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The role of Postural instability/gait difficulty and Fear of falling in predicting falls in non-demented older adults

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Abstract

Introduction—Postural instability/gait difficulty (PIGD) and fear of falling (FoF) frequently co-exist, but their individual predictive values for falls have not been compared in aging. This study aims to determine both independent and combined effect of PIGD and FoF to falls in older adults without dementia.

Methods—PIGD and other extrapyramidal signs were systematically assessed in 449 community-dwelling participants without Parkinson's disease (76.48 ± 6.61 ys; 56.8% female) enrolled in this longitudinal cohort study. Presence of FoF was measured by a single-item question (Do you have a FoF?) and self-confidence by the Activities-specific Balance Confidence scale (ABC scale).

Results—One hundred sixty-nine participants (38 %) had an incident fall over a mean follow-up of 20.1 ± 12.2 months. PIGD was present in 32% and FoF in 23% of the participants. Both PIGD (adjusted hazard ratio (aHR): 2.28; p = 0.016) and self-confidence (aHR: 0.99; p = 0.040) predicted falls when entered simultaneously in the Cox model. However, presence of FoF (aHR: 1.99; p = 0.021) and self-confidence (aHR: 0.98; p = 0.006) predicted falls only in individuals with PIGD.

Conclusions—PIGD and FoF were associated with future falls in older adults without dementia but FoF was a fall's predictor only in individuals with PIGD.

Keywords

Fall; Fear of falling; Postural instability/gait difficulty; Extrapyramidal signs; Aging

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1. Introduction

The incidence of falls is high in community-dwelling older adults (30%) (Deandrea et al., 2010). History of a previous fall, fear of falling (FoF) and postural instability/gait difficulty (PIGD) have been identified as risk factors for falls in different studies in healthy older adults (Buracchio et al., 2010; Deandrea et al., 2010; Verghese et al., 2010). A recent study has established that balance confidence followed by FoF avoidance behavior and motor performances assessed by the Timed up and go represented the best predictors of falls in older adults (Landers et al., 2015).

The PIGD phenotype – clinically defined by postural instability and gait difficulties - is very common in aging, with a prevalence of around 22% for postural instability (Stevens et al., 2008) and 19% for neurological gait difficulty in community dwelling older adults without dementia (Verghese et al., 2010). In aging, individual cardinal domains of extrapyramidal signs (EPS) - also called mild parkinsonian signs (Louis and Bennett, 2007) - such as bradykinesia, rigidity, rest tremor, or PIGD, have been differentially associated with adverse clinical outcomes, such as dementia or mortality (Louis and Bennett, 2007). PIGD that reflects postural and gait disturbances is a stronger predictor for falls compared to other EPS (bradykinesia, rigidity and rest tremor) in normal aging (Buracchio et al., 2010). PIGD also represents one of the strongest factors associated with FoF in older adults (Kumar et al., 2014). Due to the high prevalence of PIGD and FoF in aging and their respective roles in falls mechanisms (Friedman et al., 2002; Scheffer et al., 2008), there is a need to study the contribution of FoF for falls in older adults with and without PIGD.

To address these knowledge gaps, we conducted a longitudinal study of community residing non-demented older adults without Parkinson's disease (PD) to study the respective role of FoF and PIGD (among the EPS) on incidental falls; and especially to examine the influence of FoF in participants with and without PIGD. Then, we studied the role of global EPS (i.e. PIGD, bradykinesia, rigidity and rest tremor) on incidental falls. FoF and PIGD have been both individually identified as strong predictors of falls in aging (Buracchio et al., 2010; Deandrea et al., 2010; Verghese et al., 2010). While these two features commonly co-exist in older adults, they differ in their neural substrates that may increase risk for falls (Buchman et al., 2012). Hence, we hypothesized that both risk factors will predict incident falls. Establishing the relative contribution of PIGD and FoF to fall risk is important as their respective management approaches are different. Identifying common and different falls predictors in older adults with and without PIGD has direct clinical implication in term of rehabilitative approach and falls risk management.

2. Methods

2.1. Participants

Of the 484 older adults screened for enrollment in the Central Control of Mobility in Aging (CCMA) cohort study between June 2011 and January 2015, 449 non-demented older adults (76.48 ± 6.61 ys; 56.8% female) (mean follow-up: 20.1 ± 12.2 months (range: 1.4 – 43.5 months)) were included in this analysis. The study procedures were detailed previously (Holtzer et al., 2014). Briefly, inclusion criteria included age 65 and older and residing in

lower Westchester County identified from a population list. Potential participants were first contacted by mail, then by a structured telephone interview. Exclusion criteria included presence of dementia, significant loss of vision or hearing, inability to ambulate independently even by using a walking device, and current or past history of neurological or psychiatric disorders or medical procedures that may affect mobility. Eligible individuals were scheduled for in-person visits at our research center. During the visits, participants received comprehensive structured neurological, cognitive and mobility examinations. Additional exclusion criterion for the present analysis was incomplete of neurological assessment (n = 30) by the study clinician at baseline, including evaluation of EPS. We excluded two participants with Parkinson's disease and three diagnosed with dementia at consensus case conferences (Holtzer et al., 2008). Diagnoses of dementia were assigned according to the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (Association, 2000) at a consensus case conference involving neuropsychologists and behavioral neurologists after reviewing the neuropsychological tests and the neurological examination and the functional data of each participant (Holtzer et al., 2014). The institutional review board approved the experimental procedures and all participants provided written informed consent in accordance with the tenets of the Declaration of Helsinki.

2.2. Postural instability/gait difficulty and Extrapyramidal signs

PIGD, as well as other EPS features (bradykinesia, rigidity and rest tremor) were systematically ascertained in participants by the study clinician (blinded to cognitive status, fear of falling assessments and the purpose of the present study) using the motor evaluation portion (Part III) of the original version of the Unified Parkinson's Disease Rating Scale (UPDRS). Individual EPS were calculated by summing clinician ratings (0–4) within 4 core domains: 1) PIGD (UPDRS#29-30); 2) bradykinesia (UPDRS#23-26, 31); 3) rigidity (UPDRS#22); and 4) rest tremor (UPDRS#20). In accordance with our previous studies, EPS were diagnosed by the presence of any one of these four cardinal domains; this approach has shown good internal reliability (Allali et al., 2014; Mahoney et al., 2014). Mild PIGD and other EPS features were defined by the presence of one point in any one of the EPS features; and moderate/severe PIGD and other EPS features were defined by a severity score > 1. Combining participants with a score > 1 into the same category (moderate/severe) has been suggested by the distribution the UPDRS scores. Good internal consistency (Cronbach's α: 0.85), and good inter-rater reliability (kappa: 0.60–0.90) have been previously established for the UPDRS in non-demented older adults without PD (Mahoney et al., 2014).

2.3. Falls and fear of falling assessments

A fall was defined as unintentionally coming down to the floor or lower level not due to a major intrinsic or extrinsic event. At the initial visit, history of falls in the previous twelve months was obtained during participant interviews. Then, every 2–3 months, the participants were interviewed by telephone or during their annual in-house visit about any falls since the last contact. The agreement between our telephone and in-house fall interviews has been previously reported to be highly reliable (Verghese et al., 2002).

Fear of falling was systematically assessed during our in-house interview by two approaches. First, presence of FoF was assessed using the single-item question: “Do you have a fear of falling?” (‘yes’ or ‘no’ responses). This single-item question has shown a good test-retest reliability in our previous study (kappa: 0.72) (Oh-Park et al., 2011). Second, the self-confidence was measured by the Activities-specific Balance Confidence (ABC) scale – a fall-related efficacy measure - that is particularly appropriate for high functioning older adults such as the CCMA participants included in this study (Powell and Myers, 1995). The ABC is a 16-item scale, where subjects rate from 0 % (no confidence) to 100 % (completely confident) their level of balance confidence when performing 16 different activities of daily living. This scale was initially developed in elderly populations (Powell and Myers, 1995).

2.4. Covariates

Comorbidities were assessed by the clinician and summarized as the Global Health Score (GHS) based on presence or absence of diabetes, chronic heart failure, arthritis, hypertension, depression, stroke, chronic obstructive pulmonary disease, angina, and myocardial infarction (range 0–9). Depressive symptoms were assessed by the Geriatric Depression Scale-15 (GDS-15); and global cognitive performance by the Repeatable Battery for Assessment of Neuropsychological Status (RBANS) total score. Gait velocity (cm/s) was measured with an instrumented walkway (GAITRite, CIR systems, Havertown, PA) at usual pace, while the participants were wearing their own shoes.

2.5. Statistics

Descriptive statistics were calculated and we compared incident fallers and non-fallers using independent sample t-tests or Fisher’s exact test, as appropriate. Data were represented graphically, as well as with descriptive statistics, and the proportional hazard model assumptions were formally met for each model. Univariable and multivariable Cox proportional hazards models were used to compute hazard ratios (HRs) with 95% confidence intervals to predict incident falls based on baseline groups, where we compared participants without any EPS feature (reference group); with those presenting 1 point (mild group); and with those presenting at least 2 points (moderate/severe group) in the UPDRS subcategories (PIGD, bradykinesia and rigidity). Due to the very low prevalence of rest tremor (6%), we were not able to include this feature in the model. Age, gender, education, other EPS (bradykinesia and rigidity), GHS, GDS-15, RBANS total score, history of falls in the previous twelve months and gait velocity were used as covariates. The time scale was follow-up time (days) to an incident fall or final contact. All analyses were conducted using SPSS version 21 (SPSS Inc., Chicago, Ill., USA).

3. Results

Characteristics of the incident fallers and non-fallers are provided in Table 1. The incidence of falls during the conduct of the study was 37.6% for the entire sample without any difference between PIGD and non-PIGD participants (42.3% versus 35.5%, respectively; $p = 0.176$); or EPS and non- EPS participants (37.1% versus 38.4%, respectively; $p = 0.770$).

Incident fallers were older and reported increased concern about falls in both single-item questions and ABC scale. The overall prevalence of FoF was 23.4% at the single-item question and the mean ABC scale score was 85.3 ± 15.0%. The prevalence of PIGD was 31.6%, whereas the overall prevalence of EPS was 57.7% (rigidity: 32.1%; bradykinesia: 25.4% and rest tremor: 6.0%). Among EPS features, only the prevalence of the moderate/severe form of PIGD was higher in the faller group (9% versus 4%; p = 0.037), whereas the other EPS features were similar between both groups. Incident fallers presented an increased rate of comorbidity (GHS: 1.78 ± 1.07 versus 1.54 ± 1.04; p = 0.020) and a higher prevalence of previous falls (26% versus 15%; p = 0.004) in comparison to non-fallers.

The presence of moderate/severe PIGD was the most robust predictor of falls in the adjusted Cox models (adjusted HR (aHR): 2.28; p = 0.016). Age, self-confidence (ABC scale), GHS and history of falls were the other significant predictors of falls in the adjusted model. There was no significant statistical interaction between PIGD and ABC scale in this model. Presence of FoF (single-item FoF question) increased the risk of fall by 71% in the unadjusted Cox proportional hazards model (HR: 1.75; p = 0.001), but not in the fully adjusted Cox models (aHR: 1.38; p = 0.101). The presence of EPS overall (HR: 1.08; p = 0.607) or any moderate/severe EPS feature (HR: 1.11; p = 0.550) did not predict fall even in the unadjusted model (Table 2).

Predictors for falls differed between participants with and without PIGD (Table 3a), as well as between participants with and without EPS (Table 3b). In participants with PIGD, self-confidence (ABC scale) and comorbidity (GHS) were the two significant falls predictors, whereas in the non-PIGD group, age, female gender and previous falls constituted the falls predictors (Table 3a). The presence of FoF (single-item question) was also a predictor of fall (aHR: 1.99; p = 0.021) with comorbidity (aHR: 1.48; p = 0.003) in participants with PIGD, but not in the non-PIGD group (aHR: 1.04; p = 0.868) (data not reported in the Table 3).

In participants with EPS, the presence of moderate/severe PIGD, a concern about falling (ABC scale) and GHS were the three predictors for falls in the fully adjusted model; the presence of moderate/severe PIGD doubling the risk of falls (aHR: 2.55; p = 0.010) (Table 3b). No significant statistical interaction between PIGD and ABC scale was reported in the EPS group. In participants without EPS, age and gender female were the two predictors of falls, whereas the presence of FoF or the self-confidence (ABC scale) did not predict falls.

4. Discussion

Our study reported that PIGD and concern about falling predicted the occurrence of falls in non-demented older adults without PD. The predictors for falls differed between participants with and without PIGD: FoF, previous falls and comorbidity predicted falls in the PIGD group, whereas age and gender female in the non-PIGD group. Self-confidence (i.e. ABC scale) but not mere presence of FoF influenced risk of falls in our cohort, especially in individuals with PIGD.

The presence of moderate or severe PIGD constituted the most robust predictor for falls. PIGD combined two items from the UPDRS assessing gait and postural control; both

components have been independently considered as falls predictors in aging (Allali et al., 2015; Verghese et al., 2010). Both vascular (de Laat et al., 2012) and neurodegenerative lesions, especially when located in the basal ganglia, (Buchman et al., 2012) contribute to PIGD in aging, and have been both associated with falls (Hsu et al., 2014; Nagamatsu et al., 2013). Similarly, concern about falling, a well-known falls predictor in aging (Delbaere et al., 2010), has been also associated with brain volume reduction in regions important for higher level of gait and postural control (prefrontal cortex and cerebellum) (Tuerk et al., 2016). Among the individual EPS features, only PIGD was a significant predictor of falls, by more than doubling the risk of falls in participants with moderate/severe PIGD in comparison to individuals without PIGD. In comparison with previous studies assessing gait as falls' predictor, the presence of neurological gait abnormalities has been associated with a risk ratio of 1.49 (95% C.I. 1.11–2.00) for falls; among the subtypes of neurological gaits, unsteady and neuropathic gaits have been considered as predictor of falls (Verghese et al., 2010). Disturbed quantitative gait parameters have been also identified as predictors for falls (Verghese et al., 2009). The presence of moderate/severe PIGD was even a best falls predictor than having a fall in the previous twelve months. A previous longitudinal study reported that EPS worsening predicted falls in a similar sample of non-demented older adults without PD; however this study did not report if presence of EPS at initial visit predicted incidental falls (Buracchio et al., 2010). To our knowledge, no previous study has compared individual EPS features for their predictive validity for falls.

Fall predictors in EPS individuals share similarities with those found in Parkinson's disease (PD), such as PIGD and FoF, as well with those not reported in PD: age and gender (Lindholm et al., 2015; Pickering et al., 2007). Interestingly, previous falls, considered as the best predictor for incidental falls in PD (Canning et al., 2014; Pickering et al., 2007), showed a trend for the EPS participants ($p = 0.054$), but not in the non- EPS group ($p = 0.297$). However, comorbid disorders that are reported as a strong falls predictors for the EPS participants – increasing the risk of fall of 32 % - have not been considered as a major falls predictor in PD (Canning et al., 2014). This discrepancy focusing on comorbidity reflects the specificities of EPS in comparison of PD, such as the increasing incidence of EPS with age as well as the major role of cardiovascular comorbidities in the pathophysiology of EPS (Louis and Bennett, 2007; Mahoney et al., 2014).

FoF has been identified as a strong predictor of falls in aging studies (Friedman et al., 2002). Here, we showed for the first time that in older adults without EPS or PIGD, the presence of FoF and the self-confidence (single-item question and ABC scale, respectively) do not predict falls when adjusting for age and gender. This discrepancy between EPS and non-EPS participants regarding FoF as a falls predictor can be interpreted as a protective mechanism employed by the EPS group regarding their motor limitations. This mechanism could however have deleterious consequences in term of activities avoidance, social isolation or quality of life (Scheffer et al., 2008). An alternate interpretation of this discrepancy of FoF as a fall's predictor between older adults with and without EPS or PIGD could point out that participants with EPS or PIGD are at a transitional stage between normal and pathological aging. This transitional stage implies an underlying neuropathological process that interferes in the association between FoF and incidental fall. This finding regarding FoF

as a specific falls predictor in EPS individuals should increase awareness for clinical intervention in this population.

The predictive value of FoF for falls differed if FoF were measured by the single-item question (Do you have a fear of falling?) or by a questionnaire of fall-related efficacy (ABC scale): the fall-related efficacy scale representing a more robust falls predictor than the single-item question. The prevalence of the single-item question was in the similar range (23.4%) as previous comparable studies (Friedman et al., 2002; Oh-Park et al., 2011); and the ABC scale-score was also similar to previous studies (Hatch et al., 2003). Although the single-item question predicted falls in the unadjusted model by increasing the risk of fall of 71%, it did not remain significant after adjustment that is not in line with the Friedman's study using also the same single-item question (Friedman et al., 2002). In contrast with this previous study, here we excluded participants with PD; FoF playing a major role in PD (Lindholm et al., 2015; Pickering et al., 2007). Interestingly, Cumming et al. found similar finding than the current study regarding the discrepancy between the presence of FoF and the self-confidence as falls predictor: when FoF was assessed by a fall-related efficacy scale (Fall Efficacy Scale (Tinetti et al., 1990)), it was a falls predictor, but not when assessed by the single-item question (Cumming et al., 2000). Furthermore, like in our study, the single-item question predicted falls in the unadjusted model, but not after adjustment for covariates (Cumming et al., 2000). This discrepancy could be explained by the lower reliability of the single-item question in comparison to a multiple-item fall-related efficacy questionnaire as suggested by previous authors (Powell and Myers, 1995; Scheffer et al., 2008; Tinetti et al., 1990).

Due to the high prevalence of PIGD and FoF in aging (Delbaere et al., 2010; Friedman et al., 2002; Louis and Bennett, 2007; Oh-Park et al., 2011; Scheffer et al., 2008; Verghese et al., 2010), this study has some important clinical implications in term of medical screening and therapeutic intervention. As FoF predicted falls in individuals with PIGD or with EPS, and that FoF is considered as a modifiable risk factor for falls (Scheffer et al., 2008), FoF should be screened with a special attention in these individuals.

Measuring FoF with two validated instruments (Oh-Park et al., 2011; Powell and Myers, 1995) in combination with a validated comprehensive neurological assessment of EPS (Allali et al., 2014; Mahoney et al., 2014) represents the main strengths of this longitudinal study. However, some limitations should be acknowledged: as no validated scale for identifying extrapyramidal symptoms exists in older adults without PD, we used the UPDRS validated in PD patients to assess EPS, like in previous studies conducted by different research groups (Allali et al., 2014; Buchman et al., 2012; de Laat et al., 2012); although we excluded participants with dementia, recall bias could still affect the report of incidental fall by using a bi-monthly telephone interview or by reporting fear of falling at baseline assessment; this very healthy sample (GHS: 1.63 ± 1.06) with the consequence of a low impact of EPS (EPS total score: 2.51 ± 3.77) forces us to use EPS feature as a 3 steps scale (no; mild; moderate/severe) instead of a continuous measure; similarly, the low prevalence of rest tremor (6%) prevents us to study this EPS feature, as a falls predictor; a measure of the various drug classes was not included as covariate in our analyses; and finally, the highly functioning study sample could limit the generalization of the study findings.

5. Conclusion

In conclusion, PIGD and FoF predicted falls in this sample of non-demented older adults without PD, but falls predictors differed between older adults with and without PIGD; FoF being a specific falls predictors in participants with PIGD, but not in participants without PIGD. Since FoF is a modifiable risk factor for falls, clinicians and future falls intervention studies should focus on it, especially in individuals with PIGD. Finally, PIGD, demonstrated as a major risk factor for falls in this highly functioning sample of older adults, should be taken into consideration earlier in falls prevention's strategy.

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Abbrevations

ABC	Activities-specific Balance Confidence
CCMA	Central Control of Mobility in Aging
EPS	extrapyramidal signs
FoF	fear of falling
GDS-15	Geriatric Depression Scale-15
GHS	Global Health Score
HRs	hazard ratios
PD	Parkinson's disease
PIGD	postural instability/gait difficulty
RBANS	Repeatable Battery for Assessment of Neuropsychological Status
UPDRS	Unified Parkinson's Disease Rating Scale

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HIGHLIGHTS

- PIGD and fear of falling are associated with future falls.
- Fear of falling predicts falls in individuals with PIGD.
- Predictors for falls differed between participants with and without PIGD.

Table 1

Clinical Characteristics (n = 449)

	Fallers (n = 169)	Non-Fallers (n = 280)	P-value*
Age (years)	77.51 ± 6.93	75.86 ± 6.35	**0.010**
Female, n (%)	103 (61)	152 (54)	0.171
Education (years)	14.56± 2.99	14.41± 3.08	0.610
ABC-score (range 0–100)	82.8 ± 16.8	86.8 ± 13.6	**0.010**
Presence of FoF, n (%)	50 (30)	55 (20)	**0.020**
EPS, n (%)			0.957
Absent	73 (43)	117 (42)	
Mild	32 (19)	54 (19)	
Moderate/Severe	64 (38)	109 (39)	
PIGD, n (%)			0.073
Absent	109 (65)	198 (71)	
Mild	45 (27)	71 (25)	
Moderate/Severe	15 (9)	11 (4)	
Bradykinesia, n (%)			0.940
Absent	126 (75)	209 (75)	
Mild	19 (11)	29 (10)	
Moderate/Severe	24 (14)	42 (15)	
Rigidity, n (%)			0.726
Absent	113 (67)	192 (69)	
Mild	10 (6)	20 (7)	
Moderate/Severe	46 (27)	68 (24)	
Tremor, n (%)			0.372
Absent	159 (94)	263 (94)	
Mild	5 (3)	4 (1)	
Moderate/Severe	5 (3)	13 (5)	
GHS (range 0–9)	1.78 ± 1.07	1.54 ± 1.04	**0.020**
Falls in the past 12 months, n (%)	44 (26)	41 (15)	**0.004**
Gait velocity (cm/s)	96.7 ± 23.3	99.1 ± 21.3	0.283
GDS-15 (range 0–15)	2.03 ± 1.88	2.06 ± 1.90	0.851
RBANS total score (range 55–145)	91.7 ± 10.7	91.4 ± 12.7	0.814

ABC: Activities-specific Balance Confidence; FoF: fear of falling; EPS: extrapyramidal signs; PIGD: postural instability/gait difficulty; GHS: global health score: GDS: geriatric depression scale; RBANS: Repeatable Battery for the Assessment of Neuropsychological Status;

Presence of fear of falling is assessed by the question “Do you have a fear of falling?”;

* using two-sample t-tests or Fisher’s exact tests, as appropriate.

Table 2

Univariable and Multivariable Cox Regression Models for the occurrence of the first fall in all participants (n= 449)

	Univariable	**Multivariable***
	HR [95% CI] P-value	**aHR [95% CI] P-value**
Age	1.03 [1.01;1.06] **0.002**	1.03 [1.01;1.06] **0.015**
Female	1.38 [1.01;1.89] **0.041**	1.36 [0.98;1.89] 0.067
Education	1.02 [0.97;1.07] 0.517	1.03 [0.98;1.09] 0.226
ABC score	0.98 [0.97;0.99] **<0.001**	0.99 [0.98;1.00] **0.040**
Presence of FoF	1.75 [1.25;2.43] **0.001**	1.38 [0.94;2.00] 0.101
PIGD		
Absent	Ref.	Ref.
Mild	1.22 [0.86;1.73] 0.264	1.00 [0.70;1.45] 0.983
Moderate/Severe	2.79 [1.61;4.78] **<0.001**	2.28 [1.17;4.45] **0.016**
Bradykinesia		
Absent	Ref.	Ref.
Mild	1.42 [0.88;2.31] 0.155	0.93 [0.54;1.60] 0.795
Moderate/Severe	1.32 [0.85;2.05] 0.210	0.77 [0.45;1.32] 0.343
Rigidity		
Absent	Ref.	Ref.
Mild	0.80 [0.42;1.52] 0.488	0.68 [0.35;1.32] 0.251
Moderate/Severe	1.03 [0.73;1.46] 0.855	0.90 [0.60;1.33] 0.581
GHS	1.20 [1.05;1.38] **0.008**	1.22 [1.05;1.41] **0.008**
Falls in the past 12 months	1.76 [1.24;2.48] **0.001**	1.50 [1.04;2.15] **0.028**
Gait velocity	0.99 [0.98;1.00] **0.005**	1.00 [0.99;1.01] 0.789
GDS-15	1.03 [0.95;1.12] 0.498	0.96 [0.87;1.06] 0.436
RBANS total score	1.00 [0.98;1.01] 0.444	1.00 [0.98;1.01] 0.654

HR: hazard ratio; aHR: adjusted hazard ratio; 95% CI: confidence interval; ABC: Activities-specific Balance Confidence; FoF: fear of falling; EPS: extrapyramidal signs; PIGD: postural instability/gait difficulty; GHS: global health score: GDS: geriatric depression scale; RBANS: Repeatable Battery for the Assessment of Neuropsychological Status.

*All independent variables (age, gender, education, ABC score, PIGD, bradykinesia, rigidity, GHS, falls in the past 12 months, gait velocity, GDS-15, and RBANS total score) are entered simultaneously into the Cox regression model, except for presence of FoF, where presence of FoF was entered simultaneously into the Cox regression model with age, gender, education, PIGD, bradykinesia, rigidity, GHS, falls in the past 12 months, gait velocity, GDS-15, and RBANS total score.

Table 3a

Multivariable* Cox Regression Models for the occurrence of the first fall in participants with and without postural instability/gait difficulty (PIGD)

	No PIGD (n = 307)	**PIGD (n = 142)**
	aHR [95% CI] P-value	**aHR [95% CI] P-value**
Age	1.04 [1.01;1.07] **0.014**	1.01 [0.97;1.05] 0.688
Female	2.03 [1.35;3.05] **0.001**	0.56 [0.31;1.02] 0.057
Education	1.00 [0.93;1.06] 0.874	1.09 [0.99;1.20] 0.074
ABC score	1.00 [0.98;1.01] 0.613	0.98 [0.96;0.99] **0.006**
GHS	1.07 [0.89;1.29] 0.458	1.48 [1.15;1.91] **0.003**
Falls in the past 12 months	1.73 [1.11;2.71] **0.016**	1.03 [0.56;1.90] 0.915
Gait velocity	1.00 [0.99;1.01] 0.591	1.00 [0.98;1.01] 0.396
GDS-15	0.95 [0.84;1.07] 0.394	1.04 [0.88;1.23] 0.657
RBANS total score	1.00 [0.98;1.02] 0.834	1.00 [0.97;1.02] 0.769

aHR: adjusted hazard ratio; 95% CI: confidence interval; ABC: Activities-specific Balance Confidence; FoF: fear of falling; EPS: extrapyramidal signs; PIGD: postural instability/gait difficulty; GHS: global health score: GDS: geriatric depression scale; RBANS: Repeatable Battery for the Assessment of Neuropsychological Status;

*All independent variables (age, gender, education, ABC score, GHS, falls in the past 12 months, gait velocity, GDS-15, and RBANS total score) are entered simultaneously into the Cox regression model.

**All independent variables (age, gender, education, ABC score, PIGD, bradykinesia, rigidity, GHS, falls in the past 12 months, gait velocity, GDS-15, and RBANS total score) are entered simultaneously into the Cox regression model.p

Table 3b

Multivariable** Cox Regression Models for the occurrence of the first fall in participants with and without extrapyramidal signs (EPS)

	No EPS (n = 190)	**EPS (n = 259)**
	aHR [95% CI] P-value	**aHR [95% CI] P-value**
Age	1.04 [1.00;1.09] **0.035**	1.03 [0.99;1.06] 0.114
Female	2.63 [1.52;4.53] **0.001**	0.87 [0.55;1.36] 0.865
Education	0.99 [0.91;1.08] 0.844	1.05 [0.98;1.13] 0.173
ABC score	1.00 [0.97;1.02] 0.740	0.98 [0.97;1.00] **0.023**
PIGD	-	
Absent		Ref.
Mild		1.22 [0.75;2.01] 0.426
Moderate/Severe		2.55 [1.26;5.16] **0.010**
Bradykinesia	-	
Absent		Ref.
Mild		0.97 [0.53;1.76] 0.917
Moderate/Severe		0.81 [0.45;1.44] 0.469
Rigidity	-	
Absent		Ref.
Mild		0.82 [0.39;1.73] 0.607
Moderate/Severe		0.95 [0.58;1.54] 0.826
GHS	1.12 [0.89;1.40] 0.340	1.32 [1.08;1.62] **0.008**
Falls in the past 12 months	1.40 [0.77;2.54] 0.274	1.58 [0.99;2.50] 0.054
Gait velocity	1.00 [0.99;1.02] 0.589	1.00 [0.99;1.01] 0.883
GDS-15	1.00 [0.85;1.16] 0.952	0.98 [0.86;1.12] 0.807
RBANS total score	0.99 [0.97;1.01] 0.435	1.00 [0.98;1.02] 0.796

aHR: adjusted hazard ratio; 95% CI: confidence interval; ABC: Activities-specific Balance Confidence; FoF: fear of falling; EPS: extrapyramidal signs; PIGD: postural instability/gait difficulty; GHS: global health score: GDS: geriatric depression scale; RBANS: Repeatable Battery for the Assessment of Neuropsychological Status;

*All independent variables (age, gender, education, ABC score, GHS, falls in the past 12 months, gait velocity, GDS-15, and RBANS total score) are entered simultaneously into the Cox regression model.

**All independent variables (age, gender, education, ABC score, PIGD, bradykinesia, rigidity, GHS, falls in the past 12 months, gait velocity, GDS-15, and RBANS total score) are entered simultaneously into the Cox regression model.p