4]. Specifically in older individuals, the presence of chronic diseases is considered one of the leading causes of death[5], since age-related changes can cause a progressive decline in functions of organic systems, increasing predisposition to chronic health conditions, with consequent reduction in intrinsic capacity and, ultimately, death[6].

Intrinsic capacity represents the composite of physical and mental capacities of an individual[7], comprising the inter-related domains of cognition, psychological, sensory, locomotion and vitality[7–9]. It is regarded as a multi-dimensional indicator related to functional status, which can be used in planning and assessment of health care models recommended in the guidelines of the World Health Organization (WHO) on integrated care for older people[7,9].

Thus, there is evidence that intrinsic capacity, as a composite score and/or its domains, predicts negative outcomes in community-dwelling older adults, such as transition of frailty conditions[10], functional disability for activities of daily living [11–13], time in long-term care facilities[12] and occurrence of falls[13,14]. However, where the death outcome is concerned, there is a dearth of studies investigating these pooled components among community-dwelling older adults[15–17]and knowledge gaps exist on the predictive value of intrinsic capacity for mortality, especially in Brazil, where no investigations on the subject were found.

Given the gap in scientific knowledge on the subject, the objective of the present study was to analyze intrinsic capacity and its ability to predict all-cause mortality in older adults living in a health microregion of Minas Gerais state, Brazil.

METHOD

An analytical, quantitative study was conducted, guided by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) tool and drawing on the observable variables from the database of the project "*Envelhecimento Ativo, Funcionalidade Global e Qualidade de Vida entre idosos da Microrregião de Saúde de Uberaba* (MG)" (Active Aging, Global Functioning and Quality of Life among older Adults from the Uberaba health microregion) by the Public Health Research Group. The cited study was based on a multiple-stage cluster sample of 977 older adults interviewed in 2018. The sample included individuals aged ≥60 living in the urban area of the Health Microregion of Uberaba (Minas Gerais state), Brazil. Individuals exhibiting severe stroke complications with aphasia and localized loss of strength in upper and lower limbs; severe or unstable Parkinson´s disease with major impairment of motricity, speech or affectivity; and subjects with cognitive decline, were excluded. Cognitive decline was defined as having a classification of decline on the Mini-Mental State Exam (MMSE)[18], and not having an informant to answer the Pfeffer Functional Activities Questionnaire (FAQ)[19] and/or attaining a final score ≥6 points on the scale[19].

Analysis of the database showed that, of the 977 older adults interviewed, 31 had cognitive decline on the Pfeffer FAQ and failed to complete the full interview. Thus, the base reference sample for the 2nd phase comprised 941 older adults, determined after adjusting for all deaths that had occurred between 31 January 2018 and 31 January 2023. On the living status follow-up, 77 participants were excluded,

comprising 38 not found after 3 attempts at contact and 39 for absence of telephone (n=39). Thus, the final study sample included 864 older adults.

The initial data were collected during home visits by direct interview and by applying tests of physical performance using scales validated for use in Brazil. Ten interviewers from the health area were selected and underwent training, trials and received information on ethics issues related to the study. The interviewers were trained by the researchers from the research group and overseen until displaying competence in applying the scales.

Sociodemographic and economic data, along with number of morbidities, were collected using a structured questionnaire devised by members of the Public Health Research Group based on the scientific literature.

Intrinsic capacity was assessed for the domains cognition, psychological, sensory, locomotion and vitality[7,9].

The cognitive domain was assessed by applying the MMSE, translated and validated for use in Brazil[18], which provides information on different cognitive parameters. The score ranges from 0 points, indicating highest degree of cognitive impairment of the individual, to 30 points, indicating best cognitive capacity[18].

The psychological domain was measured using the Short Form Geriatric Depression Scale (GDS-15) validated for use in Brazil, which has 15 items and an overall score ranging from 0 to 15 points[20].

Locomotion was assessed using the Brazilian version of the Short Physical Performance Battery (SPPB), comprising the sum of points on balance, gait speed and chair stand tests[21]. Total score ranges from 0 (disability) to 12 (best performance) points[21]. Subjects scoring 0-3 points were classified as having disability; 4-6 points, low physical performance; 7-9 points, moderate physical performance; and 10-12 points, good physical performance[21]. Thus, higher scores on the SPPB indicate greater physical performance.

With regard to the sensory domain, this was measured by posing the question: "How do you rate the functioning of your hearing, vision, taste, smell and touch?" with respondents choosing from the following options: very good, good, fair, poor and very poor.

The vitality domain was measured based on the following items: unintentional weight loss; exhaustion/fatigue; hand-grip strength; and body mass index (BMI), probed as follows: unintentional weight loss was assessed by the question: *"In the past year, have you unintentionally lost more than 4.5kg or 5% of your body weight?"*. Self-reported exhaustion/fatigue was measured using items 07 and 20 from the Brazilian version of the Center for Epidemiologic Studies Depression Scale. Participants scoring 2 or 3 on any of the questions met the criteria for this item[22].

Decline in muscle strength was determined according to hand-grip strength, measured using a Jamar Saehan® hydraulic hand dynamometer. The recommendations of the American Society of Hand Therapists were adopted: the participant was seated comfortably on a chair without arm rests and both feet flat on the floor, shoulders adducted, elbows flexed to 90 degrees, and forearms neutral, and thumbs raised upward; and wrists in a comfortable position extended to 0-30º; with handle position II elected. The examiner provided a loud verbal stimulus prompting the subject to pull the dynamometer handle using their dominant hand, squeeze for 6 seconds and then relax. Three measures were obtained, expressed in kilograms/force (kgf), with a 1-minute interval between tries and mean value recorded[23].

Body weight was measured using a portable digital balance with a capacity of 150 kg and accuracy to the nearest 100 g. The subject wore light clothes and removed footwear. Height (m) was measured using a 2-meter flexible, inelastic measuring tape, with graduations in centimeters and subdivisions in millimeters, affixed to the wall in an area with a flat level floor without skirting board. With footwear removed, the subject was placed in an orthostatic position with feet together and their back against the marker and gaze to the horizon. BMI was calculated

using the formula: BMI = weight (kg) / [height]^2 (m). Nutritional status was classified according to the following BMI cut-off values: underweight (≤22 kg/m^2), normal weight (>22 and <27 kg/m^2) and excess weight (≥27 kg/m^2)[24].

Regarding deaths, this information was obtained by consulting the burial system of the City Authorities of Uberaba, Minas Gerais, Brazil[25] and the National Deaths Registry[26]. In the event of doubts or disparities concerning the exact registry, telephone calls were made to the residence of the person in question using the contact number given at the time of data collection.

The sociodemographic variables collected were: sex (female; male); age group, in years (60 ⊢70; 70 ⊢80; ≥80; mean full years of life); education, in full years of formal study (none; 1 ⊢5; ≥5; mean full years of study); morbidities (0; 1 ⊢5; ≥5; mean number of morbidities) and death (yes; no). The variables measuring intrinsic capacity domains were represented on the same scale of values (1-10)[27]. For cognitive capacity, a value of 1 was assigned to the lowest score on the MMSE (19 pontos), a value of 2 to the next, and so forth. The value of 10 was attributed for scores 28, 29 and 30. Scores on the GDS-15 (psychological capacity) ranging from 0 to 10 were used without modification, while a value of 10 was attributed for higher scores. These scores were subsequently transformed using the formula: score on GDS-15 =11 – original score. For the locomotion capacity, the values for classifications of physical performance were assigned: 1 for disability/poor; 3.5 for low ; 7.5 moderate; and 10 good. Similarly, for sensory capacity values were: 1 for very poor/poor; 3.5 for fair; 7.5 for good; and 10 for very good. Values assigned for the vitality domain variables were: unintentional weight loss, 0 for yes and 1 for no; the same for hand-grip strength (0 – decline; 1 – no decline), exhaustion/fatigue (0 – yes; 1 – no) and BMI (0 – normal weight; 1 – underweight/excess weight). Based on the values for each variable, vitality score was derived using weighting of indicators: unintentional weight loss x4; hand-grip strength x3; exhaustion/fatigue x2; BMI x1, such that final score ranged from 0 to 10[27]. Final intrinsic capacity score was calculated as the arithmetic mean of scores on each domain, represented on a scale of 1 to 10[27].

The data were treated using descriptive analysis, with categorical variables expressed as absolute and relative frequency, and quantitative variables as mean and standard deviations. Analysis of intrinsic capacity and its value for predicting all-cause mortality was carried out using a fitted multivariate Cox regression model to calculate hazard ratios (p<0.05).

The project was approved by the Ethics Committee for Research in Humans of the Universidade Federal do Triângulo Mineiro (UFTM), under permit no. 2.053.520. Participants were explained the study goals and provided with pertinent information and the Free and Informed Consent Form. After agreement by participants to take part and signing of the form, interviews were conducted in compliance with Resolution no. 466/2012 of the National Board of Health, Ministry of Health.

DATA AVAILABILITY

The dataset underpinning the study results are available upon request from the corresponding author.

RESULTS

Of the 864 participants studied, most were female (67.1%), aged 70 ⊢79 years (41.7%), had education of 1 ⊢4 years (52.5%) and ≥5 morbidities (67.6%) (Table 1).

Table 1. Distribution of sociodemographic and health variables of older adults (N = 864) living in the urban area of a health microregion of Minas Gerais state, Brazil, 2018.

Variables	n (%)	Mean and Standard Deviation
Sex		
Male	284 (32.9)	
Female	580 (67.1)	
Age group (in full years)		
60 ⊢ 69	324 (37.5)	
70 ⊢ 79	360 (41.7)	
≥80	180 (20.8)	
Age (in full years)		73.2(±8.0)
Education (in full years)		4.5(±3.9)
None	151 (17.5)	
1 ⊢ 4	454 (52.5)	
≥5	259 (30.0)	
Morbidities		6.5(±3.4)
None	12 (1.4)	
1 ⊢ 4	268 (31.0)	
≥5	584 (67.6)	

Regarding cognitive capacity, mean score on the MMSE was 25.0 (±3.8) points. The assessment of psychological capacity showed that 24.0% of participants exhibited signs of depressive symptoms. For locomotion capacity, most participants had good physical performance (39.1%). On the evaluation of sensory capacity, the majority of participants rated the functioning of their senses as good (52.4%). For the vitality domain, 13.3% had unintentional weight loss, 37.2% exhibited reduced hand-grip strength; 36.9% exhaustion/fatigue and 44.2% excess weight (Table 2). Mean intrinsic capacity score was 5.8 (±1.6) points (Table 2).

During the mean follow-up time (58.0±13.1 months) for the study, there was a total of 142 deaths (16.4%).

With regard to the ability of intrinsic capacity to predict mortality, for every additional point on intrinsic capacity score, the risk of mortality was reduced by 21% (p<0.001). Moreover, female gender (p<0.001) and advanced age (p<0.001) were associated with greater risk of death (Table 3).

Table 2. Distribution of intrinsic capacity domains and scores of older adults (N = 864) living in the urban area of a health microregion of Minas Gerais state, Brazil, 2018.

Variables	n (%)	Mean and Standard Deviation
Cognitive capacity		6.9(±3.1)
Psychological capacity (indicative of depressive symptoms)		7.3(±2.8)
Yes	207 (24.0)	
No	657 (76.0)	
Locomotion capacity (physical performance)		7.2(±3.0)
Poor	94 (10.9)	
Low	109 (12.6)	
Moderate	323 (37.4)	
Good	338 (39.1)	
Sensory capacity (functioning of senses)		6.2(±2.7)
Very poor/poor	110 (12.7)	
Fair	187 (21.6)	
Good	453 (52.4)	
Very good	114 (13.3)	
Vitality		6.9(±2.5)
Unintentional weight loss		
Yes	115 (13.3)	
No	749 (86.7)	
Reduced hand-grip strength		
Yes	321 (37.2)	
No	543 (62.8)	
Exhaustion/Fatigue		
Yes	319 (36.9)	
No	545 (63.1)	
Body Mass Index		
Underweight	213 (24.7)	
Normal weight	269 (31.1)	
Excess weight	382 (44.2)	
Intrinsic capacity		5.8(±1.6)

Table 3. Final Cox regression model for intrinsic capacity score for death in older adults (N = 864) living in the urban area of a health microregion of Minas Gerais state, Brazil, 2018-2023.

Variables	Death		
	HR	CI (95%)	*p**
Intrinsic capacity	0.79	0.71-0.88	<0.001
Age	1.05	1.03-1.07	<0.001
Morbidity	1.04	0.99-1.09	0.063
Sex			
Male	1**	-	-
Female	1.87	1.33-2.63	<0.001

HR: Hazard Ratio; CI: Confidence Interval; * p<0.05; ** 1 – reference value.

DISCUSSION

The aim of the present investigation was to analyze intrinsic capacity and its value for predicting all-cause mortality in older adults. Taken together, the results revealed that a higher composite score for intrinsic capacity was associated with a lower risk of mortality. To our knowledge, this is one of the first studies to investigate the effect of intrinsic capacity and other predictors on all-cause mortality in Brazilian community-dwelling older adults. To this end, the present study adopted the domains suggested by the WHO[7] and used a similar approach to previous studies[12,16,28–30], only with some differences in instruments and form of scoring.

The mean intrinsic capacity score found in this study was lower than the value reported in an earlier survey based on data from the *Rede de Pesquisa e Fragilidade em Idosos do Brasil* (Research Network and Frailty in Brazilian Older Adults)[27]. In this context, it should be noted that older adults with low composite score, or classified as having impaired intrinsic capacity, also have higher risk of death[12,15–17,28–32].

The present study showed that 16.4% of the participants had died over the period, a similar rate to that found by the 10/66 Dementia Research Group (DRG). The cited investigation was conducted in geographic areas of 8 different countries, and found that 18.4% of the 14,923 participants had died within a period averaging 4.2 years[31]. During a 3-year follow-up of 220 Chinese older adults aged ≥75 years, 11.8% of the participants died[32].

The main finding of the present study was a 21% reduction in mortality for every 1-point increase in intrinsic capacity score. A lower result was identified in the I-Lan Longitudinal Aging Study (ILAS), where an increase of 1 percentage point in intrinsic capacity score for 5 domains was associated with a 5% lower mortality hazard ratio (HR=0.95; 95%CI 0.93-0.97)[28]. A study of 754 older adults in North America showed a 5% increase in the hazard ratio of death for every 1-point reduction in intrinsic capacity, comprising the 5 domains cognition, vitality, mobility, psychosocial and sensory[12].

In Belgium, an increase of 1 standard deviation in the Z-score of intrinsic capacity was associated with a 49% decrease in risk of death (HR=0.51; 95% 0.36-0.72)[15]. Despite this finding, the study noted that the sensory domain could not be assessed because of missing data, and so results apply only to the cognition, nutrition, mobility and psychosocial domains[15].

Two studies which adopted the domains recommended by the WHO for intrinsic capacity (cognition, locomotion, sensory, psychological and vitality) also found an association of the construct with death[16,30]. In Taiwan and China, individuals with low intrinsic capacity had a 2.19 and 2.56 times greater hazard ratio for death, respectively, compared to the high intrinsic capacity group[16,30].

Although the WHO defines 5 domains for intrinsic capacity[7], previous studies have shown differences in the way each of these is assessed in terms of instruments employed [15,33] and composite score calculation, possibly explaining the disparity in findings[12,29]. In addition, there are numerous other factors that can contribute to decline in intrinsic capacity[34,35] and impact the life course from birth to death[9].

Despite the issues outlined, the body of scientific evidence suggests that intrinsic capacity plays a role in contributing to a high hazard ratio for mortality in community-dwelling older adults[12,15,16,28–30], as demonstrated in the present study. The concept of intrinsic capacity is a key concept for promoting health aging[6,7] and considered a better predictor of adverse health outcomes than the presence of comorbidities[32].

The study has some limitations which should be taken into account when interpreting its findings. First, no tracking of intrinsic capacity at different timepoints was carried out, precluding the identification and elucidation of trajectories or the occurrence of possible changes. Second, there are issues in relation to the domains, such as sensory, in that these were obtained via self-report, potentially distorting results. Third, given that intrinsic capacity was regarded as a composite construct, no individual analysis of the effect of the different domains on the outcome was performed. Fourth, despite adoption

of the intrinsic capacity domains according to the WHO, there were differences in the instruments. Nevertheless, strengths of the present study include the fact that the sample was a population of older adults living in the community, representing a potential target of interventions for promoting healthy aging. Further, given the study was conducted in a developing country, it can provide information for other regions with a similar profile and help inform the planning of individual and collective actions.

CONCLUSION

Intrinsic capacity played a predictive role regarding mortality among community-dwelling older adults, even after adjusting for potential confounding variables, showing that increased intrinsic capacity score was associated with a reduced risk of death.

Therefore, intrinsic capacity should be assessed and followed in communities and households so that declines, even if slight, can be detected and factored into individualized care plans. Hence, adverse health outcomes, such as mortality, can also be either averted or delayed.

AUTHORSHIP

- Vinício Soares Cabral – conception and design, writing of article or its critical review, approval of version for publication; and overseeing all aspects of the study, vouching for issues pertaining to the accuracy or integrity of all parts of the study.
- Érica Midori Ikegami – conception and design, data analysis and interpretation, writing of article or its critical review, approval of version for publication; and overseeing all aspects of the study, vouching for issues pertaining to the accuracy or integrity of all parts of the study.
- Nayara Gomes Nunes Oliveira – conception and design, data analysis and interpretation, writing of article or its critical review, approval of version for publication; and overseeing all aspects of the study, vouching for issues pertaining to the accuracy or integrity of all parts of the study.
- Neilzo Nunes Oliveira – conception and design, writing of article or its critical review, approval of version for publication; and overseeing all aspects of the study, vouching for issues pertaining to the accuracy or integrity of all parts of the study.
- Darlene Mara dos Santos Tavares – conception and design, writing of article or its critical review, approval of version for publication; and overseeing all aspects of the study, vouching for issues pertaining to the accuracy or integrity of all parts of the study.

Edited by: Letícia Sampaio Figueiredo

REFERENCES

1. Choi J, Ki M, Kwon HJ, Park B, Bae S, Oh CM, et al. Health indicators related to disease, death, and reproduction. J Prev Med Public Health. 2019;52(1):14–20. Available from: https://doi.org/10.3961/jpmph.18.250
2. Hernandez JBR, Kim PY. Epidemiology morbidity and mortality. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2022.
3. Organização Pan-Americana da Saúde. Indicadores de saúde. Elementos conceituais e práticos. Washington, DC: Organização Pan-Americana da Saúde; 2018.
4. Dicker D, Nguyen G, Abate D, Abate KH, Abay SM, Abbafati C, et al. Global, regional, and national age-sex-specific mortality and life expectancy, 1950–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2018;392(10159):1684–735. Available from: https://doi.org/10.1016/S0140-6736(18)31891-9
5. Cheng X, Yang Y, Schwebel DC, Liu Z, Li L, Cheng P, et al. Population ageing and mortality during 1990–2017: A global decomposition analysis. PLoS Med. 2020;17(6):e1003138. Available from: https://doi.org/10.1371/journal.pmed.1003138

6. Organização Mundial da Saúde. Relatório Mundial de Envelhecimento e Saúde [Internet]. Genebra: Organização Mundial da Saúde; 2015 [citado em 25 de junho de 2022]. 252 p. Available from:: https://sbgg.org.br/wp-content/uploads/2015/10/OMS-ENVELHECIMENTO-2015-port.pdf

7. Organização Pan-Americana da Saúde. Atenção Integrada para a Pessoa Idosa (ICOPE). Orientações sobre a avaliação centrada na pessoa e roteiros para a atenção primária [Internet]. Washington, D.C.: Organização Pan-Americana da Saúde; 2020 [citado em 25 de junho de 2022]. 252 p. Available from:: https://www.who.int/publications-detail-redirect/WHO-FWC-ALC-19.1

8. Cesari M, Carvalho IA, Amuthavalli Thiyagarajan J, Cooper C, Martin FC, Reginster JY, et al. Evidence for the domains supporting the construct of intrinsic capacity. J Gerontol A Biol Sci Med Sci. 2018;73(12):1653–60. Available from: https://doi.org/10.1093/gerona/gly011

9. Organização Pan-Americana da Saúde. Construindo a saúde no curso de vida: conceitos, implicações e aplicação em saúde pública [Internet]. Washington, D.C.: Organização Pan-Americana da Saúde; 2021 [citado em 25 de junho de 2022]. 252 p. Available from:: https://iris.paho.org/bitstream/handle/10665.2/53571/9789275723029_por.pdf?sequence=1&isAllowed=y

10. Liu S, Kang L, Liu X, Zhao S, Wang X, Li J, et al. Trajectory and correlation of intrinsic capacity and frailty in a Beijing elderly community. Front Med (Lausanne). 2021;8:751586. Available from: https://doi.org/10.3389/fmed.2021.751586

11. Beard JR, Jotheeswaran AT, Cesari M, Araujo de Carvalho I. The structure and predictive value of intrinsic capacity in a longitudinal study of ageing. BMJ Open. 2019;9(11):e026119. Available from: https://doi.org/10.1136/bmjopen-2018-026119

12. Stolz E, Mayerl H, Freidl W, Roller-Wirnsberger R, Gill TM. Intrinsic capacity predicts negative health outcomes in older adults. J Gerontol A Biol Sci Med Sci. 2022;77(1):101–5. Available from: https://doi.org/10.1093/gerona/glab279

13. Yu J, Si H, Qiao X, Jin Y, Ji L, Liu Q, et al. Predictive value of intrinsic capacity on adverse outcomes among community-dwelling older adults. Geriatr Nurs. 2021;42(6):1257–63. Available from: https://doi.org/10.1016/j.gerinurse.2021.08.010

14. Liu S, Yu X, Wang X, Li J, Jiang S, Kang L, et al. Intrinsic Capacity predicts adverse outcomes using Integrated Care for Older People screening tool in a senior community in Beijing. Arch Gerontol Geriatr. 2021;94:104358. Available from: https://doi.org/10.1016/j.archger.2021.104358

15. Locquet M, Sanchez-Rodriguez D, Bruyère O, Geerinck A, Lengelé L, Reginster JY, et al. Intrinsic capacity defined using four domains and mortality risk: a 5-year follow-up of the SarcoPhAge cohort. J Nutr Health Aging. 2022;26(1):23–9. Available from: https://doi.org/10.1007/s12603-021-1702-7

16. Meng LC, Huang ST, Peng LN, Chen LK, Hsiao FY. Biological features of the outcome-based intrinsic capacity composite scores from a population-based cohort study: Pas de Deux of Biological and Functional Aging. Front Med (Lausanne). 2022;9:851882. Available from: https://doi.org/10.3389/fmed.2022.851882

17. Prince MJ, Acosta D, Guerra M, Huang Y, Jacob KS, Jimenez-Velazquez IZ, et al. Intrinsic capacity and its associations with incident dependence and mortality in 10/66 Dementia Research Group studies in Latin America, India, and China: A population-based cohort study. PLoS Med. 2021;18(9):e1003097. Available from: https://doi.org/10.1371/journal.pmed.1003097

18. Bertolucci PHF, Brucki SMD, Campacci SR, Juliano Y. O Mini-Exame do Estado Mental em uma população geral: impacto da escolaridade. Arq Neuropsiquiatr. 1994;52(1):01–7. Available from: https://doi.org/10.1590/S0004-282X1994000100001

19. Brasil. Envelhecimento e Saúde da Pessoa Idosa - Cadernos de Atenção Básica, no. 19 [Internet]. Brasília, DF: Ministério da Saúde; 2006 [citado em 25 de junho de 2022]. 252 p. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/evelhecimento_saude_pessoa_idosa.pdf

20. Almeida OP, Almeida SA. Confiabilidade da versão brasileira da Escala de Depressão em Geriatria (GDS) versão reduzida. Arq Neuropsiquiatr. 1999;57(2B):421–6. Available from: https://doi.org/10.1590/S0004-282X1999000300013

21. Nakano. Versão brasileira da Short Physical Performance Battery SPPB: adaptação cultural e estudo da confiabilidade [dissertação]. Campinas (SP): Faculdade de Educação, Universidade Estadual de Campinas; 2007.

22. Batistoni SST, Neri AL, Cupertino APFB. Validity of the Center for Epidemiological Studies Depression Scale among Brazilian elderly. Rev Saude Publica. 2007;41(4):598–605. Available from: https://doi.org/10.1590/s0034-89102007000400014

23. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci. 2001;56(3):M146-156. Available from: https://doi.org/10.1093/gerona/56.3.m146

24. Lipschitz, DA. Screening for nutritional status in the elderly. Prim Care. 1994; 21:55-67. Available from: https://doi.org/10.1016/S0095-4543(21)00452-8

25. Prefeitura de Uberaba. Consulta sepultados [Internet]. Consulta Sepultados. Brasil; 2023 [citado 01 de fevereiro de 2023]. 252 p. Available from: : http://servico.uberaba.mg.gov.br/cemiterio/cemiterio/sepultados.php

26. CNF Brasil. CNF Brasil [Internet]. Cadastro Nacional de Falecidos. Brasil; 2021 [citado 01 de fevereiro de 2023]. Available from: : https://www.falecidosnobrasil.org.br/

27. Wiggers E. Capacidade Intrínseca entre idosos do Estudo FIBRA [dissertação]. Ribeirão Preto (SP): Universidade de São Paulo; 2021.

28. Lee WJ, Peng LN, Lin MH, Loh CH, Hsiao FY, Chen LK. Intrinsic capacity differs from functional ability in predicting 10-year mortality and biological features in healthy aging: results from the I-Lan longitudinal aging study. Aging (Albany NY). 2023;15(3):748–64. Available from: https://doi.org/10.18632/aging.204508

29. Yu R, Lai ETC, Leung G, Ho SC, Woo J. Intrinsic capacity and 10-year mortality: Findings from a cohort of older people. Exp Gerontol. 2022;167:111926. Available from: https://doi.org/10.1016/j.exger.2022.111926

30. Zhang N, Zhang H, Sun MZ, Zhu YS, Shi GP, Wang ZD, et al. Intrinsic capacity and 5-year late-life functional ability trajectories of Chinese older population using ICOPE tool: the Rugao Longevity and Ageing Study. Aging Clin Exp Res. 2023;35:2061–8. Available from: https://doi.org/10.1007/s40520-023-02489-6

31. Gonzalez-Bautista E, Llibre-Guerra JJ, Sosa AL, Acosta I, Andrieu S, Acosta D, et al. Exploring the natural history of intrinsic capacity impairments: longitudinal patterns in the 10/66 study. Age Ageing. 2023;52(7):1–9. Available from: https://doi.org/10.1093/ageing/afad137

32. Lu F, Liu S, Liu X, Li J, Jiang S, Sun X, et al. Comparison of the predictive value of intrinsic capacity and comorbidity on adverse health outcome in community-dwelling older adults. Geriatr Nurs. 2023;50:222–6. Available from: https://doi.org/10.1016/j.gerinurse.2023.02.001

33. Zhou J, Chang H, Leng M, Wang Z. Intrinsic capacity to predict future adverse health outcomes in older adults: a scoping review. Healthcare (Basel). 2023;11(4):450. Available from: https://doi.org/10.3390/healthcare11040450

34. Ma L, Chhetri JK, Zhang L, Sun F, Li Y, Tang Z. Cross-sectional study examining the status of intrinsic capacity decline in community-dwelling older adults in China: prevalence, associated factors and implications for clinical care. BMJ Open. 2021;11(1):e043062. Available from: https://doi.org/10.1136/bmjopen-2020-043062

35. Rao AR, Waris M, Saini M, Thakral M, Hegde K, Bhagwasia M, et al. Prevalence and factors associated with impairment in intrinsic capacity among community-dwelling older adults: an observational study from South India. Curr Gerontol Geriatr Res. 2023;2023:e4386415. Available from: https://doi.org/10.1155/2023/4386415