ABSTRACT: Mild cognitive impairment is common in nondemented Parkinson’s disease (PD) patients and may be a harbinger of dementia. In view of its importance, the Movement Disorder Society commissioned a task force to delineate diagnostic criteria for mild cognitive impairment in PD. The proposed diagnostic criteria are based on a literature review and expert consensus. This article provides guidelines to characterize the clinical syndrome and methods for its diagnosis. The criteria will require validation, and possibly refinement, as additional research improves our understanding.
In Parkinson’s disease (PD) there is a spectrum of cognitive dysfunction, ranging from mild cognitive impairment (MCI) to PD dementia (PDD). A Movement Disorder Society (MDS) commissioned task force recently evaluated the literature pertaining to mild cognitive impairment in PD (PD-MCI), and determined that MCI is common in nondemented PD patients and is associated with increasing age, disease duration, and disease severity. Moreover, PD-MCI predicts the development of dementia, which can occur in up to 80% of PD patients over the long term.

There has been significant heterogeneity, however, in the definition of PD-MCI and the clinical correlates predicting progression to PDD. A uniform definition of PD-MCI is important, because it will help identify (1) the clinical characteristics of the earliest stage of PD cognitive impairment, (2), the best predictors of conversion from PD-MCI to PDD, (3) the effects of PD-MCI on quality of life and day-to-day functioning, (4) a well-characterized patient population and a potential outcome measure for clinical trials, and (5) a useful clinical entity that will allow clinicians, patients, caregivers, and researchers to communicate better, thereby improving patient care and research efforts. Specific criteria for diagnosing MCI in PD will enable clinicians and researchers to identify patients at increased risk of developing PDD and who may benefit from early interventions. PD-MCI criteria may also facilitate research aimed at determining disease pathogenesis in the earlier stages of disease.

In view of the importance of early recognition of PD-MCI, the MDS Task Force has delineated diagnostic criteria that include (1) characterization of the clinical syndrome and (2) methods for its diagnosis. The proposed criteria are based on a literature review and expert consensus. They will require validation and possibly refinement as additional research improves our understanding of the epidemiology, presentation, neurobiology, assessment, evolution, and treatment of PD-MCI.

**Current Methods of Defining MCI**

Different criteria for defining MCI in the general population have been proposed, and several have undergone revision. MCI criteria by Petersen et al. require (1) a subjective complaint of cognitive decline by the patient, preferably corroborated by a reliable source, (2) minimal effect of the decline on day-to-day functioning and the absence of dementia, and (3) evidence of cognitive abnormalities that cannot be simply attributed to age. Such evidence can be based solely on clinician judgment, although formal neuropsychological testing is deemed helpful. Specific neuropsychological tests and cut-off scores are not stated. Quantitative measurements of function and activities of daily living are not required. Categorization into single-domain, multiple-domain, amnestic, and nonamnestic subtypes is based on the results of neuropsychological testing. Proposed MCI criteria recently developed by the National Institute on Aging and the Alzheimer’s Association MCI criteria committee and the DSM-5 Neurocognitive Disorders Work Group would also allow cognitive decline to be detected by health care providers as an alternative to patient or informant report.

**Methodology**

The MDS Task Force first reviewed literature on the epidemiology and phenomenology of PD-MCI. In December 2010, the MDS Task Force participants held a 2-day in-person meeting to critically review current knowledge on MCI in general and in PD specifically, different PD-MCI subtypes, progression of PD-MCI to PDD, the neurobiology of PD-MCI, the role for biomarkers in the diagnosis of cognitive problems in PD, and methods of cognitive assessment. The primary objective of the task force was to develop criteria for PD-MCI that would best differentiate these patients from those with normal cognition or dementia. Participants summarized the information presented during group discussions and submitted it to the task force chair (I.L.), who developed the initial manuscript draft. This draft was reviewed and revised in an iterative process by the task force members between January and June 2011, including an in-person meeting in June 2011. This article summarizes the task force’s consensus.

**PD-MCI Heterogeneity, Subtypes, and Dementia Risk**

In its first review, the MDS Task Force concluded that PD-MCI is common in nondemented patients (mean prevalence, 27%; range, 19%–38%) and is associated with the subsequent development of PDD.

Key Words: Parkinson’s disease; cognition; mild cognitive impairment; diagnostic criteria; dementia
a range of cognitive domains affected. Overall, non-
amnestic, single-domain impairment (i.e., any single
nonmemory domain) is the most common subtype of
PD-MCI.

Although few studies have evaluated the relationship
between specific PD-MCI subtypes and the develop-
ment of PDD, there is preliminary evidence from pre-
valent cohorts that nonamnestic single-domain MCI
subtype, executive deficits, impaired verbal flu-
cy, visuospatial deficits, and memory and lan-
guage dysfunction all predict PDD. In a population-based,
longitudinal study of incident cases, neuropsychological features with a more posterior
cortical basis were associated with incident dementia,
whereas frontostriatal based deficits were not, thereby suggesting two distinct cognitive syndromes
with potentially different etiologies and prognoses.

PD-MCI Criteria

PD-MCI is a syndrome defined by clinical, cognitive,
and functional criteria (Table 1). The proposed MDS
Task Force criteria are rooted in the MCI criteria pre-
viously described, but modified to address issues rela-
tively specific to PD. The criteria were also designed
to be consistent with the MDS proposed PDD criteria
and thereby allow transitions between categories of
normal cognition, MCI, and dementia. Similarly,
the proposed PD-MCI criteria utilize a two-level
operational schema depending on the comprehensiv-
ness of neuropsychological testing. Level I and II
categories both represent PD-MCI, but differ regarding
method of assessment, level of diagnostic certainty,
and extent of clinical characterization.

The criteria are also designed to be applicable to a
range of populations, including patients of different
ethnic and educational backgrounds, and be reliable
and valid for MCI definition in clinical trials and lon-
gitudinal studies wherein MCI is an outcome measure
or an inclusion/exclusion criterion. The following sec-
tions outline proposed criteria for PD-MCI, guidelines
for level I and II diagnostic categories, and considera-
tions entertained in developing these criteria.

Inclusion Criteria

First, the diagnosis of PD must be clinically estab-
lished (Table 1). PD-MCI is characterized by an insidi-
ous decline in cognitive abilities caused primarily by
the underlying disease process. The cognitive decline
may be reported by either the patient or informant, or
observed by the clinician. This allows for the greatest
sensitivity in detecting cognitive decline. Cognitive def-
icits should be present on testing, and specific recom-
mendations are presented for diagnosing PD-MCI
with subtyping (Appendix A; Tables 2 and 3). Finally,
cognitive deficits should not interfere significantly with
functional independence.

Exclusion Criteria

Exclusion criteria include parkinsonism other than idio-
pathic PD, fulfillment of MDS criteria for PDD, other
plausible primary explanations for cognitive deterioration,
and other PD-associated comorbidities that, in the opinion

<table>
<thead>
<tr>
<th>TABLE 1. Criteria for the Diagnosis of PD-MCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Inclusion criteria</td>
</tr>
<tr>
<td>- Diagnosis of Parkinson’s disease as based on the UK PD Brain Bank</td>
</tr>
<tr>
<td>- Gradual decline, in the context of established PD, in cognitive ability reported by either the patient or informant, or observed by the clinician</td>
</tr>
<tr>
<td>- Cognitive deficits on either formal neuropsychological testing or a scale of global cognitive abilities (detailed in section III)</td>
</tr>
<tr>
<td>- Cognitive deficits are not sufficient to interfere significantly with functional independence, although subtle difficulties on complex functional tasks may be present</td>
</tr>
<tr>
<td>II. Exclusion criteria</td>
</tr>
<tr>
<td>- Diagnosis of PD dementia based on MDS Task Force proposed criteria</td>
</tr>
<tr>
<td>- Other primary explanations for cognitive impairment (e.g., delirium, stroke, major depression, metabolic abnormalities, adverse effects of medication, or head trauma)</td>
</tr>
<tr>
<td>- Other PD-associated comorbid conditions (e.g., motor impairment or severe anxiety, depression, excessive daytime sleepiness, or psychosis)</td>
</tr>
<tr>
<td>- In the opinion of the clinician, significantly influence cognitive testing</td>
</tr>
<tr>
<td>III. Specific guidelines for PD-MCI level I and level II categories</td>
</tr>
<tr>
<td>A. Level I (abbreviated assessment)</td>
</tr>
<tr>
<td>- Impairment on a scale of global cognitive abilities validated for use in PD or</td>
</tr>
<tr>
<td>- Impairment on at least two tests, when a limited battery of neuropsychological tests is performed (i.e., the battery includes less than two tests within each of the five cognitive domains, or less than five cognitive domains are assessed)</td>
</tr>
<tr>
<td>B. Level II (comprehensive assessment)</td>
</tr>
<tr>
<td>- Impairment on at least two neuropsychological tests, represented by either two impaired tests in one cognitive domain or one impaired test in two different cognitive domains</td>
</tr>
<tr>
<td>- Impairment on neuropsychological tests may be demonstrated by:</td>
</tr>
<tr>
<td>o Performance approximately 1 to 2 SDs below appropriate norms</td>
</tr>
<tr>
<td>o Significant decline demonstrated on serial cognitive testing</td>
</tr>
<tr>
<td>o Significant decline from estimated premorbid levels</td>
</tr>
<tr>
<td>IV. Subtype classification for PD-MCI (optional, requires two tests for each of the five cognitive domains assessed and is strongly suggested for research purposes)</td>
</tr>
<tr>
<td>- PD-MCI single-domain—abnormalities on two tests within a single cognitive domain (specify the domain), with other domains unimpaired or</td>
</tr>
<tr>
<td>- PD-MCI multiple-domain—abnormalities on at least one test in two or more cognitive domains (specify the domains)</td>
</tr>
</tbody>
</table>

*See Table 2. Examples of scales of global cognitive abilities validated in PD. |
*See Table 3. Examples of neuropsychological tests for the five cognitive domains. |
*Subtype classifications are applicable only to those PD-MCI who have had at least two tests within each of the five cognitive domains administered. |
of the clinician, may have significantly influenced cognitive testing (see Table 1 for specific examples).

### Specific Guidelines for PD-MCI Level I and Level II Categories

**Level I (Abbreviated Assessment, Possible PD-MCI)**

The level I category allows for the diagnosis of PD-MCI based on an abbreviated cognitive assessment, because comprehensive testing may not always be practical or available. Level I criteria provide less diagnostic certainty than level II. The requirements for level I are impairment on a scale of global cognitive abilities validated for use in PD (Table 2; and see cut-off guidelines for global cognitive tests21–25) or impairment of a limited battery of neuropsychological tests (e.g., including only one test per cognitive domain or those assessing fewer than five cognitive domains). Identical to the MDS PDD operational criteria, the relevant cognitive domains

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**TABLE 2. Examples of Neuropsychological Scales for Assessing Global Cognitive Abilities and Estimating Premorbid Intelligence**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Neuropsychological Tests40</th>
<th>Estimated Time of Test, min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global cognition</td>
<td>MoCA22,58</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>PD-CRS24,59</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>SCOPA-COG59,60</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>MDRS22,59,61</td>
<td>20 to 30</td>
</tr>
<tr>
<td>Estimated premorbid</td>
<td>NART40</td>
<td>5</td>
</tr>
<tr>
<td>intelligence</td>
<td>WTAR40</td>
<td>5</td>
</tr>
</tbody>
</table>

Some of these tests are copyrighted and require permission from the authors to be used. The PD-CRS is a scale owned by the Movement Disorders Society (see www.movementdisorders.org/publications/rating_scales/).

*See also reference no. 57.

**TABLE 3. Examples of Tests for Cognitive Domains and Estimated Time**

<table>
<thead>
<tr>
<th>Cognitive Domain</th>
<th>Neuropsychological Tests40</th>
<th>Estimated Time of Test, min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention and working memory</td>
<td>WASI-IV (or earlier version) Letter Number Sequencing</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>WASI-IV Coding (or earlier version) or other substitution task, written or oral</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Trail Making Test48</td>
<td>5 to 10</td>
</tr>
<tr>
<td></td>
<td>Digit span backward or digit ordering</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Stroop color-word test</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>WAIS-IV (or earlier version) Similarities</td>
<td>10 to 15</td>
</tr>
<tr>
<td></td>
<td>Confrontation naming task, such as Boston Naming Test (or short-form validated in PD) or Graded Naming Test</td>
<td>5 to 15</td>
</tr>
<tr>
<td>Executive function</td>
<td>Wisconsin Card Sorting Test (CST), or modified CST (Nelson’s modification)</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Tower of London test–Drexel version, or Stockings of Cambridge (CANTAB)</td>
<td>10 to 15</td>
</tr>
<tr>
<td></td>
<td>Verbal fluency test, such as letter fluency (COWAT or similar tests), category fluency (animals, supermarket, or similar), or alternating fluency tasks (if a well-standardized version is used). Not more than one verbal fluency test abnormality should be used to satisfy the MCI criterion of two abnormal test performances because of the strong relationship among these tests; 10 points Clock Drawing Test</td>
<td>5</td>
</tr>
<tr>
<td>Language</td>
<td>WASI-IV (or earlier version) Similarities</td>
<td>10 to 15</td>
</tr>
<tr>
<td></td>
<td>Confrontation naming task, such as Boston Naming Test (or short-form validated in PD) or Graded Naming Test</td>
<td>5 to 15</td>
</tr>
<tr>
<td>Memoryb</td>
<td>Word list learning test with delayed recall and recognition conditions, such as Rey’s Auditory Verbal Learning Test, California Verbal Learning Test, Hopkins Verbal Learning Test, and Selective Reminding Test</td>
<td>10 to 20</td>
</tr>
<tr>
<td></td>
<td>Prose recall test with a delayed recall condition, such as Wechsler Memory Scale-IV Logical Memory subtest (or earlier version) or Rivermead Behavioural Memory Test paragraph recall subtest</td>
<td>10 to 15</td>
</tr>
<tr>
<td></td>
<td>Brief Visuospatial Memory Test–Revised (BVMT-R)</td>
<td>10 to 15</td>
</tr>
<tr>
<td>Visuospatialc function</td>
<td>Benton’s Judgment of Line Orientation</td>
<td>5 to 10</td>
</tr>
<tr>
<td></td>
<td>Hooper Visual Organization Test</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Clock copying (e.g., Royall’s CLOX)</td>
<td>5</td>
</tr>
</tbody>
</table>

Two highly similar tests (e.g., two list learning tests or two story recall tests) should not be used to meet the MCI criterion of two test-score abnormalities. Similarly, highly correlated scores from the same test (e.g., immediate and delayed recall of a word list) should not be used to meet the criterion of two test abnormalities. Abnormality of two highly correlated scores only increases confidence in the existence of impairment.

*See also reference no. 40 for references.

**Level II Categories**

Level II categories, which allow for more comprehensive cognitive assessment, are further divided into Level II A and Level II B, depending on the number of abnormalities that meet the MCI criteria. Level II A categories require two test abnormalities, whereas Level II B categories require three or more test abnormalities. The specific guidelines for Level II categories are provided in the MDS PDD operational criteria.

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are attention and working memory as well as executive, language, memory, and visuospatial functions (see Table 3 for examples of tests to assess these domains). When a limited battery of neuropsychological tests is performed, impairment must be present on at least two tests to diagnose PD-MCI by level I criteria. Level I criteria do not allow complete subtyping of PD-MCI.

**Level II (Comprehensive Assessment)**

For the diagnosis of PD-MCI by level II criteria and PD-MCI subtyping, the task force recommends formal, comprehensive neuropsychological testing that includes at least two tests for each of the five cognitive domains previously listed. Impairment should be present on at least two tests, either within a single cognitive domain or across different cognitive domains. Impairment on neuropsychological tests may be demonstrated in several ways: performance between 1 to 2 standard deviations (SDs) below age, education, gender, and culturally appropriate norms, significant decline on serial cognitive testing, or significant decline from estimated premorbid levels. In a patient who does not score 1 SD below the normative mean but who reports a change in cognition and has undergone serial neuropsychological testing, a significant (i.e., at least 1 SD or exceeding the reliable change index [RCI]; Appendices B and C) deterioration in cognition over time is acceptable to diagnose PD-MCI. The use of two tests in each cognitive domain (minimum of 10 tests) for the level II category addresses all cognitive domains equally, can increase sensitivity, and allow full subtyping of PD-MCI.

**Subtype Classification for PD-MCI**

Classification of PD-MCI subtypes is important for research purposes and to explore whether impairments in different cognitive domains have a different neurobiological substrate and course. To classify PD-MCI as single or multiple domain, comprehensive neuropsychological testing with at least two tests per cognitive domain must be performed (level II). Presence of two abnormal tests within a single cognitive domain, with the other domains unimpaired, represents a single-domain subtype. If at least one test in two or more cognitive domains is impaired, then PD-MCI should be subtyped as multiple domain. The decision to require an impairment of at least one test in two or more cognitive domains for PD-MCI multiple domain was based on previous studies that show that more stringent requirements (i.e., a total of four abnormal tests, two tests in two domains) would significantly decrease sensitivity to enhance specificity, which could adversely affect epidemiological studies. The proposed criteria recommend specification of the affected domain(s), rather than using amnestic or nonamnestic terminology, so that potential differences among subtypes may be better studied. Examples of subtype designation would be PD-MCI single domain (i.e., executive) or PD-MCI multiple domain (i.e., memory, visuospatial). Appendix C gives examples of applications of PD-MCI criteria.

**Discussion**

Diagnostic criteria for PD-MCI are justified for several reasons. Recent studies in incident and cross-sectional PD cohorts have revealed the extent and nature of cognitive dysfunction in nondemented PD patients. Prospective studies to better understand the course, associated features, and consequences of such cognitive deficits, as well as improved ways to investigate therapeutic interventions in such patients, are underway. For research purposes, uniform criteria will allow clearly defined patient populations to be included in such studies. For clinical purposes, physicians and patients can use this designation to validate that cognitive impairment exists, but not to the extent of being labeled dementia.

**Terminology**

The term MCI, as applied to the general population, denotes a state of impaired cognitive function without attribution of underlying etiology. As such, MCI is a syndrome and, in many patients, a transitional state. Other terms have also been used to define cognitive impairment in nondemented patients. The task force chose to use the term PD-MCI, given its current use in PD literature.

**Reports of Cognitive Decline**

Empirical evidence to address how to best capture subjective reports of disability is limited. Given these uncertainties, the task force criteria recommend the inclusion of reports of cognitive decline made by either the patient, informant, or clinician observer to increase the likelihood of capturing a change in cognitive function. However, PD patients and their caregivers may both over- and underreport cognitive impairment, and instruments that can reliably assess decline are needed.

To diagnose PD-MCI, cognitive decline should occur within the context of clinically diagnosed PD. In some cases, however, the onset of mild cognitive impairment relative to the motor symptoms is historically vague, and in other cases, cognitive symptoms occur concurrently. In these scenarios, differentiating PD-MCI from incipient dementia with Lewy bodies (DLB) can be challenging. More research is needed to establish the boundaries between incipient DLB and PD-MCI. Careful clinical and neuropsychiatric assessments and longitudinal evaluations will be needed to establish accurate diagnoses.

**Absence of Significant Functional Decline**

Existing MCI criteria do not specify how to document the absence of marked functional decline (e.g., observation, interview, self-report, or rating scales), but emphasize the absence of significant functional impairment resulting from cognitive impairment as the primary feature that differentiates MCI from dementia.
A broad survey of key functional areas, such as management of medications or finances, should be considered, because impairments in different cognitive domains of MCI may be associated with reduced performance in different aspects of day-to-day functioning. There are challenges in separating contributions of cognitive or motor deficits to functional tasks in PD, and this area requires additional study.

**PD-Associated Comorbidities**

Mood disorders, apathy, psychosis, and rapid eye movement sleep behavior disorder (RBD) are common in PD and may impair cognition or be associated with dementia. Moreover, anxiety and cognitive slowing during “off” periods can adversely affect neuropsychological test performance. Thus, patients with motor fluctuations should ideally be assessed in the “on” state, be devoid of anticholinergic medication (or other drugs known to have an effect on cognition), and not have nonmotor features deemed sufficiently severe to invalidate the results of the neuropsychological evaluation. It is the responsibility of the person administering the neuropsychological instruments to judge the extent to which such symptoms might interfere with the testing.

Although the task force maintains consistency with the MDS PDD criteria, in the proposed PD-MCI criteria, the presence of prominent behavioral features, such as psychosis or severe depression, preclude a reliable diagnosis of PD-MCI. Should these symptoms be present, patients should be retested when they have improved or when symptoms have resolved. Apathy may interfere with testing and frequently co-occurs with PDD. The clinician should judge whether specific cognitive deficits exist in addition to apathy, or whether cognitive impairment is only secondary to reduced motivation or effort. Furthermore, although psychosis, RBD, and apathy have been associated with cognitive impairment or development of PDD, there is insufficient evidence to recommend that the presence of these symptoms strongly supports a diagnosis of PD-MCI.

**Neuropsychological Evaluation**

**Cognitive Domains and Tests**

Although assigning various cognitive tasks to domains is somewhat arbitrary, it is critical for research purposes. The task force followed the general conventions of clinical neuropsychology and cognitive neuroscience and of cognitive research in PD in particular. Examples of tests used in PD for global cognitive abilities and cognitive domains are provided (Tables 2 and 3).

The task force recommends the use of at least two tests in each cognitive domain for the diagnosis of PD-MCI (level II). Though the optimal number of neuropsychological tests within a given cognitive domain likely depends on the choice of tests and their sensitivity, Schinka et al. demonstrated that the diagnosis of MCI based on two tests per domain is probably more valid than when one test per domain is used. An excessive or imbalanced number of tests per domain, however, might bias both diagnosis and subtyping of PD-MCI. Additional research on the optimal number and type of tests per cognitive domain and how this affects PD-MCI classification is needed. The recommendation to use two tests in each of the five cognitive domains is particularly applicable to research studies, because this will allow for full subtyping of PD-MCI and permit greater sensitivity in epidemiological studies. It is anticipated that when sufficient research has been completed, the domains and numbers of tests required for a diagnosis of PD-MCI may be modified to make it easier to apply the criteria in clinical practice.

**Assessment of Premorbid Functioning**

Whether or not a patient is cognitively impaired is judged against the background of his or her premorbid level of functioning, as well as demographic corrections and the psychometric characteristics of the tests used. If premorbid cognitive evaluation is available, test performance may be compared with previous scores, taking into account measurement error, retest effects, and errors resulting from multiple comparisons.

Information on handling measurement errors with RCI's is provided (see Appendix B).

Estimated premorbid levels may be based on demographic characteristics (e.g., education level and occupation) and reading ability and vocabulary using tests such as the National Adult Reading Test (NART) and Wechsler Test of Adult Reading (WTAR). These tests allow reasonably accurate estimates of verbal intelligence and are quite insensitive to cerebral deterioration in the absence of aphasia or marked dysarthria.

Following the DSM-5 draft criteria for a mild neurocognitive disorder, stronger evidence of cognitive decline comes from having previous test data on patients. Consequently, the task force advocates neuropsychological evaluation early in the course of PD to establish baseline cognitive abilities. When such baseline data are available, subsequent scores would ideally be compared to the baseline performance and converted to an RCI or similar construct that considers test-retest reliability and potential practice effects.

**Cutoffs for Neuropsychological Tests and Domains**

Studies of MCI have commonly utilized a range of cut-off scores at 1 to 2 SDs or more below the mean using normative data. One issue in using a rigid cut-off score, such as −1.5 SD, is that high-functioning people (e.g., those scoring at least 0.5 SD above the mean relative to an appropriate normative sample premorbidly) would have to experience a decline of >2 SDs to meet a −1.5-SD cutoff. Assuming a normal distribution of test
scores, 30% of people scoring 0.5 SD or more above the mean premorbidly would not be detected as having experienced a marked decline in cognition, even with a 1.5-SD decline in performance (i.e., false negatives), whereas 7% scoring 1.5 or more SD below the mean premorbidly would be falsely assumed to have cognitive decline, even without any change in performance over time (i.e., false positives). The requirement for impaired performance on at least two tests reduces the risk for false positives, but not false negatives.

Differences in cut-off scores utilized have led to a wide range of prevalence estimates for PD-MCI, and one study found that the best criterion to minimize the inclusion of cognitively normal patients as having MCI was to require deficits of at least -1.5 SD in two scores within any single domain (resulting in 30% PD-MCI) or deficits of at least -1.5 SD in two scores from different domains (37% PD-MCI). The proposed PD-MCI criteria are consistent with these cut-off scores, but because of potential differences among tests and premorbid patient function, we propose a less-rigid recommendation of a range of 1 to 2 SDs below appropriate norms.

**Motor Impairment and Neuropsychological Testing**

Some of the recommended neuropsychological tests contain relatively simple conditions that require timed motor responses. Standard scores of these simple conditions may be used to take pure motor slowing into account (Table 3). Nonetheless, it is recommended that patients be tested in their optimal motor state, using tests that minimize motor demands.

**Incorporation of Biomarkers in Criteria**

Molecular and imaging biomarkers have been studied in PD-associated cognitive impairment. Most studies, however, have been small and have lacked detailed neuropsychological testing, prospective longitudinal evaluations, and independently validated data. Therefore, the task force does not recommend the inclusion of biomarkers as part of the PD-MCI criteria at this time, although future validation of biomarker candidates is highly desired and may lead to revised criteria. An anticipated biomarker for PD-MCI should be detectable at diagnosis, easily and widely accessible, and validated in independent cohorts. There is a need for prospective, longitudinal assessments of accessible biomarkers (including cerebrospinal fluid, blood, and neuroimaging) that also incorporate neuro-pathological correlation. Though the National Institute on Aging Alzheimer's Association MCI criteria committee has incorporated biomarkers into research criteria for MCI and Alzheimer's disease, the field of PD has not advanced sufficiently to consider biomarkers as criteria for cognitive decline at present.

To summarize, there are several differences between the diagnostic criteria proposed by the MDS and other established criteria, such as Petersen's original MCI criteria: (1) MCI is defined within the context of an existing etiology, namely PD; (2) PD-MCI includes not just "memory" complaints, but also other cognitive changes; (3) cognitive decline can be noted by different sources; (4) PD-MCI must have deficits on either formal neuropsychological testing or a test of global cognitive abilities; (5) specific level I and II categories are outlined, including the number of domains, tests per domain, and cut-off scores suggested; and (6) subtyping is recommended only for evaluations in which two neuropsychological tests for each of the five domains are assessed and is strongly suggested for research purposes.

In conclusion, the proposed MDS Task Force PD-MCI criteria provide a uniform method by which to characterize and diagnose MCI in PD, providing a framework to advance our understanding of the epidemiology, presentation, neurobiology, assessment, and treatment of PD-MCI. Studies are needed to validate the proposed PD-MCI criteria, and further refinement may be necessary as additional research on PD-MCI is conducted.

**References**


