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Psychometric Extension of the Memory for Names Test

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PSYCHOMETRIC EXTENSION OF THE MEMORY FOR NAMES TEST

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ABSTRACT

The purpose of this study was to re-evaluate the psychometric properties of the Memory for Names (Mem4Names) test among a sample of older adults without cognitive impairment. Mem4Names is a test of famous face recognition that was shown to be a reliable and valid measure of semantic memory in older adults both with and without cognitive impairment (Brouillette et al., 2011). The current study re-examined the psychometric properties of the Mem4Names test among 133 volunteers at Pennington Biomedical Research Center's Institute for Dementia Research and Prevention. The study confirmed previously reported calculations of the test's reliability by calculating Cronbach's alpha and Guttman's split-half coefficient. Convergent validity for the Mem4Names test was established through its correlation with a theoretically similar measure of memory, the Wechsler Memory Scale Logical Memory Delayed subtest. Confirmatory factor analysis identified a one-factor solution for the Mem4Names test. The results concluded that the Mem4Names test is a reliable and valid measure of semantic memory for cognitively intact older adults.

CHAPTER 1: INTRODUCTION

The neurocognitive disorder previously known as *dementia* is a degenerative cognitive condition affecting nearly 35 million individuals over the age of 60 (Holzer, Warner, & Iliffe, 2013; Prince et al., 2014). It is characterized by progressive deterioration in memory and other cognitive abilities (McKhann et al. 2011). There are multiple types of dementia; the most common is Alzheimer's disease (AD), which makes up nearly 70% of diagnosed cases (Chen, Lin, & Chen, 2009; Holzer et al., 2013). AD has an insidious onset, making it difficult to initially differentiate from typical age-related changes. However, the progressive cognitive decline associated with AD is severe enough to interfere with daily activities (McKhann et al., 2011), whereas typical aging does not (Holzer et al., 2013). In the United States, an estimated 5 million individuals over age 60 have AD (Alzheimer's Association, 2014; Prince et al., 2013). This number is expected to increase along with the growing older adult population (Alzheimer's Association, 2015). It is estimated that by 2050, approximately 10 million individuals will have AD (Alzheimer's Association, 2015). There is no known cure for AD; available treatments are effective only at temporarily reducing the neuropsychiatric symptoms associated with the disease (Fereshtehnejad, Johnell, & Eriksdotter, 2014; Herrmann, Chau, Kircanski, & Lanctôt, 2011; Nordström, Nordström, Eriksson, Wahlund, & Gustafson, 2013). Alzheimer's Association (2015) reported that in 2013, AD was the fifth leading cause of death in those over age 65.

Although there is no definitive treatment for AD, researchers recommend early detection for timely care, support, and treatment of disease symptoms (Albert et al., 2011; McKhann et al., 2011; Wimo et al., 2013). Although AD can be confirmed only through autopsy, diagnosis occurs by a process of elimination through a blend of physical examination, laboratory and

biomarker tests, imaging, and comprehensive neuropsychological evaluation (Wimo et al., 2014). Neuropsychological evaluation has been shown to be especially sensitive to subtle changes in cognition (Levy & Chelune, 2007; Sano, 2006) and can detect preclinical AD as accurately as biomarkers (Ewers et al., 2012). Research trends have focused on assessment of semantic memory as a method of providing early detection of AD processes (Frank, Hennig-Fast, Klünemann, Schmitz, & Greenlee, 2011; Greene, Hodges, & Baddeley, 1995; Thompson, Graham, Patterson, Sahakian, & Hodges, 2002; Werheid & Clare, 2007). Semantic memory involves the recall of conceptual information, such as ideas and facts; verbal fluency, such as naming people, places, or things; and executive functioning, or the ability to carry out a task to command (Simons, Graham, Galton, Patterson, & Hodges, 2001; Werheid & Clare, 2007). One way to assess semantic memory is through recognition of famous faces (Werheid & Clare, 2007). Historically, impairments in semantic memory have been noted in individuals with AD (Estévez-González et al., 2004). However, recent studies have uncovered a link between semantic memory and preclinical AD (Thompson et al., 2002; Estévez-González et al., 2004; Frank et al., 2011). Several studies on semantic memory have addressed famous face recognition as a means of discriminating between typical cognitive aging and prodromal AD (Ahmed, Arnold, Thompson, Graham, & Hodges, 2008; Frank et al., 2011; Semenza, Mondini, Borgo, Pasini, & Sgaramella, 2003; Werheid & Clare, 2007). The studies found that individuals with preclinical AD performed more poorly on famous facial recognition tasks than control groups (Estévez-González et al., 2004; Frank et al., 2011; Thompson et al., 2002). Similarly, Thompson et al. (2002) found that famous face recognition was more predictive of AD development than other memory measures.

Early detection of cognitive impairment is optimal, as it influences treatment decisions (Pozueta et al., 2011) and allows for service utilization to begin when the patient can still participate in care decisions (Borson et al., 2013). Healthcare professionals, including social workers, may find early detection tools helpful to identify those individuals with pre-clinical AD. As the population of adults with AD increases, social workers will ever more be needed to provide psychoeducational and therapeutic services to both individuals with AD and their caregivers (Cheung et al., 2014; de Vugt & Verhey, 2013; Kaplan & Berkman, 2011). Interventions involving both individuals with AD and their caregivers have been shown to reduce caregiver burden (Pinquart & Sörensen, 2006), and delay future institutionalization (de Vugt & Verhey, 2013). Researchers have demonstrated that such interventions are most effective in the early stages of disease progression (Kaplan & Berkman, 2011; Cheung et al., 2014). Therefore, it is crucial for researchers to continue exploring psychometric assessments capable of providing early detection of AD processes.

In order to investigate the predictive potential of semantic memory assessments, researchers at Pennington Biomedical Research Center's Institute for Dementia Research and Prevention developed the Memory for Names (Mem4Names) test. Mem4Names is a test of famous face recognition that was shown to be a reliable and valid measure of semantic memory in older adults (Brouillette et al., 2011). Additionally, Mem4Names was capable of discriminating between typical cognition and that of mild cognitive impairment (MCI) or early-stage AD (Brouillette et al., 2011). The purpose of this thesis is to re-evaluate the psychometric properties of the Mem4Names test when used to assess semantic memory in a sample of cognitively intact older adults.

CHAPTER 2: LITERATURE REVIEW

In order to discuss the utility of the Mem4Names test in discriminating between typical cognition and major neurocognitive disorder in AD, it is imperative to first provide an in-depth synopsis of neurocognitive disorders. Therefore, the purpose of this literature review is four-fold. First, comprehensive information about neurocognitive disorders is provided. Second, a thorough explication of the Mem4Names test is given. Third, theoretical principles and applicability to the study are explored. Lastly, research questions and hypotheses are analyzed.

The *Diagnostic and Statistical Manual of Mental Disorders*, or *DSM-5* (5th ed.; American Psychiatric Association [APA], 2013), introduced the term *major neurocognitive disorder* as a replacement for *dementia*. This was done in an effort to reduce the stigma associated with dementia (Foley & Heck, 2014). While the new terminology is preferred, the *DSM-5* acknowledged that *dementia* is considered standard when used to refer to neurodegenerative disorders that predominately affect older adults (APA, 2013). It was further stated that the new terminology should not be imposed in settings where it is not customary (APA, 2013; Ganguli et al., 2011). Researchers agreed that practitioners and patients should continue to utilize the terminology with which they are most familiar in order to ensure comprehension (Crowe, 2015; Foley & Heck, 2014). Prominent bodies in the field of AD research including the World Health Organization (2015a, 2015b), Alzheimer's Association (2016), and the National Institute on Aging (2015) continue to utilize the traditional language. For the purposes of the literature review, the term dementia will be utilized here. The new terminology will be used whenever possible, especially when referring to future research and the results from the current study.

Prevalence

Worldwide, approximately 35 million individuals over the age of 60 have AD or other dementias (Alzheimer's Association, 2014; Prince et al., 2013). Current projections estimate the worldwide prevalence to double every 20 years to 66 million by the year 2030 (Prince et al., 2013). Annual incidence rates are between 0.4% of individuals ages 65-69 and 10% of those over age 90 (Hampel et al., 2011). According to a recent meta-analysis, approximately 60% of individuals with dementia were located in low- to middle-income countries (Prince et al., 2013). This number is also expected to increase to over 70% by the year 2050 (Ferri et al., 2005; Prince et al., 2013). Prince et al. (2013) found China was home to the greatest population of individuals with AD and the United States second. Some studies have shown African Americans and ethnic minorities to have a higher prevalence of dementia than Caucasians (Logue et al., 2011; Nielsen, Vogel, Phung, Gade, & Waldemar, 2011; Plassman et al., 2007; Potter et al., 2009). Alzheimer's Association (2014) estimated prevalence rates for African Americans as two times higher than that of Caucasians. Prevalence rates for Hispanics were estimated to be 1.5 times higher than Caucasians (Alzheimer's Association, 2014). Nielsen et al. (2011) noted that prevalence rates for minority populations may actually be higher than reported due to the underutilization of health care systems observed in this population. In the United States, an estimated 5 million individuals over age 60 have AD (Alzheimer's Association, 2014; Prince et al., 2013). Women represent over half of this number (Alzheimer's Association, 2014; Chen et al., 2009). It is estimated that by 2050, approximately 10 million individuals in the United States will have AD (Alzheimer's Association, 2015).

Diagnostic Criteria

According to the *DSM-5* (APA, 2013), a neurocognitive disorder (NCD) is diagnosed through clinical interview, objective cognitive assessment, and assessment of daily functioning. In general, a diagnosis of NCD can be made when cognitive or behavioral symptoms affect daily functioning and represent a decline from previous functioning (APA, 2013; McKhann et al., 2011). The cognitive or behavioral dysfunctions are not explained by a medical condition, such as delirium, or psychiatric disorder. In order to meet *DSM-5* criteria, dysfunctions should be present in at least two of six domains: memory, language, executive function, attention, perceptual-motor, and social cognition (APA, 2013; McKhann et al., 2011). Although not considered a cognitive domain, *DSM-5* includes functional status as part of the diagnostic criteria (APA, 2013). NCDs are further delineated based upon severity and certainty of diagnosis (Foley & Heck, 2014). The *DSM-5* distinguishes between *mild* and *major* NCDs to describe severity of impairment (Sachs-Ericsson & Blazer, 2015). A mild NCD is characterized by subtle decline in cognitive functioning with greater effort required to maintain functional independence, whereas a major NCD is characterized by more substantial cognitive deficits to the extent that daily functioning is impaired (Sachs-Ericsson & Blazer, 2015). Certainty, or confidence, of diagnosis is provided by the descriptions *possible* and *probable* (Foley & Heck, 2014). When there is a strong family history or evidence of genetic biomarkers indicative of AD, a diagnosis of NCD due to probable AD is supported (APA, 2013). In absence of genetic etiology, a diagnosis of NCD due to possible AD is utilized (APA, 2013). Despite such diagnostic certainty, AD can only be confirmed through autopsy.

Memory. Memory encompasses learning, retaining, and retrieval of information. Deficits in memory represent the most noticeable symptom of AD (Dubois et al., 2007; Sexton et

al., 2010). Symptoms of memory impairment appear as repetitive questioning, misplacing personal belongings, forgetting appointments, and getting lost on familiar routes (APA, 2013; McKhann et al., 2011). Researchers have noted that episodic memory (recall of autobiographical events) and semantic memory (generalized knowledge about the world) are affected early in the disease process and gradually worsen over time (Greene et al., 1995; Grilli & Verfaellie, 2014; Holzer et al., 2013). Researchers indicated over 90% of individuals with AD exhibit impairment in episodic memory (Dubois et al., 2007). Likewise, recall of recent events is impaired prior to impairment in remote memory.

Executive function. Reasoning, planning, behavior control, and judgment comprise *executive functioning*. Deficits in executive functioning can be seen as an inability to manage finances, poor decision making, difficulty in carrying out multi-step tasks, and inability to resume tasks after interruption (APA, 2013; Greene et al., 1995; Stopford, Thompson, Neary, Richardson, & Snowden, 2012). Current research indicated executive dysfunction occurs early in the disease process (Baudic et al., 2006; Sgaramella et al., 2001). Executive dysfunction is closely related to impaired performance of daily tasks (Marshall et al., 2011). As an individual's ability to control behavior and attend to complex task worsens, the ability to live independently becomes impaired (Collette, Van der Linden, & Salmon, 1999; Marshall et al., 2011).

Attention. Impairment in attentional capacity may appear as difficulty following conversations within a group, inability to solve mental calculations, and delayed completion of routine tasks (APA, 2013). Research has indicated that deficits in different types of attentional ability may appear at different stages of disease progression (Baudic et al., 2006; Collette et al., 1999). For example, ability to perform tasks of sustained attention remains unaffected in the early stages of AD, while capacity to perform more complex tasks involving divided and

selective attention show marked impairment (Baudic et al., 2006). Research supports that the ability to divide attention in order to perform dual tasks is in part controlled by the areas of executive functioning (Baudic et al., 2006; Collette et al., 1999). As indicated prior, impairments in executive functioning appear early in the disease process and continue to decline.

Perceptual-motor. Perceptual-motor ability encompasses the way an individual perceives the environment, makes sense of it, and reacts to it. Deficits in perceptual-motor ability appear early in disease progression and deteriorate over time (Tippett & Sergio, 2006). Individuals with mild AD often get lost, appear disoriented, and have difficulty locating objects for which they are searching (Tabuchi, Konishi, Saito, Kato, & Mimura, 2014). As the disease progresses, individuals with moderate to severe AD may be unable to orient their clothes to the body, have increased difficulty with depth perception, and may be unable to recognize faces or objects (APA, 2013). Researchers have found individuals with AD have difficulty with visuomotor skills, that is, tasks involving hand-eye coordination (Tippett & Sergio, 2006). Reaction times are also more impaired in persons with AD when compared to non-AD individuals (Tales et al., 2002; Tippett & Sergio, 2006).

Language. Language encompasses word finding, comprehension, fluency, and adapting language to a situation (Ferris & Farlow, 2013). While mild deficits in language ability are considered part of typical aging (Dubois et al., 2007), individuals with AD experience aphasia, that is, loss of verbal fluency, word finding abilities, and language comprehension (Ferris & Farlow, 2013). Impairments occur early in the disease process and may appear as hesitations while speaking, paraphasia (misusing words), and errors in comprehending written or spoken content (Dubois et al., 2007; Ferris & Farlow, 2013; McKhann et al., 2011). As the disease progresses into the moderate to severe stages, verbal fluency and comprehension are severely

impaired. Decline in language abilities has been associated with noncognitive impairments such as in behavior and functional status (Ferris & Farlow, 2013). Ferris and Farlow (2013) surmised behavioral and mood disturbances become compromised when individuals with AD become unable to express their needs. Loss of communication ability has been associated with restlessness, agitation, and wandering as well as other behavioral symptoms (Ferris & Farlow, 2013; Savundranayagam, Hummert, & Montgomery, 2005).

Social cognition. Disturbances in mood, personality, and behavior are frequently observed in individuals with AD (Chiu, Chen, Yip, Hua, & Tang, 2006; Holzer et al., 2013; McKhann et al., 2011). Researchers have estimated 75-90% of individuals with AD experience noncognitive symptoms associated with the disease (Chiu et al., 2006; Gao et al., 2013; Srikanth et al., 2005). Alterations in personality and behavior can be noted in individuals during the early stages of dementia and become more noticeable over time (Ryan et al., 2012). The most common behavioral and psychological symptoms of dementia (BPSDs) are apathy, irritability, dysphoria, and agitation (Chiu et al., 2006; Srikanth et al., 2005). Other prominent BPSDs include disinhibition, loss of empathy, compulsive or purposeless activities, and delusional ideation (Chiu et al., 2006; McKhann et al., 2011). BPSDs are also present in individuals with mild impairment (Rocca et al., 2010; Ryan et al., 2012). A meta-analysis indicated individuals with mild AD have increased risk of depression compared to those without any form of cognitive impairment (Huang, Wang, Li, Xie, & Liu, 2011; Scoggins, Scott, & Hyer, 2012). Psychotic symptoms and behavioral disturbances increase from the mild to moderate and severe stages (Chiu et al., 2006; Dubois et al., 2007; Srikanth et al., 2005). Symptom type and severity become more disruptive as the disease progresses (Holzer et al., 2013). Chiu et al. (2006) said BPSDs are a major factor in caregiver burden and influence the decision to institutionalize.

Functional status. Functional status is measured by examining activities of daily living (ADLs) and instrumental activities of daily living (IADLs). ADLs are tasks such as personal care, toileting, mobility, and eating. IADLs include tasks such as paying bills, grocery shopping and meal preparation, remembering appointments, and medication management (Mayo et al., 2013). Functional impairments appear early in the disease process, with some deficits in IADLs appearing in the prodromal stage (Brown, Devanand, Liu, Caccappolo, & Alzheimer's Disease Neuroimaging Initiative, 2011; Ha & Kim, 2014; Mayo et al., 2013). Researchers found over half of individuals with mild impairment experienced deficits in at least one IADL (Brown et al., 2011; Marshall et al., 2011). Brown et al. (2011) found two IADLs in particular (remembering appointments and medications, and assembling financial records) showed greatest disparity between non-impaired cognition and mild cognitive impairment (MCI). Researchers found 34% of individuals with MCI and 4% of individuals with AD could perform these two activities independently (Brown et al., 2011). Findings from Brown et al. (2011) indicate performance of more complex tasks deteriorates early in the disease, while that of routine tasks remains relatively preserved.

Risk Factors

Age. Recent prevalence rates estimated almost 7% of individuals 60 and over had some form of dementia (Plassman et al., 2007; Prince et al., 2013), and nearly 70% of those had AD (Chen et al., 2009; Holzer et al., 2013). Prevalence rates increase with advanced age (Prince et al., 2013). Plassman et al. (2007) found nearly 37% of individuals over the age of 90 had dementia, almost 80% of them with AD. Although AD is predominately seen in people over the age of 60, some individuals can develop the disease at a younger age. Early-onset AD occurs

before age 60 and is attributed to a rare genetic mutation (Bekris, Yu, Bird, & Tsuang, 2010). Early-onset AD accounts for only 6–7% of all cases of AD (Plassman et al., 2007).

Sex. Women are approximately 20% more likely to develop dementia than men (Chen et al., 2009; Prince et al., 2013). Currently, two-thirds of Americans with AD are women (Alzheimer's Association, 2014). One possible explanation for this disparity is that women on average outlive men and thus are more likely to live to an age where AD is a risk (Alzheimer's Association, 2014; Prince et al., 2013). Another explanation may be females' increased likelihood of carrying a specific gene variation associated with late-onset AD (Bendlin et al., 2010).

Genetic. The risk to a person who has a first-degree relative with AD is 6 times that of the general population (Bendlin et al., 2010). The increased risk may be due in part to similar genetics, environment, or an interaction between the two. Researchers postulate that heritability of AD is due to the Apolipoprotein E (APOE) gene. APOE is the most well-known genetic risk factor for late-onset AD (Meng & D'Arcy, 2013; Weinstein, Wolf, Beiser, Au, & Seshadri, 2013). It is associated with 5-10% of all AD cases (Bendlin et al., 2010). The strength of the association between the APOE gene and AD is stronger among women than men (Bendlin et al., 2010). It also diminishes with age, being stronger among people between 55 and 65 years old and less so among adults older than 65 years (Bendlin et al., 2010). African Americans are more likely to carry a particular variation of the APOE gene, which may account for higher prevalence of AD in this population (Logue et al., 2011).

Chronic health conditions. Vascular risk factors such as hypertension, diabetes, and hypercholesterolemia are strongly associated with the development of dementia. Research showed a correlation between high blood pressure in midlife and dementia in later life (Bendlin

et al., 2010; Obisesan et al., 2012; Patterson, Feightner, Garcia, & MacKnight, 2007). Midlife hypertension increases risk of stroke, a risk factor for vascular dementia (Hampel et al., 2011). Midlife hypertension also appeared to have the highest association between AD risk in subsequent exploration (Obisesan et al., 2012; Rodrigue et al., 2013). The interaction between late-life hypertension and AD is less clear (Paganini-Hill, 2012; Strand et al., 2013). While high blood pressure is a potentially modifiable risk factor, research on treating hypertension to reduce AD risk is inconclusive at this time (Igase, Kohara, & Miki, 2012).

Type 2 diabetes is most common in middle age and has been associated with greater risk of developing dementia in later life (Bendlin et al., 2010; Cheng, Huang, Deng, & Wang, 2012; Lin & Sheu, 2013; Patterson et al., 2007). A recent meta-analysis estimated a 60% increase in the risk of developing AD when type 2 diabetics were compared to non-diabetic controls (Vagelatos & Eslick, 2013). However, the etiology of the association is not well understood. Research hypothesizes increased risk is a result of the interaction between type 2 diabetes and other risk factors such as genetics and lifestyle (Vagelatos, & Eslick, 2013). Antidiabetic treatments such as insulin therapy and Metformin have been studied for potential benefit in treating AD. To date, no conclusive evidence indicates effectiveness of these treatments (Myint, Win, & Aung, 2013).

Hypercholesterolemia (high cholesterol) at midlife is considered a well-established risk factor for AD (Bendlin et al., 2010; Obisean et al., 2012; Shepardson, Shankar, & Selkoe, 2011; Strand et al., 2013). It is thought that high levels of *total* cholesterol in the blood increase the risk of developing dementia by improving the likelihood of stroke (Strand et al., 2013). However, some research has concluded that low levels of a certain type of cholesterol, *high-density lipoproteins* (HDLs), may impair cognitive functioning (Obisean et al., 2012), while a

high level of HDLs may serve as a protective factor (Obisean et al., 2012; Reitz et al., 2010). Similarly, high levels of *low-density lipoprotein* (LDLs) may increase the risk of dementia (Reitz et al., 2010; Shepardson et al., 2011). Cholesterol-lowering medications, called statins, are being investigated for their utility in both the prevention and treatment of AD. Currently, no consensus reports the effectiveness of statin use for this purpose (Reitz et al., 2010; Shepardson et al., 2011; Strand et al., 2013).

Depression. Chronic diseases put individuals at an increased risk of depression, which may serve as a risk factor for developing AD (Huang, Dong, Lu, Yue & Liu, 2010; Patterson et al., 2007). A recent meta-analysis of longitudinal studies found individuals with depression had two times higher incidence of MCI and dementia than non-depressed controls (Gao et al., 2013). Wallin, Boström, Kivipelto, and Gustafson (2013) found depression to increase dementia risk in those over 80 years old. However, Patterson et al. (2007) found this association was statistically significant in males only. A similar meta-analysis suggested a bidirectional interaction between cognition and mood (Huang et al., 2011). Huang et al. (2011) found that individuals with AD were at a higher risk of depression when compared to those without any form of cognitive impairment.

Traumatic brain injury (TBI). Roughly 10 million individuals worldwide sustain a TBI per year (Hyder, Wunderlich, Puvanachandra, Gururaj, & Kobusingye, 2007). For individuals over age 65, there has been a reported 21% increase in TBI cases (Sivanandam & Thakur, 2012). History of brain injury increases the risk of developing dementia. It is thought that brain changes subsequent to TBI accelerate the disease processes of cognitive decline and functional impairment (Bigler, 2013; Sivanandam &Thakur, 2012). However, research is mixed as to the exact relationship between TBI and AD development. A literature review by

Tsitsopoulos and Marklund (2013) found that TBI results in biomarkers such as amyloid plaques and neurofibrillary tangles similar to those found in AD. These biomarkers were observed postmortem in 30% of individuals with TBI (Sivanandam & Thakur, 2012; Tsitsopoulos & Marklund, 2013). However, Johnson et al. (2013) found brain atrophy post-TBI increased the likelihood of AD rather than deposition of biomarkers. Severity of brain injury may also correlate to AD development. A systematic review found that moderate and severe TBI, as opposed to mild TBI, is associated with developing AD (Lee et al., 2013).

Types of Dementia

The most prevalent form of dementia is AD, which makes up nearly 70% of diagnosed dementia cases (Chen et al., 2009; Holzer et al., 2013). Additional, lesser known types of dementia such as vascular dementia and dementia with Lewy bodies are discussed below.

Vascular dementia (VaD). Vascular dementia is the second most prevalent form of dementia in older adults and accounts for roughly 30-40% of all dementias (Melkas, Jokinen, Hietanen, & Erkinjuntti, 2014). VaD identifies cognitive impairment subsequent to cerebrovascular injury, such as stroke or brain hemorrhage (Levine & Langa, 2011). VaD has a clinical presentation of executive dysfunction and BPSDs as opposed to other dementias that present with memory impairment as the primary deficit (APA, 2013). In individuals over the age of 65, history of stroke approximately doubles the risk of dementia (Gorelick et al., 2011; Savva, Stephan, & the Alzheimer's Society Vascular Dementia Systematic Review Group; 2010). Men are more likely to develop vascular dementia than women (Chen et al., 2009; Prince et al., 2013), primarily due to men's increased risk of cerebrovascular disease (Emdin et al., 2016).

Frontotemporal dementia (FTD). FTD is an early-onset neurodegenerative disorder associated with atrophy in the frontal lobes of the brain (Gislason et al., in press). FTD is differentiated from other dementias through a clinical presentation of either progressive language or behavioral impairment (APA, 2013; Salloway, 2012). Of the two variants, behavioral impairment is the most common (Rohrer, Warren, Fox, & Rossor, 2013). Memory remains fairly intact until the latter stages of the disease. FTD is estimated to be prevalent in roughly 10% of all dementia cases (Seelaar, Rohrer, Pijnenburg, Fox, & van Swieten, 2011). Nearly 50% of FTD is familial (Seelaar et al., 2011), indicating a genetic component. Lillo, Garcin, Hornberger, Bak, and Hodges (2010) reported a wealth of research indicating FTD may be a precursor to another neurodegenerative disorder, amyotrophic lateral sclerosis.

Dementia with Lewy bodies (DLB). DLB accounts for 10-22% of dementia cases in those 65 years or older (Auning, Rongve, & Aarsland, 2012; McKeith et al., 2004). DLB is thought to be caused by accumulation of proteins, called Lewy bodies, in the brain. However, autopsy has revealed that amyloid plaques and tangles typically seen in AD are also present in the brains of individuals with DLB (Teaktong, 2013; Winslow et al., 2014). The clinical presentation of DLB includes hallucinations, Parkinsonism, fluctuating cognition, and violent dreams (APA, 2013; Salloway, 2012). Memory impairment is not evident in the early stages of the disease but appears as the disease progresses (McKeith et al., 2004). DLB and Parkinson's disease share similar characteristics, so much so that diagnostic criteria for DLB requires onset of cognitive decline to be within one year of Parkinsonism (APA, 2013; McKeith et al., 2004).

Severity of AD

Mild cognitive impairment (MCI). Exhibiting a lesser impairment than dementia, MCI has a clinical presentation of mild deficits in one or more cognitive domains (Albert et al., 2011;

Forst & Kurz, 1999). The most noticeable dysfunctions are observed in acquiring new information and completing complex cognitive tasks (Forst & Kurz, 1999). Overall, performance of ADLs is not impaired (Albert et al., 2011; Dubois et al., 2007), although mild impairment in performance of IADLS is noted (Brown et al., 2011; Marshall et al., 2011). Subtle alterations in mood and behavior are noted but do not interfere with overall functioning (Rocca et al., 2010; Ryan et al., 2012; Srikanth et al., 2005). MCI has traditionally been considered predictive of AD conversion. However, not every individual who has MCI will go on to develop dementia or AD. A recent meta-analysis indicated that only 32% of individuals meeting criteria for MCI converted to dementia within 5 years (Mitchell & Shiri-Feshki, 2009).

Mild AD. Individuals in the mild stage of AD present with impaired memory and learning abilities (Forstl & Kurz, 1999; Tarawneh & Holtzman, 2012). Difficulties with planning, problem solving, and organization become more apparent and begin to interfere with daily functioning (Baudic et al., 2006; Marshall et al., 2011; Sgaramella et al., 2001). While most individuals with mild AD are still functional enough to live independently, they may need support with complex IADLs such as managing medications, driving, shopping, and house cleaning (Forstl & Kurz, 1999; Tarawneh & Holtzman, 2012). Language skills become impaired resulting in decreased communication (Ferris & Farlow, 2013). Noncognitive features such as apathy, depression, and irritability are frequently observed and may interfere with social engagement (Srikanth, Nagaraja, & Ratnavalli, 2005).

Moderate AD. Individuals in the moderate stage of AD present with short-term and episodic memory impaired to the extent that individuals tend to "live in the past" (Forstl & Kurz, 1999, p. 289). Executive functioning and communication significantly deteriorates (Holzer et al., 2013; Tippett & Sergio, 2006), resulting in increased dependence on support systems.

BPSDs become more prominent (Srikanth et al., 2005), and psychotic features such as paranoid and delusional ideation begin to appear (Chiu et al., 2006). Psychotropic medication usage increases during this stage to modify the more prominent BPSDs and behavioral disturbances (Chiu et al., 2006). While the majority of individuals with AD live at home (Alzheimer's Association, 2014), long-term care services such as nursing home care and assisted living are most likely to be utilized during the moderate stage (Rockwood et al., 2014).

Severe AD. In the final stage of AD, almost all cognitive domains are severely impaired. Biographical memory is lost and language has deteriorated to the degree that individuals cannot express their most basic needs (Ferris & Farlow, 2013). Motor functions needed for chewing and swallowing are impaired. Individuals who are hospitalized may be equipped with feeding tubes to provide nourishment (Forstl & Kurtz, 1999). Additionally, physiological changes take place resulting in organ dysfunction (Shen, Lu, & Li, 2012). Hospice services tend to be utilized for palliative care. Alzheimer's Association (2014) reported that 11% of hospice admissions were dementia cases.

Life Expectancy

Studies have approximated survival time of 4.6 years after the onset of dementia (Alzheimer's Association, 2014; Fitzpatrick, Kuller, Lopez, Kawas, & Jagust, 2005). However, survival rates differ by the type of dementia. According to Fitzpatrick et al. (2005), individuals diagnosed with VaD had a higher risk of death than those with AD. Fitzpatrick et al. (2005) reported that individuals with VaD had the shortest survival time at almost 4 years after dementia onset compared to a median survival of 7 years for AD. Comorbidity may also accelerate physical decline (Melis et al., 2013). According to Melis et al. (2013), dementia patients with two or more chronic diseases experienced functional decline at a more rapid rate than those

dementia patients without comorbidities. Physical decline has been associated with low levels of self-care, incontinence, and impaired mobility (Doraiswamy, Leon, Cummings, Marin & Neumann, 2002). Multimorbidity is also associated with an increased likelihood of hospitalization and subsequent mortality in persons with dementia (Doraiswamy et al., 2002; Melis et al., 2013). A systematic review estimated about 32% of older adult deaths were attributed to AD in 2010 (Weuve, Hebert, Scherr, & Evans, 2014). By the year 2050, the number of deaths due to AD is projected to be 1.6 million (Weuve et al., 2014). Pneumonia, dehydration, and septicemia are the main causes of death for individuals with AD (Forstl & Kurtz, 1999; Hendriks, Smalbrugge, Hertogh, & van der Steen, 2014).

Diagnosis

Most cases of AD are believed to be due to a mixture of genetic and environmental risk factors such as those discussed earlier. In light of this, diagnosis of AD encompasses evaluation of multiple domains. There is no single diagnostic tool to confirm the presence of neurocognitive disorders or AD. The diagnostic procedures can include a variable combination of physical examination, laboratory and biomarker tests, imaging, and comprehensive neuropsychological evaluation (Wimo et al., 2014) to rule out other diseases and disorders. Current guidelines recommend early detection and accuracy in diagnosis for timely treatment, care, and support (Albert et al., 2011; McKhann et al., 2011; Wimo et al., 2013). Despite the intricate process, however, a definitive diagnosis of AD cannot be made antemortem.

Physical exam. According to a literature review by Samsi et al. (2014), most individuals with a memory complaint approach their primary care physician (PCP) for initial assessment. A systematic review of American PCPs' practice patterns reported 93% of physicians are involved in screening and/or diagnostic evaluation for dementia in their older patients (Stewart et al.,

2014). Murphy et al. (2014) reported similar findings when surveying Australian general practitioners. The majority of physicians utilize a formal screening tool such as the Mini-Mental Status Examination (MMSE) as part of their evaluation for dementia (Murphy et al., 2014; Stewart et al., 2014). Additionally, PCPs rule out physical etiologies of dementia such as hypothyroidism or infection via routine laboratory tests (Murphy et al., 2014; Stewart et al., 2014). Stewart et al. (2014) also reported that brain imaging such as a computed tomography (CT) scan is utilized in the primary care setting as a part of the diagnostic process.

Biomarkers. Cerebral spinal fluid (CSF) can be used to measure biochemical changes in the brain. CSF assesses the deposition of beta amyloid peptides and tau proteins, which compose the plaques and neurofibrillary tangles associated with AD (Genius et al., 2012; Mattsson et al., 2009). Studies have shown that levels of beta amyloid and tau proteins in CSF can identify AD with good accuracy (Genius et al., 2012; Mattsson et al., 2009; Meng & D'arcy, 2013). Recent sensitivity estimates were approximated between 80 and 90% (Genius et al., 2012; Mattsson et al., 2009). CSF is obtained via lumbar puncture, making it an invasive procedure not typically performed in the primary care setting. CSF biomarker testing has been utilized mostly in research settings (Gooblar, Carpenter, Coats, Morris, & Snider, in press).

To date, no single causal genetic mutation has been identified for AD. However, it is agreed that the APOE gene is associated with a number of brain changes, including late-onset AD (Bendlin et al., 201). The APOE gene has four variations based upon the interaction of different alleles. Of the variations, the Ɛ4 allele is associated with the highest risk of AD development and earlier onset (Bendlin et al., 2010; Genius, Klafki, Benninghoff, Esselmann, & Wiltfang, 2012; Meng & D'Arcy, 2013). While carrying one or more Ɛ4 alleles increases risk 12-fold (Genius et al., 2012), it does not predict who will develop AD (Bendlin et al., 2010).

APOE is a blood-based biomarker, meaning it is measured by blood sampling. Although less invasive than CSF sampling, APOE genotyping is currently a less sensitive measure (65% sensitivity) than CSF sampling (Genius et al., 2012).

Neuroimaging. Neuroimaging provides a mode to distinguish AD from other dementias by measuring brain structure and function (Hampel et al., 2011). Both CT and magnetic resonance imaging (MRI) are utilized to identify structural brain abnormalities such as tumor, stroke, or significant atrophy (Tanev, Sablosky, Vento, & O'Hanlon, 2012). However, these imaging techniques are not sensitive enough to identify early stages of dementia (Tanev et al., 2012). Positron emission tomography (PET) and functional MRI are being used in specialized settings to more accurately identify diagnostic markers commonly seen in AD. These more sensitive imaging methods can detect deposition of beta amyloids in the brain (Ewers, Sperling, Klunk, Weiner, & Hampel, 2011). Additionally, functional MRI measures blood flow and oxygenation to determine abnormal brain activation patterns associated with different dementias (Ewers et al., 2011). Neuroimaging may be a useful tool for predicting which individuals will develop dementia later in life (Ewers et al., 2011; Hampel et al., 2011).

Neuropsychological assessment. Neuropsychological testing involves a comprehensive evaluation of an individual's cognitive and noncognitive functioning. The results from psychometric tests can confirm cognitive deficits and provide clues for identifying dementia type (Holzer et al., 2013; Sano, 2006). Included in an evaluation are measures of memory, language, reasoning, attention and concentration, visuospatial skills, and mood. An individual undergoing a neuropsychological evaluation may be asked to perform a series of tasks such as learning and recalling a list of words, naming objects or animals, reciting a span of numbers forwards and

backwards, and drawing a clock. Ewers et al. (2012) determined that the most predictive measures for developing AD are those assessing memory and executive functioning. Ewers et al. (2012) also reported some neuropsychological tests were as accurate as biomarkers in predicting AD. Neuropsychological assessments can detect subtle impairments that may develop into more pronounced deficits (Levy & Chelune, 2007; Sano, 2006). Neuropsychological assessment tools are particularly helpful in detecting pre-clinical AD, as they provide information on cognitive domain deficits and can assist in distinguishing between dementia types (Ewers et al., 2013; Holzer et al., 2013; Sano, 2006; Weintraub, Wicklund, & Salmon, 2012). Additionally, neuropsychological assessments can differentiate between typical cognitive aging and atypical cognition indicative of dementia (Holzer et al., 2013).

Treatment

Current treatments for AD offer modest improvement in cognition and behavior. These benefits are short-lived in duration and provide no disease modification (Barnett, Lewis, Blackwell, & Taylor, 2014). Even though current treatments have limited efficacy, they can improve symptoms enough to maintain an individual's quality of life as well as keep the individual living in the community longer (Barnett et al., 2014; Moore, Patterson, Lee, Vedel, & Bergman, 2014). Although pharmaceutical treatments continue to undergo development, none have currently proven effective at halting or reversing disease progression (Fereshtehnejad et al., 2014; Herrmann et al., 2011; Nordström et al., 2013).

Pharmaceutical. Acetylcholine esterase inhibitors such as donepezil, galatamine, and rivastigmine are considered the standard treatment for mild to moderate dementias (Hampel et al., 2011; Herrmann et al., 2011; Holzer et al., 2013; Moore et al., 2014). These drugs work by increasing levels of a specific neurotransmitter in the brain (Fereshtehnejad et al., 2014).

Memantine, a treatment that works via different brain receptor channels, is indicated for moderate to severe dementias (Herrmann et al., 2011; Moore et al., 2014). Memantine works by blocking excessive neurotransmitters. The two classes of antidementia drugs are effective in reducing neuropsychiatric symptoms and have limited efficacy in reducing cognitive impairment (Hampel et al., 2011; Herrmann et al., 2011). On average, both acetylcholine esterase inhibitors and memantine improve cognition and mood for 3 to 6 months (Ballard et al., 2011). Psychotropic medications such as antidepressants, antipsychotics, and anxiolytics are used to reduce BPSDs (Chiu et al., 2006; Fereshtehnejad et al., 2014). With the exception of antidepressants, most psychotropics are utilized in the later stages of the disease when significant BPSDs are present (Chiu et al., 2006; Fereshtehnejad et al., 2014; Hampel et al., 2011). Current pharmaceutical research is focused on disease-modifying drugs rather than symptom-modifying. This research involves the identification of biomarkers, such as beta amyloid and tau proteins (Hampel et al., 2011). Substantial research outlines the effects of statins, antidiabetic treatments, and antihypertensives in treating AD (Igase et al., 2012; Myint et al., 2013; Reitz et al., 2010; Shepardson et al., 2011; Strand et al., 2013). To date, no conclusive evidence indicates these treatments are effective for AD.

Non-pharmaceutical. Nonpharmacological interventions are commonly utilized to reduce BPSDs (Cabrera et al., in press). Although a systematic review found mixed results, psychosocial interventions are purported to be the most effective at managing behavioral disturbances (Brodaty & Arasaratnam, 2012; Cabrera et al., 2015) and are comparable to treatment with antipsychotics (Brodaty & Arasaratnam, 2012). Intervention techniques such as physical activity, reminiscence therapy, music therapy, and massage may be effective in reducing agitation, wandering, and general mood disturbances (Hulme, Wright, Crocker,

Oluboyede, & House, 2010). However, research has yielded inconclusive results regarding the efficacy of such interventions (Cabrera et al., 2015; Hulme et al., 2010). Since nonpharmacological interventions modify disruptive behaviors associated with AD, Chen et al. (2014) indicated such interventions may be more effective for individuals in the moderate stages of the disease.

Prevention. Risk factor reduction has become the focus of current research. Studies have indicated some factors that increase risk for AD are modifiable or preventable (Ballard et al., 2011; Hampel et al., 2011). It has been suggested that preventative efforts need to be initiated by midlife or earlier (Hampel et al., 2011; Nordström et al., 2013). Nordström et al. (2013) reported that individuals with familial history of early-onset dementia should begin reducing modifiable risk factors as early as adolescence. Aerobic exercise has been studied as a possible prevention to AD (Obisean et al., 2012). Exercise can increase HDL levels, improve oxygenation in the brain, and reduce hypertension (Obisean et al., 2012). The physiological benefits may, in turn, impact cognitive decline. In general, improvements in cardiovascular fitness have been shown to improve cognition (Obisean et al., 2012) and reduce risk of AD (Ballard et al., 2011). However, these improvements may be short-term. Eriksson Sörman, Sundström, Rönnlund, Adolfsson, and Nilsson (2014) determined engaging in physical and other leisure activities may provide short-term effects on cognition, but it does not protect against dementia development over a long period. Currently, evidence on the efficacy of risk factor reduction is mixed (Hampel et al., 2011).

Memory for Names Test

The Memory for Names (Mem4Names) test was developed in 2009 by researchers at Pennington Biomedical Research Center's Institute for Dementia Research and Prevention

(IDRP). IDRP personnel developed Mem4Names for the purpose of discriminating between typical cognition and that of MCI or early-stage AD (Brouillette et al., 2011). Current research trends have focused on early detection of AD processes with special attention paid to deficits in semantic memory (Frank et al., 2011; Greene et al., 1995; Thompson et al., 2002; Werheid & Clare, 2007). Semantic memory involves the ability to recall conceptual information including person-related concepts, that is, an individual's name, occupation, or other contextual clues (Semenza et al., 2003; Werheid & Clare, 2007). Semantic memory also includes verbal fluency, knowledge about concepts and facts, and the ability to draw an object after being given the object's name (Simons et al., 2001). Impairments in semantic memory are commonly seen in the pre-clinical stages of dementia (Grabowski, 2008; Greene et al., 1995; Grilli & Verfaellie, 2014; Hodges & Patterson, 1995) and have been described as predictors of AD progression in numerous studies (Blackwell et al., 2004; Carter, Caine, Burns, Herholz, & Lambon Ralph, 2012; Pozueta et al., 2011). Evaluation for deficits in semantic memory has been recommended to assess individuals at risk of AD (Carter et al., 2012). The utility of using famous face recognition in assessing semantic memory is well documented in the literature (Werheid & Clare, 2007). Several studies have addressed recognition of famous faces as a means of discriminating between typical cognitive aging and prodromal AD (Ahmed et al., 2008; Frank et al., 2011; Semenza et al., 2003; Werheid & Clare, 2007). Seidenberg et al. (2009) found that individuals with MCI performed more poorly in providing famous face recognition than a control group. Similarly, researchers demonstrated that deficits in famous face recognition are predictive of AD conversion (Thompson et al., 2002; Estévez-González et al., 2004; Frank et al., 2011).

In order to differentiate between cognitively intact, mildly impaired, and AD individuals, IDRP researchers developed the Mem4Names test. The test includes facial images of political figures, historical figures, and notable entertainers (Brouillette et al., 2011). Images were selected on the basis of being easily recognizable to individuals born before 1950 and include figures such as Bob Hope, Jaqueline Kennedy Onassis, and President Barack Obama (Brouillette et al., 2011). A total of 234 participants were administered the 72-item assessment (Brouillette et al., 2011). The study sample was divided into three groups depending on pre-test cognitive performance. The three subsamples were delineated as normal controls, MCI, and dementia (Brouillette et al., 2011). Individual items (e.g., President Barack Obama) were scored as three subscales depending on the participant's response. The ability to spontaneously provide a first and last name or correct title (e.g., Barack Obama, President Obama) would elicit a *Correct* score. A score for *Context* was given if the participant could provide contextual clues regarding the figure in the absence of spontaneous naming (e.g., "He's the current president"). Participants unable to provide the figure's name were then cued with the first name of the individual. The ability to recall the figure's name if cued would elicit a score for *Cued*.

Psychometrics. Statistical analyses conducted by IDRP researchers confirmed the reliability and validity of the Mem4Names test. Cronbach's alpha was high (0.96), indicating good internal consistency reliability (Brouillette et al., 2011). Likewise, test-retest reliability coefficients were large for Correct (r = 0.89), Context (r = 0.87), and Cued (r = 0.79) subscale scores (Brouillette et al., 2011). Construct validity was assessed using exploratory principal components analysis. It concluded Mem4Names Correct items measured a single construct (Brouillette et al., 2011). Eigenvalues between the first factor (19.5) and second factor (3.9) confirmed that Mem4Names Correct items load on the same factor (Brouillette et al., 2011).

Convergent validity coefficients were calculated between Mem4Names Correct scores and two verbal memory tests, the Boston Naming Test (BNT) and the Controlled Oral Word Association Test (COWAT). Convergent validity coefficients were significant for the BNT ($r = 0.65$) and both animal ($r = 0.47$) and vegetable ($r = 0.37$) subscales of the COWAT (Brouillette et al., 2011). Exploratory principal components analysis was also used to determine if Mem4Names Correct scores loaded on the same factor as the BNT and COWAT. Factor loadings for the BNT (0.82), animal naming (0.80), vegetable naming (0.72), and Mem4Names Correct scores (0.80) indicated a single factor was measured (Brouillette et al., 2011). Multivariate analysis of variance indicated significant differences in performance ($p < .01$) between the normal control, MCI, and AD groups (Brouillette et al., 2011). Last, cut-off scores for determining cognitive status, as well as sensitivity and specificity, were calculated by receiver operating characteristic (ROC) analyses. In order to differentiate between non-impaired cognition and MCI, ROC analysis concluded that a cut-off score of 49 out of a possible 72 items had 68.3% sensitivity and 68.6% specificity (Brouillette et al., 2011). The cut-off score to differentiate between MCI and AD was calculated as 28, with 79.2% sensitivity and 80.5% specificity (Brouillette et al., 2011). The Mem4Names test was shown to be a reliable and valid measure of semantic memory capable of distinguishing between sub-clinical cognition and that of MCI and AD.

Theoretical Foundation

Neuropsychological tests that target semantic memory for famous faces, such as Mem4Names, are useful in their ability to identify pre-clinical AD prior to impairment in other cognitive domains (Brambati, Peters, Belleville, & Joubert, 2012; Brouillette et al., 2011; Rizzo, Venneri, & Papagno, 2002). Detection of disease processes at the prodromal stage is considered optimal, as it can influence treatment decisions (Pozueta et al., 2011). Early diagnosis of

dementia allows the family and the individual with dementia to begin service utilization at a time when the patient can still be involved in care decisions (Borson et al., 2013). Early diagnosis also allows caregivers to accept and become adapted to the caregiver role, which may reduce caregiver burden (de Vugt & Verhey, 2013).

The issue of dementia care is becoming increasingly important to the helping professions (Kaplan & Berkman, 2011; Lin, Macmillan, & Brown, 2011; Tranvåg, Petersen, & Nåden, 2013). It is estimated that nearly 70% of all dementia care is provided by unpaid caregivers, typically a family member or loved one (Kaplan & Berkman, 2011). Unpaid caregivers are more likely to experience chronic health conditions, emotional stress and depression, and lower life expectancies than non-caregivers (Kaplan & Berkman, 2011). As such, it is important to understand the implications in providing care to an individual with dementia as well as a theoretical framework for providing such care.

Purpose and Research Questions

The purpose of this study is to assess the psychometric properties of the Mem4Names test utilizing data from a different sample of older adults in order to expound upon the original study. Although the original study reported the Mem4Names test was psychometrically strong, further published data is limited. Lacking such empirical evidence, additional inquiry into the test's properties is warranted. The current study will not only analyze the psychometric properties of the Mem4Names test, but it will also serve to confirm or refute the original study findings. As such, the following research questions will be addressed:

R_1: What is the factor structure of the Mem4Names test?

R_2: What is the internal consistency of the Mem4Names test?

R_3: What is the validity of the Mem4Names test?

Brouillette et al. (2011) reported the Mem4Names test showed favorability towards psychometrically sound properties. However, further examination is needed to explore the psychometric validity of the scale. Brouillette et al. (2011) analyzed convergent validity by assessing the relationship between global scores on the Mem4Names test and those of two measures of verbal fluency, the BNT and COWAT. The Mem4Names test was designed to differentiate between typical and atypical cognition by evaluating deficits in semantic memory (Brouillette et al., 2011). However, the original study solely explored verbal fluency in semantic memory rather than additional arenas. As discussed below, the current study will test the convergent validity of the Mem4Names test by using theoretically similar measures of semantic memory, that is, episodic memory and conceptual knowledge, as opposed to strictly verbal fluency.

CHAPTER 3: METHODOLOGY

Design and Sampling

The current study is a secondary data analysis utilizing a cross-sectional design to investigate the psychometric properties of the Mem4Names test. Data were obtained from the IDRP's longitudinal cognitive studies for 2010. Participants of the longitudinal studies receive annual cognitive testing (Brouillette et al., 2011). As the current study is a secondary data analysis using de-identified data, the Louisiana State University Institutional Review Board granted exemption status. The current study likewise was approved by the Director of the IDRP.

The study sample consists of 133 participants who were enrolled in the IDRP's longitudinal studies in 2010 and were classified as having no cognitive impairment. This study sample was determined by participants' scores on the Uniform Data Set (UDS) neuropsychological battery. The UDS was established by the National Alzheimer's Coordinating Center in 2005 for the purpose of standardizing cognitive test batteries across its 29 Alzheimer's Disease Centers (Weintraub et al., 2009). The UDS is a compilation of neuropsychological tests that assess most cognitive domains affected by dementia and AD (Weintraub et al., 2009) and includes measures such as the Mini Mental Status Examination (MMSE), the Boston Naming Test (BNT), and the Trail Making Test: Part A and B (Brouillette et al., 2011). The study sample characteristics are reported below.

Measures

Mem4Names. As discussed in the literature review, the Mem4Names test was developed in 2009 by IDRP personnel for the purpose of discriminating between typical cognition and that of MCI or early-stage AD (Brouillette et al., 2011). Participants were shown 72 items consisting of facial images of political figures, historical figures, and notable

entertainers (Brouillette et al., 2011). Images were selected on the basis of being easily recognizable to individuals born before 1950. The test was administered using standardized instructions. Participants were advised to provide both the first and last names of each famous person (Brouillette et al., 2011). In lieu of the famous person's full name in the case of recall failure, participants were instructed to provide the context of the individual pictured. Individual items were scored as three subscales dependent upon the participant's ability to spontaneously name the famous person (Correct), provide contextual clues regarding the famous person in the absence of spontaneous naming (Context), and ability to recall the famous person's name if cued (Cued). Participants who were able to spontaneously provide the correct first and last name of the famous person received a score of one for *Correct* and were then administered the next item. Participants who could not provide a response received a score of zero for *Correct* and were asked to provide the context of the famous person. Proper context was determined either by examiner cue (i.e., "What is he/she famous for?") or by spontaneous participant elaboration (Brouillette et al., 2011). Participants who could provide proper context received a score of one for *Context*. Participants unable to give context received a score of zero. After assessing context, participants were then cued with the first name of the famous person and scored based on the ability to provide the last name (Brouillette et al., 2011). Participants who provided the last name of the famous person received a score of one for *Cued*.

Clock Drawing Test (CDT). The CDT was developed in the 1980s for the purpose of measuring visuospatial deficits (Babins, Slater, Whitehead, & Chertkow, 2008) and is considered a useful screening tool for the diagnosis of dementia (Ehreke, Luppa, König, & Riedel-Heller, 2010; Mainland & Shulman, 2013; Seigerschmidt, Mösch, Siemen, Förstl, & Bickel, 2002). The CDT assesses multiple cognitive domains including executive function, visuospatial skills,

and conceptual knowledge (Babins et al., 2008). Participants were given standardized instructions to draw the face of the clock and set the clock to read the time of 11:10 (Babins et al., 2008). Participants were scored based on five main components: overall drawing skills (2 points), placement of clock center (2 points), placement and size difference of clock hands (6 points), clock numbering (6 points), and gross planning ability (2 points; Babins et al., 2008). In order to differentiate between typical and atypical cognition, a cutoff score of 15 out of a possible 18 points has been suggested (Babins et al., 2008). Researchers reported the CDT had a mean sensitivity and specificity of 85% for distinguishing dementia from typical cognition (Babins et al., 2008; Ehreke et al., 2010; Seigerschmidt et al., 2002; Shulman, 2000). Interrater reliability was found to be high (K = 0.92; Nair et al., 2010; Shulman, 2000; Seigerschmidt et al., 2002). Similarly, convergent validity coefficients were significant (r = 0.62) when compared to the MMSE (Seigerschmidt et al., 2002; Shulman, 2000). After extensive study, the CDT has demonstrated to be a psychometrically sound assessment for the diagnosis of dementia (Babins et al., 2008; Ehreke et al., 2010; Mainland & Shulman, 2013; Nair et al., 2010; Schramm et al., 2002; Seigerschmidt et al., 2002; Shulman, 2000). The utility of the CDT for diagnosing MCI is currently being explored. However, researchers found the 18-point CDT is capable of detecting the subtle changes in cognitive performance indicative of MCI (Babins et al., 2008; Ehreke et al., 2010).

Wechsler Memory Scale Logical Memory-Delayed (WMS LM-2). Developed in 1945, the Wechsler Memory Scale (WMS) is one of the most oft-used memory assessments in both clinical and research settings (Theisen, Rapport, Axelrod, & Brines, 1998). The WMS is composed of seven subtests assessing learning, recall, attention, and visuospatial abilities (Prigatano, 1978). In its decades of use, the WMS has shown consistent validity and reliability

for individuals aged 16 to 90 (Cullum, Butters, Tröster, & Salmon, 1990; Johnson, Storandt, & Balota, 2003; Prigatano, 1978; Theisen et al., 1998). Prigatano (1978) found test-retest reliability to be adequate using Cohen's Kappa (0.80). Elwood (1991) reported a reliability coefficient of 0.75 for the Logical Memory-Delayed subtest. Wong and Gilpin (1993) found the WMS correlates highly (r = 0.65) with similar assessments of memory. The WMS has proven useful in measuring cognitive functioning across the life span, as it provides age-adjusted norms and standard scores (Cullum et al., 1990; Theisen et al., 1998). Additionally, the WMS is capable of distinguishing between performance indicative of typical aging from that of dementia (Cullum et al., 1990). Johnson et al. (2003) reported the WMS demonstrated 84% sensitivity and 87% specificity. Because the WMS has repeatedly demonstrated sound psychometric properties, the National Alzheimer's Coordinating Center included select subtests into the UDS battery (Weintraub et al., 2009). The WMS LM-2 subtest assesses both immediate and delayed verbal recall. Participants were read a story consisting of 25 story elements then asked to provide any information remembered (Bell, 2006). Participants were scored on the ability to provide verbatim recollection of the story, with each recalled unit receiving a score of one (Bell, 2006; Johnson et al., 2003). After a 20- to 30-minute delay, participants were again asked to provide any story elements he or she recalled. Raw scores were summed. Performance on the WMS LM-2 subtest is utilized in the current study, as delayed recall of verbal material shows more significant impairment in individuals with atypical cognition than immediate recall (Hodges & Patterson, 1995).

Analytic Plan

Descriptive statistics. Descriptive statistics are reported for all standardized psychometric assessments stated previously. For all parametric variables, means, standard

deviations, and, where applicable, raw scores are reported. Frequencies and percentages are reported for all non-parametric variables.

Research questions. All statistical analyses were performed using SPSS software version 22.0 (Statistical Package for the Social Sciences™, 2013). Confirmatory factor analysis (CFA) was utilized to explore the factor structure of the Mem4Names test. CFA was performed in order to confirm or dispute the results from exploratory factor analysis conducted by Brouillette et al. (2010). As each item on the Mem4Names test is nominal, categorical principal components analysis was analyzed using the CATPCA command in SPSS. Reliability of the Mem4Names test was calculated using Cronbach's alpha and Guttman's split-half coefficient. Convergent validity was analyzed via zero-order correlations to assess the relationship between global scores on the Mem4Names test and theoretically similar measures: the CDT and WMS LM-2. Reliability and validity is reported using Pearson's *r*.

CHAPTER 4: RESULTS

Descriptive Statistics

Sample characteristics. As reported earlier, the study sample was composed of 133 participants who were enrolled in the IDRP's longitudinal studies in 2010. The sample was primarily well-educated (M = 16 years, SD = 2.53) Caucasian (90.2%) females (70%) with an average age of 67 years (SD = 8.05).

Psychometrics. The means and standard deviations for the Mem4Names test, CDT, and WMS LM-2 are reported in Table 1.

Table 1. Descriptive statistics for instrumentation

Variable	Range	*M (SD)*
Mem4Names		
Correct score	0-72	55.7 (13.25)
Context score	0-72	10.3 (7.64)
Cued score	0-72	12.7 (7.69)
Clock Drawing Test	0-18	16.8 (1.34)
WMS Logical Memory-2	0-25	13.3 (3.23)

Research Questions

The factor structure of the Mem4Names test was assessed using confirmatory categorical principal components analysis. A minimum eigenvalue was set at 1.0 with no limitation on the number of possible factors (Ledesma & Valero-Mora, 2007; Zwick & Velicer, 1986). One item (Abraham Lincoln) was removed from analysis due to lack of variability. Therefore, factor analysis was conducted on 71 items. Eigenvalues between the first factor (14.96) and second factor (3.80) confirmed that Mem4Names Correct items load on the same factor. Of the 71 items evaluated, 22 items had eigenvalues greater than 1.0.

A common practice in statistical analysis is to employ the Kaiser criterion (Floyd & Widaman, 1995), that is, interpret only those factors with eigenvalues greater than 1.0 (Fabrigar,

Wegener, MacCallum, & Strahan, 1999; Ledesma & Valero-Mora, 2007; Zwick & Velicer, 1986). However, researchers have proposed that this method overestimates the number of major components, thus leading to misinterpretation of the data (Ledesma & Valero-Mora, 2007). Due to the large number of items with eigenvalues greater than 1.0, the scree test method was utilized to determine the number of applicable factors (Ledesma & Valero-Mora, 2007; Zwick & Velicer, 1986). The scree test is a visual way to plot the eigenvalues of factors in order to examine their slope (Fabrigar et al., 1999; Floyd & Widaman, 1995). Eigenvalues at or above the elbow of the graph are retained (Fabrigar et al., 1999; Floyd & Widaman, 1995). Inspection of the scree plot in Figure 1 confirms a single factor is appropriate. This single factor accounted for approximately 20% of the variance.

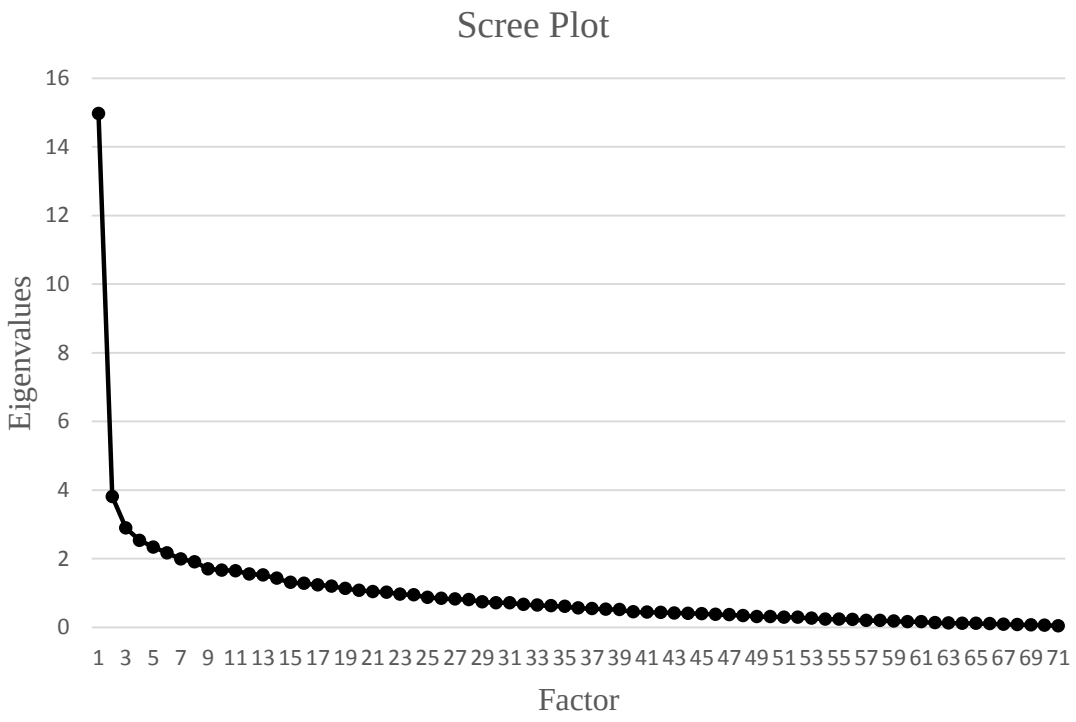

Figure 1. Principal Component Analysis

Reliability was calculated utilizing Cronbach's alpha and Guttman's split-half coefficient. Both Cronbach's alpha (0.94) and Guttman's split-half (0.95) were high, indicating excellent internal consistency reliability. Correlation coefficients were calculated between Mem4Names Correct scores and two theoretically similar tests, the CDT and the WMS LM-2, to test for convergent validity. The correlation coefficient was significant for the WMS LM-2 (r = 0.42) at the 0.01 level. However, the correlation between the CDT and the Mem4Names test was not significant.

CHAPTER 5: DISCUSSION

Review of Results

Similar to the original study reported by Brouillette et al. (2011), this study found the Mem4Names test showed favorability towards psychometrically sound properties. The results of the current study's factor analysis are consistent with those of the original study. This study likewise found a one-factor solution within the Mem4names test. Roughly 20% of the variance was accounted for with this single factor. Brouillette et al. (2011) found a similar level of variance: 27%. While there is agreement between the current and original studies regarding factor structure, there is a question of what accounts for the unexplained variance of the scale. It is possible that the large number of scale items created potential error by including too many items that measured the same factor (Floyd & Widaman, 1995). Fabrigar et al. (1999) also suggested that a homogenous sample can result in low estimates of factor loadings. In light of this, some refinement is needed to enhance the factor structure of the test. One solution would be to eliminate factors with eigenvalues less than 1.0. The researchers isolated approximately 13 scale items meeting this criteria. Although outside the scope of the current study, future analysis should focus on investigating the factor structure of the Mem4Names test.

Both Cronbach's alpha and Guttman's split half coefficients exceeded the recognized cut-off of 0.70 (Bello-Haas, Klassen, Sheppard, & Metcalf, 2011). These results approximate those reported by Brouillette et al. (2011). Therefore, this study confirms the reliability of the Mem4Names test.

Researchers have agreed that correlation coefficients between 0.30 and 0.50 exhibit moderate correlational strength (Divaris, Vann, Baker, & Lee, 2012; Evans, 1996; Mukaka, 2012). Therefore, the correlation between the WMS LM-2 and Mem4Names ($r = 0.42$, $p < .01$)

was statistically significant. The results indicate that the Mem4Names test is theoretically similar to a measure of memory, and not just that of verbal fluency as was originally tested by Brouillette et al. (2011). Researchers have noted that memory, both episodic and semantic, are affected early in the disease process and gradually worsen over time (Greene et al., 1995; Grilli & Verfaellie, 2014; Holzer et al., 2013). Furthermore, researchers found that impairment on measures of episodic and semantic memory, including famous face recognition, was predictive of cognitive decline (Dudas, Clague, Thompson, Graham, & Hodges, 2005; Hantke et al., 2013) The results from this study agree with previous research into semantic memory, which indicated episodic memory and semantic memory are linked (Dudas et al., 2005; Hantke et al., 2013). The validity of the scale was also supported by the single factor structure solution noted through factor analysis.

While the Mem4Names test was significantly correlated to the WMS LM2, the correlation between the Mem4Names test and the CDT, a measure of conceptual knowledge, was not significant. This may be due to the complexity of the CDT. The CDT assesses multiple cognitive domains including executive function, visuospatial skills, and conceptual knowledge (Babins et al., 2008). While the CDT examines conceptual knowledge in semantic memory, it is possible that executive function is the primary cognitive domain measured (Libon, Malamut, Swenson, Sands, & Cloud, 1996).

Social Work Implications

The results of the current study confirm that the Mem4Names test has favorable psychometric properties. As a result, the Mem4Names test is capable of effectively measuring semantic memory performance in individuals without cognitive impairment. Deficits in semantic memory have been observed in the pre-clinical stages of dementia (Grabowski, 2008;

Greene et al., 1995; Grilli & Verfaellie, 2014; Hodges & Patterson, 1995). Additionally, impairment in semantic memory has been described as a predictor of AD conversion (Blackwell et al., 2004; Carter et al., 2012; Pozueta et al., 2011). Famous face recognition is well documented as a measure of semantic memory (Thompson et al., 2002; Estévez-González et al., 2004; Frank et al., 2011; Werheid & Clare, 2007). Therefore, it is paramount to continue investigating the utility of assessing semantic memory in the context of providing early detection of disease processes. Early detection of cognitive impairment is optimal as it influences treatment decisions (Pozueta et al., 2011), allows service utilization to begin when the patient can participate in care decisions (Borson et al., 2013), and may provide caregivers an opportunity to accept and become adapted to the caregiver role, thus reducing caregiver burden (de Vugt & Verhey, 2013).

Social workers are increasingly being called upon to provide practical, educational, and therapeutic services to both individuals with AD and their caregivers and family members (Kaplan & Berkman, 2011). Social workers may aid in advance care planning (Robinson et al., 2011), and serve as liaisons between legal, health care, and community services (Kaplan & Berkman, 2011; Ray et al., 2014). As discussed prior, resource utilization is most effective during the earliest stages of disease processes (Borson et al., 2013). There may be conflict between AD caregivers and care recipients if it is thought the care recipient cannot take responsibility for his or her decisions (Brannelly, 2011). Social workers are poised to provide care that is respectful of an individual's right to self-determination (National Association of Social Workers, 1999) while also balancing the needs of both the caregiver and care recipient (Tranvåg, Petersen, & Nåden, 2013).

In light of the importance of early service utilization in managing AD-related behaviors, it is vital that researchers develop reliable and valid measures that differentiate between prodromal AD and typical cognition. Instruments capable of detecting deficits in semantic memory have been the focus of current research (Dudas et al., 2005; Hantke et al., 2013, Li et al., 2011; Thompson et al., 2002). Researchers have concluded that famous face recognition is vulnerable to deficits in semantic memory (Dudas et al., 2005). Furthermore, Hantke et al. (2013) found that assessments of semantic memory, as opposed to those of episodic memory, are less taxing on the test-taker while at the same time providing more accurate predictive potential. Since deficits in famous face recognition have been linked to AD development, further investigation into the utility of measures such as the Mem4Names test is warranted as a means to provide early detection.

Limitations and Future Research

The current study has several limitations relating to the homogeneity of the study sample utilized. The majority of participants in the current study were Caucasian women. Education was also high in the study sample, with a mean level of education at 16 years. While the current study included a larger non-White population than the original study, approximately 90% of participants in the study sample reported being Caucasian. The lack of diversity in the study sample may limit the ability to generalize the results to the general population. Yancey, Ortega, and Kumanyika (2006) stated that racial and ethnic minority populations are generally more hesitant to participate in research studies. This reluctance leads to a disparity in health-related research (Yancey et al., 2006). Since AD affects African Americans and Hispanics at significantly higher rates than Caucasians (Alzheimer's Association, 2014), future research should focus on recruiting a more racially/ethnically diverse population. Previous studies found

that in order to conduct research within minority populations, researchers should focus on eliminating barriers to participation (Ejiogu et al., 2011; Odierna & Bero, 2014). Such barriers can include transportation, motivation, perceived benefit, and the environment (Ejiogu et al., 2011; Odierna & Bero, 2014). The authors recommended a community-based approach to conducting research in order to improve racial/ethnic diversity (Ejiogu et al., 2011; Odierna & Bero, 2014).

A second limitation relates to the attributes of those who generally participate in research studies. Bhamra, Tinker, Mein, Ashcroft, and Askham (2008) asserted that individuals who participate in volunteer AD research are inherently different than the general population. Individuals who participate in research are more likely to have higher educational attainment, and higher socio-economic status than those who do not participate in research. Additionally, individuals who volunteer for research studies are more likely to do so for altruistic reasons, rather than for monetary benefit (Ejiogu et al., 2011). According to Brayne and Davis (2012), the preponderance of AD research has utilized volunteer participants in clinical settings. The authors stated that the generalizability of current AD research can be called into question due to *selection bias* (Brayne & Davis, 2012). This reinforces the necessity to explore the efficacy of the Mem4Names test among more diverse samples.

While the current study confirmed the psychometric properties of the Mem4Names test, it did not explore the scale's ability to discriminate between groups of differing cognitive performance. The current study assessed the Mem4Names test using only cognitively intact individuals. Future research should investigate the predictive validity of the Mem4Names test. A study sample similar to the original study may provide greater insight into the utility of the Mem4Names test in discriminating cognitive performance. Likewise, future research should

investigate the utility of clinical cut-off scores. The original study examined cut-off scores in order to differentiate between non-impaired cognition and that of MCI and AD (Brouillette et al., 2011). Furthermore, these cut-off scores exhibited high sensitivity and specificity in distinguishing between typical cognition and that of MCI and AD (Brouillette et al., 2011). Additional exploration into both of these areas will be useful in establishing normative data for the Mem4Names test.

Conclusion

Approximately 35 million individuals over the age of 60 have AD or other dementias (Alzheimer's Association, 2014; Prince et al., 2013). By 2030, it is projected that approximately 66 million individuals will be diagnosed with a form of cognitive impairment (Prince et al., 2013). In light of this exponential growth, it is imperative that researchers continue investigating cognitive assessments that provide early detection of neurocognitive disorders, such as AD. The purpose of this thesis was to re-assess the psychometric properties of the Memory for Names test. This test is a measure of semantic memory that was developed for the purpose of discriminating between non-impaired cognition and that indicative of MCI or AD. Deficits in semantic memory are seen early in the disease process and are considered a risk factor for AD conversion (Blackwell et al., 2004; Carter et al., 2012; Pozueta et al., 2011). Consequently, current research trends are focusing on tests of semantic memory as a method of providing early detection. The Mem4Names test was shown to be a reliable and valid measure of semantic memory. However, future research is needed to explore its ability to provide early detection of disease processes.

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APPENDIX: LSU IRB APPROVAL

ACTION ON EXEMPTION APPROVAL REQUEST

Institutional Review Board
Dr. Dennis Landin, Chair
130 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu | lsu.edu/irb

TO: Heather Foil
Social Work

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: November 16, 2015

RE: IRB# E9657

TITLE: Psychometric Extension of the Memory for Names Test

New Protocol/Modification/Continuation: New Protocol

Review Date: 11/16/2015

Approved X **Disapproved**

Approval Date: 11/16/2015 **Approval Expiration Date:** 11/15/2018

Exemption Category/Paragraph: 4a

Signed Consent Waived?: N/A

Re-review frequency: (three years unless otherwise stated)

LSU Proposal Number (if applicable):

Protocol Matches Scope of Work in Grant proposal: (if applicable)

By: Dennis Landin, Chairman

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. **SPECIAL NOTE:**

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb*

VITA

Heather Chance Foil was raised in Baton Rouge, Louisiana. She graduated from Louisiana State University in 2005 with a Bachelor of Science degree in psychology and sociology. Following graduation, she began her career as a psychometrist at The Neuromedical Center, thus stimulating her interest in Alzheimer's disease. In 2009, Heather joined her mentor, Robert Brouillette, as a research associate at Pennington Biomedical Research Center's Institute for Dementia Research and Prevention. She currently works on clinical drug trials for the treatment and modification of Alzheimer's disease. She is a candidate to receive her Master in Social Work in 2016 from Louisiana State University. Heather plans to continue her work in the field of Alzheimer's research.