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Association between visual deficit and clinical-functional characteristics among community-dwelling older adults

Associação entre déficit visual e aspectos clínico-funcionais em idosos da comunidade

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Abstract

Objective: To identify functional factors associated with visual deficits among community-dwelling older adults. **Methods:** Ninety-six older adults were assessed for visual acuity by means of the Snellen Eye Chart and categorized as low vision (visual acuity < 0.3) or normal vision (visual acuity ≥0.3). The functional factors analyzed were the number of falls, presence of eye diseases, mental health according to the Geriatric Depression Scale (GDS), functional status in daily activities according to the Brazilian OARS Multidimensional Functional Assessment Questionnaire (BOMFAQ) and functional mobility according to the Timed Up & Go Test (TUG). Inferential analysis was performed using the chi-square test, Mann-Whitney test and Spearman correlation coefficient, taking α=0.05. **Results:** Low vision was found in 17.7% (n=17) of the older adults. Compared to the older adults with normal vision, those with low vision had more advanced age (p<0.001) and more eye and adnexa diseases (p=0.023), higher scores for depressed mood (p=0.002), worse balance in the TUG (p=0.003) and higher numbers of impaired instrumental activities of daily living (p=0.009). Lower visual acuity was correlated with more advanced age, greater number of falls, greater number of impaired activities and longer time spent on the TUG. **Conclusions:** The visually impaired older adults in this sample showed greater functional impairment. The data from the present study will contribute to the development of physical therapy assessments that can identify functional limitations among visually impaired older adults and thus establish a better therapeutic plan for resolving the daily difficulties of these individuals.

Key words: visual acuity; low vision; activities of daily living; mobility limitation; older adult.

Resumo

Objetivo: Identificar os fatores funcionais associados com o déficit visual em idosos da comunidade. **Métodos:** Foram avaliados 96 idosos quanto à acuidade visual por meio da tabela direcional de Snellen e categorizados em relação à baixa visão (acuidade visual <0,3) e visão normal (acuidade visual ≥0,3). Os fatores funcionais analisados foram: número de quedas, presença de doenças visuais, saúde mental, pela *Geriatric Depression Scale* (GDS), funcionalidade nas atividades diárias pelo *Brazilian OARS Multidimensional Functional Assessment Questionnaire* (BOMFAQ) e a mobilidade funcional pelo *Timed Up & Go Test* (TUG). A análise inferencial foi realizada por meio dos testes Qui-Quadrado, Mann-Whitney e Coeficiente de Correlação de Spearman, considerando α=0,05. **Resultados:** Apresentaram baixa visão 17,7% (n=17) dos idosos. Em relação aos idosos com visão normal, os idosos com baixa visão apresentaram idade mais avançada (p<0,001), maior número de doenças de olho e anexos (p=0,023), maiores pontuações para humor deprimido (p=0,002), pior equilíbrio no TUG (p=0,003) e maior número de atividades instrumentais de vida diária comprometidas (p=0,009). Na análise de correlação, quanto menor a acuidade visual, maior a idade, o número de quedas, o número de atividades comprometidas e o tempo no TUG. **Conclusões:** Os idosos com déficit visual desta amostra exibiram maior comprometimento funcional. Os dados deste estudo contribuem para a elaboração de uma avaliação fisioterapêutica voltada aos aspectos que possam identificar as limitações funcionais dos idosos com déficit visual e, consequentemente, estabelecer um plano terapêutico mais direcionado a sanar as dificuldades no cotidiano desses idosos.

Palavras-chave: acuidade visual; baixa visão; atividades cotidianas; limitação da mobilidade; idoso.

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Introduction

The decline in the visual function of older adults is a source of concern in public health[1]. Despite its high prevalence[2], most older adults do not mention complaints about vision because they consider this deficit typical of old age[2,3]. Thus, visual deficit in older adults goes under-detected in clinical practice[2]. In the visual system, the impairment can occur in a cumulative and progressive manner through metabolic and environmental damage, which characterizes the close relationship between vision and senescence[3]. Associated with physiological changes that occur in vision due to aging, chronic eye diseases corroborate the decline in the visual function of older adults[4].

Visual impairment is usually defined by the value of visual acuity, which is part of an individual's functional vision[4]. Visual acuity is the parameter that gives the most general expression of the ability to distinguish shapes and contrasts. It also measures the ability to judge the distance between two points in space and the resolution of their images on the retina[5]. It is the best value to characterize visual loss[2], and it is considered the criterion for defining visual impairment by the World Health Organization (WHO)[6].

An important factor associated with the difficulty of older adults in performing activities of daily living (ADLs) is visual deficit[7-9]. The limitation of social participation and activities that older adults wish to or need to perform leads to decreased quality of life[7], which links the presence of vision impairment in older adults to high rates of depression[8]. Furthermore, the safe execution of ADLs is largely dependent on balance, with higher degrees of visual deficit associated with greater postural instability[10,11]. Falls are attributed, at least in part, to the decline in the ability of older adults to extract relevant information from the environment to stabilize[12] and compensate for body imbalance[13,14].

Older adults with visual impairment tend to exercise less and have consequent loss of muscle strength, functionality and balance[12], making them a target population for physical therapy care. It is important to understand why this happens in this population to define strategies for effective intervention to maintain function and quality of life. However, to define these strategies, it is necessary to investigate the relationship between low vision and functional capacity. Factors related to functionality can be recognized by direct and indirect measures. The direct measures are based on the quality of execution in physical performance tests, while the subjective or indirect measures consist of self-reported data to identify the perception of physical function. In older adults, the direct measures usually point out more limitations than do the indirect measures[15], which shows that older adults often do not perceive a certain difficulty in daily activities as functional impairment.

However, this triad of physical therapy, function and visual impairment is little studied. It is necessary to investigate the relationship between vision and clinical and functional characteristics to understand the difficulties inherent to visual deficits associated with aging. Thus, the present study aims to identify functional factors associated with visual impairment among community-dwelling older adults.

Methods

A descriptive analytical study was conducted by means of cross-sectional quantitative research. This research was previously approved by the Research Ethics Committee of the Faculty of Medical Sciences (FCM) of Universidade Estadual de Campinas (UNICAMP), protocol number 766/2005. The convenience sample was composed of 96 community-dwelling older adults in the city of Amparo, located in the state of São Paulo. To select participants according to the inclusion and exclusion criteria, we performed a query of the database of a population survey on aging that included the registry of older adults at the city's Family Health Units.

The inclusion criteria were: age equal to or greater than 65 years and no use of walking aids. Exclusion criteria were: sensory and physical limitations that were completely incapacitating for ADLs, cognitive impairment (inability to understand and answer a simple verbal command and mimic movements), blindness (visual acuity less than 0.1 on the Snellen Chart[10]), amputation or use of upper or lower limb prostheses, neurological sequelae, Parkinson's disease, lower limb or spinal fracture after age 65, severe coronary disease, severe labyrinthitis, diagnosed neuropathy and debilitating foot deformity. All participants were invited to participate in the study as volunteers and received information about the research and the basic procedures. Those who were willing to participate signed an informed consent form as recommended by Resolution 196/96 of the National Research Ethics Committee. Participants were submitted to the research protocol, which included sociodemographic data (gender, age, marital status and level of schooling) and clinical and functional data (number of falls, eye diseases, visual acuity, functional capacity, functional mobility and mental health).

The number of self-reported falls was relative to the past year. A fall was described as an unintentional event that resulted in a change of position from the individual's original position to a lower level not preceded by loss of consciousness or as a result of external forces, i.e. an inevitable accident[16]. The older adults were questioned on the presence of visual diseases during an interview, and the health records were analyzed. These diseases were classified as "Diseases of the Eye and Adnexa", a

category covered by the International Statistical Classification of Diseases (ICD)[17].

The assessment of visual acuity was performed by means of the Snellen E chart, a standardized measure for visual analysis[18]. This assessment is widely used because it can be understood by literate and illiterate individuals, and it is easy-to-use and low-cost[10]. The test is performed with the individual seated five meters from the chart, which is fixed to the wall at eye level of the assessed individual. The individual must state the direction that the letter "E" faces (up, down, right or left). The visual assessment can be made with each eye separately or both, with or without corrective lenses, depending on the purpose of the measurement. In the present study, the intention was to verify visual functionality, therefore the older adults were allowed to wear corrective lenses as usual, and both eyes were measured simultaneously.

The score is derived according to the last line in which all Es were read correctly. The value of visual acuity is described by the decimal value displayed on the side of each line of the chart. Some forms of description are the logarithmic description using the logMAR system[19] and the fractional description in meters (3/60) or feet (20/400)[6]. The equivalence between methods can be calculated by the standard equation [0.1 x test distance in meters/5], which provides the final value in decimal scores[10]. In the present study, values below 0.3 (or its equivalent fraction 20/60 and 6/18) are indicative of low vision, as adopted by several authors[1,6,20].

For the assessment of functional capacity, the Brazilian OARS Multidimensional Functional Assessment Questionnaire (BOMFAQ)[21] was applied. This is an easy-to-use instrument with cross-cultural validity to Brazil, which assesses self-reported difficulty in achieving eight ADLs and seven instrumental activities of daily living (IADLs). The assessed ADLs are: lying down and getting out of bed, eating, combing hair, walking on a level floor, bathing, dressing, going to the bathroom in time and trimming toe nails. The assessed IADLs are: climbing stairs, taking medication on time, walking close to home, shopping, preparing meals, taking a bus and cleaning the house. We used the total number of ADLs which the older adults had difficulty performing, the total number of IADLs in which older adults reported difficulty and the overall number of impaired activities (ADLs + IADLs).

For the evaluation of mental health, the instrument administered was the Geriatric Depression Scale (GDS)[22], translated and validated to Brazilian Portuguese[23]. The short version has 15 yes-no questions concerning the emotional state of patient during the week preceding the assessment. The cutoff point of 5/6 was considered the most appropriate to indicate the normal values and depression values, respectively[24]. For the functional mobility assessment, the Timed Up & Go Test (TUG) was used. Its performance is related to balance, gait and functional capacity in older adults[25]. It uses a chair and a stopwatch to measure the time it takes for the older adult to get up from a chair, walk three meters, turn, walk back to the chair and sit[25].

Participants were recruited by telephone or home visits to schedule the date and time for the assessment. The entire protocol was applied in a single day by three assessors (two physical therapists and a health agent) previously trained for test application. It lasted approximately one hour and took place in a quiet, well-lit room.

Statistical analysis

Descriptive data analysis was performed to characterize the sample. The Kolmogorov-Smirnov test was applied to verify the normal distribution of data. Due to the lack of normal distribution of the dependent variable, non-parametric tests were applied. The dependent variable of the study was visual acuity, used to characterize groups with normal vision (visual acuity ≥0.3) and low vision (visual acuity <0.3).

To compare the categorical qualitative variables with the dependent variable, the chi-square test was used. When compared with quantitative variables, the Mann-Whitney test was applied. The Spearman Correlation Coefficient was used to verify the correlation between the result of the Snellen chart and the remaining variables. Statistical analysis was performed with the software *Statistical Package for the Social Sciences* (SPSS) - version 10.0, with a significance level for statistical tests of 0.05 (5%).

Results

The total sample was composed of 96 community-dwelling older adult aged between 65 and 91 years with a mean age of 74.82 (±6.93) years. These older adults were equally distributed as to gender (50.0% female and 50.0% male), and 66.7% (n=64) of them were married, and 42.7% (n=41) had completed primary school. With regard to visual acuity, 82.3% of the older adults (n=79) had normal vision (visual acuity ≥0.3) and 17.7% (n=17) had low vision (visual acuity <0.3). There was no significant difference between male and female in relation to different groups of visual acuity. The presence of eye and adnexa diseases as well as higher scores on the GDS (indicative of depressive mood) were significantly higher in the group with lower visual acuity (<0.3) compared to the older adult group with normal vision (visual acuity ≥0.3) (Table 1).

Table 2 presents the results of the comparative analysis of visual acuity of older adults and age and functional variables.

Compared to the older adults without visual deficits, the older adults with low vision were older, had poorer mobility and a greater number of impaired IADLs. Only the total number of impaired ADLs was not statistically significant with respect to visual acuity (Table 2). Regarding the overall value of visual acuity by the Snellen chart, there was significant negative correlation with all the quantitative variables, as described in Table 3. All correlations were weak, with the exception of age which had a moderate correlation with visual deficits.

Discussion

The visual system is responsible for mediating part of the individual's motor learning[11]. This learning is a result of the integration between vestibular, proprioceptive and visual information by characterizing the external environment so that ADLs can be performed efficiently and with little effort[11]. There appears to be a cycle of disability surrounding visual deficit. Older adults with visual deficits have difficulty performing ADLs and walking safely outdoors, thereby tending to reduce participation and to isolate themselves socially. This, in turn, affects their mental and physical health[3,4]. The results of the present study revealed the perpetuation of this same cycle of factors associated with visual deficit.

The older adults of this study were aged over 65 years, characterized as older adults by WHO[8]. In this age group, the prevalence of eye diseases increases and contributes significantly to visual decline[3,8]. Regarding older adults of advanced age (75 years or more), the prevalence of low vision increases dramatically from 5.6% to 30.0%[20]. This relationship between age and eye disease is strengthened by the fact that the older adults with lower visual acuity in this sample had more diseases of the eye and adnexa and more advanced age than the older adults with normal vision. It is also important to mention that, of the variables correlated with the Snellen chart values, age had the highest correlation with visual deficit. It was also the most-cited factor in association with visual impairment [2,4,8-10].

In the current study, there was no significant difference between genders when comparing the groups with different visual acuity. However, more males had visual impairment, corroborating the findings of Romani[3]. According to the author, men have professions that are likely to expose them to visual conditions of greater risk[3]. According to Lee and Scudds[10], women have a 67% greater risk of developing visual impairment than men[20]. However, there is no consensus in the literature on the prevalence of visual impairment in relation to gender or ethnicity[26].

This study showed that older adults with greater visual impairment had higher scores in the GDS, confirming that age over 60 years and visual disability are factors associated with depression[8]. Hayman et al.[27] found that individuals with GDS scores indicative of depression had higher levels of physical and visual damage. Mental and physical health and visual

Table 1. Related characteristics of community-dwelling older adults categorized into visual acuity groups. Absolute and relative frequencies of data and comparative analysis.

Categories		Frequency n (%)		Chi-Square p value
		Visual Acuity ≥0.3	Visual Acuity <0.3	
Gender	Female	41 (51.9)	7 (41.2)	0.423
	Male	38 (48.1)	10 (58.8)	
Diseases of the eye and adnexa	Yes	13 (16.5)	7 (41.2)	0.023
	No	66 (83.5)	10 (58.8)	
GDS Score	0 to 5 points	58 (73.4)	6 (35.3)	0.002
	6 to 15 points	21 (26.6)	11 (64.7)	

GDS=Geriatric Depression Scale.

Table 2. Variability and comparative analysis of age and functional factors of older adults with regard to visual acuity.

	Visual Acuity	Mean	Standard Deviation	Median	Minimum	Maximum	Mann-Whitney Test p value
Age	≥0.3	73.58	6.39	73	65	91	<0.001
	<0.3	80.59	6.58	81	66	94	
Number of Impaired ADLs	≥0.3	1.15	1.33	1	0	6	0.149
	<0.3	1.71	1.57	1	0	5	
Number of Impaired IADLs	≥0.3	1.49	1.62	1	0	6	0.009
	<0.3	2.53	1.59	2	0	5	
TUG	≥0.3	12.97	4.00	12.37	7.62	28.18	0.003
	<0.3	15.92	4.16	15.40	8.91	25.41	

ADL=activities of daily living; IADL=instrumental activities of daily living; TUG=Timed Up & Go Test.

Table 3. Correlation between visual acuity by the Snellen-E chart and age, falls, impaired activities and mobility variables.

	Spearman Test r value	Significance p value
Age	-0.531	<0.001
Number of Falls	-0.204	0.046
Number of Impaired Activities	-0.338	0.001
TUG	-0.408	<0.001

TUG=Timed Up & Go Test.

deficits are the most important factors to explain depression in older adults[27]. The use of the Impact of Vision Impairment (IVI) instrument revealed that older adults feel frustrated and worried about visual decline for "a good part of time"[9]. Factors such as low vision and lack of opportunity or confidence to socialize, associated with functional impairment, may contribute to depression[27].

Visual impairment is also directly related to the restriction on the social participation of older adults, because the low vision, especially when added to the limitations on personal and environmental contexts of older adults, contributes to functional decline and therefore hinders the performance of ADLs[9]. Ribeiro et al.[8] stated that the progressive and gradual decline in vision forces the older adults to change the way they carry out their activities. The study by Berger and Porell[4] established a hierarchical relationship between ADLs and IADLs for older adults with visual impairment. Thus, low vision is associated with increased risk of impairment in both, but the IADLs are more impaired by low vision than ADLs[4]. This happens because the IADLs are more challenging activities that depend on complex visual and cognitive skills, unlike the ADLs which require more motor skills in a known environment[4]. Older adults with low visual acuity have difficulty in performing IADLs and in the total number of impaired activities, corroborating the findings of Berger and Porell[4]. The lack of significant difference for ADLs in older adults with visual deficit may indicate that this impairment is not sufficiently significant for these simpler activities to be impaired. It may also indicate that, in an indirect assessment such as BOMFAQ, older adults do not refer to a difficulty with a task they can finish as functional impairment. This highlights the importance of assessing older adults through direct and indirect measures as performance assessment can identify the beginning of the decline in function before it is reported by the older adult[15].

Lamoureux, Hassell and Keeffe[9] also found a relationship between visual acuity and restriction of participation. Through the application of the IVI, visual acuity was considered a risk factor for self-reported difficulty[9]. The older adults reported having a considerable amount of restriction of participation in activities in the areas of "leisure and work", "consumer and social interaction" and "mobility"[9]. However, they reported a small amount of difficulty in the area of "household and personal care"[9].

Unlike the ADLs, which are activities performed at home, the IADLs are more complex and usually performed outdoors. Older adults with visual deficits and impairment in performing IADLs often have difficulty walking outdoors in a less safe environment and have increased risk of falls[14]. Thus, the level of visual acuity also affects balance[10]. According to Lee and Scudds[10], older adults without visual impairment were more stable compared to older adults with visual impairment in the activities proposed by the Berg Balance Scale because the older adults with low vision cannot rely on the visual feedback from the environment that helps the central nervous system (CNS) to control balance[10].

In a descriptive meta-analysis, Bohannon[28] determines the reference values of the time spent on TUG for older adults according to age group. The older adults in this study exceeded the average time spent on TUG for predicted values, even for the older group (11.3 seconds), regardless of visual impairment. However, the decline in visual acuity further increases the time spent on TUG.

Older adults without visual impairment behave differently when they encounter an obstacle in their path[12]. They focus on the obstacle to be overcome first and thereby shift the focus from the current activity to planning for the future activity[12]. Diverting attention away from the current activity is dangerous behavior for older adults because it may increase the risk of falls. This behavior is even more dangerous when the focus of attention is a complex object which cannot be seen clearly due to the visual deficit.

Thus, the difficulty to remain stable in complex environments and tasks may predispose older adults to falls. There was correlation between the number of falls of older adults and the values of the Snellen chart in this study, confirmed by the fact that older adults with low vision were more advanced in age and less mobile compared to older adults with normal vision. The relationship between falls and visual impairment was demonstrated by some authors[1,2,29], as was the relationship between falls and age[12,14,30], falls and mobility and falls and difficulty performing ADLs[10,29], corroborating the findings of the present study. Individuals with bilateral visual field loss, even with visual acuity ≥ 0.3, are six times more like to fall than older adults without visual field loss[1], which indicates that not only visual acuity but also visual field loss are related to the risk of falling[1].

According to WHO projections[6] based on the world's population, there will be 58 million blind people in 2010 and 75 million in 2020. The estimates for low vision affect approximately three times as many people. In Brazil, there are 16.6 million people with some degree of visual impairment, with nearly 150

thousand blind people and the rest with significant visual impairment[31]. It is worth noting that this study examined healthy older adults with regard to functional vision, i.e. both eyes with corrective lenses, which is a limitation given the lower prevalence of visual deficit (17.7%) compared to population projections. However, these characteristics of the study show that, even among healthy older adults, it is necessary to consider the existence of visual impairment associated with significant functional impairment.

Regarding the limitations of the present study, it is necessary to consider that the report of falls history may be biased as to the number and type of instability that older adults consider as a fall, even with the use of the definition by Tinetti, Speechley and Ginter[16]. Although older adults diagnosed with dementia were not included, the use of a cognitive screening test as an exclusion criterion can assist with more precise data on self-reported measures. In the current study, the older adults with visual deficit had more advanced age, a greater number of eye and adnexa diseases, higher scores for depressive mood in the GDS, poorer performance in TUG, greater number of falls, greater number of IADLs and activities with difficulty. Therefore, the older adults with impaired visual acuity exhibited greater functional impairment than those without visual impairment. In terms of applications for rehabilitation, however, the literature is scarce and the emphasis of physical therapy is limited to falls and environment adaptation[13,14,32].

Thus, the findings of the present study may assist in developing proposals for rehabilitation focused on individuals with visual deficit. It is important that older adults be aware of how visual impairment affects the performance of ADLs and the balance in the interaction with the environment, predisposing them to falls. Therapeutic exercises, combined with functional and balance training, especially outdoors, may offer more safety while performing tasks to older adults with visual impairment.

The physical therapist may suggest environmental changes such as removing or anchoring loose rugs, painting steps, improving lighting, installing handrails on stairs, installing grab bars in bathrooms and removing obstacles[13], which can be extremely effective in security and in facilitating the implementation of tasks. Therefore, assistance to older adults with visual deficits is an open field for physical therapy rehabilitation. Through the difficulties reported, presented and characterized in this study, physical therapists can plan their treatment. They can also establish simple criteria to assess older patients with regard to visual impairment and direct the treatment to improve balance, mobility and ADLs. In spite of that, more research is needed to characterize the general older adult population with vision impairment.

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