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Short communication

SPES/SCOPA and MDS-UPDRS: Formulas for converting scores of two motor scales in Parkinson's disease

D. Verbaan [a,*], S.M. van Rooden [a], C.P. Benit [b], E.W. van Zwet [c], J. Marinus [a], J.J. van Hilten [a]

[a] Department of Neurology, Leiden University Medical Center, Leiden, The Netherlands
[b] Department of Neurology, Medical Center Haaglanden, Westeinde Hospital, The Hague, The Netherlands
[c] Department of Medical Statistics and Bioinformatics, Leiden University Medical Center, Leiden, The Netherlands

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ABSTRACT

Background: Motor impairment in Parkinson's disease (PD) can be evaluated with the Short Parkinson's Evaluation Scale/Scales for Outcomes in Parkinson's disease (SPES/SCOPA) and the Movement Disorder Society-Unified Parkinson's Disease Rating Scale (MDS-UPDRS). The aim of this study was to determine equation models for the conversion of scores from one scale to the other.
Methods: 148 PD patients were evaluated with the SPES/SCOPA-motor and the MDS-UPDRS motor examination. Linear regression was used to develop equation models.
Results: Scores on both scales were highly correlated ($r = 0.88$). Linear regression revealed the following equation models (explained variance: 78%):

1. MDS-UPDRS motor examination score = 11.8 + 2.4 * SPES/SCOPA-motor score
2. SPES/SCOPA-motor score = −0.5 + 0.3 * MDS-UPDRS motor examination score.

Conclusion: With the equation models identified in this study, scores from SPES/SCOPA-motor can be converted to scores from MDS-UPDRS motor examination and vice versa.

1. Introduction

Although the clinical spectrum of Parkinson's disease (PD) has broadened to include non-motor features, motor features are still the most frequently evaluated features. They define the cardinal set of disease characteristics, are in part responsive to dopaminergic interventions, and have proved reliable characteristics to measure disease progression. Over time, numerous rating scales have been introduced to evaluate PD motor features [1]. The growing recognition of clinimetric deficits of existing rating scales fuelled developments to improve these instruments. For example, because of consorted efforts of the Movement Disorder Society, the Unified Parkinson's Disease Rating Scale (UPDRS) [2] has evolved into an instrument with better clinimetric properties, the MDS-UPDRS [3,4]. However, an important limitation of the MDS-UPDRS is its duration. Mean completion time for the investigator part is 30 min, including 15 min for the motor examination part only [4], which may be problematic in clinical and research settings. The duration along with the clinimetric weaknesses of the earlier version of the scale (UPDRS) created the need for a brief, valid and reliable rating scale for the evaluation of PD [5]. First, the Short Parkinson's Evaluation Scale (SPES) was developed, which is a simple and short scale for the assessment of motor impairment and disabilities in PD [6]. Later, the SCales for Outcomes in PArkinson's disease (SCOPA) study proposed several modifications to the SPES in order to improve the clinimetric aspects of the scale, which resulted in a new PD rating scale, the SPES/SCOPA [7]. Like the MDS-UPDRS, the SPES/SCOPA is reliable and valid [7,8], but has a much shorter total administration time of 8.1 min [7]. This advantage makes the SPES/SCOPA-motor a good alternative to the MDS-UPDRS motor examination for settings with limited time or staff to assess patients.

Since the SPES/SCOPA-motor and MDS-UPDRS motor examination differ in the number, content and scaling of items, scores of the two scales cannot easily be compared. The aim of this study was to determine equation models for the conversion of scores from one scale to the other.

* Corresponding author. Department of Neurology, K5Q-92, Leiden University Medical Center, P.O. Box 9600, NL-2300 RC Leiden, The Netherlands. Tel.: +31 71 5262547; fax: +31 71 5248253.
E-mail address: D.Verbaan@lumc.nl (D. Verbaan).

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2. Methods

2.1. Participants

All patients fulfilled the United Kingdom Parkinson's Disease Society Brain Bank criteria for idiopathic PD [9]. Patients visiting the outpatient clinic of the Leiden University Medical Center (LUMC) were included, whereas some patients were recruited from general practices in the vicinity. There were no exclusion criteria. Most patients were assessed at the LUMC. To avoid bias towards recruiting less severely affected patients, patients who were unable to come to the hospital were assessed at home. This study was approved by the medical ethical committee of the LUMC and all patients gave written informed consent.

2.2. Assessment procedure

Patients were evaluated with the SPES/SCOPA-motor [7], the MDS-UPDRS motor examination [4] and the Hoehn and Yahr scale (H&Y) [10]. The SPES/SCOPA-motor includes 14 items (Table 1) with four response options, ranging from 0 (normal) to 3 (severe) (range 0–42). The MDS-UPDRS motor examination includes 33 items (Table 1) with five response options, ranging from 0 (normal) to 4 (severe) (range 0–132). All patients were examined by the same investigator trained in assessing the included scales. Age, sex, age at onset (first symptoms as perceived by the patient), disease duration, medication, and patients' state during the assessment ("on" or "off"), were also recorded. For each patient a levodopa dosage equivalent (LDE) was calculated [11].

2.3. Statistical analysis

If data from the SPES/SCOPA-motor or MDS-UPDRS motor examination was missing (for both scales this had to be less than 25%), the mean score of the non-missing items of that scale of that patient was imputed to replace the missing value(s). The Kolmogorov–Smirnov test was performed to test if the distributions of the SPES/SCOPA-motor or MDS-UPDRS motor examination scores showed deviations from normality. The relation between the MDS-UPDRS motor examination and the SPES/SCOPA-motor scores was assessed with Pearson's correlation coefficient. Spearman's rho was used to assess the relation between both scores and disease severity (H&Y). Correlation coefficients were defined as very weak ($r = 0$–0.19), weak ($r = 0.20$–0.39), moderate ($r = 0.40$–0.59), strong ($r = 0.60$–0.79) and very strong ($r = 0.80$–1.00) [12]. Simple linear regression models were used to construct equation models for the conversion of scores from one scale to the other. Multiple forward linear regression analysis was used to explore if any remaining unexplained variance could be attributed to other variables (age, gender, disease duration, H&Y score, and LDE). A p-value < 0.05 was considered significant. All analyses were performed with SPSS 16.0.

Table 1
Items of the SPES/SCOPA-motor and the MDS-UPDRS motor examination.

SPES/SCOPA-motor	MDS-UPDRS motor examination
1. Rest tremor; LUE, RUE	1. Rest tremor; lip/jaw, LUE, RUE, LLE, RLE
	2. Constancy of rest tremor
2. Postural tremor; LUE, RUE	3. Postural tremor; LUE, RUE
	4. Kinetic tremor; LUE, RUE
3. Rapid alternating movements of hands; LUE, RUE	5. Finger tapping; LUE, RUE
	6. Hand movements; LUE, RUE
	7. Pronation–supination movements of hands; LUE, RUE
	8. Toe tapping; LLE, RLE
	9. Leg agility; LLE, RLE
4. Rigidity; LUE, RUE	10. Rigidity; neck, LUE, RUE, LLE, RLE
5. Rise from chair	11. Arising from chair
6. Postural instability	12. Postural instability
7. Gait	13. Gait
8. Speech	14. Speech
9. Swallowing	
	15. Facial expression
10. Freezing during "on"	16. Freezing of gait
	17. Posture
	18. Global spontaneity of movement (body bradykinesia)

LUE: left upper extremity; RUE: right upper extremity; LLE: left lower extremity; RLE: right lower extremity.

3. Results

A total of 148 PD patients (67% men) with a mean (SD) age of 66.9 (9.6) years participated. Patients' mean (SD) age of onset was 55.2 (12.0) and their mean disease duration was 11.6 (6.6) years. Most patients had a mild or moderate disease severity (H&Y stage: 1 (1%), 2 (59%), 3 (18%), 4 (16%), and 5 (6%)). 83% of the patients used levodopa and 54% of the patients used dopamine-agonists. The mean (SD) total LDE was 720.1 (569.4) mg/day. Most patients (91%) were "on" during the assessment, whereas some were "off" (4%) or did not use any antiparkinsonian medication (5%).

Overall, 51 items (1.0% of the total MDS-UPDRS items in this study) and 4 items (0.2% of the total SPES/SCOPA items in this study) were missing and imputed for the MDS-UPDRS and the SPES/SCOPA-motor, respectively. The mean (SD) motor scores were 14.9 (5.8) (SPES/SCOPA-motor, range 3–32), and 48.0 (16.0) (MDS-UPDRS motor examination, range 17–88). Both motor scores were very strongly related ($r = 0.88$, $p < 0.001$). The distributions of the scores of the SPES/SCOPA-motor and the MDS-UPDRS motor examination showed no major deviations from normality (Kolmogorov–Smirnov: $p = 0.390$ and $p = 0.554$, respectively). Correlations between motor scores and disease severity (H&Y) were strong to moderate (SPES/SCOPA-motor: $r_s = 0.64$, $p < 0.001$, MDS-UPDRS motor examination: $r_s = 0.57$, $p < 0.001$).

The equation model for the conversion of SPES/SCOPA-motor scores into MDS-UPDRS motor examination scores was: MDS-UPDRS motor examination score = 11.8 + 2.4 * SPES/SCOPA-motor

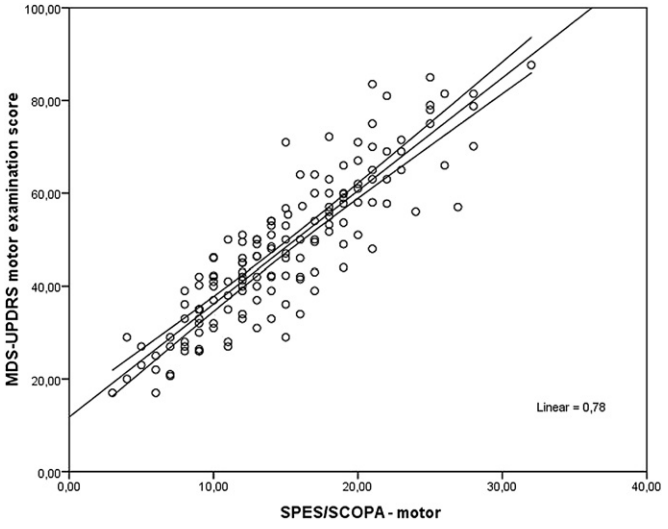

Fig. 1. Scatterplot with regression line (95% CI) and explained variance of the relation between SPES/SCOPA-motor scores and MDS-UPDRS motor examination scores.

score ($p < 0.001$). The total explained variance of the model was 78% (Fig. 1). Additional to the 78% explained variance by the SPES/SCOPA-motor score, LDE and age both explained 1% of the remaining variance of the MDS-UPDRS motor examination score (total model, $p < 0.001$).

The equation model for the conversion of MDS-UPDRS motor examination scores into SPES/SCOPA-motor scores was: SPES/SCOPA-motor score $= -0.5 + 0.3 *$ MDS-UPDRS motor examination score ($p < 0.001$). Additional to the 78% explained variance by the MDS-UPDRS motor examination score, H&Y (3%), and LDE (1%) explained 4% of the remaining variance of the SPES/SCOPA-motor score (total model, $p < 0.001$).

4. Discussion

In clinical research, standardized rating scales are of tremendous value for the reliable evaluation of participants. The MDS-UPDRS motor examination and the SPES/SCOPA-motor are rating scales for the evaluation of motor impairments in PD with good clinimetric properties [4,7]. Although both scales in essence capture the same information, the MDS-UPDRS motor examination requires significantly more time. Arguments to choose one or the other may depend on the setting, time, and staff available. Regardless of which instrument is used, it remains desirable that results of different studies can be compared. To permit comparisons between studies using the SPES/SCOPA-motor and those using the MDS-UPDRS motor examination, equation models were developed to allow conversion of scores from one scale to the other.

The MDS-UPDRS was only recently launched. Therefore, this is the first study evaluating the relation between the SPES/SCOPA-motor and the MDS-UPDRS motor examination. Correlations between the SPES/SCOPA-motor and the earlier UPDRS motor examination have been calculated previously and showed similar or higher ($r = 0.88$ and $r = 0.96$) coefficients when compared to the correlation coefficient found in this study [7,8].

The maximum explained variance of a model in which scores from one instrument are converted to the other, will partly depend on the measurement errors of both instruments and will therefore never be 100%. However, in order to consider a conversion model as reliable, the explained variance should be high, and the additional explained variance of other influencing variables should be minimal. In our study, both assumptions were met with an explained variance of 78% and a minimal additional explained variance of other variables (2% and 4%).

Although the conversion models can be considered reliable, differences between scales regarding number, content and scaling of items may have influenced the percentage of explained variance. Firstly, some items are only included in one of the scales (Table 1). Secondly, although both scales assess the most important PD motor aspects, the MDS-UPDRS motor examination addresses resting tremor, bradykinesia, and rigidity more comprehensively. Thirdly, for some symptoms differences exist between scales in content or execution. For instance, postural instability is tested with (MDS-UPDRS) or without (SPES/SCOPA) a preceding warning. Fourthly, the scales differ in the number of response options; four (SPES/SCOPA) and five (MDS-UPDRS), respectively. Finally, although the evaluation of patients in this study was as accurate and thorough as possible, there were some missing values. Imputation of missing values may add noise to the actual results, and therefore imputation of missing values in this study may have led to some loss of variance, although this effect is negligible in our study since the number of missing values was very low.

Although patients in this study reflected a wide range of age, disease severity, disease duration and age of onset, the study sample had a relatively young mean age at onset and a high percentage of patients in H&Y stage 2, compared to the general PD population. A higher percentage of patients in H&Y stages 1 and 5 would probably have had some influence on the equation models, but it is difficult to predict the amount as well as the direction of change within the models. Conclusively, SPES/SCOPA-motor scores can easily be converted to MDS-UPDRS motor examination scores and vice versa, using the equation models calculated in this study, which makes comparisons between studies using the different scales possible. Additionally, it presents an alternative for situations in which time or staff constraints limit the use of the lengthier MDS-UPDRS.

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