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Impaired Financial Abilities in Parkinson's Disease Patients With Mild Cognitive Impairment and Dementia

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Abstract

Purpose—Financial capacity (FC) is an instrumental activity of daily living (IADL) critical to independent functioning and sensitive to cognitive impairment in dementia. Little is known about FC in cognitively impaired patients with Parkinson's disease (PD). The present study investigated FC in PD patients with prodromal and clinical dementia.

Methods—Participants were 20 older controls and 35 PD patients who met consensus criteria for either mild cognitive impairment (PD-MCI, n=18) or PD dementia (PDD, n=17). FC was assessed using a standardized performance based measure consisting of 9 domain and two global scores (Financial Capacity Instrument; FCI)(1). FCI domain and global performance scores were compared across groups. Capacity impairment ratings (no impairment, mild/moderate impairment, severe impairment) were calculated for each PD patient's domain and global scores.

Results—Relative to controls, PD-MCI patients were impaired on both FCI global scores and domains of basic monetary skills, financial concepts, and investment decision-making. Relative to both controls and PD-MCI patients, PDD patients were impaired on virtually all FCI variables. With respect to impairment ratings, greater than 50% of PD-MCI patients and greater than 90% of PDD patients were classified as either mild/moderate or severely impaired on the two FCI global scores.

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Conclusions—Impairment of financial capacity is already present in PD-MCI and is advanced in PDD. Complex cognitively-mediated IADLs such as financial capacity appear to be impaired early in the course of PD dementia.

Keywords

financial ability; functional change; MCI (mild cognitive impairment); Parkinson's disease with dementia; Parkinson's disease/ Parkinsonism

1. INTRODUCTION

Impairments in instrumental activities of daily living (IADL) such as driving, financial skills, and medication adherence are common consequences of Parkinson's disease (PD)(2). IADL decline in PD has often been linked to the progressive motor dysfunction of PD(3). However, completion of complex everyday functional activities requires maintenance of cognitive abilities as well as motor skills(4). A major current challenge in PD research is to find ways of reliably identifying and distinguishing motor and non-motor contributions to IADL impairment and disability in patients with PD(5). This issue has important diagnostic relevance, as most diagnostic classification systems for dementia require evidence of functional decline attributable to cognitive impairment exclusive of motor impairment. The identification of functional measures sensitive to cognitive and other non-motor features of PD thus represents an important clinical goal for the field(6).

Limited scientific attention has been directed towards understanding cognitively-based IADL impairment in PD. Recent studies have investigated IADL and ADL loss in patients with PD dementia (PDD) and found global deterioration in daily functional skills(7), as well as higher order skills such as making medical decisions(8). Even less is known about IADL performance in PD patients with milder forms of cognitive impairment not meeting criteria for dementia. To date, studies of prodromal dementia groups have almost exclusively focused on investigating types and patterns of cognitive loss, and not changes in IADL function(9). This represents an important research gap. Studies of IADL function in PD patients with different levels of cognitive impairment can lead to a better understanding of the natural trajectory of functional disability and progression to dementia in PD, and can lead to supportive interventions(10).

An important IADL in PD that has received little or no attention is the capacity to understand and manage personal finances (financial capacity; FC). FC is a complex, multidimensional IADL that is primarily cognitively-mediated, has relatively few motor demands, and has strong linkages to individual autonomy(11). Financial skills include using coins and currency, paying bills, managing a checkbook, making investment decisions, and exercising financial judgment. Patients with amnestic mild cognitive impairment (MCI) due to Alzheimer's disease show mild but significant impairments in financial skills(12), and decline in financial skills has been associated with conversion of these patients to Alzheimer's type dementia over a one-year period (13). Thus, FC is likely to be a cognitively-based IADL vulnerable to impairment in PD patients with MCI.

In the present study we investigated FC in well characterized PD patients with either mild cognitive impairment (PD-MCI) or dementia (PDD) using performance and rating-based measurements.

2. Methods

2.1. Subjects

Patients with PD and healthy older adult controls were recruited through the Alzheimer's Disease Research Center (ADRC) at the University of Alabama at Birmingham (UAB). All participants were diagnostically characterized in ADRC consensus conference by a team of neurologists, neuropsychologists, and nursing staff with experience in evaluating patients with cognitive and functional impairment and movement disorders. Informed consent was obtained from all participants as part of our Institutional Review Board-approved study.

Controls—Controls (n=20) were community-dwelling healthy older adults who underwent neurological and neuropsychological evaluations to ensure the absence of medical and psychiatric conditions that could impair cognition.

Patients with Parkinson's Disease and Cognitive Impairment—Thirty-five patients with PD and cognitive impairment participated. Using Queens Square Bank criteria(14), all patients were diagnosed with idiopathic PD by a board-certified neurologist in the UAB Movement Disorders Clinic. In addition, inclusion criteria required that all PD patients had developed cognitive impairment at least one or more years following the onset of their motor symptoms. This approach is consistent with current consensus recommendations for distinguishing PDD from dementia with Lewy bodies (DLB)(15). PD patients were excluded if they had prior neurosurgical intervention, history of substance abuse, concomitant serious medical illness, or cognitive impairment associated with a major psychiatric condition such as major depression (patients with mild depression were not excluded). In addition, we excluded persons with clinical features consistent with atypical parkinsonism or Alzheimer's disease with secondary parkinsonism. All PD patients were receiving pharmacological treatment for their movement disorder (see Table 1).

Diagnosis of PD with Mild Cognitive Impairment—Using the International Working Group's (IWG) classification system for mild cognitive impairment (MCI) as a guideline (16), we identified a subset of our PD patients [n=18] (PD-MCI) who were mildly cognitively impaired but did not meet criteria for dementia(5, 17). This group showed impairment on at least one cognitive domain (≥ 1.5 SD below applicable normative data) using the UAB ADRC neuropsychological test battery. This test battery consisted of standardized measures across five cognitive domains (attention/working memory, executive function, memory, language, and visuospatial function). Based on collateral report, PD-MCI patients had intact activities of daily living skills (ADLs), and minimal or no cognitively-based impairment of instrumental ADLs exclusive of motor impairment. The relative contribution of motor versus cognitive impairment to IADL performance was determined via the clinicians' judgment at the time of the UAB ADRC consensus conference. The consensus group's determination in this regard was based upon review of the combination of

available clinical/medical information and patient/informant reports. It was noted that 77% (27/35) of collateral informants were patient spouses. The other 23% of informants consisted of 5 daughters, 2 sisters, and one friend who lived in the same retirement community. Spouses had daily contact with patients and the other informants had at least weekly patient contact.

Classification of the MCI subtypes was as follows(16): MCI amnestic multi-domain (n = 9), MCI nonamnestic single domain (n = 3), and MCI nonamnestic multi-domain (n = 5).

The diagnostic decisions regarding MCI diagnosis for our patients were made prior to the publication of recent Movement Disorder Task Force guidelines on MCI diagnosis(18), but would be considered at the Level II (comprehensive assessment) categories type.

Diagnosis of Parkinson's Disease Dementia (PDD)—The remaining 17 PD patients were diagnosed with PDD based on DSM-IV criteria for dementia and clinical recommendations for PDD diagnosis (5, 17). PDD patients demonstrated objective evidence of cognitive impairment on two or more cognitive domains. In addition, collateral report indicated significant decline in IADLs and in many cases ADLs. Relative contribution of motor versus cognitive impairment to IADL performance was again determined by the consensus conference clinicians similar to the process described for PD-MCI patients.

2.2. Measures

Participants received a clinician-based rating of global cognitive status and dementia stage (Clinical Dementia Rating staging; CDR(19)). Participants completed a battery of neuropsychological tests including measures of global cognitive function (Dementia Rating Scale, 2nd edition; DRS-2(20)), motor speed (Purdue Pegboard Test(21)), and mood (Geriatric Depression Scale-30 item version; GDS(22)). Due to space constraints, only a representative sample is presented for descriptive purposes (see Table 2). We plan future studies to address cognitive models of financial capacity loss in PD.

An abbreviated 10-item version of the Unified Parkinson's Disease Rating Scale (UPDRS(23), Motor Scale- part III) was included as a clinical measure of motor symptoms. This abbreviated version was used in a prior study by our group(24). It was developed because not all patients were rated by their medical treatment team using the same version of the UPDRS. The shared items were those assessing: speech expression, facial expression, tremor at rest, neck rigidity, upper and lower extremity rigidity (left and right; four items), posture, and body bradykinesia/hypokinesia.

Financial Capacity Measure—Participants completed the Financial Capacity Instrument (FCI), a conceptually-based, psychometric measure assessing a range of abilities including basic monetary skills, bill payment, bank statement management, and financial judgment(1). The FCI has demonstrated reliability and validity in studies of Alzheimer's disease (AD) and MCI(12). The FCI consists of nine financial domains (see Table 3) reflecting financial activities expected of community-dwelling, cognitively intact older adults. Two overall total scores are computed using combined scores of Domains 1-7, and also combined scores of Domains 1-7 plus 9. Because Domain 8 (Knowledge of Personal Assets/Estate

Arrangements) requires corroboration by the study partner and can be subjective, this domain is treated as experimental and is not included in either total score.

Prior/Premorbid Financial Capacity—The Prior Financial Capacity Form (PFCF) is a rating instrument that identifies a participant's prior ability/experiences across each of the FCI variables.(1) Because identifying prior financial experience is critical to the evaluation of current financial abilities, we administered the PFCF to all participants, and also a knowledgeable collateral source (e.g., family member) to identify any gaps in prior financial experience. Any participant who lacked prior ability experience in one or more of the FCI domains (as reported by patient and corroborated by informant) was excluded from the analysis for that specific domain and also for total score.

The data exclusion procedures for prior/premorbid experience resulted in the exclusion of 2 PDD patients for Domain 9 and one for the two Total Scores (Domains 1-7 +9). Two PD-MCI patients were excluded from analysis on Domain 8. No controls were excluded.

2.3 Analyses

Demographic, clinical, and FCI variables were analyzed using either one-way analysis of variance or $\chi 2$ analyses as appropriate.

We also calculated for each PD patient a capacity impairment classification rating (no impairment, mild/moderate impairment, severe impairment) using cut-off scores derived from our control group performances on the FCI variables. A no impairment rating was assigned if a score was less than 1.5(SD) *below* the control group mean for a particular FCI variable; a mild/moderate impairment rating was defined as a score 1.5 SD to 2.5 SD *below* the control group mean; and a severe impairment rating was defined as a score greater than 2.5 SD *below* the control group mean. Non-parametric analyses were employed to examine between group differences in classification ratings.

All analyses were conducted using SPSS 11.0(25). An alpha of .05 was used for all statistical analyses. Post-hoc comparisons between groups were performed using Least Significant Difference.

3. Results

3.1 Demographic, Clinical, and Cognitive Characteristics

Table 1 presents demographic and clinical findings by group. Groups did not differ in age, years of education, distribution of gender or race. PDD patients obtained higher CDR global scores and UPDRS scores than the PD-MCI patients and controls, and the PD-MCI patients had higher scores on these scales than controls. Both PD groups had higher GDS scores than controls. Although the PD-MCI patients obtained a lower DRS-2 Total score, this score difference was not statistically significant. Controls and PD-MCI patients both performed statistically better than the PDD group on the DRS-2 total score.

3.2 Financial Capacity Performance

Table 2 presents the group comparisons on the FCI variables. The PDD group performed significantly below control and PD-MCI groups on FCI total scores and all FCI domains except Financial Judgment and Knowledge of Personal Assets/Estate Arrangements.

The PD-MCI group performed significantly below control group on FCI total scores and on three domains (Basic Monetary Skills, Financial Concepts, and Investment Decision-Making). While not statistically significant, the PD-MCI group's raw scores on the remaining domains were consistently lower than the control group.

3.3 Capacity Impairment Classification Ratings for the PD-MCI and PDD Groups

Table 3 shows capacity impairment ratings for the patient groups across FCI domains and total scores. A substantial proportion of PD-MCI patients demonstrated capacity compromise (i.e., combination of *mild/moderate and severe impairment ratings*) across the majority of financial domains. Between 20-50% of PD-MCI patients demonstrated capacity compromise across 4 of the 9 financial domains (see Table 3) including bank statement management and financial judgment. For domains 2, 4, and 9 (Financial Concepts, Checkbook Management, and Investment Decisions), 50% or more PD-MCI patients were capacity compromised. Over 50% of the PD-MCI patients were capacity compromised on the two FCI global scores.

Over 50% of the PDD patients demonstrated capacity compromise on 7 of the 9 domains (see Table 3) while 20-50% of PDD patients demonstrated capacity compromise for the Financial Judgment and Assets/Estate Arrangement domains. Over 90% of the PDD patients displayed capacity compromise on each of the two FCI global scores.

4. Discussion

There is increasing interest in understanding how IADLs are affected in cognitively impaired PD(26) patients(7, 24, 26). For example, prior work from our group has shown that cognitively impaired PD patients display impaired medical decision-making capacity relative to older controls(8). In the current study, we examined how financial abilities were affected in PD patients with varying levels of cognitive impairment. Using a performance-based measure of financial capacity, we found that a substantial proportion of cognitively impaired PD patients demonstrated impaired financial abilities compared to healthy older adults.

The present study found that the PDD group demonstrated near global ranging financial skill deficits as evidenced by impairment relative to controls across 7 of the 9 FCI domains, as well as on the two FCI global scores. PDD patients showed particularly striking impairments in the FCI domains assessing Bank Statement Management, Bill Payment, and Investment Decision-Making. Only the domains of Financial Judgment and Knowledge of Assets/Estate Arrangements were relatively preserved in the PDD group. These findings demonstrate near global impairment in financial skills in the majority of PDD patients which was similar in type to prior findings reported in mild Alzheimer's disease(27).

We also found varying degrees of financial skill impairment in our PD-MCI patient sample, suggesting emerging compromise in this important IADL area. In our present study, the PD-MCI group performed below controls on the domains of Basic Monetary Skills, Financial Concepts, and Investment Decision-Making. The PD-MCI group also demonstrated significantly lower overall FCI total scores compared to controls. Closer inspection revealed that the PD-MCI group experienced difficulty on individual items within Domain 1 (Basic Monetary Skills) that required timed mental computation skills (e.g., “How many dimes are in $1 and 30 cents?”). Difficulties on these types of financial tasks may reflect emerging difficulties in working memory and processing mental operations. On Domain 2 (Financial Concepts), the PD-MCI group experienced difficulty with tasks requiring complex mental calculations and application of financial concepts (e.g., calculating health care reimbursement rates and deductibles). This type of financial task requires the application of financial conceptual knowledge along with preservation of arithmetic skills and processing speed abilities. PD-MCI patients also displayed poorer performance compared to controls in their ability to make investment decisions. These findings are consistent with other recent studies that have found impaired medical decision-making capacity(24) and risky decision-making tendencies(28) in PD patients with mild cognitive dysfunction. Cognitive deficits in the areas of working memory, processing speed, and retrieval of semantic knowledge are characteristic of PD and may explain in part the emerging financial task difficulties observed in PD-MCI patients (29, 30).

While overall financial capacity was impaired at the group level for PD-MCI patients, Table 3 highlighted notable performance heterogeneity across individual PD patients. For example, between 20-50% of PD-MCI patients were classified as capacity compromised across four financial domains (Basic Monetary Skills, Cash Transactions, Bank Statement Management, and Financial Judgment). Over 50% of PD-MCI patients displayed capacity compromise on the Financial Concepts domain and the Investment Decision domain.

In contrast, less that 20% of PD-MCI patients were classified as having capacity compromise across two domains (Bill Payment, and Knowledge of Assets/Estate Arrangements). Performance variability may reflect a combination of the degree of cognitive demands (i.e., working memory load) required by a particular financial task and the level of cognitive impairment experienced by an individual patient.

The underlying basis for impaired financial skill performance in cognitively impaired PD patients likely reflects a combination of cognitive, motor, and neuropsychiatric factors. However, the precise inter-relationships are not yet specified. Such understanding awaits multivariate analyses with larger samples before more definitive statements can be made about differential contributions of motor, cognitive and neuropsychiatric variables to financial capacity performance. These findings also highlight the need for standardized methods of assessing non-motor aspects of IADL impairment in PD dementia.

The present study was exploratory in scope and had several limitations. First, this study involved relatively small sample sizes which affect validity. However, even with our small sample sizes, we found several statistically significant group differences between PD-MCI patients, PDD patients, and controls. While we believe the present samples are

representative of our movement disorder clinic population, larger samples will permit more precise identification of impaired financial skills in patients with PD, and more firmly establish whether various demographic characteristics may impact financial task performance. For example, while not statistically significant, our PDD group had higher proportion of males and were nearly 5 years older relative to the PD-MCI group. Second, we acknowledge that the FCI is a laboratory-based measure and cannot capture the full extent of a participant's everyday real world financial activities. Third, we did not have data on socioeconomic status or quality of education, potentially important covariates for interpreting findings relevant to financial capacity. Fourth, our study limited assessment of psychiatric symptoms to depression (i.e., GDS). We did not collect data on other neuropsychiatric symptoms in this study group (i.e., impulse control disorders, hallucinations) that may have impacted the financial capacity results in some cases. Future studies will need to incorporate such information. Finally, we were unable to address the issue of financial decline in PD patients with cognitive impairment. This important question awaits a prospective longitudinal study design.

In summary, the present study contributes to the growing scientific understanding of IADL impairment in PD by demonstrating that financial skills are impaired in both PD-MCI and PDD patients. The study results illustrate the importance of timely clinical assessment of IADL function, such as financial capacity, in persons with PD and cognitive impairment. Such assessment is an essential component in the clinical determination of dementia, and can assist families by identifying and tracking areas of functional decline and vulnerability. Further study is needed to develop a more comprehensive understanding of the cognitive, motor, and neuropsychiatric factors that contribute to loss of financial capacity in PD patients.

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REFERENCES

1. Marson D, Sawrie S, Snyder S, McInturff B, Stalvey T, Boothe A, et al. Assessing financial capacity in patients with Alzheimer's disease: A conceptual model and prototype instrument. Archives of Neurology. 2000; 57:877–884. [PubMed: 10867786]
2. Singh R, Pentland B, Hunter J, Provan F. Parkinson's disease and driving ability. J Neurol Neurosurg Psychiatry. 2007; 78(4):363–6. [PubMed: 17178820]
3. Shulman LM, Gruber-Baldini AL, Anderson KE, Vaughan CG, Reich SG, Fishman PS, et al. The evolution of disability in Parkinson's disease. Mov Disord. 2008; 23(6):790–0796. [PubMed: 18361474]
4. Cahn DA, Sullivan EV, Shear PK, Pfefferbaum A, Heit G, Silverberg G. Differential contributions of cognitive and motor component processes to physical and instrumental activities of daily living in Parkinson's disease. Arch Clin Neuropsychol. 1998; 13(7):575–583. [PubMed: 14590618]
5. Emre M, Aarsland D, Brown R, Burn DJ, Duyckaerts C, Mizuno Y, et al. Clinical diagnostic criteria for dementia associated with Parkinson's disease. Mov Disord. 2007; 22(12):1689–707. quiz 1837. [PubMed: 17542011]

6. Dubois B, Burn D, Goetz C, Aarsland D, Brown RG, Broe GA, et al. Diagnostic procedures for Parkinson's disease dementia: recommendations from the movement disorder society task force. Mov Disord. 2007; 22(16):2314–24. [PubMed: 18098298]
7. Sabbagh MN, Lahti T, Connor DJ, Caviness JN, Shill H, Vedders L, et al. Functional ability correlates with cognitive impairment in Parkinson's disease and Alzheimer's disease. Dement Geriatr Cogn Disord. 2007; 24(5):327–34. [PubMed: 17851237]
8. Griffith HR, Dymek MP, Atchison P, Harrell L, Marson DC. Medical decision-making in neurodegenerative disease: mild AD and PD with cognitive impairment. Neurology. 2005; 65(3): 483–5. [PubMed: 16087924]
9. Caviness JN, Driver-Dunckley E, Connor DJ, Sabbagh MN, Hentz JG, Noble B, et al. Defining mild cognitive impairment in Parkinson's disease. Mov Disord. 2007; 22(9):1272–7. [PubMed: 17415797]
10. Weintraub D, Moberg PJ, Duda JE, Katz IR, Stern MB. Effect of psychiatric and other nonmotor symptoms on disability in Parkinson's disease. Journal of the American Geriatric Society. 2004; 52(5):784–788.
11. Lawton M, Brody E. Assessment of older people: Self-maintaining and instrumental activities of daily living. The Gerontologist. 1969; 9:179–185. [PubMed: 5349366]
12. Griffith HR, Belue K, Sicola A, Krzywanski S, Zamrini E, Harrell L, et al. Impaired financial abilities in mild cognitive impairment: A direct assessment approach. Neurology. 2003; 60(3): 449–457. [PubMed: 12578926]
13. Triebel K, Martin R, Griffith HR, Marceaux J, Okonkwo O, Harrell L, et al. Declining financial capacity in mild cognitive impairment: A one-year longitudinal study. Neurology. 2009; 73:928–934. [PubMed: 19770468]
14. Hughes AJ, Daniel SE, Blankson S, Lees AJ. A clinicopathologic study of 100 cases of Parkinson's disease. Arch Neurol. 1993; 50(2):140–8. [PubMed: 8431132]
15. Lippa CF, Duda JE, Grossman M, Hurtig HI, Aarsland D, Boeve BF, et al. DLB and PDD boundary issues: diagnosis, treatment, molecular pathology, and biomarkers. Neurology. 2007; 68(11):812–9. [PubMed: 17353469]
16. Winblad B, Palmer K, Kivipelto M, Jelic V, Fratiglioni L, Wahlund LO, et al. Mild cognitive impairment--beyond controversies, towards a consensus: report of the International Working Group on Mild Cognitive Impairment. J Intern Med. 2004; 256(3):240–6. [PubMed: 15324367]
17. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 4th. American Psychiatric Association; Washington, D.C.: 1994.
18. Litvan I, Goldman J, Troster AI, Schmand B, Weintraub D, Petersen RC, et al. Diagnostic criteria for mild cognitive impairment in Parkinson's Disease: Movement Disorder Society Task Force guidelines. Movement Disorders. 2012; 27(3):349–356. [PubMed: 22275317]
19. Morris J. The Clinical Dementia Rating (CDR): Current version and scoring rules. Neurology. 1993; 43:2412–2414. [PubMed: 8232972]
20. Jurica, PJ.; Leitten, CL.; Mattis, S. Dementia Rating Scale-2: Professional manual. Psychological Assessment Resources; Lutz, FL: 2001.
21. Tiffin, J. Purdue Pegboard examiner's manual. London House; Rosemont, IL: 1968.
22. Yesavage J. Development and validation of a geriatric depression screening scale: A preliminary report. Journal of Psychiatric Research. 1983; 17:37–49. [PubMed: 7183759]
23. Fahn, S.; Elton, R.; Committee MotUD. Unified Parkinson's Disease Rating Scale. In: Fahn, S.; Marsden, C.; Caine, D.; Lieberman, A., editors. Recent Developments in Parkinson's Disease. Macmillan Health Care Information; Florham Park, NJ: 1987. p. 153-163.
24. Martin R, Okonkwo O, Hill J, Griffith HR, Triebel K, Bartolucci A, et al. Medical decision-making capacity in cognitively impaired Parkinson's disease patients without dementia. Movement Disorders. 2008; 23(13):1867–1874. [PubMed: 18759361]
25. Inc. S. Statistical Package For The Social Sciences (SPSS). 2003 In. 11.0 ed.
26. Sabbagh MN, Silverberg N, Bircea S, Majeed B, Samant S, Caviness JN, et al. Is the functional decline of Parkinson's disease similar to the functional decline of Alzheimer's disease? Parkinsonism Relat Disord. 2005; 11(5):311–5. [PubMed: 15886042]

27. Martin R, Griffith HR, Belue K, Harrell L, Zamrini E, Anderson B, et al. Declining financial capacity in patients with mild Alzheimer disease: a one-year longitudinal study. Am J Geriatr Psychiatry. 2008; 16(3):209–19. [PubMed: 18263665]

28. Pagonabarraga J, Garcia-Sanchez C, Llebaria G, Pascual-Sedano B, Gironell A, Kulisevsky J. Controlled study of decision making and cognitive impairment in Parkinson's disease. Mov Disord. 2007; 22(10):1430–1435. [PubMed: 17534944]

29. Woods S, Troster A. Prodromal frontal/executive dysfunction predicts incident dementia in Parkinson's disease. Journal of the International Neuropsychology Society. 2003; 9:17–25.

30. Janvin C, Aarsland D, Larsen JP, Hugdahl K. Neuropsychological profile of patients with Parkinson's disease without dementia. Dement Geriatr Cogn Disord. 2003; 15(3):126–31. [PubMed: 12584427]

Table 1

Demographic and Clinical Characteristics of Study Participants

Variables	Controls n = 20	PD-MCI n = 18	PDD n = 17	p †
Age	69.5 (8.1)	66.9 (9.3)	71.0 (6.1)	.311
Education	15.2 (2.7)	14.7 (2.5)	15.1 (3.3)	.870
Gender, n (%)				
Female	10 (50.0)	9 (50.0)	4 (23.5)	.184
Male	10 (50.0)	9 (50.0)	13 (76.5)	
Race, n (%)				
African American	2 (10.0)	2 (11.1)	0 (0.0)	.378
Caucasian	18 (90.0)	16 (88.9)	17 (100.0)	
CDR – global, n (%)				
0.0	20 (100.0)	0 (0.0)	0 (0.0)	<.001
0.5	0 (0.0)	18 (100.0)	9 (52.9)	
1.0	0 (0.0)	0 (0.0)	8 (47.1)	
UPDRS-10 item Revised	0.2 (0.6)	8.2 (3.6)	11.9 (3.9)	<.001[a]
GDS – 30 item	3.4 (3.3)	10.9 (8.5)	9.2 (3.8)	<.001[b]
DRS-2 Total Score	139.5 (3.0)	134.7 (5.1)	116.8 (14.1)	<.001[C]
PD Medications	N/A			
Carbidopa/levodopa		8	13	
Carbidopa/levodopa/ Entacapone		5	2	
Pramipexole		1	4	
Ropinirole		5	3	
Amantadine		1	3	
Entacapone		0	2	
Trihexyphenidyl		1	1	
Cholinesterase Inhibitor	N/A			
Donepezil		4	6	
Galantamine		0	2	
Rivastigmine		1	1	

Except for gender, race, and CDR – global, values are mean (SD). PD-MCI = Parkinson's disease with mild cognitive impairment; PDD = Parkinson's disease dementia.

DRS-2 = Dementia Rating Scale-2; GDS = Geriatric Depression Scale-30 item

CDR - global = Clinical Dementia Rating Scale-global score.

D Control mean greater than PD-MCI mean. PD-MCI mean greater than PDD mean

† p value for omnibus test of group differences.

[a] PDD mean greater than PD-MCI mean and PD-MCI mean greater than Control mean (higher scores reflect greater levels of motor impairment).

[b] PD-MCI and PDD means are greater than Control mean.

[C] Control mean equal to PD-MCI mean and PD-MCI mean greater than PDD mean.

Table 2

Comparison of FCI Performance Across Groups

Domains	Score Range	Controls n = 20	PD-MCI n = 18	PDD n = 17	p †	post hoc
D1. Basic Monetary Skills	0-34	32.9 (1.9)	29.8 (4.5)	23.1 (6.7)	<.001	C > PD-MCI > PDD
D2. Financial Concepts	0-32	30.4 (1.3)	26.8 (2.9)	21.6 (6.6)	<.001	C > PD-MCI > PDD
D3. Cash Transactions	0-24	22.3 (1.8)	21.2 (2.6)	13.8 (5.2)	<.001	C, PD-MCI > PDD
D4. Checkbook Management	0-50	48.7 (2.2)	44.6 (5.1)	33.9 (11.0)	<.001	C, PD-MCI > PDD
D5. Bank Statement Management	0-39	36.2 (2.9)	32.7 (4.2)	19.9 (10.2)	<.001	C, PD-MCI > PDD
D6. Financial Judgment	0-16	14.5 (1.1)	13.3 (3.1)	13.8 (1.6)	.259	----
D7. Bill Payment	0-46	44.4 (2.2)	42.9 (5.8)	22.2 (9.4)	<.001	C, PD-MCI > PDD
D8. Knowledge of Assets/Estate Arrangement	0-26	23.9 (1.9)	23.0 (2.3)	23.2 (1.8)	.373	----
D9. Investment Decisions	0-17	15.1 (1.4)	12.1 (2.8)	8.0 (4.9)	<.001	C > PD-MCI > PDD
Domains 1-7 Total Score	0-241	229.3 (7.6)	211.3 (15.1)	148.3 (44.3)	<.001	C > PD-MCI > PDD
Domains 1-7, 9 Total Score	0-267	244.4 (7.7)	223.4 (16.5)	156.1 (50.5)	<.001	C > PD-MCI > PDD

Values are mean (SD). PD-MCI = Parkinson's disease with mild cognitive impairment, PDD = Parkinson's disease dementia.

Post hoc comparisons were performed using Least Significant Difference test ($p < .05$).

C > PD-MCI > PDD = Control mean is greater than PD-MCI mean and PD-MCI mean is greater than PDD mean; C, PD-MCI > PDD = Control mean is greater than PD-MCI mean and PD-MCI mean is greater than PDD mean.

Not all FCI domains had all data points for a group, due to data exclusion based on no prior/premorbid experience for that financial domain. Control group sample size equal to 20 on all FCI variables. PD-MCI group sample size was equal to 18 except for Domain 8 (n = 16). PDD group sample size was equal to 17 except for Domain 8 (n = 15), Domain 9 (n = 15), and Total Score (Domains 1-7, 9) (n = 15).

† p value for omnibus test of group differences.

Table 3

Capacity impairment ratings for PD-MCI and PDD patients

	No Impairment	Mild/Moderate Impairment	Severe Impairment	Z	p
D1. Basic Monetary Skills					
PD-MCI	61% (11/18)	6% (1/18)	33% (6/18)	−2.6	.009
PDD	18% (3/17)	6% (1/17)	77% (13/17)		
D2. Financial Concepts					
PD-MCI	33% (6/18)	0% (0/18)	67% (12/18)	−1.2	.24
PDD	12% (2/17)	6% (1/17)	82% (14/17)		
D3. Cash Transactions					
PD-MCI	78% (14/18)	11% (2/18)	11% (2/18)	−3.8	.001
PDD	18% (3/17)	6% (1/17)	77% (13/17)		
D4. Checkbook Management					
PD-MCI	50% (9/18)	33% (6/18)	17% (3/18)	−3.5	.001
PDD	12% (2/17)	6% (1/17)	82% (14/17)		
D5. Bank Statement Management					
PD-MCI	72% (13/18)	11% (2/18)	17% (3/18)	−4.1	.001
PDD	6% (1/17)	12% (2/17)	82% (14/17)		
D6. Financial Judgment					
PD-MCI	61% (11/18)	22% (4/18)	17% (3/18)	−.90	.36
PDD	77% (13/17)	12% (2/17)	12% (2/17)		
D7. Bill Payment					
PD-MCI	83% (15/18)	6% (1/18)	11% (2/18)	−4.9	.001
PDD	0% (0/17)	12% (2/17)	88% (15/17)		
D8. Assets/Estate Arrangement					
PD-MCI	81% (13/16)	13% (2/16)	6% (1/16)	−1.0	.31
PDD	93% (14/15)	7% (1/15)	0% (0/15)		
D9. Investment Decisions					
PD-MCI	50% (9/18)	11% (2/18)	39% (7/18)	−1.9	.06
PDD	27% (4/15)	0% (0/15)	73% (11/15)		
Total Score - Domains 1-7					
PD-MCI	44% (8/18)	6% (1/18)	50% (9/18)	−2.8	.005
PDD	6% (1/17)	0% (0/17)	94% (15/17)		
Total Score - Domains 1-7, 9					
PD-MCI	33% (6/18)	17% (3/18)	50% (9/18)	−2.6	.008
PDD	7% (1/15)	0% (0/15)	93% (14/15)		

Z = Mann-Whitney nonparametric test, using z score statistic.

PD-MCI = Parkinson's disease with mild cognitive impairment. PDD = Parkinson's disease dementia.

Not all Domains had all data points for the group due to data exclusion based on no prior/premorbid experience for that financial domain. PD-MCI group sample size equal to 18 except for Domain 8 (n = 16). PDD group sample size equal to 17 except for Domain 8 (n = 15), Domain 9 (n = 15), and Total Score (Domains 1-7, 9) (n = 15).