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ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

Subscale correlations between MSSS-88 and PRISM scales in evaluation of spasticity for patients with multiple sclerosis

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SUMMARY

Introduction/Objective Patient-reported outcomes have been recognized as an important way of assessing health and well-being of patients with multiple sclerosis (MS).
The aim of the study is to determine the correlation between different subscales of Patient-Reported Impact of Spasticity Measure (PRISM) and Multiple Sclerosis Spasticity Scale (MSSS-88) scales in the estimation of spasticity influence on different domains

Methods The study is a cross-sectional observational study. MSSS-88 and PRISM scales were analyzed in five domains (body-function domain, activity domain, participation domain, personal factors/wellbeing domain, and hypothesis). For statistical interpretation of the correlation we performed the Spearman's ρ-test, concurrent validity, divergent validity, and the linear regression model.

Results We found a significant correlation between subscales of evaluated MSSS-88 and PRISM scales for body domains; the highest correlation was between the need for assistance/positioning (NA/P) and walking (W). Spasticity has the weakest correlation with the need for intervention (NI). The presence of pain has a negative impact and significant positive correlation between pain discomfort and NI. In the domain of body function for males, there was a non-significant correlation between muscle spasms and NI. The same applies for social functioning and social embarrassment domains, as well as for emotional health and psychological agitation for personal factors / wellbeing domain. The differences between genders of MS patients persist in different domains; muscle spasms are strong predictors for NI, and body movement is a strong predictor versus W for NA/P.

Conclusion MSSS-88 and PRISM scales can be considered reliable in measuring different domains of disability for MS patients with spasticity. Because it is shorter, quicker, and simple to use, it is concluded that the PRISM scale can successfully compete with and replace the MSSS-88 scale in certain domains.
Keywords: multiple sclerosis; spasticity; scales; patient-oriented scales

INTRODUCTION

Multiple sclerosis (MS) presents a chronic autoimmune disorder with particular influence on the central nervous system, characterized by inflammation, demyelination, and axonal degeneration, and is the most common cause of neurologic disability in young adults [1, 2]. The epidemiology assessment incidence and prevalence can demonstrate the existence of spatial, temporal, and demographic variations of disease risks which are important for identifying genetic and environmental factors that act together to cause the disease [3].

The important group of clinical manifestations refers to the functional disability with various degrees of neurological affection and therefore reduction of functional capacity. Although the symptoms individually vary, the majority of persons with MS present with some degree of spasticity. The reported prevalence of spasticity in MS is up to 65% in Europe and 85% in the USA [4, 5]. Spasticity is often disabling and may affect the physical, psychological, and social well-being of patients with MS [6, 7].

Outcome measurement is important for assessing disability, and selecting an appropriate scale of measurement is one of the most important steps in clinical research. Many of the available disability outcome measures used in clinical trials of MS are insensitive to change over time, inadequately validated, or insensitive to patient-perceived health status or the quality of life [8].

To be appropriate to the task, a scale must be valid, accurate, precise, efficient, and easy to use, sensitive to changes in the disease without being sensitive to symptom fluctuations, and it needs to cover the whole range of the disease [9]. Outcome measures are difficult to choose because of the diversity and the progressive and fluctuating nature of disease.

Patient-reported outcomes have been increasingly recognized as an important way for

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assessing health and well-being from a personal perspective. For this purpose, the Multiple Sclerosis Spasticity Scale (MSSS-88) has been developed to address how spasticity affects daily life of people with MS [10]. Previously, we have validated MSSS-88 in MS patients with spasticity and also provided findings on the correlation among different functional scales [11]. We hypothesized that correlations in different domains in MSSS-88 scale is expected with different domains of daily activities for patients with MS. Since Patient-Reported Impact of Spasticity Measure (PRISM) was originally developed and validated in the spinal cord injury population, we have previously validated PRISMSR (PRISM in the Serbian language) in persons with MS [12].

The PRISMSR shows adequate validity and reliability for assessing the impact of spasticity on the quality of life in persons with MS, provides a unique personal experience of spasticity, and may complement other clinical outcome measures [13]. We tried to demonstrate whether these two scales correlate completely, or in certain domains.

Therefore, the aim of our study was to assess the correlation among different subscales of PRISM and MSSS-88 scales in the estimation of spasticity influence on different domains of daily activities for patients with MS.

METHODS

The cross sectional observational study included 58 patients with diagnosed MS that we recruited at the "Dr Miroslav Zotović" Clinic for Rehabilitation. This type of study was used since our participants differed in the variable of interest, while they shared variables such as educational background, socioeconomic status, and ethnicity; thus, the study environment wasn't manipulated. Patients were evaluated separately regarding gender [males (n = 17) and females (n = 41)].

Prior to the inclusion in the study, the patients were informed about the study protocol and informed consent was obtained. The study was approved by the Institutional Review Board for Human Research of the Clinic for Rehabilitation in Belgrade.

The criteria for inclusion in the study were as follows: age above 18 years; duration of MS for more than a year, from the diagnosis established by magnetic resonance imaging and oligoclonal band; remission of the disease longer than three months and the presence of spasticity either subjectively reported or documented on clinical examination.

MSSS-88 and PRISM scales were analyzed in five domains (body function domain, activity domain, participation domain, personal factors / well-being domain, and hypothesis domain). Body domain included MSSS-88 subscales [muscle stiffness (MSS), muscle spasms, pain and discomfort (PD), body movement (BM), and walking (W)] and PRISM subscales [need for intervention (NI) and need for assistance/positioning (NA/P)]. Activity domain included MSS-88 subscale activities of daily life (ADL) and PRISM subscale daily activities (DA). Participation domain included MSSS-88 subscale social functioning (SF) and PRISM subscales social embarrassment (SE) and social avoidance/anxiety (SAA). Personal factors / well-being domain included MSSS-88 emotional health (EH) subscale and PRISM SAA and psychological agitation (PA) subscales. Hypothesis domain included MSSS-88 (PD, W, ADL, SF, and EH subscales, and PRISM positive impact (PI) subscale.

MSSS-88 scale contains a total of 88 questions divided into eight subscales: MSS – 12 items, PD – nine items, MS – 14 items, ADL – 11 items, W – 10 items, BM – 11 items, EH – 13 items, SF – eight items. Each item is ranked on a four-point Likert scale: 1 (not bothered at all), 2 (a little bothered), 3 (moderately bothered), and 4 (extremely bothered).

PRISM scale consists of 44 items grouped into seven subscales. SAA – 11 items, PA – five items, DA – six items, NA/P – five items, PI – four items, NI – five items, and SE – five items. The participants answered to which extent each statement is true for their situation using a five-point Likert-type scale (0 – "never", 1 – "rarely", 2 – "sometimes", 3 – "often," and 4 – "very often"). The reported score for PI is reversed (0 – "very often", 4 – "never"); thus, the higher the score, the lower the positive impact of spasticity.

Statistical analysis

Data were presented as whole numbers (n) and as percentage (%). The χ^2 test was used for statistical interpretation of categories distribution for different parameters in Table 1.

For statistical interpretation of correlation strength and significance among different subscales of evaluated scales (MSSS-88 and PRISM), we performed Spearman's ρ-test, where ρ was indicated as the measure of strength, while p-value represented statistical significance. Statistical significance was set at $p < 0.05$. Body function, activity and participation domains, and personal factors / well-being domains were analyzed through concurrent validity, while hypothesis was analyzed by divergent validity. We used the linear regression model for predictor subscales of MSSS-88 and on subscale values of PRISM.

Table 1. Demographic and multiple sclerosis-related characteristics of the sample (n = 58)

Parameters	Categories	n (%)	p
Gender	male	17 (31%)	< 0.001
	female	41 (69%)	
Education	high school	42 (72%)	< 0.001
	college/university	16 (28%)	
Employment	unemployed	7 (12%)	< 0.001
	employed	19 (33%)	
	retired	32 (55%)	
Marital status	single	11 (19%)	< 0.001
	married	35 (60%)	
	divorced/widowed	12 (21%)	
Type of MS	primary progressive MS	32 (55%)	< 0.001
	relapse-remitting MS	8 (14%)	
	secondary progressive MS	18 (31%)	

RESULTS

The mean age of the studied participants was 45 ± 10 years. Females, individuals with high school education, those who were retired as well as married were significantly more frequent than others ($p < 0.001$) (Table 1). The significantly predominant type of MS was the primary progressive (55%), followed by the secondary progressive (31%), and relapsing-remitting (8%) ($p < 0.001$) (Table 1).

There is a significant positive correlation between every tested subscale, with the highest positive correlation for the NA/P subscale of the PRISM, and the BM subscale ($\rho = 0.727$) and for the W subscale of the MSSS-88 scale ($\rho = 0.730$) (Table 2). The weakest positive correlation was obtained between the PI subscale of PRISM and the SF subscale of the MSSS-88 scale ($\rho = 0.339$) (Table 2).

There is a significant positive correlation between every tested subscale except for the PI subscale of the PRISM with the SF subscale ($\rho = 0.259$; $p = 0.101$) and with the EH subscale of the MSSS-88 ($\rho = 0.289$; $p = 0.066$) (Table 3). There is the highest positive correlation for the NA/P subscale of the PRISM and the BM subscale of the MSSS-88 ($\rho = 0.752$) and for the W subscale of the MSSS-88 scale ($\rho = 0.761$) (Table 3). The weakest positive correlation was obtained between the PI subscale of the PRISM and the SF subscale of the MSSS-88 scale ($\rho = 0.259$) (Table 3).

There is a significant positive correlation between every tested subscale except for the NI subscale of the PRISM and muscle spasms subscale of the MSSS-88 ($\rho = 0.471$; $p = 0.056$), for the SE subscale of the PRISM and the SF subscale of the MSSS-88 ($\rho = 0.288$; $p = 0.260$), for the PA subscale of the PRISM and the EH subscale of the MSSS-88 ($\rho = 0.455$; $p = 0.066$), and the PI subscale of the PRISM with the PD subscale of the MSSS-88 ($\rho = 0.443$; $p = 0.074$) (Table 4). There is the highest positive correlation for the PI subscale of the PRISM and the EH subscale of the MSSS-88

Table 2. Correlations between subscales of the MSSS-88 and PRISM scales

MSSS-88 subscales	PRISM subscales	ρ	p
CONCURRENT VALIDITY: Body function domain			
MSS	NI	0.568	0.000
MS		0.652	0.000
PD		0.607	0.000
BM	NA/P	0.727	0.000
W		0.730	0.000
CONCURRENT VALIDITY: Activity domain			
ADL	DA	0.671	0.000
CONCURRENT VALIDITY: Participation domain			
SF	SE	0.384	0.003
	SAA	0.619	0.000
CONCURRENT VALIDITY: Personal factors / well-being domain			
EH	SAA	0.593	0.000
	PA	0.553	0.000
DIVERGENT VALIDITY: Hypothesis domain			
PD	PI	0.418	0.001
W		0.625	0.000
ADL		0.530	0.000
SF		0.339	0.009
EH		0.417	0.001

MSS – muscle stiffness; MS – muscle spasms; PD – pain and discomfort; BM – body movement; W – walking; AD – activities of daily life; SF – social functioning; EH – emotional health; NI – need for intervention; NA/P – need for assistance/positioning; DA – daily activities; SE – social embarrassment; SAA – social avoidance/anxiety; PA – psychological agitation; PI – positive impact; ρ – correlation factor

Table 3. Correlations between subscales of the MSSS-88 and PRISM scales in female subjects

MSSS-88 subscale	PRISM subscales	ρ	P
CONCURRENT VALIDITY: Body function domain			
MSS	NI	0.616	0.000
MS		0.702	0.000
P D		0.615	0.000
BM	NA/P	0.752	0.000
W		0.761	0.000
CONCURRENT VALIDITY: Activity domain			
ADL	DA	0.668	0.000
CONCURRENT VALIDITY: Participation domain			
SF	SE	0.450	0.003
	SAA	0.620	0.000
CONCURRENT VALIDITY: Personal factors / Well-being domain			
EH	SAA	0.561	0.000
	PA	0.643	0.000
DIVERGENT VALIDITY: Hypothesis domain			
PD	PI	0.430	0.004
W		0.600	0.000
ADL		0.503	0.001
SF		0.259	0.101
EH		0.289	0.066

MSS – muscle stiffness; MS – muscle spasms; PD – pain and discomfort; BM – body movement; W – walking; AD – activities of daily life; SF – social functioning; EH – emotional health; NI – need for intervention; NA/P – need for assistance/positioning; DA – daily activities; SE – social embarrassment; SAA – social avoidance/anxiety; PA – psychological agitation; PI – positive impact

Table 4. Correlations between subscales of MSSS-88 and PRISM scales in male subjects

MSSS-88 subscale	PRISM subscales	ρ	P
CONCURRENT VALIDITY: Body function domain			
Muscle stiffness	NI	0.438	0.007
Muscle spasms		0.471	0.056
P D		0.537	0.026
BM	NA/P	0.630	0.006
W		0.667	0.003
CONCURRENT VALIDITY: Activity domain			
ADL	DA	0.691	0.002
CONCURRENT VALIDITY: Participation domain			
SF	SE	0.288	0.260
	SAA	0.640	0.005
CONCURRENT VALIDITY: Personal factor s/ well-being domain			
EH	SAA	0.682	0.002
	PA	0.455	0.066
DIVERGENT VALIDITY: Hypothesis domain			
PD	PI	0.443	0.074
W		0.688	0.002
ADL		0.615	0.008
SF		0.607	0.009
EH		0.809	0.000

MSS – muscle stiffness; MS – muscle spasms; PD – pain and discomfort; BM – body movement; W – walking; AD – activities of daily life; SF – social functioning; EH – emotional health; NI – need for intervention; NA/P – need for assistance/positioning; DA – daily activities; SE – social embarrassment; SAA – social avoidance/anxiety; PA – psychological agitation; PI – positive impact

Table 5. Predictor parameters of the MSSS-88 for the subscales of the PRISM

Parameters	B	SE	p
	NI		
MSS	-0.045	0.099	0.653
MS	0.203	0.089	0.027
PD	0.048	0.120	0.691
	NA/P		
BM	0.176	0.077	0.026
W	0.194	0.111	0.087
	PI		
PD	0.065	0.105	0.535
W	-0.018	0.080	0.818
ADL	0.092	0.061	0.138
SF	-0.064	0.114	0.576
EH	0.092	0.066	0.167

MSS – muscle stiffness; MS – muscle spasms; PD – pain and discomfort; BM – body movement; W – walking; AD – activities of daily life; SF – social functioning; EH – emotional health; NI – need for intervention; NA/P – need for assistance/positioning; PI – positive impact; SE – social embarrassment; B – predictor parameter

($\rho = 0.809$) (Table 4). The weakest positive correlation was obtained between the SE subscale of the PRISM and the SF subscale of the MSSS-88 scale ($\rho = 0.288$) (Table 4).

Muscle spasms are strong predictors for the NI. Furthermore, BM is a strong predictor versus W for the NA/P (Table 5).

DISCUSSION

Numerous scales used in clinical practice for spasticity measurements assessing subjective and objective parameters make it more complex to perform reliable measurements of spasticity degree presented by the patient [14].

We have demonstrated that there are significant correlations between subscales of the evaluated MSSS-88 and PRISM scales for body domains, where the highest correlation between the NA/P and W was noted. Such finding regarding the correlation between the NA/P and W could be explained by the fact that assistance over the rehabilitation treatment period reduces secondary comorbidities and influences mobility. Previous studies are in line with such observations – it was noticed that training of the locomotor system is to a certain degree beneficial for the rehabilitation outcome in patients with MS [15, 16].

Our study stressed that spasticity (MSS and muscle spasms) has the weakest correlation particularly with the NI. This could be to a certain extent explained by the fact that there are different degrees of spasticity. In the study by Haas [17], it was pointed out that 80% of MS patients in the UK study reported spasticity, with more than 50% of moderate to severe degree. However, in a study by Flachenecker et al. [18], it was stated that 74% of patients with spasticity reported stiffness. In the same study it was also noted that the need for treatment increases with the spasticity degree [19]. It should be underlined that treatment satisfaction is also variable from the perspective of both physicians and patients. Therefore, individual approach in interventional programs in the rehabilitation treatment of patients with spasticity is desirable, in order to improve efficacy of the functional outcome and spasticity reduction. This would ultimately improve the patients' quality of life long-term.

Previous studies have demonstrated that the presence of pain in patients with MS has a negative impact on daily activities and the overall quality of life [20]. Our findings are consistent with previous reports, stressing a significant positive correlation between pain discomfort and the NI.

In a study by Casetta et al. [21], it was noticed that MS in the male population has a stronger impact on disability than in the female one. Our study has demonstrated that in the domain of body function for males, there was a non-significant correlation between muscle spasms and the NI. In the participation domains, non-significant correlation was gained between the SF and SE. The same is true for the correlation between the EH and PA for the personal factors / well-being domain. In the hypothesis domain, females had a non-significant correlation between the SF and EH of the MSSS-88 scale, and the PI of the PRISM scale, while for males, a non-significant correlation was between the PD and PI. Our results stress that differences between genders of MS patients persist in different domains. Previously, the role of gender of MS patients on activities of daily living was evaluated in the study by Buchanan et al. [22], where different domains were shown to have different impact on these activities regarding gender. Such findings underline the necessity for individually-based rehabilitation programs with particular attention to the gender-based planning.

Aside the presence of MSS, we have demonstrated that muscle spasms are strong predictors for the NI. This could be justified by the fact that spasms are more severe than the presence of spasticity in terms of objective perspective. Further, BM is a strong predictor versus W for the NA/P. This is in line with the fact that W implies a certain ability of body movement and thus, in some cases, reduces the necessity for NA/P.

CONCLUSION

After comparing and considering these two scales (PRISM and MSSS-88), it is evident that each has its own characteristics and advantages. The MSSS-88 evaluates the negative impact of spasticity across eight domains, but the scale is lengthy (88 items) and does not consider possible positive aspects of spasticity. The PRISM includes 44 items and it has been developed to assess how spasticity effects the quality of the life in persons with MS. The PRISM scale is simple, accounts for both the negative and positive aspects of spasticity and it is not time-consuming. Given the facts above, we have demonstrated that both scales could be considered reliable in measuring different domains of disability for MS patients with spasticity. Because of its brevity, speed of use and simplicity, the PRISM scale can successfully compete with and replace the MSSS-88 scale in certain domains.

Thus, both should be considered valuable measuring instruments in the assessment of patients' functional status and further rehabilitation program planning.

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Повезаност између субскала *MSSS-88* и скале *PRISM* у евалуацији спастицитета код оболелих од мултипле склерозе

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САЖЕТАК

Увод/Циљ Упитници који укључују властито доживљавање болести се све више користе јер су веома важни у процени здравља и задовољства оболелих од мултипле склерозе. Циљ рада је био да се провери повезаност различитих субскала утицаја болесниковог става на измерени спастицитет (*PRISM*) и скале спастицитета код мултипле склерозе (*MSSS-88*) у процени утицаја спастицитета на различите домене активности дневног живота код болесника са мултиплом склерозом.

Методе У опсервационој студији пресека анализиране су скале *MSSS-88* и *PRISM* у пет домена: телесни домен, домен активности, домен учешћа, домен личних фактора и добробити и домен претпоставки. За статистичку интерпретацију користили смо Спирманов ρ тест, валидност тестова (конкурентну и дивергентну), линеарни регресиони метод.

Резултати Постоји значајна повезаност између субскала *MSSS-88* и *PRISM* за телесни домен. Посебно јака повезаност била је између потребе за асистенцијом, односно позиционирањем и хода. Спастицитет има посебно слабу повезаност кад је реч о болесницима са мултиплом склерозом и потребама за интервенцијом код њих. Присуство бола код болесника има негативан утицај, уз позитивну повезаност између феномена бола, нелагодности и потребе за интервенцијом. У домену телесне функције за мушкарце није било значајне разлике између мишићних спазама и потребе за интервенцијом. У домену учешћа није постигнута ρ тест значајна разлика између социјалног функционисања и социјалне непријатности, исто и између емоционалног здравља и психолошке агитације за домен добробита и личних фактора. Разлика између полова постоји у различитим доменима. Мишићни спазам је снажан предсказатељ потребе за интервенцијом. Телесна покретљивост је снажан предиктор наспрам хода и потребе за асистенцијом и позиционирањем.

Закључак *MSSS-88* и *PRISM* су поуздане у мерењима различитих домена инвалидности код којих је присутан спастицитет. Скала *PRISM* је краћа, бржа, једноставнија и може успешно да замени скалу *MSSS-88* у одређеним областима.

Кључне речи: мултипла склероза; спастицитет; скале