Using the *International Classification of Functioning, Disability and Health* as a Framework to Examine the Association Between Falls and Clinical Assessment Tools in People With Stroke

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[Beninato M, Portney LG, Sullivan PE. Using the *International Classification of Functioning, Disability and Health* as a framework to examine the association between falls and clinical assessment tools in people with stroke. *Phys Ther.* 2009;89:816–825.]

Background. Falls in people with stroke are extremely common and present a significant health risk to this population. Development of fall screening tools is an essential component of a comprehensive fall reduction plan.

Objective. The purpose of this study was to examine the accuracy of clinical measures representing various domains of the *International Classification of Functioning, Disability and Health* (ICF) relative to their ability to identify individuals with a history of multiple falls.

Design. A case series study design was used.

Setting. The study was conducted in a community setting.

Participants. Twenty-seven people with stroke participated in the study.

Measurements. Clinical assessment tools included the lower-extremity subscale of the Fugl-Meyer Assessment of Sensorimotor Impairment (FMLE) and Five-Times-Sit-to-Stand Test (STS) representing the body function domain, the Berg Balance Scale (BBS) representing the activity domain, the Activities-specific Balance Confidence (ABC) Scale as a measure of personal factors, and the physical function subscale of the Stroke Impact Scale (SIS-16) as a broad measure of physical function. We used receiver operating characteristic (ROC) curves to generate cutoff scores, sensitivities, specificities, and likelihood ratios (LRs) relative to a history of multiple falls.

Results. The FMLE and the STS showed a weak association with fall history. The BBS demonstrated fair accuracy in identifying people with multiple falls, with a cutoff score of 49 and a positive LR of 2.80. The ABC Scale and the SIS-16 were most effective, with cutoff scores of 81.1 and 61.7, respectively, positive LRs of 3.60 and 7.00, respectively, and negative LRs of 0.00 and 0.25, respectively.

Limitations. A limitation of the study was the small sample size.

Conclusion. The findings suggest that the ICF is a useful framework for selecting clinical measures relative to fall history and support the need for prospective study of tools in more-complex domains of the ICF for their accuracy for fall prediction in people with stroke.

Falls following stroke are disturbingly frequent, with reported fall rates ranging from 22% to 73% in community-dwelling people with stroke.[1–9] Stroke has the second-highest rate of falls of common neurological diagnoses, following Parkinson disease.[10] Falls after stroke can result in hip fractures,[11,12] soft tissue injuries,[13] and increased immobility, leading to greater disability.[2] Development of effective screening tools to determine fall risk in this population is an important component of a comprehensive fall reduction plan.

Recently, considerable work has been done in the area of fall risk factors as they pertain to people with stroke who are living in the community.[1–9,14–16] Despite this growing body of study, the findings on risk factors associated with falls in this population are somewhat equivocal. Understanding the multifactorial nature of fall risk requires a broad context in which these factors can be examined. One approach to classifying these factors is through the domains of the *International Classification of Functioning, Disability and Health* (ICF).[17] The ICF is a classification system for the description of health, reflecting positive and negative aspects of body functions and structures, activities, and participation in life roles. Combined, these constructs reflect the positive aspect of health referred to as *functioning* or the negative aspect described as *disability* (Fig. 1).[17] The ICF also incorporates contextual factors of the environment and personal factors, such as psychological states, which interact with the other domains of the ICF and contribute to the overall health state of the individual. Examination of clinical measures relative to the ICF may reveal a domain of measure most closely associated with falls in people with stroke and may lead to more-accurate detection of those at risk.

The literature on falls in people with stroke to date includes measures within various domains of the ICF, with varying results. For example, on the body function level, overall motor function assessed by the Scandinavian Stroke Scale[9] and lower-extremity motor function measured by the lower-extremity portion of the Fugl-Meyer Assessment of Sensorimotor Impairment (FMLE)[8] were not associated with falls, whereas upper-extremity motor function measured by the Rivermead Motor Assessment Upper Limb Scale was associated with falls.[4] Yates et al[3] found a combination of lower-extremity motor function (measured by the FMLE) and sensation to be more closely associated with falls than motor function alone. Strength (force-generating capacity) was not associated with falls when measured by chair rise[6,8] or maximum isometric knee extension.[6] On the activity

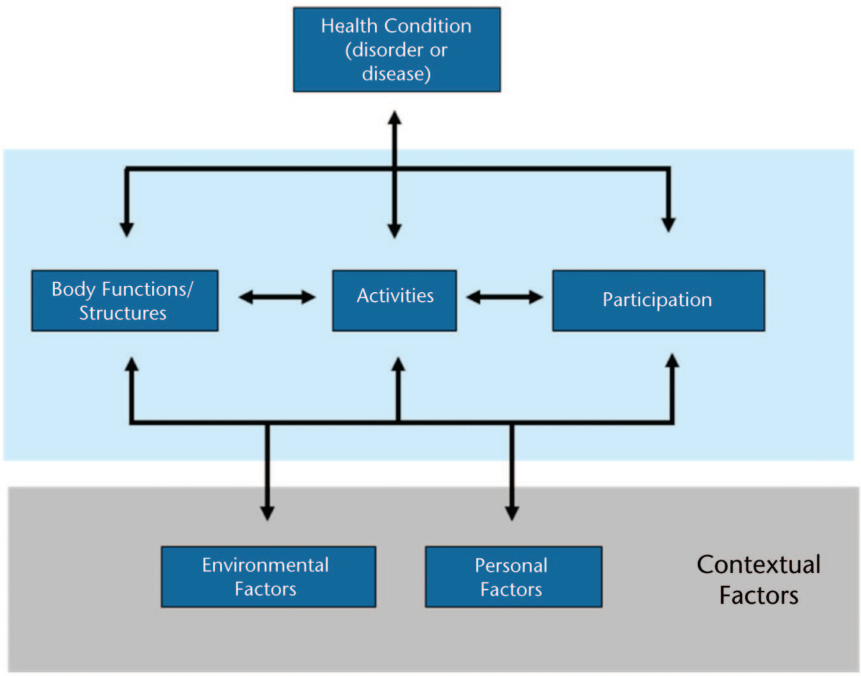

Figure 1.
The World Health Organization *International Classification of Functioning, Disability and Health* (ICF) model. Body Functions/Structures, Activities, and Participation domains together encompass the positive aspect of health referred to as functioning or, when restricted, are described as disability.[17] The ICF also incorporates contextual factors of the environment and personal factors that interact with function or disability and contribute to the overall health state of the individual. Reprinted with permission of the World Health Organization from *International Classification of Functioning, Disability and Health: ICF*. Geneva, Switzerland: World Health Organization; 2001.

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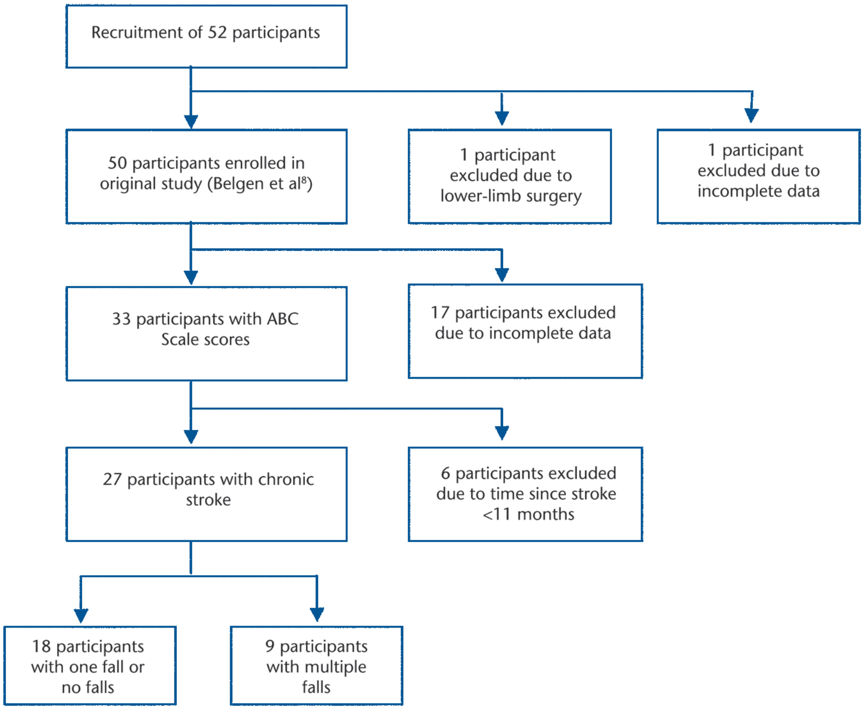

Figure 2.
Flow diagram of participant enrollment demonstrating the current sample as a subsample of a previous study by Belgen et al.[8] ABC Scale=Activities-specific Balance Confidence Scale.

level, measures of activities of daily living (ADL) have been associated with falls by some[4–6] but not all investigators.[9] With regard to balance assessment, impaired balance has been associated with falls using observer-based tools such as the Berg Balance Scale (BBS),[5,8] whereas other authors[6,7] have not seen such associations. These conflicting findings make it difficult to establish the role of body function and activity measures in fall risk assessment, and warrant further investigation.

Participation domain measures have been studied on a limited basis in people with stroke. Forster and Young[2] found less social activity as measured by the Frenchay Activities Index[18] associated with falls in community-dwelling people with stroke, but Mackintosh et al[1] did not find participation level as measured by the Adelaide Activities Profile[19] associated with fall history. Several studies that included measures related to personal factors found depression to be associated with falls,[2,4,9] whereas other studies have not.[1,6,20] Hyndman and colleagues[15] have established associations between attention deficits and falling[5,21] and with gait impairment. Impaired balance self-efficacy[8,16] and fear of falling[4] have been associated with falling but have been studied to a lesser extent than measures in other domains of the ICF. Further study of measures at these more-complex levels of the ICF may reveal strong associations with falls because falls are multifactorial.

The purpose of this study was to explore several clinical assessment tools representing various domains of the ICF to determine their relationship with fall history in a sample of community-dwelling people with chronic stroke. Furthermore, we expected these findings, based on retrospective fall history, to clarify direction for future prospective studies of fall risk in people with stroke living in the community.

Method

Participants

We used a sample of convenience of people with chronic stroke living in the community. These participants were a subset of subjects selected from a larger sample reported on previously (Fig. 2).[8] The original inclusion criteria[8] were presence of unilateral stroke, ability to ambulate independently at least 10 m with or without an assistive device, and ability to follow 3-step commands. Exclusion criteria were the presence of any other neurological diagnosis and a history of fracture or surgical procedure in the lower extremities in the prior 6 months. The present subset of participants was chosen based on 2 additional inclusion criteria: the availability of data for the Activities-specific Balance Confidence (ABC) Scale[22] and the presence of chronic stroke (duration of 11 months or longer). We were particularly interested in studying the ABC Scale relative to fall history, but data for that variable were available for only 33 participants because it was added later in the data collection period. We also sought to focus the study on people with chronic stroke to minimize any influence of spontaneous recovery over the prior 6 months. Participants were classified as those with a history of multiple falls (more than one fall) and those with one fall or no falls over the prior 6 months. Several researchers of falls in people with stroke have suggested that a one-time fall may be an isolated event and fall risk assessment should be based on an incidence of multiple falls.[2,8,23] Accordingly, we followed the approach of other stroke researchers[2,4,6–8] and analyzed scores relative to a history of multiple falls. All participants gave voluntary, written informed consent.

Procedure

Participants filled out a questionnaire to provide demographic information, including age, stroke onset, side affected, medical history, and fall history over the previous 6 months. A *fall* was defined according to Tinetti and colleagues' definition.[24] Ambulation ability was self-reported as indoors only, community limited (defined as less than 2 blocks, regardless of speed), or community unlimited (defined as more than 2 blocks, regardless of speed).

Clinical Assessment Tools

We chose 2 clinical tools representing the body function domain of the ICF. Lower-extremity motor function was measured using the FMLE.[25] The FMLE, the lower-limb subscale of the Fugl-Meyer Assessment of Sensorimotor Impairment, is scored on a scale of 0 to 2 for items related to reflex activity, movement synergies, and coordination, with a possible total score range of 0 to 34.[25] The FMLE has excellent test-retest (r^2=.96[26,27]) and intertester (r^2=.89[26,27]; intraclass correlation coefficient [ICC]=.92[28]) reliability. Our other body function assessment was the Five-Times-Sit-to-Stand Test (STS). The STS was used as a composite measure of lower-limb strength.[29] Participants were required to rise from a sitting position in a standard-height chair (45 cm), with arms folded across the chest, to a full standing position and then back to a sitting position 5 times as fast as possible. They were instructed not to let the back of their legs come in contact with the chair. The time taken to complete the task was recorded to the nearest 0.1 second. The original version designed for use with elderly people[29] was modified from 10 chair rises to 5 chair rises for use with people with stroke.[30] Lord et al[31] reported good test-retest reliability (ICC=.89) in elderly people.

The activity domain was assessed using the BBS,[32,33] which consists of 14 items scored on a scale of 0 to 4, with a possible total score range of 0 to 56. Test-retest reliability has been reported as excellent in elderly people (ICC=.99[34] and .98[35]) and in people with stroke (ICC=.99).[34,36] Intrarater reliability also is excellent (ICC=.92 in elderly people and .98 in people with stroke).[34,36]

As a broad measure of physical function, we used the SIS-16,[37] the physical function subscale of the Stroke Impact Scale (SIS), version 3.0.[38] The SIS-16 comprises 16 items selected from the original 28 items of the composite physical domain of the SIS[37] and includes items from the body function domain (eg, "bladder and bowel control"), activity domain (eg, "bathe yourself"), and participation domain (eg, "go shopping") and, therefore, reflects physical function across all ICF domains.[17,37] Total scores ranging from 0 to 100 were generated using an algorithm.[39] Through Rasch analysis, person separation reliability of .94 has been established.[37]

With regard to contextual factors within the ICF framework, we measured the personal factor of balance self-efficacy with the ABC Scale,[22] which includes 16 items that evaluate people's confidence in performing a task without losing their balance. The tasks range from walking around the house to walking on icy sidewalks. Each of the 16 items is scored on a scale of 0 to 100, where 0 represents no confidence and 100 represents complete confidence in performing the activity without loss of balance. The final, averaged score had a possible range of 0 to 100. The ABC Scale recently has been validated for use in people with stroke, with good internal consistency (Cronbach alpha=.94)[40,41] and good test-retest reliability (ICC=.85).[41]

Data Analysis

All statistics were calculated using SPSS version 15.0.* Descriptive statistics were generated for the whole sample and according to fall history category. Comparisons among the fall category groups were made using the chi-square test for categorical variables (eg, sex and stroke side), *t* tests for normally distributed continuous variables (eg, age), and Mann-Whitney *U* test for continuous variables with skewed distributions (eg, stroke length) and ordinal variables (FMLE, STS, BBS, SIS-16, and ABC Scale). We applied a Bonferroni correction for multiple comparisons based on the number of clinical measures examined (significance level $P \leq .01$).

Sensitivity (Sn) and specificity (Sp) were calculated for each clinical measure using history of multiple falls as the diagnosis of interest. We generated receiver operating characteristic (ROC) curves where the area under the curve (AUC) was assessed as an indication of the overall ability of the test to detect a history of multiple falls.[42–44] The point on the curve closest to the upper left-hand corner was chosen as the cutoff score with the best overall balance between Sn and Sp for detecting a history of multiple falls. This approach for choosing a cutoff point provided consistency for comparison across clinical measures.

Using the Sn and Sp associated with the identified cutoff score, positive likelihood ratios (+LR; Sn/1 − Sp) and negative likelihood ratios (−LR; 1 − Sn/Sp) were generated.[45–48] Confidence intervals for Sn, Sp, and LRs were calculated based on a method described by Simel et al.[49] We then generated posttest probabilities to determine the probability of a person being correctly classified as

* SPSS Inc, 233 S Wacker Dr, Chicago, IL 60606.

Table 1.
Group Characteristics and Comparisons[a]

Characteristic	Whole Sample (N=27)	One Fall/No Falls Group (n=18)	Multiple Falls Group (n=9)	*P* (One Fall/No Falls Groups vs Multiple Falls Group)
Sex, male/female	15/12	11/7	4/5	.41
Side affected, right/left	13/14	8/10	5/4	.59
Age (y), $\overline{X}\pm$SD (range)	57.2±12.4 (35–80)	55.2±11.6 (35–75)	61.2±13.5 (47–80)	.24
Stroke length (mo), median (range)	34.0* (11–312)	48.0* (11–312)	23.0* (11–169)	.20
ABC Scale, $\overline{X}\pm$SD (range)	77.1±16.4 (48–100)	84.9±12.3 (58–100)	61.4±11.7 (48–80)	<.0001
SIS-16, $\overline{X}\pm$SD or median (range)	65.3±10.2 (40.6–76.6)	71.9* (51.6–76.6)	56.8±10.2 (40.6–71.9)	.003
BBS, $\overline{X}\pm$SD or median (range)	49.0* (26–56)	50.5±4.0 (43–56)	42.6±9.9 (26–56)	.03
FMLE, median (range)	24* (10–32)	23.5* (13–30)	25* (10–32)	.62
STS, $\overline{X}\pm$SD or median (range)	18.3±9.1 (10.5–55.6)	16.0±4.9 (10.5–26.3)	18.6* (11.3–55.6)	.20

[a] ABC Scale=Activities-specific Balance Confidence Scale, SIS-16=physical function subscale of the Stroke Impact Scale, BBS=Berg Balance Scale, FMLE=Fugl-Meyer Assessment of Sensorimotor Impairment lower-extremity subscale for motor function, STS=Five-Times-Sit-to-Stand Test. Asterisk indicates median is reported due to ordinal or skewed data. *P* values reported for group comparison between one fall/no falls group versus multiple falls group; *P* values derived from chi-square test for sex and side affected, *t* test for age, and Mann-Whitney *U* test for stroke length, ABC Scale, SIS-16, BBS, FMLE, and STS. Significance at *P*<.01 after Bonferroni correction.

having a history of multiple falls when the cutoff score on the clinical assessment tool was achieved. A posttest probability was generated by converting the pretest probability (the incidence of multiple falls in the sample[48]) to an odds ratio and multiplying this ratio by either the +LR or the −LR to generate a posttest odds ratio. The posttest odds ratio then was converted to a posttest probability.[45–48] This analysis was repeated for each of the 5 clinical assessment tools examined.

Results

The overall fall rate for the whole sample was 1.1 fall per person (SD=1.31, range=0–4, 95% confidence interval [CI]=0.62–1.60) over the 6-month period, with 14 participants (52%) who had no falls, 13 participants (48%) reporting at least one fall, and 9 participants (33%) reporting multiple falls. The fall rate for those with multiple falls was 2.8 falls per person (SD=0.67, range=2–4, 95% CI=2.35–3.22) over the 6-month period. Only one participant reported being limited to indoor ambulation. The other 26 participants (94%) self-reported ambulating independently in the community, with 17 participants (63%) reporting unlimited ambulation (more than 2 blocks). Almost half of the participants (48%; n=13) did not use an assistive device for ambulation. Straight canes (44%; n=12) or quad canes (7%; n=2) were used by 14 participants (52%).

Descriptive statistics and group comparisons are shown in Table 1. Median time since stroke was 34 months. The median FMLE was 24, and the mean STS was 22.8 seconds. The median BBS score was 49. The mean scores of the ABC Scale and the SIS-16 were 77.1 and 65.3, respectively. Participants reporting multiple falls had significantly lower scores on the ABC Scale and the SIS-16 than those reporting one fall or no falls.

The results from the ROC curve analysis (Fig. 3), LRs, and pretest and posttest probabilities are reported in Table 2. Both the ABC Scale and the SIS-16 demonstrated good overall accuracy in detecting participants with a history of multiple falls based on the AUC, Sn, and Sp. The BBS and the STS were less accurate. The FMLE was only slightly better than chance (AUC=0.56) in detecting a history of multiple falls. Because of these poor results from the FMLE, no cutoff score was determined, and no further analysis was performed on this variable.

The pretest probability was assumed to be 33% based on the observed incidence of multiple falls for the current sample. The SIS-16 generated the largest +LR (7.00) and the highest posttest probability (77.8%). These findings mean that based on performance on the test alone, if the 61.7 cutoff was not achieved, we could be 78% confident that an individual was classified correctly as having a history of multiple falls. The ABC Scale had the smallest −LR (0.00), with a calculated posttest probability of 0.0%. These findings mean that if the cutoff of 81.1 was achieved, we could be relatively certain that the individual did not have a history of multiple falls. In this way, these posttest probabilities were indicators of the accuracy of the clinical tests for classifying participants based on fall history.

Discussion

The ICF appears to provide a useful framework for selecting clinical mea-

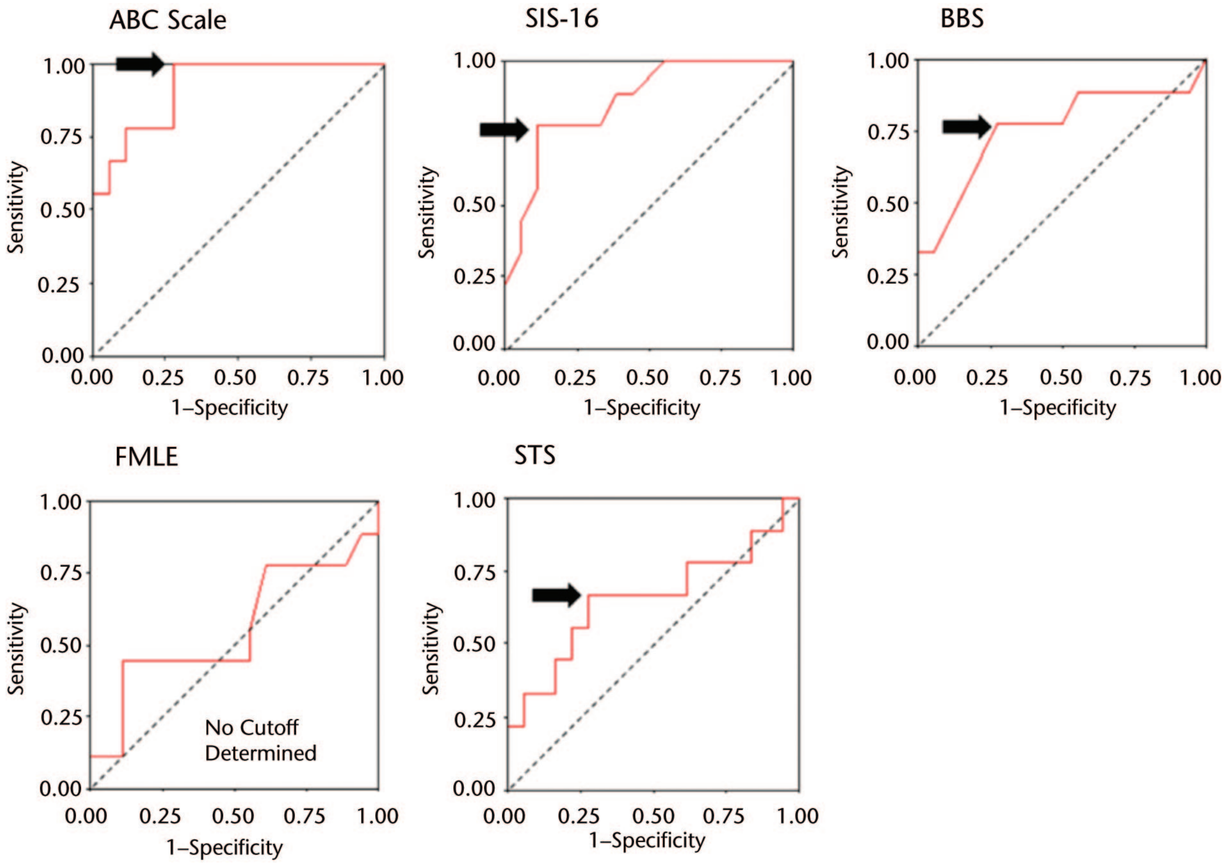

Figure 3.
Receiver operating characteristic curves generated with history of multiple falls versus one fall or no falls as outcome state. Dashed diagonal line represents area of 0.50 for reference (minimum to maximum area range=0.0–1.00). Arrows indicate cutoff scores. ABC Scale=Activities-specific Balance Confidence Scale, SIS-16=physical function subscale of the Stroke Impact Scale, BBS=Berg Balance Scale, FMLE=Fugl-Meyer Assessment of Sensorimotor Impairment lower-extremity subscale for motor function, STS=Five-Times-Sit-to-Stand Test.

sures relative to fall history. The current findings suggest that there is a relationship between the ICF domain associated with a clinical measure and that clinical measure's accuracy in detecting falls. Neither of the 2 clinical measures of body function examined was strongly associated with a history of falls. In agreement with our previous findings,[8] we found no association between the FMLE and a history of multiple falls. The STS also was not strongly associated with fall status. On the contrary, Lamb et al[6] have found the inability to perform a single chair rise to be associated with a history of multiple falls in women with stroke living in the community. In populations without stroke, other researchers have found the STS to be associated with falls in elderly people[50,51] and useful in identifying people with balance disorders,[52] but to a lesser extent than the Dynamic Gait Index (DGI)[53] or the ABC Scale.[52] We agree with Boulgarides et al,[54] who investigated a battery of body function measures in elderly people and suspected that these weak associations between fall status and this domain may be due, in part, to the limited scope of each measure relative to the multifactorial nature of falls. Yates et al,[3] in people with stroke, and Brauer et al,[55] in elderly people, have shown that combining body function measures may improve their Sn over using them in isolation. Selecting the right combination of assessments within this domain may be a critical factor for improving accuracy. It also is important to consider that many other body function assessments exist, and the findings based on the few measures chosen for the present study cannot be generalized to all clinical tools in this domain.

Our activity domain measure, the BBS, was more effective than the body function measures at identifying individuals with a history of multiple falls when comparing the AUCs of these measures. The BBS, with an AUC of 0.76, might be considered moderately effective, given that a

Table 2.
Receiver Operating Characteristic Curves, Likelihood Ratios, and Posttest Probability Statistics[a]

Measure	ABC Scale	SIS-16	BBS	FMLE	STS
ROC curve area (95% CI)	0.92 (0.82–1.02)	0.86 (0.72–1.01)	0.76 (0.54–0.98)	0.56 (0.30–0.82)	0.66 (0.41–0.90)
Cutoff score	81.1	61.7	49	N/A	17.9
Sn/Sp	1.00/0.72	0.78/0.89	0.78/0.72	N/A	0.67/0.72
95% CI for Sn	N/A	0.51–1.05	0.51–1.05		0.36–0.98
95% CI for Sp	0.51–0.93	0.75–1.03	0.51–0.93		0.51–0.93
+LR (95% CI)	3.60 (1.71–7.57)	7.00 (1.81–27.08)	2.80 (1.23–6.36)	N/A	2.4 (1.00–5.75)
−LR (95% CI)	0.00 (N/A)	0.25 (0.07–0.86)	0.31 (0.09–1.08)	N/A	0.46 (0.17–1.22)
Posttest probability of falls if cutoff score is not achieved (%)	64.3	77.8	58.3	N/A	54.5
Posttest probability of falls if cutoff score is achieved (%)	0.0	11.1	13.3	N/A	18.7

[a] ABC Scale=Activities-specific Balance Confidence Scale; SIS-16=physical function subscale of the Stroke Impact Scale; BBS=Berg Balance Scale; FMLE=Fugl-Meyer Assessment of Sensorimotor Impairment lower-extremity subscale for motor function; STS=Five-Times-Sit-to-Stand Test; ROC=receiver operating characteristic curve; CI=confidence interval; Sn=sensitivity; Sp=specificity; +LR=positive likelihood ratio; –LR=negative likelihood ratio; N/A=not applicable; posttest probability of falls, where "falls" refers to multiple falls in the previous 6 months.

perfect diagnostic test has an AUC of 1.00 and a test with an AUC of 0.50 is only as good as chance.[45] These findings confirm previous findings relative to the association between the BBS and a history of multiple falls in people with stroke.[5,8] In their prospective study of people with chronic stroke in the community, Harris et al[7] found no difference in BBS scores between people who fell (once or multiple times) and people without falls. These current, modest results may be due to the fact that the BBS shows a ceiling effect at 3 months poststroke[56] and, indeed, showed a ceiling effect in the present sample of high-functioning individuals. We cannot conclude, therefore, that balance measures, in general, are uninformative relative to fall history. The results do indicate that the BBS was mismatched with the ability level of this sample, and perhaps another, more challenging balance assessment such as the DGI or a dual-task paradigm such as that used by Hyndman and Ashburn[5,21] would have demonstrated greater Sn. Combining the BBS with other assessments also may improve its utility, as Andersson et al[57] demonstrated by combining the BBS with the Stops Walking While Talking Test[21] in a 12-month prospective study following hospitalization for stroke.

Of all of the clinical tools examined, measures of balance confidence (ABC Scale) and stroke physical function (SIS-16) were most closely associated with a history of multiple falls. The current findings agree with findings of Lajoie and Gallagher[58] in elderly people and Pang and Eng[16] in people with stroke, who found associations between the ABC Scale and fall status. To our knowledge, this is the first study to examine the SIS-16 relative to its relationship to fall history. The SIS-16 measures across all 3 domains of the ICF, and this broader view of physical functioning after stroke appears to be more strongly related to fall history than more-focused physical measures in single domains. These associations with fall history also may occur because both the ABC Scale and the SIS-16 reflect an individual's perceptions of activity and function within daily routines and contexts, in contrast to body function measures that reflect only performance of isolated tasks without a functional context. Context specificity is an important component of self-efficacy theory[59] and was a guiding consideration in the development of the ABC Scale.[60,61] The current findings suggest that context matters and needs to be considered when evaluating potential fall risk evaluation tools. These findings also suggest that clinical measures of more-global states of physical functioning, which include more than one ICF domain and measures of personal factors, are potentially useful fall screening tools and need to be further examined in this population.

Our approach in this study was to identify a single cutoff score for each clinical tool and then to establish associations with fall history based on whether or not participants achieved that score. We chose the point closest to the upper left-hand corner of the ROC curve because we could apply this criterion consistently across clinical tools. We agree with other authors,[45,62] however, that from a safety standpoint it is more important to have a highly sensitive test with small −LRs when considering fall risk. With negative test results on the ABC Scale, for example, a low risk for falls may be assumed without fear of erroneously directing a person away from treatment.

Our approach also established relationships between scores and fall history according to a scoring dichotomy, although fall risk probably exists across a gradient rather than as a present or absent phenomenon. In support of this notion, Muir and colleagues[63] demonstrated that +LRs associated with categories of BBS scores are useful for detecting fall risk at different levels across a range of scores. This approach appears to be superior to a dichotomous approach and needs further investigation in all populations, including people with stroke.

This study is limited by its small sample size, resulting in the potential for type II error on the group comparisons. The upper limit of some confidence intervals for Sn or Sp exceeded 1.00, which is another reflection of the error with a small sample size.[64] Furthermore, some CIs for the AUC and Sn and Sp are quite broad, including a lower limit near 0.50, indicating that the test may be only slightly better than chance if the true value is near the lower limit. However, if the true value is near the upper limit, the test may be clinically useful. With such wide CI limits, caution needs to be exercised in interpreting the current results until they can be verified with a larger sample.

The retrospective nature of the study design also limits interpretation of the results in several ways. The primary objective was to examine the associations between clinical measures and fall history, which may or may not equate to usefulness for detecting prospective fall risk. The predictive value of these clinical measures, therefore, should not be assumed. Using retrospective recall of falls also adds error, as exact recollection of fall history may have been faulty. In addition, measurements and surveys were conducted at some time subsequent to any actual fall event. The person's status at the time of measurement, therefore, may have been somewhat different than at the time of the fall. In fact, the fall may have influenced certain measurement constructs such as balance confidence. Future prospective studies with multiple measurement points will eliminate these potential confounders.

Based on these results, we would recommend further study of combining clinical tools with ICF domains to potentially improve accuracy over using tools in isolation, particularly at the body function level. We recommend the use of measures other than the BBS, such as the DGI, for balance function for similar samples of individuals who are high-functioning. Most importantly, we think these exploratory findings suggest that further study should be pursued relative to measures of disability and contextual factors within the ICF and their relationship to fall risk. These promising results from the SIS-16 and the ABC Scale suggest that tools in these domains may be useful as fall risk screening tools in community-dwelling people with stroke.

Conclusion

The ICF appears to be an informative framework for examining clinical assessment tools for their association with fall history and for guiding further examination of potential fall screening tools in people with chronic stroke. Clinical measures on the body function level appear to have only weak association with fall history and may not be useful as fall screening measures when used in isolation. Balance measures in the activity domain need to be matched to the level of function of the sample, and, in this case, it appears that the BBS was not the optimal instrument to use. The SIS-16 and the ABC Scale, as measurements of disability and contextual factors, had the strongest associations with fall history, indicating that measurement within these complex domains of the ICF may be best matched with the complex nature of falls in this population. Prospective studies are needed to determine the usefulness of these measures as fall prediction tools in people with stroke.

All authors provided concept/idea/research design and writing. Dr Beninato and Dr Sullivan provided data collection and participants. Dr Beninato and Dr Portney provided data analysis. Dr Beninato provided project management.

The study was approved by the Spaulding Rehabilitation Hospital Institutional Review Board.

Poster presentations of this research were given at the Combined Sections Meeting of the American Physical Therapy Association; February 6–9, 2008; Nashville, Tennessee; and at the Quality of Care and Outcomes Research in Cardiovascular Disease and Stroke Conference; May 9–11, 2007; Washington, DC.

This article was received May 30, 2008, and was accepted April 9, 2009.

DOI: 10.2522/ptj.20080160

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Invited Commentary

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Investigation of falls is essential to sound clinical decision making and health promotion in community-dwelling people with stroke. Pursuing knowledge of the risk factors to predict falls highlights our efforts in addressing the high burden associated with falls. Findings from such investigations could be used in planning falls assessment.[1,2] It then becomes imperative to select instruments that reflect the variables that need to be examined. Within this context, Beninato and colleagues[3] innovatively used the *International Classification of Functioning, Disability and Health* (ICF)[4] as a reference framework. Specifically, they examined the usability of the ICF as a criterion for content validity of measures that were used to evaluate their prediction of falls in individuals with stroke. They were successful in their application and illustrated that the ICF indeed can be useful for content validity assessment and outcomes measurement in stroke.

Beninato and colleagues' study illustrated the value of the ICF in clinical decision making toward patient care. Their study contributes to the growing body of evidence on the practicality of the ICF and the still-existing need to take the ICF beyond just being a conceptual framework. Their use of the ICF as a reference in the selection of instruments should be commended. It was evident that there was recognition to cover the different domains that are explicitly covered by the ICF components of "body functions and structures," "activities and participation," "environmental factors," and "personal factors" by having assessment tools that represent these ICF components.

Since its approval 8 years ago, the ICF ushered in a new era in research, academics, and clinics in terms of outcomes measurement. The ICF provided constructs and domains and a classification system that are essential to health researchers and heath care providers alike. The ICF is a tool that can be used in any health setting, irrespective of health condition, and in any health care service, making the ICF universal in its scope. Despite the emerging trend of "ICF-ization" in the literature today, a gap regarding the ICF's broad and concrete application in the real world remains. Thus, efforts should continue and expand in order to realize the effective translation of research to clinical practice based on the strong arguments that favor the use of the ICF. The ICF matters because it not only provides the contents to describe functioning but also brings *meaning* to functioning. The ICF is not based solely on a hierarchical classification system, but it also recognizes the multiple biopsychosocial players and their interaction with one another that influence functioning. The ICF not only is a conceptual framework, but can be operationalized in ways that could complement clinical testing and measurements and the conduct of research trials.

Beninato et al used the ICF at the component level to select their outcome measures. However, further steps could be taken, because the ICF provides more-specific and more-detailed domains of functioning than just the component-level description.

ICF as a Basis for Selecting Instruments

Because the ICF provides us with "what" to measure, it can be useful in examining the content of mea-