Predictive physical frailty markers of depressive symptoms in older people in primary health care

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Abstract

Objective: to identify which markers of physical frailty predict depressive symptoms (DS) in old people assisted in Primary Health Care. *Method:* this is a quantitative, descriptive, and correlational cross-sectional study was carried out at the Basic Health Unit in Curitiba, (PR), Brazil, with a sample of 389 old people. Data were collected from January to October 2019, using a sociodemographic and clinical questionnaire, depression scale (Center for Epidemiological Studies) and to evaluate the phenotype of Frailty. The statistical analyzes were performed using descriptive statistics, inferential statistics (Pearson's chi-square), with statistical significance level $p < 0.05$, and logistic regression, reporting the estimate, *p* value (Wald test), Prevalence Ratio with a 95% confidence interval. *Results:* of the 389 old people, 103 (26.5%) had DS; among these 63 (61.2%) were pre-frail, 19 (18.4%) frail and 21 (20.4%) non-frails. The markers fatigue/exhaustion ($p \leq 0.001$) reduced level of physical activity ($p \leq 0.001$), unintentional weight loss ($p=0.003$) and the condition of pre-frailty and frailty were associated with DS s ($p=\leq 0.001$). The final predictive model for DS included the markers of fatigue/exhaustion (PR 5.11; 95%CI; 3.81-6.87; $p<0.0001$) and reduced level of physical activity (PR 2.16, 95%CI %; 1.45-3.22; $p<0.0001$). *Conclusion:* the markers of fatigue/exhaustion phenotype and reduced physical activity are predictors of DS in the old people. This result highlights the importance and need to assess these markers, and the effectiveness of actions to combat sedentary lifestyle in the old people in primary health care.

Keywords: Frail elderly. Depression. Frailty. Primary Health Care.

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INTRODUCTION

Physical frailty in older people is considered a geriatric syndrome and has become a concern for public health, due to the increase in the population's life expectancy. This syndrome presents itself as a multidimensional condition, compromising different biological functions. It was also defined by experts as a "clinical condition characterized by an increase in vulnerability in the individual, when exposed to internal and external stressors", in addition to being one of the main contributors to functional decline and early mortality in older people[1].

The identification of frailty through physical phenotype includes the assessment of five markers: unintentional weight loss, self-reported fatigue/exhaustion, reduced level of physical activity, decreased gait speed and handgrip strength. The quantity of identified markers classifies older people as non-frail (none), pre-frail (one or two) or frail (three or more)[2].

Frailty has an expressive prevalence in older people in the community. A systematic review with meta-analysis analyzed a sample of 13,392 individuals (≥65 years) from 22 European countries and identified 18% of frail older people[3]. In South America, there is a study that included Brazil, Chile, Peru, Colombia, Ecuador, Argentina and Venezuela, which identified an average prevalence of 21.7% of frailty, with one in five older residents in the community being identified as frail[4].

Although the phenotype is physical, the multifactorial frailty allows us to observe the relationship with cognitive, psychological and social functioning aspects[5]. The relationship between frailty and psychosocial factors was investigated in a study with meta-analysis that included 8,023 individuals. Frail individuals were twice as likely to develop depression (OR: 2.64; 95% CI: 1.59-4.37), compared to non-frail, and those with depression were three times more likely to develop frailty (OR:3.72; 95% CI: 1.95-7.08), which demonstrates the bidirectional relationship between the conditions[6].

Similar to frailty, Depressive Symptoms (DS) are also common in the aging process. Furthermore, studies show related to frailty markers, as older people in this condition can reduce the level of physical activity, decrease strength and present fatigue/exhaustion[7]. Also, loss of interest, decline in functional capacity and social participation, with a tendency to isolation, are common[8].

The potential impact of DS and incident frailty in older people was investigated in a study carried out in Latin American countries (Cuba, Dominican Republic, Mexico, Venezuela, Puerto Rico and Peru) in a cohort of 12,844 older people. The results showed a reciprocal relationship between both conditions and an increased risk of 59% (HR=1.59; 95% CI: 1.40-1.80) older people with DS to develop frailty[9].

The prospective relationship between increased risk of frailty and DS and the reciprocal interaction between conditions were demonstrated by studies that identified, in addition to somatic symptoms, the association between the condition and some markers in relation to DS. Among them, fatigue/exhaustion, reduced gait speed, decreased physical activity, unintentional weight loss, comorbidities and cognitive and functional impairments are frequent[10]. As well as the markers, the frailty condition was also investigated in the cross-sectional and longitudinal analysis in a study carried out in China with 1,264 older people. There were associations between the pre-frail and frail condition, in addition to the handgrip strength marker with the occurrence of DS in older people[11].

Experts considered it necessary to evaluate the symptoms presented by the older people, especially in relation to fatigue/exhaustion and its causes, since this component proved to be the first symptom to manifest in older adults[1].

Clarifying the relationship between frailty and DS has important implications for understanding the factors that contribute to the etiology and prognosis of these variables. The emphasis on the markers of the physical frailty phenotype is relevant, since, in some studies, there is a predominance of them, however, there are few studies on how they behave in predicting DS and in the frailty condition of the older people.

Based on the above, the aim of the study was to identify which markers of physical frailty can predict DS in older people assisted in Primary Health Care.

METHOD

This is a cross-sectional, correlational study, carried out in a Basic Health Unit (UBS) that makes up the Primary Care network in the city of Curitiba (PR), Brazil, from January to October 2019. The UBS was elected among 110 other units in the municipality, as it has a population of 23,890 people with an active registry, 4,439 of which are older people, representing 18.58% of the enrolled population.

Participants were older people of both sexes, aged over 60 years, registered and residing in the coverage area of the UBS. The non-probabilistic sample, representative of the population of older people attended at the UBS, was defined by a sample calculation that indicated 354 older people, to whom 10% was added due to the possibility of losses, the final sample consisted of 389 older people. A confidence level of 95% (CI=95%) was considered, with a significance level of 5% (α=0.05).

The older people were invited to participate in the research individually, according to the demand for care at the UBS. The objectives and ethical aspects of the research were explained. After solving any doubts, the older people and caregivers signed the Informed Consent Form (ICF).

The following inclusion criteria were defined: being 60 years old or older, of both sexes; reside in a household registered with the UBS; presenting cognitive capacity identified by the Mini Mental State Examination[12] according to cutoff points proposed according to education[13] or being accompanied by a family caregiver at the time of data collection, when not presenting cognitive capacity to answer the questionnaires.

Older people residing in long-term institutions or physically incapable of performing the proposed tests, being in a wheelchair or presenting amputation of lower and/or upper limbs were excluded.

Three previously trained researchers applied the Mini Mental State Examination (MMSE), and later data collection was performed using a sociodemographic and clinical questionnaire, depression scale and Physical Frail assessment tests. As measures to minimize risks and protect the older participants, the handgrip strength and gait speed tests were applied by two researchers simultaneously, to promote greater safety and avoid an episode of the participant's fall during the performance of the gait speed test.

The sociodemographic and clinical characterization consisted of the covariates: age, sex, education, marital status, family income, existing and/or self-reported morbidities. The *Center for Epidemiological Studies* (CES-D) scale was used to screen for depressive symptoms. The Scale contains 20 items on mood, somatic symptoms, interactions with others and motor functioning. The answers are in Likert scale, and the score varies from 0 to 60 points. Older people with a score of 12 to 60 is indicative of the presence of DS[14].

To assess physical frailty, the five markers of the Fried[2] phenotype were considered, which classifies individuals with three or more criteria as frail; pre-frail, with one or two criteria; and those that do not have any of the following components are non-frail: reduced handgrip strength (HGS), reduced gait speed (GS), fatigue/exhaustion, unintentional weight loss, and reduced level of physical activity.

HGS was measured using a Jamar® hydraulic dynamometer, considering the average of the three measurements taken by the older people, those who comprised the lowest strength quintile were considered frailty markers[2]. For the assessment of GS, the older person was instructed to walk, in the usual way, counting the distance of 4.6 meters. After adjusting for sex and median height, those with the lowest quintile were considered fragile for this component[2].

Fatigue/exhaustion was identified by self-report, according to the older person's response to items 7 and 20 of the *Center for Epidemiological Scale - Depression* (CES-D)[14], (A) felt that they had to make an effort to cope with their everyday tasks; and (B) felt that they couldn't get on with their things. Unintentional weight loss was verified by the body mass index (BMI), calculated from anthropometric measurements and associated with the older person's self-report. Weight loss greater than or equal to 4.5 kg in the last twelve months was considered unintentionally (no diet or exercise)[2].

The reduction in the level of physical activity was assessed using the *Minnesota Leisure Activity Questionnaire*, validated for Brazilian older people[15], which includes questions regarding the frequency and duration of activities performed in the last year.

Data were organized and presented by descriptive statistics (absolute and relative frequency), inferential (Pearson's chi-square) with a statistical significance level of $p \leq 0.05$). Logistic regression models with different structures in the linear predictor were adjusted. At first, a model was carried out, individually, for each marker of physical frailty and the condition of physical frailty in relation to DS. Then, the effect of markers on DS was jointly evaluated, adjusting a single model with selection of variables (*backward*) using the Likelihood Ratio Test (LRT) at the 5% level. For the models, the estimate and p value (Wald test), the Prevalence Ratio (PR) with a 95% confidence interval were reported, as well as the measures of accuracy, sensitivity, specificity, and the Cox and Snell, and Nagelkerke of Mc Fadden Pseudo R^2 coefficients.

The study followed the recommendations contained in Resolution No. 466/2012 and Resolution No. 510/2016. Afterwards, it was referred to the Ethics Committee of the Health Sciences Sector of the Federal University of Paraná, which received a favorable opinion under number 2,918,847.

RESULTS

Of the 389 participants, a mean age of 70.45±6.87 years (60-94) was identified. There was a predominance of females (n=255; 65.6%), with low education (n=138; 35.5%), married (n=187; 48.1%), with a family income of 2-4 minimum wages (n=156; 40.1%). As for the frailty condition, 186 (47.8%) older people were pre-frail, 169 (43.4%) non-frail and 34 (8.8%) frail.

DS were observed in 103 (26.5%, 95%CI; 22.2%-31.2%) of older people. Among them, and there was a predominance of pre-frail (n=63; 61.2%), followed by non-frail (n=21; 20.4%) and frail (n=19; 18.4%) (Table 1).

Regarding the frailty markers, fatigue/exhaustion, reduced level of physical activity and unintentional weight loss were associated with DS, as shown in Table 1.

The frail condition was also associated with DS ($p<0.001$). The logistic regression model of the frailty condition in relation to DS indicated that the prevalence of DS in pre-frail older people was 2.6 times when compared to non-frail older people ($p<0.001$). In the frail condition, the prevalence of DS was 3.4 times that of non-frail older people. Compared to pre-frail, frail older people still had 1.85 times more DS (Table 2).

Table 3 shows the regression analysis with models independently adjusted for each frailty marker in relation to depressive symptoms. In the analysis of the five frailty components, three had statistically significant *p*-values: fatigue/exhaustion ($p<0.001$) unintentional weight loss ($p<0.003$) and reduced physical activity ($p<0.001$). Of these, the model with the fatigue/exhaustion covariate obtained better (and higher) coefficients of qualitiy of adjustments measures.

The final regression model, after selecting the variables, showed that an older person with fatigue/exhaustion had a 5.11 times higher prevalence of DS when compared to another older person who does not have this frailty marker. The model also includes the reduced level of physical activity marker, indicating that an older person in this condition had a 2.16 times higher prevalence of DS compared to those without a reduction in physical activity (Table 4).

When considering the covariates age, sex, education, marital status and family income and the frailty markers in the regression model, only fatigue/exhaustion and reduced level of physical activity remained in the model, showing that the results are independent of sociodemographic covariates.

Table 1. Absolute and relative frequency distribution and association between markers, frailty condition and SD of older people. Curitiba, Paraná, Brazil, 2020.

Frailty markers	Frailty Condition	Depressive symptoms (n= 389)		*p* Value
	n (%)	Yes n=103	No n =286	
Decreased Hand Grip Strength				0,076
Yes		28 (27.2%)	54 (18.9%)	
No		75 (72.8%)	232 (81.1%)	
Reduced Gait Speed				0.491
Yes		10 (9.7%)	35 (12.2%)	
No		93 (90.3%)	251 (87.8%)	
Fatigue/Exhaustion				<0.001*
Yes		52 (50.5%)	14 (4.9%)	
No		51 (49.5%)	272 (95.1%)	
Unintentional weight loss				0.003*
Yes		32 (31.1%)	49 (17.1%)	
No		71 (68.9%)	237 (82.9%)	
Reduced level of physical activity				<0.001*
Yes		37 (35.9%)	45 (15.7%)	
No		66 (64.1%)	241 (84.3%)	
Frailty Condition				<0.001*
non-frail	148 (51.7%)	21 (20.4%)	169 (43.4%)	
pre-frail	123 (43.0%)	63 (61.2%)	186 (47.8%)	
Frail	15 (5.2%)	19 (18.4%)	34 (8.7%)	

* Chi-square test, p≤ 0.05

Table 2. Regression model of the frailty condition in relation to the DS of older peple. Curitiba, Paraná, Brazil, 2020.

Frailty Condition	Estimate	PR	CI for PR (95%)	*p* Value	Adjustment quality measures		
					Coxsnell R^2 (%)	Nagelkerke R^2 (%)	McFadden R^2 (%)
Pre-frail/Non-frail	1.283	2.610	1.707-3.991	<0.001			
Frail/ Non-frail	2.189	3.373	2.407-4.706	<0.001	9.310	13.586	8.453
Frail/Pre-frail	0.905	1.853	1.186-2.896	0.017			

PR: Prevalence Ratio; CI: Confidence Interval, R^2 Coxsnell, R^2 Nagelkerke, Pseudo R^2 Mcfadden.

Table 3. Regression models for the older person's DS independently adjusted for each marker of physical frailty and qualitiy of adjustments measures. Curitiba, Paraná, Brazil, 2020.

Frailty marker	Estimate	PR	CI for PR (95%)	*p* Value	Adjustment quality measures		
					Coxsnell R^2 (%)	Nagelkerke R^2 (%)	McFadden R^2 (%)
Decrease in handgrip strength	0.472	1.397	0.975-2.001	0.078	0.773	1.128	0.671
Reduced Gait Speed	-0.259	0.822	0.463-1.458	0.492	0.125	0.183	0.108
Fatigue / Exhaustion	2.986	4.989	3.766-6.610	<0.001	22.611	32.996	22.174
Unintentional weight loss	0.779	1.713	1.222-2.403	0.003	2.138	3.120	1.869
Reduced level of physical activity	1.099	2.098	1.523-2.891	<0.001	4.327	6.315	3.827

PR: Prevalence Ratio; CI: Confidence Interval, R^2 Coxsnell, R^2 Nagelkerke, Pseudo R^2 Mcfadden. PR and CI(95%) were calculated from the linear predictor and are in the Prevalence Ratio (PR) scale.

Table 4. Predictive variables of the final predictive model of depressive symptoms. Curitiba, Paraná, Brazil, 2020.

Frailty marker	Estimate	aPR	CI for PR (95%)	*p* Value	Adjustment quality measures		
					Coxsnell R^2 (%)	Nagelkerke R^2 (%)	McFadden R^2 (%)
Fatigue/Exhaustion	2.983	5.116	3.811-6.869	<0.0001	24.986	36.462	24.870
Reduced Physical Activity Level	1.092	2.160	1.450-3.218	<0.0001			

aPR: Adjusted Prevalence Ratio; CI – Confidence Interval, R^2 Coxsnell, R^2 Nagelkerke, Pseudo R^2 Mcfadden; aPR and CI(95%) were calculated from the linear predictor and are in the Prevalence Ratio (PR) scale.

DISCUSSION

The present study investigated which markers of physical frailty can predict the occurrence of DS in older people. Predictive analyzes indicated a greater chance of older people who present fatigue/exhaustion and a low level of physical activity to develop DS. Furthermore, the frailty condition, obtained through these and other markers, explain that the higher the level of the frailty condition, the greater the chance of developing DS. There was a prevalence of the fatigue/exhaustion marker among older people with DS, followed by a reduction in the level of physical activity and unintentional weight loss.

The prevalence of DS among older people was higher than the national average, estimated in a systematic review with meta-analysis carried out with older people living in the community[16]. Lower estimates have been identified in national and international literature. In Pelotas (RS), researchers estimated the prevalence of DS at 15.2%[17], 14.2% in São Paulo (SP)[18], 9.8% in Australia and 5.0% in the USA[19]. The variability of DS percentages among older people in different Brazilian cities is due to the different methods used to classify DS, the instruments used and the characteristics of the samples[16].

There was a predominance of females in the sample of older people with depressive symptoms. This result was consistent with other studies that showed women at higher risk of developing DS compared to men[20,21].

Although the highest prevalence in females is not universal, women experience more the accentuated progression of DS over time[22]. This high frequency of DS among women suggests their greater social vulnerability in relation to men. This condition can be explained by physiological and hormonal differences, low level of education, low income and sociocultural issues[23].

The proportion of older people in the frail condition was analyzed in the general sample (n=389) and it was observed that the percentages of pre-frailty and frailty were high among older people with DS. Both conditions (frail and pre-frail) were associated with depressive symptoms.

The cross-sectional associations between pre-frailty, frailty and depressive symptoms verified in this study were also observed in Brazilian research with 2,042 community-dwelling older people that analyzed the relationships between the presence of depression and specific DS and conditions of pre-frailty and frailty. The results also indicated the association between DS and the frail condition (p<0.001)[24].

The mechanisms of associations between frailty and depressive disorders are still unclear and hampered by the overlapping symptoms. Frail older people can more easily develop DS due to impaired functionality, low physical activity and social activities. At the molecular level, frail older people may have increased levels of low-grade inflammation, such as increased cytokines of interleukin-6, C-reactive protein, or tumor necrosis factor-α, which may act as moderate risk factors for onset of DS [11,25].

The fatigue/exhaustion, reduced level of physical activity markers showed a strong association with DS. Changes in motor behavior, such as weakness associated with depression, can contribute to the low level of physical activity. A study carried out in Japan, with 3,191 older people in the community, showed that physical activity was associated with a reduced risk of DS regardless of the frequency and duration of the activity[26]. Physical activity performed individually or in groups involves feelings of pleasure, self-esteem, fun, facilitates the change of focus from pain and loneliness, relieves tension. Thus, older people should be encouraged to engage in physical activities in their daily lives.

It is considered that depressive symptoms and physical frailty have a negative impact on physical and psychosocial functioning, loss of independence and autonomy of the older person. The inclusion of practices that aim to minimize or avoid such health conditions becomes necessary at different levels of care, especially in Primary Health Care.

In the study, it was observed that the greater the frailty condition, the greater the chance that the older person would have DS. These results corroborate the cross-sectional study carried out in Singapore, with a sample of 721 community older people aged 60 years or over. The study identified a prevalence of frailty in 24.5% of older people and an independent association between the level of frailty and DS. It was found that with the increase in the level of frailty severity, the older peple reported substantially higher DS scores[25].

In the present study, frailty was identified as a predictor of DS in older people. Similar data were found in a systematic review study that identified the level of frailty as a longitudinal predictor of depressive symptoms. The study observed that one in ten older people had DS, and identified a high percentage of older people with DS and in the frail condition[27]. It is noted that the importance and need to observe that the presence of DS affects behavior and levels of physical activity in older people, with a consequent reduction in social participation, risk of depression and increased frailty.

The presence of the reduced physical activity level marker in the model gives the older person a 2.16 times higher prevalence of DS, compared to those without the respective marker. Evidence points to physical activity as a protective factor for DS [28,29]. The benefits of physical activity for health maintenance in older people have been consistent with positive results or associations in mood, self-esteem and a lower occurrence of DS.

As for the association between fatigue/exhaustion and DS, it was also identified in other studies in the literature, being considered an important indicator of decline related to aging and strongly associated with negative health events[18,30].

The predictive models analyzed confirm the importance of assessing fatigue/exhaustion and the low level of physical activity for preventing the development of DS in community-dwelling older people. The approach in clinical practice with a

focus on fatigue and exhaustion and the low level of physical activity are essential for screening older people at risk of DS both in the context of Primary Health Care, as well as in outpatient networks that serve users in this age group.

Fatigue/exhaustion by self-report should be a priority in clinical practice and in gerontological care, directing greater attention to this condition, given the adverse health outcomes of older people, such as physical inactivity, falls, hospitalization and poorer quality of life[31].

Due to the scarce energy reserve, exhaustion is common, which is sometimes admitted as a symptom of old age, however it can come from DS and the first signs of poor prognosis of frailty[1,32]. These are measurable and modifiable conditions if identified early, which contributes to the prevention and minimization of outcomes such as DS and frailty in the older people population.

The causality of the presence of DS in older people evaluated in this research is unknown, but the strong association with frailty markers that act in a disabling cascade, with an impact on the older person's autonomy and the potential development of DS suggests the importance of self-reported frailty assessment and causes of fatigue/exhaustion.

As limitations of the study, it is noteworthy that the data were obtained in a cross-sectional study. Thus, inferences about the causality of the relationship between predictor variables and DS should be made with caution, since this is a research with results from a local population in the region of Curitiba, Paraná. Another limitation refers to instruments with self-report questions to assess DS, which can lead to biases due to the need for the older person to report feelings and/or memories. The *Minnesota Leisure Time Activities* instrument to assess the level of physical activity contains activities that are not compatible with the reality of the Brazilian population, which can impact the measurement of energy expenditure in older people.

CONCLUSION

The condition and frailty markers fatigue/exhaustion and reduced level of physical activity were predictors of depressive symptoms (DS) in older people. Pre-frailty and frailty were higher in older people with DS in the studied sample.

Pre-frailty was shown to be a prevalent condition among older people in which symptoms of fatigue and lack of energy and interpersonal sensitivity are added to a decrease in positive affect. Once the frail and pre-frail older person is identified, it is important to consider the strong relationship between these conditions.

The fatigue/exhaustion and reduced level of physical activity frailty markers were shown to be predictors of DS in older people, the first being the one with the greatest predictive power.

DS can present impaired screening due to the subjectivity of reported symptoms. The screening of physical frailty, in turn, is carried out with a focus on the physical dimension of the older person, which facilitates the diagnosis and directs health care. In this context, the importance of implementing screening for physical frailty in primary health care is highlighted.

These results favor the Geriatric and Gerontological practice, since when evaluating the causes of common complaints related to fatigue and the reduction of activities of daily living, the professional identifies changes early, and enables assertive behaviors for frail and pre-frail older people with increased risk for developing depressive symptoms. Actions can be aimed at encouraging the practice of physical exercise and through the implementation of actions to improve the management of frailty, which provide the prevention of DS. Thus, considering the modifiable relationship that exists in them, actions are taken to prevent or delay these conditions in older people.

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