DOI: http://dx.doi.org/10.23925/2176-901X.2021v24i1p329-349

Association between frailty and dual sensory loss: hearing and vision*

Asociación entre fragilidad y pérdida sensorial double: audición y visión

Associação entre fragilidade e dupla perda sensorial: auditiva e visual

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ABSTRACT: Dual sensory loss (DSL) refers to the presence of both hearing- and vision-loss. The objective of this study was to explore the link between frailty and DSL in older adults. This cross-sectional study was conducted in a public health rehabilitation center with one hundred seven older adults Participants with hearing loss had significantly higher levels of frailty scores (p =0.014). We observed that the variable frailty had a statistically significant association with hearing loss, glaucoma, male older adults and cognitive decline a risk factor for frailty in older adults.

Keywords: Comorbidity; Aging; Rehabilitation.

***RESUMEN**: La pérdida sensorial dual (DSL) se refiere a la presencia de pérdida de audición y visión. El objetivo del presente estudio fue explorar el associacion entre la fragilidad y el DSL en adultos mayores. Este estudio transversal se llevó en un centro de rehabilitación de salud pública con ciento siete adultos mayores. Los participantes con pérdida auditiva tuvieron niveles significativamente más altos de puntuaciones de fragilidad (p = 0,014). Se observó que la variable fragilidad tenía una asociación estadísticamente significativa con la pérdida de audición, glaucoma, adultos mayores masculinos y el deterioro cognitivo un factor de riesgo de fragilidad en los adultos mayores.*
***Palabras clave**: Comorbilidad; Envejecimiento; Rehabilitación.*

***RESUMO**: A dupla perda sensorial (DPS) refere-se à presença tanto da perda de audição quanto da visão. O objetivo do presente estudo foi explorar a associação entre fragilidade e DPS em idosos. Este estudo transversal foi realizado em um centro de reabilitação em saúde pública com 107 idosos. Os participantes com perda auditiva apresentaram níveis significativamente maiores de escores de fragilidade (p =0,014). Observou-se que a variável fragilidade apresentou associação estatisticamente significante com perda auditiva, glaucoma, idosos do sexo masculino e declínio cognitivo, como fator de risco para fragilidade em idosos.*
***Palavras-chave**: Comorbidade; Envelhecimento; Reabilitação.*

Introduction

There are expected changes in auditory and visual abilities that are associated with the ageing process (Kricos, 2007; Wittich, & Gagné, 2018). Thus, it is common for older adults to have hearing and/or visual impairments (Guthrie, *et al*., 2016).

Dual sensory loss (DSL) refers to the presence of both hearing and vision loss, and can vary in its time of onset (congenital or acquired), severity or order of onset *(*Wittich, *et al*., 2013).

In this study we focused on those difficulties experienced by older adults who have acquired hearing and vision loss associated with age-related changes and pathologic conditions. Its definition can be based on observable performance thresholds (e.g., distance visual acuity > 20.40 or pure-tone average audiograms of > 25 dB hearing level (Kiely, *et al*., 2013), or can be defined by the resulting levels of functioning, as measured in its effects on access to information or the ability to live independently (Center for Welfare and Social Issues, 2016).

According to the Center for Disease Control and Prevention (2005), the prevalence of older adults reporting DSL is approximately 17%. According to the World Federation of the Deafblind (2018), the prevalence of persons with combined vision and hearing impairment ranges between 0.2 and 2% of the population, depending on the country, and increases substantially with older age, to as high as 5-35 %, depending on the group. The prevalence of DSL is expected to increase because the population of most developed countries is aging. In Brazil, an exploratory, cross-sectional study was performed carried out with 314 non-institutionalized elderly people linked to a chronic disease management program sponsored by a health plan operator located in the city of São Paulo. The results demonstrated that advanced age was an important predictive factor for the appearance of sensory losses, especially Dual Sensory Loss and having a previous hearing or visual loss increases the risk of their development (Garcia, *et al*., 2021).

Extensive literature is available on how DSL diminishes communication and well-being (Heine, & Browning, 2015), causes social isolation, depression, reduced independence (Kiely, *et al*., 2013), increases the risk of mortality (Gopinath, *et al*., 2013) and cognitive impairment in older adults (Schneider, *et al*., 2011). Moreover, poor self-rated health (Jardim, *et al*., 2010), decreased ability to perform instrumental activities of daily living (Raina, *et al*., 2004; Grue, *et al*., 2009), functional decline (Lin, *et al*., 2004), mobility decline (Viljanen, *et al*., 2012), increased risk of falls (Grue, *et al*., 2009; Kulmala, *et al*., 2009) are also reported.

However, little is known about the association between frailty and DSL, as it may affect optimal rehabilitation in older adults with DSL. Frailty is a major public health concern, especially among older adults aged > 65 years in both Asian and Western populations, where over half are either pre-frail or frail (Fried, *et al*., 2004).

A systematic review and meta-analyses demonstrated clear cross-sectional associations of Vision loss (VL) and Hearing loss (HL) with pre-frailty and frailty (Tan, *et al*., 2020). Longitudinal studies included in this systematic review further suggest that VL and HL are risk factors for frailty. These findings are an important contribution to the management of frailty in older adults and emphasize sensory loss as an important new dimension in managing this multi-faceted syndrome.

Wittich, *et al*. (2012) reported on the sensory and demographic characteristics of population with DSL across three rehabilitation agencies in Montréal, whereby 69.1% were over the age of 65 years, and 43% of the sample being over the age of 85 years. The study showed that the large majority of this client group had residual vision and hearing that could be maximized in the rehabilitation process in order to restore functional abilities and social participation. Given this potential, multidimensional assessment is important to ensure effective rehabilitation of older adults with DSL, in addition to increasing our knowledge about the psychosocial impact of this combined impairment on the quality of life of older adults. Several studies have aimed to met the urgent need for evidence-based protocols and interventions in sensory rehabilitation (Vreeken, *et al*., 2013). However, until now, little attention has been paid to the development and evaluation of interventions for the vulnerable group of DSL patients who represent an urgent research priority (Kiessling, *et al*., 2003).

Thus, this study aimed to verify if there is an association between frailty and dual sensory loss in older adults.

Methods

This cross-sectional study was approved by the Ethical Review Committee of the Pontifical Catholic University of Sao Paulo, Brazil (# CAEE: 43831015.1.0000.5482).

Participants

One hundred seven older adults with vision and/or hearing loss, between the ages of 60 to 92 years participated in the study. All of them were clients of a public rehabilitation center in Sao Paulo, Brazil, and spoke Portuguese as their first language.

Individuals self-reporting neurological disease, cognitive deficits or those using a wheelchair were excluded (they could not perform some tests of the proposed evaluation). Participants were informed concerning the purpose of the study, and then provided informed written consent.

Materials

The following health outcomes were administered on the following order:

Hearing Variables. All participants completed an audiological evaluation. The sample selection and evaluation procedures occurred in a sound-proof room, meeting specifications for permissible ambient noise (ISO 8253-1 1989) at the Rehabilitation Center. Participants exhibited no visible alterations of the ear canal and tympanic membrane under otoscopic examination. Tympanograms were obtained in all participants (Jerger, 1970). Acoustic reflexes were obtained at 500, 1000 and 2000 Hz on both ears, and pure-tone audiometry (PTA) was conducted in both ears. Each participant presented with pure-tone thresholds at each octave frequency from 0.25 to 8 kHz (including 3 and 6 kHz) worse than the 25 dB HL. Classification of the audiograms based on the degree of hearing loss was performed in accordance with Lloyd and Kaplan (1978) which described: pure-tone average (0.5-2kHz) < 25 dB HL (normal); 26-40 dB HL (mild); 41-55 dB HL (moderate); 56-70 dB HL (moderately severe); and 71-90 B HL (severe).

Visual Variables. Best-corrected high contrast distance acuity was measured by an ophthalmologist in the rehabilitation center. Cataract was defined as the presence of nuclear, cortical, or posterior subcapsular opacity at least in one eye with a best-corrected visual acuity of less than one eight of lens circumference (Yoon, *et al*., 2011).

Functional Variables. The *Avaliação Multidimensional da Pessoa Idosa*/AMPI [Multidimensional Assessment of the Elderly Person] (MS, 2006), was developed to prepare health professionals for the application of screening tests and evaluation of functional capacity in the elderly in Brazil. In 2006, the National Health Policy of the Elderly was established through a protocol of functional evaluation of the elderly. It is composed of 17

questions about health, diseases, sensory disorders, mobility and independence. Each question is scored as No (0) or Yes (1), and a total score is calculated, resulting in the following classification: 0-5 points = healthy elderly; 6-10 points = pre-fragile elderly, > 11 points = fragile elderly.

The *Katz Index of Independence in Basic Activities of Daily Living (ADL)* (Katz, 1983) is a combination of self-report and performance-based measures to perform basic activities including personal care, mobility, and eating. Clients were scored yes/no for independence in each of the six functions (bathing, dressing, toilet, transference, continence, feeding). A score of 6 indicates full function (patient independent), while 4 indicates moderate impairment, and 2 or less indicates severe functional impairment (patient very dependent).

The *Lawton scale of Instrumental Activities of Daily Living (IADL)* (Lawton, & Brody, 1969). This scale measures eight activities: preparing meals, doing housework, washing clothes, handling money, using the telephone, taking medications, shopping, and using transportation. Participants were asked to answer questions such as: "Are you able to prepare your meals? Are you able to take your remedies properly? Are you able to shop? Are you able to track your money or finances? Are you able to use the phone? Are you able to clean your home or do small housework? Are you able to wash and iron your clothes? Are you able to leave home alone to more distant places, using some transportation, without the need for special planning?". For each item, the scoring by the evaluator indicated independence (1 Point) if the task was completed without supervision, direction or personal assistance. Dependence (0 Points) was scored if the task was completed with supervision, direction, personal assistance or total care.

The *Timed Up and Go (TUG)* predicts falls and was used to screen for fall risk (Woellner, Araújo, & Martins, 2014). It measures, in seconds, the time taken by an individual to stand up from a standard arm chair (approximate seat height of 46 cm, arm height 65 cm), walk a distance of 3 meters (approximately 10 feet), turn, walk back to the chair, and sit down. Healthy older adults usually complete the task in 10 seconds or less. A score of more or equal to 14 seconds has been shown to indicates a high risk of falls (Podsiadlo, & Richardson, 1991). A practice trial was completed before the timed trial; the patient started

in a seated position, then stood up upon the therapist's command, walked 3 meters, turned around, walked back to the chair and sat down. The time stopped when the patient was seated. A piece of tape was placed on the floor 3 meters away from the chair so that it was easily seen by the participant. They were asked to pay attention to this instruction: "On the word 'GO' you will stand up, walk to the line on the floor, turn around and walk back to the chair and sit down. Walk at your regular pace." The researcher start timing on the word 'GO' and stopped timing when the participant was seated again correctly in the chair with their back resting on the back of the chair.

The *Geriatric Depression Scale* (Sheikh, & Yesavage 1986) was administered in its Short Form. Participants were asked to answer 15 questions with Yes or No regarding how they felt in the last week, with items such as: Have you dropped many of your activities and interests? One point was scored for each positive answer. According to the authors, a scores of > 5 points is suggestive of depression, and a total score ≥ 10 points is almost always indicative of severe depression and should be referred to a follow-up (Fountoulakis, *et al*., 1999)

The *Mini Mental State Examination (MMSE*) is a 30-point questionnaire that is used extensively in clinical and research settings to screen for cognitive impairment. The cut-off note proposed by Brucki, *et al*. (2003) was used = 20 points for illiterates; 25 points for people with education from 1 to 4 years; 26.5 for 5 to 8 years; 28 for those aged 9 to 11 and 29 to over 11 years, considering the recommendation of using the highest cut scores (Herrera, *et al*., 2002) Administration of the test took between 15 and 20 min and examined functions including repeating named prompts (3 points), attention and calculation (5 points), recall (3 points), language (8 points), ability to follow simple commands (5 points), temporal orientation (5 points) and visual constructive capability (1 point). The materials were not adapted for low vision or for hearing loss but none of the participants expressed difficulties to see the form or to hear the information. The MMSE was performed in the second and last session after establishing a good rapport with the participant, in a closed room without interruption. The participants were asked to answer each question. A score was calculated for each category and added to the evaluation of the cut-off score, according to the level of education indicated by the participant.

Procedures

An audiologist conducted all assessments with the exception for the visual acuity measurement that was completed by an ophthalmologist. Participants attended two sessions of 2 hours each with one week interval.

There were no costs associated because the multidimensional evaluation was incorporated into the clinical care that existed in the rehabilitation center. In the first session, the structured AMPI interview was administered face-to-face in a quiet room, at times in the presence of a family member.

Statistical analyses

This study was developed based on the data of 107 older adults, who were divided into groups according to the variables being analyzed. The analyses were made considering the variable "frailty" as the dependent variable of the study

The data were organized and processed with the Statistical Package for the Social Sciences (SPSS®).

Considering the purposes of this research and aiming to better interpret the results to be obtained, the variables used here were converted into dichotomic variables – i.e., having only two possible answers. Firs, the chi-square test was applied for independence, and Fisher's exact test, when convenient, as they make it possible to verify the dependence relationship between qualitative variables.

Results

Descriptive analysis

Initially, the study encompassed 21 variables of which one dependent variable refers to the condition of frailty. A total of 107 older adults participated in the study. They were aged 60 to 95 years (mean = 72 years; standard deviation: 8.28); of these, 55 (51.4%) were

men, and 52 (48.6%), women. As for the use of medications, 63 (58.9%) of these older adults took four medications per day at the most, and 44 (41.1%) took more than four medications.

Regarding their self-perception of health, 62 (57.9%) of those interviewed considered their health very good/good, while 45 (42.1%) considered it average/poor/very poor. Only 11 (10,3%) of those assessed had chronic diseases; 45 (42.1%) had poor oral health; 44 (41.1%) had been hospitalized; 40 (37.4%) had signs of weight loss; 48 (44.9%) presented symptoms of mild depression; 59 (55.1%) had cataract; 11 (10.3%) had glaucoma; and 74 (69.2%) presented signs of pre-frailty or frailty.

Regarding auditory acuity 67 (62.6%) patients have hearing loss which is the same number of patients who have vision loss. When patients who have both limitations are observed, 42 (39.3%) are affected by dual sensory loss.

Concerning the performance in the BADL, 98 (91.6%) of the older adults were independent; however, observing their performance in ~~the~~ IADL, the number of older adults who can independently perform their activities drops to 64 (59.8%). Concerning the risk of falls, assessed with the Timed "Up and Go" test, 40 (37.4%) of the older adults registered a test time above 13.5 seconds, which indicates mobility difficulties and risk of potential falls. Also, in the MMSE cognition test, 64 (59.8%) of the older adults tended to have cognitive deficits.

Tables 1 shows the association between the frailty of older adults with the functional capacity variables. Along with this information, the respective p-values are also presented, resulting from the independence tests, which make it possible to verify whether there is a significant relationship between the dependent variables and those related to the functional capacity of the older adults assessed. In the same table it is observed that the variable frailty had a statistically significant association with adult´s sex, hearing loss and glaucoma.

Table 1. Functional capacity variables and p-values for the group of older adults with and without frailty.

Variable	Classification	Frailty		p-value
		Older Adult without Frailty	Older Adult with Frailty	
Sex	Male Female	10 (9,3%) 21 (19,6%)	45 (42,1%) 31 (29,0%)	**0,011***
Age Group	60 to74 years 75 or >	17 (15,9%) 14 (13,1%)	45 (42,1%) 31 (29,0%)	0,678
Self-perception of health	Very good/good Average/poor/very poor	15 (14,0%) 16 (15,0%)	47 (43,9%) 29 (27,1%)	0,201
Chronic Disease	No Yes	2 (1,9%) 29 (27,1%)	9 (8,4%) 67 (62,6%)	0,405
Daily Medications	1 – 4 >5	19 (17,8%) 12 (11,2%)	44 (41,1%) 32 (29,9%)	0,830
Previous Hospitalization	No Yes	22 (20,6% 9 (8,4%)	41 (38,3%) 35 (31,3%)	0,105
Depression	No Yes	19 (17,8%) 12 (11,2%)	40 (37,4%) 36 (33,6%)	0,414
Cognitive decline	No Yes	8 (7,5%) 23 (21,5%)	35 (32,7%) 41 (38,3%)	0,053
Poor Oral Health	No Yes	22 (20,6%) 9 (8,4%)	40 (37,4%) 36 (33,6%)	0,081
ABVD[1]	Independent Dependent	27 (25,2%) 4 (3,7%)	71 (66,4%) 5 (4,7%)	0,279
AIVD[2]	Independent Dependent	16 (15,0%) 15 (14,0%)	48 (44,9%) 28 (26,2%)	0,269
Falls	No Yes	15 (14,0%) 16 (15,0%)	42 (39,3%) 34 (31,8%)	0,531
Incontinence	No Yes	22 (20,6%) 9 (8,4%)	61 (57,0%) 15 (14,0%)	0,296
Weight Loss	No Yes	20 (18,7%) 11 (10,3%)	47 (43,9%) 29 (27,1%)	0,795

Vision Loss	No	12 (11,6%)	28 (26,2%)	0,856
	Yes	19 (17,8%)	48 (44,9%)	
Hearing Loss	No	6 (5,6%)	34 (31,8%)	**0,014***
	Yes	25 (23,4%)	42 (39,3%)	
Time up Go (risk of falls)	No	25 (23,4%)	62 (57,9%)	0,911
	Yes	6 (5,6%)	14 (13,1%)	
Cataract	No	12 (11,2%)	36 (33,6%)	0,414
	Yes	19 (17,8%)	40 (37,4%)	
Glaucoma	No	31 (29,0%)	65 (60,7%)	**0,031***
	Yes	0 (0,0%)	11 (10,3%)	
Dual Sensory Loss	No	16 (15,0%)	49 (45,8%)	0,217
	Yes	15 (14,0%)	27 (25,2%)	

Legend: BADL: basic activities of daily living; IADL: instrumental activities of daily living
* Significant at the 5% significance level (p-value < 0.05).
Source: The author, 2020.

Factorial analysis

After individually verifying which independent variables had a statistically significant association with the variable frailty, the next step was to assess with the factorial analysis the intercorrelation between these independent variables to transform them into new synthesized variables with equivalent dimensions: the factors. This transformation into another set of variables is done with the least possible loss of information.

Table 2 presents the factors that resulted from the analysis. Considering the Kaiser criterion, the first six components/factors whose self-values were higher than or equal to 1 were retained. Together, these six factors came to 68,13% of the information contained in the original data.

Table 2: Variance explained and accumulated throughout the components/factors

Componente/Fator	Autovalor	Explicação (%)	Explicação acumulada (%)
CP1	3.29	16.43	16.43
CP2	2.63	13.16	29.59
CP3	2.35	11.76	41.35
CP4	1.57	7.84	49.19
CP5	1.38	6.90	56.08
CP6	1.27	6.36	62.44
CP7	1.14	5.68	68.12
CP8	0.96	4.78	72.90
CP9	0.90	4.48	77.38
CP10	0.78	3.92	81.30
CP11	0.64	3.21	84.51
CP12	0.58	2.88	87.40
CP13	0.53	2.64	90.04
CP14	0.44	2.22	92.26
CP15	0.37	1.86	94.12
CP16	0.36	1.78	95.89
CP17	0.31	1.56	97.46
CP18	0.24	1.18	98.64
CP19	0.20	1.02	99.66
CP20	0.07	0.34	100.00

Source: The author, 2020.

After identifying the factors to be retained with the Kaiser criterion, the most representative variables within each factor were identified. This representativity is based on the factorial load of the original variables within the different factors. The higher the module value of the factorial load, the greater the discriminating power of the variable on the said factor.

In Table 3, the factorial loads of the variables are observed in relation to each of the six extracted factors, highlighting the greatest factorial load (in the module), and identifying with which factor the variable is most strongly related.

The communality is also presented. This is a measurement that assesses how well each variable is explained by the factors. The closer the communality value comes to 1, the better is the variable explained by the factors.

Table 3: Estimated factorial load and communality of each factor

Variables	Factorial Loads							Communality
	1	2	3	4	5	6	7	
Sex	-0.08	0.14	-0.15	-0.23	**-0.62**	0.45	-0.23	0.73
Age Group	0.07	-0.03	0.04	0.10	-0.02	**0.71**	0.07	0.53
Self-perception of health	0.26	**0.55**	0.33	-0.11	-0.33	0.19	-0.13	0.66
Chronic diseases	**-0.17**	0.03	0.09	0.16	-0.8	-0.15	0.11	0.74
Medicaments	**-0.58**	0.12	0.09	0.21	-0.24	-0.15	-0.03	0.48
Hospitalizations	-0.13	-0.37	0.01	0.40	-0.18	**-0.53**	0.10	0.64
Depression	**-0.61**	0.22	-0.12	-0.21	0.01	-0.22	-0.13	0.55
Cognitive Decline MEEM[3]	-0.23	0.18	0.15	**0.70**	0.13	-0.09	0.17	0.65
Poor Oral Health	0.02	0.10	0.13	-0.07	-0.11	-0.25	**-0.85**	0.82
ABVD[4] Katz	-0.23	**0.67**	-0.03	0.01	-0.13	0.19	-0.08	0.56
AIVD[5] Lawton	**-0.64**	0.07	-0.22	-0.1	-0.42	0.14	-0.08	0.68
Falls	**-0.48**	0.27	0.18	0.00	-0.13	-0.16	0.09	0.38
Incontinence	-0.02	-0.17	-0.13	**0.73**	-.07	0.08	0.25	0.65
Weight Loss	-0.8	-0.17	**0.19**	-0.13	0.12	0.10	-0.03	0.75
TUG[6]	-0.18	**0.85**	0.01	0.08	0.06	-0.06	-0.03	0.78
Cataract	0.13	-0.01	0.40	0.05	-0.12	-0.23	**-0.67**	0.69
Glaucoma	-0.49	0.12	0.01	0.48	0.09	0.19	**-0.52**	0.80
Hearing loss	0.12	**0.50**	0.41	-0.36	0.01	0.37	0.12	0.71
Vision Loss	-0.30	-0.14	**0.82**	0.26	-0.02	-0.15	0.06	0.87
Dual sensory Loss	0.02	0.24	**0.90**	-0.18	0.03	0.19	0.01	0.95
Self-value	3.29	2.63	2.35	1.57	1.38	1.27	1.14	
Explanation (%)	16.43	13.16	11.76	7.84	6.90	6.36	5.68	
Accumulated Explanation (%)	16.43	29.59	41.35	49.19	56.08	62.44	68.12	

Legend: MMSE: mini-mental state examination; BADL: basic activities of daily living; IADL: instrumental activities of daily living ; TUG : Time up Go

Source: The author, 2020.

With this identification, the factors can be interpreted as follows:

CP1: Older adults who do not have chronic diseases, that did not take medications, did not present signs of depression, were classified as independent in Lawton's IADL, and did not have falls.

CP2: Older adults with average/poor/very poor self-perception of health, assessed as partially or totally dependent in Katz's BADL, with risk of falls in TUG and with hearing loss.

CP3: Older adults with weight loss, visual loss and dual sensory loss

CP4: Older adults with signs of cognitive decline and incontinence;

CP5: Male older adults.

CP6: Older adults aged 60 to 74 years, with chronic diseases, have not already been hospitalized.

CP7: older adults without poor oral health, who do not suffer from cataracts and glaucoma.

Table 4. The descriptive summaries of the models formulated for each of the sensory variables according to the logistic regression model – frailty

Variables	**Estimates**	**Stand error**	**Odds ratio**	**p-value**
Intercept	1.098	0.254	**3.000**	**0.000***
CP4	0.647	0.261	1.910	0.013*
CP5	0.549	0.276	1.731	0.047*
CP7	-0.546	0.255	0.580	0.032*

* Significance 5% (p-value< 0,05).
Source: The author, 2020.

Discussion

We observed that 69.2% (N=74) of the sample was considered pre-fragile or fragile. Among the group of fragile patients 42 (57%) have hearing loss and 48 (75%) presented vision loss. Compared to the non-fragile group (n=33) we found that 25 (75%) presented hearing loss and 19 (58%) a vision loss. Dual sensory loss was reported in 27 (36%) patients of the fragile group and in 15(45%) of the non- fragile group. Even more interesting was the observation that in the both group the number of people with no kind of sensory loss is lower than the number of people with one or two sensory loss.

According to Tan, *et al*. (2020) hearing and visual loss in older age are frequent conditions as we found in this study. The authors proposed a novel phenotype called "sensorial frailty" in order to be included in many models of frailty and related diagnostic tools.

Frailty may be a predictor of adverse outcomes, such as falls, increased use of healthcare services, additional health conditions, institutionalization, impairment, negative impact on quality of life, mortality, and its prevalence is particularly relevant for the field of public health. Markle-Reid and Browne (2003) emphasized that the concept of frailty in older adults should be multi-dimensional, covering physical, psychological, social and environmental factors. In this study, the frailty index was constructed using the AMPI – a multidimensional approach assessment that includes sensorial, physical, functional and psychological factors. It is interesting to note that participants with hearing loss had significantly higher levels of fragility scores compared to those with vision loss only or dual sensory loss.

According to Fried, *et al*. (2004), the challenge to the physician and to the healthcare system generally, in caring for these complex patients, should not be underestimated. We argue that rehabilitation of frail older adults with hearing loss and visual loss presents special challenges. Recognizing the value of measuring frailty may benefit the patient and the healthcare system alike. By identifying frail individuals with DSL, we could increase patient-centered care and have a more efficient and effective healthcare system. It could lead to more targeted assessments for people who need them and end the unnecessary assessments of

severely frail people. Therefore, sensorial frailty evaluation can assist clinicians in identifying patients who might benefit more from innovative processes of care than from aggressive medical treatments. Also, clinicians can use the information from the frailty assessments to discuss the risks and benefits of possible treatments with patients and caregivers, which can lead to a more informed and rational shared decision.

The important thing to notice in our study is that the logistic regression analyses indicates that male older adults with poor oral health were more likely to have frailty. Results from this research mirror previous findings. The Population-Based Cohort Study of Older British Men demonstrated that having fair to poor self-rated oral health, difficulty eating, dry mouth, and more oral health problems were associated with greater likelihood of being frail (Ramsay, *et al.*, 2018).

In addition a systematic review from three countries (Mexico, Japan, and UK) identified significant longitudinal associations between oral health indicators and frailty that highlight the importance of oral health as a predictor of frailty in older age (Faisal, & Sabbah, 2019). This suggests a need for further research exploring the role of nutrition as a mediator of the relationship between oral health and frailty.

Analyzing the functional capacity variables and p-values for the group of older adults with and without frailty, we found tha*t* there is a significative value between the two groups for the following variables: sex (p=0,011), hearing loss (p=0,014) and glaucoma (p=0,031). In this study hearing loss was also a significant marker for frailty. "Sensory frailty" may represent a possible condition of intervention and a possible target for secondary prevention of cognitive impairment in older age, social isolation, late-life depression, and frailty (Tan, *et al*., 2020).

Regarding the frailty, the odds ratio of CP4 indicates that older adults that had a cognitive decline and urinary incontinence were 1.91 times more likely to have a frailty compared with older adults with opposite characteristics. The odds ratio of CP5 indicates that male older adults were 1,73 times more likely to have frailty when compared with female older adults. The odds ratio of CP7 indicates older adults with poor oral health, with cataract and glaucoma were 1,72 times more likely to have ~~a~~ frailty compared with older adults with opposite characteristics.

In order to facilitate the interpretation of the odds ratio of CP7 (older adults without poor oral health, who do not suffer from cataracts and glaucoma.) the component profile and the value of the odds ratio were inverted by the statistical analysis.

Our results also indicated a significant association between visual impairment such as cataract and glaucoma and frailty. Theses results are consistent with research conducted at Jonhs Hopkins School of Medicine that investigated the association between visual impairment and frailty (Swenor, *et al*., 2020).

Ocular diseases such as glaucoma that are severe enough to cause visual impairment may severely reduce the quality of life. Hearing loss also impairs the quality of life of the older adults, and the problem is even greater if the dual senses are lost. Thus, the identification of common risk factors of these multiple disorders might lead to the development of effective preventive interventions.

Our findings support the hypothesis that older adults that had a cognitive decline were more likely to have a frailty condition compared with older adults with opposite characteristics. This connects to recent studies of epidemiological evidence suggests that frailty may increases the risk of future cognitive decline and dementia and that cognitive impairment may increase the risk of frailty, suggesting that cognition and frailty may interact in advanced aging. Therefore, through frailty prevention, it may be also possible to prevent cognitive-related adverse outcomes. This is a controversial question.

In order to answer the question, two longitudinal population-based studies were conducted. The first was a 6-year follow-up period, showing that no impact of sensory intervention (cataract surgery or hearing aids) on cognitive measures and cognitive decline rates were not significantly attenuated in individuals using hearing aids than those without hearing aids (Valentijn, *et al*., 2005). The other one, a recent population-based study with a 25-year follow-up suggested that the treatment of Age Related Hearing Loss with hearing aids may attenuate cognitive decline, suggesting some long-term protective effects of hearing aids on cognitive decline (Amieva, Ouvrard, & Giulioli, 2015).

The multidimensional nature of frailty required an approach based on different pathogenesis because this clinical condition may include sensorial, physical, social, nutritional, cognitive, and psychological phenotypes (Panza, *et al*., 2019).

Limitations

The results need to be considered with certain limitations in mind. Even though this study enrolled 107 participants, our analyses were limited by relatively small samples in each category of impairment. The limitations of this research are related to the cross-sectional study and the impossibility of adopting a probabilistic sample. In addition, older adults with self-reported neurological disease, cognitive deficits or those using a wheelchair were excluded, limiting our ability to generalize our findings to persons with more complex health characteristics due to the characteristics of AMPI. Finally, the specifics of healthcare provision in Brazil may not allow general access to equal levels of care across all strata of society. Therefore, the outcomes reported here may be unique to individuals that had access to service in this study context.

Conclusion

Our findings indicate that there is no association between frailty and dual sensory loss in older adults. These results also show that frailty was associated with a single loss: hearing loss, or visual loss, especially with glaucoma. In this study participants with hearing loss had significantly higher levels of fragility scores compared to those with vision loss only or dual sensory loss. There are some other factors that we think it will be important to be emphasized: male older adults living with vision and hearing impairment, self-report poor oral health, experience incontinence, cognitive decline are more likely to be frail. The authors recommend to professionals who work with older adults to apply the AMPI – Multidimensional Assessment of the Elderly Person in order to better understand the older adult that is in a healthcare unit, It is important to notice that any outcomes may have great clinical relevance for care delivery in this vulnerable population. More research is needed to determine resilience and functional capacity in fragile older adults and identify barriers and facilitators that may affect optimal rehabilitation in this population, to optimally facilitate their quality of life, independence and ability to participate in society.

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Recebido em 18/02/2021
Aceito em 30/03/2021

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* **Source of support**: This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, Brasil (CAPES) - Finance Code 001.

Conflict of interests: The authors declares is no conflict of interest.