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Official Japanese Version of the International Parkinson and Movement Disorder Society–Unified Parkinson's Disease Rating Scale: Validation Against the Original English Version

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Abstract: The International Parkinson and Movement Disorder Society (MDS)-sponsored revision of the Unified Parkinson's Disease Rating Scale (MDS-UPDRS) has been developed and is now available in English. Part of the overall program includes the establishment of official non-English translations of the MDS-UPDRS. We present the process for completing the official Japanese translation of the MDS-UPDRS with clinimetric testing results. In this trial, the MDS-UPDRS was translated into Japanese, underwent cognitive pretesting, and the translation was modified after taking the results into account. The final translation was approved as the Official Working Draft of the MDS-UPDRS Japanese version and tested in 365 native-Japanese–speaking patients with PD. Confirmatory analyses were used to determine whether the factor structure for the English-language MDS-UPDRS could be confirmed in data collected using the Official Working Draft of the Japanese translation. As a secondary analysis, we used exploratory factor analyses to examine the underlying factor structure without the constraint of a prespecified factor organization. Confirmatory factor analysis revealed that Comparative Fit Index for all parts of the MDS-UPDRS exceeded the minimal standard of 0.90, relative to the English version, and therefore the Japanese translation met the prespecified criterion to be designated, called an official MDS translation. Secondary analyses revealed some differences between the English-language MDS-UPDRS and the Japanese translation; however, these differences were considered to be within an acceptable range. The Japanese version of the MDS-UPDRS met the criterion as an Official MDS Translation and is now available for use (www.movementdisorders.org).

The UPDRS has been widely used since the 1980s as a standard clinical rating scale for Parkinson's disease (PD).[1,2] However, increasing evidence indicates that several symptoms frequently experienced by PD patients that affect their quality of life, such as sleep problems, sensory disturbance, urinary problems, constipation, and fatigue, are not adequately evaluated in the original

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UPDRS.[3] In 2001, the International Parkinson and Movement Disorder Society (MDS) sponsored a critique of the UPDRS and subsequently developed a new version of the scale, termed the MDS-sponsored UPDRS revision. This new version, the MDS-UPDRS, was intended to be less ambiguous than its predecessor as well as to incorporate a number of clinically pertinent PD-related problems poorly captured in the original version.[4] In 2008, the MDS-UPDRS successfully passed clinimetric testing with high internal consistency and reliable factor structures for each part of the scale.[4] The new MDS-UPDRS comprises four parts: Part I evaluates nonmotor experiences of daily living, Part II evaluates motor experiences of daily living, Part III evaluates motor function, and Part IV evaluates motor fluctuations and dyskinesia.

After publication of the MDS-UPDRS, the MDS set forth a specific program to designate successful translations of non-English-language versions as official MDS translations. For this purpose, the MDS has set a strict protocol and criteria for testing. Currently, several official translations (Italian,[5] Spanish,[6] French, Estonian, German, and Slovakian) have already been established, and several other language programs are in progress. Herein, we present the scale translation and clinimetric testing results of the Japanese version of the MDS-UPDRS.

Patients and Methods

Translation of the MDS-UPDRS

The MDS-UPDRS was translated into Japanese by a team of natural Japanese speakers fluent in English who belong to the Department of Neurology of Wakayama Medical University in Japan, led by Kondo. The resultant Japanese translation was further reviewed by a team led by Mizuno from the Movement Disorder Society of Japan to establish the original Japanese translation of the MDS-UPDRS. The translation was then back-translated by a team of colleagues fluent in English and Japanese who had not been involved in the original forward translation. The back-translation was reviewed by the administrative team in charge of the overall translation program (Stebbins, Goetz, LaPelle, and Tilley).

Cognitive Pretesting

Cognitive pretesting is a qualitative approach to assess instrument completion in terms of task difficulty for examiner and respondent as well as respondent interest, attention span, discomfort, and comprehension.[7] Where there were observed differences between the back-translated Japanese and English versions, items were selected for cognitive pretesting, along with questions that had been identified during cognitive pretesting of the English version. Cognitive pretesting was performed on the following sections: Part I Hallucinations and Psychosis; Features of Dopamine Dysregulation Syndrome; and Urinary Problems; Part II Freezing; Part III Postural Stability; and Rest Tremor Amplitude; Part IV Time Spent with Dyskinesia; and Functional Impact of Dyskinesia. Three experienced Japanese movement disorder specialists not involved in the original translation performed cognitive pretesting. Based on the results of the initial cognitive pretesting, additional round(s) of translation, back-translation, and cognitive pretesting could be required. After taking the cognitive pretesting results into account, the final Japanese translation was obtained.

Testing of the Japanese Version of the MDS-UPDRS

A total of 30 experienced Japanese movement disorder specialists were recruited as members of the MDS-UPDRS Japanese version validation team led by Kashihara (members are listed in the Appendix) to examine native-Japanese–speaking PD patients who had provided informed consent. The sample size for the translation study was based on the need for 5 participants per questionnaire item in order to perform the statistical analysis.[8] There are 65 items on the MDS-UPDRS: Thus, a sample of at least 325 was required. Any participants with missing values within a part were excluded from the analysis of that part only. Hence, the sample size could vary by part. The investigators obtained approval to collect the data in accord with relevant institutional ethics policies regarding human subjects. Anonymized patient data were transferred to the analysis team by a secure website. The protocol for validation of the MDS-UPDRS Japanese version was approved by the ethics committees of each institute. Informed consent was obtained from all participants before the study.

Data Analysis

Factor Analysis

M-plus (version 6.11)[9] was used to perform confirmatory and exploratory factor analyses (EFA), because the variables are categorical. We used a weighted least squares with mean- and variance-adjusted weighted least square (WLSMV) approach to factor estimation that minimizes the sum of squared differences between observed and estimated correlation matrices not counting diagonal elements. To assist in interpretation of the factors, we used an orthogonal CF-varimax rotation that constrains the factors to be uncorrelated. These methods were chosen to follow those used in the original examination of the English MDS-UPDRS.[4]

Primary Analysis

We conducted a confirmatory factor analysis (CFA)[10] as the primary analysis of the Japanese data to determine whether the factor structure for the English-language MDS-UPDRS[4] could be confirmed in data collected by using the Japanese translation. This was the primary question of interest. The CFA was conducted separately for the MDS-UPDRS Parts I to IV, with the Japanese data constrained to fall into the factors defined in the English-language data.[4] We evaluated the CFA results based on the comparative fit index (CFI). According to

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protocol, to establish a successful translation and earn the designation of "official MDS-UPDRS translation," the CFI for each part (I–IV) of the translated instrument must be 0.90 or greater, relative to the English-language version.[4] Root mean square error of approximation (RMSEA) was also calculated as another test of model fit. RMSEA values <0.05 were considered to be a good fit, and RMSEA values of 0.1 or more were considered to be a poor fit. WLSMV estimators were used to confirm a model fit.

Secondary Analysis

As a secondary analysis, we conducted an exploratory factor analysis[11] for Parts I to IV of the Japanese version of the MDS-UPDRS to explore the underlying factor structure without the constraints of a prespecified factor structure. We used a Scree plot to choose the number of factors to retain for each part. The subjective Scree test[12] is scatter plot of eigenvalues plotted against their ranks with respect to magnitude to extract as many factors as there are eigenvalues that fall before the last large drop (i.e., an "elbow" shape) in the plot. Once the factors were chosen, an item was retained in a factor if the factor loading for the item was 0.40 or greater.

The default estimator for factor analysis in M-plus is unweighted least squares (ULS). When ULS converges, it yields more-accurate parameter estimates and standard errors than does WLSMV. However, WLSMV generally outperforms ULS in convergence rates. Thus, Forero et al.[13] suggest the use of ULS. In the case of nonconvergence, however, they suggest using WLSMV, because this method might converge when ULS does not. In this case, whereas the ULS algorithm did converge, it converged to an incorrect value (i.e., a percent of variance explained that was greater than 1.0), so WLSMV was used.

The chi-square test was used to analyze, additionally, the differences in the distribution of responses for each item of the MDS-UPDRS between PD patients of Japanese and English groups.

Results

Cognitive Pretesting

A total of 12 patients with PD and their examiners were interviewed using a structured interview format typical in cognitive pretesting. During the first round of cognitive pretesting, minor word changes were suggested for features of dopamine dysregulation syndrome, urinary problems, and time spent with dyskinesia. In response to comments from patients and caregivers, we enlarged the size of characters used in questions from Part IB and Part II. No items were identified as problematic during a second round of cognitive pretesting conducted with 10 patients with PD. The modified version of the scale was approved as the Official Working Draft of the Japanese MDS-UPDRS for testing in a larger group of patients with PD.

Data Analysis

Demographics

Participants' demographic characteristics are shown in Table 1. The Japanese data set included 365 native-Japanese–speaking patients with PD who were examined using the MDS-UPDRS. In the Japanese sample, there was a greater proportion of female patients, compared to the English sample. The two cohorts were similar on age and duration of disease, but the distribution of H & Y stages were significantly different between the two cohorts ($P < 0.0005$; Table 1).

Primary Analysis: CFA

Table 2 displays the CFA models for each part of the MDS-UPDRS. For all four parts of the Japanese version, the CFI was 0.93 or greater, in comparison to the English-language factor structure. Our prespecified criterion was a CFI of 0.90 or greater; thus, we conclude that the English factor structure was confirmed in the Japanese data set.

Secondary Analysis: EFA

The factor structure of the EFA for the English version has been used as the basis for all CFAs, but our EFA of the Japanese

TABLE 1 Demographics of Japanese patients with PD in comparison with the MDS-UPDRS (English version) data

	English	Japanese	*P* Value
Total N	876	365	ns
% male	63.2	45.2	<0.0005
Age (mean ± SD)	68.2 ± 10.8	69.0 ± 9.2	ns
Disease duration (mean years ± SD)	8.3 ± 6.7	7.8 ± 6.1	ns
Years of education	NA	12.6 ± 2.7	ns
H & Y stage			<0.0005
0	0	2	
1	63	28	
2	467	164	
3	174	116	
4	109	42	
5	53	11	

SD, standard deviation; NA, not available; ns, not significant.

TABLE 2 Confirmatory factor analysis model fit

Part I: Nonmotor aspects of experiences of daily living (a two-factor model)[a]	
Japanese	CFI = 0.93; RMSEA = 0.09 (351 patients)
English language	CFI = 0.97; RMSEA = 0.05 (849 patients)
Part II: Motor aspects of experiences of daily living (a three-factor model)	
Japanese	CFI = 0.99; RMSEA = 0.07 (356 patients)
English language	CFI = 0.99; RMSEA = 0.05 (851 patients)
Part III: Motor examination (a seven-factor model)	
Japanese	CFI = 0.94; RMSEA = 0.08 (336 patients)
English language	CFI = 0.95; RMSEA = 0.08 (801 patients)
Part IV: Motor complications (a two-factor model)	
Japanese	CFI = 1.00; RMSEA = 0.06 (350 patients)
English language	CFI = 1.00; RMSEA = 0.00 (848 patients)

[a]Dopamine dysregulation syndrome was not included in this analysis because it did not load on any factor in the U.S. version.

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data set differs from that of the English-language data set in some aspects. The results of the EFA for the English and Japanese versions are shown in Table 3, including the number of factors and their associated eigenvalues and percent variance.

The Scree plots were used to determine the number of factors to be retained from the EFA. Comparison between the Scree plots for the English and Japanese cohorts revealed similarities in shape of the plots (Fig. 1), but differences were noted in the relationship between factors and their eigenvalues and percent of variance (Table 3): For Part I: Nonmotor aspects of experiences of daily living, we extracted two factors; for Part II: Motor aspects of experiences of daily living, we extracted three components; for Part III: Motor examination, we extracted seven factors; and for Part IV: Motor complications, we extracted two factors.

Chi-square (χ^2) test (Table 4) revealed greater distribution of less-severe scores on the cognitive impairment items (Part I: item 1.1) in the Japanese group, compared to the English group ($\chi^2 = 23.457$; df = 4; $P = 0.0001$). There was no significant difference of the distribution of scores on the hallucinations and psychosis item (Part I: item 1.2) ($\chi^2 = 5.962$; df = 4; not significant). In many other items, PD patients in the English group showed greater distribution of more-severe scores, including depressed mood, pain and other sensations, lightheadedness on standing, fatigue, and sleep problems in Part I; speech, saliva and drooling, doing hobbies and other activities, tremor, and getting out of bed in Part II; speech, facial expression, rigidity, finger tapping, hand movements, pronation supination, toe tapping, leg agility, and tremor in Part III; and time spent with dyskinesia, functional impact of dyskinesias, time spent in the OFF state, complexity of motor fluctuations, and painful OFF-state dystonia in Part IV. Japanese PD patients showed greater distribution in more-severe scores than English groups in items constipation problems in Part I and postural stability in Part III.

Discussion

The overall factor structure of the Japanese version was consistent with the English version based on the CFIs for all four parts of the MDS-UPDRS in the CFA (all CFI ≥0.93). The Japanese scale was confirmed to share a common factor structure with the English scale. Therefore, this version can be designated as the official Japanese version of the MDS-UPDRS.

EFA, in which variability from sample to sample is expected, identified isolated item differences of factor structure between the Japanese and English versions of the MDS-UPDRS. However, the distribution of factors with their associated eigenvalues and percent variances were similar across the two languages.

In our study, female preponderance was noted as the previous study reported from Japan.[14] This may, in part, be because of the longer life expectancy (by approximately 6.5 years) in Japanese women, in comparison to men.

Another interesting difference between the Japanese- and English-language versions data sets for the MDS-UPDRS concerned the pattern of responses to items 1.1 (cognitive impairment) and 1.2 (hallucinations and psychosis). For the

TABLE 3 Comparison of English-language and Japanese exploratory factor structures for parts I to IV of the MDS-UPDRS

	English		Japanese	
Factor	Eigenvalues	Percent Variance	Eigenvalues	Percent Variance
Part I				
1	4.421	34.0	5.045	42.0
2	1.231	9.5	1.244	10.4
3	1.051	8.1	1.081	9.0
4	1.007	7.7	0.866	7.2
5	0.811	6.2	0.721	6.0
6	0.724	5.6	0.642	5.4
7	0.673	5.2	0.594	5.0
8	0.630	4.8	0.508	4.2
9	0.616	4.7	0.472	3.9
10	0.542	4.2	0.375	3.1
11	0.519	4.0	0.288	2.4
12	0.399	3.1	0.160	1.3
13	0.376	2.9		
Part II				
1	6.898	53.1	7.293	56.1
2	1.128	8.7	1.062	8.2
3	1.000	7.7	0.826	6.4
4	0.728	5.6	0.684	5.3
5	0.595	4.6	0.534	4.1
6	0.542	4.2	0.494	3.8
7	0.425	3.3	0.445	3.4
8	0.390	3.0	0.431	3.3
9	0.380	2.9	0.370	2.8
10	0.294	2.3	0.260	2.0
11	0.245	1.9	0.240	1.8
12	0.198	1.5	0.219	1.7
13	0.178	1.4	0.141	1.1
Part III				
1	12.112	36.7	14.451	43.8
2	5.035	15.3	4.190	12.7
3	2.173	6.6	2.429	7.4
4	2.051	6.2	1.961	5.9
5	1.615	4.9	1.668	5.1
6	1.485	4.5	1.238	3.8
7	1.104	3.3	0.922	2.8
8	0.903	2.7	0.793	2.4
9	0.720	2.2	0.685	2.1
10	0.615	1.9	0.596	1.8
11	0.552	1.7	0.558	1.7
12	0.495	1.5	0.514	1.6
13	0.479	1.5	0.472	1.4
14	0.407	1.2	0.360	1.1
15	0.403	1.2	0.348	1.1
16	0.361	1.1	0.330	1.0
17	0.323	1.0	0.246	0.7
18	0.314	1.0	0.233	0.7
19	0.267	0.8	0.203	0.6
20	0.265	0.8	0.194	0.6
21	0.223	0.7	0.183	0.6
22	0.203	0.6	0.147	0.4
23	0.164	0.5	0.138	0.4
24	0.145	0.4	0.115	0.3
25	0.141	0.4	0.099	0.3
26	0.109	0.3	0.058	0.2
27	0.091	0.3	0.027	0.1
28	0.077	0.2	0.013	0.0
29	0.055	0.2	0.004	0.0
Part IV				
1	3.811	63.9	3.656	60.9
2	0.942	15.6	1.210	20.2
3	0.640	10.7	0.725	12.1
4	0.241	4.0	0.168	2.8
5	0.208	3.5	0.130	2.2
6	0.159	2.3	0.111	1.9

Dotted line shows the factors selected in the English cohort.

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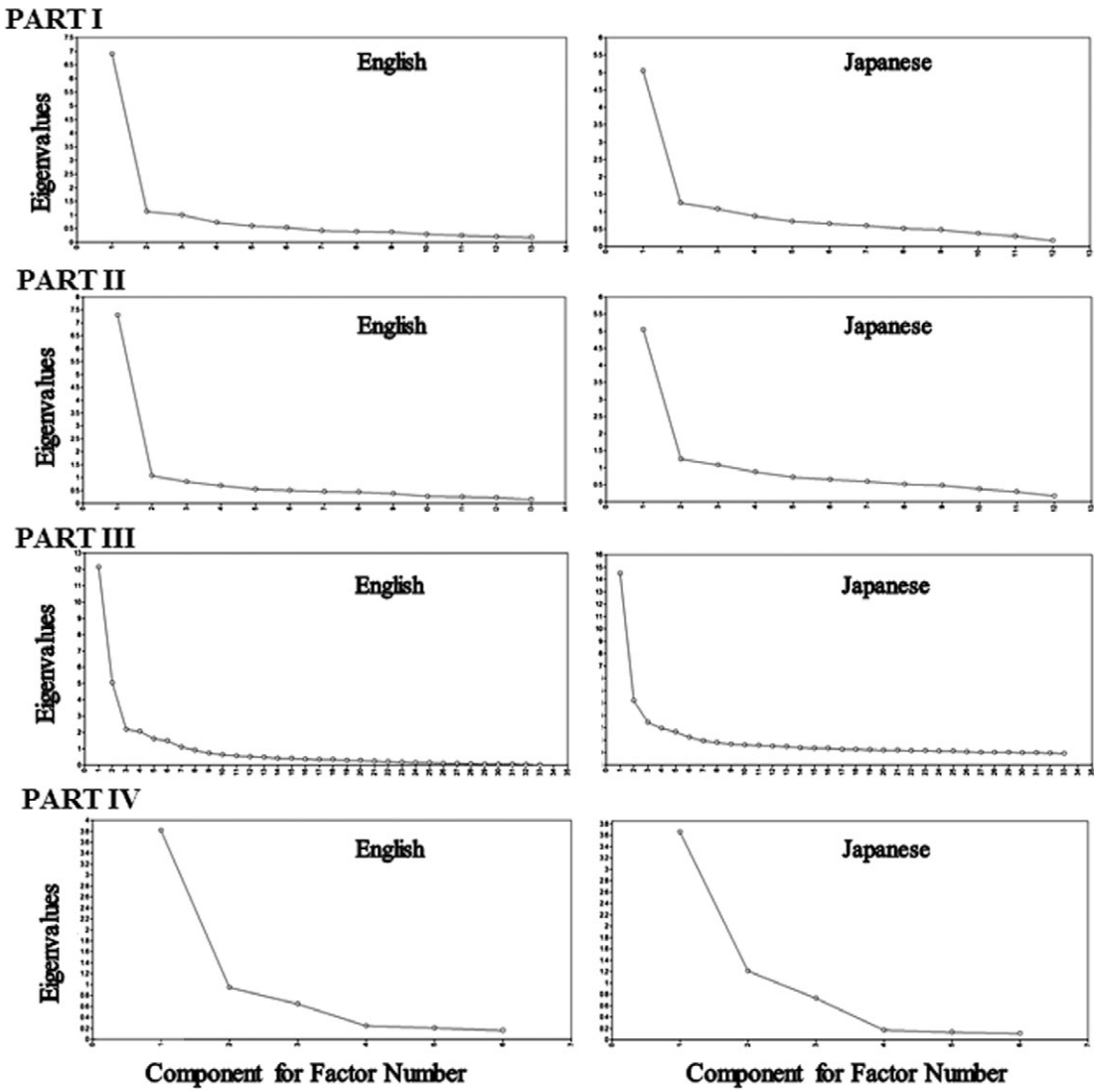

Figure 1 Scree plots for the English and Japanese exploratory factor analyses.

hallucination item, the Japanese and English frequencies for each rating option were very similar (77% and 78%, respectively), but cognitive impairment ratings were different in the two cultures. A much greater percentage (62.2%) of Japanese had 0 scores, in comparison to the English-speaking sample (48.9%). In general, among reports in Western cultures, cognitive impairment and hallucinations are shared or overlapping behaviors and such data have been used to argue shared common pathogeneses.[15,16] Results of the chi-square test indicate that severity of motor and nonmotor symptoms are generally more severe in patients of English groups than those of Japanese groups. Even after taking these differences into consideration, the present results from the Japanese sample may indicate that cognitive impairment is less frequent or viewed differently and thereby may be underreported for cultural reasons in Japan, in comparison to the Western culture.

Contrary to majority of items, constipation problems and postural stability were rated more severe in Japanese patients than English patients. Differences in genetic factor, eating habits, and amount of daily exercise between two populations are possible factors to produce different response to the former item. The reason why postural stability was rated more severely in Japanese groups remains unknown. Factors including examiner's manner to pull patients may be clarified in future.

In conclusion, the CFI for the Japanese version of the MDS-UPDRS was 0.93 or greater. Therefore, the Japanese version meets the criterion for designation as an official translation of the MDS-UPDRS. This is the first Asian- or non-Indo-European–language translation of the MDS-UPDRS. The Japanese version of the MDS-UPDRS is available from the MDS website (http://www.movementdisorders.org/publications/rating_scales/). The establishment of additional non-English translations will further facilitate the understanding of PD symptoms and help accelerate qualified clinical trials and discussions worldwide.

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TABLE 4 Distribution of responses by MDS-UPDRS by language[a]

	English		Japanese			English		Japanese	
Part I									
Cognitive impairment*	Frequency	%	Frequency	%	Daytime sleepiness	Frequency	%	Frequency	%
0	428	48.86	227	62.19	0	212	24.2	104	28.49
1	256	29.22	93	25.48	1	216	24.66	73	20.00
2	121	13.81	25	6.85	2	364	41.55	147	40.27
3	53	6.05	17	4.66	3	59	6.74	32	8.77
4	17	1.94	3	0.82	4	16	1.83	8	2.19
999	1	0.11	0	0.00	999	9	1.03	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Hallucinations and psychosis	Frequency	%	Frequency	%	Pain and other sensations*	Frequency	%	Frequency	%
0	687	78.42	280	76.71	0	303	34.59	148	40.55
1	89	10.16	38	10.41	1	289	32.99	117	32.05
2	51	5.82	26	7.12	2	130	14.84	60	16.44
3	35	4	14	3.84	3	106	12.1	31	8.49
4	13	1.48	4	1.10	4	39	4.45	4	1.10
999	1	0.11	3	0.82	999	9	1.03	5	1.37
Total	876	100	365	100.00	Total	876	100	365	100.00
Depressed mood*	Frequency	%	Frequency	%	Urinary problems	Frequency	%	Frequency	%
0	471	53.77	223	61.10	0	325	37.1	144	39.45
1	265	30.25	84	23.01	1	281	32.08	118	32.33
2	81	9.25	36	9.86	2	137	15.64	60	16.44
3	45	5.14	21	5.75	3	88	10.05	32	8.77
4	12	1.37	0	0.00	4	38	4.34	10	2.74
999	2	0.23	1	0.27	999	7	0.8	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Anxious mood	Frequency	%	Frequency	%	Constipation problems*	Frequency	%	Frequency	%
0	413	47.15	192	52.60	0	384	43.84	90	24.66
1	307	35.05	116	31.78	1	287	32.76	120	32.88
2	96	10.96	39	10.68	2	119	13.58	74	20.27
3	41	4.68	15	4.11	3	70	7.99	63	17.26
4	17	1.94	1	0.27	4	9	1.03	18	4.93
999	2	0.23	2	0.55	999	7	0.8	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Apathy	Frequency	%	Frequency	%	Lightheadedness on standing*	Frequency	%	Frequency	%
0	584	66.67	249	68.22	0	490	55.94	238	65.21
1	141	16.1	61	16.71	1	216	24.66	78	21.37
2	88	10.05	27	7.40	2	103	11.76	37	10.14
3	52	5.94	20	5.48	3	51	5.82	10	2.74
4	8	0.91	7	1.92	4	9	1.03	1	0.27
999	3	0.34	1	0.27	999	7	0.8	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Features of DDS	Frequency	%	Frequency	%	Fatigue*	Frequency	%	Frequency	%
0	747	85.27	315	86.30	0	217	24.77	141	38.63
1	57	6.51	23	6.30	1	335	38.24	128	35.07
2	44	5.02	20	5.48	2	184	21	57	15.62
3	19	2.17	4	1.10	3	81	9.25	33	9.04
4	6	0.68	0	0.00	4	50	5.71	4	1.10
999	3	0.34	3	0.82	999	9	1.03	2	0.55
Total	876	100	365	100.00	Total	876	100	365	100.00
Sleep problems*	Frequency	%	Frequency	%					
0	280	31.96	138	37.81					
1	202	23.06	103	28.22					
2	207	23.63	81	22.19					
3	140	15.98	39	10.68					
4	40	4.57	3	0.82					
999	7	0.8	1	0.27					
Total	876	100	365	100.00					
Part II									
Speech*	Frequency	%	Frequency	%	Doing hobbies and other activities*	Frequency	%	Frequency	%
0	252	28.77	159	43.56	0	227	25.91	130	35.62
1	236	26.94	78	21.37	1	289	32.99	99	27.12
2	233	26.6	82	22.47	2	185	21.12	65	17.81
3	126	14.38	43	11.78	3	81	9.25	41	11.23

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TABLE 4 (Continued)

	English		Japanese			English		Japanese	
4	22	2.51	3	0.82	4	84	9.59	29	7.95
999	7	0.8	0	0.00	999	10	1.14	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Saliva and drooling*	Frequency	%	Frequency	%	Turning in bed	Frequency	%	Frequency	%
0	341	38.93	186	50.96	0	277	31.62	122	33.42
1	115	13.13	49	13.42	1	378	43.15	144	39.45
2	203	23.17	64	17.53	2	111	12.67	48	13.15
3	157	17.92	46	12.60	3	55	6.28	31	8.49
4	53	6.05	18	4.93	4	50	5.71	19	5.21
999	7	0.8	2	0.55	999	5	0.57	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Chewing and swallowing	Frequency	%	Frequency	%	Tremor*	Frequency	%	Frequency	%
0	549	62.67	241	66.03	0	189	21.58	118	32.33
1	230	26.26	81	22.19	1	360	41.1	154	42.19
2	54	6.16	22	6.03	2	212	24.2	69	18.90
3	34	3.88	18	4.93	3	72	8.22	17	4.66
4	3	0.34	3	0.82	4	36	4.11	7	1.92
999	6	0.68	0	0.00	999	7	0.8	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Eating tasks	Frequency	%	Frequency	%	Getting out of bed*	Frequency	%	Frequency	%
0	363	41.44	158	43.29	0	180	**20.55**	**101**	27.67
1	265	30.25	114	31.23	1	317	36.19	140	38.36
2	187	21.35	79	21.64	2	199	22.72	73	20.00
3	42	4.79	8	2.19	3	104	11.87	35	9.59
4	10	1.14	5	1.37	4	70	7.99	15	4.11
999	9	1.03	1	0.27	999	6	0.68	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Dressing	Frequency	%	Frequency	%	Walking and balance	Frequency	%	Frequency	%
0	220	25.11	82	22.47	0	184	21	74	20.27
1	322	36.76	176	48.22	1	336	38.36	156	42.74
2	211	24.09	67	18.36	2	105	11.99	38	10.41
3	76	8.68	28	7.67	3	172	19.63	61	16.71
4	42	4.79	12	3.29	4	74	8.45	33	9.04
999	5	0.57	0	0.00	999	5	0.57	3	0.82
Total	876	100	365	100.00	Total	876	100	365	100.00
Hygiene	Frequency	%	Frequency	%	Freezing	Frequency	%	Frequency	%
0	342	39.04	126	34.52	0	453	51.71	176	48.22
1	367	41.89	160	43.84	1	182	20.78	74	20.27
2	88	10.05	47	12.88	2	89	10.16	40	10.96
3	33	3.77	25	6.85	3	90	10.27	49	13.42
4	38	4.34	7	1.92	4	56	6.39	25	6.85
999	8	0.91	0	0.00	999	6	0.68	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Handwriting	Frequency	%	Frequency	%					
0	161	18.38	106	29.04					
1	251	28.65	151	41.37					
2	222	25.34	75	20.55					
3	146	16.67	22	6.03					
Part III									
Speech*	Frequency	%	Frequency	%	Arising from chair	Frequency	%	Frequency	%
0	189	21.58	148	40.55	0	422	48.17	197	53.97
1	379	43.26	143	39.18	1	245	27.97	106	29.04
2	213	24.32	53	14.52	2	78	8.9	24	6.58
3	69	7.88	15	4.11	3	71	8.11	22	6.03
4	22	2.51	4	1.10	4	55	6.28	16	4.38
999	4	0.46	2	0.55	999	5	0.57	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Facial expression*	Frequency	%	Frequency	%	Gait	Frequency	%	Frequency	%
0	96	10.96	88	24.11	0	202	23.06	81	22.19
1	300	34.25	137	37.53	1	351	40.07	187	51.23
2	361	41.21	109	29.86	2	167	19.06	47	12.88
3	89	10.16	23	6.30	3	97	11.07	36	9.86
4	26	2.97	7	1.92	4	55	6.28	14	3.84
999	4	0.46	1	0.27	999	4	0.46	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Rigidity, neck	Frequency	%	Frequency	%	Freezing of gait	Frequency	%	Frequency	%
0	260	29.68	134	36.71	0	655	74.77	250	68.49
1	247	28.2	97	26.58	1	95	10.84	50	13.70
2	274	31.28	92	25.21	2	60	6.85	30	8.22
3	73	8.33	36	9.86	3	26	2.97	13	3.56

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TABLE 4 (Continued)

	English		Japanese			English		Japanese	
4	16	1.83	4	1.10	4	38	4.34	19	5.21
999	6	0.68	2	0.55	999	2	0.23	3	0.82
Total	876	100	365	100.00	Total	876	100	365	100.00
Rigidity, RUE*	Frequency	%	Frequency	%	Postural stability*	Frequency	%	Frequency	%
0	176	20.09	93	25.48	0	422	48.17	150	41.10
1	282	32.19	142	38.90	1	157	17.92	66	18.08
2	342	39.04	111	30.41	2	60	6.85	44	12.05
3	69	7.88	14	3.84	3	149	17.01	84	23.01
4	6	0.68	2	0.55	4	86	9.82	20	5.48
999	1	0.11	3	0.82	999	2	0.23	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Rigidity, LUE*	Frequency	%	Frequency	%	Posture	Frequency	%	Frequency	%
0	205	23.4	99	27.12	0	173	19.75	78	21.37
1	268	30.59	135	36.99	1	337	38.47	129	35.34
2	317	36.19	121	33.15	2	206	23.52	84	23.01
3	77	8.79	9	2.47	3	125	14.27	52	14.25
4	7	0.8	1	0.27	4	33	3.77	21	5.75
999	2	0.23	0	0.00	999	2	0.23	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Rigidity, RLE	Frequency	%	Frequency	%	Global spontaneity of movement	Frequency	%	Frequency	%
0	272	31.05	109	29.86	0	108	12.33	49	13.42
1	248	28.31	125	34.25	1	278	31.74	155	42.47
2	275	31.39	106	29.04	2	279	31.85	97	26.58
3	67	7.65	23	6.30	3	184	21	51	13.97
4	10	1.14	1	0.27	4	27	3.08	12	3.29
999	4	0.46	1	0.27	999	0	0	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Rigidity, LLE	Frequency	%	Frequency	%	Postural tremor, right hand	Frequency	%	Frequency	%
0	286	32.65	116	31.78	0	544	62.1	223	61.10
1	227	25.91	120	32.88	1	262	29.91	119	32.60
2	275	31.39	100	27.40	2	43	4.91	19	5.21
3	75	8.56	26	7.12	3	23	2.63	2	0.55
4	11	1.26	1	0.27	4	1	0.11	2	0.55
999	2	0.23	2	0.55	999	3	0.34	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Finger tapping, right hand*	Frequency	%	Frequency	%	Postural tremor, left hand*	Frequency	%	Frequency	%
0	122	13.93	95	26.03	0	518	59.13	234	64.11
1	342	39.04	167	45.75	1	276	31.51	98	26.85
2	252	28.77	64	17.53	2	49	5.59	27	7.40
3	144	16.44	35	9.59	3	29	3.31	2	0.55
4	15	1.71	3	0.82	4	1	0.11	1	0.27
999	1	0.11	1	0.27	999	3	0.34	3	0.82
Total	876	100	365	100.00	Total	876	100	365	100.00
Finger tapping, left hand*	Frequency	%	Frequency	%	Kinetic tremor, right hand*	Frequency	%	Frequency	%
0	108	12.33	91	24.93	0	546	62.33	258	70.68
1	298	34.02	135	36.99	1	265	30.25	89	24.38
2	265	30.25	96	26.30	2	46	5.25	15	4.11
3	181	20.66	37	10.14	3	13	1.48	1	0.27
4	22	2.51	5	1.37	4	2	0.23	1	0.27
999	2	0.23	1	0.27	999	4	0.46	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Hand movements, right hand*	Frequency	%	Frequency	%	Kinetic tremor, left hand*	Frequency	%	Frequency	%
0	187	21.35	129	35.34	0	493	56.28	236	64.66
1	346	39.5	160	43.84	1	293	33.45	105	28.77
2	231	26.37	57	15.62	2	72	8.22	22	6.03
3	98	11.19	17	4.66	3	14	1.6	1	0.27
4	12	1.37	2	0.55	4	0	0	1	0.27
999	2	0.23	0	0.00	999	4	0.46	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Hand movements, left hand*	Frequency	%	Frequency	%	Rest tremor amplitude, RUE*	Frequency	%	Frequency	%
0	164	18.72	118	32.33	0	586	66.89	281	76.99
1	311	35.5	147	40.27	1	112	12.79	51	13.97
2	250	28.54	78	21.37	2	121	13.81	26	7.12
3	125	14.27	17	4.66	3	53	6.05	6	1.64

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TABLE 4 (Continued)

	English		Japanese			English		Japanese	
4	25	2.85	4	1.10	4	3	0.34	1	0.27
999	1	0.11	1	0.27	999	1	0.11	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Pronation: supination movements, right hand*	Frequency	%	Frequency	%	Rest tremor amplitude, LUE*	Frequency	%	Frequency	%
0	199	22.72	100	27.40	0	603	68.84	280	76.71
1	335	38.24	159	43.56	1	120	13.7	56	15.34
2	216	24.66	64	17.53	2	99	11.3	20	5.48
3	107	12.21	35	9.59	3	45	5.14	9	2.47
4	17	1.94	6	1.64	4	5	0.57	0	0.00
999	2	0.23	1	0.27	999	4	0.46	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Pronation: supination movements, left hand	Frequency	%	Frequency	%	Rest tremor amplitude, RLE	Frequency	%	Frequency	%
0	162	18.49	76	20.82	0	777	88.7	319	87.40
1	297	33.9	138	37.81	1	52	5.94	25	6.85
2	235	26.83	101	27.67	2	35	4	18	4.93
3	150	17.12	42	11.51	3	9	1.03	2	0.55
4	29	3.31	8	2.19	4	0	0	0	0.00
999	3	0.34	0	0.00	999	3	0.34	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Toe tapping, right foot*	Frequency	%	Frequency	%	Rest tremor amplitude, LLE	Frequency	%	Frequency	%
0	168	19.18	89	24.38	0	795	90.75	319	87.40
1	323	36.87	149	40.82	1	46	5.25	24	6.58
2	228	26.03	96	26.30	2	20	2.28	17	4.66
3	129	14.73	24	6.58	3	12	1.37	2	0.55
4	27	3.08	6	1.64	4	0	0	0	0.00
999	1	0.11	1	0.27	999	3	0.34	3	0.82
Total	876	100	365	100.00	Total	876	100	365	100.00
Toe tapping, left foot*	Frequency	%	Frequency	%	Rest tremor amplitude, lip/jaw*	Frequency	%	Frequency	%
0	154	17.58	68	18.63	0	780	89.04	349	95.62
1	251	28.65	140	38.36	1	63	7.19	12	3.29
2	268	30.59	111	30.41	2	18	2.05	3	0.82
3	154	17.58	36	9.86	3	13	1.48	0	0.00
4	46	5.25	10	2.74	4	1	0.11	1	0.27
999	3	0.34	0	0.00	999	1	0.11	0	0.00
Total	876	100	365	100.00	Total	876	100	365	100.00
Leg agility, right leg*	Frequency	%	Frequency	%	Constancy of rest*	Frequency	%	Frequency	%
0	250	28.54	119	32.60	0	409	46.69	219	60.00
1	329	37.56	163	44.66	1	214	24.43	79	21.64
2	190	21.69	61	16.71	2	91	10.39	28	7.67
3	86	9.82	18	4.93	3	85	9.7	21	5.75
4	18	2.05	4	1.10	4	67	7.65	17	4.66
999	3	0.34	0	0.00	999	10	1.14	1	0.27
Total	876	100	365	100.00	Total	876	100	365	100.00
Leg agility, left leg*	Frequency	%	Frequency	%					
0	216	24.66	99	27.12					
1	298	34.02	142	38.90					
2	213	24.32	90	24.66					
3	106	12.1	30	8.22					
4	38	4.34	3	0.82					
999	5	0.57	1	0.27					
Total	876	100	365	100.00					
Part IV									
Time spent with dyskinesias*	Frequency	%	Frequency	%	Functional impact of fluctuations	Frequency	%	Frequency	%
0	563	64.27	273	74.79	0	433	49.43	194	53.15
1	173	19.75	41	11.23	1	165	18.84	56	15.34
2	87	9.93	30	8.22	2	81	9.25	32	8.77
3	27	3.08	12	3.29	3	119	13.58	60	16.44
4	17	1.94	6	1.64	4	63	7.19	19	5.21
999	9	1.03	3	0.82	999	15	1.71	4	1.10
Total	876	100	365	100.00	Total	876	100	365	100.00

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TABLE 4 (Continued)

	English		Japanese			English		Japanese	
Functional impact of dyskinesias*	Frequency	%	Frequency	%	Complexity of motor fluctuations*	Frequency	%	Frequency	%
0	695	79.34	308	84.38	0	404	46.12	192	52.60
1	90	10.27	27	7.40	1	291	33.22	125	34.25
2	29	3.31	19	5.21	2	69	7.88	21	5.75
3	46	5.25	7	1.92	3	50	5.71	17	4.66
4	5	0.57	2	0.55	4	46	5.25	3	0.82
999	11	1.26	2	0.55	999	16	1.83	7	1.92
Total	876	100	365	100.00	Total	876	100	365	100.00
Time spent in the OFF state*	Frequency	%	Frequency	%	Painful OFF state dystonia*	Frequency	%	Frequency	%
0	383	43.72	183	50.14	0	680	77.63	319	87.40
1	341	38.93	113	30.96	1	114	13.01	28	7.67
2	106	12.1	50	13.70	2	45	5.14	4	1.10
3	22	2.51	14	3.84	3	13	1.48	6	1.64
4	14	1.6	2	0.55	4	15	1.71	5	1.37
999	10	1.14	3	0.82	999	9	1.03	3	0.82
Total	876	100	365	100.00	Total	876	100	365	100.00

[a]999 = missing.
*$P < 0.05$ by chi-square test (df = 4).
DDS, dopamine dysregulation syndrome; RUE, right upper extremity; LUE, left upper extremity; RLE, right lower extremity; LLE, left lower extremity.

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(1) Research Project: A. Conception, B. Organization, C. Execution; (2) Statistical Analysis: A. Design, B. Execution, C. Review and Critique; (3) Manuscript: A. Writing of the First Draft, B. Review and Critique.

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