Instrumental Activities of Daily Living Performance Among People With Parkinson's Disease Without Dementia

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MeSH TERMS

- activities of daily living
- cognition
- Parkinson disease
- self care
- task performance and analysis

OBJECTIVE. To investigate the performance of cognitively demanding instrumental activities of daily living (IADLs) among people with Parkinson's disease (PD) without dementia.

METHOD. Seventy-seven participants with PD and 57 participants without PD underwent standardized, performance-based IADL evaluation using the Performance Assessment of Self-care Skills. Activity performance was rated for independence, adequacy, and safety.

RESULTS. The PD group had lower independence and adequacy scores than the non-PD group for almost every activity. Medication management, shopping, and sharp utensil use were the activities most sensitive to group differences. In the PD group, older age, lower Mini-Mental State Examination scores, and decreased motor function were associated with poorer IADL performance.

CONCLUSIONS. People with relatively early and mild PD demonstrated measurable deficits in the performance of cognitively demanding IADLs. This work highlights the importance of using objective assessments of IADL function to detect early functional changes in people with PD.

Foster, E. R. (2014). Instrumental activities of daily living performance among people with Parkinson's disease without dementia. *American Journal of Occupational Therapy*, 68, 353–362. <http://dx.doi.org/10.5014/ajot.2014.010330>

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Parkinson's disease (PD) is a neurodegenerative disorder associated with motor impairments (e.g., rigidity, bradykinesia) and nonmotor impairments (e.g., cognitive dysfunction, depression) that negatively affect activities, participation, and quality of life (Duncan & Earhart, 2011; Schrag, Jahanshahi, & Quinn, 2000; Shulman et al., 2008). People with PD are typically referred to occupational therapy when significant physical disability is present (Dixon et al., 2007). At this point, interventions tend to focus on basic activities of daily living (ADLs; e.g., dressing, bathing) and functional mobility (Murphy & Tickle-Degnen, 2001; Rao, 2010). However, it is increasingly recognized that people with PD experience functional limitations early in disease progression. For example, they report having difficulty with and giving up instrumental ADLs (IADLs; e.g., housework, managing finances, cooking; Foster & Hershey, 2011; Shulman et al., 2008). Nonmotor impairments, such as cognitive dysfunction, are thought to be important contributors to these early functional changes (Foster & Hershey, 2011; Gallagher, Lees, & Schrag, 2010).

Careful research has allowed rehabilitation researchers to objectively characterize physical function in PD, including the performance of IADLs with mostly physical demands such as sweeping, transferring laundry, and carrying groceries (e.g., Schenkman et al., 2011). In contrast, evidence regarding the performance of IADLs with high demands on memory or executive function (e.g., preparing meals, managing finances and medication; Perneczky, Pohl, Sorg, Hartmann, Komossa, et al., 2006; Perneczky, Pohl, Sorg, Hartmann, Tomic, et al., 2006) is lacking. Studies assessing these more cognitively demanding IADLs in people

with PD have relied on subjective measures, which are important for providing the patient or caregiver perspective but have some limitations. In particular, studies have shown that although people with PD can accurately report their basic ADL function (Brown, MacCarthy, Jahanshahi, & Marsden, 1989; Shulman et al., 2006), they tend to overestimate their cognitive IADL function (Shulman et al., 2006). Additional limitations of subjective measures in PD include questionable accuracy resulting from discrepancies between self- and proxy reports and the association of depressive symptoms with overreporting of problems (e.g., Fleming, Cook, Nelson, & Lai, 2005; Sitek, Soltan, Wiczorek, Robowski, & Slawek, 2011). The limitations of subjective measures suggest that objective, performance-based measures may be necessary to obtain a more complete picture of cognitive IADL function in PD. A better understanding of the nature and mechanisms of IADL function in PD is critical to begin addressing the early functional changes occurring in this population.

The purpose of this study was to investigate IADL performance in people with PD without dementia—specifically, to determine whether people with relatively early and mild PD have difficulty with cognitively demanding IADLs—because the potential functional relevance of subtle cognitive deficits in this population is inadequately addressed in rehabilitation research and practice related to PD. We conducted standardized observations of simulated IADLs and assessed performance for safety, quality, and the type and amount of assistance needed for successful activity completion. We also explored potential demographic and clinical correlates of performance.

Method

Research Design

This study had a cross-sectional, descriptive design. It was approved by the Human Research Protection Office at the Washington University School of Medicine (WUSM) and was completed in accordance with the Helsinki Declaration. All participants provided written informed consent before testing.

Participants

Study participants were volunteers with PD and matched healthy adult (termed *non-PD*) volunteers. Participants with PD were recruited from the clinical research database of the WUSM Movement Disorders Center, and non-PD participants were recruited from the WUSM Research Participant Registry and word of mouth. Participants with PD met criteria for idiopathic typical PD (Racette, Rundle,

Parsian, & Perlmuter, 1999), were classified at Hoehn and Yahr Stages 1–3 (indicating mild to moderate disease severity; Hoehn & Yahr, 1967), and were being treated with and experienced clear motor benefit from levodopa-carbidopa. Exclusionary criteria for the participants with PD included suspected dementia or global cognitive impairment (determined by physician, caregiver report, or a score <25 on the Mini-Mental State Examination [MMSE]; Folstein, Folstein, & McHugh, 1975), a standardized score <85 on the Wechsler Test of Adult Reading (Wechsler, 2001), other neurological conditions, brain surgery, history of or current psychotic disorder, significant current psychiatric symptoms, or any condition that would practically interfere with testing. Exclusionary criteria for the non-PD participants were the same as those for the participants with PD plus the presence or suspected presence of PD, a biological family history of PD, and being a caregiver or spouse of someone who has PD.

Procedure

Testing was conducted in the NeuroClinical Research Unit at WUSM. Participants with PD were tested while on their regular antiparkinsonian medications. Demographic information was collected via interview. The MMSE was administered to measure global cognitive function, the Older American Resource and Service Instrument (Fillenbaum, 1988) was used to determine the number of comorbid conditions, and the Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996) was used to assess the presence and severity of depressive symptoms. The bulk of the testing session consisted of performance-based IADL assessment (described in detail next). PD-related clinical characteristics from within 3 mo of testing, including Hoehn and Yahr stage, motor dysfunction severity (Unified Parkinson's Disease Rating Scale [UPDRS] Motor subscale; Fahn & Elton, 1987), disease duration, and antiparkinsonian medications were obtained from the clinical research database.

Primary Measures

IADL Performance. The clinic version of the Performance Assessment of Self-care Skills (PASS; Rogers & Holm, 1984) was used to measure IADL performance. Clinic testing was chosen to enhance standardization across participants and for logistical purposes. The PASS is an objective, criterion-referenced measure of activity performance. It has high test–retest reliability ($r_s = .82-.92$) and interrater agreement (>90%), and it can discriminate between clinical groups (e.g., healthy older adults and those with depression or knee osteoarthritis; Holm & Rogers,

2008). Nine of the IADLs with a cognitive emphasis were administered for this study: (1) oven use—baking muffins; (2) stovetop use—making a can of soup; (3) sharp utensil use—peeling, coring, and cutting an apple; (4) bill paying by check—writing checks for two utility bills; (5) checkbook balancing—entering two withdrawals (the utility bills) and one deposit and balancing the account; (6) mailing bills—preparing the two utility bills for mailing; (7) shopping—selecting grocery items from an array and paying for them, using coupons and calculating change (performed at a table); (8) medication management—indicating time for next dose of two medications and filling a medication organizer according to prescription labels; and (9) small home repairs (i.e., flashlight repair)—determining why a flashlight is not working (burned-out bulb) and fixing it. The cleanup activity (cleaning cookware, dinnerware, and work area after meal preparation), which is classified as an IADL with a physical emphasis, was included because it is a natural component of meal preparation. The bill paying by check, checkbook balancing, mailing, and shopping activities can be combined into a money management activity group, and the oven use, stovetop use, use of sharp utensils, and cleanup can be combined into a meal preparation activity group. Each activity consists of criterion-referenced critical subtasks that the practitioner uses to rate performance. The conditions, critical subtasks, instructions, and materials for each activity are specified, allowing for controlled and standardized observation of activity performance.

Observed performance was rated for independence, adequacy, and safety. Independence was rated using a dynamic assessment approach. When a participant could no longer proceed independently or made a mistake, the examiner began a process of graduated cueing to facilitate task performance. Cueing followed a nine-level hierarchy of cues that increased in their power of assistance as the level increased: 1 = verbal supportive, 2 = verbal nondirective, 3 = verbal directive, 4 = gesture, 5 = task object or environmental rearrangement, 6 = demonstration, 7 = physical guidance, 8 = physical support, and 9 = total assist. Examiners were trained to refrain from cueing unless absolutely necessary, to start with the lowest level of cueing possible, and to provide two to three cues from a level before moving to the next level. The level and number of cues needed for each critical subtask were used to determine the independence score for that critical subtask (range = 0–3: 0 = *more than three Level 7–8 cues given, any Level 9 cues given, or unable to perform task*; 1 = *more than three Level 1–6 cues or three or fewer Level 7–8 cues given, no Level 9 cues*; 2 = *three or fewer Level 1–6 cues given, no Level 7–9 cues*; 3 = *no cues given*). Critical subtask scores were

then averaged to obtain the Independence summary score for the entire activity. In addition, the total number of cues required was recorded for each activity, and a weighted cue score was calculated for each activity. The weighted cue score incorporates both the number and the level of cues required; it is a sum of the number of cues given at each level multiplied by the cue level. Each PASS activity received a single Adequacy summary score that reflected overall quality of performance (range = 0–3: 0 = *unacceptable: subtasks consistently performed with lack of precision or economy of effort and action*, 3 = *acceptable: subtasks performed with precision and economy of effort and action*) and a single Safety summary score that reflected whether there were any noted risks to the participant's physical safety during activity performance (range = 0–3: 0 = *risks of such severity observed that activity was discontinued to prevent harm*, 3 = *safe practices observed*).

After piloting the original PASS with a sample of 20 participants (10 with PD, 10 non-PD; data not included in this article), some modifications and specifications were made to enhance objectivity and standardization of administration and scoring for the purposes of this study. For example, we created numerical cutoff values for the Independence summary scores and standardized cueing protocols for commonly encountered performance errors. All modifications and procedures were documented in a standard operating procedures manual. The principal investigator (Erin R. Foster), four occupational therapy students, and a research assistant administered the PASS for this study. Training involved obtaining a thorough background with the PASS, completing multiple in-person observations, scoring and reviewing training videos, practicing on multiple student and healthy older adult volunteers, completing a checkout with the principal investigator, and being observed by the principal investigator multiple times (≥ 5) in the context of the study before being permitted to administer it alone.

Interrater reliability was established with a sample of 25 participants (12 with PD, 13 non-PD). Decision consistency, reported as percentage of agreement, is appropriate for criterion-referenced instruments such as the PASS (Raina, Rogers, & Holm, 2007; Rogers et al., 2003). Percentage of agreement among examiners was 95% for Independence (range = 92%–98%), 92% for Adequacy (range = 85%–96%), and 91% for Safety (range = 85%–95%). Total cues given, highest cue level, and weighted cue scores all achieved similarly excellent agreement (all $>82\%$). Ongoing interrater reliability was not tested statistically throughout the study; however, a number of procedures were implemented to ensure consistency in administration and scoring among examiners over time. All PASS sessions

were videotaped, and the principal investigator (Foster) regularly reviewed a random sample of these videotapes (10%) for quality of administration. Weekly study team meetings were held during which questions regarding administration or scoring were discussed and decisions were made by consensus among examiners.

Daily Life Experience With the Activities Assessed by the PASS. Before PASS performance, participants were asked whether they performed each tested activity in daily life (e.g., “Do you use the oven in your daily life?”). Possible response options were *no*, *sometimes*, and *yes*. Internal consistency reliability of this questionnaire was moderate and acceptable for the present purposes ($\alpha = .73$).

Statistical Analyses

Descriptive statistics were calculated for all variables. Distributions were visually inspected and statistically tested (Kolmogorov–Smirnov) for normality. Independent-samples *t* tests were used for group comparisons of normally distributed data (most demographic data, PASS time). Nonparametric tests (χ^2 , Mann–Whitney *U*, Kruskal–Wallis, Spearman’s *r*) were used for group comparisons of categorical and non-normally distributed data, as well as for the correlational analyses. Between-groups effect sizes were estimated using Cohen’s *d*. All statistical tests were two-tailed, and $p < .05$ was considered significant.

Results

Participant Characteristics

The final sample consisted of 77 participants with PD and 57 non-PD participants. Demographic and clinical characteristics of the sample are presented in Table 1. Groups were equivalent in age, gender distribution, education, comorbidities, and MMSE scores ($p \geq .28$). BDI–II scores were significantly different across groups, $t(132) = -3.4$, $p = .001$, with the PD group reporting more frequent or severe depressive symptoms than the non-PD group. Racial distributions were also significantly different across groups, $\chi^2(4) = 9.87$, $p = .04$. The PD group consisted of proportionately more White or Caucasian and American Indian or Native American and fewer Black or African American participants than the non-PD group. Of the PD participants, 40 were receiving levodopa–carbidopa only, 19 were receiving levodopa–carbidopa with a dopamine agonist, 13 were receiving levodopa–carbidopa with a catechol-O-methyltransferase (COMT) inhibitor, and 5 were receiving levodopa–carbidopa with a dopamine agonist and a COMT inhibitor. Most PD participants had mild bilateral motor signs without postural instability (i.e., Hoehn & Yahr Stage 2).

Table 1. Participant Characteristics (N = 134)

Variable	Non-PD	PD
<i>n</i>	57	77
Male/female ratio, <i>n</i>	28/29	42/35
Age, yr, <i>M</i> (<i>SD</i>)	61.9 (5.9)	62.5 (5.1)
Education, yr, <i>M</i> (<i>SD</i>)	15.8 (2.4)	15.2 (2.2)
Race, <i>n</i> ^a		
White or Caucasian	48	72
Black or African American	7	1
American Indian or Alaska Native	0	2
Asian	0	1
Declined to state	2	1
No. of comorbid conditions, <i>M</i> (<i>SD</i>)	3.2 (2.3)	3.0 (2.5)
BDI–II, ^a <i>M</i> (<i>SD</i>)	6.5 (8.3)	11.4 (7.9)
MMSE, <i>M</i> (<i>SD</i>)	29.2 (1.0)	29.1 (1.2)
UPDRS Motor (on medications), <i>M</i> (<i>SD</i>)	—	15.7 (7.2)
Disease duration, yr, <i>M</i> (<i>SD</i>)	—	5.0 (3.8)
Levodopa equivalent daily dose, mg, <i>M</i> (<i>SD</i>)	—	1,033 (610)
Hoehn & Yahr stage, <i>n</i>	—	
1		3
2		65
2.5		7
3		2

Note. — = not applicable. BDI–II = Beck Depression Inventory II; *M* = mean; MMSE = Mini-Mental State Examination; PD = Parkinson’s disease; *SD* = standard deviation; UPDRS Motor = Unified Parkinson’s Disease Rating Scale, Motor subscale.

^aPD different from non-PD, $p < .05$.

PASS Performance: Time and Summary Scores

PD participants took significantly longer to complete the PASS than did non-PD participants (PD participants, mean [*M*] = 80 min, standard deviation [*SD*] = 17 min; non-PD participants, *M* = 65 min, *SD* = 12 min), $t(125) = -5.62$, $p < .001$.

Independence and Adequacy summary scores for the PASS activities are presented in Table 2. Performance was very high overall, with group Independence averages ≥ 2.9 and group Adequacy averages >2.3 . The PD group had equal or lower Independence summary scores than the non-PD group for every activity; these differences were significant for sharp utensil use ($U = 1,876$, $Z = -1.95$, $p = .05$), shopping ($U = 1,737$, $Z = -2.87$, $p = .004$), medication management ($U = 1,738$, $Z = -2.25$, $p = .03$), meal preparation ($U = 1,676$, $Z = -2.18$, $p = .03$), and all activities ($U = 1,519$, $Z = -3.04$, $p = .002$). The PD group also had lower Adequacy summary scores than the non-PD group for every activity; these differences were significant for sharp utensil use ($U = 1,730$, $Z = -2.66$, $p = .008$), shopping ($U = 1,723$, $Z = -2.84$, $p = .004$), checkbook balancing ($U = 1,690$, $Z = -2.51$, $p = .01$), medication management ($U = 1,738$, $Z = -2.34$, $p = .02$), flashlight repair ($U = 1,867$, $Z = -1.94$, $p = .05$), and all activities ($U = 1,638$, $Z = -2.55$, $p = .01$).

Table 2. Independence and Adequacy Summary Scores for the PASS Activities for the PD and Non-PD Groups

PASS Activity	Independence			Adequacy		
	Non-PD, <i>M (SD)</i>	PD, <i>M (SD)</i>	<i>d</i>	Non-PD, <i>M (SD)</i>	PD, <i>M (SD)</i>	<i>d</i>
Meal preparation	2.97 (0.04)	2.94 (0.07) ^a	0.50	2.73 (0.28)	2.67 (0.29)	0.21
Oven use	2.96 (0.08)	2.90 (0.16)	0.46	2.65 (0.48)	2.61 (0.52)	0.08
Stovetop use	2.99 (0.04)	2.98 (0.05)	0.25	2.78 (0.44)	2.77 (0.42)	0.02
Use of sharp utensils	2.98 (0.06)	2.93 (0.16) ^a	0.38	2.91 (0.29)	2.72 (0.45) ^b	0.48
Cleanup	2.95 (0.11)	2.95 (0.12)	0.00	2.58 (0.52)	2.56 (0.57)	0.04
Money management	2.96 (0.04)	2.94 (0.06)	0.40	2.73 (0.23)	2.65 (0.28)	0.31
Bill paying by check	2.99 (0.03)	2.99 (0.01)	0.00	2.95 (0.22)	2.93 (0.25)	0.08
Checkbook balancing	2.97 (0.06)	2.95 (0.08)	0.29	2.73 (0.45)	2.51 (0.53) ^b	0.43
Mailing bills	2.92 (0.10)	2.91 (0.12)	0.09	2.52 (0.53)	2.36 (0.55)	0.30
Shopping	2.98 (0.06)	2.91 (0.16) ^b	0.54	2.88 (0.33)	2.66 (0.48) ^b	0.51
Medication management	2.96 (0.09)	2.89 (0.15) ^a	0.54	2.79 (0.41)	2.57 (0.55) ^a	0.43
Flashlight repair	2.95 (0.12)	2.92 (0.14)	0.23	2.82 (0.38)	2.68 (0.47) ^a	0.32
All activities	2.96 (0.03)	2.93 (0.05) ^b	0.60	2.74 (0.16)	2.66 (0.22) ^b	0.40

Note. Possible range of scores = 0–3. PD group, *n* = 77; non-PD group, *n* = 57. *M* = mean; PD = Parkinson's disease; *SD* = standard deviation.

^aPD < non-PD, *p* ≤ .05 (Mann-Whitney *U*). ^bPD < non-PD, *p* ≤ .01 (Mann-Whitney *U*).

Effect sizes for these group differences were in the small to medium range (Table 2).

Safety for the meal preparation activities and flashlight repair was high overall, with group averages at or above 2.84. No significant group differences were found in Safety for oven use, stove use, cleanup, or flashlight repair (*p* ≥ .26). There was a trend-level difference in Safety for sharp utensil use, *U* = 2,016, *Z* = −1.74, *p* = .08. The non-PD group had perfect Safety scores for sharp utensil use (*M* = 3.00, *SD* = 0.0), but the PD group did not (*M* = 2.95, *SD* = 0.22) because minor risks were observed for 4 PD participants.

PASS Performance: Cueing

The number of cues required and proportion of participants requiring cues for the PASS activities are presented in Table 3. Most participants (91% with PD, 84% non-PD) required at least one cue throughout the duration of the PASS. Significantly more participants with PD required cues for shopping and medication management compared with non-PD participants, $\chi^2 > 4.6$, *p* < .03.

As with the summary scores, the PD group required the same number or more cues than the non-PD group for every activity. In the entire sample, the PD group required significantly more cues for sharp utensil use, shopping, medication management, and all activities (*U* < 1,870, *Z* > |−1.98|, *p* < .05). Within the subgroup of participants who required cues for each activity, the PD group required significantly more cues than the non-PD group for oven use, shopping, and all activities (*Z* > |−2.06|, *p* < .05).

The pattern of group differences for weighted cue scores was similar to that of the total number of cues required. In the entire sample, the PD group had higher weighted cue scores for sharp utensil use, shopping, medication management, and all activities (*U* < 1,870,

Z > |−1.99|, *p* < .05; Figure 1). Within the subgroup of participants who required cues for each activity, the PD group had higher weighted cue scores for oven use, shopping, and all activities (*Z* > |−2.29|, *p* < .02).

Daily Life Experience With Activities

Daily life experience with the PASS activities was high overall. The proportion of participants answering *sometimes* or *yes* to the question of whether they performed the activity in daily life ranged from 65% for balancing a checkbook to 99% for using sharp utensils to cut food. No group differences were found in daily life experience for most of the activities ($\chi^2 < 4.24$, *p* > .12); however, daily life experience with managing medications was different across groups, $\chi^2(2) = 7.03$, *p* = .03. Almost all (97%) of the participants with PD reported managing medications in daily life, whereas 82% of the non-PD participants reported managing medications in daily life. PASS Independence summary scores differed according to daily life experience for oven use, $\chi^2(2) = 6.14$, *p* = .05; balancing a checkbook, $\chi^2(2) = 9.88$, *p* = .007; and mailing bills, $\chi^2(2) = 6.77$, *p* = .03, such that more experience was associated with better test performance.

Association of PASS Performance and Demographic or Clinical Variables

Associations between PASS performance and demographic or clinical variables (i.e., those reported in Table 1) were tested within each group separately because of the group differences in PASS performance. Total PASS time and weighted cue scores were used for this analysis.

In the PD group, age was significantly correlated with medication management (*r*_s = .30, *p* = .009), and MMSE score was significantly correlated with the money management

Table 3. Percentage of Participants Who Required Cues and Number of Cues Required for the PASS Activities for the PD and Non-PD Groups

PASS Activity	Participants Who Required Cues, <i>n</i> (%)		No. of Cues Required, <i>M</i> (<i>SD</i>)			
			Among All Participants		Among Only Those Participants Who Required Cues	
	Non-PD	PD	Non-PD	PD	Non-PD	PD
Meal preparation	29 (51)	47 (61)	1.8 (2.6)	3.1 (3.9)	3.6 (2.6)	5.2 (3.8)
Oven use	17 (30)	26 (34)	0.7 (1.4)	1.6 (2.8)	2.5 (1.5)	4.6 (2.9) ^a
Stovetop use	7 (12)	9 (12)	0.3 (0.9)	0.3 (1.0)	2.4 (1.1)	2.9 (1.1)
Use of sharp utensils	4 (7)	14 (18)	0.1 (0.5)	0.6 (1.4) ^a	1.8 (1.0)	3.3 (1.6)
Cleanup	12 (21)	15 (19)	0.6 (1.4)	0.6 (1.4)	3.1 (1.2)	3.1 (1.6)
Money management	38 (67)	54 (71)	3.0 (3.1)	3.6 (4.0)	4.4 (2.8)	5.0 (3.9)
Bill paying by check	2 (4)	4 (5)	0.1 (0.3)	0.2 (0.8)	2.0 (0.0)	3.0 (2.0)
Checkbook balancing	11 (19)	22 (29)	0.6 (1.4)	0.9 (1.6)	3.1 (1.4)	3.1 (1.5)
Mailing bills	25 (43)	45 (58)	1.8 (2.9)	2.1 (2.5)	3.8 (2.2)	4.4 (3.0)
Shopping	7 (12)	23 (30) ^a	0.1 (0.4)	0.7 (1.4) ^a	1.1 (0.4)	2.4 (1.6) ^a
Medication management	12 (21)	30 (39) ^a	0.7 (1.4)	1.4 (2.3) ^a	3.1 (1.1)	3.7 (2.3)
Flashlight repair	10 (18)	22 (29)	0.5 (1.5)	0.7 (1.6)	2.6 (2.1)	2.9 (2.5)
All activities	48 (84)	70 (91)	5.9 (5.2)	8.8 (7.5) ^a	6.5 (5.2)	10.4 (7.0) ^a

Note. PD group, *n* = 77; non-PD group, *n* = 57. *M* = mean; PD = Parkinson's disease; *SD* = standard deviation.

^aPD > non-PD, *p* < .05 (χ^2 or Mann-Whitney *U*).

($r_s = -.33$, $p = .004$), medication management ($r_s = -.33$, $p = .004$), and all activities ($r_s = -.42$, $p < .001$) such that higher age and lower MMSE score were associated with poorer performance on these activities. UPDRS Motor score was significantly correlated with oven use ($r_s = .26$, $p = .03$) and all activities ($r_s = .24$, $p = .04$) such that decreased motor function was associated with poorer performance on these activities. No other demographic or clinical variables were associated with PASS performance in the PD group.

In the non-PD group, MMSE score was significantly correlated with mailing bills ($r_s = -.28$, $p = .04$) and money management ($r_s = -.26$, $p = .05$) such that lower MMSE score was associated with poorer performance on these activities. No other demographic or clinical variables were associated with PASS performance in the non-PD group.

Some gender-related differences were found in PASS performance. In the non-PD group, women performed better than men on oven use, cleanup, meal preparation, and all activities, $U < 289$, $Z > | -2.30 |$, $p < .02$, whereas men performed better than women on flashlight repair, $U = 325$, $Z = -1.97$, $p = .049$. In the PD group, women performed better than men on meal preparation and all activities, $U < 489$, $Z > | -2.36 |$, $p < .02$.

Discussion

Our purpose was to investigate IADL performance among people with PD without dementia. To this end, we used an objective performance-based measure (the PASS; Rogers & Holm, 1984) to assess performance of 10 common

IADLs in a well-characterized sample of participants with mild to moderate PD without dementia and healthy adults. Performance in both groups was very high in general, with a substantial proportion of participants not requiring any cues for the various activities. When cueing was required, typically only a low power of assistance (a low level of cueing) was necessary to facilitate activity performance. Such high performance is not surprising given that the sample consisted of independent, community-dwelling adults. Nonetheless, the PD group consistently scored lower on all metrics across all of the activities assessed, and significantly so for a number of specific activities.

We found that people with relatively early PD demonstrated measurable deficits in the performance of cognitively demanding IADLs. Our results are generally consistent with those of Shulman et al. (2008), who showed that emerging disability could be detected early in PD (Hoehn & Yahr Stages 1–2). However, our specific findings contrast with prior work in that cognitively demanding IADLs were previously not thought to be problematic until later in disease progression (Shulman et al., 2008). This discrepancy may stem from the fact that self-report measures of IADL function, which may underestimate disability in PD (Shulman et al., 2006), have been used in previous research. Objective, performance-based measures can be used in conjunction with self- or informant-report measures to provide a more comprehensive assessment of activities that require higher order cognitive abilities in this population. Moreover, performance-based measures can provide information beyond whether a person can perform an activity, such as the quality and safety of

Figure 1. Weighted cue scores for (A) each PASS activity and (B) the PASS activity groups for the Parkinson's disease ($n = 77$) and non-Parkinson's Disease ($n = 57$) groups.

Note. Values are means $\pm$ standard errors. * $p < .05$.

performance, the specific parts of an activity that are problematic, and the type of assistance required for successful performance. This detailed information is useful in guiding intervention.

In terms of the specific PASS activities, the medication management, shopping, and sharp utensil use activities appeared to be the most sensitive to performance problems associated with PD. A larger proportion of participants with PD required assistance on these activities or required more assistance than non-PD participants. The findings related to medication management are particularly clinically relevant, because adherence to medication is critical for optimal daily function in PD. Although almost all of the participants with PD reported managing their medications independently in daily life, many were unable to do so during testing. The novelty of the PASS activity and the laboratory context (vs. a familiar regimen in the home environment) may have played a role in the observed PD-related performance problems. However, any negative effect of these experimental factors was likely mitigated by the fact that the medication regimen of the PASS is less complicated than many PD patients' actual daily regimens.

Plus, performance problems dovetail with reports of medication nonadherence in people with PD and difficulty with more complex medication scheduling tasks (Grosset, Bone, & Grosset, 2005; Kulkarni et al., 2008; Manning et al., 2012). Research should continue to investigate factors that may underlie medication management problems in people with PD and strategies to address them.

Our findings related to sharp utensil use also require discussion because of the safety issues associated with this activity. When participants required cues for this activity, the cues were typically related to following the PASS-specific cutting directions (i.e., cut the apple into eight sections with the skin and core removed) rather than to using a knife per se. Notably, the cutting directions were listed on a meal preparation recipe card, which was presented to the participants during the instruction phase and was available for them to reference during performance. It appears that the participants with PD were less likely to check the recipe card to ensure they were performing the activity correctly. Several of the PD participants demonstrated minor safety risks that were addressable with simple verbal cues (e.g., "Try a different knife" or "Why don't you use the cutting board?") but that suggest a failure to account for impaired motor and postural control during activity performance. This potential lack of judgment may lead to future, more significant safety concerns.

The Adequacy data revealed additional PD-related decrements in the flashlight repair and checkbook balancing activities. Participants with PD did not require more assistance than non-PD participants to complete these activities, but they performed the activities less efficiently, less precisely, or with increased effort. These performance problems may be early warning signs of future need of assistance, but they risk going unrecognized, and therefore unreported, by people with PD and their caregivers because of their subtle nature and gradual emergence. The ability of the PASS to detect such problems may make it particularly useful for the assessment of function in a relatively slow-progressing condition such as PD.

The associations of PASS performance and clinical characteristics provide some clues to the risk factors for IADL dysfunction in PD and will guide future investigation. Although MMSE scores were within the normal range in this sample, they were significantly correlated with PASS performance, thus confirming that cognition is important for the selected PASS activities and suggesting that administering the PASS in conjunction with more sensitive tests of specific cognitive processes may enhance our understanding of the mechanisms underlying IADL performance in PD (Gildengers et al., 2007). Fewer relationships were found with UPDRS

score, which indicates that although motor dysfunction contributes to functional capacity, it may be less important than other factors early in the disease. Interestingly, there were no associations with depressive symptoms, which have been found in previous literature to predict reported participation in and performance of daily activities (Foster & Hershey, 2011; Holroyd, Currie, & Wooten, 2005; Weintraub, Moberg, Duda, Katz, & Stern, 2004). Although not of direct relevance to the group differences observed in this study, the effects of daily life experience and gender highlight the importance of considering a person's occupational profile when interpreting scores on a test such as the PASS.

Limitations and Future Research

The interpretation of our results is somewhat limited by the generally high performance of our sample. Our study yielded higher scores than previous research (Raina et al., 2007; Rogers et al., 2003), a result that may indicate true differences in IADL function across different clinical populations or may be related to the older age of previous samples or the potentially less restrictive cognitive entry criteria for previous studies. Alternatively, it could be the result of our conservative approach to cueing. Examiners were trained to refrain from cueing unless absolutely necessary, to give participants ample time to catch or correct their mistakes before cueing, and to provide the minimal amount of assistance necessary to support performance. These practices were adopted to allow for individual differences in the way people perform activities, the reality that people make mistakes, and the notion that performance does not have to be perfect to be sufficient for daily function.

Another potential reason for the low variance in scores is that the PASS cueing hierarchy may lack sensitivity to subtle differences in the need for cognitively oriented support at the upper range of performance. In future studies using the cognitively demanding IADLs of the PASS with mildly impaired populations, researchers may want to consider subdividing the cue levels at the higher end of the spectrum to increase sensitivity. In addition, exploration of factors that distinguish those with PD who did and did not require cues is warranted. Regardless of these issues, we were able to detect consistent PD-related performance problems, many of moderate magnitude, which suggests true deficits in IADL performance in many people.

Implications for Occupational Therapy Practice

In summary, people with relatively early and mild PD without dementia demonstrated deficits on an objective

measure of IADL performance. Although subtle, these deficits are clinically relevant, because IADLs are critical for productive and independent living. In addition, subtle deficits may predict the emergence of overt disability or significant risks to safety in the near future. The practical implications of our findings are as follows:

- Limitations in IADLs among clients with PD may go undetected by self- or informant-report measures.
- Practitioners can use objective, performance-based measures to gain a more comprehensive understanding of IADL function in clients with PD.
- Objective measures may enable the identification of early functional changes and, thus, more timely interventions for this population.
- Strategies to support the performance of IADLs and other complex activities in the early stages of PD may allow people to maintain their independence, participation, and quality of life longer and may even slow the rate of functional decline. ▲

Acknowledgments

I thank Margo Holm, Ketki Raina, and Joan Rogers (University of Pittsburgh, School of Health and Rehabilitation Sciences, Department of Occupational Therapy) for training and support related to the Performance Assessment of Self-care Skills. I also thank Joan Rogers for her helpful feedback on this article. This work was supported by the National Institutes of Health (K23HD071059, UL1TR000448), the Greater St. Louis Chapter of the American Parkinson Disease Association (APDA), and the APDA Center for Advanced PD Research at Washington University in St. Louis.

References

- Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory—II*. San Antonio, TX: Psychological Corporation.
- Brown, R. G., MacCarthy, B., Jahanshahi, M., & Marsden, C. D. (1989). Accuracy of self-reported disability in patients with parkinsonism. *Archives of Neurology*, 46, 955–959. <http://dx.doi.org/10.1001/archneur.1989.00520450025014>
- Dixon, L., Duncan, D., Johnson, P., Kirkby, L., O'Connell, H., Taylor, H., & Deane, K. H. (2007). Occupational therapy for patients with Parkinson's disease. *Cochrane Database of Systematic Reviews*, 2007, CD002813. <http://dx.doi.org/10.1002/14651858.CD002813.pub2>
- Duncan, R. P., & Earhart, G. M. (2011). Measuring participation in individuals with Parkinson disease: Relationships with disease severity, quality of life, and mobility. *Disability and Rehabilitation*, 33, 1440–1446. <http://dx.doi.org/10.3109/09638288.2010.533245>
- Fahn, S., & Elton, R. L.; Members of the UPDRS Development Committee. (1987). Unified Parkinson's Disease Rating Scale. In S. Fahn, C. D. Marsden, M. Goldstein, & D. B. Calne

- (Eds.), *Recent developments in Parkinson's disease* (pp. 153–163). Florham Park, NJ: Macmillan Healthcare Information.
- Fillenbaum, G. G. (1988). *Multidimensional functional assessment of older adults: The Duke Older Americans Resources and Services Procedures*. Hillsdale, NJ: Erlbaum.
- Fleming, A., Cook, K. F., Nelson, N. D., & Lai, E. C. (2005). Proxy reports in Parkinson's disease: Caregiver and patient self-reports of quality of life and physical activity. *Movement Disorders*, 20, 1462–1468. <http://dx.doi.org/10.1002/mds.20592>
- Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-Mental State": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189–198. [http://dx.doi.org/10.1016/0022-3956\(75\)90026-6](http://dx.doi.org/10.1016/0022-3956(75)90026-6)
- Foster, E. R., & Hershey, T. (2011). Everyday executive function is associated with activity participation in Parkinson disease without dementia. *OTJR: Occupation, Participation and Health*, 31, 16–22. <http://dx.doi.org/10.3928/15394492-20101108-04>
- Gallagher, D. A., Lees, A. J., & Schrag, A. (2010). What are the most important nonmotor symptoms in patients with Parkinson's disease and are we missing them? *Movement Disorders*, 25, 2493–2500. <http://dx.doi.org/10.1002/mds.23394>
- Gildengers, A. G., Butters, M. A., Chisholm, D., Rogers, J. C., Holm, M. B., Bhalla, R. K., . . . Mulsant, B. H. (2007). Cognitive functioning and instrumental activities of daily living in late-life bipolar disorder. *American Journal of Geriatric Psychiatry*, 15, 174–179. <http://dx.doi.org/10.1097/JGP.0b013e31802dd367>
- Grosset, K. A., Bone, I., & Grosset, D. G. (2005). Suboptimal medication adherence in Parkinson's disease. *Movement Disorders*, 20, 1502–1507. <http://dx.doi.org/10.1002/mds.20602>
- Hoehn, M. M., & Yahr, M. D. (1967). Parkinsonism: Onset, progression and mortality. *Neurology*, 17, 427–442. <http://dx.doi.org/10.1212/WNL.17.5.427>
- Holm, M. B., & Rogers, J. C. (2008). The Performance Assessment of Self-Care Skills (PASS). In B. Hemphill-Pearson (Ed.), *Assessments in occupational therapy mental health* (2nd ed., pp. 101–110). Thorofare, NJ: Slack.
- Holroyd, S., Currie, L. J., & Wooten, G. F. (2005). Depression is associated with impairment of ADL, not motor function in Parkinson disease. *Neurology*, 64, 2134–2135. <http://dx.doi.org/10.1212/01.WNL.0000165958.12724.0D>
- Kulkarni, A. S., Balkrishnan, R., Anderson, R. T., Edin, H. M., Kirsch, J., & Stacy, M. A. (2008). Medication adherence and associated outcomes in Medicare health maintenance organization-enrolled older adults with Parkinson's disease. *Movement Disorders*, 23, 359–365. <http://dx.doi.org/10.1002/mds.21831>
- Manning, K. J., Clarke, C., Lorry, A., Weintraub, D., Wilkinson, J. R., Duda, J. E., & Moberg, P. J. (2012). Medication management and neuropsychological performance in Parkinson's disease. *Clinical Neuropsychologist*, 26, 45–58. <http://dx.doi.org/10.1080/13854046.2011.639312>
- Murphy, S., & Tickle-Degnen, L. (2001). The effectiveness of occupational therapy-related treatments for persons with Parkinson's disease: A meta-analytic review. *American Journal of Occupational Therapy*, 55, 385–392. <http://dx.doi.org/10.5014/ajot.55.4.385>
- Perneckzy, R., Pohl, C., Sorg, C., Hartmann, J., Komossa, K., Alexopoulos, P., . . . Kurz, A. (2006). Complex activities of daily living in mild cognitive impairment: Conceptual and diagnostic issues. *Age and Ageing*, 35, 240–245. <http://dx.doi.org/10.1093/ageing/afj054>
- Perneckzy, R., Pohl, C., Sorg, C., Hartmann, J., Tosic, N., Grimmer, T., . . . Kurz, A. (2006). Impairment of activities of daily living requiring memory or complex reasoning as part of the MCI syndrome. *International Journal of Geriatric Psychiatry*, 21, 158–162. <http://dx.doi.org/10.1002/gps.1444>
- Racette, B. A., Rundle, M., Parsian, A., & Perlmutter, J. S. (1999). Evaluation of a screening questionnaire for genetic studies of Parkinson's disease. *American Journal of Medical Genetics*, 88, 539–543. [http://dx.doi.org/10.1002/\(SICI\)1096-8628\(19991015\)88:5<539::AID-AJMG19>3.0.CO;2-S](http://dx.doi.org/10.1002/(SICI)1096-8628(19991015)88:5<539::AID-AJMG19>3.0.CO;2-S)
- Raina, K. D., Rogers, J. C., & Holm, M. B. (2007). Influence of the environment on activity performance in older women with heart failure. *Disability and Rehabilitation*, 29, 545–557. <http://dx.doi.org/10.1080/09638280600845514>
- Rao, A. K. (2010). Enabling functional independence in Parkinson's disease: Update on occupational therapy intervention. *Movement Disorders*, 25(Suppl. 1), S146–S151. <http://dx.doi.org/10.1002/mds.22784>
- Rogers, J. C., & Holm, M. B. (1984). *Performance Assessment of Self-Care Skills test manual* (Version 3.1). Pittsburgh, PA: Author.
- Rogers, J. C., Holm, M. B., Beach, S., Schulz, R., Cipriani, J., Fox, A., & Starz, T. W. (2003). Concordance of four methods of disability assessment using performance in the home as the criterion method. *Arthritis and Rheumatism*, 49, 640–647. <http://dx.doi.org/10.1002/art.11379>
- Schenkman, M., Ellis, T., Christiansen, C., Barón, A. E., Tickle-Degnen, L., Hall, D. A., & Wagenaar, R. (2011). Profile of functional limitations and task performance among people with early- and middle-stage Parkinson disease. *Physical Therapy*, 91, 1339–1354. <http://dx.doi.org/10.2522/ptj.20100236>
- Schrag, A., Jahanshahi, M., & Quinn, N. (2000). How does Parkinson's disease affect quality of life? A comparison with quality of life in the general population. *Movement Disorders*, 15, 1112–1118. [http://dx.doi.org/10.1002/1531-8257\(200011\)15:6<1112::AID-MDS1008>3.0.CO;2-A](http://dx.doi.org/10.1002/1531-8257(200011)15:6<1112::AID-MDS1008>3.0.CO;2-A)
- Shulman, L. M., Gruber-Baldini, A. L., Anderson, K. E., Vaughan, C. G., Reich, S. G., Fishman, P. S., & Weiner, W. J. (2008). The evolution of disability in Parkinson disease. *Movement Disorders*, 23, 790–796. <http://dx.doi.org/10.1002/mds.21879>
- Shulman, L. M., Pretzer-Abhoff, I., Anderson, K. E., Stevenson, R., Vaughan, C. G., Gruber-Baldini, A. L., . . . Weiner, W. J. (2006). Subjective report versus objective measurement of activities of daily living in Parkinson's disease. *Movement Disorders*, 21, 794–799. <http://dx.doi.org/10.1002/mds.20803>
- Sitek, E. J., Soltan, W., Wiczorek, D., Robowski, P., & Slawek, J. (2011). Self-awareness of memory function in

- Parkinson's disease in relation to mood and symptom severity. *Aging and Mental Health*, 15, 150–156. <http://dx.doi.org/10.1080/13607863.2010.508773>
- Wechsler, D. (2001). *Wechsler Test of Adult Reading manual*. San Antonio, TX: Psychological Corporation.
- Weintraub, D., Moberg, P. J., Duda, J. E., Katz, I. R., & Stern, M. B. (2004). Effect of psychiatric and other non-motor symptoms on disability in Parkinson's disease. *Journal of the American Geriatrics Society*, 52, 784–788. <http://dx.doi.org/10.1111/j.1532-5415.2004.52219.x>