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# Validation of the Hebrew Version of the Unified Dyskinesia Rating Scale

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**Abstract**
***Background:*** The Unified Dyskinesia Rating Scale (UDysRS) is a well-established tool for producing comprehensive assessments of severity and disability associated with dyskinesia in patients with Parkinson's disease (PD). The scale was originally developed in English, and a broad international effort has been undertaken to develop and validate versions in additional languages. Our aim was to validate the Hebrew version of the UDysRS. ***Methods:*** We translated the UDysRS into Hebrew, back-translated it into English, and carried out cognitive pretesting. We then administered the scale to non-demented native Hebrew-speaking patients who fulfilled the Brain Bank diagnostic criteria for probable PD ($n = 250$). Data were compared to the Reference Standard data used for validating UDysRS translations. ***Results:*** The different portions of the Hebrew UDysRS showed high internal consistency ($\alpha \geq 0.92$). A confirmatory factor analysis in which we compared the Hebrew UDysRS to the Reference Standard version produced a comparative fit index (CFI) of 0.98, exceeding the threshold criterion of CFI > 0.9 indicating factor validity. A secondary exploratory factor analysis provided further support to the consistency between the factor structures of the Hebrew and Reference Standard versions of the UDysRS. ***Conclusion:*** The UDysRS Hebrew version shows strong clinimetric properties and fulfills the criteria for designation as an official International Parkinson and Movement Disorder Society-approved translation for use in clinical and research settings.



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## Introduction

Parkinson's disease (PD) is one of the most common neurodegenerative disorders in the elderly, second only to Alzheimer's. Levodopa, introduced in 1959, is currently the "gold standard" medication for PD symptoms. Though the drug elicits improvement in symptoms, chronic use of levodopa is associated with eventual appearance of motor complications in up to 94% of patients, and particularly in patients with young-onset PD, long disease duration, high disease severity, long duration of levodopa therapy, or high total levodopa dose [1]. Some of these motor complications are attributable to the wearing-off of the effects of levodopa. Others are drug-induced dyskenesias [2], a class of movement disorders that includes chorea, dystonia, ballism, myoclonus, and akathisia [3].

Currently, the scale that is most commonly used to assess dyskinesia severity and associated disability is the Unified Dyskinesia Rating Scale (UDysRS). This scale, which was validated in 2008 [4], was developed on the basis of several predecessors, including the Lang-Fahn Scale, the Unified Parkinson's Disease Rating Scale Part IV, the Abnormal Involuntary Movement Scale, and the Rush Dyskinesia Rating Scale, among others. None of these prior scales, on its own, was sufficient to capture all key elements of dyskinesia (anatomical distribution, phenomenology, duration, intensity, functional disability, relationship to ON or OFF state, and patient perception) [5, 7–9]. The International Parkinson and Movement Disorder Society (MDS) has determined that the UDysRS has excellent clinimetric properties and is a reliable, valid tool for assessing dyskinesia in PD patients [10].

The UDysRS was developed in English, and the MDS has initiated a broad international effort to develop and validate versions of the scale in additional (non-English) languages. Thus far, official translations of the UDysRS have been produced in Chinese (traditional), French, German, Greek, Hungarian, Italian, Japanese, Korean, Portuguese, Russian, Slovak, Spanish, and Turkish [11]. Herein, we aim to validate the Hebrew version of the UDysRS to explore its dimensionality and to compare it to that of the Spanish version of the UdysRS, which is the Reference Standard for UdysRS translations [12].

## Materials and Methods

*Overview of the English-Language Version of the UDysRS*

The UDysRS is made up of 4 parts. Each part consists of several items, each of which is scored on a Likert scale from 0 (normal) to 4 (severe). Parts I and II are administered to the PD patient and refer to the patient's subjective experiences in the previous week (*Part I*: patient's subjective perception of frequency and activities-of-daily-life influence of ON-dyskinesia; *Part II*: patient's subjective perception of the frequency and impact of OFF-dystonia). Parts III and IV are completed by an objective rater (*Part III*: objective assessment of dyskinesia – severity, anatomical distribution, and type – in 4 activities observed at the clinic (or video recorded); *Part IV*: disability assessment based on Part III). Total scores range from 0 to 44 for Part I, 0–16 for Part II, 0–28 for Part III, and 0–16 for Part IV, with a total score range of 0–104. The UDysRS was designed to be understandable from a patient/caregiver point of view, with vocabulary and grammar adapted to seventh-grade reading levels.

*Translation of the UDysRS*

The UDysRS was translated into Hebrew by a team of investigators led by Drs. Giladi and Gurevich. Next, colleagues who had not been involved in the translation process and who were fluent in English and Hebrew back-translated the Hebrew version into English. The back-translation was reviewed by the US team (Stebbins, Goetz, LaPelle, and Tilley).

*Cognitive Pretesting*

Cognitive pretesting is a qualitative approach used to assess various aspects of examiners' and respondents' perceptions of a task, including difficulty level, respondent interest, attention span, discomfort, and comprehension [13]. We carried out a cognitive pretesting procedure to further investigate several items on the scale and specifically (1) items that were identified as different between the back-translated Hebrew version and the English version and (2) items that had been flagged as raising concerns in cognitive pretesting of the English version. The following items were included in the pretesting procedure: Instructions to Raters and Instructions to Patients, Time Spent with Dyskinesia, Chewing and Swallowing, Exciting or Emotional Settings, Effects of Spasms or Cramps Separate from Pain on Activities, Objective Impairment Ratings, and Objective Disability Ratings.

We carried out a first round of cognitive pretesting with 10 patients and 3 raters. This round revealed several minor issues for one set of instructions for the raters. Slight modifications were made to the translation on the basis of this feedback. We then carried out an additional round of cognitive pretesting, with a new set of 3 raters. No problems were identified in this round. Thus, we proceeded to test the translated scale in a larger group of PD patients.

*Participants and Procedure*

Hebrew-speaking PD patients from the Movement Disorder Unit of the Tel Aviv Medical Center participated in the study during the years 2014–2018. The study population comprised 250 non-demented patients (66.4% males; mean age 68.5 ± 8.8) who had been diagnosed with PD according to the UK Brain Bank criteria [14] and were being treated with levodopa. This sample size is the same as the sample size used for the Reference Standard (Spanish) version and was based on the requirements for factor analysis (see below) [12]. The mean duration of motor symptoms among patients in the sample was 11.8 ± 6.7 years. Dyskinesia was present in 98.4% of the patients, for 6.7 ± 5.4 years.

**Table 1.** Distribution of scores for each question

| | Median | Min | Max | 25th percentile | 75th percentile |
|---|---|---|---|---|---|
| *Q1 | 2.00 | 0 | 4 | 1.00 | 3.00 |
| Q2 | 1.00 | 0 | 4 | 1.00 | 2.00 |
| Q3 | 1.00 | 0 | 4 | 1.00 | 2.00 |
| Q4 | 2.00 | 0 | 4 | 1.00 | 3.00 |
| Q5 | 2.00 | 0 | 4 | 1.00 | 4.00 |
| Q6 | 2.00 | 0 | 4 | 1.00 | 4.00 |
| Q7 | 3.00 | 0 | 4 | 1.00 | 4.00 |
| Q8 | 2.00 | 0 | 4 | 1.00 | 3.00 |
| Q9 | 2.00 | 0 | 4 | 1.00 | 4.00 |
| Q10 | 2.00 | 0 | 4 | 1.00 | 3.00 |
| Q11 | 2.00 | 0 | 4 | 1.00 | 3.00 |
| *Q12 | 1.00 | 0 | 4 | 0.00 | 3.00 |
| Q13 | 1.00 | 0 | 4 | 0.00 | 3.00 |
| Q14 | 1.00 | 0 | 4 | 0.00 | 3.00 |
| Q15 | 1.00 | 0 | 4 | 0.00 | 3.00 |
| Historical subscore | 26.00 | 1 | 97 | 16.00 | 37.00 |
| Q16 | 2.00 | 0 | 4 | 0.00 | 4.00 |
| Q17 | 2.00 | 0 | 4 | 0.00 | 4.00 |
| Q18 | 2.00 | 0 | 4 | 0.00 | 4.00 |
| Q19 | 2.00 | 0 | 4 | 0.00 | 4.00 |
| Q20 | 1.50 | 0 | 4 | 0.00 | 4.00 |
| Q21 | 2.00 | 0 | 4 | 0.00 | 4.00 |
| Q22 | 2.00 | 0 | 4 | 0.00 | 4.00 |
| Q23 | 1.00 | 0 | 4 | 1.00 | 2.00 |
| Q24 | 2.00 | 0 | 4 | 1.00 | 3.00 |
| Q25 | 2.00 | 0 | 4 | 1.00 | 4.00 |
| Q26 | 2.00 | 0 | 37 | 1.00 | 4.00 |
| Objective subscore | 18.50 | 0 | 85 | 8.00 | 35.75 |
| Total score | 46.00 | 1 | 133 | 27.00 | 71.25 |

* Questions 1 and 12 are excluded from the factor analysis.

*Statistical Analysis*

We performed both descriptive and factor analyses. We used confirmatory factor analysis (CFA) [15, 16] to compare our data to the corresponding Reference Standard data [12]. We used a mean- and variance-adjusted weighted least-squares estimator to confirm model fit and computed the root mean square error of approximation (RMSEA) to check goodness of fit. CFA results were evaluated using the comparative fit index (CFI), where CFI ≥ 0.90 indicated a good fit between the Hebrew UDysRS and the Reference Standard version.

In addition, we carried out an exploratory factor analysis (EFA) to explore the underlying factor structure for the Hebrew version of the scale, using an unweighted least-squares approach. We also carried out an EFA in which we used a scree plot to choose how many factors to retain. For each factor, we retained items with factor loadings of 0.40 or greater. To assist in interpretation of the factors, we used an orthogonal CF-VARIMAX rotation that set the factors to be uncorrelated [17].

To carry out our factor analyses, we used M-plus, version 6.11, as the variables are categorical [18]. We note that, in line with the Reference Standard validation procedure [12], questions 1 and 12 (time of ON-dyskinesia and time of OFF-dystonia, respectively) were considered as descriptive indices of impairment or disability (as opposed to measures) and were omitted from both the EFA and the CFA.

*Ethics*

The study protocol was approved by the Tel Aviv Medical Center IRB committee and in accordance with the Declaration of Helsinki. We obtained participants' signed informed consent prior to data collection. De-identified data (without patient names or medical record numbers) were transmitted for analysis through a secure Web site.

## Results

*Descriptive Statistics and Internal Consistency*

The distributions of participants' answers to each question in the Hebrew version of the UDysRS are presented in Table 1. For parts I and II of the scale (rated by

**Table 2.** Exploratory factor structures of the UDysRS (without "Time Spent with On Dyskinesia" and "Time Spent with Off Dystonia" the same as in the Reference Standard of the MDS UDysRS)

| Item | Item factor loading | |
|---|---|---|
| | Reference Standard | Hebrew |
| *Factor 1* | | |
| Percent variance | 56.0 | 59.1 |
| Speech | 0.63 | 0.68 |
| Chewing/swallowing | 0.65 | 0.67 |
| Eating tasks | 0.77 | 0.78 |
| Dressing | 0.85 | 0.72 |
| Hygiene | 0.81 | 0.68 |
| Handwriting | 0.78 | 0.58 |
| Doing hobbies/activities | 0.74 | 0.73 |
| Walking/balance | 0.75 | 0.61 |
| Public/social | 0.70 | 0.55 |
| Exciting situations | 0.71 | 0.49 |
| *Factor 2* | | |
| Percent variance | 11.5 | 9.5 |
| Face | 0.73 | 0.81 |
| Neck | 0.76 | 0.82 |
| Right hand/arm/shoulder | 0.69 | 0.86 |
| Left hand/arm/shoulder | 0.66 | 0.85 |
| Trunk | 0.75 | 0.84 |
| Right foot/leg/hip | 0.66 | 0.85 |
| Left foot/leg/hip | 0.67 | 0.87 |
| Communication | 0.79 | 0.63 |
| Drinking | 0.78 | 0.66 |
| Dressing | 0.70 | 0.75 |
| Ambulation (walking) | 0.65 | 0.80 |
| *Factor 3* | | |
| Percent variance | 6.5 | 6.2 |
| Dystonia effects on activities (not pain) | 0.89 | 0.80 |
| Effect of pain from dystonia | 0.98 | 0.93 |
| Dystonia pain severity | 0.93 | 0.87 |

MDS, International Parkinson and Movement Disorder Society; UDysRS, Unified Dyskinesia Rating Scale.

patients), the floor effect was 0, the ceiling effect was 0.4%, and Cronbach's alpha was 0.92. For parts III and IV (rated by objective raters), the floor effect was 9.6%, the ceiling effect was 8%, and Cronbach's alpha was 0.96.

*Confirmatory Factor Analysis*

Comparing the factor structures of the Hebrew UDysRS and of the Reference Standard version, we obtained a CFI of 0.98, RMSEA = 0.09 (250 patients) compared to a CFI of 0.98, and RMSEA = 0.08 (250 patients) in the Reference Standard version. This value exceeded our threshold of 0.90, indicating a good fit between the 2 versions of the UDysRS.

*Exploratory Factor Analysis*

The results of our EFA using unweighted least-squares approach suggest some differences between our dataset and the Reference Standard dataset. For example, a factor that explained 59.1% of the variance for the Hebrew version of the scale explained only 56% of variance for the Reference Standard version. However, the factor loading structures in the 2 versions of the UDysRS were quite similar (Table 2). Likewise, the scree plot, from which we extracted 3 factors, suggests that the factor structure of the Hebrew UDysRS is quite consistent with that of the Reference Standard (Fig. 1).

## Discussion and Conclusion

In response to the MDS' initiative to develop and validate non-English-language versions [19] of the UDysRS, this study validated the Hebrew-language version of the scale. Analyzing data from 250 PD patients, we showed that the overall factor structure of the Hebrew UDysRS is consistent with that of the Reference Standard version, producing a CFI of 0.98. An EFA, where variability from sample to sample is expected, identified isolated item differences of factor structure between the Hebrew and Reference Standard versions of the UDysRS. These subtle differences may relate to differences in sample composition (e.g., different genetic status) or cultural differences. Additional sample bias may have resulted from our reliance on data from a single movement disorder center. We note, however, that spoken Hebrew is relatively homogeneous across different regions in Israel, such that it seems improbable that inclusion of data from other centers would have revealed substantial differences in interpretation of the scale. Accordingly, we suggest that the Hebrew-language version fulfills the criteria for designation as the official Hebrew version of the UDysRS, for use in clinical and research settings. As such, it will provide opportunities to contribute data from Hebrew-speaking individuals to large multicenter studies evaluating dyskinesia in PD patients.

## Statement of Ethics

This work was approved by our center's IRB committee. All participants gave their informed consent before their inclusion in the study. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this work is consistent with those guidelines.

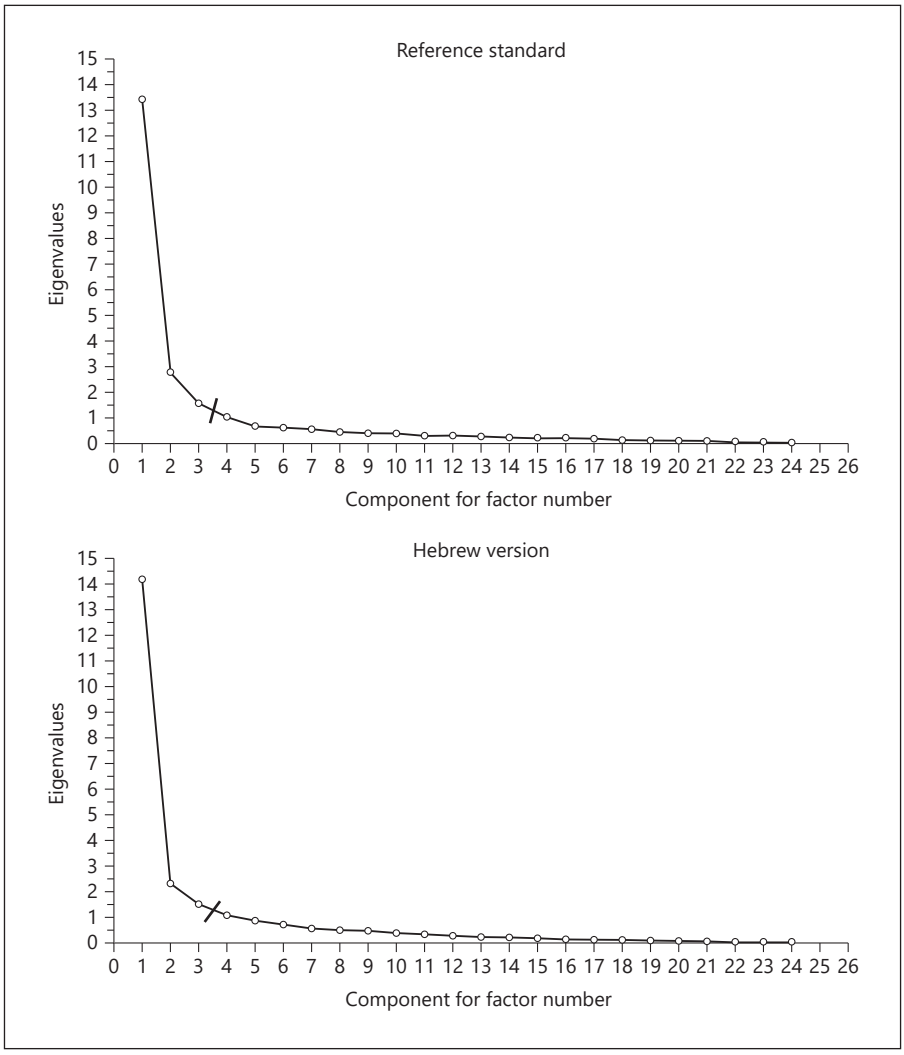


**Fig. 1.** Scree plot for Hebrew dataset (without "Time Spent with On Dyskinesia" and "Time Spent with Off Dystonia" the same as in the Reference Standard of the MDS UDysRS). MDS, International Parkinson and Movement Disorder Society; UDysRS, Unified Dyskinesia Rating Scale.

## Disclosure Statement

The authors declare that there are no conflicts of interest relevant to this work.


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