**Supplementary Material**

**Methods**

**Cognitive Status**

 **Neuropsychological Assessment.**

We substituted three neuropsychological tests for those recommended, as seen in Table S1. Objective cognitive impairment was defined using the cut-off scores (1.5 SD or 2.0 SD) below age- and, when available, education-adjusted norms (see Table S1).

 **Prediction of MD-Diagnosed Dementia**

 We elected to perform additional analyses in which each classification of PD-MCI predicted a common dementia outcome (e.g., as opposed to DRS-classified PD-MCI predicting DRS-classified PDD). Dementia classification at wave 3 was based on modified DSM-IV criteria and independent of neuropsychological testing as previously published (Camicioli et al. 2011). We performed these analyses for PD patients only.

**Results**

 **Prediction of MD-Diagnosed Dementia**

 The following results are summarized in Table S2.

First, we investigated if MDS 1.5 classification at wave 1 predicts clinician-diagnosed dementia at wave 3. Of the 27 classified as PD-CN with the MDS 1.5 at baseline, (a) 21 (77.8%) were classified as PD-CN and (b) 5 (18.5%) were classified as PDD by the MD at wave 3 (1 of those that converted to PDD was classified as PD-MCI with MDS 1.5 criteria at wave 2.). The remaining 1 (3.7%) dropped out of the study before wave 3. Of the 24 classified as PD-MCI with MDS 1.5 criteria at baseline, (a) 15 (62.5%) were classified as PDD and (b) 7 (29.2%) were classified as PD-CN by the MD at wave 3 (3 of those that reverted were classified as PD-CN by MDS 1.5 criteria at wave 2). The remaining 2 (8.3%) dropped out of the study before wave 3. In sum, a PD-CN diagnosis with MDS 1.5 criteria at wave 1 predicts future MD-diagnosed cognitive stability 77.8% of the time whereas a PD-MCI diagnosis with MDS 1.5 criteria at wave 1 predicts future MD diagnosis of PDD status or study drop out 70.8% of the time.

 Second, we investigated if MDS 2.0 classification at wave 1 predicts clinician-diagnosed dementia at wave 3. Of the 35 classified as PD-CN with MDS 2.0 at baseline, (a) 28 (80.0%) were classified as PD-CN and (b) 6 (17.1%) were classified as PDD by the MD at wave 3. The remaining 1 (2.9%) dropped out of the study before wave 3. Of the 16 classified as PD-MCI with MDS 2.0 criteria at baseline, (a) 14 (87.5%) were classified as PDD and (b) 0 were classified as PD-CN by the MD at wave 3. The remaining 2 (12.5%) dropped out of the study before wave 3. In sum, a PD-CN diagnosis with MDS 2.0 criteria at wave 1 predicts future MD-diagnosed cognitive stability 80.0% of the time whereas a PD-MCI diagnosis with MDS 2.0 criteria at wave 1 predicts future MD diagnosis of PDD status or study drop out 100.0% of the time.

Third, we investigated if CDR classification at wave 1 would predict clinician-diagnosed dementia at wave 3. Of the 43 PD participants classified as PD-CN at baseline, (a) 26 (60.5%) were classified as PD-CN and (b) 15 (34.9%) were classified as PDD by the MD at wave 3 (6 of those that converted to PDD were diagnosed as PD-MCI or PDD with the CDR at wave 2.). The remaining 2 (4.7%) dropped out of the study before wave 3. Of the 8 classified as PD-MCI with the CDR at baseline, (a) 5 (62.5%) were classified as PDD and (b) 2 (25.0%) were classified as PD-CN by the MD at wave 3. The remaining 1 (12.5%) dropped out of the study before wave 3. In sum, PD-CN diagnosis with the CDR at wave 1 predicts future MD-diagnosed cognitive stability 60.5% of the time whereas a PD-MCI diagnosis with the CDR at wave 1 predicts future MD diagnosis of PDD status or attrition 75.0% of the time.

Fourth, we investigated if DRS classification at wave 1 predicts clinician-diagnosed dementia at wave 3. Of the 28 classified as PD-CN with the DRS at baseline, (a) 21 (75.0%) were classified as PD-CN and (b) 7 (25.0%) were classified as PDD by the MD at wave 3 (3 of those that converted to PDD were classified as PD-MCI with the DRS at wave 2). Of the 23 classified as PD-MCI with the DRS at baseline, (a) 13 (56.5%) were classified as PDD and (b) 7 (30.4%) were classified as PD-CN by the MD at wave 3 (3 of those that reverted to PD-CN were classified as PD-CN with the DRS at wave 2). The remaining 3 (13.0%) dropped out of the study before wave 3. In sum, a PD-CN diagnosis with the DRS at wave 1 predicts future MD-diagnosed cognitive stability 75.0% of the time whereas a PD-MCI diagnosis with the DRS at wave 1 predicts future MD diagnosis of PDD status or study drop out 69.5% of the time.

**References**

Benedict, R. H. B. (1997). *Brief Visuospatial Memory Test—Revised: Professional Manual*. Odessa, FL: Psychological Assessment Resources, Inc.

de Frias, C. M., Dixon, R. A., Fisher, N., & Camicioli, R. (2007). Intraindividual variability in neurocognitive speed: A comparison of Parkinson's disease and normal older adults. *Neuropsychologia, 45*(11), 2499-2507. doi:http://dx.doi.org/10.1016/j.neuropsychologia.2007.03.022

Delis, D. C., Kramer, J. H., Kaplan, E., & Ober, B. A. (2002). *Manual for the California Verbal Learning Test 2.* San Antonio, TX: The Psychological Corporation.

Goldman, J. G., Holden, S., Ouyang, B., Bernard, B., Goetz, C. G., and Stebbins, G. T. (2015).

Diagnosing PD-MCI by MDS task force criteria: How many and which neuropsychological tests? Movement Disorders, 30(3), 402-406. doi:10.1002/mds.26084

Heaton, R. K., Miller, W., Taylor, M. J., & Grant, I. (2004). *Revised comprehensive norms for an expanded Halstead-Reitan battery: Demographically adjusted neuropsychological norms for African American and Caucasian adults*. Lutz, FL: Psychological Assessment Resources, Inc.

Hildebrandt, H., Fink, F., Kastrup, A., Haupts, M., and Eling, P. (2013). Cognitive profiles of patients with mild cognitive impairment or dementia in Alzheimer’s or Parkinson’s disease. Dementia and Geriatric Cognitive Disorders Extra, 3(1), 102-112. doi: [10.1159/000348350](https://dx.doi.org/10.1159/000348350)

Ivnik, R. J., Malec, J. F., Smith, G. E., Tangalos, E. G., & Petersen, R. C. (1996). Neuropsychological tests' norms above age 55: COWAT, BNT, MAE token, WRAT-R reading, AMNART, STROOP, TMT, and JLO. *Clin Neuropsychol, 10*(3), 262-278. doi:10.1080/13854049608406689

Litvan, I., Goldman, J. G., Tröster, A. I., Schmand, B. A., Weintraub, D., Petersen, R. C., Mollenhauer, B., Adler, C. H., Marder, K., Williams-Gray, C. H., Aarsland, D., Kulisevsky, J., Rodriguez-Oroz, M. C., Burn, D. J., Barker, R. A., and Emre, M. (2012). Diagnostic criteria for mild cognitive impairment in Parkinson’s disease:

Movement Disorder Society task force guidelines. Movement Disorders, 27(3), 349-356.

doi:10.1002/mds.24893

Wechsler, D. (1981). *Manual for the Wechsler Adult Intelligence Scale - Revised*. New York, NY: Psychological Corporation.

Welsh et al., (1994) The Consortium to Establish a Registry for Alzheimer’s disease. (CERAD) Part V. A normative study of the neuropsychological battery. Neurology, 44, 609-614.

Werheid, K., Hoppe, C., Thone, A., Muller, U., Mungersdorf, M., & von Cramon, D. Y. (2002). The adaptive Digit Ordering test: Clinical application, reliability, and validity of a verbal working memory test. *Arch Clin Neuropsychol, 17*(6), 547-565.

Wood, K.-L., Myall, D. J., Livingston, L., Melzer, T. R., Pitcher, T. L., MacAskill, M. R., Geurtsen, G. J., Anderson, T. J., and Dalrymple-Alford, J. C. (2016). Different PD-MCI criteria and risk of dementia in Parkinson’s disease: 4-year longitudinal study. *Parkinson’s Disease, 2*, 15027. doi:10.1038/npjparkd.2015.27

**Table S1.** Neuropsychological tests used in each domain and the **r**eferences for the published normative data that were used to correct neuropsychological scores for age and, if available, education. Substituted tests (from the optimal battery) are listed and rationalized.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Domain** | **Test** | **Normative Data Reference** | **Substituted?** | **Rationalization for Substitution** |
| Attention and Working Memory | Trail Making Test Part A | Heaton, R. K., Miller, W., Taylor, M. J., & Grant, I. (2004). *Revised comprehensive norms for an expanded Halstead-Reitan battery: Demographically adjusted neuropsychological norms for African American and Caucasian adults*. Lutz, FL: Psychological Assessment Resources, Inc. | No | N/A |
| Attention and Working Memory | Digit Span test | Wechsler, D. (1981). *Manual for the Wechsler Adult Intelligence Scale - Revised*. New York, NY: Psychological Corporation. | Yes | Symbol Digit Modalities was not collected in our sample. Digit Span has been used in prior studies (e.g., Hildebrandt et al., 2013)  |
| Executive Function | Trail Making Test Part B | Heaton, R. K., Miller, W., Taylor, M. J., & Grant, I. (2004). *Revised comprehensive norms for an expanded Halstead-Reitan battery: Demographically adjusted neuropsychological norms for African American and Caucasian adults*. Lutz, FL: Psychological Assessment Resources, Inc. | No | N/A |
| Executive Function | Digit Ordering Test | Werheid, K., Hoppe, C., Thone, A., Muller, U., Mungersdorf, M., & von Cramon, D. Y. (2002). The adaptive Digit Ordering test: Clinical application, reliability, and validity of a verbal working memory test. *Arch Clin Neuropsychol, 17*(6), 547-565. | Yes | Substituted for the Clock Drawing test due to circularity concerns as Clock Drawing was used in clinical diagnosis. We chose the DOT because it was successfully included in a composite measure of executive function in this sample (de Frias, Dixon, Fisher, and Camicioli, 2007) |
| Memory | California Verbal Learning Test II | Delis, D. C., Kramer, J. H., Kaplan, E., & Ober, B. A. (2002). *Manual for the California Verbal Learning Test 2.* San Antonio, TX: The Psychological Corporation. | Recommended measures - different tests | Captured verbal memory and used the same subcomponent measurements (free recall, long-delay recall) (Goldman et al., 2015; Litvan et al., 2012) |
| Memory | Brief Visuospatial Memory Test | Benedict, R. H. B. (1997). *Brief Visuospatial Memory Test—Revised: Professional Manual*. Odessa, FL: Psychological Assessment Resources, Inc. | Recommended measures - different tests | Captured figural memory and used the same subcomponent measurements (learning, delayed recall) (Goldman et al., 2015) |
| Language | Boston Naming Test | Welsh et al., (1994) The Consortium to Establish a Registry for Alzheimer’s disease. (CERAD) Part V. A normative study of the neuropsychological battery. Neurology, 44, 609-614. | No | N/A |
| Language | Category Verbal Fluency | Heaton, R. K., Miller, W., Taylor, M. J., & Grant, I. (2004). *Revised comprehensive norms for an expanded Halstead-Reitan battery: Demographically adjusted neuropsychological norms for African American and Caucasian adults*. Lutz, FL: Psychological Assessment Resources, Inc. | No | N/A |
| Visuospatial Function | Judgement of Line Orientation | Ivnik, R. J., Malec, J. F., Smith, G. E., Tangalos, E. G., & Petersen, R. C. (1996). Neuropsychological tests' norms above age 55: COWAT, BNT, MAE token, WRAT-R reading, AMNART, STROOP, TMT, and JLO. *Clin Neuropsychol, 10*(3), 262-278. doi:10.1080/13854049608406689 | No | N/A |
| Visuospatial Function | Picture Completion Test | Wechsler, D. (1981). *Manual for the Wechsler Adult Intelligence Scale - Revised*. New York, NY: Psychological Corporation. | Yes | Substituted for Intersecting Pentagons task due to circularity concerns. Picture Completion used in other studies (e.g. Wood et al., 2016) |

**Table S2.** Ability of cognitive status at wave 1 (defined using MDS, CDR, or DRS

criteria) to predict a global dementia outcome (MD-diagnosed) at wave 3 for PD

participants.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **MD diagnosed as PD-CN at Wave 3** | **MD Diagnosed as PDD at Wave 3** | **Dropped out by Wave 3** |
| **MDS 1.5** PD-CN at W1 PD-MCI at W1**MDS 2.0**PD-CN at W1 PD-MCI at W1**CDR** PD-CN at W1 PD-MCI at W1**DRS** PD-CN at W1 PD-MCI at W1 | **21** (77.8%)**7** (29.2%)**28** (80.0%)**0** **26** (60.5%)**2** (25%)**21** (75.0%)**7** (30.4%) | **5** (18.5%)**15** (62.5%)**6** (17.1%)**14** (87.5%)**15** (34.9%)**5** (62.5%)**7** (25.0%)**13** (56.5%) | **1** (3.7%)**2** (8.3%)**1** (2.9%)**2** (12.5%)**2** (4.7%)**1** (12.5%)**0****3** (13.0%) |

*Note.* Green symbolizes a favorable predictive number and red symbolizes a

discrepancy between prediction and outcome. Abbreviations: MD, medical doctor;

MDS, Movement Disorders Society; SD, standard deviation; CDR, Clinical Dementia

Rating scale; DRS, Dementia Rating Scale; PD-MCI, Parkinson’s disease mild

cognitive impairment; PDD, Parkinson’s disease dementia; PD-CN, Parkinson’s

disease cognitively normal.