**BRIEF COMMUNICATION**

# Evaluating the Validity and Reliability of the Korean Version of the Scales for Outcomes in Parkinson's Disease–Cognition

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## ABSTRACT

**Objective**    The Scales for Outcomes in Parkinson's Disease–Cognition (SCOPA-Cog) was developed to assess cognition in patients with Parkinson's disease (PD). In this study, we aimed to evaluate the validity and reliability of the Korean version of the SCOPA-Cog (K-SCOPA-Cog).

**Methods**    We enrolled 129 PD patients with movement disorders from 31 clinics in South Korea. The original version of the SCOPA-Cog was translated into Korean using the translation-retranslation method. The test–retest method with an intraclass correlation coefficient (ICC) and Cronbach's alpha coefficient were used to assess reliability. Spearman's rank correlation analysis with the Montreal Cognitive Assessment-Korean version (MOCA-K) and the Korean Mini-Mental State Examination (K-MMSE) were used to assess concurrent validity.

**Results**    The Cronbach's alpha coefficient was 0.797, and the ICC was 0.887. Spearman's rank correlation analysis revealed a significant correlation with the K-MMSE and MOCA-K scores ($r = 0.546$ and $r = 0.683$, respectively).

**Conclusion**    Our results demonstrate that the K-SCOPA-Cog has good reliability and validity.

**Keywords**    Parkinson's disease; Dementia; Neurocognitive test; Validation study.

## INTRODUCTION

Cognitive impairment is a major nonmotor symptom affecting quality of life in Parkinson's disease (PD) patients.[1] The prevalence of dementia in PD patients is reported to be approximately 30%, and the risk of dementia in individuals with PD is 4–6 times greater than that in the general population.[2] The clinical spectrum of cognitive impairment includes PD-mild cognitive impairment (MCI), Parkinson's disease dementia (PDD), and dementia with Lewy bodies, and the associated criteria are well established.[3,4] In terms of clinical criteria, neuropsychological tests, including screening and the standard battery, are essential for the diagnosis of cognitive dysfunction in PD patients.

Neuropsychological tests usually differ from country to country because of language and cultural differences; therefore, standardization and validation tests are necessary for their use. In Korea, several screening tests for cognition, including the Mini-Mental State Examination (MMSE), have been developed or translated into Korean.[5,6] Most of these tests are designed for Alzheimer's disease and related disorders that focus on cognition. In PDD patients, executive function is usually more prominently impaired than memory or language domains. Therefore, it is not appropriate to investigate PD-MCI and early-stage PDD using these tests. The Movement Disorder Society recommends five scales, including the Dementia Rating Scale, Montreal Cognitive Assessment (MOCA), Parkinson's Disease Cognitive Rating Scale, Mini-Mental Parkinsonism, and the Scales for Outcomes of Parkinson's Disease–Cognition (SCOPA-Cog).[7] Of these, only the MOCA has been translated and used frequently in Korea.

The SCOPA is composed of a rating scale for motor and nonmotor symptoms in PD patients, including autonomic dysfunction, sleep, and psychiatric symptoms. The SCOPA-Cog is part of the SCOPA and consists of 10 items divided into four domains: memory (four items), attention (two items), executive function (three items), and visuospatial function (one item).[8] The optimal cutoff value reported with maximum accuracy is 22/23.[9] While most of the other parts of the SCOPA have been translated into Korean and validated, the SCOPA-Cog has not yet been translated and validated.[10,11] Therefore, in this study, we translated the questionnaire into Korean and investigated the reliability and validity of the Korean version of the SCOPA-Cog (K-SCOPA-Cog).

## MATERIALS & METHODS

### Participant enrollment

This was a nationwide multicenter cross-sectional trial. Participants from 31 movement disorder clinics were enrolled. The inclusion criteria were as follows: 1) patients who were diagnosed with PD according to the United Kingdom Parkinson's Disease Society[12] criteria and 2) patients who received a stable dose of dopaminergic medications. The exclusion criteria were as follows: 1) use of antipsychotic medication due to psychological issues; 2) severe cognitive impairment (MMSE <20); and 3) other neurological diseases, including stroke and Alzheimer's disease. All participants underwent the Unified Parkinson's Disease Rating Scale Part I-III, IV, Hoehn and Yahr stage (H&Y stage), Montreal Cognitive Assessment-Korean version (MOCA-K), Korean Mini-Mental State Examination (K-MMSE), and Korean version of Parkinson's Disease Quality of Life-39 (PDQ-39) tests to assess symptoms of PD. All participants provided informed consent. This study was approved by the Institutional Review Board of Korea University Guro Hospital (IRB no. 2014GR0273).

### Translation process into Korean

The SCOPA-Cog was translated into Korean as follows: two independent bilingual translators translated the English version of the SCOPA-Cog into Korean. The taskforce team, consisting of five authors, reviewed the translated SCOPA-Cog and decided on a single word for the final version. Another bilingual translator back-translated the text into English. Any discrepancies between the original and translated versions were reviewed and corrected. Four patients with PD were interviewed and tested for the pretest of the translated version. Through this process, the final version of the K-SCOPA-Cog was obtained (Supplementary Material in the online-only Data Supplement).

### Statistical analysis

We used the Shapiro–Wilk test for normality of the MOCA-K, K-MMSE, and SCOPA-Cog data. The reliability and validity analyses were performed separately for each domain. To evaluate reliability, we investigated internal consistency using Cronbach's alpha coefficient, which was considered acceptable when the alpha value was 0.7 or higher. We also used test–retest methods for intrarater reliability and obtained intraclass correlation coefficients (ICCs). An ICC >0.70 for the total measurement score was taken as the criterion of acceptable stability. The interval between the test and retest was 10–14 days to minimize memory or practical effects. Concurrent validity is used to assess the degree to which a measurement tool corresponds to that of an established scale measured simultaneously. To assess concurrent validity, the correlations between the SCOPA-Cog and other scales were obtained using Spearman rank correlation coefficients (rs) and nonparametric partial correlation coefficients adjusted for potential confounding variables such as age, disease duration, and education period. To compare two correlation coefficients, Fisher's r-to-z transformation method was used. We also investigated the associations between age, disease duration, years of education, and H&Y stage, which have been reported to be independent predictors of SCOPA-Cog scores.[13]

## RESULTS

In total, 129 patients with PD (63 males, 66 females) were enrolled in this study. The mean Unified Parkinson's Disease Rating Scale Part III and H&Y stage were 19.76 ± 11.19 and 2.11 ± 0.61, respectively. The mean age and education level of the participants were 66.62 ± 8.94 years and 3.01 ± 1.71 years, respectively. The mean K-MMSE and MOCA-K scores were 26.84 ± 3.74 and 22.63 ± 5.05, respectively.

The mean total SCOPA-Cog score was 22.40 ± 6.95, and histogram analysis revealed a normal distribution. Using the D'Agostino-Pearson test for testing normality, the results showed that SCOPA-Cog followed a normal distribution ($p = 0.262$), whereas K-MMSE and MOCA-K did not ($p < 0.001$ and $p = 0.002$, respectively) (Figure 1).

Table 1 presents the results of the reliability and concurrent validity of the SCOPA-Cog. The Cronbach's alpha coefficient for

**Table 1.** Validity and reliability of the K-SCOPA-Cog

| Domain of K-SCOPA-Cog | Reliability | | Validity[†] | |
| --- | --- | --- | --- | --- |
| | ICC | Cronbach's α coefficient if item deleted | K-MMSE | MOCA-K |
| Memory | 0.902** | 0.628 | 0.463** | 0.574** |
| Attention | 0.767** | 0.598 | 0.534** | 0.580** |
| Executive | 0.719** | 0.512 | 0.343** | 0.474** |
| Visuospatial | 0.859** | 0.589 | 0.361** | 0.468** |
| Total | 0.887** | 0.797 | 0.546** | 0.683** |

**$p < 0.01$; [†]non-parametric partial correlation coefficients were adjusted for age, disease duration, and education period. $p$ values were derived from Fisher's r to z transformation method.
K-SCOPA-Cog, Korean version of Scales for Outcomes of Parkinson's Disease-Cognition; ICC, intraclass correlation coefficient; MOCA-K, Montreal Cognitive Assessment-Korean version; K-MMSE, Korean Mini-Mental State Examination.
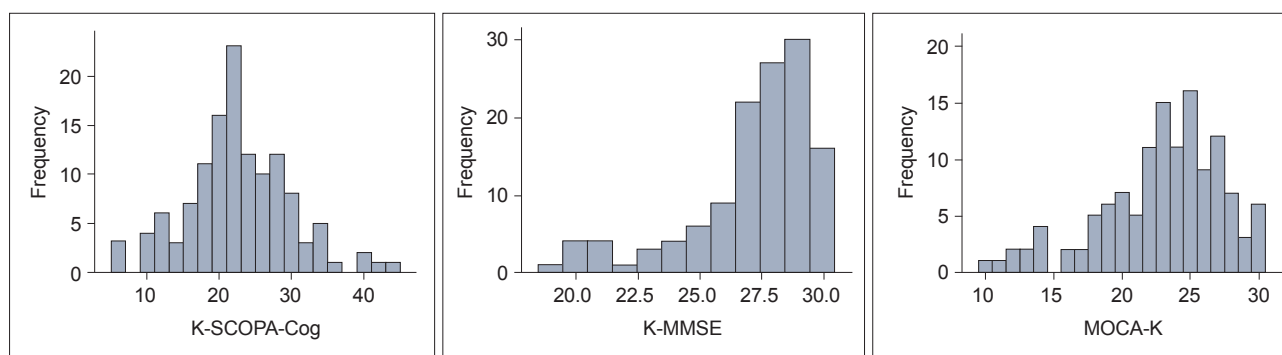


**Figure 1.** Histograms of the distributions of the K-SCOPA-Cog, K-MMSE, and MOCA-K scores. According to the Shapiro–Wilk test, the K-SCOPA-Cog showed a normal distribution ($p = 0.262$); however, the K-MMSE ($p < 0.001$) and MOCA-K ($p = 0.002$) showed a nonnormal distribution. K-SCOPA-Cog, Korean version of the Scales for Outcomes of Parkinson's Disease-Cognition; MOCA-K, Montreal Cognitive Assessment-Korean version; K-MMSE, Korean Mini-Mental State Examination.

total SCOPA-Cog was 0.797, and the range of each domain was from 0.512 to 0.628. The ICC for the intrarater reliability of all items and domains was 0.887, ranging from 0.719 to 0.902.

Spearman's rank correlation analysis revealed that the SCOPA-Cog score was significantly correlated with the K-MMSE ($r = 0.546$, $p < 0.001$) and MOCA-K ($r = 0.683$, $p < 0.001$) scores. However, the correlations of K-MMSE and MOCA-K did not significantly differ (r-to-z transformation $p = 0.078$). Among the demographic data, only age was associated with the SCOPA-Cog score ($r = -0.264$, $p < 0.002$); however, years of education ($r = 0.064$, $p = 0.471$), disease duration ($r = -0.142$, $p = 0.112$), and H&Y stage ($r = 0.044$, $p = 0.635$) were not.

## DISCUSSION

In this study, we translated the SCOPA-Cog into Korean and demonstrated its reliability and validity. Cognitive screening tests are essential for the diagnosis of PDD and PD-MCI, and the SCOPA-Cog is the recommended tool for such conditions.

The Cronbach's alpha coefficient of the total K-SCOPA-Cog was 0.797, which indicates excellent internal consistency. However, the Cronbach's alpha coefficient for each domain did not reach a satisfactory level. These findings align with similar results observed in previous reports of other versions of the SCOPA-Cog.[14] Given that the total score of the SCOPA-Cog is usually used rather than the domain score as a screening tool, the relatively lower Cronbach's alpha coefficient is deemed to be a limitation of the SCOPA-Cog.

The ICCs for all 10 items were high, ranging above 0.7, indicating good intrarater reliability. In the domain-specific analysis, all domains showed statistical significance, with the memory domain exhibiting the highest reliability. This result is also in accordance with a previous report in which the ICC of the original SCOPA-Cog total score was 0.78.[15]

In this study, patients with moderate-to-severe dementia were excluded; therefore, only those with mild-to-moderate cognitive dysfunction (MMSE score >20) were enrolled. Therefore, in the data quality analysis, the K-MMSE showed a ceiling effect with a median value of 28 points. However, the distribution of the SCOPA-Cog differed from that of the K-MMSE and MOCA-K, showing a nonnormal distribution. Consistent with previous results, these findings suggest that the SCOPA-Cog can be used as a screening tool for the detection of early stage cognitive dysfunction in PD patients.[8]

In terms of concurrent validity, the MOCA-K and K-MMSE scores were significantly correlated with the SCOPA-Cog score. It has been reported that the MOCA-K is the most suitable screening tool for cognitive dysfunction in PD patients.[16] The SCOPA-Cog consists of a domain for executive function that is more similar to the MOCA than to the MMSE. Cognitive dysfunction in PD patients is usually prominent in executive function rather than in memory or language functions. However, our results revealed that the correlation with the SCOPA-Cog did not significantly differ between the K-MMSE and MOCA-K. This might be due to selection bias arising from the enrollment of patients with mild cognitive dysfunction according to the inclusion criteria.

This study has several limitations. First, we did not compare the PD-MCI, PDD, or control groups. Therefore, we could not obtain the clinical properties or cutoff scores for screening. Second, because only patients with MCI were included, we could not investigate the validity and reliability of the scale in patients with severe dementia.

In conclusion, the K-SCOPA-Cog showed acceptable reliability and validity, and a normal distribution even in patients with mild cognitive dysfunction. The results of our study support the use of the SCOPA-Cog as a screening tool for cognitive dysfunction in South Korea.

### Conflicts of Interest

Jee-Young Lee, Jinyoung Youn, and Kyum-Yil Kwon, a contributing editor of the *Journal of Movement Disorders*, were not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

### Author Contributions

Conceptualization: Mee Young Park, Jin Whan Cho, Jee-Young Lee, Seong-Beom Koh, Tae-Beom Ahn. Data curation: Jee-Young Lee, Jin Whan Cho, Tae-Beom Ahn, Sang Jin Kim, Sang-Myung Cheon, Joong-Seok Kim, Yoon-Joong Kim, Hyeo-Il Ma, Jong Sam Baik, Phil Hyu Lee, Sun Ju Chung, Jong-Min Kim, In-Uk Song, Han-Joon Kim, Young-Hee Sung, Do Young Kwon, Jae-Hyeok Lee, Ji-Young Kim, Ji Young Yun, Hee Jin Kim, Jin Yong Hong, Mi-Jung Kim, Jinyoung Youn, Ji Seon Kim, Eungseok Oh, Hui-Jun Yang, Won Tae Yoon, Sooyeoun You, Kyum-Yil Kwon, Su-Yun Lee, Younsoo Kim, Hee-Tae Kim, Mee Young Park. Investigation: Jee-Young Lee, Jin Whan Cho, Tae-Beom Ahn, Sang Jin Kim, Sang-Myung Cheon, Joong-Seok Kim, Yoon-Joong Kim, Hyeo-Il Ma, Jong Sam Baik, Phil Hyu Lee, Sun Ju Chung, Jong-Min Kim, In-Uk Song, Han-Joon Kim, Young-Hee Sung, Do Young Kwon, Jae-Hyeok Lee, Ji-Young Kim, Ji Young Yun, Hee Jin Kim, Jin Yong Hong, Mi-Jung Kim, Jinyoung Youn, Ji Seon Kim, Eungseok Oh, Hui-Jun Yang, Won Tae Yoon, Sooyeoun You, Kyum-Yil Kwon, Su-Yun Lee, Younsoo Kim, Hee-Tae Kim, Mee Young Park. Methodology: Jinse Park, Jin Whan

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