3-2021

Performance on the Texas Functional Living Scale in a Memory Disorder Clinic

Kathryn Kim Grueninger

Performance on the Texas Functional Living Scale

in a Memory Disorder Clinic

by

Kathryn Kim Grueninger, M.S.

Master of Science
Clinical Psychology
Florida Institute of Technology
Melbourne, Florida
2017

A Doctoral Research Project
submitted to the School of Psychology at
Florida Institute of Technology
In partial fulfillment of the requirements
For the degree of

Doctor of Psychology
In Clinical Psychology

Melbourne, Florida
March, 2021

We the undersigned committee, having examined the submitted doctoral research project, "Performance on the Texas Functional Living Scale in a Memory Disorder Clinic" by Kathryn Kim Grueninger, M.S. hereby indicates its unanimous approval.

____

Anthony LoGalbo, Ph.D.
Associate Professor
School of Psychology
Committee Chair

____

Patrick Aragon, Psy.D.
Assistant Professor
School of Psychology
Committee Member

____

David Wilder, Ph.D.
Professor
School of Behavior Analysis
Committee Member

____

Robert Taylor, Ph.D.
Professor and Interim Dean
College of Psychology and Liberal Arts

Abstract

Title: Performance on the Texas Functional Living Scale in a Memory Disorder Clinic

Author: Kathryn Kim Grueninger, M.S.

Major Advisor: Anthony LoGalbo, Ph.D., ABPP

Objective: The present study examines the clinical utilization of an objective performance-based measure in a memory disorder clinic sample.

Method: One year of archival cognitive testing data from a total of 176 Health First Memory Disorder Clinic patients was utilized for the current study. Participants were included in this study if they completed a brief neuropsychological evaluation which included the Texas Functional Living Scale (TFLS) and were also diagnosed with Normal Cognition (NC), Mild Cognitive Impairment (MCI), or Alzheimer's disease (AD). Patients' psychosocial history regarding their self-reported or informant-reported abilities with performing instrumental activities of daily living (IADLs) was obtained from their electronic medical records and included as predictors in this present study.

Results: Results showed that overall TFLS scores differed significantly across diagnostic category. Specifically, scores from the AD group were significantly lower than both MCI and NC groups. Correlation analysis revealed that overall TFLS scores were positively and significantly correlated with overall MoCA total score, suggesting that those who tend to score higher on the MoCA (a brief screener of global cognitive functioning), also obtained higher TFLS score. Further correlational analyses demonstrated that there were positive correlations found between TFLS scores and tests of executive functioning, as well as other tests of cognition. Lastly, results demonstrated that patients who had reported impaired abilities in at least 2 of 3 IADLs (i.e., medication management, financial management, and driving) demonstrated lower TFLS scores, suggesting more impaired abilities in completing basic adaptive functioning skills. Meanwhile, those who reported intact abilities in 2 of 3 IADLs demonstrated higher TFLS scores, suggesting more intact abilities in completing basic adaptive functioning skills.

Conclusion: Not surprisingly, the TFLS scores among the AD group were significantly worse compared to MCI and NC groups; therefore, further assisting in the differential diagnosis, particularly between individuals who fall between MCI and AD presentations. Although TFLS scores positively correlated with measures of global cognitive functioning (MoCA) and tests of executive functioning, they also demonstrated positive correlations with many other areas of testing, suggesting that the TFLS measures more than just executive functioning. Future research studies should continue to repeat similar study designs to demonstrate reliability strength, and to also increase sample size among the diagnostic categories. This study was limited by the data collection time frame; in the future, it would be helpful to have more time to collect data from more diverse diagnostic groups (i.e., including other dementias). However, this study suggests that the TFLS demonstrated significant clinical utility, particularly with differential diagnosis among the three diagnostic groups (with the exception of MCI and NC). This study

also provides clinical relevance with making diagnostic decisions, which will then assist with appropriate treatment recommendations.

TABLE OF CONTENTS

Acknowledgment

First and foremost, I would like to extend my love and gratitude to my parents, brothers and sister-in-laws for providing continuous support and encouragement throughout my academic career. Their unconditional love and steadfast presence helped guide me through some of the most trying times of graduate school; and for that, I will be forever grateful. Secondly, I would like to thank my wonderful friends. They happily celebrated my milestones and accomplishments with me; and yet, they were also there to provide much needed support during the setbacks and more difficult times.

I would also like to express my deepest appreciation to my committee chair, Dr. Anthony LoGalbo. I am indebted to him for his constant encouragement, guidance, and support throughout this journey. His positivity, enthusiasm, and dedication to educating students and sharing the depth and breadth of his neuropsychology knowledge has instilled in me a love for the field and the work we do, and it will always motivate and guide me towards becoming a more skilled and thoughtful clinician. Furthermore, I would like to thank Dr. Frank Webbe for his expertise, time, and invaluable perspective. Both Dr. LoGalbo and Dr.Webbe saw my potential and invested countless hours into my training, and for that, I will truly be forever grateful.

Lastly, I am extremely thankful to the Health First Memory Disorder Clinic in Melbourne, Florida. For 3.5 years, I have enthusiastically involved myself in various roles and have loved every minute of the experience. Without their help and support, this entire study could not have been completed.

Chapter 1

Introduction

Current population trends continue to demonstrate the need for greater understanding of the complexity in working with and providing care for individuals who are 65 years and older. The United States Census Bureau (2017) projects that the population in this age group will double over the next few years, rising from 49 million in 2016 to an estimated 95 million by 2060. With longer life expectancies, individuals can continue to experience fulfilling lives with their family and friends as well as maintain employment status or hobbies which contribute to their overall well-being. While there may be more pleasurable and productive opportunities for older adults who live longer, increased longevity also increases the chances of certain factors which can be detrimental. For example, some may experience higher medical costs due to increased likelihood of acquiring additional medical complications, and higher cost of living, whether it is due to being placed in an assisted living facility or acquiring in-home care. Additionally, older adults are at increased risk of developing dementia given that advancing age is the greatest risk factor for dementia.

A significant amount of research has focused on understanding the numerous factors that contribute to maintaining or negatively affecting cognition as we age. The study of cognitive decline has been an area of interest for years, dating back to the early 1900s when Alois Alzheimer discovered a novel case of a 50 year old woman who, upon autopsy, showed senile plaques and neurofibrillary tangles in her brain, which later became some of the hallmark findings in the diagnosis of

Alzheimer’s disease (Hippius, H., & Neundorfer, G., 2003). Since the discovery of the brain anomalies found by Alzheimer, extensive time and research has been undertaken to better identify, manage, and treat factors that are related to cognitive decline among the elderly (Tuokko, H.A., Smart, C.M., 2018).

One of the significant advancements over the years involved adopting a general consensus on how to accurately identify and further diagnose cognitive decline, which is a significant component to effective detection and management of the disease. In 1986, the National Institute on Aging (NIA) funded the Consortium to Establish a Registry for Alzheimer’s Disease (CERAD) to help address the need for standardized clinical procedures and neuropsychological assessments for evaluating Alzheimer’s disease (Fillenbam et al., 2008). Through their research, they were able to establish a standardized battery that was reliable and valid in assessing Alzheimer’s disease. In addition to developing a brief, but adequate battery of neuropsychological tests to assess AD, CERAD further introduced a standardized means of viewing neuroimaging, as well as developing appropriate training tools to be used within all of the Alzheimer Disease treatment centers (Fillenbaum et al., 2008).

More recently, the American Psychiatric Association (2013) developed specific criteria in the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) to distinguish a major versus mild cognitive decline. A mild Neurocognitive Disorder (NCD) is diagnosed when the individual demonstrates relatively minor declines in one or more cognitive domains. These domains include: (a) complex attention, (b) executive functioning, (c) learning and memory, (d) language, (e) perceptual-motor, and (f) social cognition. These declines in cognition must be evident either through objective neuropsychological testing or via patient and/or collateral or clinician report, and these changes are a decline from their previous premorbid functioning; however, maintaining intact instrumental activities of daily living (IADL) functioning is a component of having a mild NCD (APA, 2013). IADLs include complex behaviors, which often involve the ability to live independently in the community, such as managing finances. Additionally, a major NCD is diagnosed when either there is a significant decline in one or more cognitive domains based upon standardized neuropsychological testing or the patient or patient's family or provider's report is indicative of a significant decline in comparison to their premorbid functioning (APA, 2013). These declines must be significantly different from their expected baseline level of functioning, and the changes must interfere with the individual's ability to complete accurately their instrumental activities of daily living (IADLs). Additionally, the suspected etiology for cognitive decline can also be specified using various subtypes, including Alzheimer's disease, vascular dementia, dementia with Lewy bodies, dementia due to Parkinson's disease, frontotemporal dementia (FTD), dementia due to a traumatic brain injury, etc. (APA, 2013). The DSM-5 also allows for the provider to specify whether the dementia is with or without a behavioral disturbance, which includes behaviors related to exhibiting psychotic symptoms, mood disturbance, etc., as well as specifying the severity of the dementia (i.e., mild, moderate, or severe; APA, 2013).

As part of a thorough memory evaluation, it is important to inquire about the patient's ability to perform their activities of daily living (ADLs). ADLs are somewhat synonymous with the term adaptive functioning. Adaptive functioning refers to daily skills that are needed for individuals to function independently, and this can range from aspects of self-care such as bathing and maintaining personal hygiene, to more general socialization and other independent living skills such as driving and managing finances. It is of note that ADLs overlap with aspects of adaptive functioning, particularly with respect to money management, communication, driving, managing household tasks, etc. Whereas adaptive functioning can be viewed as an overall umbrella term for daily living skills, ADLs can further be differentiated into basic ADLs (BADLs), which typically pertain to aspects of self-care such as bathing, dressing, and grooming, versus instrumental ADLs (IADLs), which typically refer to more complex tasks such as managing finances and medications, and driving. For the purpose of this paper, the terms ADLs, IADLs and BADLs will be used to describe relevant aspects of an individual's independent living skills, although the main focus of study will be on IADLs.

Chapter 2

Study Purpose

The purpose of this study is to gather data on IADLs and neuropsychological functioning from a memory disorder clinic population toward examining the clinical utility of an instrument that measures IADLs: the Texas Functioning Living Scale (TFLS). In order to understand the significance of the study, an explanation of necessary background information pertaining to the importance of accurate assessment of IADLs within a memory disorder clinic population will be presented. Specifically, the introduction will include: (a) current understanding of what we know about healthy aging; (b) a description of risk factors related to development of cognitive impairment; (c) a description of Mild Cognitive Impairment; (d) a description of Alzheimer's disease and other related dementias; (e) current use of measurements used to assess ADLs and their limitations; a(f) background information about the TFLS; and (g) the specific aims and hypotheses that will be addressed in this study.

Chapter 3

Review of the Literature

Healthy Aging

Various cognitive changes are typical, if not expected, throughout the aging process. Better understanding and appreciation of typical cognitive changes allows for more appropriate diagnostic conclusions, particularly when atypical cognitive and behavioral presentations are observed, which then further assist with recommending subsequent treatment and interventions. Furthermore, understanding which cognitive domains are impaired versus intact further aides the diagnostic process and understanding of the trajectory of the diagnosis.

One aspect of cognitive functioning relates to an individual's overall general intellectual functioning. This domain differs from more specific cognitive domains, such as memory, language, and attention, etc. Research has demonstrated that elderly individuals tend to remain relatively intact with respect to their crystalized abilities and knowledge, in comparison to fluid abilities and knowledge (Craft, Cholerton, & Reger, 2017). In particular, crystallized intelligence describes and includes an individual's ability to remember knowledge and utilize that knowledge for particular applications based on one's experience and learned behaviors; on the other hand, fluid knowledge considers an individual's ability to problem solve in novel situations (Kent, 2017). Additionally, individuals tend to maintain much of their verbal abilities as they age, whereas visual abstract thinking and aspects of executive functioning tend to slowly decline over time (Craft, Cholerton, & Reger, 2017).

Many other cognitive domains can be impacted with the process of normal aging as well. For example, different memory changes often occur. In particular, the ability to learn new information, with a relatively slower learning curve over repeated trials of learning the same information, becomes more difficult amongst healthy aging adults (Luo & Craik, 2008; Craft, Cholerton, & Reger, 2017). However, despite less information being encoded through learning, their retention of information appears relatively persevered (Craft, Cholerton, & Reger, 2017). Furthermore, working memory, although also a component of the attention domain, and episodic memory are also more negatively affected by normal age-related changes (Luo & Craik, 2008). Prospective memory is another component of memory that is important, especially for the aging population. In general, prospective memory is an individual's ability to intentionally remember to perform a behavior at a later point in time (Luo & Craik, 2008). Zeintl et al. (2006) found that prospective memory performance was able to predict subjective memory complaints related to prospective memory within a sample of adults aged 65-80; however, there was less significance when the individual was experiencing depressive symptoms. Thus, they suggested that individuals who endorse a lower level of emotional distress and memory concerns may be more likely to rely on their self-reported prospective memory concerns, which can serve as a valid measure of their prospective memory ability (Zeintl et al., 2006). Relying on our prospective memory can be beneficial and useful in our daily living activities and in determining the level of assistance, which may be necessary in one's life, particularly as it relates to their abilities to perform important IADLs independently.

Individuals experiencing normal aging may also demonstrate difficulties with completing aspects of executive functioning. Executive functioning can be viewed as a general term, which includes cognitive flexibility, problem-solving, planning, multitasking, and ability to cope with novelty (Lezak, Howieson, Bigler,

& Tranel, 2012). They are an important cognitive ability, particularly when performing “real world” behaviors as an adult. These skills allow adults to complete complex actions, resulting in the ability to initiate goal-directed behavior, sustain attention to tasks despite the interruption or distraction, but also the ability to stop or disinhibit a behavior (McAlister & Schmitter-Edgecombe, 2016). As individuals age, executive functioning tends to decline slightly, but there does not appear to be significant changes in “real world” executive functions which would involve multi-tasking or planning, in comparison to individuals who are presenting with more severe dysexecutive problems (Craft, Cholerton, & Reger, 2017).

Aspects of language tend to change with age as well. Whereas basic comprehension remains relatively preserved with aging, there are other aspects of language where changes are relatively normal to observe (Craft, Cholerton, & Reger, 2017). Confrontational naming tends to remain relatively intact with the progression of aging, until a relative decline around the ages of 70 and older (Zec, Markwell, Burkett, & Larsen, 2005). Coincidentally, word-finding difficulties tend to be a common complaint with aging individuals, often referred to as the “tip of the tongue” phenomena. However, these individuals tend to be able to recall the correct word when given cues, suggesting that it is more of a retrieval problem than the loss of abilities to name the object (Craft, Cholerton, & Reger, 2017). Additionally, another language change that may be present with normal aging involves verbal fluency. Verbal fluency is the rate at which an individual can spontaneously recall words under a set amount of time, which fall under either a phonemic or semantic category. Although it can be viewed as an executive functioning measure as well, due to the task requiring flexible thinking, self-regulation, and self-monitoring (Lezak et al., 2012), it also requires a language retrieval component. While phonemic fluency tends to remain relatively stable as age progresses, there tends to be more a decline in semantic or categorical fluency (Clark et al., 2009).

In terms of attentional abilities, individuals experiencing normal aging may not experience much change in sustained attention; however, there may be more difficulties with complex, divided attentional tasks, such as during occasions when multi-tasking is required (Craft, Cholerton, & Reger, 2017). Psychomotor functioning tends to also decline with age. As individuals age, they tend to demonstrate a slower processing speed but also slower motor skills, which is consistent with normal age-related changes (Luo & Craik, 2008; Craft, Cholerton, & Reger, 2017). Therefore, it is crucial to understand how expected slower processing speed may affect other cognitive domains that are contingent on accuracy and speed (Harada, Natelson Love, & Triebel, 2013). Lastly, visuospatial skills may also see some degree of normal decline in performance as well, even when speed is accounted for (de Bruin, Bryant, MacLean, & Gonzalez, 2016).

Understanding and recognizing typical changes in cognition that are relatively normal for the elderly can be helpful particularly when interpreting neuropsychological test data. Furthermore, considering an individual's premorbid functioning can be crucial to not only determine whether performance is normal when compared to a normative group, but also when compared to that individual's prior abilities. Baseline measures are often helpful for detecting cognitive changes; however, the reality of all patient's having baseline testing is rare. Furthermore, not all assessments administer the same battery of tests, making it more difficult to make direct comparisons. Therefore, understanding how to measure or estimate premorbid intellectual functioning, without the comparison of baseline testing, can be crucial and helpful in further delineating cognitive changes which would inform subsequent treatment recommendations.

Premorbid functioning can often be estimated in different ways. One method involves considering the individual's demographics, such as education level and occupational functioning, which are two variables, which have been correlated with intellectual functioning (Schoenberg, Lange, Marsh, & Saklofske, 2011). An individual who obtained his or her bachelor's degree may be expected to perform at a higher level than someone who completed only nine years of formal education. Test data from individuals who have obtained education levels at either end of the spectrum should be interpreted differently because their level of education may not fall within education levels of the sample used to develop the neuropsychological testing norms, which could impact how their data is interpreted. Similarly, an individual's occupational attainment can also suggest the level of cognitive ability that they have (Schoenberg et al., 2011).

Another way to measure an individual's premorbid functioning is by administering a standardized word-reading test. Studies have found that performance on a word-reading task is highly correlated with general intellectual functioning (Nelson, 1982). One assumption and hence, advantage, of using these tests is that verbal abilities, such as word reading, tends to be relatively intact despite deteriorating cognition, therefore making it an effective means to assess premorbid functioning (Bright, Kopelman, & Jaldow, 2002). Common standardized word reading tests often utilized include the National Adult Reading Test (NART; Nelson, 1982), North American Adult Reading Test (NAART; Uttl, 2002) and the Advanced Clinical Scales Test of Premorbid Functioning (ACS TOPF).

Without taking into consideration an individual's estimate premorbid level of functioning, a potential limitation resulting in the misinterpretation of neuropsychological data can lead to over-diagnosing as well as subsequent general distress from the patient and their loved ones based on the inaccurate diagnosis. Studies have indicated that it is not uncommon for normal aging individuals to perform poorly on some aspects of testing, without actually having any cognitive decline (Tuokko & Smart, 2018). Indeed, previous research has investigated how normal aging adults may perform poorly on cognitive testing. For example, Mistridis et al. (2015) conducted a study investigating the base rates of low cognitive testing scores from the German version of the CERAD-Neuropsychological Assessment Battery (CERAD-NAB), which demonstrated that 60.6% of the normative sample obtained scores that fell at or below the 10^{th} percentile, further suggesting the need for better understanding how often it was that normal aging adults were to obtain poor cognitive test scores. Therefore, the importance of additional clinical information such as social and medical history, information regarding ADL performance, as well as brain imaging, can further aide in differential diagnosis.

Risk Factors for Cognitive Decline

Multiple risk factors have been identified to be associated with cognitive decline. Increasing age is the strongest risk factor for decline in cognition and development of a neurodegenerative disease (Mielke, 2018; APA, 2013). Cardiovascular risk factors, such as hypertension, diabetes, tobacco use, etc. have also been found to be risk factors associated with cognitive decline (Craft, Cholerton, & Reger, 2017; Peters et al., 2008). Genetic predisposition can also be a risk factor. Specifically, individuals who carry the apolipoprotein E (ApoE) gene, in particular the e4 allele, are at a higher risk of acquiring Alzheimer's disease, when compared to those who carry the e2 as well as the e3 allele (Liu, Kanekyo, Xu, & Bu, 2013). In fact, carrying the e2 allele has actually been demonstrated to be a protective factor against cognitive decline.

Mild Cognitive Impairment

Mild cognitive impairment (MCI) is often diagnosed when an individual demonstrates relatively milder declines in cognition when compared to their prior cognitive functioning, which are not severe enough to interfere with accurately completing their IADLs (Lin et al., 2013). The diagnosis of MCI can be further distinguished to indicate whether it is an amnestic or non-amnestic type. It is referred to as an amnestic type when learning and memory is one of the impaired domains. Meanwhile, non-amnestic type refers to MCI when any other domain (not including learning and memory) is impaired. Additionally, providers can also specify whether the cognitive decline affects only a single cognitive domain or multiple cognitive domains. Cognitive decline has often been viewed along a spectrum, with MCI being seen as a decline in cognition in comparison from prior functioning but also a precursor to developing dementia (Lin et al., 2013).

Assessment and accurate diagnosis of MCI represents crucial aspect of an individual's medical history due to its potential for predicting cognitive and functional changes over time. Longitudinal studies demonstrated that approximately 80% of individuals who were diagnosed with MCI were more likely to develop Alzheimer's disease within a span of 5 to 8 years (Craft, Cholerton, & Reger, 2017). Research has demonstrated that an amnestic MCI is more likely to convert to Alzheimer's disease, whereas non-amnestic MCI may be more likely to represent an early onset for other dementia etiologies, such as frontotemporal dementia, vascular dementia, etc. (Craft, Cholerton, & Reger, 2017).

However, evidence also suggests that many people who are diagnosed with MCI can either continue to have stable mild cognitive deficits over time, or revert back to normal cognition, rather than progressively decline towards dementia (Koepsell & Monsell, 2012). However, Koepsell & Monsell (2012)'s longitudinal study further demonstrated that those individuals who reverted to normal cognition were still at a risk of later cognitive decline, despite the initial reversion. Regardless of subtype, the National Institute on Aging describes people with MCI as being able to still take care of themselves and complete typical daily activities but may show signs of losing items, forgetting events or appointments, or having word-finding difficulties in conversation, in comparison to same-aged peers (n.d.). Nevertheless, a thorough and accurate evaluation of functional abilities is crucial to the management of abilities and appropriate treatment that are associated with the cognitive decline.

Alzheimer's Disease and Other Related Dementia (ADRD)

The World Health Organization (WHO; 2019) defines dementia as a progressive syndrome which causes various brain illnesses that affect one's cognition, especially in their learning and memory, as well as their everyday activities. Age is the greatest risk factor for dementia; however, not everyone develops dementia (Mielke, 2018; APA, 2013). In fact, according to the CDC (n.d.), developing dementia is not a normal part of aging. Individuals with dementia are generally characterized as having difficulties with impairments in their instrumental activities of daily living (IADLs), with their basic activities of daily living (BADLs) eventually being negatively impacted as the disease progresses (Lin et al., 2013). As previously noted, activities of daily living (ADLs) can be divided into two sub-categories: basic activities of daily living (BADL) and instrumental activities of daily living (IADL). BADL are described as those activities that involve personal care, such as bathing, dressing, etc. IADLs, on the other hand, are daily activities that require more complex thinking and behaviors, and include managing one's medication, finances, etc. In the early stage of the disease, patients may have more difficulties remembering how to accurately perform their IADLs without assistance; however, their ability to maintain their hygiene and dress and bathe themselves may continue to remain intact. However, with time and as more cognitive difficulties arise; even those BADLs may require assistance from family members.

Alzheimer's disease is a progressive neurodegenerative disease, and it is the most widely diagnosed form of dementia, accounting for approximately 60-80% of all dementia cases (alz.org). The estimated range varies likely depending on the setting in which it is diagnosed, as well as the criteria used to make the diagnosis. The severity of the disease can vary among individuals; however, it generally causes worsening symptoms over time. The Alzheimer's Association reported that more than 5 million Americans who are 65 years and older are diagnosed with Alzheimer's disease, with women comprising 2/3 of this group (alz.org; 2020). This gender difference may be more accounted by the fact that women tend to have longer life longevity; therefore, women have a higher chance of acquiring more cardiovascular problems and medical complications, further increasing the chances of developing cognitive decline, when compared to their male counterparts (Mielke, 2018). In fact, incidence studies in the United States have reported that there were no significant gender differences in developing AD, regardless of age (Edland et al., 2002).

There is currently no cure for Alzheimer's disease. However, disease-modifying treatments are available to prescribe for the treatment of cognitive decline. Two classes of drugs are often utilized within the aging population: acetylcholinesterase inhibitors (AChEIs) and *N*-Methyl-D-aspartate (NMDA) receptor antagonists, and while there can be benefits to their use, each come with their own limitations as well.

AChEIs are often utilized due to their inhibitory reaction of cholinesterase, an enzyme that increasingly breaks down acetylcholine (Tuokko & Smart, 2018). AD is often associated with a decrease in the neurotransmitter, acetylcholine; therefore, the inhibitory action of AChEIs prevents the decline in acetylcholine (Birks, 2006). The most frequently used AChEIs prescribed include: donepezil (Aricept), rivastigmine (Exelon), and galantamine (Razadyne) (Tuokko & Smart, 2018). A NMDA receptor antagonist, most common being memantine (Namenda) is sometimes helpful, as its purpose tends to focus on blocking glutamatergic activity, which can negatively affect memory (Tuokko & Smart, 2018). Namzaric is another NMDA receptor antagonist, which combines both memantine and donepezil.

When memory medications were compared to one another, memantine demonstrated more efficacious results in the treatment of severe dementia cases whereas AChEIs were often helpful in treating mild to moderate stages of dementia (Di Santo, Prinelli, Adorni, Caltagirone, & Musicco, 2013). Understanding the level of severity of cognitive impairment assists geriatricians and other medical professionals with the treatment planning and potential use of disease-modifying treatments, such as the above-mentioned drugs. Therefore, accurate assessment and subsequent diagnosis can help aide in making appropriate pharmacological recommendations.

While certain medications offer advantages towards treating cognitive, behavioral, and emotional disturbances within the aging population, they can also potentially contribute to more problems if not carefully considered. For that purpose, the American Geriatrics Society developed the Beers criteria to help indicate specific medications that could become potentially harmful and inappropriate for use with the elderly population. Medications become even more problematic when taken incorrectly, which can become an issue with individuals who have cognitive impairment, as they may forget to take their medications. Inaccurate dosage of medications may further complicate or prevent the improvement of cognition, behaviors, or emotions (Tuokko & Smart, 2018). Thus, the evaluation of medication compliance and accurate self-management of medications remains a significant detail in information gathering to again, not only assist with differential diagnoses, but to also assist with developing appropriate treatment recommendations (i.e., recommending supervision of medications).

Symptoms that are commonly associated with Alzheimer's disease include difficulties with acquiring newly learned information, disorientation, confusion, as well as behavioral and mood changes, which may include suspiciousness of others, wandering, difficulty speaking, swallowing or walking, as well as a lack of insight into their cognitive deficits (alz.org). This disease not only impacts the individual but also those who are involved in the patient's care, such as the individual's family. Individuals with AD often find themselves reverting in functioning, requiring more and more assistance from others as the disease progresses. Knowing the extent of the cognitive difficulties can help the family better prepare for management of important financial and medical decisions, with the patient's best interest in mind. Whether changes involve just providing more oversight with the completion of IALs or full management of them, the family can help protect their loved one from making any poor decisions related to their finances or medical management.

Activities of Daily Living Measures

Assessment of activities of daily living (ADLs) are a crucial component to a memory evaluation, as it helps the provider differentiate whether the patient's deficits are considered to be MCI (mild NCD) or dementia (major NCD). Oftentimes, ADLs are assessed using a variety of different self and collateral report measures and questionnaires rather than formal or direct measurement. Although these self-reported formats can be rich with information, there can also be significant limitations with relying solely upon questionnaires. The subjective nature of the questionnaire format allows individuals to either exaggerate or minimize the difficulties that they may be experiencing when providing a self-report, especially if the individual does not have insight into his or her cognitive deficits. This can also be problematic for family/collateral reports because they may be attempting to answer questions about their loved one's functional behaviors without full awareness of their abilities. For example, collateral information can be problematic, especially if loved ones do not live in the same home as the patient or live out of state, Additionally, loved ones may not be intentionally observant of their loved one performing IADLs accurately on their own.

As the need for assessing functional abilities using objective measures has increased, test developers have introduced performance-based objective measures for evaluating behaviors, which allows for less reliance on potentially inaccurate self or collateral reports. These assessments generally require the patient to demonstrate completion of common IADLs in a standardized format. Examples include such tests as the Daily Living Test, which is part of the Neuropsychological Assessment Battery (NAB; Stern & White, 2003) and the Independent Living Scales (ILS; Loeb, 1996).

The NAB Daily Living composite score includes aspects of five different cognitive subtests, each targeting common daily activities for people aged 18-97, including a Driving Scenes test, Bill Payment test, Map Reading test, Judgment test, and a memory component. Assessing judgment can be a crucial aspect of evaluating functional abilities, particularly when it comes to making safe and practical judgement decisions in their daily functioning, including but not limited to their finances, medication, driving, and personal self-care. NAB's Judgement test asks the patient a series of questions related to hypothetical social and health-related reasoning (Ashendorf et al., 2018). Judgement is an aspect of an individual's executive functioning, with executive dysfunction being a common syndrome of dementia (Craft, Cholerton, & Reger, 2017). Intact judgment suggests that an individual can properly and safely self-manage and independently take care of themselves and/or others. A lack of judgment can lead to poor decision-making, which can cause more detrimental results or consequences for themselves or others around them. The Judgment test is part of the overall Executive Functioning subtest of the NAB. MacDougall & Mansbach (2013) investigated convergent validity properties of the Judgment test within an assisted living facility, finding that the overall Judgment score was significantly correlated with the oral version of the Trail Making Test (TMT) B, as well as the MMSE scores, and the Lawton IADL scale.

Memory is another component of the NAB and relevant to performing ADLs, particularly with regard to an individual being able to perform the needed activities without difficulties. Intact memory suggests that an individual can learn and benefit from receiving repetitive information, with ability to retrieve stated information over time. For aging individuals, remembering to take certain pills during certain times of the day or even remembering how to accurately fill out checks or address envelopes are important skills for adults.

Gavett et al. (2012) investigated the utility of each of the seven NAB subtests in predicting accurate diagnoses, and they discovered that the Immediate and Delayed Recall trials of the Daily Living Memory test demonstrated the best predictive ability in identifying individuals with AD. They further demonstrated that the NAB Driving Scenes, Bill Payment, and Judgment were also helpful in being able to assist with ruling out a diagnosis of AD (Gavett et al., 2012). A limitation of the Judgment test is how heavily it relies on intact language capacity and the inability to know if the individual would behave differently than what their verbal responses indicate (MacDougall & Mansbach, 2013). Furthermore, performance on the Bill Payment and Judgment tests were less sensitive in predicting coinciding collateral-related concerns/lack of concerns in either of those areas (Ashendorf et al., 2018).

The ILS test is also normed to assess IADLs for individuals who are 65 years and older, and it is composed of 5 subcategories, including Memory/Orientation, Managing Money, Managing Home and Transportation, Health and Safety, and Social Adjustment. A total of 140 points can be obtained, with higher scores indicative of higher functional performance, and the entire test takes approximately 45 minutes to administer (Loeb, 1996). Weiner et al. (2006) compared ILS to the Test of Everyday Functional Abilities (TEFA), which included all the TFLS subtests with an additional dressing component to measure basic praxis abilities (Cullum et al, 2001). They ultimately removed the dressing component due to 93% of their participants obtaining the maximum score (Weiner et al., 2006). They found that the total TEFA score demonstrated a strong correlation with the total ILS score, with each with each of the TEFA subscales correlating with their respective corresponding subscales from the ILS (Weiner et al., 2006). Limitations of the ILS test include the length of time it takes to administer the entire test as well as being only normed to administer the test to older adults (Gonzalez, Soble, Marceaux, & McCoy, 2017).

Texas Functional Living Scale (TFLS)

The TFLS was developed to formally measure an individual's functional abilities by means of a performance-based objective approach that can be administered quickly and easily (Cullum et al., 2001). The test was developed in response to the need for more useful, performance-based tests to be available to assess functional abilities within the dementia population (Cullum, Weiner, & Saine, 2009). The original TFLS was composed of five subtests assessing basic areas of functional abilities, with the combined total raw scores from each of the subtests being easily converted to an overall TFLS T-Score (Mean=50, SD= 1.5), reflecting an overall global score suggesting the degree to which an individual can perform functional abilities. Total time to administer takes approximately 15-20 minutes.

The original version included the following subtests: (a) Time, (b) Money and Calculation, (d) Communication, (e) Memory, and (f) Dressing, which measures praxis abilities. The Dressing subtest was later removed; however, this did not affect any of the results from the initial study (Cullum et al., 2001). Therefore, the finalized TFLS version was comprised of only the four following subtests: Time, Money and Calculation, Communication, and Memory. The Time subtest asks the patient to perform common daily tasks including reading information on a calendar as well as reading and set hands on a clock. The Money and Calculation subtest asks the patient to perform basic calculations such as how much time will pass from one time to another, and calculating monetary change involving simple subtractions. The Communication subtest asks the patient to perform common tasks involving financial management such as filling out a check for a fake water bill as well as completing a check to send in their payment to the water company. The Communication subtest also includes common daily tasks such as using a phonebook to look up a number and dial it on a phone, asking patients to verbalize the steps involved in making a peanut butter and jelly sandwich, and following basic instructions on a food label to demonstrate how they would use and program a microwave. Lastly, the Memory subtest involves three different activities, including one prospective memory task. At one point in the middle of the test, the patient is directly told to remove three pieces of candy out of a nearby bottle when a 5-minute alarm goes off. Their behavior is subsequently scored based on whether they spontaneously remembered to remove the candy without being prompted, after receiving a verbal prompt, after receiving a pointing prompt, or if they were unable to recall what to do or removed the wrong amount of candy. This prospective memory test is unique in that the patient is asked to perform a planned activity at a future point in time. The last memory items involve whether the patient can recall who they wrote the check to during the previous check-writing task, and how much the check was written for.

The TFLS's normative sample included 800 individuals, ranging from ages 16-90, making it a useful assessment that could administered to all adult ages. To further validate the TFLS within the dementia population, Cullum et al. (2001) conducted a study using a sample of 22 patients with possible or probable

Alzheimer's disease and 21 healthy controls (ages ranged from 64-85). They were administered the Mini Mental Status Examination (MMSE) along with the TFLS, while their caregivers completed the Blessed Dementia Rating Scale (BDRS) (Cullum et al., 2001). The TFLS demonstrated good reliability, internal consistency, and convergent and discriminant validity, and its easy administration instructions and brief administration time make it a promising performance-based measure to use within the dementia population (Cullum et al., 2001).

Other research studies have investigated the use of the TFLS with the use of other commonly used neuropsychological tests. Nguyen, Copeland, Lowe, Heyanka, and Linck (2019) focused on the impact that executive functioning abilities could have on TFLS scores, and they found that Trail Making Test B (a measure of set-shifting abilities) and the Similarities subtest from the Wechsler Abbreviated Scale of Intelligence-II (WASI-II) test (a measure of abstract reasoning) significantly predicted overall TFLS scores, whereas other executive functioning measures, such as Controlled Oral Word Association Test (COWAT) and WASI-II Matrix Reasoning subtest, did not. Based on their findings, they concluded that set-shifting and abstract reasoning difficulties, which are aspects of executive functioning, tend to have a greater influence on an individual's performance of IADLs (Nguyen et al., 2019).

Previous research has demonstrated that higher scores on the TFLS were significantly correlated with MMSE scores, which is a commonly used dementia screener in medical settings (Cullum et al., 2001). However, there has not been a study that has focused on the correlation between another common and slightly more complex cognitive screener, the Montreal Cognitive Assessment (MoCA), and performance on the TFLS.

Measuring functional abilities over time can be helpful in monitoring disease progression, even in the context of receiving treatment. Saine et al. (2002) investigated whether a cholinesterase inhibitor medication, Donepezil, which is a commonly prescribed memory medication in the treatment of AD, influenced an individual's cognition (assessed using the MMSE) as well as their functional abilities (assessed using the TFLS). A sample of 24 individuals who had AD were treated with donepezil over a 12-month period; over the year, results demonstrated that MMSE total score improvements paralleled TFLS score improvements by 3 months; however, by the end of the year, declines in both scores were noted (Saine et al., 2002). The researchers concluded that the TFLS was sensitive to the cognitive changes over a one-year period, noting that a decline in global cognitive functioning can mirror a decline in overall functional abilities; therefore, the performance one on one assessment can be informative of the other over time.

The advantage of utilizing an instrument like the TFLS in a clinical setting is that it provides the clinician or treating physician with information related to their patient's functional abilities based on a performance-based objective measure, without relying too heavily on self- report or collateral report, which may be flawed or biased, as noted earlier. Another benefit of utilizing the TFLS specifically is that it is a brief measure of functional abilities, which focuses on not only verbal responses but also the component of watching the patient demonstrate how to perform activities, based on standardized administration and scoring. Many aspects of the TFLS replicate common and essential activities that are frequently utilized within an independent living setting. These activities are familiar to most individuals, and they include reading and setting hands on a clock, reading information from a calendar, and making basic monetary calculations using actual coins and bills. Additionally, it measures a patient's ability to remember to take (hypothetical) medication out of a medication bottle after a specified period of time, use commonly used home appliances such as a phone and microwave, and demonstrate how to write a check and address an envelope. While the NAB addresses some aspects of IADLs, and the ILS takes a relatively longer time to complete the evaluation, the TFLS offers a more comprehensive measure of functional abilities, which can be completed within a shorter period, making it more appropriate to use within the elderly population.

Current Study

As noted earlier, when individuals develop dementia, they begin to lose their abilities to accurately perform various functional activities of daily living. As part of a standard cognitive evaluation, this information is typically only gathered via questionnaires or by clinical interview, relying heavily on self-report. Critical information regarding functional abilities is then used to make a differential diagnosis, such as between MCI and dementia, and in determining important clinical recommendations such as regarding treatment. This further illustrates the importance of assessing IADLs in a precise manner as a means toward making accurate clinical diagnostic conclusions. Incorporation of an objective measure of IADLs, such as the TFLS, can provide concrete evidence as to whether an individual is capable of performing these functional abilities.

Chapter 4

Study Hypotheses

Hypothesis 1.

The overall TFLS score would differ among groups such that AD would perform worse than MCI, and MCI would perform worse than WNL (which also conveys that AD would be worse than WNL).

Hypothesis 2.

Higher overall TFLS scores (which would indicate more intact adaptive functioning abilities) will be positively correlated with higher global cognitive functioning, as measured by the Montreal Cognitive Assessment (MoCA) memory screener.

Hypothesis 3.

TFLS scores will positively correlate with executive functioning tests (e.g., Trail Making Test Part B, Stroop Color Word Interference Test, and Modified Wisconsin Card Sorting Test Executive Composite score).

Hypothesis 4.

Patients who report impairments in at least 2 of the 3 primary areas of IADLs (medication management, driving, and managing finances) based on self and collateral report during the initial memory evaluation with their medical provider, will tend to also demonstrate poorer TFLS scores when compared to those patients who had no concerns or only reported impairment in one IADL area. On the other hand, patients who reported intact IADLs in at least 2 of the 3 primary areas will tend to demonstrate higher TFLS scores, suggesting more intact adaptive functioning.

Chapter 5

Method and Procedures

Data Collection

This study utilized test data collected between 2019-2020 from the research database at the Health First Memory Disorder Clinic in Melbourne, Florida. Inclusion criteria included patients who completed one brief neuropsychological evaluation with the TFLS as part of their battery and were given a diagnosis of normal cognition, mild cognitive impairment, or Alzheimer's disease (see Procedures section below for more detail regarding diagnostic procedures).

In addition to obtaining demographic and neuropsychological test data, a review of patients' electronic medical records was also conducted as a means to identify their performance of IADLs based on self- and/or collateral-report. Specifically, three primary categories of IADLs were identified: medication management, managing finances, and driving. Patients' abilities in each of these categories was coded according to their level of independence and accuracy in performing them.

Measures

All patients were administered a brief neuropsychological evaluation which assessed various cognitive domains, including learning and memory, language, attention and processing speed, executive functioning, visuospatial skills, and basic adaptive functioning skills. The following tests were administered: (a) Shepherd Verbal Learning Test (Norheim, N., Kissinger-Knox, A., Cheatham, M., Mulligan, K., & Webbe, F., 2018), (b) Brief Visual Memory Test-Revised, (c) COWAT, (d) Boston Naming Test, Short Form, (e) Western Aphasia Battery (WAB) Comprehension and Repetition, (f) Boston Diagnostic Aphasia Examination (BDAE) Cookie Theft Picture, (g) Trail Making Test A & B, (h) Stroop Color and Word- Golden version, (i) Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV) Digit Span, (j) Modified Wisconsin Card Sorting Test (M-WCST), (k) Clock Drawing Test, (l) Geriatric Depression Scale (GDS), (m) Geriatric Anxiety Inventory (GAI), and the (n) Texas Functional Living Scale (TFLS). All tests were attempted unless there were time constraints, or the tests were discontinued due to patient confusion or frustration. See Table 1 for a breakdown of the neuropsychological tests by cognitive domain.

Montreal Cognitive Assessment (MoCA)

The MoCA (Nasreddine et al., 2005) is a commonly used standardized memory screener used to measure global cognitive functioning and to detect cognitive impairment within the aging population by examining a range of domains, such as visuospatial, executive functioning, language, attention, memory, abstract reasoning, and orientation. The total raw score that can be obtained is 30, with education level being corrected for by adding 1 point for individuals who completed less than 13 years of formal education. Higher scores are indicative of more intact global cognitive functioning.

Texas Functional Living Scale (TFLS)

As an alternative to self-reported information regarding daily functioning, the TFLS was developed as a performance-based adaptive measure of functional abilities (Cullum et al., 2001). The TFLS consists of 21 items divided into four separate domains or subscales: (a) Time, (b) Money and Calculation, (c) Communication, and (d) Memory. The test generally takes about 15 to 20 minutes to administer. Tasks include having the patient read and set the hands on a clock, calculate basic monetary change, demonstrate how to write a check and fill out an envelope, and remember to take "medication" out of a provisional medication bottle after a predetermined set of time (prospective memory task). Once all items are completed, a total raw score can be converted into a standardized T-score for the overall TFLS score. The TFLS has demonstrated adequate reliability and validity in several populations (Cullum et al., 2001; Gonzalez, Soble, Marceaux, & McCoy, 2017), with the normative sample population age ranging from 16 to 90.

Procedures

Patients from a community memory disorder clinic underwent a formal clinical interview with the geriatrician and licensed clinical social worker, who also administered a brief, 10-minute cognitive screening instrument, the Montreal

Cognitive Assessment (MoCA). If the physician recommended neuropsychological testing to inform treatment, the patient was then referred and scheduled for a brief neuropsychological evaluation. Testing was administered by a clinical psychology doctoral student under the supervision of a board-certified licensed clinical neuropsychologist. On the day of the evaluation, all patients signed a consent form giving permission for their de-identified test data to be used for future research purposes. Once the informed consent was obtained, participants underwent a short battery of cognitive tests that assessed different areas of cognitive functioning, such as language, memory and learning, executive functioning, attention and concentration, processing speed, visuospatial skills, and basic adaptive functioning skills. The total time of testing took approximately 2 hours. Testing was administered in English (and those who identified as being Hispanic spoke and comprehended English adequately enough for the purpose of the testing).

Upon completion of the evaluation, a multi-disciplinary case review meeting was held, where the geriatrician, social worker, neuropsychologist, neurologist, as well as pharmacy and clinical psychology doctoral students collaborated and developed diagnostic impressions and recommendations based on the data presented for each individual patient. Testing had to be temporarily suspended from March to July 2020 due to unforeseen circumstances, and upon resuming, a slightly modified test battery was implemented. As a result, some patients did not receive the full battery of tests outlined above. Diagnostic impressions were based on the overall presentation of evaluation data, including information obtained during the initial visit with the provider and social worker, which included the psychosocial history, onset of memory loss, medical history, along with the reported IADLs, review of neuropsychological test data, as well as the review of available brain imaging.

Based on the above-mentioned information, the multidisciplinary team diagnosed each patient using the Tenth Revision of the International Classification of Diseases and Related Health Problems (ICD-10; WHO, 1992) diagnostic criteria. Patients were considered to have cognition within normal limits based on their overall neuropsychological testing presentation falling within normal ranges, along with intact IADLs, and there was a consensus regarding the diagnosis by the entire multidisciplinary team. Individuals who endorsed depression and/or anxiety were also included in the group if their cognitive domains also fell within the normal range. The MCI group included both amnestic and non-amnestic types, and their final diagnosis was based on the Peterson (2004) criteria.

IADL Coding

In order to categorize the patient's abilities in performing IADLs (i.e., medication management, financial management, and driving), patient and/or collateral information was obtained from the patient's electronic medical records (EMR). The researcher initially coded the three IADLs as described above: 0 = not impaired; able to perform task without any reported difficulty; 1 = patient currently performs the activity but has been making errors; 2 = patient requires assistance or oversight from their caregiver; or 4 = unknown, meaning that the information obtained varied between provider notes found in the EMR or the information was unavailable. As an example of discrepancies noted in the EMR, the medical provider's notes may not have noted any difficulties with managing their medications, while the social worker's notes may have indicated that the patient was missing doses and needed reminders from family. These discrepancies made it difficult, at times, to determine which information was most accurate related to the patient's abilities.

Using the categorization system described above, a total of 3 of the 176 patients used in this study had one IADL coded as a "4." For 2 of these patients, discrepant information was found initially in their EMR where one note did not report any problems with the specific IADL, but then another area noted that the patient required assistance/was dependent for that IADL; therefore, the researcher subsequently changed both of these "4's" to "2's," suggesting that these patients needed assistance or were dependent on others to complete their IADL. For the 3rd patient, updated IADL information was not available at the time of the initial evaluation, which prompted the initial coding of a "4." It was not until shortly after the initial evaluation date that another office visit was made, and the EMR provided updated information, at which point the researcher was able to then code the activity as a "2," due to the patient's records indicating that their family was needed to assist with completing all IADLs. Therefore, all 3 of these cases that were initially coded as a "4" were ultimately changed to a "2," indicating impaired IADLs based on their EMR.

Subsequently, in order to classify whether the patient demonstrated generally “intact” versus “impaired” IADLs overall, the researcher then proceeded to code IADLs in the following manner: “1” = “Intact,” meaning that the patient had a code of “0” on 2 or all 3 of the IADLs as outlined above; “1” = “Impaired,” meaning that the patient had a code of “1” or “2” on 2 or all of the IADLs as outlined above. Using this coding method, a total of 107 patients were concluded to demonstrate “impaired” overall IADLs, while 69 patients were concluded to have “intact” IADLs. One patient had to be removed from the “impaired” group due to discontinuing early on the TFLS; therefore, a TFLS total score could not be obtained for that individual. Applying diagnostic categories to this classification thus resulted in a total of 15 AD, 32 MCI, and 22 NC patients in the “Intact” group, and a total of 71 AD (1 removed due to not completing the TFLS), 30 MCI, and 5 NC patients in the “Impaired” group.

Research Design and Analysis of Data

Permission was granted to the researcher by the Health First Memory Disorder Clinic to utilize their research database. Prior to analyzing data, approval from the Florida Institute of Technology Institutional Review Board (IRB) was obtained by the researcher. Informed consent was obtained prior to each participant completing their neuropsychological evaluation. The study utilized a cross-sectional design.

Descriptive statistics were obtained to include means, standard deviations, and frequencies for patient demographic variables. Analysis of variance (ANOVA) was used to examine the relationship between multiple variables. Correlational analyses were conducted to determine the relationship between two conditions. An independent samples *t*-test was conducted to examine group differences between those who reported “intact” versus “impaired” IADLs. Data were analyzed using the Statistical Package for the Social Sciences (SPSS)-Version 25.

Chapter 6

Results

Participants

An overall total of 254 patients were tested between 2019-2020. Out of these patients, 78 did not meet the diagnostic criteria for inclusion in this study (i.e., they were diagnosed with other conditions, such as Mixed Dementia, Dementia Unspecified, Unspecified Neurocognitive Disorder, Depression, Anxiety, etc.). After removing individuals who did not meet the diagnostic criteria for inclusion, a total of 176 patients were included in the current study. Among them, 87 patients were diagnosed with Alzheimer’s disease (AD; 62.1% female, *M* = 80.71, *SD* = 6.62), 62 patients were diagnosed with Mild Cognitive Impairment (MCI; 59.7% female, *M* = 80.76, *SD* = 5.88), and 27 patients were diagnosed with Normal Cognition (NC; 48.1% female, *M* = 78.48, *SD* = 6.00). The average education level was 13.38 *(SD* =2.50) for the AD group, 13.94 *(SD* = 2.70) for the MCI group, and 14.70 *(SD* = 2.76) for the NC group. Among the 176 patients, a majority of them self-identified as being Caucasian/White (92.0%), with the remaining patients self-identifying as African American/Black (4.0%), Asian

(1.1%), Native American (0.6%), or No Response (2.3%). Only 5.1% identified as having Hispanic ethnicity. See Table 2 for further patient demographic information.

Statistical Analyses

Age and Education. There was not a significant effect of age among the three diagnostic groups [$F(2, 173) = 1.470$, $p = .233$]. Similarly, there was not a significant effect of education among the three diagnostic groups [$F(2, 173) = 2.823$, $p = .062$].

TFLS and Differentiating Diagnoses. This study explored whether TFLS scores differed among diagnostic groups such that individuals who were cognitively intact or only demonstrated mild cognitive impairments, such as those with MCI and NC, might perform better than individuals with a more severe cognitive impairment, such as those with AD. A one-way ANOVA was conducted to determine whether there was a significant difference in TFLS scores among diagnostic groups. The assumption of homogeneity of variances was not met (Levene's statistic = 12.533, $p = .000$). Therefore, a Kruskal-Wallis H test was conducted to examine the differences on TFLS scores according to the diagnostic group ($\chi^2(2) = 90.64$, $p < .001$). Results showed that there was a statistically significant difference in TFLS scores among the different diagnostic groups (see Figure 1). In particular, the TFLS t-scores among the AD group ($M = 31.70$, $SD = 5.25$) were significantly lower compared to the t-scores from the MCI ($M = 42.77$, $SD = 8.01$) and NC ($M = 48.67$, $SD = 8.61$) group, which partially supports the first hypothesis. However, there was not a significant difference between the MCI and NC group.

TFLS and Global Functioning. A bivariate correlational analysis was conducted to determine if higher TFLS T-score was positively correlated with higher global functioning (i.e., using the MoCA total score). Results showed that there was a positive and strong correlation between overall MoCA total score and TFLS score, suggesting that having more intact global cognitive functioning is related to having more intact functional abilities ($r = .702$, $p < .001$). These results support the second hypothesis that higher overall TFLS T-scores would be positively correlated with higher global cognitive functioning.

TFLS and Executive Functioning. A bivariate correlational analysis was conducted to determine if overall TFLS score was positively correlated with various tests of executive functioning. In support of the third hypothesis, results showed that TFLS scores were positively and moderately to strongly correlated with multiple measures of executive functioning, including the Clock Drawing Test ($r = .528$, $p <.001$), M-WCST Executive Function Standard Score ($r = .501$, $p < .001$), M-WCST number of perseverative errors ($r = .487$, $p <.001$), Stroop Color Word (Golden version; $r = .483$, $p < .001$), and Trail Making Test Part B ($r = .368$, $p < .001$).

Similarly, other measures of attention and processing speed were positively and moderately to strongly correlated with TFLS scores as well, including the WAIS-IV Digit Span subtest ($r = .541$, $p < .001$), Trail Making Test Part A ($r =$

.427, $p < .001$), Stroop Color Naming ($r = .384$, $p < .001$), and Stroop Word Reading ($r = .322$, $p < .001$). While these measures are considered tests of attention and processing speed, they also are somewhat related to the construct of executive functioning as the Stroop tasks of word reading and color naming and Trail Making Test Part A are subcomponents to other previously mentioned executive functioning tests. Therefore, it is not totally unexpected for these tasks to demonstrate a positive correlation with the TFLS. In fact, these results further support the hypothesis that the overall TFLS T-score is positively correlated with measures of executive functioning, as well as other cognitive tests that may have executive functioning characteristics embedded within the test.

Further correlations were conducted to assess the relationship between TFLS scores and other measures of cognition. Coincidentally, results also demonstrated that there was a positive and moderate to strong correlation between TFLS scores and language tests, including MackSF4 ($r = .505$, $p < .001$), semantic fluency ($r = .509$, $p < .001$), phonemic fluency ($r = .365$, $p <.001$), and subtests from the Western Aphasia Battery including Repetition ($r = .376$, $p < .001$) and Comprehension ($r = .304$, $p <. 001$). Additionally, results demonstrated that there was a positive and moderate correlation between TFLS scores and delayed recall from memory tasks, including the Supraspan Word List Percent Retained ($r = .494$, $p < .001$) and BVMT-R Percent Retained ($r = .304$, $p < .001$).

Lastly, results demonstrated that there was a negative correlation between TFLS scores and mood questionnaires, GAI ($r = -.253$, $p < .05$) and GDS (r = -

.170, p <.05). Although significant, these correlations were noted to be relatively weaker when compared to measures of executive functioning.

TFLS and Reported IADLs A Mann Whitney test indicated that TFLS scores in the “Intact” group (M = 43.30, SD = 10.23) were statistically significantly higher than for the “Impaired” group (M = 34.94, SD = 7.58), U = 1823.50, p < .001. This supports the fourth hypothesis that patients who reported generally more impaired IADLs tended to obtain lower scores on the TFLS score, suggesting more difficulties with performing adaptive functioning. On the other hand, those patients who reported fewer difficulties, or none at all, in their IADLs tended to obtain higher TFLS scores, suggesting more intact abilities with performing adaptive functioning (see Figure 2 below).

Chapter 7

Discussion

Impact of Study

As previously suggested, being able to accurately diagnose memory disorder clinic patients is imperative, particularly for the subsequent treatment recommendations following the evaluation. This can be even more important for those individuals who tend to fall on the borderline between an MCI and AD diagnosis. As noted earlier, a significant factor that determines whether a patient has progressed to dementia is determining whether they have intact IADLs. Obtaining that information is often collected via clinical interviews or questionnaires. For this study, information regarding IADLs was obtained from the patient and family or caregiver during the patient's office visit with the geriatrician or medical provider as well as with the social worker.

Current results revealed significant differences in TFLS total score among diagnostic groups, in that individuals with AD performed worse than those with MCI and those with normal cognition. This supports the first hypothesis and suggests that the TFLS has clinical utility in making a differential diagnosis among these diagnostic categories. In particular, it may assist with the challenging differential between MCI and AD, whereas individuals with MCI performed relatively similar to the NC group with components of the TFLS. Future research should aim to develop a better understanding of which components of the TFLS tend to be more difficult for individuals with MCI, and whether these difficulties might be early signs of progressive decline toward dementia.

TFLS scores were also positively correlated with MoCA total scores, supporting the second hypothesis and suggesting that those who score high on the MoCA tended to also perform relatively well on the TFLS. Meanwhile, as greater impairment is noted in patients' global cognition using a brief memory screener such as the MoCA, medical providers should become more conscientious of obtaining accurate information regarding their IADLs. Future research should aim to explore TFLS scores and MoCA scores over time as a means to better understand the reliability and consistency of scores between the two tests at different stages of disease progression.

The TFLS demonstrated moderate to strong positive correlations with other tests of executive functioning, supporting the third hypothesis; however, the TFLS demonstrated positive correlations with tests in other cognitive domains as well, including memory, language, and attention and processing speed. While this does not support the notion that the TFLS is exclusively an executive functioning task, correlations with measures across multiple cognitive domains is not completely unexpected, as there are components of the TFLS that clearly involve other cognitive functions. For example, there is a memory (delayed recall) subsection within the TFLS, as well as tasks requiring language such as comprehension and writing. Future research might therefore consider exploring relationships among neuropsychological tests in these cognitive domains and specific subscales of the TFLS.

Lastly, individuals with “Impaired” IADLs based on EMR records were found to perform more poorly on the TFLS compared to individuals with “Intact” IADLs, supporting the fourth hypothesis. This provides some degree of ecological validity to the TFLS in terms of corresponding to reported difficulties in aspects of daily functioning including driving and managing finances and medications. These results seem to further solidify the use of the TFLS as part of a neuropsychological battery to assist in determining patients’ abilities in performing IADLs.

Limitations and Areas for Future Research

A significant limitation of this study was the small sample size per diagnostic group, in part due to the limited one-year time frame during which test data were collected. Future research should consider incorporating larger sample sizes within diagnostic groups toward extending these results.

Relatedly, this study was limited to focusing on only three diagnostic groups (i.e., NC, MCI, and AD). Although AD may be the most prominent type of dementia that is diagnosed, difficulties with adaptive function and IADLs are not exclusive to AD and in fact many other types of dementias are observed in a memory disorder clinic setting. The lack of diagnostic variability included in this study prevents the ability for these results to be completely generalizable to the overall memory disorder population. It should also be noted that a majority of patients included in this study were Caucasian, limiting the ability to generalize to communities where more diverse populations exist.

Another limitation of this study involves difficulties obtaining accurate descriptions of patients' functional abilities (IADLs) in their electronic medical records. This information was obtained from the medical provider and social worker notes; however, as noted above, there were times when a discrepancy existed between these two sets of provider notes. Being uncertain about which EMR note was more accurate, resulting in the researcher having to make a decision that tended to lean toward the more impaired result, was a limitation of this study as well. Unfortunately, the researcher could have erred on the wrong side; therefore, the patient could have been coded incorrectly and then labeled as "impaired" versus "intact" in performing IADLs.

In order to help make the results more generalizable, a future area of study would be to replicate or conduct similar studies with a larger sample of individuals (with a wider range of memory disorders). It would also be beneficial to obtain more data from a more culturally and ethnically diverse group of individuals. In doing so, it will help further demonstrate more generalizability to the overall population as well as to other communities that may not be significantly Caucasian.

For this study, three main IADLs (i.e., managing finances and medication and driving) were primarily assessed for each patient via self and informant report. This posed another limitation of the study in that the TFLS does not include any specific section assessing driving abilities. Although there are components of the TFLS that assess for aspects of money management and medication management, it lacks the assessment of an individual's driving abilities. Although the incorporation of the Trail Making Test Part B may be a suitable and appropriate measure to assess safe driving in the elderly population (Papandonatos, Ott, Davis, Barco & Carr, 2015), future studies may want a more face valid performance-based measure that assess driving skills. For instance, the utilization of the Driving Scenes test of the Neuropsychological Assessment Battery (NAB; Stern & White, 2003) may be a useful additional measure to incorporate in a neuropsychological battery when there are concerns regarding an individual's abilities to perform their IADLs, such as driving, accurately.

Future research should continue to look at the subtests of the TFLS (not just the overall TFLS T-score) and assess whether there are correlations among the subtests and other neuropsychological tests to help differentiate which cognitive domains may be more relevant within each subtest.

Lastly, it should be noted that data collection occurred between March 2019 and October 2020. Although there were four months that TFLS data were not collected due to COVID-19 related restrictions and safety concerns, a total of 28 patients were eventually included following the re-opening of the clinic and with safety measures in place with administering the TFLS. Although it is unclear whether there are extraneous factors that could result in confounding factors related to the testing prior and after COVID-19, it should be considered and investigated in the future to determine the extent of COVID-19 emotional and medical factors in the aging population.

Conclusion

The TFLS has introduced a new possibility for more accurate assessment of adaptive functioning to aid diagnosis within a memory disorder clinic population. This is particularly helpful given the subsequent treatment recommendations that are provided, for both the patient and the family. Although Cullum et al. (2001) introduced and normed this test for people 16-90, it is even more imperative within the elderly population where a change or decline in functional status can occur with age. The utilization of the TFLS in a memory disorder clinic provides objective data to the provider which assesses adaptive functioning, removing potential inaccuracies or discrepancies in self and collateral reports. This can be even more helpful in cases when the patient lives alone and there is no one to verify that he/she is performing their IADLs accurately and without difficulty. As the aging population continues to live longer, and medical visits regarding memory concerns become more frequent, having an objective measure to assist with the overall assessment and diagnosis can be extremely helpful within the medical profession to counteract any patient situations where obtaining accurate information may not be feasible.

Additionally, observations regarding TFLS performance among diagnostic groups within a memory disorder clinic population, and the relationship between performances on the TFLS and other neuropsychological tests, benefits providers within the neuropsychology field by improving confidence in the ability to ascertain the degree to which a patient might be experiencing difficulties in aspects of daily functioning. This clinical information can then be utilized to improve diagnostic accuracy, particularly in differentiating individuals with MCI from early stages of AD.

References

Alzheimer's Association. (March 11, 2020). Primary care physicians on the front lines of diagnosing and providing Alzheimer's and dementia care: Half say medical profession not prepared to meet expected increase in demands. Retrieved: https://www.alz.org/news/2020/primary-care-physicians-on-the-front-lines-of-diag

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

Ashendorf, L., Alosco, M.L., Bing-Canar, H., Chapman, K.R., Martin, B., Chaisson, C.E., Dixon, D., Steinberg, E.G., Tripodis, Y., Kowall, N.W., &

Stern, R.A. (2018). Clinical utility of select Neuropsychological Assessment Battery tests in predicting functional abilities in dementia. *Archives of Clinical Neuropsychology, 33*(5), 530-540. DOI: 10.1093/arclin/acx100.

Birks, J. (2006). Cholinesterase inhibitors for Alzheimer's disease. *Cochrane Database of Systematic Reviews, 1,* CD005593. https://doi.org/10.1002/14651858.CD005593.

Bright, P., Kopelman, M., & Jaldow, E.J. (2002). The national adult reading test as a measure of premorbid intelligence: A comparison with estimates derived from demographic variables. *Journal of the International Neuropsychology Society, 8*, 847-854. DOI: 10.1017.S1355617702860131.

Craft, Suzanne, Cholerton, B., & Reger, M. (2017) Hazzard's geriatric medicine and gerontology, 7th ed. In J.B. Halter, In J.G. Ouslander, In S. Studenski, In K.P. High, In S. Asthana, In M.A. Supiano, & In C. Ritchie (Eds) *Cognitive changes associated with normal and pathological aging* (unknown pages). New York: McGraw-Hill Education.

Cullum, C.M., Saine, K., Chan, L.D., Martin-Cook, K., Gray, K., & Weiner, M.F. (2001). Performance-based instrument to assess functional capacity in dementia: The Texas Functional Living Scale. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology, 14,* 103-108.

Cullum, C.M., Weiner, M.F., & Saine, K.C. Texas Functional Living Scale Examiner's Manual. San Antonio, TX: Pearson, 2009.

Clark, L.J., Gatz, M., Zheng, L., Chen, Y., McCleary, C., & Mack, W.J. (2009). Longitudinal verbal fluency in normal aging, preclinical and prevalent Alzheimer disease. *American Journal of Alzheimer's Disease and Other Dementias, 24*(6), 461-468. doi: 10.1177/1533317509345154.

de Bruin, N., Bryant, D.C., MacLean, J.N., & Gonzalez, C.L.R. (2016). Assessing visuospatial abilities in healthy aging: A novel visuomotor task. *Frontiers in Aging Neuroscience, 8*:7. DOI: 10.3389/fnagi.2016.00007.

Di Santo, S.G., Prinelli, F., Adorni, F., Caltagirone, C., & Musicco, M. (2013). A meta-analysis of the efficacy of donepezil, rivastigmine, galantamine, and memantine in relation to severity of Alzheimer's disease. *Journal of Alzheimer's Disease, 35,* 349-361.

Edland, S.D., Rocca, W.A., Petersen, R.C., Cha, R.H., & Kokmen, E. (2002). *Archives of Neurology, 59*(10), 1589-1593.

Fillbaum, G.G., van Belle, G., Morris, J.C., Mohs, R.C., Mirra, S.S., Davis, P.C., Tarlot, P.N., Silverman, J.M., Clark, C.M., Welsh-Bohmer, K.A., &

Heyman, A. (2008). CERAD (consortium to establish a registry for Alzheimer's disease) The first 20 years. *Alzheimer's Dementia, 4*(2) 96-109. doi: 10.1016/j.jalz.2007.08.005.

Gavett, B.E., Lou, K.R., Daneshvar, D.H., Green, R.C., Jefferson, A.L., & Stern, R.A. (2012). Diagnostic accuracy statistics for seven Neuropsychological Assessment Battery (NAB) test variables in the diagnosis of Alzheimer's disease. *Applied Neuropsychology: Adult, 19*(2), 108-115. DOI: 10.1080/09084282.2011.643947.

Gonzaelz, D. A., Soble, J.R., Marceaux, J.C., & McCoy, K.J.M. (2017). An evaluation of the Texas Functional Living Scale's latent structure and subscales. *Archives of Clinical Neuropsychology, 32,* 104-109.

Harada, C.N., Natelson Love, M.C., & Trievel, K. (2013). *Clinics in Geriatric Medicine, 29*(4), 737-752. DOI: 10.1016/j.cger.2013.07.002.

Hippius, H., & Neundörfer, G. (2003). The discovery of Alzheimer's disease. *Dialogues in clinical neuroscience*, *5*(1), 101–108.

Kent, P. (2017). Fluid intelligence: A brief history. *Applied Neuropsychology: Child, 6*(3), 193-203. https://doi-org.portal.lib.fit.edu/10.1080/21622965.2017.1317480

Koepsell, T.D., & Monsell, S.E. (2012). Reversion from mild cognitive impairment to normal or near-normal cognition: Risk factors and prognosis. *American Academy of Neurology, 79,* 1591-1598. DOI:10.1212/WNL.0b013e31826e26b7.

Lezak, M.D., Howieson, D.B., Bigler, E.D., & Tranel, D. (2012). Neuropsychological Assessment (5th ed.). Oxford University Press.

Lin, J.S., O'Connor, E., Rossom, R., Perdue, L.A., Burda, B.U., Thompson, M, & Eckstrom, E. (2013). Screening for Cognitive Impairment in Older Adults: An Evidence Update for the U.S. Preventive Services Task Force. Evidence Report No. 107. AHRQ Publication No. 14-05198-EF-1. Rockville, MD: Agency for Healthcare Research and Quality.

Liu, C., Kanekiyo, T., Xu, H., & Bu, G. (2013). Apolipoprotein E and Alzheimer disease: Risk, mechanisms, and therapy. *Nature Reviews Neurology, 9* (2), 106-118. DOI: 10.1038/nrneurol.2012.263.

Luo, L., & Craik, F.I. (2008). Aging and Memory: A Cognitive Approach. *The Canadian Journal of Psychiatry, 53*(6), 346-353. DOI: 10.1177/070674370805300603

Loeb, P. (1996). Independent Living Scales. San Antonio, TX: Psychological Corporation.

MacDougall, E.E. & Mansbach, W.E. (2013). The Judgment test of the Neuropsychological Assessment Battery (NAB): Psychometric considerations in an assisted-living sample. *The Clinical Neuropsychologis, 27*(5), 827-839. DOI: 10.1080/13854046.2013.786759.

McAlister, C., & Schmitter-Edgecombe. (2016). Executive function subcomponents and their relations to everyday functioning in healthy older adults. *Journal of Clinical Experimental Neuropsychology, 38*(8), 925-940. doi:10.1080/13803395.2016.1177490.

Mielke, M. (2018). Sex and gender differences in Alzheimer's disease dementia. *Psychiatric Times, 35*(11), 14-17.

Mistridis, P., Egli, S.C., Iverson, G.L., Berres, M., Willmes, K., Welsh-Bohmer, K.A., & Monsch, A.U. (2015). Considering the base rates of low performance in cognitively healthy older adults improves the accuracy to identify neurocognitive impairment with the Consortium to Establish a Registry for Alzheimer's Disease-Neuropsychological Assessment Battery (CERAD-NAB). *European Archives of Psychiatry and Clinical Neuroscience*, *265*(5), 407-417. DOI: 10.1007/s00406-014-0571-z

Nasreddine, Z.S., Phillips, N.A., Bedirian, V., Charbonneau, S., Whitehead, V., Collin, I., Cummings, J.L., & Chertkow, H. (2005). The Montreal cognitive assessment, MoCA: A brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society, 53*(4), 695-699.

National Institute on Aging. (n.d.). Memory, Forgetfulness, and Aging: What's Normal and What's Not? Retrieved from https://www.nia.nih.gov/health/memory-forgetfulness-and-aging-whats-normal-and-whats-not"

Nelson, H.E. (1982). National Adult Reading Test (NART): For the Assessment of Premorbid Intelligence in Patients with Dementia: Test Manual, NFER-Nelson, Windsor, UK.

Norheim, N., Kissinger-Knox, A., Cheatham, M., Mulligan, K., & Webbe, F. (2018). A-32 The Shepherd Verbal Learning Test: Simple 10-item supraspan test for use in a memory clinic population. *Archives of Clinical Neuropsychology, 33*(6), 703-794.

Papandonato, G.D., Ott, B.R., Davis, J.D., Barco, P.P., & Carr, D.B. (2015). The clinical utility of the Trail Making Tests as predictors of driving performance in older adults. *Journal of the American Geriatric Society 63*(11), 2358-2364. doi: 10.1111/jgs.13776.

Peters, R., Poulter, R., Warner, J., Beckett, N., Burch, L, & Bulpitt, C. (2008). Smoking, dementia and cognitive decline in the elderly, a systematic review. *BMC Geriatrics, 8*(36). https://doi.org/10.1186/1471-2318-8-36.

Petersen, R.C. (2004). Mild cognitive impairment as a diagnostic entity. *Journal of Internal Medicine, 25,* 183-194.

Saine, K., Cullum, C.M., Martin-Cook, K., Hynn, L., Svetlik, D.A., & Weiner, M.F. (2002). Comparison of functional and cognitive donepezil effects in Alzheimer's disease. *International Psychogeriatrics, 14*(2), 181-185.

Schmitter-Edgecombe, M., Parsey, C., & Lamb, R. (2014). Development and psychometric properties of the instrumental activities of daily living: Compensation scale. *Archives of Clinical Neuropsychology, 29*, 776-792.

Schoenberg, M.R., Lange, R.T., Marsh, P., Saklofske, D.H. (2011). Premorbid Intelligence. In: Kreutzer, J.S., DeLuca, J., Caplan B. (eds). Encyclopedia of Clinical Neuropsychology. Springer, New York, NY.

Stern, R.A., & White, T. (2003). Neuropsychological assessment battery. Lutz, FL: Psychological Assessment Resources.

Tuokko, H. A., & Smart, C. M. (2018). Neuropsychology of cognitive decline: A developmental approach to assessment and intervention. The Guilford Press.

U.S. Census Bureau (2017). Methodology, Assumptions, and Inputs for the 2017 National Population Projections. Retrieved from https://www.census.gov/data/tables/2017/demo/popproj/2017-summary-tables.html

Uttl, B. (2002). North American Adult Reading Test: Age norms, reliability, and validity. *Journal of Clinical and Experimental Neuropsychology, 24*(8), 1123-1137. DOI: 10.1076/jcen.24.8.1123.8375.

Weiner. M.F., Gehrmann, H.R., Hynan, L.S., Saine, K.S., Cullum, C.M. (2006). Comparison of the Test of Everyday Functional Abilities with a direct measure of daily function. *Dementia and Geriatric Cognitive Disorders, 22,* 83-86. DOI: 10.1159/000093388.

World Health Organization. (September 19, 2019). Dementia. Retrieved from: https://www.who.int/news-room/fact-sheets/detail/dementia

World Health Organization (1992). The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines. Geneva: World Health Organization.

Zec, R.F., Markwell, S.J., Burkett, N.R., & Larsen, D.L. (2005). A longitudinal study of confrontation naming in the "normal" elderly. *Journal of the International Neuropsychological Society, 11*(6), 716-726. DOI: 10.1017/S1355617705050897.

Zeintl, M., Kliegel, M., Rast, P., & Zimprich, D. (2006). Prospective memory complaints can be predicted by prospective memory performance in older adults. *Dementia and Geriatric Cognitive Disorders, 22,* 209-215. DOI: 10.1159/000094915

Table 1.

Neuropsychological Measures by Cognitive Domain

Learning/ Memory	**Language**	**Attention/ Processing Speed**	**Executive Functioning**	**Visuospatial**	**IADLs**	**Global functioning**
Supraspan Word List (verbal memory)	Controlled Oral Word Association Test	Trails A	Trails B	Clock Drawing Test	TFLS	MocA
BVMT-R (visual memory)	MackSF4	Stroop Word Reading and Color Naming	Stroop Color-Word			
	WAB Comprehension/ Repetition	WAIS-IV Digit Span	M-WCST			

Table 2.

Descriptive Statistics of Patient Demographic Information

	Variable	N	Percent
AD group			
	Gender		
	Female	54	62.1
	Male	33	37.9
	Race and Ethnicity		
	American Indian	1	1.1
	Asian	2	2.3
	Black	6	6.9
	White	75	86.2
	No Response	3	3.4
	Hispanic	7	8.0
	Age		
	60-69	5	5.7
	70-79	33	37.9
	80-89	44	50.6
	90+	5	5.7
	Educational Attainment		
	0 through 11th grade	12	13.8
	High School graduate	33	37.9
	Some college or associate degree	16	18.4
	College graduate or more	26	29.9
MCI group			
	Gender		
	Female	37	59.7
	Male	25	40.3
	Race and Ethnicity		
	American Indian	0	0
	Asian	0	0
	Black	1	1.6
	White	61	98.4
	No Response	0	0
	Hispanic	0	0
	Age		
	60-69	2	3.2
	70-79	23	37.1
	80-89	33	53.2
	90+	4	6.5
	Educational Attainment		
	0 through 11th grade	5	8.1
	High School graduate	23	37.1

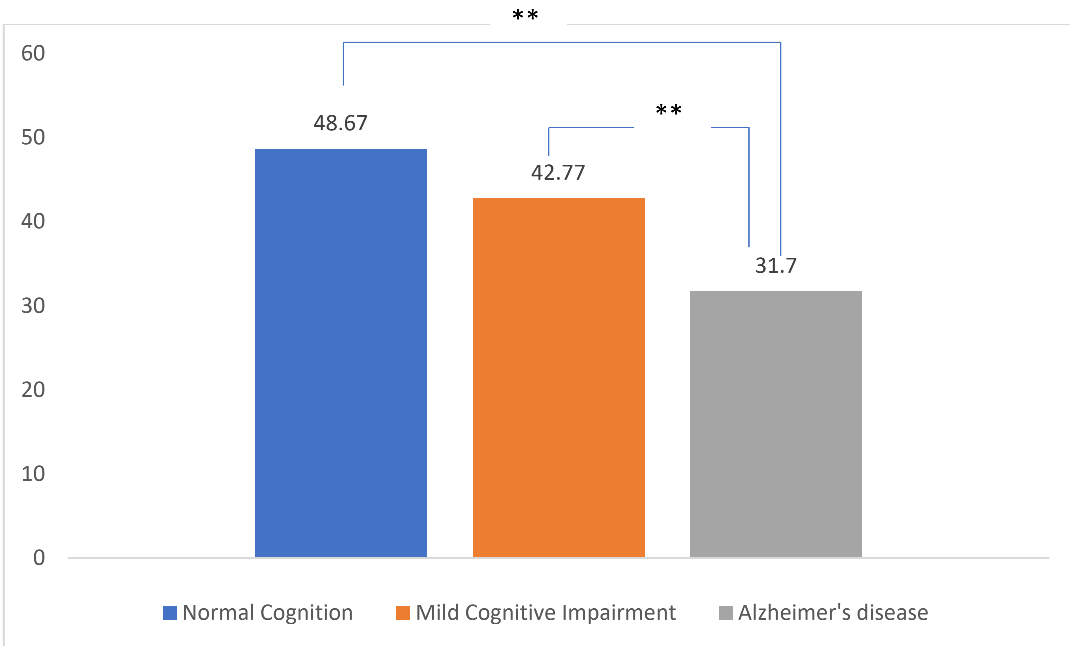
	Some college or associate degree	13	21.0
	College graduate or more	21	33.9
NC group			
	Gender		
	Female	13	48.1
	Male	14	51.9
	Race and Ethnicity		
	American Indian	0	0
	Asian	0	0
	Black	0	0
	White	26	96.3
	No Response	1	3.7
	Hispanic	2	7.4
	Age		
	60-69	2	7.4
	70-79	14	51.9
	80-89	10	37.0
	90+	1	3.7
	Educational Attainment		
	0 through 11th grade	1	3.7
	High School graduate	9	33.3
	Some college or associate degree	4	14.8
	College graduate or more	13	48.1

Table 3. *Means, standard deviations, and correlations with neuropsychological tests*

Variable	M	SD	*r*
MoCA	19.52	4.79	.702**
Executive Functioning			
Stroop Color Word	8.03	3.81	.483**
Stroop Interference	49.30	9.32	.254**
Trail Making Test Part B	8.29	3.51	.368**
M-WCST Executive Function	86.01	18.15	.501**
M-WCST Perseverative Errors	43.81	11.05	.487**
Clock Drawing Test	8.23	2.05	.528**
Attention and Processing Speed			
WAIS-IV Digit Span	8.27	3.15	.541**
Stroop Word Reading	8.60	2.89	.322**
Stroop Color Naming	8.82	3.20	.384**
Trail Making Test Part A	8.65	3.80	.427**
Language			
Phonemic Fluency	9.34	2.99	.365**
Semantic Fluency	6.98	2.98	.509**
MackSF4	11.70	3.01	.505**
WAB Comprehension	11.33	1.14	.304**
WAB Repetition	6.52	0.94	.376**
Memory			
BVMT-R Percent Retained	65.64	53.67	.304**
Supraspan Percent Retained	37.55	33.63	.494**
Mood			
GAI	3.74	4.78	-.253**
GDS	6.48	5.22	-.170*

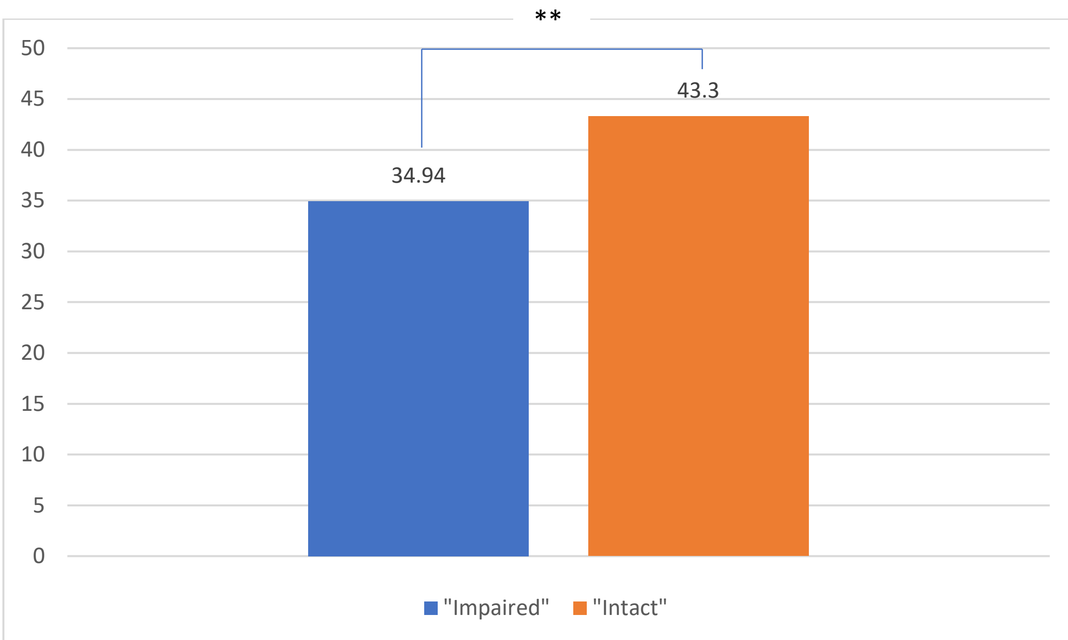
Note. * $p < .05$, ** $p < .01$

Figure 1. *Comparison of TFLS scores by Diagnosis*



Note. **p<.001

Figure 2. *Comparison of Average TFLS scores Between Impaired/Intact Groups*



Note. **p<.001