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The Physical and Cognitive Performance Test for Residents in Assisted Living Facilities

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Abstract

OBJECTIVE—The aim of this study is to develop and evaluate the psychometric properties of a new performance-based instrument (the Physical and Cognitive Performance Test for Assisted Living Facilities; PCPT ALF) designed to assess the physical and cognitive skills associated with the performance of activities of daily living (ADL) and instrumental activities of daily living (IADL).

DESIGN—There were three stages in this study: development of instrument items and validity testing, a feasibility pilot study and a cross-sectional trial to establish construct and criterion validity and reliability.

SETTING—One 116-bed ALF.

PARTICIPANTS—Following a pilot test with 10 residents, a cross-sectional trial was conducted with 55 additional residents.

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MEASUREMENTS—The Barthel Index and the Functional Independence Measure were used to estimate criterion validity. Construct validity was examined using exploratory factor (EFA) analyses.

RESULTS—Disattenuated correlations between the PCPT ALF and other tools were all above 0.72 supporting criterion validity. Internal consistency (physical ability, $\alpha = 0.95$; cognitive support, $\alpha = 0.92$) and one week test-retest reliability (PCPT ALF, $p=0.93$) were high as was inter-rater reliability (0.99=physical ability; 1.00 =cognitive support). In two EFAs, one each for the physical ability and cognitive support subscales, a one factor solution accounted for 64.1% of the variance and 63.5% of the variance, respectively.

CONCLUSION—The findings provide early evidence of the PCPT ALF instrument's score validity and reliability. If confirmed, this study's findings may be used in future work to assess the success of interventions to prevent or slow decline in the skills associated with ADL/IADL performance in ALFs.

Keywords

dementia; motor activity; Activities of Daily Living; institutionalized persons

Americans age 65 and older are increasingly utilizing assisted living facilities (ALFs), particularly when experiencing physical and cognitive impairments.¹ Four out of 10 ALF residents report three or more limitations in the performance of activities of daily living/instrumental activities of daily living (ADL/IADL).^{2,3} Seven out of 10 ALF residents also have cognitive impairment (CI) or dementia, which affects their ability to perform tasks independently.^{4,5} Once in an ALF, older adults express a strong desire to age in place and avoid admission to more formal care settings, such as nursing homes. Discharge to a higher level of care may be associated with decline in physical and/or cognitive performance, further ADL/IADL impairment and the lack of resources in an ALF to manage more severe impairments.⁶

While nursing homes have standardized criteria for admission, staffing, and ADL/IADL assessment, ALFs are not regulated by federal government nursing home rules and have neither standardized resident assessments nor entry or discharge criteria.⁷⁻⁹ Assessing and evaluating whether an older adult can safely reside in an ALF requires a comprehensive assessment of his/her cognitive and physical skill levels. For example, dressing not only requires knowledge and memory of the steps involved but also physical flexibility, balance and strength. Accurate and regular assessment of the physical and cognitive skills associated with ADL/IADL performance is necessary to ensure a match between resident abilities and ALF resources and to develop individualized interventions to prevent de-conditioning, which can lead to increased care needs.

Current instruments used to assess ADL/IADL in skilled nursing are not optimal as they require intrusive direct rater observation of personal care tasks and specialized training to administer, have ceiling and floor measurement effects and do not measure the cognitive support required to complete ADL/IADL tasks.¹⁰⁻¹⁸ The primary objective of this study was to develop and evaluate the psychometric properties of a new instrument (the Physical and

Cognitive Performance Test for Assisted Living Facilities; PCPT ALF) designed to assess the physical and cognitive skills required to perform ADL/IADL tasks. Instrument development focused on measuring multiple physical domains associated with ADL/IADL performance (e.g., strength, endurance) as well as needed cognitive domains (e.g., executive functioning).

METHODS

Instrument Development and Establishment of Face Validity

Item development for the PCPT ALF was guided by a conceptual framework integrating physical and cognitive skills required to perform ADL/IADL.¹⁵ Items were revised until all ADL/IADL skills were represented (see Table 1). Each item was designed to be performance-based, easily administered in an ALF by a single individual and scored from 3 (independent) - 0 (unable).

Given that there were no guidelines to concurrently measure the cognitive support required to complete a task, the authors worked with a PhD-prepared psychologist with expertise in aging to delineate the cognitive demands associated with each physical task. Cognitive supports were defined for each task and scored as: 3 (no prompting), 2 (verbal cueing), 1 (modeling the task; see Table 1). To assess the resident's highest level of physical ability, up to three trials with escalating cognitive support were allowed. Overall, PCPT ALF scores ranged from 8–51 (0–27 on physical abilities and 8–24 on cognitive support) with higher scores indicating greater physical and cognitive skills associated with ADL/IADL performance.

Once a set of items and scoring protocols were assembled, an assessment of face validity was conducted.^{19,20} Two PhD-prepared nurse scientists with expertise in geriatrics and tool development reviewed the items vis-a-vis the conceptual framework⁸ and existing ADL/IADL measures including the Katz ADL,¹³ Barthel Index,¹⁶ Functional Independence Measure (FIM),¹⁷ Resident Assessment Instrument (RAI),¹⁴ Tinetti Gait and Balance Test¹¹ and the Physical Performance Test (PPT, and nursing home version).^{10,12} Subsequently, PCPT ALF items were refined to ensure a complete assessment of ADL/IADL, ease of administration, and clarity of administration.

The tool was then assessed by six additional experts using a Content Validity Index.²¹ Reviewers rated each item using a 4-point scale where a score of 3 or 4 indicates a relevant item. All PCPT ALF items received ratings of 3 by every reviewer; the experts did not recommend additional items but did suggest removing the cognitive support associated with the 50' walk/self-propelled wheelchair item as this task was very easy for participants to understand. This resulted in 9 items on the physical ability subscale (range 0–27) and 8 items on cognitive support subscale (range 8–24).

Test of Feasibility

Next, we conducted a feasibility test with 10 ambulatory ALF residents with a range of physical and cognitive abilities to determine the appropriateness of tasks in the ALF environment, ease of administration, and resident performance and burden. We administered

the PCPT ALF once to each participant with research staff observing and taking field notes with each administration. We used these field notes along with discussions among the investigators and other experts to reach consensus on the final set of items, scale scoring and administration.

Establishing Validity/Reliability of the Final Instruction

Design—To establish criterion and construct validity, we conducted a test-retest study with measures administered at baseline and one-week later using 55 additional ALF residents. The Barthel Index,¹⁶ FIM,¹⁷ and the PCPT ALF instrument were administered in the same order on the same day and time each week using standardized procedures. Study-trained ALF staff collected data for the observational components of the Barthel and the physical items of the FIM while research staff collected all data for the PCPT ALF. We reduced missing data (3.7%) through review of the medical record and discussions with direct care workers.

This study was approved by the University of South Florida Institutional Review Board and VA office (IRB#01455). Participants or their legally authorized representatives provided written informed consent.

Study Measures—The Barthel Index consists of 10 ADL/IADL activities including feeding, bathing, dressing, grooming, bowel and bladder control.¹⁶ The stair climbing item was eliminated as ALF residents rarely need to use stairs. Items are scored to reflect the degree to which the person can complete the task independently. Previous work suggests scores below 60 (on a 0–100 scale) indicate more dependence than independence with a score of 20 or below reflecting total dependence in self-care and mobility.^{22,23} The Barthel has high sensitivity and medium specificity to ADL/IADL-related changes in ALFs residents.¹⁵

The 13-item motor subscale of the FIM is a well-validated tool that measures the ability to perform tasks such as eating, grooming and transfers.¹⁷ Items are rated on a 7-point ordinal scale ranging from complete dependence to independence, with higher scores indicating greater independence. Previous work examining FIM motor task scores report a mean of 44 among older stroke patients²⁴ and a mean of 34 among older adults with Parkinson's disease.²⁵

The Montreal Cognitive Assessment (MoCA) was used to measure overall cognitive performance. The MoCA is a valid and reliable tool with high sensitivity and specificity for detecting mild CI.²⁶

Medical charts were reviewed for demographic information (age, education, gender), medical history, chronic and acute medical conditions and medication use.

Analyses

We calculated disattenuated correlations between the PCPT ALF and the established measures of physical and cognitive performance to establish criterion validity. We used this particular approach to correct for the lack of reliability in the measures.^{27,28} To examine

construct validity, we conducted exploratory factor analyses (EFA) separately for the physical ability and cognitive support items using principal components analysis with Varimax rotation. We performed separate EFAs because the subscales had different scoring ranges. Recommendations for EFA sample sizes center on the number of subjects per item/variable to achieve stable estimates and range from 3:1 to 6:1, with a minimum of 50.^{29,30}

To examine one-week test-retest reliability, we used paired t-tests. IRR was assessed for all study measures using percent agreement between research staff raters. Cronbach's alpha was used to estimate internal consistency of subscale items on each occasion. We used IBM SPSS Statistics 22 (Chicago, IL) for all analyses.

RESULTS

Descriptive Statistics

Resident participants in the study averaged 79 years of age (SD: 9.9 years). About 56% were female, 62% were nonHispanic White and nearly 41% had a high school education or greater. Table 2 shows descriptive statistics for each of the study measures. The mean PCPT ALF score was 41.9 (median = 47.0; range = 10–51) reflecting the full range of possible scores. Fifteen percent of participants were at the highest possible score on the Barthel instrument. On the FIM, no residents scored above 56 (range 0–70). Comparatively fewer residents scored at the floor (1.8% scored the lowest possible score) and ceiling (3.7% scored the highest possible score) on the PCPT ALF. There were no missing data on the PCPT ALF. In contrast, four residents had missing responses on the FIM and the Barthel, due to direct care worker uncertainty on how a resident performed a personal care task. Three residents who were highly ambulatory but had severe dementia were unable to complete the MoCA and received a score of 0 (per scoring convention). These residents scored in the bottom 5th percentile of the PCPT ALF.

On the PCPT ALF, some physical ability items were completed with little/no cognitive support. For example, 77% of respondents required no cognitive support to stand and 75% of respondents required no cognitive support to pick up a pen. Other items required more cognitive support to perform; 16.5% of residents required the task to be modeled before they could write a sentence and 14.7% required the task to be modeled before they could reach behind their head and hold for 15 seconds.

Construct and criterion validity

As shown in Table 3, a one factor solution accounted for 64.1% of the variance for the physical ability subscale indicating good cohesion among the items using the criterion of number of eigenvalues > 1. Similarly, a one factor solution accounted for 63.5% of the variance in the cognitive support subscale.

Disattenuated correlations between the instruments (0.86 between the PCPT ALF total score and the Barthel Index; 0.93 between the PCPT ALF total score and the FIM; 1.00 between the Barthel Index and the FIM) were high -- supporting criterion validity. There was a moderately high correlation between the PCPT ALF physical abilities subscale and the MoCA ($\rho=0.57$; $p < 0.01$) and a high correlation between the PCPT ALF cognitive support

subscale and the MoCA ($\rho=0.75$; $p=0.01$). There were moderate to high correlations between the PCPT ALF cognitive subscale and the Barthel ($\rho=0.67$; $p=0.01$) and the FIM ($\rho=0.64$; $p=0.01$); the PCPT ALF physical abilities subscale and the Barthel ($\rho=0.76$; $p=0.01$) and the FIM ($\rho=0.85$; $p=0.01$), and the PCPT ALF physical and cognitive subscales ($\rho=0.73$; $p=0.01$), confirming the important relationship between physical performance and cognitive ability.

Internal consistency, test-retest, and inter-rater reliability

The PCPT ALF physical ability ($\alpha=0.95$) and cognitive support subscales ($\alpha=0.92$) indicating excellent internal consistency. There was good support for one-week test-retest reliability ($N=54$) with no statistically significant differences in scores (PCPT ALF, $t=0.25$, $p=0.81$; $DF=53$). PCPT ALF physical ability items were highly correlated in week one and week two except for the turn in place task ($\rho=0.52$). PCPT ALF cognitive support items were also highly correlated except for the reach/scoop task ($\rho=0.56$) and the put on and remove a jacket task ($\rho=0.56$). IRR was good across all instruments (99% agreement on physical ability and 100% on cognitive support subscales; 99% on the Barthel; 77% on the FIM).

DISCUSSION

Our findings provide initial support for the validity and reliability of scores on the PCPT ALF. Additionally, this tool was easier to use in the ALF environment because no direct observation of IADL/IADL tasks was required. This eliminates the need for clinicians or researchers to either directly observe personal care tasks or rely on direct care workers to score performance on those tasks. These characteristics resulted in no missing data as well as the ability to easily establish IRR. Tools currently used in ALFs were not designed for this setting and did not fully capture this population's range of ADL/IADL.⁸ The PCPT ALF captured the ADL/IADL performance of the sample and had fewer floor/ceiling effects than the Barthel Index and FIM. Providing an easy-to-administer and score performance assessment instrument will support the ability of staff to regularly assess for changes in resident performance. Capturing early change can lead to revised plans of care with a goal to preserve or improve physical and cognitive performance.

Consistent with other performance-based instruments, the PCPT ALF captures multiple physical and cognitive skills.^{10,12} Previous work suggests that to enter into and remain in this environment residents require strength, endurance, balance, and gait physical abilities.¹⁵ This study suggests ALF residents may also require specific cognitive supports including memory, executive function, language, and visuospatial abilities to maintain their current level of independence. As far as we know, the PCPT ALF is the only instrument that integrates the skills associated with ADL/IADL performance specifically designed for this population and setting.

The study has several limitations. We recruited residents from one ALF. Because of the wide-variation across assisted living environments, including staffing and resident eligibility requirements, additional research should be conducted across diverse facilities and ALF residents. Due to the cross-sectional design, we were also unable to examine how changes in

the time it takes a resident to complete a task may be associated with the ADL/IADL decline and whether the PCPT ALF predicts actual decline in ADL/IADL performance.

This study's findings support that the PCPT ALF may be used in the earlier detection of cognitive change and eventually in developing tailored interventions focused on preventing decline. Additional work is needed to determine whether PCPT ALF subscales should be combined or used separately in terms of intervention development and testing. Tool developers may also examine the unique contribution of each of the subscales and potentially refine individual scale items. For example, the "sit to stand" and "pick up a pen" cognitive support items may be removed as most residents understood these tasks. Additional work on the associated physical and cognitive domains with ADL/IADL tasks may also be warranted. Finally, additional work is needed to examine how the PCPT ALF may be used to understand when a resident would benefit from the next level of care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Physical and cognitive domains associated with each task in the Physical and Cognitive Performance Test for Assisted Living Facilities (PCPT ALF).

PCPT ALF Task	ADL/IADL (Primary Physical Domains)	Primary Cognitive Domains
Scoring Convention	3=independent, 2=semi-independent, 1=semi-dependent, 0=unable	3=no prompting, 2=verbal cueing, 1=modeling
1. Write a sentence	IADL, writing a check (dexterity)	Memory, comprehension, executive function, language, visuospatial ability
2. Reach/scoop	ADL, eating (flexibility, dexterity, range of motion, endurance)	Executive function, visuospatial ability
3. Lift Book	IADL, light housekeeping tasks (upper body strength, flexibility, range of motion)	Executive function, visuospatial ability
4. Reach behind head and hold	ADL, grooming; (upper body endurance, flexibility, range of motion)	Executive function, memory
5. Put on and remove a jacket	ADL, dressing (flexibility, balance, range of motion)	Executive function, memory
6. Pick up pen from floor	IADL, light housekeeping tasks (lower body dexterity, flexibility, range of motion)	Memory, visuospatial ability
7. Sit to stand	ADL, mobility (lower body strength)	Memory, executive function
8. Turn in place	ADL, mobility (lower body strength, gait, balance)	Memory, executive function, visuospatial ability
9. Walk or wheel 50'	ADL, mobility (lower body strength, gait, balance, endurance)	None

ADL is Activities of Daily Living; IADL is Instrumental Activities of Daily Living. A cognitive domain expert worked with the authors to identify the accompanying cognitive domains associated with each physical ability. Physical ability and cognitive support domain items were examined by six additional expert reviewers using a Content Validity Index to determine the content relevance of the proposed items.

Table 2

Scores on Study Instruments (n=55).

Measure	M±SD	Median	Possible Range	Study Range
Physical and Cognitive Performance Test for Assisted Living Facilities	41.9±10.6	47.0	8–51	10–51
<i>Physical Ability Items</i>				
Write a Sentence	2.4±0.8	3.0	0–3	0–3
Reach/Scoop	2.7±0.7	3.0	0–3	0–3
Lift a Book	2.6±0.8	3.0	0–3	0–3
Reach Behind Head and Hold	2.6±0.9	3.0	0–3	0–3
Put on and Remove a Jacket	2.2±1.0	3.0	0–3	0–3
Pick up a Pen From the Floor	2.5±1.0	3.0	0–3	0–3
Sit to Stand	2.3±1.2	3.0	0–3	0–3
Turn in Place	2.0±1.0	2.0	0–3	0–3
Walk or Wheel 50'	2.6±1.0	3.0	0–3	0–3
Physical Abilities Subscale	21.9±7.0	25.0	0–27	1–27
<i>Cognitive Support Items</i>				
Write a Sentence	2.3±0.7	2.0	1–3	1–3
Reach/Scoop	2.5±0.6	3.0	1–3	1–3
Lift a Book	2.6±0.6	3.0	1–3	1–3
Put on and Remove a Jacket	2.3±0.5	2.0	1–3	1–3
Pick up a Pen From the Floor	2.7±0.5	3.0	1–3	1–3
Sit to Stand	2.6±0.7	3.0	1–3	1–3
Turn in Place	2.5±0.7	3.0	1–3	1–3
Cognitive Support Subscale	19.9±4.2	22.0	8–24	8–24
Barthel Index	60.8±28.5	75.0	0–90 ^I	0–90
Functional Independence Measure	38.5±14.5	45.0	0–70	3–56
Montreal Cognitive Assessment	11.7±8.7	11.0	0–30	0–27

^I One item from the Barthel Index measuring stair climbing was eliminated as this skill is not critical for residency and stairs are often not available.

Table 3

Factor Structure of the Physical and Cognitive Performance Test for Assisted Living Facilities (PCPT ALF) (n=55)

PCPT ALF Item	Factor Loadings
Factor 1 (Physical Ability)	Cronbach α =0.95
Write a Sentence	0.79
Reach/Scoop	0.76
Lift a Book	0.89
Reach Behind Head and Hold	0.69
Put on and Remove a Jacket	0.85
Pick up a Pen From the Floor	0.76
Sit to Stand	0.84
Turn in Place	0.79
Walk or Wheel 50'	0.84
Factor 2 (Cognitive Support)	Cronbach α =0.92
Write a Sentence	0.67
Reach/Scoop	0.80
Lift a Book	0.84
Put on and Remove a Jacket	0.64
Pick up a Pen From the Floor	0.90
Sit to Stand	0.85
Turn in Place	0.84

Results of two separate Exploratory Factor Analyses using the criterion of number of eigenvalues > 1 for the physical ability and cognitive support items.