

## Association between concern about falling and depression symptoms in cognitively impaired older adults: a cross-sectional study

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### Resumo

Concerns about falling and depressive symptomatology are well-known fall-risk factors in older people. However, whether both factors are inter-related it is not fully elucidated among individuals with cognitive issues. To shed light in this field, we analyzed the association between the concerns about falling and depressive symptoms in older adults with cognitive impairments. This cross-sectional study was composed of 67 community-dwelling cognitively impaired older adults (age:  $71 \pm 5$  years; sex: 78% female). We assessed their concerns about falling (independent) and depression symptoms (outcome) using the Falls Efficacy Scale - International (FESI) and the short-version of Geriatric Depression Scale (GDS-15), respectively. Covariates included age, sex, education, fall history, physical (Short-Physical Performance Battery), and cognitive function (Brazilian version of Montreal Cognitive Assessment). Linear regression models were performed in order to examine the independent relationship between FESI and GDS scores. All analyses were computed using STATA and significance was set at  $P < 0.05$ . Participants with higher depressive symptoms ( $GDS \geq 5$  points) showed a significantly poor score on FESI (Mean difference: -5.3 points; 95%CI = -9.9 to -0.7;  $p = 0.02$ ). The regression model showed an association between the FESI and GDS-15 after adjustment for confounders ( $\beta = 0.08$ ; 95% CI = 0.02; 0.14), suggesting that higher concerns about falling are associated with higher depressive symptoms. Concerns about falling are associated with depressive symptoms among cognitively impaired older adults independently of overall physical function, global cognition, and fall history.

**Palavras-chave:** Cognitive impairment. Depression. Falls. Physical performance. Older adults

### INTRODUCTION

Falls are one of the most common geriatric syndromes and is associated with a high public health and social burden<sup>1,2</sup>. The prevalence of falls in Brazil is around 25% which is similar with global estimates<sup>3</sup>. Older people who have a history of falling have several associated risk factors

such as mild cognitive impairment<sup>4,5</sup> and dementia<sup>6</sup>. Cognitively impaired individuals present higher fall rates<sup>6</sup>, which has a huge importance considering that fall events might increase the odds for severe injuries, hospitalizations, and physical dependence. Elderly individuals with a fall history have

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greater concerns towards other episodes of falls<sup>7,8</sup>, and these worries are associated with greater social isolation and reduced quality of life; predictors that may contribute to increasing mental and psychiatric disorders.

In the same line, depressive symptoms are also prevalent among the elderly<sup>9</sup>. Older people with high depressive symptoms are at risk for both cognitive decline and fall-related outcomes (e.g., fear of falling)<sup>10</sup>. Previous studies have highlighted the relationship between concerns about falling and depressive symptomatology<sup>10,11</sup>, 11. For instance, Drummond et al. found that higher levels of depression symptoms were associated with incident (RR= 1.46; 95%CI=0.75–2.85) and persistent concerns of falling (RR=1.50; 95%CI=1.08–2.08) in older adults. Interestingly, however, the studies which have looked at the association between

both outcomes have often disregarded the role of confounders including fall history, probable mild cognitive impairment, as well as physical function measurements. Understanding the relationship between the concern about falling and depressive symptoms is relevant in public health terms because this information can help formulate preventive and therapeutic strategies targeting these issues, particularly among the older population with cognitive decline.

Therefore, the purpose of this study was to analyze the association between the concerns about falling and depressive symptoms in older adults with cognitive impairments independently of baseline physical and cognitive function and fall history. Our main hypothesis is that higher levels of concerns about falling is associated with depressive symptoms.

## METHODS

### Study design and ethical issues

This is a cross-sectional analysis performed with baseline data from the resistance exercise with instability (REI) study trial. The REI study was a randomized controlled trial, prospectively registered (RBR-4KQS22) and designed to investigate the effects of REI on cognitive function in community-dwelling older adults with cognitive impairment<sup>12</sup>. The local ethical approval was obtained from Local Research Ethics Board (#81016817.7.0000.5207). All participants provided written informed consent prior to the baseline assessment. An additional methodological description is available in a previously published trial protocol<sup>13</sup> and primary outcome analysis<sup>12</sup>.

### Participants

Sixty-seven older individuals with self-reported subjective cognitive complaints and/or Montreal Cognitive Assessment (MoCA) scores lower than 26 points<sup>14</sup>, of both biological sexes, participated in the study. Individuals were required to meet the following eligibility criteria: 1) 60 years old or older; 2) had not performed structured exercise classes such as aerobic and resistance training in the last 3 months; 3) no overt or unstable disease which contraindicates practicing physical exercises; 4) no previously diagnosed or self-reported cardiovascular disease (i.e. stroke, acute coronary syndromes, peripheral arterial occlusive disease, etc.), neurological or

psychiatric disease; and 5) have enough preserved visual and hearing function to adequately complete the cognitive function measurements.

### **Descriptive and clinical measures**

The general characteristics of participants included age, biological sex, education, and previous fall history (in the last year) were measured using a face-to-face interview. In accordance with previous consensus, falls were considered as “an unexpected event in which participants came to rest on the ground, floor, or lower level”. Body mass (kg) and height (meters) were measured to compute body mass index (kg/m<sup>2</sup>); the instrumental and basic activities of daily living were measured using the self-reported Lawton-Brody<sup>15</sup> and Katz<sup>16</sup> scales, respectively.

The Short Physical Performance Battery (SPPB)<sup>18</sup> and the Brazilian version of MoCA<sup>14</sup> were used to analyze clinical measurements of overall physical and cognitive function, respectively. Both SPPB and MoCA are widely used in clinical and research to classify physical and cognitive status.

The Brazilian version of the MoCA<sup>14</sup> is composed of 12 different simple cognitive tasks targeting multiple domains of cognitive function such as visual-spatial/executive functions including naming, memory, attention, language, abstraction, and orientation. The total score was obtained by the sum of each domain ranging up to 30 points (better overall cognitive performance). The SPPB<sup>17</sup> had five different tests to evaluate physical domains including balance (static balance during bipodal, semi-tandem, and tandem support), gait performance (usual gait speed over four meters), and lower limbs function (sit-to-stand test five times). The total score was obtained by the sum of the scores of each test ranging from 0

(poor physical function) to 12 points (better physical function).

Dependent and independent variables were obtained by a single and well-trained evaluator.

### **Dependent variable**

The short version of the Geriatric Depression Scale (GDS)<sup>18</sup> was used to measure depression symptoms. The GDS is a 15-item screening tool with wide application in several settings such as community, acute, and long-term care. The presence of depressive symptoms is defined as five or more symptoms in the 15-items or the equivalent for those participants who responded to 10 to 14 items. However, considering the limited number of participants in the current study, we used the GDS score as a continuous measure (higher values indicating more symptoms) in regression models and a categorical measure (high depression symptoms  $\geq 5$  points) in unpaired comparisons.

### **Independent variable**

The validated and translated version of Falls Efficacy Scale-International (FESI)<sup>19</sup> was used to measure the concern about falling. This scale encompasses questions about the different concerns during 16 activities. Each question had scores ranging from one to four (higher values suggest greater concerns). We used the sum of scores in each question to compute an overall value of concern about falling that ranged from 16 (without concern) to 64 (extreme concern).

### **Statistical analysis**

Descriptive data using mean and standard deviation or relative frequency were summarized as appropriate. We examined the normality of data by means Shapiro Wilk test. The relationship between the concern about falling and depression symptoms was

examined using Pearson product-moment correlation coefficient. Differences between concern about falling among participants with high and low depressive symptoms were checked using an independent t-test (data are presented as mean difference and 95% confidence intervals [CI]). Furthermore, we used a multiple linear regression analysis to test association between dependent and independent variables. To control for potential confounders, the following covariates were used in an adjusted model: age (continuous variable), biological sex

(male and female) and fall history (yes or no). We also added the values of overall physical and cognitive function that were obtained using the SPPB and MoCA.

Unstandardized coefficients (standard error) and 95%CI are presented. We also computed collinearity statistics and residual analysis to ensure that the assumptions of linear regression were met in the final regression model. All statistical procedures were performed using STATA software, version 13 (StataCorp LLC, College Station, Texas-USA), considering a p-value of 5%.

## RESULTS

From 167 participants screened, 78 were assessed for eligibility. However, after baseline assessment, 11 were excluded because they did not meet inclusion criteria (n=6), they refused to participate in the assessments (n=1), and/or were excluded for other reasons (n=4). Thus, 67 participants had completed baseline assessments and were included in the cross-sectional analysis. Descriptive data of participants included in this cross-sectional study are presented in Table 1. Most participants were women, and the mean of age was roughly 70 years old.

A comparison of FESI scores between participants with high and low depressive symptoms is presented in Figure 1. A significant difference was observed between groups (mean difference= -5.3 points; 95%CI = -9.9 to -0.7;

p=0.02), indicating that individuals with high depressive symptom have higher FESI scores.

Pearson's correlation demonstrated a positive and significant correlation between depressive symptoms and concerns about falling.

Crude and multiple regression models to compute the association between variables of interest are presented in Table 2. There was a statistically significant association between concerns about falling and depressive symptoms ( $\beta = 0.08$ ; SE=0.03; 95%CI= 0.02; 0.14) after controlling for confounders including age, biological sex, education, overall cognitive and physical function, and previous positive fall history. This suggests that higher scores of concerns are independently associated with higher scores of depressive symptoms.

**Table 1** – Descriptive and clinical data of participants (n=67), Petrolina-PE.

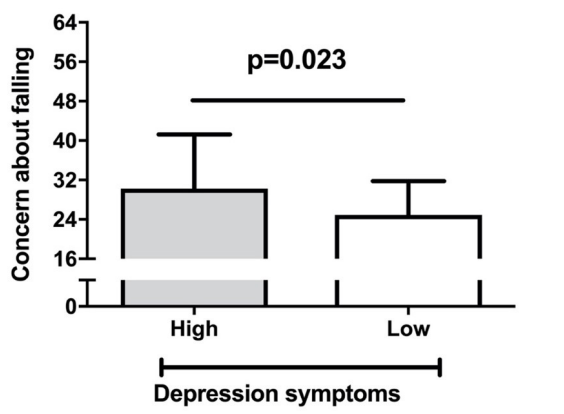
Variables	Total (n=67)	Low symptoms (n=49)	High symptoms (n=18)
Sex (% women)	52 (78)	36 (73)	16 (89)
Age (years)	71 (5)	72 (6)	69 (3)
Education (<12 yrs.)	30 (45)	22 (46)	8 (22)
BMI (kg/m <sup>2</sup> )	28.1 (4.9)	27.6 (5.2)	29.4 (3.8)
Katz scale	0.16 (0.41)	0.14 (0.35)	0.25 (0.57)
Lawton and Brody	26 (1)	26 (1)	26 (2)
Fall history (% yes)	17 (26)	11 (23)	6 (35)
MoCA (0-30)	19.2 (4.4)	19.5 (4.1)	18.5 (5.1)
SPPB (0-12)	9 (2)	10 (2)	9 (1)
GDS (0-15)	2.6 (2.1)	1.6 (1.3)	5.7 (0.7)
FESI (16-64)	26 (8)	25 (7)	31 (11)

Note: BMI - Body mass index; FESI - Falls efficacy scale international; MoCA - Montreal Cognitive Assessment; SPPB - Short physical performance battery.

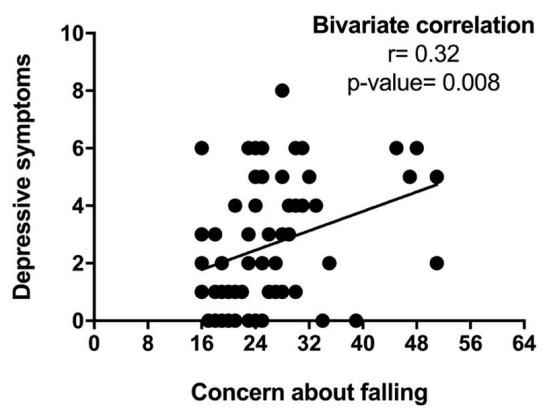
**Table 2** – Cross-sectional results of crude and multivariate analysis; relationship between concern about falling with depressive symptoms in older adults with cognitive impairment.

Independent variables	Crude analysis		Adjusted analysis	
	$\beta$ (SE)	95%CI	$\beta$ (SE)	95%CI
<b>FESI</b>	<b>0.08 (0.03)</b>	<b>0.02; 0.14</b>	<b>0.08 (0.03)</b>	<b>0.02; 0.14</b>
Age			-0.12 (0.04)	-0.21; -0.03
Biological sex			0.95 (0.70)	-0.45; 2.35
Education			-0.21 (0.51)	-1.25; 0.82
MoCA			-0.09 (0.05)	-0.20; 0.02
SPPB			-0.28 (0.18)	-0.65; 0.07
Fall history			1.30 (0.58)	0.12; 2.49

Note: FESI - Falls efficacy scale international; MoCA - Montreal Cognitive Assessment; SPPB - Short physical performance battery;  $\beta$  (SE)= Unstandardized coefficients (standard error); 95%CI- 95% confidence intervals; F7, 56= 3.36; R<sup>2</sup>-adjusted= 0.20; n=64 participants were included in multivariate model. **Bold denotes p-value < 0.05.**



**Figure 1** – Scores of concerns about falling among participants with high and low depressive symptoms (GDS  $\geq$  5 points for high). Data are displayed as mean  $\pm$  SD.



**Figure 2** – Correlation (Pearson) between concern about falling and depressive symptoms among participants.



## DISCUSSION

Our main findings showed an independent association between concerns about falling and depressive symptoms among older individuals with cognitive impairment. The clinical and public health message is that using strategies with an interdisciplinary-based approach to mitigate the increase of fall events and concerns with falling among the older adults might contribute to improve mental and psychological health, thereby establishing factors which, directly and indirectly, can positively impact the quality of life and well-being in older people.

The findings obtained herein are in line with previous literature about depression symptoms and fall risk outcomes including concerns or 'fear' of falling<sup>10,20,21</sup>. However, most studies have not been taking into account the roles of physical and cognitive functions as well as previous fall events as covariates in regression models. Here, we showed that higher levels of depressive symptomatology are associated with higher levels concerns about falling independently of overall physical and cognitive status and fall history; our estimates point out that this relationship presented an explained variance of 20%. A recent study<sup>11</sup> demonstrated that older individuals with depressive symptoms were 50% more likely to have concerns about falling – measured by FES-I scale – when compared with those without depressive symptoms. Indeed, the relationship between depression and concerns about falling are complex and some authors have been claimed conceptual models to understand this issue. For instance, laboni and Flint<sup>10</sup> stated that the complex interplay between mood and fall-related outcomes might partially explained by direct and indirect influence of common risk factors such as

physical and cognitive/brain impairments, previous fall history, comorbidities, social and behavior aspects (social isolation), medication use, and others.

Clinical and public health perspectives employing preventable strategies using an interdisciplinary team (considering physicians, therapists, psychologist, and other health-related experts) might also be designed to target fall-related outcomes<sup>22, 23</sup>. We hypothesize that this construct can have the potential to mitigate mental and psychological disorders such as depression, which is a disease with a global burden. This is an urgent research topic to explore because most clinical trials which have tested the effects of interventions for fall-related outcomes showed inconclusive results on depression measures<sup>10</sup>. These results might be related to selection bias (inclusion criteria restricted to individuals without depressive symptoms or even having been previously diagnosed with depression), higher rates of dropout and low protocol adherence.

We recognize that the current study has limitations. The first is our cross-sectional design which does not establish a cause-and-effect relationship. Subjective cognitive complaints measurements were self-reported; thus, it was not possible to distinguish the type of the complaint (attention, memory, or both). However, beyond this measure, we classified probable cognitive impairment through MoCA scores. Another issue which deserves highlighting was that we did not diagnose depression. We only explored the presence of 'symptoms', thus, extrapolating our results from patients diagnosed with depression and its different levels should be done with caution. Finally, we did not measure anxiety in our sample. Previous studies have

been described showing higher levels of anxiety associated with both depression and fall-related outcomes<sup>24,25</sup>. Future studies should consider this confounder and expand the knowledge about the complex interplay of depression and concerns about falling.

## CONCLUSION

Concerns about falling are associated with depressive symptoms among older adults with cognitive impairment independently from physical and cognitive function and fall history. Preventive strategies that effectively promoting self-efficacy may potentially contribute to reducing mental health issues among the older individuals.

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