Published in final edited form as:
Mov Disord Clin Pract (Hoboken). 2014 September 1; 1(3): 200–212. doi:10.1002/mdc3.12058.

Official Japanese Version of the Movement Disorder Society-Unified Parkinson's Disease Rating Scale: validation against the original English version

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Co., Kyowa Hakko Kirin Co., Otsuka Pharm Co., Hisamitsu, Ono Pharm Co., Meiji Seika,
Honoraria: Boehringer Ingelheim, Glaxo Smith Kline, Dainippon Sumitomo Pharm Co., FP Pharm Co., NOVARTIS, Kyowa Hakko Kirin Co., Otsuka Pharm Co., Genzyme, Panasonic Healthcare Co., UCB INC.
Royalties: Maruzen, Igaku-Shoin, Nishimura.
Ryosuke Takahashi reports the following:
Consultant: KAN Research Institute, Inc., Daiichi-Sankyo.
Grants/Research Support: Dainippon Sumitomo Pharm Co., Boehringer Ingelheim, NOVARTIS, Pfizer Co., Ltd., Glaxo Simith Kline, Takeda Pharmaceutical Co., Mitsubishi Tanabe Pharma, Eisai Co., Ltd.,
Honoraria: Boehringer Ingelheim, Glaxo Smith Kline, Dainippon Sumitomo Pharm Co., FP Pharmaceutical Co., Medical Review, NOVARTIS, Daiichi-Sankyo, Kyowa Hakko Kirin Co., Mitsubishi Tanabe Pharma, Eisai Co., Ltd., Nihon Pharmaceutical Co., Otsuka Pharmaceutical Co., Janssen Pharmaceutical Company, SANOFI, Alfresa Pharma Co., Japan Blood Products Organization, ASBIO Pharma Co., MSD.
Atsushi Takeda reports the following:
Grants: the Ministry of Education, Culture, Sports, Science and Technology of Japan, the Ministry of Health, Labour and Welfare of Japan.
Honoraria: Otsuka Pharmaceutical Co., Kyowa Hakko Kirin Co., Ltd., Glaxo Smith Kline, Daiichi-Sankyo, Dainippon Sumitomo Pharm Co., FP Pharmaceutical Co., Takeda Pharmaceutical Co., Boehringer Ingelheim, NOVARIS, Ono Pharmaceutical,
Royalties: Iyaku Journal, Chugai-Igakusha, Igaku-Shoin, Medical View, Elsevier Japan, Aruta Shuppan.
Yoshio Tsuboi reports the following:
Grants: the Ministry of Health, Labour and Welfare of Japan.
Honoraria: Eisai Co., Ltd., Otsuka Pharmaceutical Co., Kyowa Hakko Kirin Co., Glaxo Smith Kline, Daiichi-Sankyo, Dainippon Sumitomo Pharm Co., FP Pharmaceutical Co., Mitsubishi Tanabe Pharma, Teijin Pharma, Boehringer Ingelheim, NOVARTIS.
Yoshikazu Ugawa reports the following: Grants: the Ministry of Education, Culture, Sports, Science and Technology of Japan, the Ministry of Health, Labour and Welfare of Japan, the Support Center for Advanced Telecommunications Technology Research, the Association of Radio Industries Businesses, the Uehara Memorial Foundation, NOVARTIS Foundation (Japan) for the Promotion of Science, JST, Nihon Kohden.
Honoraria: Taiwan Society of Clinical Neurophysiology, Indonesia Society of Clinical Neurophysiology, Taiwan Movement Disoders Society, Astellas Pharma, Eisai Co. Ltd., Dainippon Sumitomo Pharm Co., FP Pharmaceutical Co., Otsuka Pharmaceutical Co., Elsevier Japan, Kissei Pharmaceutical Co., Kyorin Pharma, Kyowa Hakko Kirin Co., Glaxo Smith Kline, SANOFI, Daiichi-Sankyo, Takeda Pharmaceutical Co., Mitsubishi Tanebe Pharma, Teijin Pharma, Nippon Chemiphar Co., Nihon Pharmaceutical Co., Boehringer Ingelheim, NOVARTIS, Bayer Yakuhin, Mochida Pharma.
Royalties: Chugai-Igakusha, Igaku-Shoin Ltd, Medical View, Blackwell Publishing.
Mitsutoshi Yamamoto reports the following:
Honoraria: Dainippon Sumitomo Pharm Co., Boehringer Ingelheim, NOVARTIS, Glaxo Simith Kline, FP Pharmaceutical Co., Kyowa Hakko Kirin Co., Otsuka Pharm Co.
Fusako Yokochi reports the following:
Honoraria: Glaxo Smith Kline, Otsuka Pharmaceutical Co., Medtronic, AbbVie Japan
Fumihito Yoshii reports the following:
Grants: Eisai Co., Ltd., Dainippon Sumitomo Pharm Co., FP Pharmaceutical Co.
Takeda Pharmaceutical Co., Mitsubishi Tanabe Pharma, Glaxo Smith Kline, Boehringer Ingelheim, Daiichi-Sankyo, Mitsubishi Tanabe Pharma, Pfizer
Honoraria: Glaxo Smith Kline, Dainippon Sumitomo Pharm Co., Boehringer Ingelheim, NOVARTIS, AbbVie Japan, Ono Parmaceutical Co., Otsuka Pharmaceutical Co., Janssen Pharmaceutical Co.
Glenn T. Stebbins reports the following:
Consulting and Advisory Board Membership with honoraria: Adamas Pharmaceuticals, Inc., Ceregene, Inc., CHDI Management, Inc., Ingenix Pharmaceutical Services (i3 Research), Neurocrine Biosciences, Inc.
Grants and Research: National Institutes of Health, Michael J. Fox Foundation for Parkinson's Research, Dystonia Coallition.
Honoraria: Movement Disorder Society, American Academy of Neurology, Michael J. Fox Foundation for Parkinson's Research.
Salary: Rush University Medical Center
Barbara C Tilley reports the following:
Grants: NIH grants (NINDS, NHLBI, NIMHD, NIGMS), Pfizer Data and Safety.
Monitoring Committee, NIH Data and Safety Monitoring Committees.
Salary: University of Texas Health Science Center School of Public Health at Houston, Division of Biostatistics.
Sheng Luo has nothing to declare.
Lu Wang has nothing to declare.
Nancy R Lapelle reports the following:
Cognitive Testing, Qualitative Research, and Program/Process Evaluation Consulting:
UMass Medical School (UMMS) Lamar Soutter Library, UMass Medical School Inter-Professional Development, The Association of Academic Health Sciences Libraries, Medical University of South Carolina (MUSC) College of Nursing and Hollings Cancer Center, Movement Disorder Society
Grants/Research: Dr. Lapelle is a subcontractor on a variety of research and evaluation grants with principal investigators at UMMS and MUSC.
Christopher G. Goetz reports the following:
Consulting and Advisory Board Membership with honoraria: AOP Orphan, Addex Pharma, Advanced Studies of Medicine, Boston Scientific, CHDI, Health Advances, ICON Clinical Research, Ingenix (i3 Research), National Institutes of Health, Neurocrine, Oxford Biomedica, Synthonics.
Grants/Research: Funding from NIH, Michael J. Fox Foundation, NIH. Dr. Goetz directs the Rush Parkinson's Disease Research Center that receives support from the Parkinson's Disease Foundation. He directs the translation program for the MDS-UPDRS and UDysRS and receives funds from the MDS for this effort.
Honoraria: Movement Disorder Society, American Academy of Neurology, Movement Disorder Society, University of Pennsylvania, University of Chicago, University of Luxembourg.
Royalties: Oxford University Press, Elsevier Publishers, Wolters Kluwer Health-Lippincott, Wilkins and Williams.
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Abstract

Background—The Movement Disorder Society (MDS)-sponsored revision of the Unified Parkinson's Disease (PD) Rating Scale (UPDRS) (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.

Methods—In this trial, the MDS-UPDRS was translated into Japanese, underwent cognitive pre-testing, and the translation was modified after taking the results into account. The final translation was approved as 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 pre-specified factor organization.

Results—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 Japanese translation met the pre-specified 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.

Conclusions—The Japanese version of the MDS-UPDRS met the criterion as an Official MDS Translation and is now available for use (www.movementdisorders.org).

Keywords

Parkinson's disease; MDS-UPDRS; UPDRS; Rating scale; validation

Introduction

The Unified Parkinson's Disease Rating Scale (UPDRS) has been widely used since the 1980's 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 UPDRS.[3] In 2001, the 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, and 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 non-motor 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 the 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. As of now, several official translations (Italian,[5] Spanish,[6] French, Estonian, German, 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 (MDSJ) 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, Tilley).

Cognitive Pretesting

Cognitive pretesting is a qualitative approach to assess instrument completion in terms of task difficulty for examiner and respondent, and respondent interest, attention span, discomfort, and comprehension.[7] Where there were observed differences between the back-translated Japanese version and the English version, 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 Table 1) 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 accordance with relevant institutional ethics policies regarding human subjects. Anonymized patient data were transferred to the analysis team via a secure website. The protocol for the validation of the MDS-UPDRS Japanese version was approved by the ethics committees of each institute. Informed consent was obtained from all participants prior to the study.

Data Analysis

Factor Analysis—M-plus, Version 6.11[9] was used to perform confirmatory and exploratory factor analyses (EFA), as 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–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 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 (REMSA) was also calculated as another test of model fit. REMSA values < 0.05 were considered to be good fit and REMSA values of 0.1 or more were considered to be poor fit. WLSMV estimators were used to confirm model fit.

Secondary Analysis—As a secondary analysis we conducted an exploratory factor analysis[11] for Parts I–IV of the Japanese version of the MDS-UPDRS to explore the underlying factor structure without the constraints of a pre-specified 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, as this method might converge when ULS does not. In this case, while 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 Parkinson's disease 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 2. The Japanese dataset 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 patient compared to the English sample. The two cohorts were similar on age, duration of disease but the distribution of Hoehn and Yahr stages were significantly different between the two cohorts ($p < 0.0005$) (Table 2).

Primary analysis – confirmatory factor analysis—Table 4 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 with the English-language factor structure. Our pre-specified criterion was a CFI of 0.90 or greater; thus, we conclude that the English factor structure was confirmed in the Japanese dataset.

Secondary analysis – exploratory factor analysis—The factor structure of the EFA for the English version has been used as the basis for all confirmatory factor analyses, but our EFA of the Japanese dataset differs from that of the English-language dataset in some aspects. The results of the EFA for the English and Japanese versions are shown in Table 5; include 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 reveal similarities in shape of the plots (Figure 1), but differences were noted in the relationship between factors and their eigenvalues and percent of variance (Table 5) for Part I: Non-motor 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. For Part IV: Motor complications, we extracted two factors.

Chi-square test (Table 3) 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, ns). In many other items, PD patients in the English group showed greater distribution of more severe scores including –Depressed mood, Pain and other sensations, Light headedness on standing, Fatigue, and Sleep problems in Part I; Speech, Saliva and drooling, Doing hobbies and other activities, Tremor, 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 confirmatory factor analysis (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.

Exploratory factor analysis, 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. [4] This may in part be due to 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 Item 1.1-Cognitive Impairment and Item 1.2 - Hallucinations and Psychosis. For the 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 chi-square test indicate that severity of motor and non-motor 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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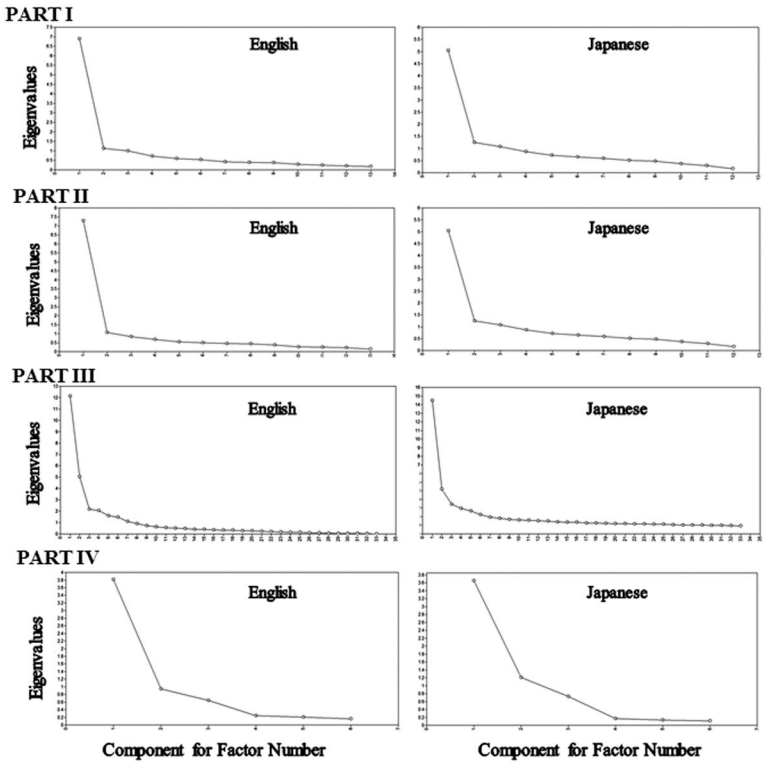

Figure 1.
SCREE plots for the English and Japanese exploratory factor analyses.

Table 1

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Investigators involved in the cognitive pretesting and/or vatidation and their affiliations. Investigators are listed in alphabetical order.

Table 2

Demographics of Japanese patients with Parkinson's disease in comparison with the MDS-UPDRS (English version) data

	English	Japanese	*p*
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
Hoehn and Yahr Stage			<0.0005
0	0	2	
1	63	28	
2	467	164	
3	174	116	
4	109	42	
5	53	11	

Table 3

Distribution of Responses by MDS-UPDRS by English- and Japanese-Language

Part I

	English		Japanese			English		Japanese	
Cognitive impairment*	**Freq.**	**%**	**Freq.**	**%**	**Daytime sleepiness**	**Freq.**	**%**	**Freq.**	**%**
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	Freq.	%	Freq.	%	Pain and other sensations*	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Urinary problems	Freq.	%	Freq.	%
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

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Part I

	English		Japanese			English		Japanese	
Cognitive impairment*	**Freq.**	**%**	**Freq.**	**%**	**Daytime sleepiness**	**Freq.**	**%**	**Freq.**	**%**
Anxious mood	Freq.	%	Freq.	%	Constipation problems*	Freq.	%	Freq.	%
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	Freq.	%	Freq.	%	Light headedness on standing*	Freq.	%	Freq.	%
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	Freq.	%	Freq.	%	Fatigue*	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%					

Part I

	English		Japanese			English		Japanese	
Cognitive impairment*	**Freq.**	**%**	**Freq.**	**%**	**Daytime sleepiness**	**Freq.**	**%**	**Freq.**	**%**
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

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Doing hobbies and other activities***	**Freq.**	**%**	**Freq.**	**%**
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
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*	Freq.	%	Freq.	%	Turning in bed	Freq.	%	Freq.	%
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

Part II

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Doing hobbies and other activities***	**Freq.**	**%**	**Freq.**	**%**
Chewing and swallowing	Freq.	%	Freq.	%	Tremor*	Freq.	%	Freq.	%
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	Freq.	%	Freq.	%	Getting out of bed*	Freq.	%	Freq.	%
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	Freq.	%	Freq.	%	Walking and balance	Freq.	%	Freq.	%
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	Freq.	%	Freq.	%	Freezing	Freq.	%	Freq.	%
0	342	39.04	126	34.52	0	453	51.71	176	48.22

Part II

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Doing hobbies and other activities***	**Freq.**	**%**	**Freq.**	**%**
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	Freq.	%	Freq.	%					
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					
4	87	9.93	11	3.01					
999	9	1.03	0	0.00					
Total	876	100	365	100.00					

Part III

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Arising from chair**	**Freq.**	**%**	**Freq.**	**%**
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*	Freq.	%	Freq.	%	Gait	Freq.	%	Freq.	%
0	96	10.96	88	24.11	0	202	23.06	81	22.19

Part III

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Arising from chair**	**Freq.**	**%**	**Freq.**	**%**
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	Freq.	%	Freq.	%	Freezing of gait	Freq.	%	Freq.	%
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
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*	Freq.	%	Freq.	%	Postural stability*	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Posture	Freq.	%	Freq.	%
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

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Part III

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Arising from chair**	**Freq.**	**%**	**Freq.**	**%**
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	Freq.	%	Freq.	%	Global spontaneity of movement	Freq.	%	Freq.	%
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	Freq.	%	Freq.	%	Postural tremor–Right hand	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Postural tremor–Left hand*	Freq.	%	Freq.	%
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

Part III

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Arising from chair**	**Freq.**	**%**	**Freq.**	**%**
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*	Freq.	%	Freq.	%	Kinetic tremor–Right hand*	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Kinetic tremor–Left hand*	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Rest tremor amplitude–RUE*	Freq.	%	Freq.	%
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
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

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Part III

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Arising from chair**	**Freq.**	**%**	**Freq.**	**%**
Pronation-supination movements–Right hand*	Freq.	%	Freq.	%	Rest tremor amplitude–LUE*	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Rest tremor amplitude–RLE	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Rest tremor amplitude–LLE	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Rest tremor amplitude–Lip/jaw*	Freq.	%	Freq.	%
0	154	17.58	68	18.63	0	780	89.04	349	95.62

Part III

	English		Japanese			English		Japanese	
Speech*	**Freq.**	**%**	**Freq.**	**%**	**Arising from chair**	**Freq.**	**%**	**Freq.**	**%**
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*	Freq.	%	Freq.	%	Constancy of rest*	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%					
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

	English		Japanese			English		Japanese	
Time spent with dyskinesias*	**Freq.**	**%**	**Freq.**	**%**	**Functional impact of fluctuations**	**Freq.**	**%**	**Freq.**	**%**
0	563	64.27	273	74.79	0	433	49.43	194	53.15

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Part IV

	English		Japanese			English		Japanese	
Time spent with dyskinesias*	**Freq.**	**%**	**Freq.**	**%**	**Functional impact of fluctuations**	**Freq.**	**%**	**Freq.**	**%**
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
Functional impact of dyskinesias*	Freq.	%	Freq.	%	Complexity of motor fluctuations*	Freq.	%	Freq.	%
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*	Freq.	%	Freq.	%	Painful OFF-state dystonia*	Freq.	%	Freq.	%
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

999 = missing

*; $p < 0.05$ by chi-square test (df = 4)

Table 4

Confirmatory factor analysis model fit*

Part I: Non-Motor Aspects of Experiences of Daily Living (a 2-factor model)**	
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 3-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 7-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 2-factor model)	
Japanese	CFI = 1.00, RMSEA = 0.06 (350 patients)
English-language	CFI = 1.00, RMSEA = 0.00 (848 patients)

* CFI: comparative fit index; RMSEA: root mean square error of approximation

** Dopamine Dysregulation Syndrome was not included in this analysis as it did not load on any factor in the US version.

Table 5

Comparison of English-Language and Japanese Exploratory Factor Structures for Parts I–IV of the MDS-UPDRS

Part I

	English		Japanese	
Factor	**Eigenvalues**	**Percent Variance**	**Eigenvalues**	**Percent Variance**
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

	English		Japanese	
Factor	**Eigenvalues**	**Percent Variance**	**Eigenvalues**	**Percent Variance**
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

	English		Japanese	
Factor	**Eigenvalues**	**Percent Variance**	**Eigenvalues**	**Percent Variance**
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

	English		Japanese	
Factor	**Eigenvalues**	**Percent Variance**	**Eigenvalues**	**Percent Variance**
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