



The Penn Parkinson's Daily Activities Questionnaire-15: Psychometric properties of a brief assessment of cognitive instrumental activities of daily living in Parkinson's disease[☆]



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ABSTRACT

Introduction: To describe the psychometric properties of the Penn Parkinson's Daily Activities Questionnaire-15 (PDAQ-15), a 15-item measure of cognitive instrumental activities of daily living for Parkinson's disease (PD) patients derived from the original 50-item PDAQ.

Methods: PDAQ-15 items were chosen by expert consensus. Knowledgeable informants of PD participants ($n = 161$) completed the PDAQ-15. Knowledgeable informants were defined as an individual having regular contact with the PD participant. PD participants were assigned a diagnosis of normal cognition, mild cognitive impairment, or dementia based on expert consensus.

Results: PDAQ-15 scores correlated strongly with global cognition (Dementia Rating Scale-2, $r = 0.71$, $p < 0.001$) and a performance-based functional measure (Direct Assessment of Functional Status, $r = 0.83$; $p < 0.001$). PDAQ-15 scores accurately discriminated between non-demented PD participants (normal cognition/mild cognitive impairment) and PD with dementia (ROC curve area = 0.91), participants with and without any cognitive impairment (normal cognition versus mild cognitive impairment/dementia, ROC curve area = 0.85) and between participants with mild cognitive impairment and dementia (ROC curve area = 0.84).

Conclusions: The PDAQ-15 shows good discriminant validity across cognitive stages, correlates highly with global cognitive performance, and appears suitable to assess daily cognitive functioning in PD.

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1. Introduction

Cognitive impairment in Parkinson's disease (PD) is common and detrimental [1,2]. Cognitive deficits in PD patients with mild cognitive impairment (PD-MCI) impact the ability to perform instrumental activities of daily living (IADLs) [3,4], and impairments in PD dementia (PDD) have profound functional

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consequences [5–7]. Cognitive impairment in PD is a target of therapeutic interventions, and treatment benefits should reflect improvement in cognition *and* function, as required by the Food and Drug Administration (FDA) for new Alzheimer's disease (AD) treatments [8].

The Penn Parkinson's Daily Activities Questionnaire (PDAQ) [9] is an item-response theory (IRT)-based questionnaire designed to assess cognitive IADLs in PD patients across the cognitive spectrum. The PDAQ is a 50-item questionnaire completed by a knowledgeable informant (KI) of a PD patient, such as a spouse, child, or other individual close to the patient (e.g., paid caregiver). Initial psychometric testing of the PDAQ demonstrated strong test-retest reliability, construct validity, and was sensitive and specific to cognitive impairment in PD. The 50-item PDAQ takes approximately 10–15 min to complete, so an abbreviated version of the PDAQ would be useful as a brief instrument of IADL function for use in research and clinical care. We describe the psychometric properties of the PDAQ-15, a brief version of the PDAQ consisting of 15 of the 50 original items.

2. Methods

2.1. Item selection

Of the original 50 PDAQ items, 15 were chosen for inclusion in the PDAQ-15. Items were chosen by three study team members (A.S., J.R. and D.W.) based on 1) face validity for relevance to PDD, 2) diversity of content, and 3) range of difficulty of the activity derived from the original psychometric testing of the PDAQ. The items chosen can be found in [supplementary materials](#) available online. Both the KI version and a version for self-report by PD patients are included. In the present validation study, items were scored based on KI rating of the PD patient's difficulty in performing each IADL on the following scale: “none,” “a little,” “somewhat,” “a lot,” “cannot do.” Each item is scored 0–4 (total score range = 0–60) with higher scores indicating better IADL function.

2.2. Psychometric testing

Agreement between the 50-item and 15-item versions of the PDAQ regarding ability estimates and additive scores (i.e., sum of individual item scores) were confirmed in the 50-item PDAQ development cohort. Subsequently, the PDAQ-15 was validated in the independent cohort described here. KIs completed the PDAQ-15 as part of the annual assessment process for PD patients enrolled in the University of Pennsylvania Morris K. Udall Center. Responses were obtained via paper administration. KIs were defined as an individual having regular contact with the PD patient. PD patients in the Udall Center undergo annual clinical evaluations performed by trained research staff. The University of Pennsylvania Institutional Review Board approved the study. Informed consent was obtained from all participants.

Motor examinations included Part III of the Unified Parkinson's Disease Rating Scale (UPDRS) [10] and Hoehn and Yahr [11] staging. The Mattis Dementia Rating Scale-2 (MDRS-2) [12] was used to assess global cognition. Depression was assessed with the short form of the Geriatric Depression Scale (GDS-15) [13]. Regarding ADL assessment, a well-validated questionnaire developed for AD and commonly used in PD studies (Alzheimer's Disease Cooperative Study-Activities of Daily Living Inventory; ADCS-ADL) [14] was completed by KIs. Additionally, the Direct Assessment of Functional Status (DAFS) [15,16] was administered as a direct measure of everyday functioning in a subset of PD patients. The DAFS is a performance-based assessment of daily functioning

administered in a structured format using props (e.g., checkbook, pillbox). Seven activities are assessed, including time orientation, communication, finances, shopping, grooming, eating, and medication management. The DAFS has demonstrated evidence of construct validity relative to other functional measures in older adults as well as excellent test-retest reliability. All PD patient evaluations were performed while in “on” state. PD participants were assigned a diagnosis of normal cognition, mild cognitive impairment or dementia based on agreement of two experts as part of diagnosis consensus process following the International Parkinson's and Movement Disorder Society guidelines for PD-MCI and PDD [17,18]. Experts involved in the consensus diagnosis process were blinded to PDAQ-15 scores as well as DAFS scores. The consensus diagnostic process has been described in detail in previous publication using the Penn Morris K. Udall cohort [19].

2.3. Statistical analysis

Internal consistency among the PDAQ-15 items was assessed using Cronbach's alpha and item-total correlation analyses. Association between PDAQ-15 scores, 50-item PDAQ-scores and clinical measures were assessed using linear regression and partial correlation analysis using Pearson's coefficient. Correlations between both ability estimates and additive scores were performed for the PDAQ-15 and 50-item PDAQ. Ability estimates are derived from item-response theory and indicate a respondent's location on an underlying, latent trait (here, instrumental activities of daily living with cognitive demands). Additive or observed scores are based on classic test theory, and are simply the sum of a respondent's scored responses. Although the PDAQ-15 is an abbreviated assessment which utilizes additive scoring, it was derived from the 50-item PDAQ which was developed using IRT. Therefore, we provide three indicators of the appropriate use of the shortened version. First, we correlated the ability estimates of both scales, and the additive scores of the scales. We then correlated the ability estimate of the 50-item PDAQ and additive score of the PDAQ-15. This final correlation was performed to determine if the primary 50-item PDAQ outcome was highly correlated with the primary PDAQ-15 outcome.

Regression and partial correlation were utilized to examine association between cognition and directly observed ADL function and the PDAQ-15 adjusting for age, gender, education and measures of motor function (i.e., UPDRS Part III). These analyses were performed to support construct validity and convergent validity of the PDAQ-15 regarding the scale's ability to assess cognitive IADLs relative to established measures of function (ADCS-ADL, DAFS) and cognition (MDRS-2). Additionally, discriminant validity was assessed through examining differences in the strength of correlation among the ADCS-ADL, PDAQ-15 and UPDRS-III motor score. As the ADCS-ADL includes many *basic* ADLs dependent on motor function, the PDAQ-15 focuses on *instrumental* ADLs with a cognitive demand; therefore, these analyses aimed to provide support that the PDAQ-15 may be less affected by motor function than the ADCS-ADL. Receiver operating characteristic (ROC) analyses were performed to measure the ability of the PDAQ-15 to distinguish between subjects with and without dementia (normal cognition/MCI), as well as subjects with MCI versus dementia. Optimal cut-offs were defined as the greatest combined sensitivity and specificity, with sensitivity greater than 80%. All analyses were conducted without adjustment for multiple comparisons at a two-sided alpha = 0.05 significance level. Analyses were carried out using SPSS version 22.

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