VALIDITY OF TWO FALL PREVENTION STRATEGIES SCALES FOR PEOPLE WITH STROKE, PARKINSON'S DISEASE AND MULTIPLE SCLEROSIS

ABSTRACT

Introduction: Falls are a common and persistent concern among people with neurological disorders, as they frequently result in mobility deficits and may lead to loss of functional independence. This study investigated the ceiling and floor effects, internal consistency, and convergent validity of two patient-reported fall prevention strategies scales in people with neurological disorders (PwND).

Methods: This is a prospective cohort study. Two-hundred and ninety-nine PwND (111 People with Multiple Sclerosis, 94 People with Parkinson's Disease, and 94 People with Stroke) were seen for rehabilitation and assessed. The number of retrospective and prospective falls, use of walking assistive devices, scores on Fall Prevention Strategies Survey (FPSS), Falls Behavioural Scale (FaB), and balance and mobility scales (Berg Balance Scale, Dynamic Gait Index, Timed Up and Go, Ten meters walking test, and Activities Balance Confidence) were analyzed.

Results: Total score distributions showed negligible ceiling and floor effects for both the FPSS (ceiling: 0.3%, floor: 0.3%) and the FaB (ceiling: 0%, floor: 0%). Cronbach's Alpha [lower-upper confidence] was of 0.87 [0.85-0.89] for the FPSS and 0.86 [0.84-0.88] for FaB. In terms of convergent validity, FPSS and FaB were moderately correlated (Spearman correlation coefficient= 0.65). Moreover, the correlations between FPSS and FaB and balance and mobility scales ranged from 0.25 to 0.49 ($p<0.01$). Both scales are slightly higher able to distinguish between retrospective fallers/non-fallers [AUC(95%CI): FPSS: 0.61 (0.5-0.7), FaB: 0.60 (0.5-0.6)] compared to prospective fallers/non-fallers [AUC (95% CI): FPSS: 0.56 (0.4-0.6), FaB: 0.57 (0.4-0.6)]. Both

scales accurately identified individuals who typically required the use of a walking assistive device for daily ambulation [AUC (95% CI): FPSS: 0.74 (0.7-0.8); FaB: 0.69 (0.6-0.7)].

Multiple regression analysis showed that previous falls, the use of an assistive device, and balance confidence significantly predicted participants' prevention strategies [FPSS: R^2=0.31, F(8,159)=10.5, p<0.01); FaB: R^2=0.31, F(8,164)=10.89, p<0.01)].

Conclusion: FPSS and FaB appear to be valid tools to assess fall prevention strategies in people with neurological disorders. Both scales provide unique and added value in providing information on individual behavior for fall prevention.

INTRODUCTION

Falls among people with neurological disorders (PwND), including people with multiple sclerosis (PwMS) and Parkinson's Disorder (PwPD) and post-stroke (PwST), have a multidimensional etiology[1]. A multivariate assessment is needed to identify the different factors that contribute to falls in order to provide PwND with proper fall prevention strategies to avoid falls.[2,3]

Given the high frequency of falls in PwND[4,5,6] and the severity of their consequences, fall prevention is a key point in the care of PwND. Moreover, the study of fall prevention strategies of PwND includes information on behavioral and environmental factors (eg: hazards, lighting), evaluation and adaptation of activity demands, and training in the use of compensatory strategies (eg: using a mobility device) that are not captured during routine clinical assessment.[7,8] So far, few instruments have been reported to measure behavioral changes that could have an impact in fall prevention. In this perspective, both the Falls Prevention Strategy Survey (FPSS)[9] and Falls Behavioural scale (FaB)[10,11] were developed to capture patient-reported behaviors and assess fall prevention strategies. Although these patient-reported outcome measures are commonly used for older adults and PwMS, no published study reports on their validity for PwND nor on how they relate to clinical scales used to assess functional balance. Increased awareness and validated measures of fall-risk and behavioral strategies that PwND currently use in an effort to prevent falls could provide useful insights for health professionals and guide development and implementation of more effective fall prevention strategies for PwND.

Therefore, this study aims to provide data on ceiling and floor effects, internal consistency, and convergent validity of these two scales in distinguishing between fall prevention strategies of fallers and non-fallers, and those using an assistive device in a sample of PwND.

METHODS

Study design

In this secondary analysis, data were collected as part of a prospective study conducted from February 2013 to September 2015, participants were recruited from 3 rehabilitation centers in Italy.[2] Eligible participants were inpatients and outpatients with PD, MS, or Stroke requiring rehabilitation for balance disturbances. All participants were able to maintain upright posture and walk even with assistive device. Excluded were participants having a cognitive impairment (Mini-Mental State Examination<21), major depression (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition), severe bone and/or joint disorder (based upon physician clinical judgment) interfering with balance and gait, aphasia only if it interfered with the comprehension of the study and multiple neurological diagnoses. PwMS were excluded if they had suffered a relapse within the previous 3 months. PwST were excluded if stroke had occurred within 4 weeks of study entry.

The study protocol was approved by the institutional review board (27/6/2013), and a signed informed consent was obtained from all participants before any data collection. The assessments were done by experienced research physical therapists (one therapist for each center). To ensure standardization, practice assessment sessions were held in the 3 centers and all tests were administered using written and standardized instructions. The whole assessment was performed in a single session with participants allowed to rest as needed during the examination.

Data collection

At baseline, demographic data and retrospective falls (2 months) were collected from all participants during a hospital visit. In the same session, each participant completed FPSS, FaB, and all clinical balance and mobility tests. Two months later, each participant was contacted by telephone to identify and record the number of falls they had experienced.

A fall was defined as an unexpected event where the person inadvertently came to rest on the ground or other lower level.[12] A participant was qualified as a faller when experiencing at least one fall in the observation period. Participants were categorized as using an assistive device if they required unilateral or bilateral support to walk.

Fall Prevention Strategy Survey

The FPSS is a self-reporting instrument addressing protective behaviors related to fall risk among PwMS. The FPSS assesses the adoption of fall prevention strategies, including wearing proper footwear or modifying activities.[9,13] A score of 0 is assigned to strategies participants report never using, 1 to strategies used sometimes, and 2 to strategies used regularly. The total score is the sum of the 19 items, ranging from 0 to 38, with higher scores reflecting regular use of more fall prevention strategies.

Falls Behavioural Scale

The FaB is a valid and reliable self-reporting test for assessing fall-related behaviours and for identifying people at risk of fall. The test has been validated for elderly people and provides information on the adoption of safety strategies and behaviors to avoid falls.[10] It is useful in the clinical setting for evaluating the effectiveness of fall reduction interventions that aim to encourage protective strategies when negotiating the environment, mobilizing and doing activities of daily living. The FaB is scored on a 4-point Likert scale: never (1), sometimes (2), often (3), always (4) and does not apply (no-score). Following the manual instructions, we have recoded six items to ensure high scores equal the safest behaviours and low scores the riskiest behaviours.(item 7: ”I hurry when I do things”; item 8: “I turn around quickly”; item 9 : “To reach something up high I use the nearest chair, or whatever furniture is handy, to climb on”; item 10: “I hurry to answer the phone”; item

19m: “When wearing bifocals I misjudge a step or do not see a change in floor level”; item 23: “I go out on windy days”). [10,11]

Balance and mobility scales

We assessed balance and mobility with validated and frequently used scales for PwND. To assess the balance domain[14], we used Berg Balance Scale (BBS) ranging from 0 [poor balance] to 56 [excellent balance].[14] The BBS provides information about patient’s balance-related abilities rating performance from 0 (worse) to 4 (best) on 14 items. The psychometric properties of the scale have been assessed on populations of elderly subjects with the test demonstrating to be a valid and reliable instrument.[15] The intrarater and interrater reliability of the BBS were very high, the ICC ranged from 0.98 – 0.99 for intrarater reliability and 0.98 for interrater reliability.[16] Cattaneo et al. proved the validity of the BBS for subjects with MS reporting that the scale had a good concurrent validity but not a good discriminant validity to distinguish between fallers and non-fallers.[17]

The Dynamic Gait Index (DGI) ranges from 0 [poor performances] to 24 [excellent performances]. The eight tasks of this scale include walking, walking with head turns, pivoting, walking over objects, walking around objects, and going upstairs. Jonsdottir et al. proved the validity of DGI on stroke population showing an ICC for total scores for interrater reliability of 0.96. Moreover, DGI showed a moderate positive correlation with the BBS and the ABC.[18]

To assess the mobility domain, we used the Timed Up-and- Go (TUG)[19] and Ten Meters Walking Test (10MWT)[20], measured in seconds where ‘fast performance’ corresponds to best performance. In the TUG subjects had to stand up from a chair (without armrests), walk 3 m, turn back, and sit down again while being timed while in the 10MWT the subjects were instructed to walk at their fastest speed with the mean of two trials calculated.

To assess perceived balance confidence, we used Activities Balance Confidence (ABC) ranging from 0 [low confidence] to 100 [high confidence].[17]

Data analysis

We assessed test score distributions by calculating the percentages of ceiling and floor effects. Skewness was used to describe score symmetry and Shapiro-Wilk test was used to test for normality both for FPSS and FaB.

To assess internal consistency, we analyzed the correlations between different items on the overall test score respectively for the FPSS and the FaB. We calculated the Cronbach's alpha (CA) as a measure of items homogeneity with a CA between 0.70 and 0.95 indicating a positive rating.

To assess convergent validity, we used the Spearman correlation coefficients to analyze the relationship between the two FPSS and FaB, and the relationship between each of the two scales and DGI, BBS, 10MWT, TUG, and ABC respectively. Further, the association between each of the fall prevention scales and presence/absence of falls and use/nonuse of walking assistive devices was analyzed.

Moreover, using Receiving Operating Characteristic (ROC) analysis, we analyzed the ability of the FPSS and FaB to discriminate between fallers/non-fallers and between people using/not-using AD.Results are presented as medians (Interquartile range, IQR) and Area Under the Curve (AUC) with 95% CI.

Each analysis was run for the whole sample and, separately, for PwMS, PwPD, PwST.

Finally, we ran two multivariate linear regression models, one including FPSS and one including FaB as dependent variables while fallers/non-fallers, people using/not-using AD and balance and mobility scales were used as predictors to assess which of these variables was associated with the respective scale's score while age, sex and education were used as confounders. Results from the regression model for the whole sample were comparable to those obtained for PwMS, PwPD, PwST and were not reported.

RESULTS

The sample, mean (standard deviation) age 62.4 (12.9) years, disease duration 9.6 (9.1) years, reported a median (IQR of 1 [2] retrospective falls and 0 [2] prospective falls before and after the baseline assessment (Table 1).

Total score distributions showed negligible ceiling and floor effects for both the FPSS (ceiling: 0.3%, floor: 0.3%) and the FaB (ceiling: 0%, floor: 0%).

Scores distributions are depicted in Figures 1-4. Specifically, figure 2 and 4 show The Q-Q plots. A straight line suggests our data plausibly came from the normal distribution. Concerning the whole sample, FaB was moderately left skewed (skewness=-0.38, Shapiro-wilk = 0.98, P<0.001), while FPSS showed a more symmetric distribution (skewness= 0.2, Shapiro-wilk = 0.98, P<0.03) compared to FaB.

Concerning the three pathological conditions, skewness (absolute values) was low for FaB (PwSM: skewness=0.84, Shapiro-wilk =0.95, P<0.001; PwPD: skewness=-0.11, Shapiro-wilk=0.99, P=0.50; PwST: skewness=-0.29, Shapiro-wilk=0.98, P=0.08), and FPSS (PwMS: skewness=0.03, Shapiro-wilk =0.98, P=0.24; PwPD: skewness=0.53, Shapiro-wilk=0.97, P=0.02; PwST: skewness=0.15, Shapiro-wilk=0.98, P=0.39).

Internal consistency was good for both scales. The FPSS showed a CA [95% lower- upper confidence limit] of 0.87 [0.85-0.89] for the whole sample and 0.83 [0.87- 0.9] for PwMS, 0.82 [0.86-0.9] for PwPD, and 0.82 [0.86-0.9] for PwST. The FaB showed a CA 0.82 [0.86-0.9] for the whole sample and 0.81 [0.85- 0.89] for PwMS, 0.78 [0.83-0.88] for PwPD, and 0.81 [0.85-0.89] for PwST.

Regarding convergent validity, FPSS and FaB were moderately correlated (Spearman correlation coefficient=0.65). Figure 5 reports correlations between FPSS and FaB and between these two scales and balance and mobility scales for the whole sample and subsamples, showing moderate-strong correlations for all subsamples except PwPD (weak correlations).

AUC analyses are reported in Table 2 for the whole sample of subjects having follow-up falls (n=121) AUCs for the whole sample were above 0.50 for both scales, while worse discriminant properties were observed for PwMS for retrospective and prospective fallers and PwST for prospective fallers.

Finally, the results of multivariate linear regression models showed that falls, the use of an assistive device, and balance confidence significantly predicted participants' prevention strategies when age, sex and education were controlled for. (Table 3)

DISCUSSION

This study aimed at investigating the use of FPSS and FaB for fall prevention strategies in PwND demonstrating that FPSS and FaB can offer additional insights in providing information on their behaviours for fall prevention. Specifically, we investigated ceiling and floor effects, internal consistency, and the convergent validity of these two scales in distinguishing between the fall prevention strategies of fallers and non-fallers, and those using an assistive device in a sample of PwND. The information gathered from the two scales each provides useful information, which, when used in combination might inform the health professional, and guide multifaceted strategies to optimize fall prevention efforts among PwND.

No relevant floor and ceiling effects were noted even though FPSS and FaB scores were slightly skewed, indicating that both scales are appropriate tools to assess PwND with balance disorders.

Internal consistency of FPSS and FaB was good for the whole sample and the three conditions separately, meaning that the inter-correlations among test items are good, suggesting the items measure the same latent variable, i.e. the use of fall prevention strategies in PwND.

In contrast, convergent validity of the FPSS and FaB was moderate for the whole sample and subsamples indicating that the two scales cover the same construct. While both scales investigate

the strategies PwND adopt to prevent falls, we did not find a strong correlation between them. This is probably due to slightly different item composition: for instance, the FaB is longer than the FPSS and includes sub-domains not covered by the FPSS. Specifically, the FaB includes activities individuals can perform outside home environment and identifies whether a person is willing to request help with challenging activities. Clemson et al.[7] reported ten dimensions of the FaB that contribute to understanding the kinds of actions and behavioral adaptations PwND use to enhance safety and protect themselves from falling (e.g. cognitive adaptations, protective mobility, and avoidance). On the other hand, the FPSS investigates domains related to the time spent doing physical activity, the role of physical therapists giving recommendations to prevent falls, and the action planning after a fall. In conclusion, both the FaB and the FPSS could be chosen for a more thorough investigation of fall prevention strategies, depending on the goal of the assessment. Together, the information from the two scales could provide the health professional with a multifaceted strategy to optimize fall reduction interventions for PwND.

As expected, the correlations between the FaB and the FPSS and the balance and mobility scales for the whole sample were moderate suggesting FaB and FPSS provide information on strategies used by PwND to avoid falls not captured by balance and mobility scales. This may explain why two people having similar balance impairments but different fall prevention strategies show different frequency of falls.

The subsampling analysis revealed weak correlations between the FPSS and the FaB and balance and mobility scales in PwPD suggesting lower concurrent validity for this condition. This is probably due to the lack of pathology-specific items inquiring upon PD-related disorders such as medication side-effects and freezing. While our sample included both PwPD with and without freezing of gait, reflecting a typical heterogeneity of Parkinson's population, we did not analyze separately PwPD with and without freezing of gait. However, further analyses are warranted since according to Chivers Semyour et al.[21] people who experienced freezing are more prone to fall and

have a different level of motor problems and challenges when dealing with falls resulting in different fall prevention strategies.

Thus, to improve the association between the FPSS and the FaB and balance and mobility scales for PwPD, the addition of PD specific items could be useful to better capture PD-related fall prevention behaviors (e.g. "*When I am in my off-phase I take particular care doing everyday activities?" or* "*When I freeze I take care of how I move around?").*

Consistent with existing literature ,[7, 16] the analysis of the whole sample showed that mean FPSS and FaB total scores were higher for fallers compared to non-fallers indicating that PwND who fall may require more fall prevention strategies than non-fallers. These differences were supported by AUC values slightly higher than 0.50. However, the subsampling analysis showed lower discriminatory capacity in the identification of fallers and non-fallers with an AUC value <0.50. This was true both for retrospective and prospective falls, in keeping with the concept that no major differences have been seen between these two methods to collect falls.[22] Lack of strong discriminatory power indicates that the relationship between falls and fall prevention strategies needs further investigation in the respective neurological disorders.

In our antecedent study neither scale differentiated between fallers and non-fallers when the prospective assessment period was longer than 2 months.[2] Low discriminatory power may, however, be due to attrition rate of 40% with 121 subjects lost at the 2months follow-up. In general, missing data were due to the impossibility to contact participants despite -repeated attempts. Even if data from a 6-month follow up was available, we decided to use a shorter observation period to reduce recall bias and to be consistent with the two-months retrospective falls period.

Due to the multivariate nature of falls, multiple factors must be considered to discriminate between fallers and non-fallers and to differentiate between people using/not-using an assistive device. Our results are in agreement with other studies showing that people using an assistive device are frequent fallers and are more likely to adopt fall prevention strategies.[23,24] Indeed, the multivariate linear models showed that fall prevention strategies are higher in PwND who use assistive devices

(change from cane to walker led to a change of around 5 points on the FPSS and 0.14 point on the FAB), those fall and have reduced balance perception even after controlling for age, sex, and education, likewise a 10 unit increase on the ABC scale total score results in 1.2 point increase on the FPSS and a 0.08 points on the FAB. The impact of these variables should be considered when assessing fall prevention strategies or when implementing behavioral interventions to reduce falls.

Study limitation

The strength of this study is that falls were prospectively tracked over a 2-month period. This increased the accuracy of the classification of participants as fallers or non-fallers. The collection of data on falls was dependent on the compliance of the participants. It does also have to be considered that the FaB and the FPSS were developed respectively for older adults and multiple sclerosis. Thus, it is possible that some pathology-specific items (i.e. fall prevention strategies used to deal with freezing of gait or lower limb spasticity) are missing. Finally, this study does not exhaustively explain the relationship between the frequency of falls and the use of fall prevention strategies. Further research on FPSS and FaB scales is needed to assess unidimensionality, reliability, and sensitivity to change.

Conclusion

FPSS and FaB appear to be valid tools to assess fall prevention strategies in PwND. Although balance and mobility scales inform healthcare providers on participants' balance abilities, FPSS and FaB can offer additional insights in providing information on their respective behaviors for fall prevention. These two scales have potential utility for healthcare providers as an assessment and goal-setting tool in clinical practice. Further, they could be used as prompts to discuss behavioral factors and falls, thus profiling safety strategies and restrictive behaviors adopted by the person. Moreover, these tools could be used pre- and post falls prevention interventions to reflect changes

in use of safe behavioral strategies, and ultimately to guide multidimensional interventions to reduce fall risk and the number of falls in persons at risk of falling.

Clinical Highlights

- FPSS and FaB appear to be valid tools to assess fall prevention strategies in PwND.
- FPSS and FaB can be used by healthcare providers in their clinical practice to profile safety strategies and restrictive behaviors adopted by the person or to reflect behavioral changes after multidimensional interventions.

Ackowledgements

The authors express gratitude to the NEUROFALL Group members: Elisabetta Pupillo, Marco Rovaris, Gianluca Iacobone, Alessandra Rodano`, Silvia Romi, Rita Russo, Francesca Tettamanzi (Milano), Irene Aprile, Arianna Cruciani, Isabella Imbimbo (Roma), Michela Agostini, Andrea Polli, and Andrea Turolla, (Venezia).

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Table 1: Demographic and baseline characteristics of the participants. Data are represented as counts and percentage (%) and means and standard deviations (SD)

	Whole Sample (n=299)	**PwMS (n= 111)**	**PwPD (n= 94)**	**PwST (n= 94)**
Age (Years)	62.42 (12.89)	54.01 (10.61)	70.50 (9.72)	64.37 (12.24)
Disease Duration (Years)	9.64 (9.12)	16.32 (9.61)	8.13 (5.10)	2.65 (5.16)
Sex Female, n (%)	147 (62%)	74 (67%)	33 (31%)	40 (42%)
Education (years)	12.50 (5.25)	14.85 (5.25)	11.66 (4.82)	10.51 (4.58)
Assistive device (n)				
None	141 (47%)	37 (33%)	62 (65%)	42 (44.6%)
Unilateral	64 (21%)	28 (25%)	15 (15%)	21 (22.3%)
Bilateral	49 (16%)	35 (31%)	11 (11%)	3 (3.1%)
Wheelchair	45 (15%)	11 (9%)	6 (6%)	28 (29.7%)
Retrospective falls (n)				
Non fallers	127 (42%)	32 (29%)	37 (39%)	58 (62%)
Fallers (≥1)	172 (58%)	79 (71%)	57 (61%)	36 (38%)
Prospective falls (n)				
Non fallers	121 (67%)	51 (63%)	28 (58%)	42 (82%)
Fallers (≥1)	58 (33%)	29 (34%)	20 (40%)	9 (16%)
TUG (seconds)	17.70 (14.68)	21.15 (18.24)	12.53 (7.58)	18.82 (14.02)

10MWT (seconds)	14.05 (12.25)	13.74 (14.40)	11.06 (7.18)	17.39 (12.86)
ABC (points)	50.79 (25.50)	50.05 (21.88)	55.45 (27.05)	47.06 (27.44)
BBS (points)	41.12 (11.18)	42.90 (9.81)	41.75 (11.09)	38.49 (12.30)
DGI (points)	13.82 (7.39)	11.88 (8.47)	16.08 (6.07)	13.79 (6.64)

PwPD: Parkinson's disease; PwMS: Multiple Sclerosis; PwST: Stroke; TUG: Timed Up and Go; 10MWT: 10 Meters Walking Test; ABC: Activities Balance Confidence; BBS: Berg Balance Scale; DGI: Dynamic Gait Index.

Table 2: Medians and Interquartile ranges and Area Under the Curve of FPSS and FaB for retrospective and prospective fallers/non-fallers and for people using/not using the assistive device

		Retr. Fallers	Retr. Non-Fallers	AUC (95% CI)	Prosp. Fallers	Prosp. Non-Fallers	AUC (95% CI)	Using Ass. Dev	Not Using Ass. Dev	AUC (95% CI)
FPSS	Whole sample	19 (43)	16 (37)	0.61 (0.5-0.7)	19 (32)	18 (37)	0.56 (0.4-0.6)	21 (36)	14 (44)	0.74 (0.7-0.8)
	MS	21 (31)	20 (32)	0.49 (0.4-0.6)	20 (29)	22 (34)	0.55(0.4-0.7)	22 (34)	17 (30)	0.71 (0.6-0.8)
	PD	16 (43)	15(25)	0.63 (0.5-0.8)	19 (25)	13 (29)	0.70 (0.6-0.9)	21 (24)	14 (43)	0.70 (0.6-0.8)
	ST	20 (32)	15 (35)	0.63 (0.5-0.7)	16 (16)	18 (34)	0.42 (0.2-0.6)	21 (34)	12 (22)	0.82 (0.7-0.9)
FaB	Whole sample	3 (2.3)	2.8 (2.0)	0.60 (0.5-0.6)	3.0 (1.9)	2.9 (2.1)	0.57(0.4-0.6)	3.1 (2.1)	2.7 (2.1)	0.69(0.6-0.7)
	MS	3.1 (2.1)	3.1 (1.7)	0.54 (0.4-0.7)	3.2 (1.9)	3.2 (2.0)	0.49 (0.4-0.6)	3.2 (2.0)	3.0 (1.7)	0.65(0.5-0.8)
	PD	2.9 (2.1)	2.5 (1.8)	0.66 (0.4-0.7)	2.9 (1.5)	2.7 (1.2)	0.62 (0.5-0.8)	2.7 (1.4)	2.7 (2.1)	0.63 (0.5-0.8)
	ST	2.9 (1.8)	2.8 (2.0)	0.56(0.4-0.7)	2.9 (0.8)	2.8 (1.8)	0.62 (0.5-0.8)	3.0 (2.0)	2.5 (1.7)	0.74 (0.6-0.8)

FPSS: Fall Prevention Strategy Survey; FaB: Falls Behavioural Scale; MS: Multiple Sclerosis; PD: Parkinson's Disease; ST: Stroke; AUC: Area Under the Curve; CI: Confidence Intervals; Retr. Fallers/non-fallers: Retrospective Fallers/non-fallers; Prosp. Fallers/Not-fallers: Prospective Fallers/non-fallers; Ass. Dev: Assistive Device

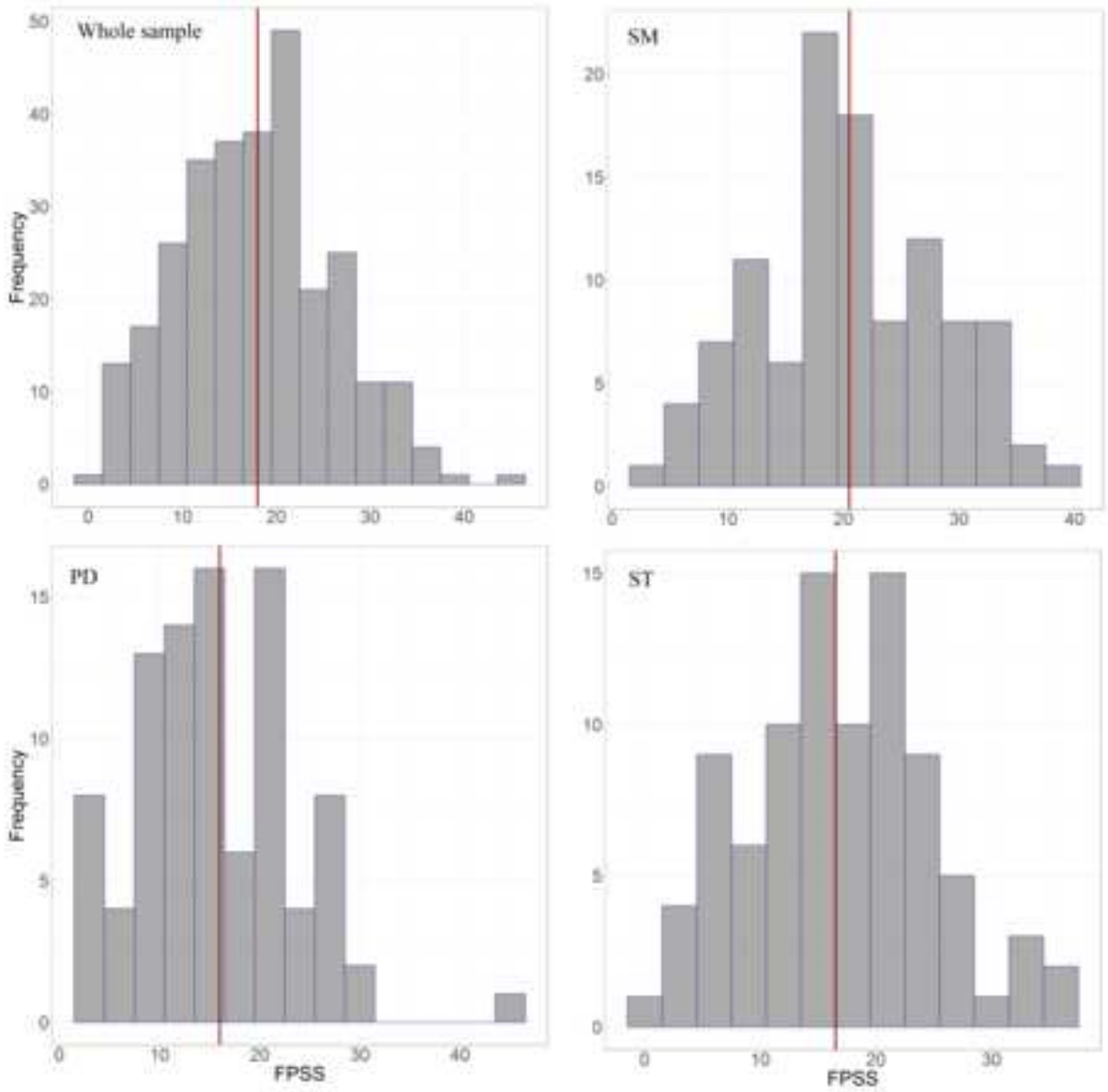
Table 3: Multiple regression models for FPSS and FaB

		Coefficient (β)	Std. Error	t value	P value
FPSS*	(Intercept)	17.37	3.30	5.26	2.90e-05*
	Retrospective fallers	2.61	1.13	2.36	0.02*
	Prospective fallers	-0.22	1.11	-0.19	0.85
	Assistive device	4.83	1.23	3.93	0.001*
	ABC	-0.12	0.03	-4.39	8.03e-06*
	BBS	0.07	0.07	0.93	0.35
	Age	-0.03	0.04	-0.69	0.49
	Gender	1.34	1.08	1.24	0.22
	Education	0.07	0.11	0.62	0.53
FaB§	(Intercept)	3.01	0.17	17.23	< 2e-16*
	Retrospective fallers	0.17	0.06	2.73	0.007*
	Prospective fallers	0.04	0.06	0.64	0.52
	Assistive device	0.14	0.07	2.06	0.04*
	ABC	-0.008	0.001	-5.50	3.2e-07*
	BBS	0.002	0.003	0.68	0.49
	Age	-0.03	0.00	-1.14	0.25
	Gender	-0.09	0.06	-1.55	0.12
	Education	0.00	0.01	0.64	0.52

*FPSS: R^2=0.31, F (8,159)=10.5, p<0.01;§FaB: R^2=0.31, F(8,164)=10.89, p<0.01)

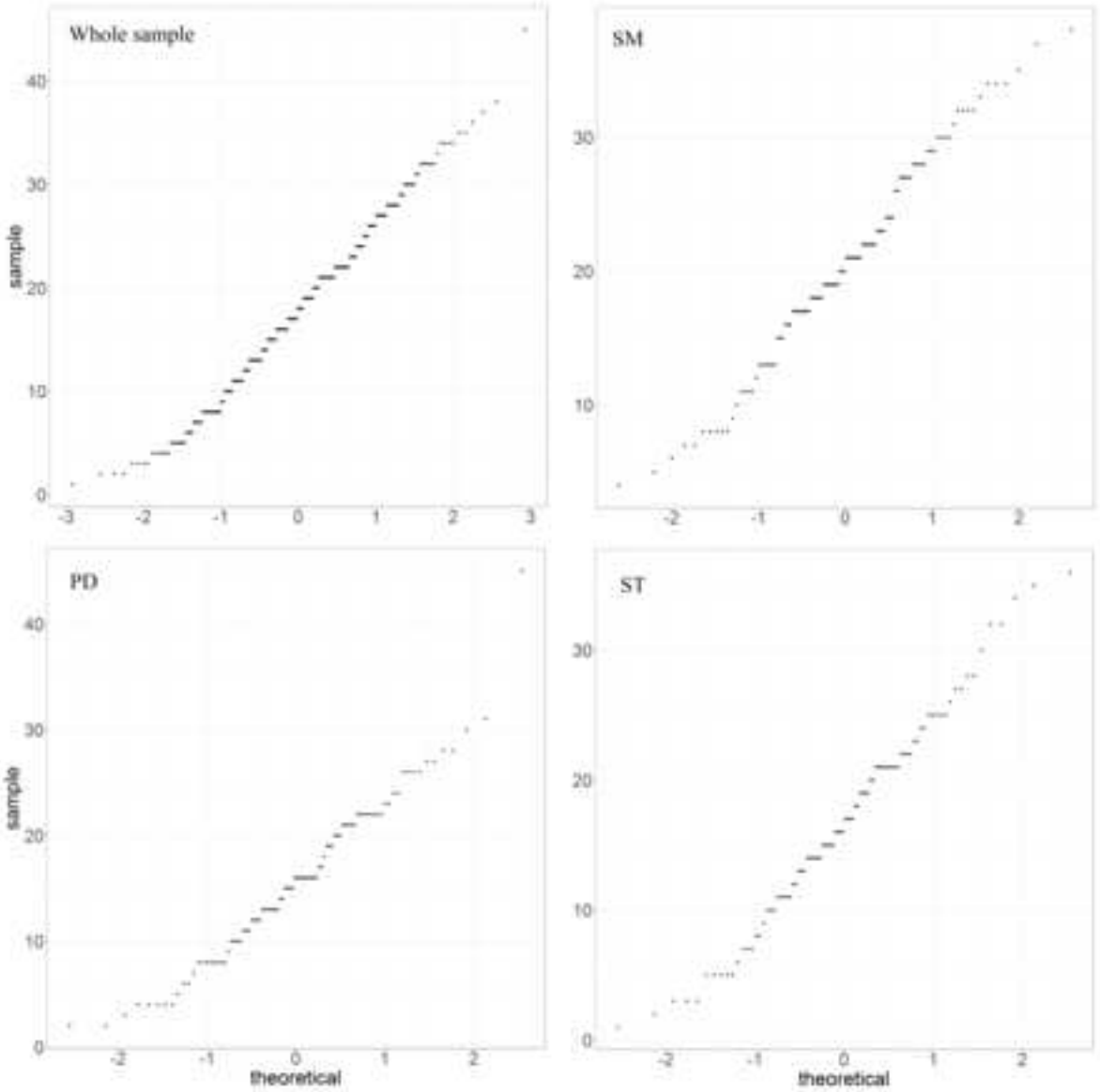
FPSS: Fall Prevention Strategy Survey; FaB: Fall Behavioural Scale; DGI: Dynamic Gait Index; ABC: Activities Balance Confidence; BBS: Berg Balance Scale

Figure 1. Scores distributions of FPSS scale for the whole sample and for the three conditions (Multiple Sclerosis, Parkinson's Disease, Stroke).



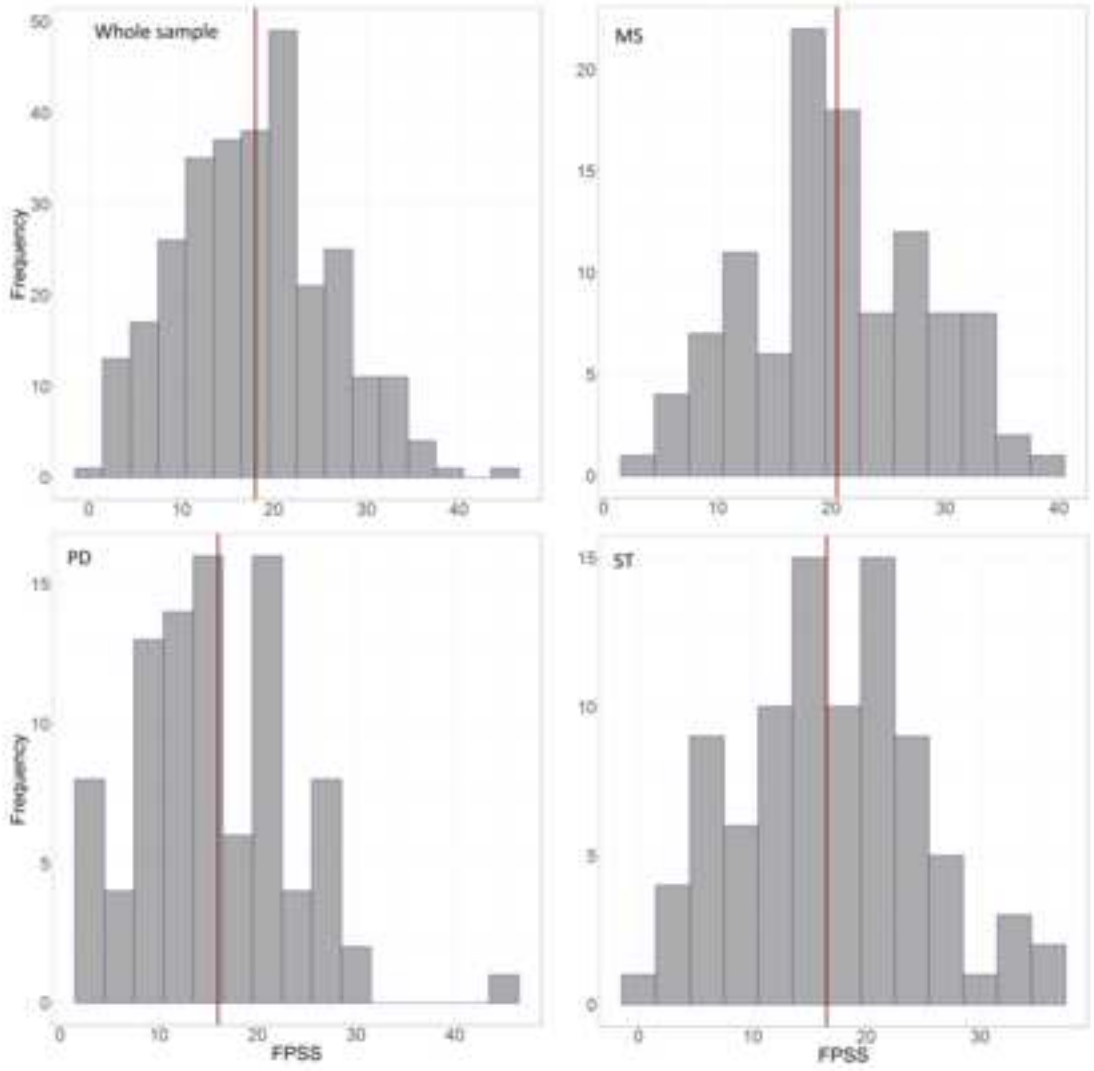
MS: Multiple Sclerosis; PD: Parkinson's Disease; ST: Stroke

Figure 2. Q-Q plots of FPSS scale for the whole sample and for the three conditions (Multiple Sclerosis, Parkinson's Disease, Stroke).



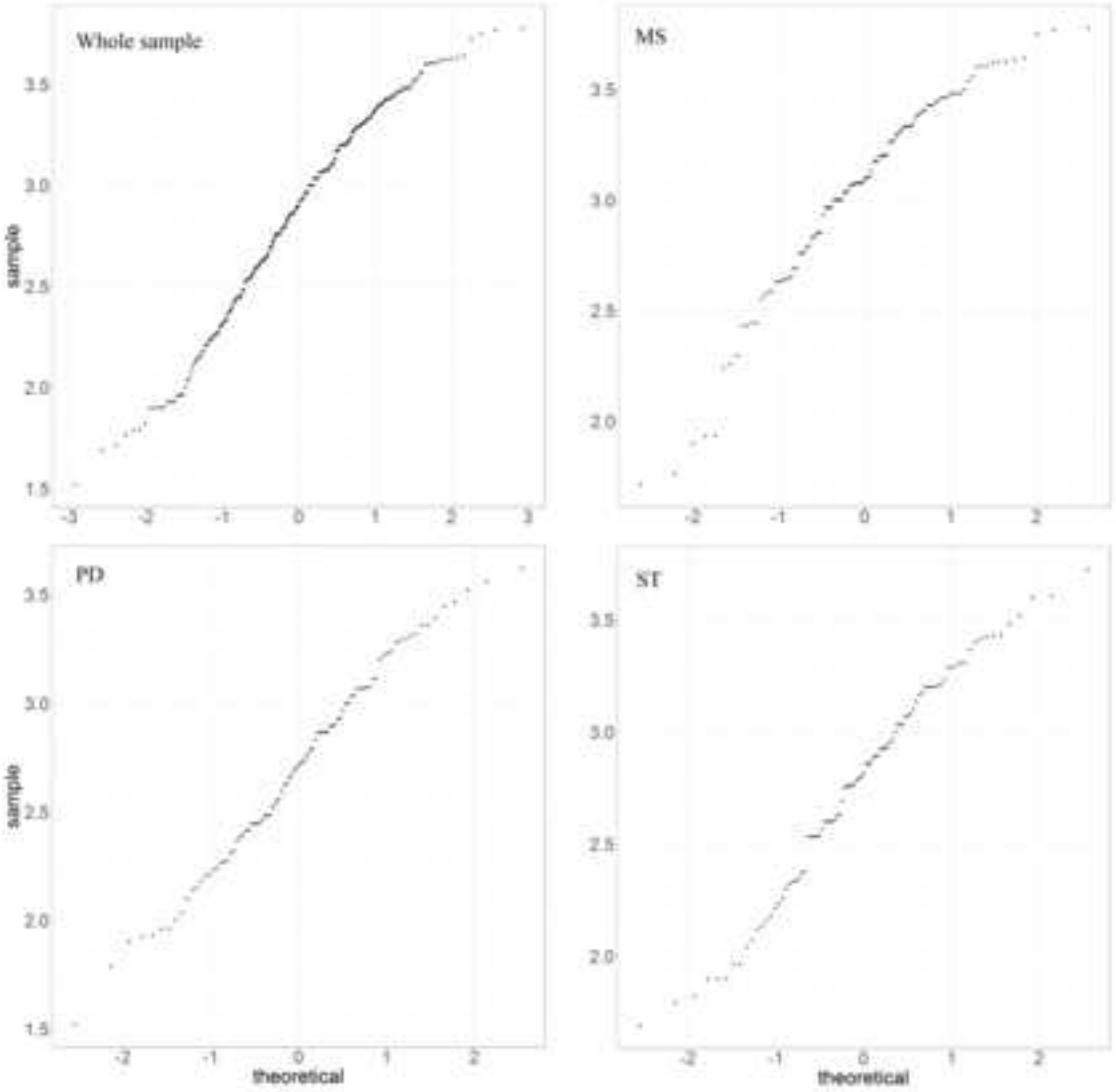
MS: Multiple Sclerosis; PD: Parkinson's Disease; ST: Stroke

Figure 3. Scores distributions of FaB scale for the whole sample and for the three conditions (Multiple Sclerosis, Parkinson's Disease, Stroke).



MS: Multiple Sclerosis; PD: Parkinson's Disease; ST: Stroke

Figure 4. Q-Q plots of FaB scale for the whole sample and for the three conditions (Multiple Sclerosis, Parkinson's Disease, Stroke).

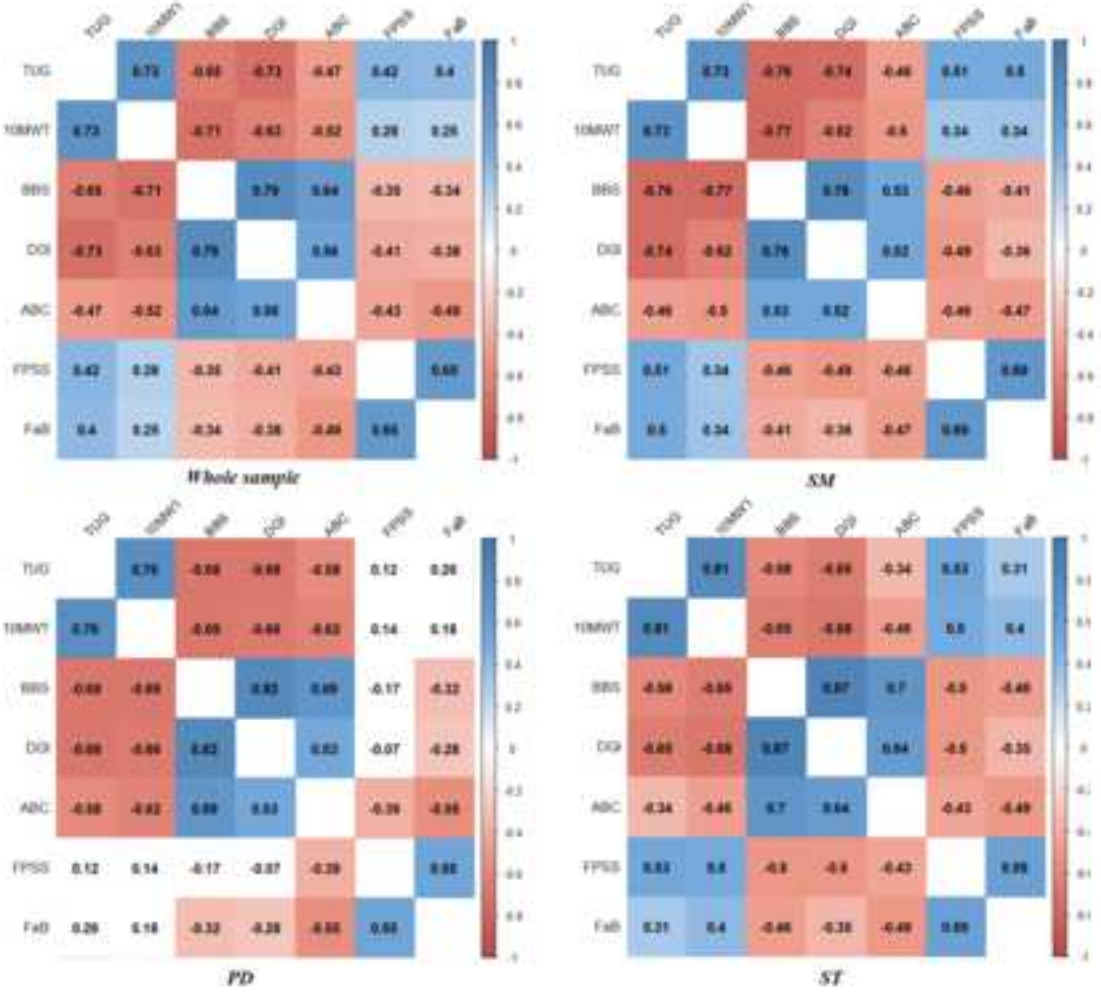


MS: Multiple Sclerosis; PD: Parkinson's Disease; ST: Stroke

Figure

Click here to access/download;Figure;Figure 5.tif

Figure 5. Convergent validity of the tests used in the study for the whole sample and for the three conditions (Multiple Sclerosis, Parkinson's Disease, Stroke)



TUG: Timed Up and Go; 10MWT: Ten Meters walking test; BBS: Berg Balance Scale; DGI: Dynamic Gait Index; ABC: Activities-specific Balance Confidence; FPSS: Fall Prevention Strategy Survey; FaB: Falls Behavioural Scale; MS: Multiple Sclerosis; PD: Parkinson's Disease; ST: Stroke