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Article *in* International Journal of Rehabilitation Research · August 2018

DOI: 10.1097/MRR.0000000000000311

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Comparison between self-reported and observed locomotion ability scores in patients with stroke: a cross-sectional study

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This study aimed to investigate (i) the validity of self-reported scores of locomotion ability in stroke survivors using the ABILOCO-Benin questionnaire, and (ii) the congruence between online Rasch analysis of the ABILOCO-Benin raw scores and a conversion table set along with the questionnaire development. Thirty-five adult poststroke patients [mean age: 52 (SD: 10) years, 60% men] recruited from the rehabilitation department of National University Hospital of Cotonou (Benin), self-reported their locomotion ability, filling out the ABILOCO-Benin questionnaire [self-reported scores (SRS)]. Afterwards, a physical therapist observed and rated the patients' locomotion ability, while they performed each of the 15 items of the questionnaire [performance-based scores (PBS)]. Both raw SRS and PBS were then converted to linear measures using (i) an online Rasch analysis method and (ii) an ordinal-to-interval transformation table. Analyses showed high correlation (intraclass correlation coefficient = 0.74, $P < 0.001$) and nonsignificant difference ($P = 0.778$) between SRS and PBS. Linear measures from online Rasch and a conversion table also exhibited high correlation (intraclass correlation coefficient = 0.92; $P < 0.001$). However, the difference between online analysis and the conversion table was significant ($P = 0.022$). In conclusion, self-report is a valid method to administer ABILOCO-Benin in stroke patients. The conversion table offers a valid opportunity for quick transfer of raw scores to linear measures. However, the accuracy of linear measures from the conversion table may be slightly affected by missing responses. *International Journal of Rehabilitation Research* **00:000–000**

International Journal of Rehabilitation Research 2018, **00**:000–000

Keywords: locomotion ability, patient-reported outcome, stroke, validity

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Received 30 May 2018 **Accepted** 20 July 2018

Introduction

One of the main goals of the neurorehabilitation program is to improve functional independence. With respect to the framework of the International Classification of Functioning, functional independence refers to the activity domain, which defines daily life activities (WHO, 2001). The latent nature of variables in this domain wherein the patient himself is the main source of information underpins the growing use of patient-reported outcomes (PRO) for the assessment of the individual's ability in performing daily life activities (Penta *et al.*, 2001; Arnould *et al.*, 2004; US Department of Health and Human Services, 2006; Batcho *et al.*, 2012).

ABILOCO-Benin is a PRO tool built on the basis of the Rasch-model to evaluate locomotion ability in poststroke patients in the West African sociocultural context (Sogbossi *et al.*, 2014). It is an adapted version of the original ABILOCO calibrated for European poststroke patients (Caty *et al.*, 2008). Although PRO tools are increasingly well integrated in clinical routine practice and research, there are some concerns about their objectivity (Kempen *et al.*, 1996; Vandervelde *et al.*, 2008). Indeed, culture, level of education and emotional state are potential bias factors for PRO tools (Guralnik *et al.*, 1989; Kempen *et al.*, 1996; Kivinen *et al.*, 1998; Vandervelde *et al.*, 2008). Studies demonstrating the validity of the self-report method are still lacking. The few studies that had addressed this question were conducted in Northern countries, mainly in Europe (Vandervelde *et al.*, 2008; Caty *et al.*, 2009). To our knowledge, there is no study having investigated the validity of self-report as the administration method of functional assessment tools in Africa. Therefore, such studies conducted in the African sociocultural context are critically needed.

Moreover, as some other Rasch-built questionnaires, the initial calibration and validation of ABILOCO-Benin was published along with an ordinal-to-interval transformation table that allows easy and quick conversion of raw scores to linear scores (Sogbossi *et al.*, 2014). This rapid conversion method intends to enable users to quickly get interval measures without having to go through online

 DOI: 10.1097/MRR.0000000000000311

analysis, which might be difficult because of many reasons, such as lack of time or limited access to the Internet. Therefore, the conversion table may encourage health professionals to use linear measures derived from this tool, instead of ordinal scores. However, the extent to which linear measures obtained from the conversion table converge with online Rasch analysis measures needs to be investigated.

The main aim of this study was to investigate the validity of self-report as the administration method of the ABILOCO-Benin questionnaire in West African stroke patients. In addition, our study aimed to evaluate the congruence of Rasch linear measures obtained either from online Rasch analysis or from a conversion table. We hypothesized that self-report may be a valid method for administering the ABILOCO-Benin questionnaire and that the conversion table would allow converting raw scores to linear measures in a simple and easy way.

Participants and methods

Participants

This cross-sectional study included adult poststroke patients screened in the patients' register in the rehabilitation center of National University Hospital of Cotonou (Cotonou, Benin) and contacted through their phone number if they were discharged. The participants were enrolled in the study if they scored at least 24 on the Mini-Mental Scale Evaluation (Tombaugh and Mcintyre, 1992), did not have either aphasia impeding communication or other orthopedic conditions that might interfere with their locomotion capacity and accepted to participate in the study. The study was approved by the ethic committee of the rehabilitation department of the National University Hospital Cotonou, and all participants provided informed consent before their inclusion in the study.

Assessment procedure

Two assessment sessions were carried out with each patient on the same day. The first assessment was based on self-report and the second was observation of performance. The patients first evaluated their locomotion ability by filling out the ABILOCO-Benin questionnaire [self-reported scores (SRS)]. Around 2 h later, the patients were invited to perform each of the tasks described through the 15 items of ABILOCO-Benin, and this individual performance was observed and rated by a physical therapist [performance-based scores (PBS)] on a separate ABILOCO-Benin sheet. The physical therapist who rated the patients was blinded from the SRS data. Similarly to SRS, the assessor rated each of the 15 tasks as 'impossible' or 'difficult' or 'easy' while the patient executed them. To avoid bias, patients got access to the full and detailed purpose of the study only after having completed both the self-report and the performance-based assessments. Before assessments, participants were only aware that the study was supposed to investigate some psychometric quality of the ABILOCO-Benin questionnaire. Items that required specific conditions were mimicked with standardized conditions for every patient. For instance, the item 'Walking several minutes at a constant speed' was evaluated by observing the patient during a 6-min walking test. The patients were instructed to keep a constant, fast, and comfortable speed during the 6-min walking period. The item 'Walking less than 5 m, indoors, hanging onto pieces of furniture' was mimicked by setting a short path with tables that patients could hold on to, to walk.

For clinical characteristics' description, patients' walking speeds were recorded with the 10-m walking test performed at a comfortable speed over a 14-m walkway, where the middle 10 m was timed for speed estimation (Salbach *et al.*, 2001). Their walking abilities were recorded as well with the Functional Ambulation Classification (FAC), an ordinal scale evaluating the patient's ability to walk on the basis of the physical support he needs (Mehrholz *et al.*, 2007). The FAC is made of six categories ordered from '0' indicating a patient not able to walk, or needs help from two or more persons, up to '5' for a patient who can walk independently anywhere (Mehrholz *et al.*, 2007).

Statistical analysis

Validity of self-report as assessment method

ABILOCO-Benin raw scores were first converted to linear scores for both self-report and performance-based versions. Conversions were performed online at *http://www.rehab-scales.org*. Concordance between SRS and PBS was investigated through intraclass correlation coefficient, model 2,1 (ICC2,1) with 'absolute agreement,' and through Bland–Altman plot. We also performed a paired *t*-test to compare mean scores from both self-report and performance-based assessments. Finally, Spearman's correlation was used for agreement at the item level on the basis of raw scores of both ways of administration.

Congruence between ABILOCO-Benin linear scores from conversion table and online Rasch analysis

ABILOCO-Benin raw scores for the self-report method were converted to linear scores using the conversion table and the online Rasch analysis. We similarly computed ICC2,1 (with 'absolute agreement'), Bland–Altman plot, and paired *t*-test to study the relationship between ABILOCO-Benin linear measures obtained from the conversion table and those from online Rasch analysis.

ICCs, Spearman's correlations, and paired *t*-tests were performed with SPSS version 16; SPSS Inc., Chicago, Illinois, USA. Bland–Altman plots were drawn with Microsoft Excel (2016) Software; Microsoft, Redmond, Washington, USA. Normality of data was tested with Kolmogorov–Smirnov test. For all analyses, P value under 0.05 was set as statistically significant.

Results

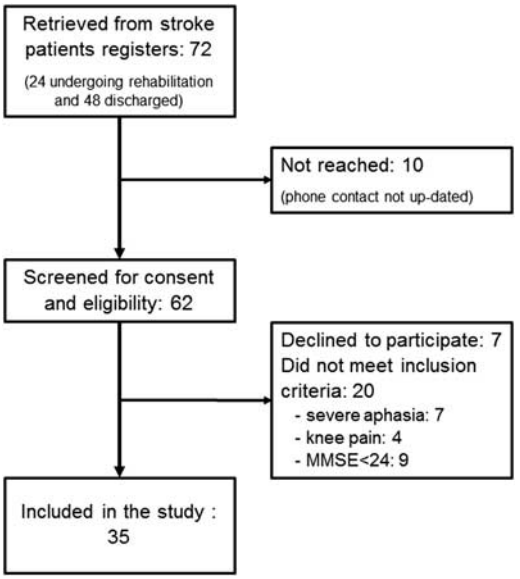
Participants

Seventy-two poststroke patients were screened in the patients' registers (Fig. 1). Ten patients could not be reached because of wrong phone numbers. From the remaining 62 patients, seven did not accept to participate in the study; 20 were excluded because of (i) severe aphasia ($n=7$), (ii) presence of knee pains associated with their hemiparesis ($n=4$), and (iii) MMSE score less than 24. Then, the study included a total sample of 35 poststroke patients (Fig. 1). Their characteristics were as follows: mean age 52 (SD: 10) years, 60% men, mean time since stroke 62 (SD: 80) months, average walking speed: 0.90 (SD: 1.25) m/s and FAC [median (25–75th percentile): 4 (4–5)].

Validity of self-report method of assessment

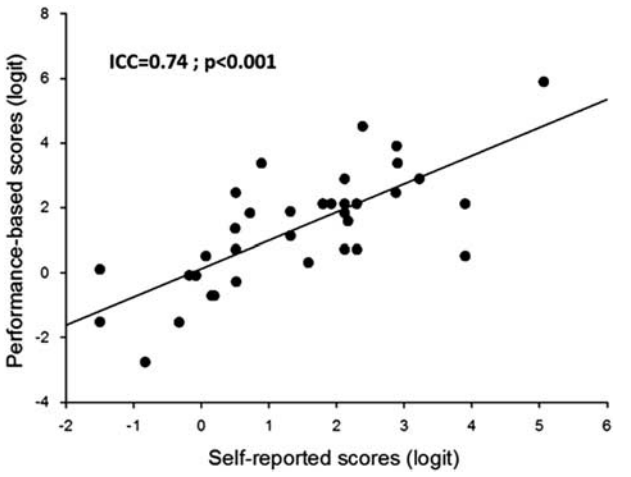
Figure 2 displays the relationship between SRS and PBS. ICC was 0.74 [95% confidence interval (95% CI): 0.54–0.86] with P less than 0.001 demonstrating a good concordance between self-report and performance-based assessments. Patients' mean score was 1.43 (SD: 1.53) logits according to SRS and 1.37 (SD: 1.80) logits based on PBS. There was no significant difference between PBS and SRS [mean (SD) = − 0.06 (SD: 1.23) logits; $P=0.778$], the 95% CI of the mean was − 0.48 to 0.36, overlapping the zero line for equality, thus reflecting good agreement between PBS and SRS. Figure 3 shows Bland–Altman plot of differences between PBS and SRS, which were normally distributed ($P=0.200$), against means of both assessments. Almost all points were within the 95% limits of agreement, which ranged from − 2.52 to 2.40.

Fig. 1



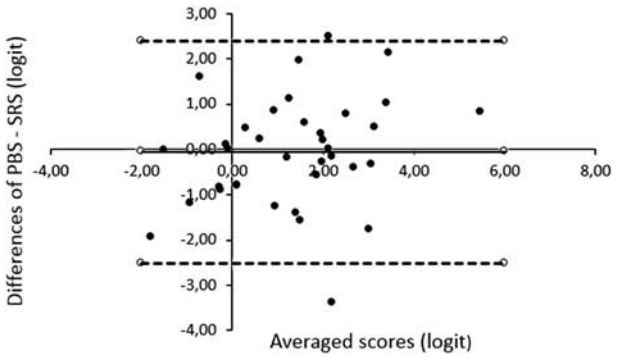
Flow diagram of participant recruitment.

Fig. 2



Relationship between performance-based and self-reported scores of locomotion ability using the ABILOCO-Benin scale. Each point represents data for each patient, with a linear regression (solid line). ICC, intraclass correlation coefficient.

Fig. 3



Bland–Altman plot of agreement between performance-based score (PBS) and self-reported score (SRS). Dashed lines showed 95% lower and upper limits of agreement. Solid line shows mean of differences between PBS and SRS.

Spearman correlations for each of the 15 items of ABILOCO-Benin are shown in Table 1. Ten items exhibited significant correlations ranging from 0.49 to 0.67. The remaining five items (2, 3, 7, 10, and 14) showed nonsignificant Spearman's correlations below 0.40. Items 10 (striding over an object with the healthy foot first) and 14 [walking more than 5 m with assistive device (e.g. cane)] showed nearly significant correlations ($r=0.33$, $P=0.072$ and $r=0.34$, $P=0.065$, respectively).

Congruence between ABILOCO-Benin linear scores from conversion table and online Rasch analysis

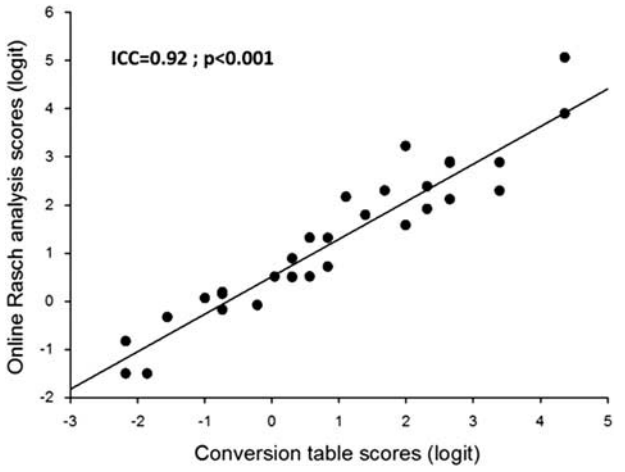
Analyses showed a significant and strong correlation, between ABILOCO-Benin linear scores from Rasch

Table 1 Correlations between self-report and performance-based assessments for each item of ABILOCO-Benin scale

Items	Items label	ρ	*P* value
1	Hopping on the paretic foot only without support	0.53	0.025
2	Going up and down stairs holding onto handrail	0.24	**0.176**
3	Walking less than 5 m, indoors, hanging onto pieces of furniture	−0.06	**0.726**
4	Walking outdoors on a flat ground without assistive device	0.57	< 0.001
5	Walking backwards without support	0.49	0.022
6	Going up stairs putting each foot on the next step without handrail	0.57	0.001
7	Walking with the help of a person who guides but does not support	0.26	**0.143**
8	Running on a flat and level ground	0.54	0.005
9	Walking while holding a fragile object (e.g. a glass full of water)	0.47	0.010
10	Striding over an object with the healthy foot first	0.33	**0.072**
11	Turning and walking in a narrow space without support	0.67	< 0.001
12	Kicking a ball with the paretic foot	0.62	< 0.001
13	Going down stairs putting both feet on each step without handrail	0.61	< 0.001
14	Walking more than 5 m with assistive device (e.g. cane)	0.34	**0.065**
15	Walking several minutes at a constant speed	0.52	0.002

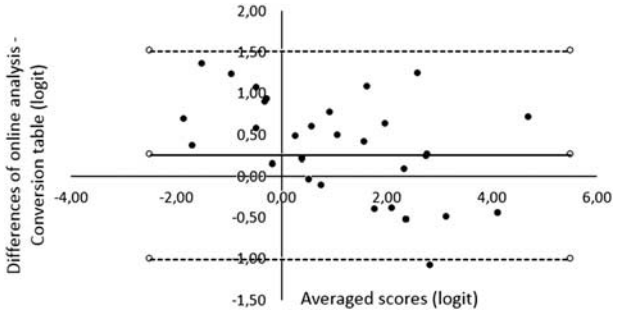
ρ = Spearman's correlation coefficient. Bold value indicates $P > 0.05$.

Fig. 4



Correlation between ABILOCO-Benin linear scores from both the conversion table and online Rasch analysis with a linear regression (solid line). ICC, intraclass correlation coefficient.

Fig. 5



Bland-Altman plot for agreement between online Rasch analysis and the ordinal-to-interval transformation table of ABILOCO-Benin. Dashed lines show 95% lower and upper limits of agreement. Solid line shows mean of differences between online analysis and the transformation table.

analysis, and those from the conversion table with ICC = 0.92 (95% CI: 0.84–0.96), with $P < 0.001$ (Fig. 4). Figure 5 displays Bland–Altman plot. Mean (SD) of differences between online conversion and the conversion table was 0.25 (SD: 0.63), close to zero; the 95% CI of the mean was 0.04–0.47. Differences between scores were normally distributed ($P = 0.115$); all points except one fell between the 95% of limits of agreement, which was −1.01 to 1.51. Paired *t*-test showed a significant difference between both conversions. The mean score was 1.43 (SD: 1.53) logits from online analysis, and 1.17 (SD: 1.87) logits from the conversion table, with *P* value of 0.022. Finally, the Pearson correlation between mean differences (online minus table-based converted scores) and individual missing responses was 0.77, with *P* value of 0.001.

Discussion

This study aimed to investigate the validity of self-report administration of ABILOCO-Benin, and the congruence of the questionnaire's conversion table from raw scores to linear measures, with a direct online Rasch analysis. The results showed that self-report is a valid method to administer the ABILOCO-Benin questionnaire. With regard to our second objective, we observed an excellent correlation between linear measures obtained from either a paper-based conversion table or an online Rasch analysis. However, the conversion table yielded slightly lower values (logit) compared with the online Rasch analysis, as shown by the Bland–Altman plot and the paired *t*-test.

To our knowledge, this is the first study assessing the validity of the self-report method for administering daily life activities' questionnaires in a West African country. Our finding is close to that of Caty *et al.* (2009) who also investigated the validity of self-assessment of the original scale, ABILOCO. They found a strong correlation

(ICC = 0.69) between the patient report and observation from the medical doctor. Similarly, investigating the validity of self-report administration of an activity limitations measure (ACTIVLIM) in Belgian adults with neuromuscular disorders, Vandervelde *et al.* (2008) also showed an excellent correlation between self-report and performance-based scores (ICC = 0.87). However, some other studies had compared patient-reported and performance-based measures of daily life activities in elderly patients and reported low to moderate correlations between both methods (Sager *et al.*, 1992; Nielsen *et al.*, 2016). Nielsen *et al.* (2016) argued that the construct measured by both PRO and performance-based tools might be different, and this may explain the poor correlation they observed (ρ: Spearman's correlation were −0.64, 0.45, and 0.53 between the Barthel Index and the Timed Up and Go Test, the 30-s Chair Stand Test, and the motor subscale of the Assessment of Motor and Process Skills, respectively) (Nielsen *et al.*, 2016). For these authors, another reason might be the fact that patients who were newly experiencing functional decline did not realize yet that they were unable to perform activities and consequently might overestimate their ability (Nielsen *et al.*, 2016). It is thus noteworthy that hospitalized patients are likely to cause bias when self-reporting their functional status. In that context, performance-based tools should be of interest. That is why, in ABILOCO-Benin, like in other Rasch-built scales [ABILHAND (Penta *et al.*, 2001), ACTIVLIM-stroke (Batcho *et al.*, 2012)], patients are instructed to respond by '?' (meaning missing data), when they are not familiar with an activity or have never performed it. In fact, nonfamiliar or never-performed activities are the ones likely to be misanswered.

Although culture and level of education are relevant factors likely to bias self-report (Kempen *et al.*, 1996; Kivinen *et al.*, 1998; Vandervelde *et al.*, 2008), our results showed that the self-report method of administration is valid in the West African sociocultural context. Correlations between self-reported ability and observed performance for individual items ranged from moderate to strong. Surprisingly, among the five items, which did not show significant correlations, three (items 2, 3, and 7) were related to the use of external assistance (handrail or home-pieces of furniture or the presence of a person). During assessments, the performance of these three items might be influenced by the standardized experimental conditions in the rehabilitation facility. While providing response to those items on self-report basis, patients might think about their own living settings, which might probably be different from the experimental environment set up for performance-based assessment. Therefore, this might have contributed in the non-significant correlations observed between SRS and PBS for these items. This finding highlighted that performance-based tools known as 'capacity tests' do not always reflect very well patients' real life (specific height of stairs, specific handrail, carpet on the floor, adapted tools, etc.) (Myers *et al.*, 1993; Copay *et al.*, 2007; Vandervelde *et al.*, 2008; Caty *et al.*, 2009). Moreover, studies argued that motivational factors such as the awareness of being in experimental conditions or the presence of assessors are source of bias for performance-based assessment (Campbell *et al.*, 1995; Vandervelde *et al.*, 2008; Caty *et al.*, 2009). Self-report tools and capacity tests should be complementary when assessing functional status of patients (Batcho *et al.*, 2012). Self-reported questionnaires can be quickly filled. They reflect very well the actual daily life of patients and allow regular assessment of patients through their rehabilitation process (Myers *et al.*, 1993; Batcho *et al.*, 2012).

As for the congruence between online Rasch analysis and the questionnaire's conversion table, the observed statistical difference between both methods might be explained by the effect of missing responses that were not considered in the conversion table. Indeed, items that are not familiar to patients are scored as missing responses, and on the basis of the difficulty of each item, Rasch analysis projects possible responses that might be given for those items and generates the linear score of the patient (Pallant and Tennant, 2007; Batcho *et al.*, 2012; Sogbossi *et al.*, 2014). The conversion table allows converting raw scores into linear measures, regardless of missing response or the relative difficulty of each item. Therefore, ABILOCO-Benin linear scores based on the conversion table should be interpreted with caution, as this table does not adjust for either missing responses, as suggested by the significant and strong correlation between mean differences and proportion of missing responses. Online conversion with Rasch analysis would be better when a filled questionnaire sheet contains missing responses (Fellinghauer *et al.*, 2018). Furthermore, the conversion table does not provide standard errors of measurement that are generally associated with patients' linear scores through online Rasch analysis. Nonetheless, this conversion table offers a simple and useful way to convert raw scores to linear measures, and its use may be encouraged whenever interval scaling is required, for example, when analyzing data in a research context. Moreover, Fellinghauer *et al.* (2018) recently recommended the imputation method, using the expectation-maximization algorithm, to deal with missing data when direct Rasch analysis is not possible, provided that missing responses are less than 15% of the distribution. The need to provide a conversion table along with the publication of Rasch-derived instruments has been recommended by Grimby *et al.* (2012) and has been
considered in most studies of Rasch-built assessment scales' development (Tate *et al.*, 2011; Batcho *et al.*, 2012; Krumlinde-Sundholm, 2012; Mills *et al.*, 2012; Holmefur and Krumlinde-Sundholm, 2016). Researchers or rehabilitation professionals should, however, keep in mind that

they have to use the same method of conversion in repeated measures designs, avoiding switching from online analysis to conversion table or inversely when following up patients.

The main limitation of this study is the small sample size that does not allow generalization of results. A secondary limitation is the setting of the study. Patients were observed in a standardized setting not in their own life environment. However, this study supports findings in the literature and is one of the scarce studies that address the validity of the self-report method of questionnaire administration in an African setting. Future studies with large sample size are needed to confirm the results.

Conclusion

Self-report is a valid method to assess locomotion ability in stroke patients using standardized questionnaires such as ABILOCO-Benin. It allows simple, rapid, and low-cost assessment of functional status of patients in various and personalized contexts. The use of questionnaire-based instruments may be encouraged widely for better monitoring of the rehabilitation outcome, including in low-income contexts. The conversion table of ABILOCO-Benin offers valid opportunity for quick transfer of raw scores to interval measures.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

Arnould C, Penta M, Renders A, Thonnard JL (2004). ABILHAND-Kids: a measure of manual ability in children with cerebral palsy. *Neurology* **63**:1045–1052.

Batcho CS, Tennant A, Thonnard JL (2012). ACTIVLIM-Stroke: a crosscultural Rasch-built scale of activity limitations in patients with stroke. *Stroke* **43**:815–823.

Campbell JP, Maxey VA, Watson WA (1995). Hawthorne effect: implications for prehospital research. *Ann Emerg Med* **26**:590–594.

Caty GD, Arnould C, Stoquart GG, Thonnard JL, Lejeune TM (2008). ABILOCO: a Rasch-built 13-item questionnaire to assess locomotion ability in stroke patients. *Arch Phys Med Rehabil* **89**:284–290.

Caty GD, Theunissen E, Lejeune TM (2009). Reproducibility of the ABILOCO questionnaire and comparison between self-reported and observed locomotion ability in adult patients with stroke. *Arch Phys Med Rehabil* **90**:1061–1063.

Copay AG, Subach BR, Glassman SD, Polly DW Jr, Schuler TC (2007). Understanding the minimum clinically important difference: a review of concepts and methods. *Spine J* **7**:541–546.

Fellinghauer CS, Prodinger B, Tennant A (2018). The impact of missing values and single imputation upon rasch analysis outcomes: a simulation study. *J Appl Meas* **19**:1–25.

Grimby G, Tennant A, Tesio L (2012). The use of raw scores from ordinal scales: time to end malpractice? *J Rehabil Med* **44**:97–98.

Guralnik JM, Branch LG, Cummings SR, Curb JD (1989). Physical performance measures in aging research. *J Gerontol* **44**:141–146.

Holmefur MM, Krumlinde-Sundholm L (2016). Psychometric properties of a revised version of the Assisting Hand Assessment (Kids-AHA 5.0). *Dev Med Child Neurol* **58**:618–624.

Kempen GI, Steverink N, Ormel J, Deeg DJ (1996). The assessment of ADL among frail elderly in an interview survey: self-report versus performance-based tests and determinants of discrepancies. *J Gerontol B Psychol Sci Soc Sci* **51**:254–260.

Kivinen P, Sulkava R, Halonen P, Nissinen A (1998). Self-reported and performance-based functional status and associated factors among elderly men: the Finnish cohorts of the Seven Countries Study. *J Clin Epidemiol* **51**:1243–1252.

Krumlinde-Sundholm L (2012). Reporting outcomes of the Assisting Hand Assessment: what scale should be used? *Dev Med Child Neurol* **54**:807–808.

Mehrholz J, Wagner K, Rutte K, Meissner D, Pohl M (2007). Predictive validity and responsiveness of the functional ambulation category in hemiparetic patients after stroke. *Arch Phys Med Rehabil* **88**:1314–1319.

Mills RJ, Pallant JF, Koufali M, Sharma A, Day S, Tennant A, *et al.* (2012). Validation of the Neurological Fatigue Index for stroke (NFI-Stroke). *Health Qual Life Outcomes* **10**:51.

Myers AM, Holliday PJ, Harvey KA, Hutchinson KS (1993). Functional performance measures: are they superior to self-assessments? *J Gerontol* **48**:196–206.

Nielsen LM, Kirkegaard H, Ostergaard LG, Bovbjerg K, Breinholt K, Maribo T (2016). Comparison of self-reported and performance-based measures of functional ability in elderly patients in an emergency department: implications for selection of clinical outcome measures. *BMC Geriatr* **16**:199.

Pallant JF, Tennant A (2007). An introduction to the Rasch measurement model: an example using the Hospital Anxiety and Depression Scale (HADS). *Br J Clin Psychol* **46**:1–18.

Penta M, Tesio L, Arnould C, Zancan A, Thonnard JL (2001). The ABILHAND questionnaire as a measure of manual ability in chronic stroke patients: Rasch-based validation and relationship to upper limb impairment. *Stroke* **32**:1627–1634.

Sager MA, Dunham NC, Schwantes A, Mecum L, Halverson K, Harlowe D (1992). Measurement of activities of daily living in hospitalized elderly: a comparison of self-report and performance-based methods. *J Am Geriatr Soc* **40**:457–462.

Salbach NM, Mayo NE, Higgins J, Ahmed S, Finch LE, Richards CL (2001). Responsiveness and predictability of gait speed and other disability measures in acute stroke. *Arch Phys Med Rehabil* **82**:1204–1212.

Sogbossi ES, Thonnard JL, Batcho CS (2014). Assessing locomotion ability in West African stroke patients: validation of ABILOCO-Benin scale. *Arch Phys Med Rehabil* **95**:1470.e3–1476.e3.

Tate RL, Simpson GK, Soo CA, Lane-Brown AT (2011). Participation after acquired brain injury: clinical and psychometric considerations of the Sydney Psychosocial Reintegration Scale (SPRS). *J Rehabil Med* **43**:609–618.

Tombaugh TN, Mcintyre NJ (1992). The mini-mental state examination: a comprehensive review. *J Am Geriatr Soc* **40**:922–935.

U.S. Department of Health and Human Services (2006). Guidance for industry: patient-reported outcome measures: use in medical product development to support labeling claims: draft guidance. *Health Qual Life Outcomes* **4**:79.

Vandervelde L, Dispa D, Van Den Bergh PY, Thonnard JL (2008). A comparison between self-reported and observed activity limitations in adults with neuromuscular disorders. *Arch Phys Med Rehabil* **89**:1720–1723.

WHO (2001). *International Classification of Functioning, Disability and Health: ICF*. Geneva: World Health Organization.