



Predicting Cognitive Impairment Using A Self-Report Discrepancy In Older Adults

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Abstract

Research in neuropsychology demonstrates that cognitive impairment can alter an individual's perception about their abilities. There is a correlational relationship between functional living and cognition, yet there may be instances when individuals do not provide accurate or reliable self-report to these abilities; corroborative data on IADLs is essential when evaluating for cognitive impairment. To date, no known studies have evaluated how a discrepancy between self-report and performance based measures predict cognitive impairment. This study creates a discrepancy score between these two measures in an attempt to predict level of dementia by examining 198 adults (age 57-90) self-referred for neuropsychological assessment. Test results from the Dementia Rating Scale 2, Texas Functional Living Scale, Lawton IADL, and ACT Word Choice were collected and utilized to create a discrepancy score between self-report and performance. A standard multiple regression was run with the criterion variable as the DRS-2 Total Score, and predictor variables as Lawton, TFLS, Discrepancy Score, and Effort to evaluate the predictive capacity of these variables. The regression model predicted a large percentage of variance in the criterion variable ($R^2 = .54$, $F(3, 194) = 77.26$, $p < .001$). Specifically, performance-based measures ($B = 30.17$, $\beta = .44$, $t = 7.43$, $p < .001$) and effort ($B = .74$, $\beta = .37$, $t = 6.21$, $p < .001$) were significantly predictive of cognitive impairment, but not the discrepancy score or self-report. Implications include that importance of including performance measures and effort in neuropsychological batteries. Limitations and directions for future research is discussed.

Keywords: dementia, mild cognitive impairment, awareness, IADLs, discrepancy

Introduction

Dementia and cognitive impairment are significant ailments that impact many elderly adults, families, caregivers, and the general population. As the number and percentage of adults over the age of 65 continues to grow, it becomes increasingly important to understand their cognitive functioning and abilities in order to adequately address needs and ensure proper care. Many older adults with cognitive impairment or dementia may

not only be unable to properly care for themselves, but do not recognize the extent of their deficits.

Consequently, proper assessment and evaluation for identifying dementia and cognitive impairment is an important step in establishing whether older adults are able to properly care for themselves. If these individuals are unable to perform basic tasks of daily living in an independent manner, it is necessary to ensure they receive adequate care and support. Two ways to evaluate whether or not older adults are able to perform tasks of daily living is through subjective self-report, and by measuring their performance objectively. Comparing these two scores and evaluating how much discrepancy exists between an individual's self-perception and their actual performance in activities of daily living may provide further insight into an individual's cognitive status and functioning, which is the goal of this present study.

Background and Importance of Topic

As adults age, their risk for developing health and brain concerns increases. Specifically, the risk for developing dementia greatly increases after the age of 65 (Mayo Clinic, 2014). Dementia is a very broad term used to describe a syndrome of various symptoms associated with memory loss, impaired judgment, and altered cognitive functioning and abilities (Alzheimer's Association, 2015a).

Alzheimer's disease and dementia in general have detrimental effects and impacts on the lives of those diagnosed. The National Center for Health Statistics of the Centers for Disease Control and Prevention (2013) reported data that 84,767 individuals died from Alzheimer's disease in 2013. Dementia can lead to severe health complications and problems for older adults, including immobility or difficulty swallowing that leads to malnutrition (Brunnstrom & Englund, 2009; Burns, Jacoby, Luthers, & Levy, 1990).

Dementia and cognitive decline not only have detrimental impacts on those diagnosed with



the disease, but also family members and caregivers. Family and friends of individuals suffering from Alzheimer's or other dementias provided unpaid care that approximated \$217.7 billion and 17.9 billion hours (Alzheimer's Association, 2015b). Alzheimer's Disease and dementia can take a tremendous toll on caregivers wellbeing, such as impacting their physical health, emotional health, and financial concerns (Alzheimer's Association, 2015b). The stress associated with caring for demented individuals can also lead to various physical diseases and complications on the caregivers (Fonareva & Oken, 2014).

In light of the impact that dementia has on not only those diagnosed, but also on their family, caregivers, and the population in general, it clearly becomes important to consider what can be done to minimize the detrimental impact. Accurately identifying dementia is perhaps the first step in providing proper treatment for individuals, and improving patients' functioning, as indicated by the Alzheimer's Association (2014). Early and accurate identification and diagnosis can lead to taking steps to minimize negative effects of mild cognitive impairment (MCI), which can possibly help to prevent further cognitive decline in these individuals (Alzheimer's Association, 2014).

Literature Search Strategies

The initial literature search method included reviewing the American Psychological Association APAPsychNet advanced searches, EBSCOhost, and Google Scholar. The author specifically targeted publications on Dementia, Alzheimer's, functional living, and awareness. Specific searches were conducted to locate relevant publications that provided a solid foundational and conceptual understanding about these concepts. The author searched for publications on cognitive awareness in older adults, specifically within the context of dementia or Alzheimer's disease. The author also utilized separate searches to include results of dementia AND awareness, Alzheimer's AND awareness, dementia AND IADL, to provide an understanding as to how these concepts relate to each other, especially in a correlational or predictive manner. Finally, the author conducted separate searches that combined these concepts. This included looking at how cognitive impairment, specifically dementia or AD, relates to functional living abilities in older adults.

In searching for individual concepts, the author also searched for publications relating to the Mattis Dementia Rating Scale (DRS), and its

validation and usefulness. This search included identifying initial research in the development of this scale, as well as understanding its psychometric properties, validity, reliability, and usefulness. As this current study utilizes scores on the Texas Functional Living Scale (TFLS), the author conducted an equivalent search strategy for this scale. Within these literature searches to gain an educational understanding of these specific concepts, no specific exclusion criteria was utilized, as the goal of these searches was to provide and gain a foundational understanding upon which to build the remainder of the literature review and hypotheses.

The author retrieved full articles based on information provided in the abstract to initially determine relevance to the current proposed study as an initial determinant for eligibility to be included in the literature review. The author considered publications that included either concepts of dementia, Mild Cognitive Impairment, or Alzheimer's Disease along with a relation to ADL, IADL, or cognitive awareness and insight. It is important to acknowledge that throughout the search process, there was significant overlap between publications that examined AD and dementia. As explained previously, AD is a specific, and likely the most common type of dementia, so publications were not excluded based on whether they entailed research on either AD or dementia in general. While the author considered all relevant publications on dementia or AD for the purpose of theoretical consideration, it is important to recognize that this study will only be examining symptoms of dementia in general, not necessarily AD.

The author primarily limited the search to publications within the past 10 years, with the exception of a few landmark studies. Several of these studies were identified as they were referenced in more recent publications. Finally, the author created a table as an overview for potentially relevant literature and publications to examine and evaluate sample population, method and measures of the study, and the primary findings. This table was useful for determining relevance and appropriateness for certain publications to be included in the literature review.

Relationship between functional living and cognitive decline/dementia.

Research has demonstrated that older adults' cognitive status is also related to their functional living abilities. Shay and colleagues (1991) demonstrated that not only does the Dementia Rating Scale (DRS), a validated measure used to



evaluate dementia, predict the severity of dementia alone, but diagnostic accuracy is also improved when combined with measuring instrumental activities of daily living. In fact, measuring these two facets in conjunction has been found to approximate the accuracy of the diagnosis equivalent to a full clinical work up of a psychiatrist and neuropsychologist (Shay et al., 1991). DePaula and Malloy-Diniz (2013) demonstrated that for individuals diagnosed with both AD and MCI, executive functioning measured by the DRS correlated with functional living ability as measured by both the Katz and Lawton-Brody indexes of Activities of Daily Living scales. Scores on the DRS specifically have also been found to directly relate to performance on Activities of Daily Living. Baird (2006) found that the DRS Memory subscale highly correlated with the Memory-Orientation subscale of the Independent Living Scale. Although the memory subscale associations were the strongest, this research found that all DRS subscales, with the exception of Construction, significantly correlated with related ILS subscales.

Measures of IADL, such as the TFLS, have been able to detect small differences between individuals with Mild Cognitive Impairment and normal controls in the Memory subscale (Binegar, Hynan, Lacritz, Weiner & Cullum, 2009). In this study, the researchers examined TFLS scores for both AD and MCI patients, as well as normal control (NC) patients as part of a longitudinal study in an attempt to identify significant differences between populations. This study ultimately found that the TFLS scores did not distinguish MCI patients from the control group in a significant manner, but suggested that repeated administrations of the TFLS may be useful in identifying patients with MCI, as the normal control patients likely will not show any decline in functioning over time (Binegar et al., 2009).

Based on the findings of these publications, it follows to assume that measuring cognitive abilities and functional living status together can help to improve the accuracy of diagnosing dementias or other cognitive impairment. As Farias and colleagues (2003) demonstrated, measuring neuropsychological status can accurately predict functional status for individuals with probable or possible Alzheimer's disease. The patients in this particular study all demonstrated significant impairment in their functional living ability, which was related to their cognitive impairments. This provides further support for the relationship between older adults'

functional living abilities and their cognitive status associated with dementia.

Level of functional living can predict dementia or cognitive status. Not only has the literature supported a correlational relationship between functional living abilities and cognitive status, but also numerous studies and publications have demonstrated a directional, predictive relationship. Measuring IADL in individuals 65 and older has been found to make valuable contributions in the case-finding procedure for identifying dementia (deLepeleire, Aertgeerts, Umbach, Pattyn, Tamsin, Nestor, & Krekelbergh, 2004). Although this study, which utilized the Barberger-Gateau's four-item IADL rather than the TFLS, indicated that the IADL measure did not provide as strong diagnostic parameters for dementia compared to the Mini Mental Status Exam (MMSE), other studies such as McLaughlin and colleagues (2010) have found contrasting results. This study showed that although dementia assessments did highly correlate to scores on the MMSE, measures of functional living, dependence on others, and overall dementia better predicted AD progression than just the MMSE. Peres and colleagues (2008) demonstrated that individuals began to show restrictions in their performance in certain IADLs as much as 10 years prior to being diagnosed with dementia. This was especially true for handling finances (Peres et al., 2008), and indicates the importance of evaluating functional living capacity for individuals suspected or at risk for dementia to aid in diagnosis.

Cognitive ability can also predict functional living capacity. Yet contrasting literature also demonstrates a predictive relationship in the opposite direction, as individuals' cognitive status can provide an accurate prediction of their ability to perform tasks of daily and functional living (Rodakowski et al. 2014). Research has demonstrated that preclinical disability provides an accurate depiction of cognitive status for older adults when compared to other cognitive and biological measures (Rodakowski et al. 2014). Older adults with MCI exhibited more preclinical disability such as requiring more cues and help with tasks of independence, safety, and adequacy (i.e., required more cues for independence, safety, and adequacy) in performance of C-IADL than those with normal cognitive function.

A further indication that cognitive functioning can directly impact functional living can be seen by the fact that different aspects of functional living are affected differently depending



on the type of damage or dementia experienced by an individual (Wicklund, Johnson, Rademaker, Weitner, & Weintraub, 2007). This particular study demonstrated that for individuals with AD and frontotemporal dementia, overall functioning, as measured by an Activities of Daily Living questionnaire, is impaired. For those individuals with progressive aphasia, functioning was only mildly impaired. Overall, it can be concluded that there are different patterns and severity of impairment in functional living activities based on different types of dementia or subscale scores (Wicklund, Johnson, Rademaker, Weitner, & Weintraub, 2007).

Beyond general cognitive functioning predicting functional living, scores on the DRS specifically have been found to predict their functional ability (Farias et al., 2003; Nadler et al., 1993). In a landmark study, Nadler and colleagues (1993) demonstrated that DRS scores were actually predictive of performance on the Occupational Therapy Evaluation of Performance and Support (OTEPS) measure of daily living. This study was conducted in a geropsychiatric hospital setting, and functional domains evaluated included hygiene, safety, medication management, financial management, community utilization, and cooking. The only functional domain found not to be predicted by the participants' Total Score was cooking (Nadler et al., 1993). They also found that this predictive relationship held true when they used the specific subtests of the DRS combined as predictors (Nadler et al., 1993), indicating that the DRS Total Score can be a useful aid for helping to determine functional living status in older adults.

Farias and colleagues (2003) demonstrated a full battery of cognitive tests was able to predict 25% of variance of Alzheimer's patients' IADLs based on a caregiver scale. This study also found that these patients' neuropsychological functioning predicted 50% of variance on a performance-based assessment. This not only demonstrates that cognitive status can be predictive of functional living capacity, but further emphasizes the need to gather data on functioning from a variety of sources and measures.

Measuring functional abilities through self-report and performance-based measures. As awareness (or lack thereof) is clearly an important factor to consider in light of cognitive impairment or dementia, it becomes necessary to determine how an individual's awareness into their functioning can be adequately and accurately assessed. Two methods to obtain this information can come from either a patient's self-report, or an

objective performance based score. Both self-report and performance-based measures of IADL have been demonstrated to be useful for evaluating and assessing functional status in cognitively healthy older adults (Schmitter-Edgecombe, Parsey, & Cook, 2011).

Self-report is based on the individual's perception, and can be used to evaluate how they view or interpret their functioning and living capacities. However, it is important to keep in mind that when evaluating individuals at risk for cognitive impairment, dementia, or AD, self-report alone may not reflect an accurate indication of cognitive functioning and result in misclassification of MCI (Edmonds, Delano-Wood, Galasko, Salmon, & Bondi, 2014). Research has demonstrated that when considering discrepancies between self and informant report for cognitive functioning, individuals who age normally will tend to overestimate their cognitive difficulties. In contrast, those who may be at greater risk for cognitive decline tend to underestimate the nature and extent of problematic functioning (Edmonds et al., 2014). Frank, Lenderking, Howard, and Cantillon (2011) demonstrated that while self-report measures can be obtained to evaluate complex activities of daily living and executive functioning, this may not be an appropriate or valid indication of functioning for all individuals, especially those with MCI or prodromal AD.

Older adults at risk or facing possible cognitive impairment or dementia can also be evaluated through performance-based measures. These objective measures can complement subjective measures, as self-report alone may not always be reliable or valid due to the individual's cognitive impairment. This is indicated by Farias, Harrell, Neumann, and Houtz (2003), who demonstrated considerable discrepancies between neuropsychological functioning predicting a performance-based assessment of daily functioning and caregiver/informant-based rating scale. This research demonstrated that a battery of various cognitive tests evaluating neuropsychological functioning explained 25% of variance in individuals diagnosed with AD's IADL as measured by a caregiver/informant-based rating scale. This study additionally showed that neuropsychological functioning accounted for 50% of variance of the Direct Assessment of Functional Status (DFAS), a performance-based assessment.

As there may be incidents of discrepancy between self-report and objective performance for individuals with dementia, it is important to gather



data from multiple sources when evaluating older adults at risk or suspected for dementia or cognitive decline. As indicated, patients with dementia or cognitive impairment may not be fully aware of the nature of their cognitive functioning, or other functional impairment that may prevent them from engaging in ADLs or IADLs. Therefore, gathering and obtaining data on functional performance from multiple sources via triangulation will likely provide a more accurate and representative indication of these individuals' true functional status and differential diagnosis. It may be more beneficial to evaluate for objective, performance-based abilities of an individual's IADLs when assessing for symptoms of dementia or other cognitive impairment.

Assessing Functional Living in older adults. One assessment instrument that is well-validated as a self-report source of information for functional skills of older adults is the Lawton IADL (Lawton & Brody, 1969). This measure assesses abilities of individuals to perform activities such as using a telephone, managing finances, or doing laundry in eight different domains. This measure can be used as a self-report for both patients and their families or caregivers.

Because literature has demonstrated the importance on relying on more than just self-report to evaluate functioning for older adults with probable or possible dementia, it is also necessary to have a validated, objective or performance-based measure of functional living. One measure to assess functional living is the Texas Functional Living Scale (TFLS; Cullum, Weiner, & Saine, 2009). The TFLS measures four domains of functional living, which include time (accurately utilizing clocks and calendars), money and calculation (counting money or writing checks), communication (e.g. using a phone), and memory (ability to remember information or to take medication) (Cullum et al., 2009). These domains are measured through 24 performance-based items. The TFLS has good concurrent criteria, as it correlates with both performance on both the Mini-Mental State Examination and the Blessed Dementia Rating Scale informant ratings (Cullum et al., 2001).

The TFLS has also been found to relate to cognitive and memory performance in older adults (Drozdick & Cullum, 2011). When comparing functional living as measured by the TFLS with measures of cognitive ability as measured by various Wechsler scales, this study found the highest correlation between the TFLS and general cognitive ability and working memory. These

results further suggest the importance memory and cognitive functioning plays on functional living (Drozdick & Cullum, 2011). The TFLS has also been found to play an important role in cognitive screening for individuals with AD. Saine, Cullum, Martin-Cook, Hynan, Svetlik, and Weiner (2002) found that cognitive enhancers such as open-label donepezil improved individuals' daily functioning as measured by the TFLS, and suggested that the TFLS may consequently be a useful conjunctive to other forms of cognitive screening and assessment.

Assessing dementia in older adults: Mattis DRS-2. The Mattis Dementia Rating Scale (DRS), as well as the Dementia Rating Scale-2 (DRS-2; Jurica, Leitten, & Mattis, 2001) are well-validated measures for evaluating neuropsychological functioning (e.g. Marson, Dymek, Duke, & Harrell, 1997; Pedraza et al., 2010; Smith et al., 1994). Sprigate, Tremont, Papandonatos and Ott (2014) found the DRS-2 to distinguish cognitively healthy adults from those with MCI and AD. They also found that healthy control patients performed better on the overall measure than those with MCI, as well as those with MCI to perform better than those with AD (Sprigate et al., 2014).

Not only has the DRS been able to differentiate between varying levels of cognitive functioning, but it has been demonstrated to differentiate between different types of dementia (Porto, Caramelli, & Nitrini, 2007), as well as predict the severity of dementia for individuals diagnosed with a neurocognitive disorder (Shay et al., 1991). Porto and colleagues (2007) also demonstrated that DRS performance can be used to differentiate patients who have Alzheimer's disease from those with vascular dementia, as well as to distinguish both of these populations from healthy controls, especially when examining scores on subscales of initiation/perseveration, memory, and attention.

Assessing effort in older adults: ACS Word Choice Test: The ACS can be used with older adults to assess current status, premorbid functions, decline in cognitive functioning, and reliable change. It is often used in conjunction with the TFLS, which assesses daily living skills. Specifically, the Word Choice Test (WCT) is used to assess suboptimal effort as an external measure. An initial landmark study on the ACS was conducted by Miller and colleagues (2011), which demonstrated that the WCT added to diagnostic accuracy of the ACS among adults with traumatic brain injury (TBI). According to this study, it was



concluded that a score of 41 or less may suggest poor effort, but this cut off has not been validated for individuals with severe cognitive impairment, or dementia.

The ACS may be an “easier” validity test compared to other similar ones, as Erdodi and colleagues (2014) found that the WCT produced higher raw scores, fewer scores suggesting less than optimal effort when compared, and more perfect scores (50/50). This study was not conducted examining a clinical sample of older adults or individuals with MCI or dementia. Moreover, there have been no known studies to date, by this current literature review, that have looked at ACS word choice and how it relates to cognitive functioning in older adults specifically. It is important to remember that these tests of performance validity evaluate effort put forth by participants, not necessarily malingering. Thus there is no way to evaluate actual rates of poor effort compared to cognitive functioning, only what can be reasonably assumed (Duff, et al., 2011).

Current Study

Studying and understanding cognitive functioning in older adults is an important task for psychologists, as this age group continues to comprise an increasing percentage of the population. Moreover, it is important to understand what risks specifically tend to impact these individuals. Cognitive decline and dementia in general will be found in a substantial number of older adults, and it is also critical to examine how this may affect individuals’ ability to live in a healthy, independent manner, and especially what can be done to identify a diagnosis accurately and early enough to potentially minimize any negative effects.

Overall, the literature clearly suggests that there will be a strong correlational relationship between an individual’s ability to carry out tasks of daily living and their cognitive status. Although the existing literature appears to be conflicting as to the directive or predictive nature of this relationship, a correlation nonetheless appears to exist, suggesting that the more demented an individual is, the less functional ability they will have in terms of ADLs and IADLs. There appears to be a distinct connection between older adults’ awareness into their abilities and functioning, and their cognition.

Because individuals with more severe cognitive impairment or dementia may have less insight into their functional abilities, and consequently may be more likely to inaccurately report their status, it is necessary to evaluate

functional living capacity from multiple sources to gain a more complete understanding of their true cognitive and functional capacity. A self-report measure can be utilized to gain insight into the patient’s perspective of their functioning. However, as has been demonstrated throughout this literature review, an additional objective or performance-based measure is necessary for a best-practice approach, especially when compared to the patient’s own interpretation of their functional abilities.

Through the plethora of different neuropsychological assessments and tests available, this review has demonstrated that the TFLS is a well-validated measure to objectively evaluate an older adult’s ability to carry out tasks of daily living based on their actual performance. No known studies to date, however, compared older adults’ performance on the TFLS to their own self-report. This present study attempts to do this by creating a discrepancy score between patients’ dichotomous self-report based on Lawton’s IADL scale. This discrepancy scale will be used as a new measure to evaluate awareness for older adults into their functional abilities.

Based on the relationship observed between awareness, cognitive decline and dementia, it follows that an individual’s awareness would predict their level of cognitive functioning. This study hypothesizes that the more unawareness, or the greater discrepancy between self-report and performance, the greater the level of dementia that will be experienced by the individual, as measured by the DRS-2 total score.

This study predicts that an individual’s discrepancy between their reported abilities and actual performance will be the most predictive of dementia status and/or cognitive decline. More specifically, the greater the discrepancy between self-report and performance-based abilities (i.e., the more an individual over-reports his or her abilities), the more severe that individual’s symptom of dementia or cognitive impairment will be. It follows that the individual’s performance-based score will be more predictive of actual cognitive ability than self-report, as the literature has demonstrated that individuals with cognitive decline have less awareness and accuracy in their reporting of their abilities.

Method

Participants

The participants were 198 older adults who ranged in age from 57-90. Mean age was 71 with a standard deviation of 9 years. Participants’



years of education ranged from 5-20 years with a mean of 14 years (indicating some college) and a standard deviation of 3 years. Participants' cognitive functioning (as measured by the MMSE) ranged from moderate to no impairment, based on cutoffs indicated in the manual (Folstein, Folstein, White & Messer, 2001). According to the MMSE manual scores ranging from 0-9 indicate severe cognitive impairment; scores ranging from 10-18 indicate moderate impairment; scores ranging from 19-23 indicate mild impairment; and scores above 24 generally indicate minimal or no impairment. Mean MMSE score for the current study was 26.63 with a standard deviation of 2.90 (with a total score range of 11-30). All participants were patients at a neuropsychology private practice in Punjab Pakistan. All participants were physician referred for neuropsychological evaluation from 2010-2014. Individuals in the present study were given the following diagnoses: Mild Cognitive Impairment (45.5%), Major Neurocognitive Disorder/Dementia (21.7%), Normal Age-Related Functioning (19.7%) Cognitive Disorder Not Otherwise Specified (4%), Executive Dysfunction (2%), Mood Disorder contributing to current cognitive functioning (2%), "Other" (1%), and 8 cases of missing data (4%).

Further demographic information can be found in Tables 1-5. Participants were selected from an existing data pool based on whether they had data and test results for the following assessments: DRS-2 total score, TFLS total score, independent living total score, and ACS word choice score, yielding a total *N* of 198. This resulted in a sample of convenience for the present study.

Measures

The participants were administered a variety of neuropsychological assessments as part of a standard battery. The present study specifically examined scores on the DRS-2, TFLS, IADL self report, and ACS word choice.

The Mattis Dementia Rating Scale

The DRS-2 measures general cognitive ability in individuals aged 56-105, especially those with low cognitive functioning. The test includes 32 stimulus cards, 36 tasks, and is broken into five subscales including Attention, Initiation/Perseveration, Construction, Conceptualization, and Memory. The original DRS has test-retest reliability for Total Score of .97, and subscales between .61 and .94 (Johnson-Greene, 2004). The DRS has acceptable internal consistency with split half reliability coefficient of

.90. The DRS-2 Total Score was utilized in the present study to be indicative of cognitive functioning and level of dementia.

The Texas Functional Living Scale (TFLS)

The TFLS is a brief and ecologically valid performance-based measure of Instrumental Activities of Daily Living designed to identify how much care is required by an individual to meet daily demands. This instrument is designed for individuals age 16-90 and takes approximately 15 minutes to administer. The instrument is a direct assessment of skills to evaluate functional capacity in IADL in areas including Time, Money, Calculation Skills, Communication, and Memory. Other uses of the TFLS include screening for dementia, monitoring functional decline, monitoring treatment or drug efficacy, and determining level of care required. The TFLS produces a total T-score that combines all domains. According to the publishers, a T-score above 40 points will suggest that an individual can live independently, while a T-score below 25 suggests the individual may need to reside in a special care unit. A T-score between 16 and 40 suggest that an individual may need partial or fully assisted living, based on their mild to moderate impairment (Pearson, 2011). The TFLS has good test-retest reliability for individuals assessed with Alzheimer's disease ($\alpha = 0.93$), but weak test-retest reliability ($\alpha = 0.53$) for the control group (Cullum, Weiner, & Saine, 2009).

Self-report of Instrumental Activities of Daily Living

The self-report IADL measure in the present study is a modification of Lawton's

(1969) Independent Activities of Daily Living Scale, converted into a dichotomous scale. This assessment includes a yes/no answer from the participant on whether they need assistance in eight different domains. These domains include assistance in: shopping, meal preparation, housekeeping, laundry, driving concerns, medication, finance, and daily decision-making. Affirmation in these domains indicates that the individual acknowledges requiring assistance, thus a total score of 0 indicates that the individual claims to not require assistance in any domains, while a score of 8 suggests they require full assistance in these IADLs. While few studies have tested the psychometric properties of the Lawton IADL scale, it has been found to test concurrent with the Physical Self-Maintenance Scale (Graf,



2013). The Lawton IADL also has inter-rater reliability of .85, and validity has been determined by correlating the test with four other scales measuring domains of functional status, which were found to be significant at the $p < 0.01$ or 0.05 level (Graf, 2013).

The Advanced Clinical Solutions (ACS) Word Choice

The ACS word choice subtest is a stand-alone performance validity test that takes approximately fifteen minutes to administer. This measure provides information about an examinee that is based on chance performance that is compared to multiple clinical groups. An individual's performance is compared to determine whether they perform more poorly than what would be expected by chance in true clinical populations. In this test, the examinee identifies words as either man-made or natural, sees and hears 50 words in succession, and then sees cards with 50 pairs of words and is to select the word that was previously presented from each pair in a forced-choice recognition format.

Procedure

Archival data were collected for patients at a neuropsychology private practice. Data were collected on demographic information (i.e. age, gender, years of education). Scores on the DRS-2, TFLS, IADL scale, and ACS word choice were also collected. The Institutional Review Board (IRB) ethics were reviewed and participants provided informed consent prior to testing. The principle investigator completed a Human Subjects Review Committee (HSRC) approval necessary to ensure the privacy and well-being of the subjects. Patient information was de-identified to protect privacy. Data were gathered by examining hard-copy files of patient test scores and information, which was entered into Microsoft Excel and SPSS for analysis. Scores were collected for the following assessments: DRS-2 total raw score, TFLS total raw score, subjective report of IADL assistance, and ACS word choice.

In order to analyze the data in a meaningful way, the data was cleaned and analysed. The self-report measure originally was measured as entered into the data set in a binomial code, where a code of 1 indicated yes (participants acknowledging needing assistance in that domain) or 2 as no (denying needing assistance in that domain). These scores were converted where a score of 0 indicates acknowledging needing assistance, and a score of 1 indicates no assistance needed. Thus, a total score of 8 on the self-report measure now indicates full independence and no

assistance needed in IADL, and a score of 0 indicates the patient acknowledging needing full assistance in IADL.

This aided in the next step in the procedure, which was the creation of a discrepancy score. This discrepancy score was used to measure the discrepancy in awareness of the participants' ability to perform instrumental activities of daily living. As the two measures of IADL ability are not equated (self-report based on a score of 0-8, and performance-based based on a score of 0-50), comparing these scores for the purpose of determining discrepancy is not ideal due to their different standards and range, so both these scores were converted into total percentages (i.e., percentage of ability reported to function independently versus total percentage of measured ability to function independently). For both the self-report and performance based measures, 100% indicates full functional ability in performing IADL, whereas 0% indicates the individual requiring full assistance. The final stage in creating this discrepancy score was finding the actual discrepancy. This was accomplished by subtracting the total percentage of self-report from the total percentage of the performance-based score to obtain a new measure of awareness.

Within the sample population, the discrepancy score ranged from -1 through .88. There were 95 cases of negative scores, indicating a higher self-report than objective performance-based abilities, and 91 cases of positive scores indicating reporting lower abilities than objectively measured. There were 12 cases with no discrepancy, indicating accurate self-report of true abilities.

Statistical Analyses

The present study utilized a multiple regression analysis to determine the best predictor of total level of dementia in older adults, as the purpose of multiple regression is to determine the relationship between several predicting variables and a single criterion variable. In the case of the present study, the criterion, or dependent variable, is level of dementia as measured by total scores on the DRS-2. The predictor or independent variables are the discrepancy as measuring awareness, and score on ACS word choice. The multiple regression was used to determine what is the best predictor of level of awareness when considering awareness and ACS word choice. The predictor variables in the regression are the total percentage of self-report, total percentage on performance-based, the discrepancy score, and effort score. The criterion



variable is the level of dementia, or cognitive impairment.

Based on the findings of existing literature, it is anticipated that a greater level of discrepancy between self-report and actual performance, and therefore a lower level of awareness about IADL ability will be more predictive of level of dementia. Therefore, it is hypothesized the discrepancy score will be the most predictive of level of dementia, and self-report will be the least predictive and correlate least to level of cognitive impairment. Based on the findings of literature that suggests cognitive decline may be confounded with lower effort or performance validity, it is predicted that lower scores on effort, as measured by the ACS word choice will correlate to cognitive decline/dementia, as measured by the DRS-2.

Results

A standard multiple regression was conducted to determine whether the independent variables, self-reported percentage of IADL, objectively measured abilities (TFLS total percentage), discrepancy score, and effort, are predictors of cognitive decline, as measured by the DRS-2 Total Score.

There were some missing data for the dataset but considering the size of the sample, all cases were used in analysis (N=198). Data screening identified some multivariate outliers. Specifically, examination of Mahalanobis distances revealed that seven cases exceeded the chi square critical value of 22.46. Therefore, these seven cases were eliminated from subsequent data analyses. Examination of residual scatterplots suggested that the assumptions of normality, linearity and homoscedasticity was likely to have been met. Normality tests revealed there were no large skews (all were between -1 and 1) for any univariate variables and thus no variables were transformed. Regression results indicated acceptable tolerance for all variables, and correlations between predictor variables were all below $r = .60$, demonstrating that there were no problems with multicollinearity.

Table 1

<i>Gender</i>		
<u>Gender</u>	<u>n</u>	<u>%</u>
Female	121	61.1
Male	76	38.4
Unknown	1	0.5

Table 2

<i>Education</i>		
	<u>n</u>	<u>%</u>
Education	13	6.6
Less than High School	62	31.5
High School	49	24.9
Some College	51	25.9
College	22	11.2
Graduate/Professional		

Table 3

<i>Cognitive Functioning</i>		
<u>Cognitive Functioning</u>	<u>n</u>	<u>%</u>
Mild/No Impairment (>23)	170	85.9
Mild Impairment (19-23)	18	9.1
Moderate Impairment (10-18)	4	2
Severe Impairment (<10)	0	0
Missing	4	2

Table 4

<i>Diagnosis</i>		
<u>Diagnosis</u>	<u>n</u>	<u>%</u>
Mild Cognitive Impairment	90	45.4
Major Neurocognitive Disorder	43	21.7
Cognitive Disorder NOS	8	4
Executive Dysfunction	4	2
Normal Age Related Functioning	39	19.7
Mood Disorder	4	2
Other	2	1
Missing	8	4



Table 5

<i>Model Summary of Cognitive Functioning measured by DRS-2</i>				
<u>DV</u>	<u>R</u>	<u>R Square</u>	<u>Adjusted R Square</u>	<u>St. Error of the Estimate</u>
DRS-2 Total	.75	.54	.54	7.34

Note: Predictors (Constant): Percentage of Self-Reported IADLS, Percentage of TFLS

Table 6

<i>ANOVA for DRS-2 Total</i>					
<u>Model</u>	<u>Sum of Squares</u>	<u>Degrees of Freedom</u>	<u>Mean Square</u>	<u>F</u>	<u>Significance</u>
Regression	12482.62	3	4160.88	77.26	.000

Note: Predictors (Constant): Percentage of Self-Reported IADLS, Percentage of TFLS

Score, ACS Word Choice Score

Table 7

<i>Regression Table</i>						
<u>Model</u>	<u>B</u>	<u>Std. Error</u>	<u>Beta</u>	<u>t</u>	<u>Sig.</u>	
Percentage of TFLS Score	30.17	4.06	.44	7.44	.000	
Percentage of Self Report IADLs	2.11	2.11	.05	1.00	.34	
ACS Word Choice (effort)	.74	.12	.37	6.21	.000	

Table 8

<i>Correlations</i>		
<u>Model</u>	<u>Partial</u>	<u>Part</u>
Percentage of TFLS Score	.471	.360
Percentage of Self Report IADLs	.072	.048
ACS Word Choice (effort)	.407	.301

The regression model predicted a large percentage of the variance in cognitive abilities as measured by the DRS-2 Total Score ($R^2 = .54$, $F(3, 194) = 77.26$, $p < .001$) (see Tables 5 and 6). In particular, the objective measure of IADL abilities ($B = 30.17$, $\beta = .44$, $t = 7.43$, $p < .001$), and effort ($B =$

$.74$, $\beta = .37$, $t = 6.21$, $p < .001$), significantly predicted participants' cognitive functioning as measured by DRS-2 (see Table 7). Of these three variables, objective measure of IADL was the best predictor. Overall, the regression model accounted





for 53.7% of the variance in participants' total DRS-2 score.

Examination of semi partial correlations squared revealed that objective measure

of IADL ($sr^2 = .36$) and effort ($sr^2 = .30$) correlated significantly with cognitive abilities.

However, the correlation between Discrepancy Score ($sr^2 = .05$) and total DRS-2 score was very low, indicating that this variable was not significantly related to the outcome variable (See Table 8).

The results indicated that the multiple regression model predicted 53.7% of the variance DRS-2, based on self-report, objective performance, discrepancy, and effort. In this sample, objective measure of IADLs and effort were significant predictors of participants' cognitive functioning, while the self-reported IADL abilities and discrepancy between objective and self-reported abilities were not significant predictors and did not contribute to variance in total DRS-2 score.

Discussion

Results of the multiple regression indicated several significant predictions. It was found that performance-based measures of IADL abilities, as measured by the TFLS, is a significant predictor of cognitive functioning, which is consistent with the current literature. Individuals who were less able to perform and complete tasks necessary for daily living, such as telling time, calculating change, handling finances, and communicating, were more likely to have some aspect of cognitive impairment.

It was also found that a standalone measure of performance-based validity, or effort, was also predictive of cognitive functioning. Individuals with a higher level of cognitive functioning were more likely to "pass" certain performance-based validity tests, indicating their performance was consistent with their true functioning. However, the findings in this study are also suggestive that those who "failed" the performance validity test (e.g., the ACS Word Choice specifically), were more likely to have diminished cognitive abilities. It is important to flesh out the distinction between failing a PVT as indication of individuals possibly putting forth sub-optimal effort, and individuals having a genuine memory impairment as the cause of their poor performance. This concept will be

explored further in the implications and further directions sections of this paper.

Self-report was not a Significant Predictor

It is interesting to note that no significant predictions were found of cognitive functioning based on self-reported IADL ability, nor the created discrepancy score. It aligns with the existing literature that self-reported abilities may not be indicative of true cognitive functioning, as individuals with more severe cognitive impairment may tend to over-report their abilities. There are various alternative explanations as to why self-report may not be a significant predictor of true abilities, a phenomenon known as symptom validity. Individuals may tend to over-report their abilities in instances when a neuropsychological diagnosis or impression could lead to unfavorable outcomes. Such outcomes could include loss of independence or autonomy, and individuals may consequently attempt to present an inaccurately positive image of their abilities (Bush et al., 2005). This often leads to instances when individuals will systematically deny more common symptoms, a phenomenon referred to as "supernormality" (Cima et al., 2003). Interestingly, even in these instances when individuals try to obtain "good" results on neuropsychology tests, Goodrich-Hunsaker and Hopkins (2009) found that these efforts often do not lead to "failure" of symptom validity tests. Therefore, these individuals could appear to be "passing" imbedded validity tests, while their self-report is still not a significant predictor of true abilities, as demonstrated in the present study.

There are also individuals who under-report their abilities, creating a discrepancy in the reverse direction. Individuals may under-report their abilities due to emotional distress or lack of self-efficacy, often times related to symptoms of depression (Rogers, et al., 2010). A particular study compared individuals with depression and MCI, individuals with depression but no MCI, and healthy controls. They found that when providing self-reports about their beliefs of Instrumental Activities of Daily Living, depressed individuals underestimated their abilities significantly more than the control group, and also overestimated their abilities significantly less than the control group (Rogers et al., 2010; Skorzko et al., 2000). Individuals may under-report their abilities due to emotional distress or lack of self-efficacy, often times related to symptoms of depression (Rogers et al., 2010). A particular study compared individuals with depression and MCI, individuals with depression but no MCI, and healthy controls. They found that when providing self-reports about their



beliefs of instrumental activities of daily living, depressed individuals underestimated their abilities significantly more than the control group, and also overestimated their abilities significantly less than the control group (Rogers et al., 2010). Interestingly, this study also found that for depressed individuals who also had a mild cognitive impairment, they actually became more realistic about their abilities, as compared with individuals with MCI and no depression (Rogers et al., 2010).

Discrepancy Score was not a Significant Predictor

While it makes sense that no significant predictor was found in the case of self-report, it is of importance to further explore possible reasons that the discrepancy score indicative of the individuals' level of awareness did not significantly predict cognitive decline, as hypothesized in the study. With regards to this particular study, it is important to note that a large majority of the population was not severely demented. Therefore, there may not have been a large enough sample size of individuals with severe impairment or discrepancy to be able to detect a significant difference. When examining the rate of diagnoses, only 21% of the sample population had a diagnosis of Major Neurocognitive Disorder or Dementia. Further research with ideally a larger N should consider running these statistics with a population that is explicitly diagnosed with Major Neurocognitive Disorder so as to seek a potentially different outcome through a more narrowly defined population. Furthermore, as nearly 86% of the sample population was measured to have very mild or no cognitive impairment as measured by the MMSE, even those with a diagnosis of dementia still may have had relatively in-tact awareness of their abilities and functioning.

A second factor that may have impacted the significance of the discrepancy scale on predicting cognitive functioning is that there was a fairly equal n size of individuals both under and over reporting true functional living abilities. 95 participants over-reported their abilities (suggesting potential lack of awareness), and 91 participants under-reported. There was a total of 12 individuals with no discrepancy between their self-reported and actual functional living abilities. Again, this reduces the overall n of individuals who potentially were over-reporting their abilities due to true cognitive impairment and/or dementia. Again, future research can examine a population with

larger n who only over-report their ability with a cut off score to more closely examine this research question.

Finally, the way in which the discrepancy score was operationally defined may have had an impact on the outcomes. If this scale utilized a greater variability (e.g., 0-100), it may have had an impact on findings, which provides additional grounds for further research and exploration.

Implications

The conclusions of this study will provide several important implications for clinical practice, as well as future research. The results of performance-based IADL test and effort to be significant predictors of cognitive impairment provide several important indications to clinical practice and neuropsychological assessment. First, clinicians and psychometrists conducting evaluations for dementia and/or cognitive decline ought to be diligent to include performance-based, objective measures of functional living into their battery. The Texas Functional Living Scale, in addition to solid psychometric properties and ecological validity, now is demonstrated to be a significant predictor of cognitive abilities and can provide valuable insights into individuals' cognitive and functional abilities.

Second the finding that an imbedded performance based validity test of effort was also a significant predictor of dementia has important clinical implications. This study demonstrates that an evaluation of effort through this specific PVT (i.e., the ACS Word Choice) can also be utilized as a potential screener for early detection of dementia in older adults. As the reviewed literature demonstrated that while there is a great value in performance and symptom-based validity tests, the context and population of those being examined is important to keep in mind for the examiner and interpreter. Dressing et al (2011) argue that symptom validity tests do not necessarily differentiate between individuals who intentionally feign neurocognitive impairment, and individuals who experience neuropsychological impairment due to mental disorders, such as conversion disorder. As the findings of this study demonstrate, individuals with more severe cognitive impairment may be more prone to "failing" embedded performance-based validity tests. Without careful consideration and interpretation, and potentially the need to supplement neuropsychological batteries with additional performance and/or symptom validity tests, clinicians may be likely to misinterpret a "failed" validity test as suboptimal



effort, rather than an indication of genuine memory impairment.

Although the discrepancy scale utilized to measure awareness was not found to be a significant predictor of dementia, this is not to say that awareness should not be taken into consideration when evaluating for cognitive decline and impairment. As indicated throughout this study and notably in the literature review, significant discrepancies between demented individuals' self-report and report of caregivers, and also found that individuals with cognitive impairment provide less accurate and reliable report than their caregivers (Wadley, Harrell, & Marson, 2003).

Limitations

The present study is not without limitations, which need to be taken into consideration when interpreting and applying the significant findings. First of all, the present study utilized a limited sample in various aspects. This was a sample of convenience, meaning the study was based off of participants whose data was available. No specific inclusion criteria were initially identified for those who were participants, other than excluding individuals who had been court-ordered for evaluation. Thus, all participants were physician referred for neuropsychological evaluation, therefore predisposing the study to a high vulnerability of selection bias and sampling error.

Furthermore, the majority of participants were Caucasian and from one specific region in Punjab Pakistan. In addition, the majority of the measured population was not severely demented; most participants were still able live independently, and did not have severe levels of IADL impairments. As stated previously, this not only likely impacted the ability of the study to find significant results in some respects, but also may impact the external validity and generalizability of significant findings.

Second, the present study utilizes the creation of a new discrepancy score as the primary predictor of results. Caution should be noted when interpreting these results, as this discrepancy score has not been validated across numerous setting and trials.

Additionally, it is important to note that the current study focuses on the discrepancy based on over-reporting only, and does not consider in what way an individual's under-reporting of abilities may relate to their cognitive abilities and functioning.

There may be additional implications found by analyzing how an individual's discrepancy relates to their cognitive functioning when they under-report their abilities, or say that they have lower level of abilities than they actually do when based on their actual performance.

Another limitation is that the self-report and objective performance-based assessment did not measure the exact same skills or abilities. Additionally, there is a greater range and variability for the performance based assessment as compared to the self-report measure, which could confound some of the results.

Future Directions

The results and findings of this study provide several opportunities for future research and new directions in research and clinical practice. First, this study can be extended to include a more diverse population in terms of race and geographic region. It may also be of benefit for future studies to consider examining individuals within a narrower range of cognitive functioning. For instance, if future research is to expand upon the existing study it would be beneficial to select a population that is largely cognitively impaired, as this would provide a sample of individuals with limitations and functioning more of interest to the proposed research.

Second, future research can examine the effects of a discrepancy in only one particular direction. That is, future research can filter and only include participants who tended to "over-report" their symptoms, as to more likely obtain a sample of individuals with less awareness of their true abilities. Furthermore, it would be interesting to examine the "reverse" discrepancy. That is, what is the impact of individuals who rate their actual IADL ability as *lower* than their actual performance-based ability?

It would also be of value for future research to expand on the present study and further examine the use of this discrepancy score to assess levels of validity and reliability. Additional research regarding psychometric properties of this rudimentary discrepancy score, and perhaps more efficient statistical means to standardize scores to compare with additional self-report or performance-based validity tests.

Finally, as the present study only examined cognitive functioning as measured by the DRS-2 Total Score, it would be beneficial to



examine if there are any significant differences of the independent variables on individuals' cognitive functioning as measured by the DRS subscales. The five subscales of Attention, Initiation-Perseveration, Construction, Conceptualization, and Memory have been demonstrated to correlate on a univariate level with their assigned neuropsychological criterion measure (Marson, Dymek, Duke, & Harrell, 1997). Greenaway, Duncan, Hanna, and Smith (2010) found that the DRS subscales of Initiation/Perseveration and Memory were predictive of performance on IADL tasks utilizing the Everyday Cognition assessment. It may be of value to further examine how the discrepancy between self and performance-based measures are predictive of executive functioning as measured by individual subscales on the DRS-2.

Research in neuropsychology has demonstrated a clear relationship between individual's ability to carry out tasks of daily living and their cognitive abilities. More specifically, individuals with greater cognitive impairment tend to have lesser abilities to perform IADLs.

However, there may be a discrepancy between these individuals' self-report and the report of other significant individuals in their lives, or their performance - based measure of these abilities. Results of this study were consistent with existing literature and in fact demonstrated predictive ability of performance-based measures, as well as performance validity tests of effort, in evaluating cognitive impairment with specific tests. Self-report was also found to not significantly predict cognitive abilities, which is expected and consistent with existing literature.

While the present study did not find the created discrepancy score to be significantly predictive of cognitive abilities, there were numerous reasons this may have been the case, which were outlined in the limitations. Despite this lack of significant findings, there are still many important implications to be considered based on the outcome of this study and proceeding in neuropsychological evaluations for dementia/cognitive impairment.

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