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PREDICTORS OF INSTRUMENTAL ACTIVITIES OF DAILY LIVING: A COMPARISON OF PERFORMANCE-BASED MEASURES AND A SELF-REPORT MEASURE

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ABSTRACT

Objective: Instrumental Activities of Daily Living (IADL) include tasks such as driving, cooking and balancing a checkbook. The ability to complete IADL is essential for well-being and independence; however, assessment methods vary greatly. This study examined the relationships and predictors of three performance-based IADL measures compared to a self-report IADL measure.

Methods: Secondary data analyses were conducted with healthy older adults from the Advanced Cognitive Training for the Independent and Vital Elderly study (ACTIVE, N=2626). Performance-based measures included the: Timed Instrumental Activities of Daily Living (TIADL), Observed Tasks of Daily Living (OTDL) and Everyday Problems Test (EPT). A shortened version of the Minimum Data Set (MDS) was used for the self-report questionnaire.

Results: Pearson correlations revealed a moderate correlation between the performance-based measures (r=.47-.60, *p*s<.001). The self-report MDS showed a weak correlation with TIADL (r= .093, $p<.001$) and OTDL (r=.051 $p<.05$), but not with EPT ($p>.05$). After accounting for demographics, health, vision, and physical functioning, cognition was a consistent predictor for performance-based IADL, but not for the MDS. Vision and the Turn 360 Test showed inconsistent results.

Discussion: Cognition is closely related to IADL among community-dwelling older adults. However, in regards to the relationship between IADL, physical functioning and sensory functioning, future research is needed. Furthermore, when administering self-report measures of IADL clinicians should use caution. Findings should be replicated in a sample with diminished cognitive capacity in order to assess utilization in a clinical setting.

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Chapter 1

Introduction

By 2030, adults aged 65 and older will comprise 20 percent of the general United States population (Centers for Disease Control and Prevention, 2013). Difficulties in Instrumental Activities of Daily Living (IADL), such as needing assistance with household tasks, shopping, and finances, increase with age. An estimated 9.7 to 10.6 percent of older adults between the ages of 65-74 have at least one functional limitation, and this rate increases to between 33.5 and 47 percent for adults who are 85 and older (National Institute on Aging, 2007). The inability to perform IADL can restrict older adult's involvement within the community, as well as activities they enjoy, contributing to a reduced quality of life and loss of independence (Centers for Disease Control and Prevention, 2013). Generally, loss of independence further leads to institutionalized care, such as hospitalization, nursing homes, adult day cares and rehabilitation (Centers for Disease Control and Prevention, 2013). The cost per year spent on long term care services for adults 65 and older in the United States is currently estimated between $210.9 billion and $306 billion (Centers for Disease Control and Prevention, 2013). Costs associated with these services have contributed to an increased concern among older adults and their families regarding how to pay for care (Centers for Disease Control and Prevention, 2013). While some pay for the cost of care themselves, a large portion of the population relies on Medicaid and Medicare, creating concern at the personal, social and government levels (Centers for Disease Control and Prevention, 2013). With the increase of the older adult population, and associated increase in functional limitations, long term care services are expected to increase within the next few decades as well (Centers for Disease Control and Prevention, 2013). In order to improve the health of older adults and reduce healthcare costs, IADL limitations need to be decreased. Effective assessments for detecting and preventing decline in IADL are one way to possibly reduce the prevalence. Research in this broad area and better identification of the individual constructs contributing to IADL is greatly needed. Therefore, this study investigated the relationships among four different methodologies and the predictors of those assessments.

IADL is comprised of skills and abilities that are essential to be independent in the community and at home (Patterson, Goldman, McKibbin, Hughs, & Jeste, 2001). Eight broad categories of IADL have been identified, namely; ability to use the telephone, shopping, food preparation, housekeeping, laundry, mode of transportation, responsibility for own medication and ability to handle finances (Graf, 2013). As IADL are key to maintaining independence, the ability to assess this important construct is crucial for healthcare professionals. By accurately determining the current level of functioning, individual care plans can be developed and identification of potential interventions can be formed to improve an individual's ability to function independently in the future (Graf, 2013).

Self-report measures (Gold, 2012) and performance-based measures (Moore, Palmer, Patterson, & Jeste, 2007) are commonly used in healthcare to evaluate older adults' IADL functioning. Both measurement methods have advantages and disadvantages. Performance-based measures typically involve observing an individual perform a specific task or group of tasks designed to simulate real-world activities (Moore et al., 2007). Performance-based measures have the advantage of objective data collected directly from measurement or observation of how an individual performed on the task (Gold, 2012). However, critics of performance-based measures have pointed out that these assessments are performed in artificial labs or clinical environments that are likely different from an individual's natural environment. This may result in bias and fail to account for other influences in the real-world, such as compensation strategies. Secondly, performance-based measures can be time-consuming, require additional administration and scoring administration training, and can be costly for both clients and professionals administering the tests (Patterson et al., 2001).

Alternatively, self-report measures are commonly used. Self-report measures require the individual to report how they think they performed on a task or group of tasks either through an interview or questionnaire (Strauss, Elizabeth, & Spreen, 2006). These measures are often quick to administer and score, inexpensive, and require little specialized equipment (Podsakoff & Organ, 1986). However, these tests assume that participants are able to give unbiased and realistic assessments of their own functioning. This may be especially questionable for at-risk populations or those with cognitive deficits. Problems such as social desirability and response bias are also common when using self-report data, thus the validity of self-report measures are a concern (Podsakoff & Organ, 1986). Some evidence suggests that self-report measures may be poor indicators of functional abilities (Rubenstein, Schairer, Wieland, & Kane, 1984; Rueda, Lau, Saito, Harvey, & Risacher, 2014). In a sample of 61 hospitalized older adults, patients, significant others and nurses were told to report on the patient's IADL functioning. Patients reported they had much higher IADL functioning compared to the reports of both the significant others and nurses (Rubenstein et al., 1984). This suggests that individuals may overestimate their own IADL functioning (Friedman et al., 1999). Another study included 1,080 older adults with a broad range of cognitive abilities ranging from, normal cognition to Alzheimer's disease. Both self-report and informant rated IADL functioning was assessed. Similar to the Friedman study, results found that the participants over-rated their own IADL abilities when compared to their actual performance of IADL tasks. Interestingly, informant ratings were more similar to the actual participant IADL performance of the tasks (Rueda, 2014). Taken together, these studies suggest that individuals overestimate their functional abilities, especially in samples with diminished cognitive capacity (Rueda et al., 2014).

Research is mixed on the relationship between self-report and performance-based measures of IADL. Owsley and colleagues (Owsley, Sloane, McGwin, & Ball, 2002), assessed 173 community-dwelling older adults (ages 65-90) on the performance-based measures of Timed Instrumental Activities of Daily Living (TIADL), The Everyday Problems Test (EPT), The Observed Tasks of Daily Living Test (OTDL) and the self-report Minimum Data Set Instrumental Activities of Daily Living Questionnaire (MDS). Results indicated that TIADL was not related to any of the performance-based measures (EPT and OTDL) or with the self-report measure (MDS). Another study assessed 698 community-dwelling older adults (ages 65-94) on the EPT, OTDL, TIADL and the MDS (Tucker-Drob, 2011). Findings were that the MDS did not have a significant relationship with any of the performance-based measures. A third study included 171 women (mean age of 74.3) who were administered the Instrumental Activities of Daily Living portion of the Functional Status Questionnaire, as well as the Physical Performance Test. This included some IADL activities such as writing a sentence and Activities of Daily Living (ADL) such as simulated eating and walking. Results showed that women had more limitations on the Physical Performance Test than they had self-report on the IADL portion of the Functional Status Questionnaire (Brach, VanSwearingen, Newman, & Krista, 2002). Together these studies suggest that caution should be used when interpreting self-report measures of IADL, as participants may be overestimating their functional abilities.

On the other hand, the results of one study may contradict these findings. The study included 88 community-dwelling older adults (ages 50-86) who were administered the self-report Lawton-Brody IADL scale, the performance-based OTDL and EPT, and direct observation of everyday activity by a trained experimenter (Schmitter-Edgecombe, Parsey, & Cook, 2011). The self-report IADL scale did not show a significant relationship with the OTDL or EPT, but did significantly correlate with the direct observation of everyday activities. These results suggest a self-report measure may accurately assess an individual's IADL and that the performance-based IADL measures may have less accuracy and validity. However, many of the direct observation activities performed in the study require more physical abilities during the activities, such as sweeping and watering plants, which have been shown to have a stronger relationship with self-report measures (Guo, Matousek, Sonn, Sundh, & Steen, 2000). This suggests that older adults may accurately assess their own physical functioning and highlights the importance of articulating the specific domain involved in the IADL (Guo et al., 2000). However, as many IADL require cognitive abilities (e.g. balancing a checkbook, determining the correct medication to take, etc.), the relationship between self-report IADL and performance-based IADL for more cognitively demanding tasks is unclear. The current study builds upon this literature by addressing similar questions focused on cognitively demanding IADL with a very large sample of healthy older adults.

In order to assess the complex relationships between self-report and performance-based IADL functioning, it is important to first understand the factors associated with IADL in older adults. Cognitive, sensory and physical functioning factors have been identified as predictors of IADL in older adults.

Research has predominantly focused on cognitive predictors of IADL. Cognition is thought to be related to IADL because individuals need to be able to recall past information and experiences, as well as work through challenges to complete IADL in everyday life (Yam & Marsiske, 2013). For example, good cognitive functioning is essential for figuring out measurements for a recipe and for paying bills. One area of cognition, memory, has been shown to predict performance-based IADL in various studies (Diehl et al., 2005; Gross, Rebok, Unverzagt, & Willis, 2011; Schmitter-Edgecombe et al., 2011; Tucker-Drob, 2011). Specifically, better memory has shown to be predictive of better performance on the EPT and OTDL (Schmitter-Edgecombe et al., 2011), a composite measure of the EPT, TIADL and OTDL (Gross et al., 2011) and the TIADL (Tucker-Drob, 2011). Better memory was also predictive of better self-report IADL scores, including better reported Lawton-Brody IADL scores (Schmitter-Edgecombe et al., 2011) and better MDS scores (Gross et al., 2011).

Reasoning has also been found to be associated with better performance-based IADL measures (Baenziger, 2013; Diehl et al., 2005; Gross et al., 2011; Whitfield, Thomas, Heyward, Gatto, & Williams, 1999). Better reasoning was a predictor of better performance on the OTDL (Baenziger, 2013; Diehl et al., 2005) and the EPT (Whitfield et al., 1999), as well as on a composite measure of EPT, OTDL and TIADL (Gross et al., 2011). Better reasoning was also found to be a significant predictor of self-report IADL, specifically the MDS (Yam, Gross, Prindle, & Marsiske, 2014).

Finally, better speed of processing was also identified as a predictor of better IADL performance (Schmitter-Edgecombe et al., 201; Burton, 2007 & Owsley, 2001). Specifically, better speed of processing was predictive of better scores on the EPT (Schmitter-Edgecombe et al., 2011), the OTDL (Schmitter-Edgecombe et al., 2011) and the TIADL (Owsley, McGwin, Sloane, Stalvey, & Wells, 2001). Better speed of processing was also a predictor of better scores on the self-report Lawton- Brody scale and the MDS (Schmitter-Edgecombe et al., 2011; Yam et al., 2014).

Better vision was also associated with better IADL. This relationship is likely due to the fact that IADL require the ability to distinguish letters and numbers among many other things. For example, when paying bills it is crucial to be able to read the numbers, as well as in the grocery store an individual needs to be able to read labels and nutrition facts. Visual acuity has been found to be associated with the TIADL, however, it is important to note that the 342 older adults used in this study were recruited from vision eye clinics and may not be representative of the broader older adult population (Owsley et al., 2001). Research regarding populations with normal vision and performance-based IADL is scarce. Better Visual acuity was also a predictor of better self-report IADL on The Lawton-Brody Scale (Keller, Morton, Thomas, & Potter, 1999). Further research is needed in this area.

IADL also require the ability to perform some physical tasks, yet these abilities have not been studied to the same extent as cognition (Yam & Marsiske, 2013). Factors such as health status and exercise have been extensively researched and found to be predictive of both performance-based and self-report IADL (Whittle & Goldenberg, 1996; Yam & Marsiske, 2013). Other measures of physical functioning have not received much attention regarding IADL. The Turn 360 Test, a measure of balance often used to assess mobility (Shubert, Schrodt, Mercer, Busby-Whitehead, & Giuliani, 2006), is one measure that has not been studied as a predictor of IADL. However, researchers have identified it as a potential measure related to IADL tasks, such as shopping (Shubert et al., 2006).

Although both self-report and performance-based measures claim to assess the same underlying construct of IADL, research is needed to empirically test the relationships between these IADL methods of assessment. Research has shown little evidence that these measures overlap with one another, yet are both used interchangeably in many health professions (Elliott & Fiszdon, 2014). Therefore, <u>the first aim of the study</u> was to determine the relationships between self-report and performance-based IADL measures. Timed Instrumental Activities of Daily Living (Owsley et al., 2001), Observed Tasks of Daily Living (Diehl et al., 2005) and The Everyday Problems Test (Willis & Marsiske, 1993) are commonly used for the performance-based IADL measures. A modified version of the Minimum Data Set (Morris et al., 1997) is a commonly used self-report IADL measure. <u>The second aim of the study</u> was to determine the predictors of both performance-based IADL and self-report IADL. Specifically, this study examined cognitive, sensory, and physical predictors of each measure. Additionally, composite variables were investigated to examine general patterns and individual measures were investigated to examine clinical relevance.

The current study builds upon the literature by addressing research gaps regarding self-report and performance-based IADL with a large and diverse sample as well as extensive IADL measures and predictor variables. Based upon past research it was hypothesized that the performance-based measures, TIADL, OTDL and the EPT would not have a significant relationship with the self-report measure, MDS. However, it was expected that the performance-based measures would significantly correlate with one another. Furthermore, it was predicted that the cognitive variables would have the most significant relationship with IADL. Additionally, it was hypothesized that Visual acuity would be strongly correlated with TIADL, since the tasks heavily relied on vision (Owsley et al., 2001). Lastly, it was hypothesized that The Turn 360 Test would be associated with performance-based measures and the self-report measure of IADL. However, it was predicted the strongest relationships would be with the performance-based measures, due to tendency for people to overestimate IADL ability.

Chapter 2

Methods

Participants

This study used baseline data from the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) trial. The goal of the ACTIVE study was to investigate the long-term impact of three cognitive interventions on cognition and everyday functioning in healthy older adults. A total of 5,000 older adults were screened for eligibility between March 1998 and October 1999. Inclusion criteria included (a) 65 years of age or older, (b) no substantial cognitive decline (score greater than or equal to 23 on MMSE and no self-reported Alzheimer's disease), (c) no substantial functional decline, (d) no medical condition that could severely impact their functioning or that may likely cause death within two years (certain cancers or stroke), (e) no severe sensory loss, (f) no severe communicative difficulties, (g) no recent participation in cognitive training interventions and (h) scheduling availability to participate in an intervention trial. The ACTIVE trial included 2,802 eligible participants between the ages of 65-94, all of whom were in good health. Further details of this study can be found in Jobe and colleagues (2001).

The current study included 2,626 participants with complete data on the variables of interest. Participants ranged in age from 65-93 (mean of 73.4, SD=5.73), mostly female (75.6%). Participants were Caucasian (73.3%), African American (26%) or other (0.8%). Education ranged from completed fourth grade to completed Doctoral degree (mean of 13.54 years of education). Vocabulary scores ranged from 0-18 (mean of 12.41).

Procedures

The study included six field sites; The University of Alabama at Birmingham, The Boston Hebrew Rehabilitation Center for Aged, The Indiana University School of Medicine, The John Hopkins University, The Pennsylvania State University and Wayne State University. All study procedures were approved by the Institutional Review Boards of each participating university. The first screening was conducted through phone interviews to identify potential participants who met inclusion criteria and who were willing to participate. Next, potential participants were administered an in person battery to assess vision (visual acuity >20/50) and dementia status (Mini-Mental State Examination >23). Third, baseline measures were collected in two-person visits for a total of four to five hours.

Measures

Outcomes.

Instrumental Activities of Daily Living (IADL). The Timed Instrumental Activities of Daily Living Test (TIADL, Owsley et al., 2001) assessed five different domains of IADL; financials, phone use, meal preparation, shopping and medication use. Items included: (a) making change, (b) remembering a name, locating that name in a phonebook and calling the associated phone number, (c) locating and reading ingredients on cans of food, and (d) reading directions on bottles of medication. Each question was scored by the amount of time the subject took to complete the task and task completion accuracy. Item scores were calculated and combined to create a total composite score in accordance with Owsley and colleagues (2001), such that lower scores reflected better performance. TIADL has been indicated to have good test-retest reliability with a correlation of .85 (Owsley et al., 2001).

The Everyday Problems Test (EPT, Willis & Marsiske, 1993) is a performance-based measure of IADL that assessed participant's ability to solve real-world problems. The EPT included four items within the domains of household management, phone usage, transportation, shopping, medications, meal preparation and financial management. Example questions are "which ingredient is mixed with the sour milk?" when given a recipe for sour milk biscuits and "to what phone number was the greatest number of calls made?" when given an itemized telephone bill. The EPT had good test-retest reliability with an overall correlation of .94 and higher scores indicated better performance (Willis & Marsiske, 1993).

The Observed Tasks of Daily Living (OTDL, Diehl et al., 2005) test is a performance-based measure of IADL and assessed participant's ability to perform real-world tasks. The OTDL focused on three domains of: managing finances, using the telephone and medication use. The OTDL has been shown to be reliable with an internal consistency of .82 and higher scores indicated better performance (Diehl et al., 2005).

Self-report IADL was measured using a modified version of the Minimum Data Set (MDS, Morris et al., 1997). The MDS assessed seven domains; meal preparation, ordinary housework, managing finances, managing health care, phone use, shopping, and travel. For each item participants indicated the (a) frequency they completed each item independently and (b) the difficulty level encountered for each item across the last seven days. Totals for each item were calculated and summed across the measure such that lower scores indicated better performance. The MDS has been shown in previous studies to be a valid measure of everyday functioning, indicating a correlation of .81 (Landi et al., 2000).

Predictors.

Demographics. Demographic data included age, race and gender (1=female, 0=male). Educational level was assessed through self-reported years of education (0-20) and the Weschler Adult Intelligence Scale vocabulary measure, which served as a performance-based proxy of education quality. Vocabulary was assessed using a paper and pencil test that required participants to choose the word that was a synonym of the target word. Higher vocabulary scores indicated better performance (Wechsler, 1955).

Depressive Symptoms**.** Depressive symptoms were measured by The Center for Epidemiological Studies-Depression-12 (CES-D-12, Radloff, 1977). The CES-D is a questionnaire that asks participants to report the frequency that they experienced depressive symptoms over the past week. Examples of statements included, “I felt that everything I did was an effort” and “I felt hopeful about the future”. Responses included “never”, “less than 1 day”, “1-2 days”, “3-4 days” or “5-7 days” out of the week with a final range of 0 to 36. After reverse coding appropriate items, scores of 16 or higher were indicative of likely depression. The CES-D-12 had an internal consistency of .89, therefore, was a reliable scale (Radloff & Teri, 1986)

General health**.** General health was measured by the Short Form-36 (SF-36, Ware & Sherbourne, 1992). The SF-36 asked 36 various health and functioning questions which were used to create two main summary measures of physical and mental health. The current study used the self-rated health items which asked participants to rate these statements, “I seem to get sick a little easier than other people", "I am healthy as anybody I know", "I expect my health to get worse" and "My health is excellent" as definitely true, mostly true, don't know, mostly false or definitely false. Participants also had to rate, "In general, would you say your health is", excellent, very good, good, fair, or poor. The SF-36 had excellent reliability, with an alpha of .90, as well as good validity (Ware & Sherbourne, 1992).

Cognitive variables. Three cognitive domains were included in the current analyses. Memory was assessed using the Hopkins Verbal Learning Test (HVLT, Brandt, 1991), the Rey Auditory Verbal-Learning Test (AVLT, Rey, 1941) and the Rivermead Behavioral Memory Test (Wilson, Cockburn, Baddeley, & Hiorns, 1989). The HVLT assessed the ability to learn and remember a list of words. Participants listened to a list of words and were then asked to write down as many words as they could remember within two minutes. This process was repeated three times. The total number of words correctly recalled across the three trials was recorded (range 0-36), higher scores indicated better performance. The HVLT has been found to have good reliability (Bennedict, Schretlen, Groninger, & Brandt, 1998).

The Rey Auditory Verbal-Learning Test (AVLT) assessed the ability to learn new verbal memories. Subjects were given five trials to recall the words from list A and then two trials to recall the words from a different list, list B. Scores were coded yes if the word was recalled and no if the word was not recalled (range 0-75). Higher scores indicated better performance on the test. The Rey Auditory-Verbal Learning Test has been shown to have moderate test re-test reliability (Schmidt, 1996).

The Rivermead Behavioral Memory Test assessed the ability to remember details (e.g. names, belonging, dates, etc.) from a story. Higher scores indicated better performance. The

Rivermead Behavioral Memory test had good test re-test reliability, good external construct validity and had a range of 0 to 17 (Wilson et al., 1989).

Reasoning was assessed using the Letter Series (Thurstone & Thurstone, 1941) and Letter Sets (Ekstrom, French, Harman, & Derman, 1976) measures. The Letter Series Test presented participants with sets of letters that formed patterns. Participants were asked to identify the pattern by deciding which letter would come next in the series. For example, if the series was c d c d c d the correct answer was c. Participants were given six minutes to complete the test. Possible scores ranged from 0-30 based on number of correct responses. Higher scores indicated better performance.

The Letter Sets Test measured a person's ability to recognize rules and patterns in a set of letters. The participant had to find one set of letters that did not fit the pattern out of all five sets. Participants were given seven minutes to complete the test. Scores ranged from 0-15 based on number of correct responses. Higher scores indicated better performance.

Speed of processing was measured using the Useful Field of View test (UFOV, Edward, Vance, Wadley, Cissell, Roenker & Ball, 2005) and the Digit Symbol Substitution test (Wechsler, 1981). The UFOV test had four tasks, each progressively more difficult. The first task required the participant to identify a central stimulus (a truck or a car). The second task required the participant to identify the same central stimulus, in addition to location of a peripheral stimulus. The third task repeated task two; however, the central and peripheral stimuli were within a field of distractors of the same size and luminance as the target stimuli. The fourth task was the same as the third task, however, it required the participant to determine whether the objects in the center of the screen were the same or different. The stimuli display time recorded required 75% accuracy of each task (range of 16 to 500 milliseconds per task). All four tasks were summed for a final UFOV score and recoded so that higher scores indicated better performance. UFOV had good reliability (Edwards, Wadley, Vance, Roenker, & Ball, 2005).

The Digit Symbol Substitution test assessed processing speed. Participants were given a sheet with a key at the top of numbers with corresponding nonsense numbers. Below this key were boxes, each with a number from 1 to 9. Participants were given 90 seconds to transcribe the nonsense symbol with the corresponding number. Possible scores ranged from 0-93 for number of correct responses. Higher scores indicated better performance.

Sensory variables. Visual acuity (Rubin & Salive, 1995) was measured using the Good-Lite LD-10 Chart in a Good-Lite Model 600 light box. Participants were asked to stand ten feet away from the chart and asked to read the line starting with the largest number five. If participants could not read this row they were directed to read the top row on the chart. The test was completed when 75% or more letters were missed on a row. Scores were coded by entering the number correct for each row (range 0 to 90). Rows at the top of the chart that were skipped received a maximum score and scores at the bottom of the chart that were not read were scored as 0. Testers then used the scoring chart to find the appropriate sum score. Higher scores indicated better performance. Participants with a score of 39 or above were eligible for the study.

***Physical Variables*.** The Turn 360 test (Steinhagen-Thiessen & Borchelt, 1999) assessed lower-body physical functioning and balance. Participants were asked to make a complete turn in place as quickly as possible. The tester demonstrated the starting position and ensured the participants only complete the task if they felt safe. Two trials were conducted and the number of steps taken to complete each turn were recorded. The two trials were averaged, lower scores indicated better performance.

Analyses

Frequency and descriptive statistics were first examined to look at distributions and ensure that all data were within the appropriate range. Next, composites were created using three steps. The first step was to assess whether it made sense conceptually to combine the variables, meaning the variables had to be related. To determine this, correlations were run among all variables considered for a composite. Second, the directionality of all items was examined by examining the positive or negative correlations. Negative correlations resulted in recoding of certain variables. Lastly, the scale of each measure was examined. Measures that were not on the same scale were converted into z-scores prior to creating composites. Composites were then calculated to create three cognitive domains: memory, reasoning and speed of processing. The memory composite was a combination of Hopkins Verbal Learning Test, Rey Auditory Verbal-Learning Test and the Rivermead Behavioral Memory Test. All three variables were in the same direction, but on different metrics. The z-scored memory measures were then averaged resulting in the memory composite. The reasoning composite was a combination of both Letter Series and Letter Sets. Both tests were in the same direction, but also on different metrics. The z-scored reasoning was averaged resulting in the reasoning composite. The speed of processing composite was a combination of all four UFOV tasks and the Digit Symbol Substitution test. Lower scores on UFOV indicated better performance, while higher scores on the Digit Symbol Substitution indicated better performance. In order to put the variables in the same direction, UFOV tasks were recoded so that higher scores indicated better performance as well. To recode UFOV, the measure was multiplied by negative one, the z-scored speed of processing measures were averaged resulting in the speed of processing composite. A composite for the Turn 360 was a combination of variables Turn 1 and Turn 2 from the Turn 360 Test. Since the variables were from the same test they were in the same direction and on the same metric. The Turn 360 measures were averaged resulting in the Turn 360 composite. TIADL was reverse coded so that higher scores indicated better performance.

Aim one of this study, to assess the relationships between performance-based and self-report IADL measures, was examined through correlational analyses between the four IADL measures. Aim two of this study, to assess the predictors of the performance-based and self-report IADL measures, was examined through multiple linear regression models. First regression assumptions and risk of multicollinearity were examined. Then, the IADL measures were included as the outcome measures, and the demographic, depressive symptoms, general health, cognitive composites, sensory measure and physical functioning measure were the predictor variables. All predictors were consistent within the four regression models so that predictors could be compared across models.

Chapter 3

Results

Descriptive Statistics

Descriptive statistics for all of the variables in the study are displayed below in Table 1.

Table 1. Descriptive Statistics

Variable	Mean(SD)	Range	Percent
Age	73.40(5.73)	65-93	
Gender (female)			75.6%
Race			
Caucasian			73.3%
African American			26.0%
Other			0.8%
Years of Education	13.54(2.69)	4-20	
Vocabulary	12.41(3.92)	0-18	
SF-36 General Health	69.36(19.02)	0-100	
CESD-12	5.11(5.04)	0-34	
Vision	73.44(11.43)	31.80-90.00	
Turn 360	6.90(1.96)	1.0-20.0	
Memory	.03(.81)	-3.12-2.48	
Reasoning	.02(.91)	-1.92-3.27	
Speed of Processing	.02(.70)	-3.49-1.91	
HVLT	26.25(5.43)	4-36	
AVLT	48.80(10.48)	0-73	
Rivermead	6.33(2.75)	0-17	
Letter Series	10.15(5.55)	0-30	
Letter Sets	5.78(2.80)	0-15	
UFOV Task 1	30.30(39.99)	16-500	
UFOV Task 2	130.58(124.01)	16-500	
UFOV Task 3	317.96(133.74)	43-500	
UFOV Task 4	455.56(69.35)	170-500	
Digit Symbol Substitution	40.70(11.06)	0-92	
TIADL	-.03(.57)	-.86-4.34	
OTDL	17.70(4.36)	1-28	
EPT	18.83(5.66)	1-28	
MDS	4.25(4.890)	0-26	

Note. N=2626. Years of Education (0= didn't go to school, 1-12=grade completed, 13= Vocational/training or some college, 14=Associate's degree, 16=Bachelor's Degree, 17=some professional school 18=Master's degree 20=Doctoral). Vocabulary (0-18). (SF-36 General Health= Short Form Health Survey (0-100). CESD-12= Center for Epidemiological Studies Depression Scale (0-36). Vision (Visual Acuity, # of correct letters per row). Turn 360 (# of steps taken to complete turn). Memory (Composite of Hopkins Verbal Learning Test, Rey Auditory Verbal Learning Test and Rivermead Behavioral Memory Test).

Reasoning (Composite of Letter Series and Letter Sets). Speed of Processing (composite of UFOV task 1-4 and Digit Symbol Substitution). HVLT= Hopkins Verbal Learning test (0-36). AVLT= Rey Auditory Verbal Learning Test (0-75). Rivermead= Rivermead Behavioral Memory Test (scored on 11 subtests of the story). Letter Series (0-30). Letter Sets (0-15). (UFOV= Useful Field of View (16-500). Digit Symbol substitution (0-93). TIADL= Timed Instrumental Activities of Daily Living (1= no errors, 2= minor errors, 3= major errors, 4= not completed in time limit). OTDL= Observed Tasks of Daily Living (0-28). EPT= Everyday Problems Test (0-28). MDS= Minimum Data Set (1=independent, 2= supervision, 3= limited assistance, 4=extensive dependence, 5=dependence, 8=activity didn't occur).

Aim 1

Performance-based IADL measures were significantly related to one another (see correlations displayed in Table 2). Better performance on the EPT was moderately correlated with better performance on the OTDL (r=.602, p<.001) and TIADL (r=.534, p<.001). Better performance on the TIADL was moderately correlated with better performance on OTDL (r=.473, p<.01). Better reported IADL on the self-report MDS was very weakly correlated with better performance on the OTDL (r=.051, p<.01) and the TIADL (r=.093, p<.001). Correlations between the MDS and EPT did not reach significance (r=-.036, p=.200).

Table 2. Correlations of Instrumental Activities of Daily Living

	1	2	3	4
1 OTDL				
2 TIADL	.473***			
3 EPT	.602***	.534***		
4 MDS	.051**	.093***	-.036	

Note: N=2626. TIADL= Timed Instrumental Activities of Daily Living (1= no errors, 2= minor errors, 3= major errors, 4= not completed in time limit). OTDL= Observed Tasks of Daily Living (0-28). EPT= Everyday Problems Test (0-28). MDS= Minimum Data Set (1=independent, 2= supervision, 3= limited assistance, 4=extensive dependence, 5=dependence, 8=activity didn't occur).
*p<.05 **p<.01 ***p<.001

Aim 2

Regression analyses were conducted to examine predictors of IADL measures. The first regression model assessed cognitive composite measures to examine patterns of general domains. Younger age was a significant predictor of better performance on the TIADL and the OTDL. Female gender was a predictor of better performance on all measures, except for the OTDL. Better vocabulary and higher education level were predictors of better performance on all of the IADL measures. Better scores on the SF-36 were associated with better scores on the MDS. Lower scores on the CESD-12 significantly predicted better performance on the OTDL and EPT. The cognitive predictors (memory, reasoning, and speed of processing composites) accounted for a significant amount of variance of the TIADL, EPT and OTDL. Each composite measure was independently a significant predictor of the TIADL, EPT and OTDL. Better scores on memory, reasoning and speed of processing were associated with better scores on the TIADL, EPT and OTDL. Memory, reasoning and speed of processing composites did not account for a significant variance for the MDS. Better vision and lower scores on the Turn 360 Test were predictors of better performance on the TIADL and better scores on the MDS.

The second regression model assessed individual cognitive measures in order to examine the contributions of specific measures as professionals in the health field, such as Occupational Therapists, can often only administer a few select measures rather than extensive battery represented by the more comprehensive composite scores. Younger age and better vocabulary were significant predictors of better performance on all performance-based measures. Female gender was a significant predictor of better performance on the TIADL and EPT, as well as better scores on the MDS. Higher education level was a significant predictor of better performance on the OTDL and EPT. Lower scores on the CESD-12 significantly predicted better performance on the OTDL and EPT. Higher scores on the SF-36 were associated with better scores on the MDS. Cognitive predictors accounted for significant variance of all IADL measures. Higher scores on the Letter Series and the HVLT independently were significant predictors of better performance on all performance-based measures. Higher scores on the Digit Symbol Substitution were associated with better performance on the OTDL and EPT. Higher scores on the Letter sets was a significant predictor of better performance on the EPT. Higher scores on the Rivermead Behavioral Memory Test and UFOV Task 2 significantly predicted better performance the OTDL and EPT. Higher scores on UFOV Task 1 significantly predicted better performance on the TIADL and EPT. Higher scores on UFOV Task 3 significantly predicted better performance on TIADL as well. The only significant cognitive predictors of the MDS were UFOV Tasks 3 and 4, such that better scores were associated with better scores on the MDS. The AVLT did not independently predict any of the IADL measures. Vision significantly predicted better TIADL performance. Lower scores on the Turn 360 were associated with better scores on the MDS.

Table 3. Regression: Composite predictors of Instrumental Activities of Daily Living

	TIADL		OTDL		EPT		MDS	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Age	-.09***	-.012, .005	-.110***	-.112, .055	-.025	-.054,.004	-.018	-.050, .019
Female Gender	.09***	.077, .164	.006	-.260, .386	-.044***	-.909, -.250	.480***	-5.867, -5.072
Years of Education	.046*	-.018, .002	.091***	.089, .206	.111***	.173, .292	.010	-.053, .091
Vocabulary	.214***	.025, .037	.140***	.111, .201	.329***	.429, .521	.042	-.004, .108
Vision	.074***	.002, .005	.008	-.009. 015	-.003	-.014, .011	.037*	.000, .031
Turn 360	-.046**	-.023, -.004	.028	-.010, .135	-.008	-.095, .052	-.102***	.164, .342
SF-36 General Health	.030	.000, .002	.017	-.004, .012	-.009	-.011, .005	.065***	-.026, -.007
CESD-12	-.002	-.004, .004	-.041*	-.065, -.006	-.032*	-.065, -.006	-.025	-.060, .012
Memory	.122***	.057, .116	.199***	.852, 1.286	.205***	1.214, 1.656	.006	-.231, .302
Reasoning	.123***	.049, .106	.173***	.622, 1.042	.233***	1.243, 1.671	-.004	-.280, .236
SOP	.223***	.148, .217	.142***	.626, 1.138	.135***	.826, 1.347	-.042	-.608, .021

Note. N=2626. CI= confidence interval. Years of Education (0= didn't go to school, 1-12=grade completed, 13= Vocational/training or some college, 14=Associate's degree, 16=Bachelor's Degree, 17=some professional school 18=Master's degree 20=Doctoral). Vocabulary (0-18). (SF-36 General Health= Short Form Health Survey (0-100). CESD-12= Center for Epidemiological Studies Depression Scale (0-36). Vision (Visual Acuity, # of correct letters per row). Turn 360 (# of steps taken to complete turn). Memory (Composite of Hopkins Verbal Learning Test, Rey Auditory Verbal Learning Test and Rivermead Behavioral Memory Test). Reasoning (Composite of Letter Series and Letter Sets). Speed of Processing (composite of UFOV task 1-4 and Digit Symbol Substitution). Hopkins Verbal Learning test (0-36). Rey Auditory Verbal Learning Test (0-75). Rivermead Behavioral Memory Test (scored on 11 subtests of the story). Letter Series (0-30). Letter Sets (0-15). (UFOV= Useful Field of View (16-500). Digit Symbol substitution (0-93). TIADL= Timed Instrumental Activities of Daily Living (1= no errors, 2= minor errors, 3= major errors, 4= not completed in time limit). OTDL= Observed Tasks of Daily Living (0-28). EPT= Everyday Problems Test (0-28). MDS= Minimum Data Set (1=independent, 2= supervision, 3= limited assistance, 4=extensive dependence, 5=dependence, 8=activity didn't occur). *p<.05 **p<.01 ***p<.001.

Table 4. Regression: Individual predictors of Instrumental Activities of Daily Living

	TIADL		OTDL		EPT		MDS	
	β	95% CI	β	95% CI	β	95% CI	B	95% CI
Age	-.088***	.005, .013	-.105***	-.108, -.051	-.024*	-.052, .005	-.017	-.049, .021
Female /Gender	.068***	-.135, -.046	-.006	-.400, .270	-.047***	-.956, -.278	-.480***	-5.886, -5.058
Education	-.047	.002, .018	.090***	.087, .204	.109***	.171, .289	.011	-.051, .092
Vocabulary	.174***	-.032, -.019	.116***	.084, .175	.300***	.386, .479	.037	-011, .103
Vision	.070***	-.005, -.002	.008	-.009, .015	-.004	-.014, .011	.030	-.002, .028
Turn 360	-.036	.001, .020	.032	.000, .144	-.006	-.090, .057	-.099***	.156, .335
SF-36	.016	-.002, .001	.011	-.005, .010	-.012	-.011, .004	.064***	-.026, -.007
CES-D	-.006	-.003, .004	-.043*	-.066, -.009	-.033*	-.066, -.008	-.024	-.059, .013
Letter series	.076**	-.013, -.003	.159***	.087, .163	.209***	.174, .251	-.001	-.048, -.046
Letter sets	.011	-.011, .006	.017	-.037, .090	.048**	.033, .162	.002	-.075, .082
HVLT	.103***	-.016, -.001	.136***	.074, .145	.138***	.108, .180	.031	-.015, .072
AVLT	-.017	-.001, .003	.030	-.005, .030	.009	--.013, .023	-.020	-.032, .013
Rivermead	.042	-.016, -.001	.060***	.036, .153	.090***	.126, .244	-.002	-.075, .069
UFOV Task 1	-.050**	.000, .001	.009	-.003, .005	-.034*	-.009, -.001	-.016	-.007, .003
UFOV Task 2	-.026	.000, .000	-.043*	-.003, .000	-.068***	-.005, -.002	.024	-.000, .003

UFOV Task 3	-.051*	.000, .000	-.032	-.002, .000	-.016	-.002, .001	-.050*	-.004, .000
UFOV Task 4	.007	.000, .000	-.028	-.004, .001	.013	-.001, .003	-.087***	.003, .009
Digit Symbol Substitution	.262	-.016, -.011	.125***	.033, .066	.092***	.031, .064	-.029	-.033, .008

Note. N=2626. CI= confidence interval. Education=Years of Education (0= didn't go to school, 1-12=grade completed, 13= Vocational/training or some college, 14=Associate's degree, 16=Bachelor's Degree, 17=some professional school 18=Master's degree 20=Doctoral). Vocabulary (0-18). SF-36= (Short Form Health Survey (0-100). CESD-12= Center for Epidemiological Studies Depression Scale (0-36). Vision (Visual Acuity, # of correct letters per row). Turn 360 (# of steps taken to complete turn). Memory (Composite of Hopkins Verbal Learning Test, Rey Auditory Verbal Learning Test and Rivermead Behavioral Memory Test). Reasoning (Composite of Letter Series and Letter Sets). Speed of Processing (composite of UFOV task 1-4 and Digit Symbol Substitution). HVLT= Hopkins Verbal Learning test (0-36). AVLT=Rey Auditory Verbal Learning Test (0-75). Rivermead= Rivermead Behavioral Memory Test (scored on 11 subtests of the story). Letter Series (0-30). Letter Sets (0-15). (UFOV= Useful Field of View (16-500). Digit Symbol substitution (0-93). TIADL= Timed Instrumental Activities of Daily Living (1= no errors, 2= minor errors, 3= major errors, 4= not completed in time limit). OTDL= Observed Tasks of Daily Living (0-28). EPT= Everyday Problems Test (0-28). MDS= Minimum Data Set (1=independent, 2= supervision, 3= limited assistance, 4=extensive dependence, 5=dependence, 8=activity didn't occur). *p<.05 **p<.01 ***p<.001.

Chapter 4

Discussion

The purpose of the study was to examine the relationships between performance-based and self-report measures of IADL, as well as the predictors of those measures. As hypothesized, the performance-based IADL measures correlated with each other; however, the self-report MDS was only weakly to not correlated with the performance-based measures. These findings are supported in the literature.

Previously, the MDS was not found to be related with TIADL (Owsley et al., 2002), OTDL or EPT (Tucker-Drob, 2011). An explanation for this may be that older adults do not accurately assess their own abilities. Researchers suggest people fail to recognize their inability to perform tasks because of what is referred to as the double curse. The skills needed to complete a task are typically the same skills needed to assess how they think they are performing those skills or tasks (Dunning, Johnson, Ehrlinger, & Kruger, 2003). This is especially true in areas that require memory and reasoning. For example, if a person has difficulty remembering what phone number to dial, they most likely have difficulty reporting their ability to dial a specific phone number as well. Furthermore, researchers suggest people tend to remember how they have performed an activity in the past, instead of how they currently perform the task (Dunning et al., 2003). Past studies have found a relationship between TIADL, OTDL and EPT (Gross et al., 2011). The relationships are thought to be explained by the similarities between tasks in each test. For example, both TIADL and OTDL assessed participant's ability to look up a specific phone number in a directory and the EPT assessed participant's ability to look up a local phone service in a telephone bill, all of which assess a similar IADL domain, e.g. telephone use.

Memory, reasoning and speed of processing composites were all significant predictors of the performance-based measures of IADL, but not the MDS. Between 7.8 and 11.2 percent of the total variance of the performance-based IADL measures was accounted for by the composite measures. This supports the hypothesis as well as the literature. Previous studies have shown memory, reasoning and speed of processing have a significant relationship with TIADL, OTDL and EPT (Gross et al., 2011; Yam et al., 2014). Regarding examination of individual cognitive measures, some demonstrated consistent relationships with the performance-based IADL measures. Findings support the hypotheses, but have not been individually researched in previous literature.

Contrary to the hypothesis, Rey Auditory Verbal-Learning Test was not a significant predictor of any of the IADL measures and Letter Sets was only a significant predictor of EPT. Rey Auditory Verbal Learning Test has been shown to independently predict functional performance in people with diminished cognitive capacity, but not independently in healthy populations (Isella et al., 2006). In past research, Letter Sets has only been analyzed in composite measures. Digit Symbol Substitution and UFOV Tasks 1-4 were significantly correlated with only a few IADL without any trend. Once again, these measures have shown to significantly predict IADL in composite measures, but not independently. Past research has indicated a significant relationship between UFOV and IADL when all tasks are utilized (Tucker-Drob, 2011). As for Digit Symbol Substitution, studies have found the measure predictive of reaction time (Salthouse, 1992), but not transferring to everyday tasks.

Vision was only a significant predictor of TIADL and was weakly correlated with the MDS. This may be due to the fact that TIADL requires the participant to perform more visual tasks than the other measures (Owsley et al., 2002). For example, some TIADL tasks required participant's to read small print on medicine bottles and in a telephone book.

Turn 360 was predictive of TIADL and MDS in the regression model for the composites and only for the MDS in the second set of models with the independent cognitive measures. This does not support the hypotheses and previous literature. Although literature has not directly linked Turn 360 to IADL, studies have shown the Turn 360 to be predictive of falls, mobility and activities of daily living (Shubert et al., 2006). As mentioned earlier, people tend to accurately assess their own physical functioning better than their cognition. The MDS asks more physical functioning questions which may account for the relationship between the MDS and the Turn 360. For example, questions from the MDS included rating ability to shop for food and travel places, which assessed more physical ability compared to tasks in the performance-based measures, regarding financials and phone use, which assessed cognition.

Limitations

A limitation of the study was that it was cross-sectional. The study can determine relationships between variables, but it cannot assess causation or change over time. Additionally, other neuropsychological cognitive test measures, such as executive functioning, may be useful in analyzing cognition and IADL, but was limited due to variables in the ACTIVE study. The sample population derived from the ACTIVE study may also be a limitation. Only healthy older adults were included in the sample population, which may not generalize to older adults in the community who are likely facing cognitive decline (Gross et al., 2011). Although due to a large and diverse sample size results should be generalizable.

Future Research

Future research is needed to see if these results are similar in samples with diminished cognitive capacity, such as mild cognitive impairment and dementia. Additionally, these results need to be replicated in a longitudinal study to see if results remain significant over time. More research is also needed in regards to physical functioning and vision's relationship with IADL. This information may be useful in the development of new interventions to improve older adult's IADL functioning by targeting the modifiable predictive factors that are strongly related to this functioning.

Conclusion

In summary, these findings suggest that performance-based IADL measures are likely taping a different construct as compared to self-report IADL measures given that other research has also found that older adults over-estimate their abilities (Friedman et al., 1999 & Rueda, 2014). Clinicians and professionals should use caution when administering self-report measures. Based on the study's results, cognition may be the most influential indicator of an older adult's IADL. Furthermore, the Hopkins Verbal Learning Test, Letter sets and UFOV may be the most effective when measuring cognition in relation to older adult's IADL. Selecting the most effective cognitive measures could save both time and money for professionals in a clinical setting.

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Pennsylvania State University — University Park, PA
Schreyer Honors College — Expected graduation *May 2015*
Bachelor of Science in Human Development and Family Studies

Activities

Fresh Start — *September 2011*
-One day service event in the state college community

Safe Start — *Summer 2012*
-Cared for toddlers under the age of 2, born alcohol and drug dependent.
-Organized activities to help develop fine and gross motor skills

Thon committee — *September 2012-May 2014*
-Year long commitment to raise money for pediatric cancer

Easter Seals Disability Services — *Fall 2013*
-Shadowed an occupational therapist
-Helped run therapy sessions

Best Buddies
-Paired with an individual with an intellectual disability — *Fall 2013*
-Helped with social and career development

Rehabilitation and Human Services USO
-Mental health discussions through meetings and guest speakers — *Fall 2013-Present*

Occupational Therapy Club — *January 2013-present*

Professional Experience

Acute Rehabilitation Center at St. Luke's Hospital — *Summer 2013*
-Shadowed occupational therapists
-Helped run therapy sessions and transported patients to therapy

Pediatric Rehabilitation Center at St. Luke's Hospital — *Summer 2013*
-Shadowed occupational therapists
-Filed patient papers

SHAARP research lab (The Study of Healthy Aging & Applied Research Programs) — *March 2014-present*
-Literature reviews
-Thesis paper/poster presentation

Leadership

HDFS USO Secretary — *May 2013- May 2014*
-Contacted faculty and students about events
-Helped run meetings and organize events

HDFS USO President — *May 2014-present*
-Organized meetings and events, as well as the agenda for them
-Acted as the Interface between faculty and staff
-Oversaw all officer positions

HDFS 411 Teacher Assistant — *January 2014-May 2014*
HDFS 229 Teacher Assistant — *August 2014-December 2014*

Honors and Awards

Spanier Renaissance Award — *September 2011*
Lord Academic Excellence Award — *September 2013*
Alumni Student Excellence Award — *Spring 2015*
Dean's List, 7 semesters