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ABSTRACT

BACKGROUND: The Multiple Sclerosis Spasticity Scale 88 (MSSS-88) is designed to capture the patient experience and impact of spasticity, but there is limited evaluation against clinician-rated measures of spasticity.

OBJECTIVE: To evaluate the convergent validity and responsiveness of the MSSS-88.

DESIGN: Longitudinal study.

SETTING: University Laboratory.

SUBJECTS: Thirty-four people with multiple sclerosis.

METHODS: People with multiple sclerosis (MS; n = 34) completed the self-reported 12-item Multiple Sclerosis Walking Scale, Multiple Sclerosis Spasticity Scale, Barthel Index alongside the clinician-rated Ashworth Scale, and a laboratory-based measure of ankle spasticity. Spasticity measure responsiveness was evaluated in 20 participants at two time points, an average of 8.75 ± 3.8 months apart.

RESULTS: In people with MS (mean age 55.1 ± 8.1 years; Expanded Disability Scale range 4.5-7.0), spasticity symptom specific subscales of the MSSS-88 (stiffness and spasms) showed strong and significant correlations with the clinician-rated Ashworth Scale ($r = 0.52$-0.53; $P < .01$). Responsiveness of the MSSS-88 was comparable to a laboratory-based measure of ankle spasticity.

CONCLUSIONS: Our findings lend additional support to the convergent validity of this measure.

KEYWORDS: outcome assessment, spasticity, psychometrics, multiple sclerosis

Introduction

Spasticity in multiple sclerosis (MS) is common, complex, and disabling with few measures capturing the complexity of this phenomenon.[1] The Multiple Sclerosis Spasticity Scale (MSSS-88) is designed to capture the patient experience and impact of spasticity.[2] This 88-item scale aims to quantify how bothered people with MS are by their spasticity. It is formed of eight subscales, three relating specifically to spasticity symptoms (subscales 1-3), three to physical functioning (subscales 4-6), one to emotional health (subscale 7), and one to social functioning (subscale 8). In turn, each subscale is suggested a stand-alone measurement.[2]

The developers provide evidence for its validity by comparing its subscales against other patient-reported measures evaluating similar constructs. Providing evidence to support the validity of a measure is an ongoing process,[3] whereby data collected in different settings, from different patient groups and in comparison with other measures contributes to existing knowledge about a measures performance. To date, the English version of the MSSS-88 has not extended to evaluation against any clinician-rated measures of spasticity. Hence, the aim of this short report was to further explore the convergent validity of the MSSS-88 by evaluating the associations between its spasticity subscales, a clinician-rated, and laboratory-based measure of ankle spasticity, as yet not undertaken. We also undertook a preliminary investigation of the relative responsiveness of the MSSS-88 and a laboratory measure of ankle spasticity.

Patients and Methods

Data were derived from three interlinked studies which investigated the effects of ankle stretching on spasticity and range of motion in people with MS.[4] Data were collected by a single assessor (JO). Ethics approval was by the National Health Service Research Ethics Committee (ref: 09/H0202/42). Participants were recruited from the South West Impact of Multiple Sclerosis (SWIMS) project database.[5] Inclusion criteria were confirmed diagnosis of MS, self-reported leg

Table 1. Participant demographic and clinical characteristics (n = 34).

Age, mean years (SD)	55 (8.1)
Sex, n (%)	
Male	8 (23.5)
Female	26 (76.5)
MS subtype, n (%)	
Relapsing-remitting	15 (44.2)
Primary progressive	8 (23.5)
Secondary progressive	10 (29.4)
Unknown	1 (2.9)
Duration of disease, years	
Median (IQR)	6.0 (12.5)
Mean (SD)	10.9 (10.3)
Range	0.5-35
EDSS score	
Median (IQR)	5.5 (1.8)
Range	4.5-7.0
12-item Multiple Sclerosis Walking Scale, median (IQR, range)	41.0 (21.0, 37.0)
Barthel Index, mean (SD), range	88.3 (12.9) 55-100
Spasticity measures	
MSSS-88, median (IQR, range)	153.0 (87.0, 276.0)
Ashworth score, median (IQR, range)	
Ankle	2.0 (1.0, 3.0)
Knee	1.0 (1.0, 2.0)
Hip	1.0 (2.0, 2.0)
Ankle spasticity,[a] N m/rad, mean (SD)	14.1 (7.9)

Abbreviations: IQR, interquartile range; MS, multiple sclerosis; MSSS-88, Multiple Sclerosis Spasticity Scale 88.
[a]Measured as rotational torsion.

stiffness, range of motion at the foot to allow neutral alignment between inversion/eversion, at least 90° range of movement at the knee with hip extended, and able to walk a minimum of 10 steps (with or without walking aid).

Evaluation of validity was through data collected from 34 people with MS. Each completed the self-reported 12-item Multiple Sclerosis Walking Scale (MSWS-12),[6] MSSS-88,[2] and Barthel Index questionnaires,[7] alongside the clinician-rated Ashworth Scale (AS),[8] and a laboratory-based measure of ankle spasticity.[4]

Relative responsiveness of the MSSS-88 and the laboratory-based measure of ankle spasticity was evaluated in 20 participants. The data were obtained at two time points, an average of 8.75 ± 3.8 months apart, during which time participants received their usual health care. Additional interventions to manage their spasticity and changes to medication between the two time points were minimal.

Associations between measures were assessed using Spearman's rank-order correlation. Strength of correlations was interpreted using the classification[9]: ≤0.29: weak; 0.30-0.49: moderate; and ≥0.50: strong. Our expectation was that spasticity symptoms subscales (ie, subscales 1-3) would have the strongest associations with clinical measures of spasticity (ie, AS) and the laboratory-based measure of ankle spasticity. Subscales 4-6 would have the strongest associations with measures of walking and activities of daily living (ADL). Responsiveness of the MSSS-88 and clinical measures of spasticity were analysed over two time periods using effect size calculations.[9]

Table 2. Spearman's correlations showing associations between MSSS-88, EDSS, and outcome measures.

MSSS-88	DISABILITY	ADL	SPASTICITY	AS	WALKING
	EDSS	BARTHEL	LABORATORY METHOD		MSWS-12
Subscale 1 (Stiffness)	0.55**	0.25	0.14	0.53**	0.68**
Subscale 2 (Pain)	0.38	0.03	0.06	0.23	0.55**
Subscale 3 (Spasms)	0.60**	0.40*	0.34	0.52**	0.59**
Subscale 4 (ADL)	0.79**	0.37	0.08	0.48*	0.90**
Subscale 5 (Walking)	0.80**	0.22	0.26	0.41*	0.82**
Subscale 6 (Movement)	0.75	0.37	0.06	0.41*	0.81**
Subscale 7 (Emotional)	0.61**	0.47*	0.17	0.45*	0.65**
Subscale 8 (Social)	0.63**	0.48*	0.11	0.48*	0.67**
MSSS-88 (Total)	0.73**	0.33	0.13	0.49**	0.85**

Abbreviations: ADL, activities of daily living; AS, Ashworth Scale; EDSS, Expanded Disability Status Scale; MSWS-12: 12-item Multiple Sclerosis Walking Scale.
*$P < .05$; **$P < .01$.

Table 3. Responsiveness data for the MSSS-88 and the laboratory measure of spasticity in people with multiple sclerosis (n = 20).

SPASTICITY MEASURE	TIME POINT 0	TIME POINT 1	EFFECT SIZE
MSSS-88 Stiffness, mean (SD)	26.1 (8.6)	25.5 (7.5)	0.07
MSSS-88 Pain, mean (SD)	14.7 (5.5)	16.0 (6.4)	0.2
MSSS-88 Spasms, mean (SD)	20.2 (9.5)	19.1 (9.2)	0.1
MSSS-88 Total, mean (SD)	156.9 (51.2)	162.2 (53.7)	0.1
Ankle spasticity, Nm/rad, mean (SD)	13.8 (12.6)	10.8 (6.1)	0.3

Abbreviations: Nm/rad, Newtons per metre radius.

Results

Data were obtained from 34 people with multiple sclerosis (mean age 55.1 ± 8.1 years, median [interquartile range, IQR] Expanded Disability Scale, EDSS 5.5 [1.8], median [IQR] disease duration 6 [12.5] years) (Table 1).

Convergent validity

'Walking', 'ADL', and 'Movement' subscales were strongly and significantly correlated with both the 12-item Multiple Sclerosis Walking Scale and the EDSS, although not with the Barthel Index (Table 2). All subscales, with the exception of pain, showed similar moderate significant correlations with the AS ($r = 0.41$-0.53, $P = .05$-$.01$). The MSSS-88 total score was weakly and not significantly correlated with the laboratory measure of ankle spasticity, strongly and significantly correlated with the 12-item Multiple Sclerosis Walking Scale and EDSS, and moderately and significantly correlated with the other measures.

Relative responsiveness

Scores on the MSSS-88 subscales 'Stiffness', 'Spasms', and the laboratory measure of ankle spasticity all decreased over the two time points. In contrast, pain subscale scores increased, as did overall MSSS-88 scores. Differences in outcomes at the two time points, as measured by effect size statistics, were negligible to small in each of these measures (Table 3).

Discussion

The aim of this short report was to further evaluate the convergent validity of the patient-reported MSSS-88. Our findings lend additional support to the validity of this measure. The correlations between the MSSS-88 subscales and corresponding functional scales had a magnitude and pattern as expected, and the spasticity symptom specific subscales of the MSSS-88 (stiffness and spasms) showed strong and significant correlations with the clinician-rated AS. These findings show a similar pattern and magnitude of correlations to those of other validation studies in German,[10] Serbian,[11] and Italian[12] versions.

Unexpected, however, were the weak and non-significant correlations between (1) the laboratory-based measure of ankle spasticity and the MSSS-88 stiffness and spasms subscales; and (2) the MSSS-88 pain subscale with either the AS or the ankle spasticity measure. We recognise that neither the Ashworth Scale nor the laboratory based measure of ankle spasticity assess spasticity during a functional task, thereby quantifying different aspects of spasticity than the MSSS-88; one explanation for the lower correlations. Also unexpected was that the correlations between the AS and all but one of the subscales (pain) was broadly similar (r = 0.41-0.53); one might have expected the spasticity symptom specific to be more strongly related with the AS than the social and emotional subscales, particularly since the authors suggest they could be used as stand-alone subscales.

We also evaluated the relative responsiveness of the MSSS-88 total score and its spasticity symptom specific subscales, with the laboratory-based measure of ankle spasticity. We found minimal change between two time points 8.75 months apart. Although broadly comparable, the laboratory-based spasticity measure demonstrated the largest effect size, albeit still small. The small magnitude of change was not surprising given that the participants did not engage in any additional interventions aimed at reducing spasticity over this time-period.

The challenge in validating the MSSS-88 subscales with clinician-based measures is that they are potentially quantifying different aspects of spasticity, i.e. a subjective versus objective perspective; being *bothered* by an impairment does not necessarily correlate with its severity. The use of the MSSS-88 as an outcome measure in the management of spasticity thus raises an interesting question as to whether the goal of spasticity management should be to reduce spasticity or to focus on lessening the perceived impact it has on people's lives? Using psychometrically robust patient reported outcome measures to quantify the perception of how bothered people with MS are by spasticity, alongside robust clinician-based measures that objectively quantify the presence or severity of spasticity, is important to capture these different elements.

There are a number of limitations of this short report. First, this report was derived from the interrogation of data generated from studies whose primary objective was not to validate the MSSS-88. The combined sample size of the studies which contributed to the data pool was small, with mild spasticity, and a relatively restricted range of disability (EDSS of 4.5-7.0), and so may not represent the wider MS population. A more

heterogeneous population would allow for greater exploration of the relationship between the MSSS-88 and other measures of spasticity. Furthermore, with regard to the responsiveness data, the timeframe between the two assessments points varied, although this does not negate the ability to compare the relative responsiveness of the measures.

Nonetheless, given the paucity of studies which have thus far explored the psychometric properties of the MSSS-88 since its development over a decade ago, this report contributes to the evidence base for what is potentially a useful patient-based outcome measure in this complex field.

Acknowledgements

Author Contributions
Study design and development of protocol was conducted by JF, JM, TG, and JO. Participant recruitment and data collection were undertaken by JO. Data analysis was led by TG and JF. Manuscript was drafted by TG.

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