To Examine the Relationship Between Neuropsychological Tests of Executive Functioning and Living Independently

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Abstract

The purpose of this study was to examine the utility of neuropsychological tests of executive functioning in predicting an individual's ability to live independently. Ninety-seven participants underwent a brief neuropsychological battery (subtests from the Delis Kaplan Executive Functioning System) as well as an assessment of independent living. A multiple regression analysis indicated that the Trail Making Test was the only significant predictor of living independently. As a result, tests of executive functioning should not solely be used as predictors of living independently. Future research should focus on assessing other areas of brain functioning, specifically, memory, processing speed, language and visual spatial to determine an individual's functional capabilities.
To Examine the Relationship between Neuropsychological Tests of Executive Functioning and Living Independently.

By

Steven Paul Greco

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Chapter I

INTRODUCTION

In the year 2000, the United States Department of Health and Human Services reported that older adults (age 65+) represented 13% of the United States population. It is estimated that by 2030 there will be approximately 70 million older adults, more than twice the number in 1999, equaling 20% of the United States population (United States Department of Health and Human Services, 2000). Factors contributing to this significant increase include an aging population led by baby boomers, as well as advancements in medical technology that have extended the human life span. As a result of this increase in life expectancy, older adults are now subjected to a rise in medical ailments (Marson, 2002). For example, Marson (2002) reported that the incidence of dementia has increased substantially over the past 15 years due to advancements in the medical field. The International Neuropsychological Society defines dementia as “a general loss of cognitive functions resulting from cerebral disease occurring in clear consciousness. The decline must be of sufficient magnitude to impair social or occupational function. Memory impairment is required for diagnosis, with at least one additional areas of impairment present such as aphasia, apraxia, agnosia, or impaired executive functioning (Loring, p. 101).”

The causes of dementia include, but are not limited to: static lesions, traumatic brain injury or progressive diseases such as Alzheimer’s, Parkinson’s, Huntington’s, Creutzfeldt-Jakob, Korsakoff’s, Vascular (Multi-Infarct), and Lewy Body disease. The etiology of dementia is classified by a number of factors,
which include the progression of the disease, affected area of the brain, molecular substrates (plaque & tangles), and manifestations among other causes (Snyder & Nussbaum, 2000). Although the causes of the disease may vary greatly, there is one constant: all forms of dementia are progressive, which means an individual’s cognitive facilities become more impaired as time evolves.

Symptoms of a dementing process can present extreme variations, from frontal impairments (self-regulation, planning, and abstraction) to motor deficits (tremors). It is inevitable that at some point insight and judgment will become compromised. As a result, an individual will exhibit difficulties in his/her decision-making abilities, which could eventually lead to complete loss of insight and judgment. The precise point in which an individual loses his/her insight and judgment is unknown.

Presently, there is a great need to establish protocol that will enable healthcare professionals to precisely identify when and if this loss of insight/judgment has occurred. Moreover, the identification of impairments in judgment and decision-making can influence an individual’s autonomous being. Hypothetically, if an individual has established insight and judgment impairments, does this mean that the same individual does not have the ability to consent to medical treatment, drive a car, or live independently? This question has not been fully addressed nor agreed upon by the medical community.

The aging population presents a myriad of needs which can affect an individual’s competency abilities. For example, the ability to drive, to give consent to participate in research, to make medical decisions, to establish
appropriate guardianship, to make financial decisions and to live independently all fall under the umbrella term of “competency.” This concept presents an important clinical, ethical, and legal dilemma. Clinically, a formal accepted standard of evaluation and assessment of competency has yet to be agreed upon. The ethical standpoint is even more complex. The process of making decisions for oneself ultimately defines a person’s autonomy. Therefore, not only does the healthcare professional need to consider what rendering one “incompetent” does to a person’s autonomy, but also the ramifications resulting from not identifying an individual’s incompetence. From a legal standard, the law recognizes the need to develop an agreed-upon standard of assessment and care. New Jersey State law explicitly states that an individual must meet “minimum mental capabilities” and health care professionals must properly conduct such an evaluation that would be reliable and representative of an individual’s competency (Wulach, 1998).

Certain conditions can directly affect whether an individual is deemed incompetent. For example, the psychiatric condition of schizophrenia and organic conditions, like dementia and severe traumatic brain injury, could compromise the competency of an individual. Moreover, people with developmental or acquired disabilities may never possess the capabilities to make personal decisions. With these conditions in mind, Wulach (1998) contended that the state through exercise of its protective “parens patriae” power, may deem these persons incompetent and appoint substitute decision makers. Therefore, once an individual is deemed incompetent, his/her ability to make choices and his/her rights as an adult are essentially stripped away.
This "parens partriae" brings forth a very important question: if an individual is diagnosed with dementia, at what stage of regression does a mental health professional determine that he or she is deemed incompetent? The law asks for health care professionals to conduct a proper evaluation, yet neglects to discuss procedural/assessment criteria. Furthermore, by law one must meet "minimum mental capabilities." However, the law fails to delineate precisely what the foregoing definition means. For example, with regard to dementia, would a classification of mild dementia meet the criteria of "minimum mental capabilities" and how does one go about measuring an individual's capabilities?

Historically, the endeavor of competency assessment was the primary responsibility of physicians. However, more recently, this responsibility has become a major concern for neuropsychologists. A neuropsychologist, according to the National Academy of Neuropsychology (2002), is an individual with specialized training in brain behavior relationships. As a result of his/her specialized training, one duty of a neuropsychologist is to determine the functional capabilities of an individual who has a cognitive disability. Beyond tests of competency in older adults, neuropsychologists also evaluate competency secondary to head injuries, stroke, and determine readiness of re-entry into the work force, among other things.

*The Role of Competency*

The term competency is both a medical and legal construct that has been used in many types of contexts. Competency concerns an individual's legal capacity to make certain decisions and to perform certain acts (Marson, 2001).
The law states that adults have the capacity to exercise choices and make decisions, until proven otherwise (Appelbaum & Roth, 1991). The law does not clearly delineate who (physician, psychologist, judge, and so forth) or what exactly can determine the criteria that meets “until proven otherwise.” Hence, there is not a recommended set of guidelines that has been approved from a legal standard.

The law further states that competencies should be regarded as specific or general. General competency is defined as the capacity to manage all of one’s affairs in an adequate manner (Appelbaum & Roth, 1991). In view of the foregoing definition, the question that needs to be addressed is: how exactly does a mental health professional define adequate manner? Although New Jersey State law fails to qualify the term, the United States Supreme Court clearly recognizes the need for statistically significant sensitivity, specificity, reliability, and validity of assessments. Specifically, in the case of Daubert vs. Merrell Dow Pharmaceuticals (1993), the Supreme Court asserted that any assessment measure, if deemed permissible in court, must follow certain standards. The Supreme Court recommended the following standards (Dixon & Gill, 2002):

a) Scientific theory can be tested and replicated.

b) Scientific theory has been published and reviewed by peers.

c) The potential error rate has been defined (falsifiability standard).

d) The scientific theory has been generally accepted in the relevant scientific community.

e) Expert testimony follows the scientific methodology of that field.
f) Scientific theory and assessment have sufficient reliability and validity.

Conversely, specific competencies aim at distinct functional capabilities that an individual can perform. Some examples of specific competencies are the ability to make a will, operate a vehicle, participate in research, provide medical consent, and manage one's financial affairs (Marson, 2002). The previous examples need to be considered before one is deemed incompetent because they do not entail one unitary set of cognitive functions. For example, driving a car and giving consent to medical research are two entirely different functional tasks. Driving a car entails both cognitive and physical capabilities, whereas giving medical consent requires decision making, without concern for processing speed, visual spatial abilities, motor coordination, among other cognitive and primary/psychomotor abilities. The individual who is being assessed for both the ability to drive a car as well as to give medical consent is utilizing different areas of cognitive functioning. Therefore, to use the term "competency" to describe the two preceding conditions is an inaccurate generalization. Considering there are multiple areas of competency, one should not state "Is he or she incompetent?"; rather one should state, "Is he or she incompetent to stand trials, make a will, consent to research, live independently?"

Over the past 15 years the medical-legal context has recognized the importance of determining limited competency. With the advent of limited competency, an individual may have the capacity to perform some actions but not others. This concept is exemplified in Marson's (2001) statement, "a mildly demented Alzheimer's patient may no longer be able to handle more complex
investment and financial decisions, but might still be able to write checks and handle small daily sums of money” (p. 271). As a result, this individual would be labeled as having limited competency to manage his or her financial affairs, rather than labeled as being wholly incompetent.

*Assessment of Competency: Where Do We Stand Today?*

There are many limitations of objective testing for competency. To begin with, established tests for competency are limited in number. For example, the *Compendium of Neuropsychological Tests, 2nd Edition*, by Spreen and Strauss (1998) is a compilation of the most widely used neuropsychological tests. The main areas of assessments include: intellectual (adults and children), achievement, executive, attention, memory, language, visual spatial, tactile, motor, personality, occupational, and symptom validity. The area of competency as an assessment domain is not recognized. In fact, the only listed assessments for competency are the Independent Living Scale and the Functional Behavioral Assessment (Spreen & Strauss, 1998). Another limitation of objective assessment in competency is the methodological problem of construct validity. As stated above, tests that are established today still focus on competency as an *all or nothing phenomenon*. It is clear that in order to assess an older adult, it is important to delineate the individual’s specific abilities that measure specific constructs, respectively.

According to Kapp and Mossman (1996), devising a measure that assesses competency is a task that is unable to be ascertained. Kapp and Mossman stated that the field of neuropsychology is still trying to find the one test, otherwise known as a “capacimeter” that will be able to determine an individual’s
competency. A test that will be able to predict functional abilities is clearly too narrow. As a result, many neuropsychologists administer a series of tests and predict from the results of the data whether an individual is capable of performing specific competencies (i.e. independent living skills, financial capabilities, participation in research, consent to medical treatment, etc).

The need to create new scales that will properly assess this medical/ethical/legal construct has become an endeavor for neuropsychologists. This role started in 2000 with the creation of Daniel Marson’s two tests that assess an individual’s specific competency ability (Marson, 2000). The constructs of Marson’s two areas of competencies are the permission to make medical decisions as well as execute financial decisions. Even though these tests are purported to measure the preceding two competency abilities, it is still not accepted that neuropsychologists will use these assessments as part of their standard assessment. In other words, the uniform agreement that specific competency assessments will become part of the comprehensive neuropsychological assessment is still not agreed upon (Marson, 2001).

Therefore, in conjunction with devising new specific competency measures, it is also important for neuropsychologists and researchers to continue to study the relationship between the predictability of neuropsychological test results and specific functional abilities of older adults.
Critique of Current Literature: Do Neuropsychological Tests Predict an Individual's Specific Competency Abilities?

Evaluations of the current research suggest that the concept of assessing competency through individual competency tests or through traditional neuropsychological tests is still very unclear. There is a body of research that supports the concept that neuropsychologists should utilize one measure that is designed to assess competency. Yet, there is a contending body of research that argues that one test can not accurately identify competency because it is inadequate and too narrow. Conversely, established neuropsychological measures could properly identify those individual's with cognitive impairments and theoretically predict from that data the individual's competency ability. Despite the disparity between the contending views on utilizing either one competency measure or a series of neuropsychological assessments, the researchers clearly emphasize and agree that further research in this area is critical. As a result, the following is an exhaustive list that examines this critical debate the findings of which are reviewed below.

Spreen and Strauss (1998), discuss the limitations of neuropsychological testing as predictors of specific competency ability. For example, the ability to distinguish whether an individual with mild dementia has the capabilities to drive a motor vehicle is often an issue of concern for the patient, caregiver, and the referring psychologist or physician. Neuropsychological tests do not provide direct information about the ability to drive safely; although in instances of severe impairment it is obvious the individual should not drive (Spreen & Strauss, 1998).
Hartje et al. (1991) supported Sreen and Strauss’ position in their contention that driving ability could not be reliably judged from neuropsychological test results. Nonetheless, more research is needed to determine functional capabilities of other specific abilities in neuropsychological tests (p. 36).

Barberger-Gateau, Colette, Rouch, Letenneur, and Francois-Dartigues (1999) examined the predictability of neuropsychological tests on Instrumental Activities of Daily Living (IADL). Instrumental activities of daily functions are concerned with a person’s ability to cope with his or her environment in terms of adaptive task. Activities of daily functioning include both instrumental and physical self-maintenance. These activities vary however in that instrumental self-maintenance requires greater complexity of neuropsychological organization than physical self-maintenance or activities of daily living. Tasks that define IADL are such as using a telephone, shopping, using a mode of transportation, responsibility for taking one’s own medication, handling one’s finances and living independently. Barberger-Gateau et al. (1999) stated that neuropsychological tests were not made to predict functional capabilities. According to Barberger-Gateau et al. (1999), there have only been a few studies that conducted a positive relationship between neuropsychological tests and functional abilities within the dementia population. However, of these few studies, Barberger-Gateau et al. (1999) proposed a limitation to the methodology due to the inadequately defined or identified specific functional ability assessed.

Bennett (2001) reported that neuropsychological tests were not designed to predict an individual’s functional abilities: “Test data taken alone often lack
ecological validity” (p. 454). Bennett reported the ecological validity of neuropsychological testing could only be done by observing the individual perform the specific competency in question. For example, if one is to assess an individual’s cooking ability, the individual must be observed performing this specific task. Therefore, it is essential to watch an individual perform his/her normal activities, in order to determine functional impairment. Bennett (2001) suggested that along with neuropsychological data a professional such as a speech or occupational therapist could provide qualitative information that could help the neuropsychologist make the prediction of functional abilities.

Robert Sbordone (1998) has completed significant research on the relationship between neuropsychological tests and real world functioning, otherwise known as ecological validity. His research has focused on the functional assessment of both traumatic brain injury (TBI) and dementia. He reports several limitations of using neuropsychological tests as predictors of functional abilities. Specifically, he stated, “While neuropsychological tests have been designed to identify cognitive impairments stemming from a brain insult and their severity, the vast majority of these tests were never designed to predict how these patients were likely to function in real-world settings, live independently, return to work, or maintain competitive employment (p. 121). Sbordone (1998) reported that there is a great need to design assessments that will adequately determine an individual’s actual functional ability.

Richardson, Nadler, and Malloy (1995) also examined the relationship between neuropsychological tests and competency ability and found positive
predictive results. The neuropsychological measures used were the Boston Naming Test, Hooper Visual Organization Test, Controlled Word Association Test, Logical Memory, & Visual Reproduction (WMS-R). The results suggest that neuropsychological measures positively correlated with four out of the five activities of daily living. The strongest correlative relationship with activities of daily functioning was that of visual spatial and memory abilities. More important, the findings also suggest that the cognitive area of executive functioning abilities is the least correlated with activities of daily living.

There were several limitations to the above study. To begin with, the test produced moderate to low levels of sensitivity in detecting impaired activities of daily living (ADL) when impairment was present. Thus, when cognition is impaired, one can observe an effect or impact on ADL. But ADL decline can also occur for other reasons as shown by Richardson’s et al. (1995) study in the presence of intact cognition. Clearly, one can conclude that whereas neuropsychological evaluations can be used to predict ADL functioning, they are not a substitute for actual assessment of daily living skills.

Paul, Cohen, Moser, Zawacki, Ott, Gordon and Stone (2002) further examined the relationship between neuropsychological tests and independent living skills. They too found significant correlations between Global Deterioration Scale ratings and performance on cognitive tests. These findings supported Richardson’s et al. (1995) study in which measures of memory abilities correlated the highest when compared to activities of daily living. In addition, Bell-McGinty, Podell, Franzen, Baird, and Williams (2002) also supported Paul et
al.'s (2002) study that neuropsychological tests positively predicted one's ability to live independently.

Recent work that examined the relationship between competency and scores on traditional neuropsychological measures has shown promising results. Not only has there been a conflict as to how one should properly assess competency, but also how to determine which cognitive domain best predicts an individual's ability to live independently.

*The Relationship between Executive Functioning and Living Independently*

Neuropsychologists who work in the context of rehabilitation with older adults are frequently asked to evaluate an individual's cognitive profile. The results from the neuropsychological tests enable the practitioners to understand whether there are any cognitive impairment in the general domains of processing speed, attention concentration, language, visual spatial, memory and executive functioning. Moreover, the results of the data purport levels of severity in cognitive functioning. Therefore, results from a neuropsychological assessment provide valuable information that helps practitioners assist an individual’s living situation, decision making abilities, and discharge plans. Recently, especially within the rehabilitation context, neuropsychological assessments have played an increasing role in delineating an individual’s cognitive strengths and weaknesses in order to address functional issues such as estimating one’s ability to drive, return to work, live independently, and handle his/her finances (Bell-McGinty, Podell, Franzen, Baird, & Williams, 2002).
Examining the relationship between neuropsychological assessments and an individual’s functional abilities began in the early 1990s. Original research that examined the relationship between neuropsychological tests and functional abilities focused on examining memory. The results from these studies were indecisive and inconclusive. Researchers hypothesized that traditional memory tests failed to examine an individual’s ability to monitor his/her environment or assess an individuals’ decision making abilities, which are both crucial behaviors to live independently (Bell-McGinty et al., 2002).

With advancements made in better understanding the role of executive functioning, research has contended that executive functioning plays a vital role when assessing an individual’s ability to live independently. Specifically, Bell-McGinty et al. (2002) reported that executive functioning is generally defined as the ability to independently perform complex, goal-oriented and self-serving behaviors (p. 828). Similarly, instrumental activities of daily living are defined as complex, real-world adaptive human behaviors that require independence, volition, organizational abilities, judgment and sequencing (Bell-McGinty et al. 2002, p. 828). As a result, in order to properly assess an individual’s ability to live independently, one should measure or assess his/her executive functioning abilities. Therefore, if an individual acquires impairments in executive functioning abilities, one can assume his/her reasoning abilities, self-control, and decision making will be compromised, thus affecting the individual’s ability to live independently. Conversely, if an individual has difficulty living
independently, then one should find impairments in his/her executive functioning abilities.

The Need for Additional Research

The current study will examine the relationship of common neuropsychological assessments of executive functioning as predictors of independent living skills. Today there is not an accepted clinical consensus on how to assess daily functional abilities. Furthermore, research continues to divide competency into separate functional abilities, which provides a greater demand on tests that can establish significant statistical sensitivity and specificity.

The recent research findings are ambivalent about the predictability of neuropsychological assessment for independent living skills. Currently it is evident that neuropsychologists do not regularly use competency measures as part of their standard battery when evaluating the older adult population (Sbordone, 1998). Hence the importance of this study is to further explore the predictability of neuropsychological tests with independent living skills.
Research Questions

1. Will neuropsychological tests, specifically those of executive functioning, positively correlate to an individual’s ability to live independently?

2. Will performances on executive functioning measures be able to predict an individual’s ability to live independently?

Research Hypotheses

1. There will be a positive relationship between scores on the Delis-Kaplan Executive Function System tests—Trail Making Test, Verbal Fluency, Sorting Test, Tower Test, Design Fluency and Digit Span (Wechsler Adult Intelligence Scale-Third Edition) and the Independent Living Scale.

2. The following executive functioning measures, Trail Making Test, Sorting Test, Tower, Test, Design Fluency and Digit Span will significantly predict an individual’s ability to live independently, as measured by the Independent Living Scale.

2a. Of all the executive functioning measures, Verbal Fluency will be the weakest predictor of an individual’s ability to live independently, as measured by the Independent Living Scale.
Definition of Terms

Neuropsychology- A branch of psychology which deals with brain-behavior relationships and measurement of the manifestations of brain functions (Loring, 1999, p. 114).


Neuropsychologist- is an individual with specialized training in brain-behavior relationship.

Competency- capacity to make personal decisions and manage one’s financial affairs. Legal competency is determined by the courts, usually with input from healthcare professionals in cases of neurological impairment (Loring, 1999, p. 41).

Activities of Daily Living Skills- skills necessary for independent or semi-independent living. Instrumental activities of daily living skills include the abilities to use the telephone, shop, prepare food, perform housekeeping tasks such as laundry and handling finances, and take medication responsibly (Loring, 1999, p. 12).

Frontal Lobe- brain area anterior to the central sulcus and superior to the Sylvian fissure. It is divided anatomically into motor, premotor, and prefrontal areas. The gyrus in the posterior frontal lobe containing pyramidal cells that provide the primary outflow for voluntary motor function (Brodmann’s area 4) is called the motor area. The premotor area is anterior to the precentral gyrus. It consists of motor association cortex and is involved with volitional muscle
activity of the contralateral side (Brodmann’s areas 6 and 8). The supplementary motor area (SMA) is located in the medial premotor cortex. Anterior to the premotor area is the prefrontal cortex. It is the largest of these three frontal regions and consists of a significant portion of the lateral and medial frontal cortex, and the entire orbital cortex (Loring, 1999, p. 36).

Executive Functioning- cognitive abilities necessary for complex goal-directed behavior and adaptation to range of environmental changes and demands. It includes the ability to plan and anticipate outcomes (cognitive flexibility) and to direct attentional resources to meet the demands of non-routine events. Many conceptualizations of executive function also self-monitoring and self-awareness since these are necessary for behavior flexibility and appropriateness. Cerebral localization also remains elusive and controversial. Regions of the prefrontal cortex may play a special role in recruiting other brain areas in a series of distributed networks that handle different components of executive functions, depending upon the processing demands of the specific task (Loring, 1999, p. 64).

Independent Living Scales (ILS)- is an individually administered assessment of adults’ competence in instrumental activities of daily living (Loeb, 1996, p. 1)
Chapter II

REVIEW OF RELATED LITERATURE

In 1998, 70 million people were age 80 or older; this number is expected to reach 370 million persons by 2050, an almost six-fold increase (Schultz, 2000). As a result of this dramatic increase, older adults will face the inevitable deterioration of cognitive decline, which has an estimated prevalence of 3 to 11 percent in community dwelling persons over age 65 (D’Epiro, 1999). This age group is increasing and therefore the number of older adults with cognitive or thinking difficulties will subsequently increase as well. One reason for this drastic increase is due to the tremendous growth and advancements within the medical field, specifically psychopharmacology. The medical field is slowly preparing for the rise of medical ailments; one most notably will be dementia.

Dementia is a neurological condition that affects nearly 2.2 million people a year (Schachter & Davis, 2000). Symptoms of a dementing process include, but are not limited to: memory loss, language impairments, motor dysfunction, poor judgment, abstract thinking deficits, difficulties learning new information, and sensory impairments (Schachter & Davis, 2000). Along with cognitive deficits, people with dementia also suffer from co-morbid psychological and emotional symptoms. For example, some emotional symptoms include but are not limited to, anxiety, depression, and delusional/hallucinational thinking (paranoia, or suspiciousness).

There are several ways in which these symptoms cause functional difficulties in everyday activities. For example, people with dementia may
frequently get lost in familiar and especially unfamiliar environments, forget common occurrences (i.e. appointments, people’s names), have problems with handling money and other expenses, getting dressed, have difficulty comprehending both written and verbal information, and have possible problems with driving and learning novel tasks. These brain changes must be noticeable enough to interfere with daily activities of living. For example, the above impairments are manifested functionally as loss of ability to care for one-self, problems recognizing familiar surroundings and people, even family members. As a result, the need for accurate assessment will affect issues of competency abilities, and will become critical for physicians and psychologists to properly identify.

Dementia is classified into the following subtypes: Alzheimer’s, Pick’s, Parkinson’s, Cerebellar degeneration, Huntington’s chorea, Frontotemporal, Progressive Supranuclear Palsy, and Amyotrophic Lateral Sclerosis (Waxman, 2000). Factors that affect diagnoses are neuroanatomical location of the dementing process, psychological symptoms, etiology, genetics, and neurochemical factors. Differential diagnosis of dementia consists mainly of etiology and neuroanatomical location of deterioration or insult (Waxman, 2000). Neuroanatomical deterioration consists of organic deterioration that is lobe or site specific. For example, the name of frontotemporal dementia is derived from organic deterioration, axonal and white matter shrinkage in the frontal and temporal lobes of the brain (Greenwood, 2000). Another example of differentiating dementias is the neurobiological substrate of the neuron. For
example, pick cells, named after Arnold Pick in the early 20th century, distinguishes the differences between Pick’s dementia from the other types of dementing processes (Greenwood, 2000). Alzheimer’s dementia is differentially diagnosed definitively at autopsy with the presence of neurofibrillary tangles and plaques within the neurons. Parkinson’s, Progressive Nuclear Palsy, and Huntington’s Chorea are all forms of dementia that affect the diencephalon, that is, the midbrain region (Waxman, 2000). Therefore, because there are neuronal changes within the midbrain region, symptomotology will be consistent with dopaminergic pathways (Waxman, 2000).

Of the different types of dementia, Alzheimer’s disease (AD) is the most common cause of dementia, accounting for 55-65% of all cases of dementia (Epstein & Connor, 1999). Prevalence of the disease doubles with every 5 years between the ages of 65-85 and is the fourth leading cause of death in the United States for those 65 and older (Epstein & Connor, 1999). AD affects women three times as often as men, but this may be largely because women live longer than men (Epstein & Connor, 1999).

Alzheimer’s disease is a degenerative brain disorder. The affected person becomes increasingly unable to process new information. At the same time, there is a diminishing ability to retrieve and use information that has accumulated throughout the person’s life (Geldmacher & Whitehouse, 1996). While certain forms of dementia are reversible, AD is currently progressive, degenerative, and irreversible. In the United States, persons diagnosed with AD represent about
10% of the population over the age of 65 and as much as 50% of those over 85 and older (Geldmacher & Whitehouse, 1996).

*Structural Abnormalities*

Although cerebral atrophy is a typical manifestation of dementia, it does not distinguish normal aging from AD accurately enough to be diagnostically definitive (Munoz & Feldman, 2000). For example, neuroradiological studies have focused on MRI that reveals “normal cortical atrophy for age” (p. 232). The MRI does not distinguish the individual’s functional strengths/weakness and is furthermore not sensitive to the intra-cellular processes. Therefore, it was recommended that MRI alone, as stated by Munoz and Feldman (2000) should not be used as a definitive marker for the diagnoses of dementia.

There are several factors that contribute to the etiology of dementia. Age is the most significant risk factor in developing a dementing process. Microscopic examination reveals the critical features of the disease are neurofibrillary tangles and senile plaques located within the neurons. As the brain ages, the neurofibrillary tangles and neurotic plaques increase making them more susceptible for the progression of the disease. Specifically, neurofibrillary tangles consist of aberrantly phosphorylated fibrillary proteins aggregated within the neuronal cytoplasm (Munoz & Feldman, 2000). Their presence signifies the failure of the neuron to properly maintain its cytoskeleton, which is the support system of the cell that maintains cellular shape. Increase amounts of neurofibrillary tangles define the stages of AD. As Munoz and Feldman (2000)
stated, "The development of tangles is a major and possibly the main mechanism of neuronal death in AD" (p. 66).

Certain neurons of the brain are more susceptible to attain neurofibrillary tangles. Munoz and Feldman (2000) reported that neurofibrillary tangles frequently occur in areas of the hippocampus that are involved in processing experiences prior to storage as permanent memories (p. 70). This process correlate with the clinical deficits observed in the early stages of AD in learning and in the creation of new memories, as well as with the relative preservation of established memories.

Along with neurofibrillary tangles, the presence of senile plaques is vital in order to establish an accurate diagnosis of AD. Research has indicated that the number of senile plaque starting within the early ages of 50, greater proportions of individuals develop cortical senile plaques, until the eighth decade when approximately 75% of the population is affected (Noyes, Daley, & French, 2000). However, the fact that density of senile plaques does not increase with age supports the notion that the brain switches from plaque-free to plaque-bearing status in a short period of time. The mechanism responsible for this change is still unknown (Noyes, Daley, & French, 2000). The spread of plaque occurs through both diffuse and localized means. In some individuals plaques can start as non-aggregated deposits throughout the cortex, whereas in other individuals they undergo an orderly sequential transformation into the mature senile plaques that are associated with the development of AD. This piece of evidence is indicative of the diffuse process of dementia from normal aging. In fact, although
the number of senile neuritic plaque increases with age, the number remains low in most cognitive intact individuals. The number of senile plaques and neurofibrillary tangles will vary among individuals with AD and will depend on genetic and environmental risk factors, as well as pre and comorbid brain pathology (Noyes, Daley, & French, 2000).

**Etiological Factors**

Other than advanced age, etiological factors for dementia are family history and genetic inheritance. Among twins with at least one affected member, 59% to 67% of monozygotes and 22% to 40% of dizygotes were concordant for AD (Munoz & Feldman, 2000). According to Munoz and Feldman (2000) the risk for AD is about four times greater for an affected family member when compared to the general population. In a number of families, the disease is inherited as an autosomal disorder. The genetic linkage to chromosome 21 has been reported in a number of families in which AD was inherited as an autosomal disorder. The E4 allele of the apolipoprotein E gene has been identified as a risk factor for AD (Munoz & Feldman, 2000). Possession of one gene copy of the E4 allele doubles the risk of developing AD; two copies increase the risk eight times. For example, in Down Syndrome the pathology is that of AD but it is an extra copy of the amyloid precursor protein gene of the duplicated chromosome 21 that is causative (Munoz & Feldman, 2000).

Zelinski, Burnight, and Lane (2001) reported that there is substantial evidence that implicates head trauma, either a single episode with loss of consciousness or repeated subconcussive injuries as risk factors for dementia.
Zelinski, Burnight, and Lane (2001) reported that boxers frequently develop dementia and upon autopsy brain correlates are positive for neurofibrillary tangles. Furthermore, the neuropathology of AD, including B-amyloid and neurofibrillary tangles accumulates rapidly following severe head injuries. However, a limitation to head-injuries post boxing is that head injuries could have occurred in patient who already had dementia.

According to D’Epiro (1999) types of dementia, especially AD, can be accurately diagnosed, on a chemical basis 70-85% of all cases. Both the history and neuropsychological examination determine diagnosis, coupled with medical diagnostic data. The alteration of cognition needs to be differentiated form delirium and pseudodementia secondary to depression. It is also important to delineate whether the dementing process was related to the use of anticholinergics, sedative/hypnotics, chronic alcohol abuse, certain antihypertensive agents, certain analgesic agents, psychotropic medications, or illicit drugs (D’Epiro, 1999).

**Diagnostics in Dementia**

Neurodiagnostically, the EEG in AD may be normal or show nonspecific diffuse slowing (D’Epiro, 1999). It can also be useful for evaluating the possibility of partial complex status epilepticus, which can mimic dementia, as well as for the periodic complexes characteristic of Creutzfeldt-Jakob disease.

A brain scan is recommended in dementia to rule out structural processes that may be masking dementia-like symptoms such as subdural hematoma, neoplasia, communicating hydrocephalus, or evidence of vascular insult (D’Epiro,
A non-contrast CT brain scan is adequate in most instances, but MRI may be the better choice if contrast enhanced study is necessary or if the evaluation for small-vessel occlusive disease is of primary concern. In AD, the CT and MRI brain scans typically present as diffuse cortical atrophy.

Physiological scans can provide useful information in selected cases. Both Positron Emission Tomography (PET) and Single-Photon Emission Computed Tomography (SPECT) have been reported to demonstrate a characteristic pattern of biparietal hypometabolism and hypofusion, respectively, in AD (Waxman, 2000). Such scanning can be helpful for distinguishing a multiple vascular insult pattern from a pattern more characteristic of AD.

One test that is often useful in making the diagnosis of AD is Magnetic Resonance Imaging (MRI). The test is used to ascertain that other causes of dementia, such as multiple strokes or a brain tumor, are not present. The MRI reveals atrophy or shrinkage of brain tissue. In fact, newer high-resolution MRI equipment can also show advanced atrophy in the specific areas of the brain that are most severely affected by AD, providing further evidence that the disease is present. However, as stated above, limitations of utilizing an MRI involve those cases where there is mild atrophy, which is described as age appropriate. When these individual's experience cognitive changes or functional changes and the MRI reveals, normal brain changes, a neuropsychological examination is warranted one that is sensitive and specific in detecting mild dementing processes.

Another type of test that may help the diagnosis of dementia with certainty is the detection of biological markers, such as body chemicals like proteins, that
are found only in people with the disease. According to D'Epiro (1999), tests that measure the spinal fluid levels of amyloid beta proteins (the protein in plaques) tau protein (protein in tangles) and a third protein associated with AD have recently been developed. There is controversy regarding this type of testing for definitive diagnosis is still questionable. However, collectively, these tests help complete the clinical assessment of AD.

Cerebral spinal fluid (CSF) analysis can be useful for the detection of general paresis (syphilis) and cryptococcal meningitis, as both can produce a dementing illness. It has been reported that amyloid beta-protein is decreased in the CSF of patients with AD, while tau protein is elevated. However, with regard to differentiating dementias from the levels of these two proteins, research has not provided reliable results for diagnostic purposes (D'Epiro, 1999).

Assessment of the Older Adult

According to Corey-Bloom et al. (1995), the first step within the assessment process is to establish whether there are cognitive impairments. In order to identify those people with dementia, those who should be evaluated include people with difficulties in memory and other cognitive complaints, either expressed by the individual or family. Once cognitive impairments are established, then it is important to determine the stage and severity of the dementing process. Individuals with cognitive impairments may or may not have functional impairments. For example, individuals can have mild memory impairments, but do not have difficulty performing everyday daily living tasks, such as using a stove, getting dressed, and driving a car. As the disease
progresses, the successful application of functional abilities becomes questionable. Therefore, dementia and competency testing is recommended in order to determine cognitive abilities.

The second step in the assessment process is a thorough intake of the individual’s history. Depending on the severity of the dementing process a thorough history may reveal deficits in several areas of intellectual functioning such as memory, language, praxis, visual spatial relationships, and judgment (Lezak, 1998). For most older adults this information should be substantiated by an informant or significant other in order to determine the accuracy of the individual’s subjective reporting. Specifically, certain functional ability should be assessed, such as recall of recent events, preparing a meal, playing games, filling out business forms or insurance forms, financial records, shopping alone, and driving (Marson, 2001).

The third step in the assessment process is mental status testing or neuropsychological assessment. The main medical disciplines that are responsible for this endeavor are neurologists, neuropsychologists, and gerontologists. Many neurologists have their own personalized office mental status test that evaluates the patient. In fact, according to Corey-Bloom et al. (1995), many physicians, especially neurologists, include the Mini Mental State Examination (MMSE) in order to determine an individual’s cognitive abilities. Areas that should be examined include orientation, implicit and explicit memory, language, praxis, calculations, visual spatial relations, and executive functioning. Moreover, age, education, ethnicity, and language have all been determinants that
affect an individual’s cognitive ability with this specialized population. There are many neuropsychological measures that are sensitive in identifying the dementing process. For example, neuropsychologists can apply fixed or flexible neuropsychological batteries that measure general areas of brain functioning. More important, Spreen and Strauss (1998) recommended neuropsychologists to use measures that are sensitive and specific to memory abilities, executive functioning, language and visual spatial abilities.

The fourth step of the assessment process is diagnostic work-up. Certain blood testing and imaging studies are necessary in the differential diagnosis of dementia to rule out metabolic and structural causes of dementia. The detailed workup depends on the suspected diagnosis but usually consists of urinalysis and blood tests (CBC, sedimentation rate, electrolytes, creatinine, liver function tests, calcium, thyroid function tests, serum B 12 level, syphilis serology, and HIV testing) (Corey-Bloom et al. 1995). Furthermore, Spreen and Strauss (1998) suggested that biological markers in the future would become increasingly used to confirm dementia. For example, some individuals at risk for developing dementia maybe further identified by the alleles inherited and apolipoprotein E (APOE).

**Legal Guidelines for Competency Assessment**

Upon completion of the assessment, if an individual is diagnosed with dementia or memory impairments, then significant changes can occur to the individual’s autonomous life. For example, because of brain impairments, the individual could possibly no longer live the usual life that he/she is accustomed
to. Therefore, the question arises at what stage is an individual deemed incompetent in fulfilling his/her autonomous right?

In the 1998 second edition of *Law and Mental Health Professionals of New Jersey*, James Wulach presented a comprehensive guideline for legal statues for Mental Health Professionals. In terms of competency, Wulach described the following areas of legal importance: competency to drive, to execute a will, contract, marry, to stand trial, obtain a driver’s license, to serve sentence, to testify, vote, to waive legal rights, guardianship, and conservatorship for adults (p. 43). In order for an individual to be deemed as competent or incompetent, the individual must meet minimum mental status requirement. However, a definitive definition of competency or the requirements posed to meet minimum mental status is never delineated in the text.

The two areas most related to competency according to state law with individuals who are diagnosed with dementia is *guardianship for adults* and *conservatorship for adults*. According to Wulach, “individuals who are unable to conduct their day-to-day affairs because of an emotional or cognitive disability may be appointed a guardian who will control their lives much as parents oversee the lives of their children” (p. 174). One can infer from the above that “cognitive disability” can refer to numerous organic conditions. For example, dementia, traumatic brain injury, toxic-metabolic, cerebrovascular accidents, seizure disorder, hypoxic event, schizophrenia, and encephalopathy are all considered a cognitive disability. However, establishing competency is not the same for all conditions. For example, a dementing process usually has an insidious onset,
which progressively becomes worse, whereas traumatic brain injury occurs quickly and can produce static impairments (Lezak, 1998).

According to New Jersey State Law, guardianship is established when an individual is deemed incompetent by a Mental Health Professional. Conservatorship for adults is an alternative approach to guardianship. Conservatorship law allows the court to appoint someone to manage the finances of a consenting adult who is no longer able to take care of his or her property and or financial affairs (p. 179). Therefore, a conservatee is defined as a person who has not been declared judicially incompetent, but who by reason of advanced age, illness, or physical infirmity is unable to care for or manage his or her property or has become unable to provide for himself or herself or other dependent on him or her for support (p. 179). In order for an individual to be deemed as conservatee, a mental health provider must evaluate the person and testify about the person’s ability to manage his or her finances and/or to provide therapeutic services to the person after a conservatorship has been imposed. Again, the law does not qualify whether the Mental Health Professional must have a doctorate and does not clarify the assessments or methodology that is deemed acceptable by either Daubert standards or by any other legal standard. Furthermore, the conservatorship hearing consists of a judge, without a jury, where an individual is required to take testimony in open court to determine whether the conservatee by reason of advanced age, illness, or physical infirmity, is unable to care for or manage his or her property or has become unable to provide for him/herself.
Lastly, once legally established, the conservator is entitled to spend, with reasonable discretion, as much of the income or principal of the conservatee as he or she chooses for the support, maintenance, education, and general use and benefit of the conservatee and his or her dependent. To reiterate the core dilemma, New Jersey State Law fails to distinguish what qualifies as “minimum mental capabilities” and how does this relate to functional capacity as well as neuropsychological performance.

*Practice Guidelines for Competency Assessment*

Baker, Lichtenberg, and Moye (1998) presented practice guidelines for the assessment of competency and capacity of the older adult. The goal of the article was to identify the need for conceptual and practical model for conducting assessments for competency and capacity in the older adult as part of legal determination of competency. Baker et al. (1998) reported a significant problem with this area is the lack of consensus on conceptual definitions and assessment techniques for competency in older adults. As a result, practitioners must rely on clinical experience and subjective techniques. In fact, Baker et al. (1998) stated the potential for low inter-rater reliability and unstandardized clinical assessments such as that described by previous research by Marson et al. (2001) is not acceptable given the potential consequences of these assessments for individual autonomy and civil liberties (p. 53).

Baker et al. (1998) further discussed two more difficulties in the area of competency. The first is the changing definition of competency and capacity. The second difficulty is the fact that different states require different guidelines
for competency. One area that has been uniformly accepted is the fact that courts across the nation recognize that capacity in one area of functioning does not necessarily imply capacity in other areas of functioning. For example, the ability to give consent to medical research and driving a car entail the same but also very different cognitive abilities.

This article discussed several practice guidelines for clinical practitioners to follow when assessing competency abilities. The National Academy of Science Institute of Medicine (as cited in Baker et al., 1998) reports that practice guidelines assist practitioners and patients in making decisions about appropriate health care for specific clinical circumstances. As a result, this would increase consistency in quality of care by defining practitioner’s behaviors that positively influence the clinical and financial outcomes of care. The American Psychological Association (APA) (as cited in Baker et al., 1998) recommends two areas when determining practice guidelines for assessing competency. The first area is the assessment of efficacy. According to the APA (as cited in Baker et al., 1998) “quantifiable clinical observations are preferred to clinical consensus that is based on experience” (p. 115). Therefore, objective data is more reliable and informative than subjective data. The second area is concerned with clinical utility. To meet criteria for the APA’s clinical utility, interventions are reviewed for three variables: feasibility, generalizability, and costs and benefits of using the intervention in actual practice.

The APA created five steps in the clinical assessment of competency with older adult. Professional conduct and sensitivity to cultural and individual
differences are emphasized. The APA cited the following key source documents that address competency assessment: the ethical principles of psychologists' conduct (APA, 1992), guidelines for providers of psychological services to ethnic, linguistic, and culturally diverse populations (APA, 1990), the standards for educational and psychological testing (APA, 1998), and specialty guidelines for forensic psychologists (Committee on Ethical Guidelines for Forensic Psychologists, 1991).

The first guideline is a question of referral clarification and clinician qualification. The referral that requests whether the individual is competent or incompetent is vague and grossly inaccurate. A proper referral should delineate the specific issue or capacity in question (rather than global competency). After a referral is clarified and determined appropriate, psychologists receiving the referral may not be the appropriate clinician to perform the competency assessment due to qualification purposes (Baker et al. 1998). Therefore, the first step in any guideline purports clarification of competency assessment being sought as well as qualified clinicians, with subspecialty in neuropsychology and gerontology.

The second recommended guideline of the APA is the assessment planning. This section guides neuropsychologists in making a number of critical decisions in planning for clinical evaluation of legal competency, such as obtaining informed consent, ensuring confidentiality, and addressing cohort and cultural differences (Baker et al., 1998).
The third guideline, according to the APA, is the assessment activity. This section provides recommendations for components of clinical interview, cognitive assessment, mental health assessment, and specific functional or decisional capacity assessment (Baker et al., 1998). The first recommendation for cognitive assessment is to utilize a comprehensive mental status examination. Specifically, according to the APA, psychologists need to compensate for age-related deficits in the areas of processing speed, sensory deficits, floor effects, and individual and cultural differences. Keeping that in mind, the measure should also be normed and validated for the age group, especially with the older adult population, and appropriate to both the competency issues in question. For example, if an individual is being assessed for driving capabilities, all of the following areas should be assessed: areas of processing speed, visuospatial abilities, higher-order functioning, and primary/psychomotor ability. The APA encouraged psychologists to directly assess the specific competency in question using instruments that evaluate activities of daily living, instrumental activities of daily living, with specific decisional capacities. Furthermore, it is important for clinicians to also gather information of the participants and his or her family's perspectives, values, and beliefs about the competency issue at hand.

The fourth guideline is the synthesis of data and communication of findings. It was recommended that psychologists not only prepare a written report but also it is their ethical responsibility to communicate these findings to the participant and family in a way that is clearly understandable and effective for the family. Appropriate recommendations should be made with regard to the functional
capabilities of the individual in order to maintain personal safety for the individual.

Last, the fifth step is a follow-up evaluation. This evaluation is to determine or identify additional information since the examination. For example, other areas of therapy may be recommended, like occupational, physical, or speech therapies. Also, it should be determined at this time whether a follow-up cognitive examination is needed in order to determine any gains or progressive deficits in the area of the identified capacity.

The APA also identified several limitations for guidelines of competency assessments as well as future areas of research. One limitation to the above guidelines is the restriction of managed care as well as the time needed to complete such a thorough examination. However, time and financial constraints should not undermine the importance of properly evaluating competency abilities from a comprehensive, neuropsychological perspective. Future research should focus on strengthening clinical assessments that measure functional and decision-making capacities. A need exists for better normative data for older adults in all ethnic groups as well as studies that assess the connection between the results and predictability of real-world functioning. The use of ecological validity of assessment data will enable practitioners to accurately determine which functional abilities are compromised and improve reliability and validity in terms of legal concepts of competency (Baker et al, 1998).
Limitations of Quantitative Assessments with Competency

Kapp and Mossman (1996) reported that there are inherited pitfalls associated with the attempt to develop and use solely quantitative measures when assessing competency abilities. Kapp and Mossman (1996) presented the term capacimeter, to describe the inherited weakness in creating an instrument that could assess all of an individual’s decision-making capacities. Specifically, the article examined primarily people with cognitive impairments, secondary to dementia, which appears most often in the elderly population. The article discussed the fact that research in competency assessment has generally agreed that it is essential to assess decision-making capacity when conducting competency assessments. However, there is not a uniform agreement within the scientific community that accepts a reliable, valid, assessment technique for this endeavor. Kapp and Mossman (1996) reported approximately two decades ago that the American Journal of Psychiatry discussed the need for an objective uniformly dependable, consistently accurate, and easily administered tool for measuring the mental decision-making capacity of older adults (p.211).

According to Kapp and Mossman (1996), the objective to find or create this one measure that would be able to accurately delineate an individual’s functional capabilities is impossible. In addition, Kapp and Mossman (1996) reported a single “all-encompassing” test, otherwise known as the above mentioned capacimeter, could never appropriately reflect the complexity of each competency domain. As a result, there will be inherited problems connected with any attempt
to construct a universally acceptable competency assessment instrument, or capacimeter.

To begin with, assessments of medical decision-making capacity are usually guided by legal standards that have evolved slowly on a state-by-state case basis. Kapp and Mossman (1996) believed that objectivity alone will not suffice in accurately determining an individual’s competency abilities. For example, he stated subjectivity, idiosyncrasy, and lack of sufficient reliability among capacity evaluators all combine to limit the accuracy in fairness of capacity assessments, both in the process of conducting them and gauging their results (Kapp & Mossman, 1996). Furthermore, it was stated that many current assessment tools for competency are inefficient and cumbersome to administer. Therefore, by designing a capacimeter, it is expected that clinicians will capture a number that will be able to quantify the individual’s ability. It is understood that if a measure could produce a definitive objective numerical readout addressing the individual’s competency ability is understandably appealing. This will allow clinicians to depend on numerical numbers and then from those numbers, make statements regarding the individual’s functional abilities and then always refer back to the number when questioned about their decision-making. Kapp and Mossman (1996) clearly discussed how this can be a tremendous pitfall for both the fields of neuropsychology and forensic psychology.

Kapp and Mossman (1996) discussed the measures that are commonly used for competency assessment. Specifically, Kapp and Mossman (1996) reviewed an analysis conducted by MacArthur that examined the
neuropsychological measures that are currently used to assess decisional capacity functions. The following are among the better known neuropsychological assessments that are used to determine competency abilities: the Mini Mental State Examination, Edelstein’s Hopemont Capacity Assessment Inventory, Neuro-behavioral Cognitive Status Examination, Dementia Rating Scale, Wechsler Memory Scale, Wechsler Intelligence Scale- Revised (Comprehension and Similarities subtests), the Geriatric Depression Scale, Center for Epidemiological Studies Depression Scale, Short Psychiatric Evaluation Scale, Global Deterioration Scale, Alzheimer's Disease Assessment Scale, Breech Cognitive Rating Score, Cambridge Mental Disorders of the Elderly Examination, Dementia of the Alzheimer's type Inventory, Dementia Diagnostic Screening Questionnaire, Halstead-Reitan Neuropsychological Battery, Mental Status Questionnaire, and the American Association of Retired Persons recently revised Executive Cognitive Functioning measure. As a result, Kapp and Mossman (1996) demonstrated how the aforementioned assessment instruments vary greatly in the construct measured, as well as the general purpose of each test. For example, the preceding neuropsychological instruments were never designed to assess an individual’s competency or capacity abilities, but rather to assess cognitive functions of memory, depression, orientation, language, visual spatial and executive functioning.

A shortcoming to Kapp and Mossman’s theoretical position is the fact that a measurement produces results only as accurate and reliable as the construct it purports to measure. This statement reflects the basic problem with assessing
competency and capacity, that is the inability to clearly define the two constructs as a universally accepted definition.

The issue of choosing an assessment instrument that would best measure an individual’s specific competency abilities (either being financial, informed consent, driving) is still an unresolved issue. Kapp and Mossman (1996) argued that the instrument used should reflect the specific aspects of mentation required for making a particular decision. In other words, a clinician would determine which test to use after a referral question is accurately identified. For example, the clinician would determine which area of cognitive functioning should be assessed based upon the referral question (orientation, memory, cognitive processing, sensory modality, or neurological functioning). Kapp and Mossman (1996) purported that one measure of global competency, capacimeter, could ultimately measure any form of competency is grossly inaccurate. An analogy presented was that of tests used by physicians. Physicians do not utilize a single test that assigns a numerical score to all patients, rather physicians ask questions, conduct physical examinations, and order laboratory tests in order to successfully diagnosis the problem.

Kapp and Mossman (1996) further contended that the problem with the area of competency is the misconception that it is an “all or nothing” phenomenon. Even though clinicians are often asked to make definitive judgments about whether cognitively impaired individual should be allowed to exercise decisional capacity, the construct is not clearly identified. For example, Kapp and Mossman (1996) stated, “perhaps the most important inherent shortcoming of any particular
instrument or combination of instruments purporting to rate or measure individuals decision-making capacity is the assumption that such instruments detect a property that yields binary answers about the presence of competency". Therefore, the capacitor is considered unfeasible because it can never provide medical legal users with definitive information.

Kapp and Mossman (1996) reported that even if clinicians were able to produce a uniformed accepted capacitor with binary results (yes/no) it still would not accurately depict the levels of competency. For example, an individual with mild dementia will inevitably have different scores compared to an individual with moderate dementia. Therefore, clinicians would still face the problem of distinguishing how a numerical score could correctly assess all of an individual’s functional capabilities. Also, would the test be able to properly identify the sensitivity and specificity of the cutoff scores when delineating levels of competency?

Kapp and Mossman (1996) concluded that each individual should receive statistically established neuropsychological assessment that is specifically designed to measure the cognitive function of the competency ability in question. Future areas of research should focus on examining specific questions of competency and then assess through both qualitative and quantitative analyses. Some examples given were the following: who should conduct capacity evaluations, which assessments should be used in the formal evaluation, what kinds of considerations should enter into the selection of instruments, what are the statistical properties of the assessment instruments, for what populations is the
assessment applicable, what conditions and circumstances reduce their accuracy, how should particular test results be interpreted and applied, how can clinicians present their findings to the court system in ways that optimize informed legal decision-making, and how do clinicians translate findings into workable solutions to provide needed assistance to patients that maximize autonomy while protecting them from the consequences of cognitive impairments?

Qualitative Perspective of Measuring Competency and Dementia

Daniel Marson, J.D., Ph.D. has spearheaded the research on competency in older adults since the early 1990s. In fact, Marson has created his own quantitative objective measure that assesses an individual’s ability to give consent to medical procedures. The title of his instrument is the Capacity to Consent to Treatment Instrument (CCTI). This measure assesses an individual’s ability to give consent to medical treatment. He concurrently contends that competency cannot solely be measured through quantitative analysis. He stated, “qualitative measures can yield clinical information about functional changes in neurological disease not available through quantitative measures” (Marson, 2001). His research examines qualitative behavioral changes associated with declining decision-making capacity with dementia patients.

To begin with, Marson (2001) discussed error analysis as a qualitative scoring system that represents the understanding of loss of competency in dementia. Specifically, he contends that error analysis has been used clinically in psychiatry and neurology since the early 1900s. An example of this would be studying behavioral changes with the dementia population in their everyday living
abilities. Another example would be the work of Ward Halstead in the early 1940s where he examined how people with brain damage lived and worked in their natural environment as he made note of their error analysis or their maladaptive behaviors. Error analysis can also provide clinical information about loss of competency that quantitative instruments are unable to capture. For example, an individual’s score on a quantitative measure does not necessarily represent an individual’s actual functional abilities. For example, as stated above, a number that is designed to determine whether an individual is competent or incompetent does not capture the individual’s true strengths and weaknesses. Furthermore, quantitative measures are structured with fixed parameter which does not allow for flexibility of behavioral observation. Marson (2001) captured this by stating, “although quantitative scores provide information regarding an individual's level of performance, qualitative scores help explain that performance” (p. 88).

Marson (2001) examined error analysis by examining the responses of both control and dementia participants on the CCTI. The study did not focus on quantitative scores, but rather whether there was consistency in error responses. The researchers examined and compared incident rates of error behaviors across groups of normal older controls, mild AD, and moderate AD participants. In addition, they identified neurocognitive correlates of the error types in the AD group and the pattern of these behaviors across different stages of the disease.

The participants consisted of 72 probable Alzheimer’s disease participants and 21 normal older controls. Using the Mini Mental State Examination score,
the Alzheimer's disease patients were divided into subgroups (20 mild dementia; 10 and up to 20 moderate dementia and lower than 10 was severe dementia).

The qualitative scoring system for the CCTI was developed to identify behavioral changes and errors reflected in the participants' responses. The error codes were developed based on Marson's experience while working with controls and dementia participants during the standardization process. The qualitative scoring system consists of 16 mutually exclusive error codes conceptualized in the following four domains: language, executive, affective, and compensatory responses. For example, the domain of language consisted of identifying changes in both expressive and receptive functioning and ranged from relatively benign errors such as circumlocution and tangentially to more serious language errors such as paraphasias and comprehension failure (Marson, 2001). The executive domain consisted of problem solving, processing, and reasoning, whereas the affective domain assessed the presence of verbalization that reflected low or clated mood.

Finally, compensatory responses examined old learning adaptations such as personalize responses and personal value statements for personal appreciation to more problematic adaptations such as unwarranted inference which was not justified by the vignettes. The other neuropsychological measures used in the study to compare error behaviors were broken down as follows:

2. Expressive language - Boston Naming Test (BNT), Controlled Oral Word Association (COWA), Animal Naming, Dementia Rating Scale (Initiation/Perseveration subscales).

3. Receptive language - Token test, Auditory Comprehension Screen, and Reading Comprehension Screen.

4. Short-term verbal memory - Wechsler Memory Scale-Revised (WMS-R):
   Logical Memory I, Verbal Paired Associations I, Dementia Rating Scale: Memory subscale.

5. Delayed verbal memory - Wechsler Memory Scale-Revised (WMS-R):
   Logical Memory II, and Verbal Paired Associations II.

6. Abstraction - Wechsler Adult Intelligence Scale-Revised (WAIS-R):
   Similarities subtest, and Dementia Rating Scale (DRS): Conceptualization subscale.

7. Social comprehension - Wechsler Adult Intelligence Scale-Revised (WAIS-R): Comprehension subtest.

8. Executive function - Dementia Rating Scale (DRS): Initiation/Perseveration subscale and Trail Making A & B.

9. Dementia severity - Dementia Rating Scale (DRS): Total score.

10. Depression - Beck Depression Inventory.

   The results of the study suggested from a quantitative standpoint, the control group performed significantly better than the participants who were diagnosed with dementia. The control group performed significantly better on virtually all neuropsychological measures. There were no significant differences
between groups on the self-report depression inventory. Turning to the qualitative responses, on the language domain those in the AD group demonstrated more miscomprehension of questions than controls (Marson, 2001). However, the mild and moderate AD groups did not differ significantly with regards to language dysfunction errors.

With regard to executive functioning, compared with controls participants with AD had significantly more instances of factual confusion, intrusion, incoherence, and loss of task (Marson, 2001). Moreover, even the mild AD group demonstrated more executive dysfunction errors than controls. In the affective domain, the only significant finding was that moderate AD participants had more melancholic responses than controls or mild AD patients.

Finally, on the compensatory response codes, the AD group produced more delegation responses than controls. There were no group differences found for personal appreciation, personalization, or unwarranted inference. The greatest qualitative difference between the control group and AD groups were representative in the executive function domain. For example, compared with controls, mild AD participants demonstrated more factual confusion intrusions and showed problems with loss of task not seen in the control group (Marson, 2001). This finding indicates that loss of task in executive abilities occurs early in the process of AD. The loss of task was defined and predicted by Trails B, a measure visual motor sequencing and attention, that operates primarily as a measurement of executive function. The impairments in detachment were defined and predicted by the Token Test which is a test of receptive language functioning.
Marson (2001) hypothesized that the Token Test is a performance test of executive function with patients who have dementia. Conversely, moderate AD patients demonstrated difficulties with incoherence, loss of detachment, and most importantly distinct problems with language, that were not seen in mild AD patients.

In summary, the authors were able to use a qualitative scoring analysis otherwise known as error analysis approach, and successfully differentiate mild, moderate, and severe dementia. It was further hypothesized that quantitative measures alone would not have identified the subtle behavioral changes in the early stages of dementia. Limitations of the present study involved the difficulties replicating and supporting the findings of a qualitative study. Another limitation to the study is that of determining and generalizing how error behaviors relate to competency abilities. The study demonstrated consistent behavioral errors that differentiated the stages of dementia, but however, did not relate these findings to specific functional abilities. The study successfully demonstrated how neuropsychological performances correlated and supported the severity of progression, but did not establish how or which qualitative behavioral errors predict certain competencies. Therefore, studies that aim at predicting performances for both qualitative means, as well as neuropsychological means to competency abilities, will be greatly needed in the future.

Neurological Model of Competency: Three Legal Standards

Decision-making ability is one of the primary symptoms of dementia. In fact, according to Marson, Chatterjee, Ingram, and Harrell (1996), as capacities
for memory, judgment, reasoning, and planning deteriorate, Alzheimer's disease patients' decision-making capacity begins to affect every sphere of life. More important, loss of competency in dementia produces crucially important consequences for patients and their families, health-care legal professionals, and for society as a whole. Marson et al. (1996) argued that the area of competency research over the past 10 years revealed little about what is known about the natural history of competency loss and dementia or about the cognitive and behavioral changes associated with competency loss. In fact, Marson stated, "neuropsychological studies of competency can illuminate the relationship of specific cognitive changes to functional decline in dementia, served as an important bridge between developments in neuroscience and law, alert clinicians to specific cognitive deficits threatening competency, and facilitate the use of specific clinical interventions to support the competency of patients with particular cognitive deficits" (p. 213).

Marson et al. (1996) examined the relationship between cognitive changes in dementia and how they correlate with particular legal standards of competency. Moreover, Marson et al. (1996) wanted to establish which cognitive domains affected an individual's competency abilities. The results indicated that the word fluency measure predicted competency performance and status of both normal older controls and Alzheimer's disease patients on a legal standard. The three legal standards included the following: the capacity to evidence treatment choice (minimally stringent), the capacity to appreciate the consequences of his/her
treatment choice (moderately stringent) and the capacity to understand the
treatment situation and choices (empirically the most stringent).

The participants of this study included 15 older adults as the control group
and 29 participants with AD recruited from the Alzheimer's Disease Center Corps
from the University of Alabama. Control participants in the AD group were
adults who were well characterized and positively documented medically,
neuropsychologically and neuroradiologically. Both neurologists and
neuropsychologists made the conclusive diagnosis of dementia, respectively.
Furthermore, the study controlled for both age and education and matched
between control and experimental groups. The 29 participants with AD were
divided into two groups based on severity: mild and moderate. This was done
using the Mini Mental State Examination (MMSE). Those who scored more than
19 on the MMSE were classified as mild while those participants who scored
more than 19 and less than 20 were classified as moderately demented.

The methodology of the study consisted of administering each participant
with two specialized clinical vignettes (aneoplasm and cardiacplasm) designed to
test the competency of AD participants under five legal standards. Each vignette
presented a hypothetical medical problem where each participant was asked to
respond how he/she would react. Medical experts that specialized in dementia
and competency assessment reviewed the medical content of each vignette. The
vignettes were written at an eighth-grade reading level with low syntactic
complexity and a moderate information load (Marson et al. 1996). Furthermore,
each vignette was presented both orally and in written format in order to meet the
different developmental demands of the participants. As a result of how each participant answered the vignette, the examiner would determine the score or legal standard he or she should receive. The legal standards were defined as LS1, LS3, and LS5. The first legal standard (LS1) determined the simple capacity to evidence a choice of treatment. Legal standard three (LS3) determined whether the participants were able to “appreciate the consequence” of their choices. Finally, legal standard five (LS5), determined the capacity to “understand the treatment situation and choices,” which was the most stringent legal standard.

Concurrently, along with each vignette, the participants were also given a battery of neuropsychological measures in order to correlate how well their decision capabilities on the vignettes compared to their neuropsychological performance. The neuropsychological measures used in the study were the Dementia Rating Scale (Conceptualization and Attention subscales), Boston Naming Test, Controlled Oral Word Association test, Trails A and Trails B. The cognitive domains assessed consisted of attention, expressive language, receptive language, short-term memory, delayed memory, abstraction, social comprehension and judgment, executive function, and dementia level.

The results suggested that on LS1, control participants did not differ significantly from the AD participants. On LS3 control participants performed significantly better than AD participants. On LS5, control participants also performed significantly better than AD participants. In addition: control participants performed significantly better than AD participants as a group on all of neuropsychological measures.
Specifically, the most stringent legal standard (LS5) which required comprehensive factual understanding of the meaning of treatment situation, and upon which both mild to moderate AD individuals consistently failed, measured conceptualization from the Mattis Dementia Rating Scale, confrontation and naming from the Boston Naming Test with the two most sensitive measures. Conversely, measures of verbal memory were not particularly strong in correlating dementia level and competency level and legal standard level. Another strong finding was the fact that declining abstract capacity, semantic knowledge, and verbal recall appeared to be strongly associated with the declining capacity of mild to moderate AD patients with regard to understanding of treatment situation and choice (Marson et al. 1996).

On the moderately stringent legal standard, moderate AD participants performed significantly below when compared to the control participants. This standard measured capacities for empathy, insight, foresight, and planning which are the so-called executive functions. The finding was that on the Controlled Oral Word Association test, a verbal fluency measure predicted competency performance of AD patients with legal standard three. This task specifically measured the generation of words to semantic categories within a one-minute time period. Performances on this measure and other word fluency measures have been associated with frontal lobe functioning. Turning to measures of visual motor tracking, that is Trails A, predicted legal standard three competency 91% of the time period. Trails B, a more demanding cognitive task, assesses processing speed ability as well as visual motor tracking and cognitive flexibility of thinking.
Trails B is a more demanding task which requires complex frontal functioning. Specifically, the task requires the individual to process two ideas simultaneously, otherwise known as shifting cognitive sets. In fact, this measure correlated very high with the controlled word fluency task. Therefore, Trails A, as a frontal dysfunction task, was highly relevant to legal standard three in identifying different kinds of consequences of treatment choices. On Trails B, a visual motor processing speed and executive functioning measure task did not correlate with determining legal standard competency. Marson et al. (1996) reported that the reason was that half of the AD participants were unable to perform the task. Hence, neuropsychological measures that are very difficult should not be used in order to differentiate legal standard prediction.

Therefore, as stringency of legal criteria became more advanced, that is, being able to evaluate at a higher level, the AD patients with moderate to severe dementia had much more difficulty appreciating and determining the proper decision-making on the vignettes. In other words, when the decision acquired more complex, difficult cognitive functioning, those with moderate and severe dementia had more difficulty.

Marson et al. (1996) discussed the importance of using the above mentioned objective vignette instruments as a criterion to determine level of competency. Moreover, the study examined the role and relationship of neuropsychological measures that were later compared to different levels of legal standards. Marson et al. (1996) concluded the study represented an initial step toward a neurological model of competency. The study found that multiple cognitive functions are
involved in the competency loss in AD, with specific cognitive functions associated with competency under each legal standard. The results offer insight into the relationship between different legal thresholds of competency and the progress of neuropsychological changes characteristic of daily functioning.

Marson et al. (1996) discussed one limitation of the study. In particular, the participants with dementia were asked to state verbally and spontaneously the actual treatment choice and consequence from the two vignettes they preferred. One limitation was that some participants may have been able to recognize the correct treatment choice; however, as a result of their language disability they were not able to correctly articulate their choice. Therefore, future recommendations are to assess both verbal reproduction abilities as well as produce the vignettes non-verbally based.

In summary, the findings were as follows: mild stage of AD resulted in declining conceptualization; semantic memory, and verbal recall compromise the capacity of dementia patients to understand the treatment situation (legal standard 5). As the participants moved from mild to moderate stages of dementia, executive dysfunction increased, thus affecting their choice and consequences of treatment (legal standard 3). As the participants moved from severe to profound stages of dementia, it is believed that their receptive and expressive impairments impaired their capacity to even express a choice of treatment (legal standard 1). Therefore, these findings support the importance of conceptualization, semantic memory, verbal recall, executive function, and receptive language as
neuropsychological characteristics that affect competency decisions and abilities with the dementia population.

*Recent Literature Review of Objective versus Subjective Assessment of Competency*

Competency assessment has been a growing area of interest within the medical, psychological and forensic arenas over the past two years. Calcedo-Barba, Gil-Gregorio, Castelli-Candia (2002) presented a review of the research published in the past twelve months relating to the forensic aspects of competency assessment. The two main issues identified were consent for research with older adults and establishment of objective criteria to measure general or specific competency abilities (e.g. independent living, financial capabilities, and driving assessment). On the subject of the empirical studies, Pucci, Belardinelli, and Borsetti (2001) developed a competency assessment instrument for adults with dementia. The methodology of the study consisted of examining basic neuropsychological tests and from the results determining the relationship with competency abilities. Competency abilities were measured using a Likert scale. Each participant was asked to rate his or her abilities using the above mentioned Likert scale. The results, gathered from several different neuropsychological measurements, suggested that only the Mini Mental State Examination correlated significantly with the competency assessment questionnaire.

According to Pucci et al. (2001), participants with Mini Mental State Examination score of seventeen or less are considered to be incompetent or marginally incompetent. A limitation of this study was that the participants
reported subjective thoughts about their functional abilities. Pucci et al. (2001) reported subjective reporting as an inherited weakness when assessing those with dementia due to the fact that judgement and insight could be compromised, thus affecting the validity of the responses.

Kim, S. Y., Karlawish, J. H., and Caine, E.D. (2002) examined issues of competency from a qualitative perspective and used the judgment of three experts as a criterion standard. They obtained the sensitivity of 90 percent and a specificity of 88 percent of the self-report questionnaires. The results revealed no differences between participants with dementia and controls. In addition, the more cognitively impaired the individuals were, the more reluctant they were to participate in the study. Kim et al. (2002) reported that this is a common feature with the dementia population, considering their lack about insight to their limitations and disabilities.

Blum, B. and Eth, S. (2000) adopted a more functional approach rather than qualitative approach to competency. They considered three possible models that could be used in the evaluation of competency. These models were designed in a linear fashion and were comprehensive in nature. For example, the first model is philosophically based with four elements: expressing a desire, understanding, appreciation and reasoning. The second model, the medical model, is based upon the identification of the disease. The third model, is functionally based, which focuses on observable behaviors in real-world setting. Blum and Eth (2000) recommended that the primary caregiver or physician use all three models whenever the question of competency arises.
Blum and Eth (2000) concluded that few medical and mental health care providers utilize a comprehensive, subjective and objective assessment style with competency. In addition, Blum and Eth (2000) reported that the issues of subjective verse, objective reporting, as well as the conceptual leap from neuropsychological measures to prediction of competency, have been the two largest problematic areas of competency. Specifically, "currently we have instruments designed to measure neuropsychological functions, instruments to assess competency, and eventually some factors will be described that will serve as bridges to correlate these two levels of assessment” (p. 45). Therefore, competency assessment is a twofold problem, that is, one issue is the level of rationality or the scientific problem and the other issue is the level of functionality, the decision to live independently and in an autonomous manner, or a moral problem. As stated above, Blum and Eth (2000) hypothesized through their research that in order to “bridge” neuropsychological measures and competency abilities, one must use a comprehensive model-based approach that measures both objective and subjective reporting from the participants.

*Neuropsychological Performance of Daily Living Activities*

As stated previously, of all the neuropsychological tests that examined the relationship of cognitive functioning and competency abilities, executive functioning appeared to be the most related. Executive functioning is an umbrella term that refers to specific cognitive abilities located within the frontal lobes of the human brain. Executive functions are concerned with the management of human behaviors that enables human beings to develop and carry out plans, form
analogies, obey social rules, solve problems, adapt to unexpected circumstances, do many tasks simultaneously, and place episodes in time and space, which ensures that memories can be retrieved (Duke & Kaszniak, 2000). Moreover, within the frontal lobes, a more specialized area, that is, the prefrontal cortex is where executive functions are processed. The prefrontal region compromises about 30% of the total cortex of the brain. Moreover, the prefrontal region is proportionally much larger in human beings than in other species and does not mature until the early teenage years (Grafman & Litvan, 1999).

The prefrontal cortex is divided mainly into two large areas: dorsolateral and ventromedial. The dorsolateral region is thought to include Brodmann’s areas 9 and 14, whereas the ventromedial region consists of Brodmann’s areas 10, 11, 12, 13, 14, and 47 (MacPherson, Phillips, & Della Sala, 2002). The cognitive functions that are carried out by the dorsolateral region are those responsible for planning, shifting cognitive sets, verbal reasoning, and problem solving. Conversely, cognitive functions that are mediated by the ventromedial region consist of the following: obeying rules of interpersonal social behavior, experience of reward and punishment, and the interpretation of emotions.

On the question of how decision-making, problem solving, abstract thinking and interpretation of emotions relate to one’s competency abilities there are many concerns. Furthermore, the question remains, will decline in executive functioning affect an individual’s ability to live independently? Over the past five years, researchers have been interested in studying the relationship between an individual’s executive functioning abilities and activities of daily living.
Specifically, Richardson, Calcedo-Barba, Bell-McGinty, Nadler, Marson and Malloy (1995) examined the predictability of neuropsychological tests, specifically those of executive functioning, memory and visual spatial abilities, to activities of daily living in the older adult population. Richardson et al. (1995), like Marson et al. (1996), reported that the dementing process inevitably produces functional deficits, which accompanies cognitive decline. As a result, neuropsychologists are often requested to evaluate people with cognitive impairments, and give recommendations based upon the individual’s functional capabilities. A specific functional ability that is frequently asked to be assessed is an individual’s ability to live independently. An inherited difficulty in making the above recommendation is that there is an unclear relationship between cognitive capacity and living independently. For example, older adults may continue to be capable of self-care despite memory decline. On the other hand, Bell-McGinty et al. (2002) suggested that mild impairments in cognitive functioning can cause drastic changes in activities of daily living. Therefore, research over the past five years has been aimed at exploring the above conflict and determining whether neuropsychological measures could properly predict an individual’s specific functional ability. In essence, it is agreed upon by Richardson et al. (1995) and Marson that the goal for neuropsychological assessment, when asked to conduct a competency assessment, is to determine how the findings will relate to real world functioning.

One of the challenges in establishing the predictability of neuropsychological measures to activities of daily living has been a problem with
assessing activities of daily living. Traditionally, methods of assessing activities of daily living have included self-report information, caregiver-based information, and performance-based measures. A shortcoming to the above subjective assessments is that the clinician must assume the caregiver or participant’s data is reliable and accurate. As adults age, if the higher order cognitive faculty such as decision-making and judgment becomes compromised, it is likely that an individual’s insight may become impaired. For example, it is not uncommon for adults with impairments in executive functioning to minimize their cognitive complaints or be unaware of their limitations or cognitive impairments. This is also seen in subjective reporting from the caregivers, due to minimizing the changes. Another shortcoming may be the fact that caregivers, especially those who cannot live with the impaired individual, may lack the opportunity to observe the individual’s activities of daily living. Therefore, Richardson et al. (1995) suggest using actual measurements that assess the functional ability in question.

Richardson et al. (1995) indicated that studies over the past 5 years have focused on the prediction between neuropsychological performance and activities of daily living through the use of mental status screening exams as well as individual neuropsychological assessments. Richardson et al. (1995) suggested that both neuropsychological performance and activities of daily living have strengths and weaknesses as baseline measures for activities of daily living. Specifically, the limitation to the mental status exam is the focus on temporal orientation with minimal assessment of other cognitive domains. Of all mental status exams, the MMSE is considered the best short form test to predict activities
of daily living. Again, Richardson et al. (1995) points out the limitations of the MMSE demonstrating high rates of false negatives in identifying cognitive impairment.

In view of using neuropsychological assessments, Richardson et al. (1995) reported only a few studies to date that have attempted to correlate performance on comprehensive cognitive assessment measures and activities of daily living. One study done by Jim Hom (1992) demonstrated a significant correlation between performances on the Halstead-Reitan Neuropsychological Battery (HRNB) and performance in activities of daily living. Specifically, Hom reported that the HRNB is appropriate and useful in assessing the early manifestations of AD, especially because the battery was developed to cover the broad range of neuropsychological functions represented by both normal and brain damaged sample. Hom (1992) administered the HRNB to 35 participants who were diagnosed as having AD and compared the results with those of 30 medically-normal controls of comparable age. Hom analyzed the test results in accordance with the general neuropsychological functions measured by tests in the HRNB as well as measures of specific functional abilities.

The results of the study suggested that the HRNB predicted each domain of activities of daily living with the exception of utilization of transportation and acquisition of money. The results of the findings by Hom were later refuted by Richardson et al. (1995) who contended that the statistical procedures and methodology of the study were questionable. As a result of the potential methodological flaws, the validity of the study should be questioned.
Calcedo-Barba et al. (2002) further examined predictive associations between a shortened version of the Luria Nebraska and performance on activities of daily living. The results suggested the cognitively oriented aspects of instrumental activities of daily livings produce the largest correlations with neuropsychological measures, particularly those assessing memory. In contrast, the neuropsychological battery failed to predict tasks involving mobility and personal self-care. Again, Calcedo-Barba et al. (2002) discussed the limitation of the study, that most notably being the small sample sizes as well as the confounding variables of depression within the sample.

Contrasting the above findings, Nadler (2000) examined the moderate association between cognitive abilities and performance-based assessment of both instrumental and basic self-care activities in the older adult population. Specifically, performances on activities of daily living tasks were most associated with neuropsychological domains of executive functions and memory. This was the first study that demonstrated a positive relationship with executive functioning abilities and activities of daily living. The study lent empirical support to the idea that neuropsychological domains of executive functioning memory could predict one’s ability to live independently. However, this study failed to support cut-off scores that would properly delineate the stages of cognitive impairment and living independently, as well as assessing more than one activity of daily living.

Bell-McGinty et al. (2002) hypothesized that neuropsychological measures would be significantly associated with functional abilities of living independently. Furthermore, it was hypothesized that the domain of frontal
systems or executive functions would be most predictive of performance and level of independence across all activities of daily living domains, followed by memory functions (Bell-McGinty et al. 2002).

The participants included 50 older adults 60 years of age or older. The participants were recruited from the Department of Neuropsychology at Henry Ford Health System in Michigan, Allegheny General Hospital in Pennsylvania, and Roger Williams Hospital in Rhode Island (Bell-McGinty et al., 2002).


Each participant was administered the aforementioned neuropsychological assessments as well as the Independent Living Scale. The results revealed that the Trail Making Test-B and the Wisconsin Card Sorting Test were the two greatest predictors of living independently. In fact, both measures accounted for 54% of the variance in daily living skills (Bell-McGinty et al., 2002). They concluded that tests of executive functioning can statistically predict an individual’s ability to live independently.

Calcedo-Barba et al. (2002) also examined the predictability of neuropsychological tests and competency abilities. The participants included 108 older adults 60 years of age or older with the mean age of 74 and a mean education of 10.6 years. The participants were grouped according to the severity
of the dementing process (mild, moderate and severe). Considering the age of the population, many participants had co-occurring medical conditions. The most frequent of these conditions was a diagnosis by history of hypertension, 49%, other cardiac related conditions 10%, angina 10 %, and coronary artery bypass 6%, cancer 5%, chronic pulmonary problems 10%, renal disease 5%, and arthritis, 13%.

The neuropsychological measures used in this study consisted of the Boston Naming Test (BNT), Hooper Visual Organizational Test (HVOT), Controlled Oral Word Association Test (COWA), and the Logical Memory and Visual Reproduction of the Wechsler Memory Scale- Revised (WMS-R). In order to measure activities of daily living, Calcedo-Barba et al. (2002) utilized the Occupational Therapy Evaluation of Performance and Support (OTEPS). The OTEPS is a standardized behavioral measure that assesses a patient’s ability to perform daily living tasks independently. The OTEPS examined everyday functioning in six areas including hygiene/self-care, safety, medication administration, cooking/ meal preparation, money management, and community access. The scoring system ranged from 0 to 2 with 0 indicating the inability to complete the task, 1 indicating the ability to perform the task with assistance, and 2 indicating the inability to independent and complete the task.

Each participant was administered the aforementioned neuropsychological assessments as well as the activities of daily living scale, OTEPS. The results revealed the Hooper Visual Organizational Test (HVOT) indicated positive predictive power and classified the participants as dependents in cooking,
medication restriction, and money management (Calcedo-Barba et al., 2002). Furthermore, the HVOT had moderate positive predictor power in classifying participants in the domains of safety and community access (Calcedo-Barba et al., 2002). However, sensitivity in detecting activities of daily living in the above results based on HVOT performance was low to moderate, ranging from .49 to .67. For example, if participants were dependent in money management, they had only a 49% chance of being detected by the HVOT (Calcedo-Barba et al., 2002).

On the Boston Naming Test, the results also produced low positive predictive power and classifying participants in medication administration, as well as low sensitivity in detecting impairment, if it existed (Calcedo-Barba et al., 2002). On examining the WMS-R, both verbal and visual memory tests produced low positive predictive power.

Results suggested in terms of specific cognitive functions that only visual spatial abilities was assessed by the HVOT which produced significant correlation with activities of daily living. However, Calcedo-Barba et al. (2002) reported that the HVOT may also provide sensitive index of overall cognitive status, which may be impacting the correlation between the measure and activities of daily living. Regardless, this measure demonstrated strong predictive ability in determining the functional abilities of living independently. Contrary to expectations, as well as past research findings, the cognitive domain of executive functioning failed to demonstrate a significant correlation with any activity of daily living ability (Calcedo-Barba et al., 2002). Calcedo-Barba et al. (2002) reported one reason the study did not support this hypothesis may be the fact that
the COWA as a neuropsychological measure is not sufficient enough in placing demands on the frontal systems. Though the COWA may reflect a variety of frontal based behaviors, according to Lezak (1998), including set maintenance, and set shifting, it may not adequately capture the frontal behaviors of planning, organizing, and initiating that are specifically involved in activities of daily living.

Finally, memory functioning whether verbal or visual was highly related to identifying impairments of memory; however, overall demonstrated moderate to low levels of sensitivity in detecting impaired activities of daily living. A limitation to the study is that the participants were not asked to perform specific functional activities of daily living in front of the examiner. Therefore, with regard to ecological validity, the findings may not successfully capture the demands of spontaneous initiation of a task. Moreover, by not assessing these activities, a clinician could not determine whether the individual successfully initiated, remembered, or even carried out the task in question. One can conclude that neuropsychological evaluations can be used to predict activities of daily living functioning; however, they are not a substitute for actual assessment of daily living skills.

In summary, results of the study are consistent with recent research providing empirical support for the use of neuropsychological measures when assessing activities of daily living in the older adult population. Specifically, according to Richardson et al. (1995), "neuropsychological evaluation appear useful in making interpretations regarding complex, cognition dependent behaviors, such as the ability to manage finances, recognize safe and unsafe
behaviors, use community resources, and comply with medication regimen" (p. 212). Conversely, there has not been an accepted agreement to whether neuropsychological assessments predict functional abilities, as well as which cognitive domain successfully predicts specific functional abilities. Research presented by Bell-McGinity (2002), Richardson (1995), Calcedo-Barba (2002), Baker (1998), and Marson (2002) all report the need for future research to further assess which domains of cognitive functioning are most related to specific activities of daily living.

Summary

The area of competency has been recognized since the early 20th century. Clinically, the ability to assess competency abilities has never been agreed upon or established within the medical or psychological community. Historically, physicians assessed competency abilities through subjective reporting by the caregivers through the utilization of checklists. However over the past ten years the area of competency has become a more evolved medical, legal, and ethical construct. There has been an ongoing debate on how to properly define and assess an individual’s competency ability. For example, there is still conflicting research with regard to utilizing an objective/quantitative measurement or a subjective/qualitative measurement. However, the goal for both forms of assessment is the same, that is, to accurately determine an individual’s functional capabilities.

The law has recognized and reported that clinicians should not examine competency as a general indicator; rather clinicians should assess specific
competency abilities. Moreover, today neuropsychologists along with physicians, psychologists, and gerontologists, are now in the forefront in assessing competency abilities. The shift to neuropsychology has occurred due to the specialized training in brain-behavior relationships as well as the objectivity of the neuropsychological assessment measures. However, even within the field of neuropsychology, a general consensus on how to measure and delineate impaired functional abilities is still undecided. For example, there are only a handful of measures that are designed to assess an individual’s functional ability (i.e. cooking, living independently, driving, financial responsibilities). Therefore, most neuropsychologists utilize neuropsychological measures that assess brain functioning, and from those results determine an individual’s functional abilities (Spreen & Strauss, 1994). The opposing camp discuss the limitation to the above theoretical stance by stating that neuropsychological tests were never designed to test an individual’s functional abilities, but rather an individual’s cognitive abilities. The core question remains, “Just because an individual has mild memory impairments, does that mean he/she is incompetent to live alone?” The current research will examine whether neuropsychological tests of executive function predict an individual’s functional capability of living independently.
Chapter III

METHODOLOGY

Design

The current study will incorporate a quasi-experimental design. The dependent variable will be the total score of the Independent Living Scale (ILS) and the six independent variables will be the scores from the following subtests of the Delis-Kaplan Executive Function System: Verbal Fluency, Trail Making Test, Tower Test, Fluency Design, Sorting Test and Digit Span from the Wechsler Adult Intelligence Scale, Third Edition (WAIS-III). There will not be random sampling or assignment of participants in the current study. As a result, each participant that agrees to take part in the study will receive the battery of neuropsychological tests of executive functioning and the Independent Living Scale (ILS).

Participants

The participants of the study will consist of 97 older adults (age 65 +) (see power analysis section). Older adults will be recruited from central and northern New Jersey. The study will not control for race, education, ethnicity or gender. The only variable that will be controlled will be age.

The participants in the study will be contacted through various sources. Fliers (letter of solicitation) will be made that will illustrate the specifics of the study and details of the assessments and feedback of the results. Participants will be recruited through telephone and in person requests throughout New Jersey. Participation of this study is completely voluntary and all information will be kept
confidential. Each participant will receive a letter of solicitation that will describe the purpose of the study. Specifically, the letter will state that the purpose of the study is to determine each individual’s level of functional abilities, otherwise described as his/her strengths and weaknesses in order to perform daily living activities.

Each participant’s data will be collected and stored within a safe with access only to the primary investigator. This data will be saved for three years and then destroyed. There is no anticipation of risk or harm in participating in this study.

*Power Analysis*

A G power analysis was conducted to determine the power of the study (Faul, & Erdselder, 1992). The power analysis was done with the intention of utilizing a multiple regression statistic for analysis with six predictor variables. The effect size was .15 medium effect size, alpha .05, power .80, and, and lambda 14.7. The sample was calculated as 97, power 80.

*Instrumentation*

*Independent Living Scales (ILS)*

Independent Living Scales (ILS), by Patricia Anderton Loeb was developed in 1996 as an assessment of adults’ competence in instrumental activities of daily living skills. The items, which target situations relevant to independent living, require the examinee to perform problem-solving activities, demonstrate knowledge and correct choices. As a result, an individual’s performance on the ILS can determine the most appropriate living arrangements for adults who may demonstrate cognitive impairments (Loeb, 1996).
Specifically, the five subscales of the ILS are: Memory/Orientation, Managing Money, Managing Home and Transportation, Health and Safety, and Social Adjustment.

Memory and Orientation assesses an individual’s general awareness of his/her surroundings and short-term memory. Managing Money assesses an individual’s ability to count money, do monetary calculations, pay bills and take precautions with money.

Managing Home and Transportation assesses the individual’s ability to use the telephone, utilize public transportation, and maintain a safe home. Health and Safety assesses the individual’s awareness of personal health status and ability to evaluate personal health problems, handle medical emergencies and take safety precautions.

Social Adjustment assesses an individual’s mood and attitude towards social relations (Loeb, 1996).

The Total Score consists of the five subscales of Memory/Orientation, Managing Money, Managing Home and Transportation, Health and Safety, and Social Adjustment. The Total Score range is from Standard Score 55 to 121. The high range, which is defined as the ability for an older adult to live independently is from 100-121 (Loeb, 1996). The moderate range is defined as the ability to live under semi-supervision ranges from 85-105 (Loeb, 1996). Lastly, the low range spans from 55-85 which is defined as the need for complete supervision of living status (Loeb, 1996). The clinical utility of the ILS, as reported by Loeb, consists of the following: assesses an older adult’s ability to care for him/herself,
determine whether an older adult can manage his/her estate or personal finances, determine the most appropriate living environment, monitor cognitive capabilities through periodic examinations to determine functional abilities, and can be used in court cases when the question of guardianship arises.

Standardization

The sample of the standardization of the ILS was collected between July 1994 and June 1995. The two populations consisted of a non-clinical sample of 590 adults, 65 years of age and older, who had no known clinical diagnoses that would affect cognitive functioning, and a clinical sample of 248 adults, 17 years of age and older, who had various clinical diagnoses (Loeb, 1996).

The non-clinical sample consisted of adults who were fluent in English, negative for acute medical injuries, cognitive disability (including dementia), psychiatric diagnosis, or ongoing dependence of drugs/alcohol. Within this non-clinical sample, data were collected on three groups according to living status: independent, semi-independent, and dependent (Loeb, 1996). Loeb (1996) reported that the independent and dependent groups were used for setting cut off scores and establishing validity (p. 7). Living statuses were based on the level of assistance required with activities of daily living (preparing meals, taking medication, using transportation, bathing, dressing, toileting, and attending social events). The data revealed that independent living consisted of an individual living in a private home, either alone or with family, who is capable of all aspects of self care, including preparing a meal, housekeeping, and attendance of social events (Loeb, 1996). The criteria that consisted of semi-independent consisted of
an individual who lived in a supervised living situation, such as a retirement community or a nursing home, as a relatively high-functioning resident who required assistance for some activities of daily living or needed part-time assistance. Some examples provided by Loeb (1996) were housekeeping, medication management, meals, transportation, social activities. Last, the dependent living situation consisted of living in a nursing home or a rehabilitation hospital or at home with full-time caregivers. In addition, the individual needed full-time supervision and assistance with most activities of daily living. Therefore, the non-clinical sample included 400 older adults living independently, 100 living semi-independently, and 90 living dependently (Loeb, 1996). Each living situation was stratified according to the adult’s age, sex, education level, race/ethnicity, and geographic region. The aforementioned characteristics were broken down as follows:

a) Age consisted of five subgroups: 65-69, 70-74, 75-79, and 85+.

b) Sex consisted of 50% females and 50% males.

c) Education level consisted of four levels: ninth grade or less (<9), 10th to 11th (10-11), high school diploma or three years of college (12-15) and four or more years of college (>16).

d) Race and ethnicity were representative of the U.S. population of adults older than 65 years of age.

e) Geographic region consisted of four regions according to the United States census: Northeast, North Central, South, and West.
The ILS was administered to the 248 adults of the clinical sample each with one of the following diagnoses: mental retardation, traumatic brain injury, chronic psychiatric disturbances, or dementia (Loeb, 1996).

**Reliability**

The internal consistency reliability was calculated on the five subscales of the ILS, two factors, and the Full Scale, which included all 590 non-clinical cases (Loeb, 1996). The coefficient alpha was used. Reliability was lowest for the two subscales that had the fewest items (Memory/Orientation and Social Adjustment). Although, the alphas still indicated high level of internal consistency. For example, Memory/Orientation (.77), Managing Money (.87), Managing Home and Transportation (.85), Health and Safety (.86), and Social Adjustment (.72), Problem-Solving (.86), Performance/Information (.92), and Full Scale (.88) (Loeb, 1996).

Test-retest reliability was assessed on 80 older adults from the non-clinical sample (mean= 77 years of age). The interval between the two tests ranged from 7 to 24 days (mean= 14 days). The sample consisted of 60% females and 40% males, and 90% Whites, 9% African Americans, and 1% Hispanics; Living status consisted of: 39% Independent, 30% Semi-independent, 31% Dependent. The results suggested that there was no significance between the means of the first and second administration (Loeb, 1996). Moreover, the correlations between the first and second administrations are all high (Memory/Orientation, .84, Managing Money, .92, Managing Home and Transportation, .83, Health and Safety, .88,
Social Adjustment, .81, Problem-Solving, .90, Performance/Information, .94, and Full Scale, .91 (Loeb, 1996).

Inter-rater reliability consisted of having the ILS scored by two independent examiners to determine consistency between the two scorers. The generalizability coefficient was used to report inter-rater reliability (Loeb, 1996). The results suggested that the inter-rater reliability for each subscale, both factors and the Full Scale was very high. Specifically, Memory/Orientation .98, Managing Money, .99, Managing Home and Transportation .98, Health and Safety .96, Social Adjustment .95, Problem Solving .98, Performance/Information .99 and Full Scale .99.

Validity

The following types of validity were used in the process of standardizing the ILS: content, factorial, concurrent, criterion-related and construct. The manual describes each in detail. Beginning with content validity, after the selection of the final items, a Q sort was sent to four experts in the psychology of aging (Loeb, 1996). These experts were asked to sort and label the items according to areas of competence. The groupings of the items determined the specified subscale, that is, Social adjustment, Managing Money. Turning to factorial validity, an exploratory principal components analysis was conducted using a Varimax rotation. One major factor was found with an eigenvalue of 17.96 (Loeb, 1996). Additional factors were found and it was determined by Loeb that a four-factor model best represented the data.
The ILS concurrent validity studies include the Wechsler Adult Intelligence Scale-Revised (WAIS-R) and MicroCog: Assessment of Cognitive Functioning to assess both convergent and divergent validity. Beginning with the WAIS-R, the overall pattern of correlations suggests that the ILS subscales assess constructs that are related, but clearly are not identical, to general intelligence as was measured by the WAIS-R (Loeb, 1996). Moreover, the Social Adjustment subscale was the least correlated with general intelligence, as was measured by the Full Scale IQ. Loeb (1996) also noted that the WAIS-R does not measure functional abilities or individual strengths and weaknesses as the ILS does. The pattern of correlations between the ILS and MicroCog suggest that the two instruments are assessing somewhat similar constructs (Loeb, 1996).

According to Loeb, there was no existing assessment of functional competence to serve as a "gold standard" to establish the sensitivity and specificity for criterion-referenced cut-scores for the ILS (p. 68). Sensitivity was defined as correctly classifying adult cases who live dependently and specificity referred to correct classification of adults who live independently (Loeb, 1996). Therefore, the ILS determined the criterion-related validity through the non-clinical sample's living statuses. Three cut scores were established. Two cut-off scores delimit the three classifications: high, moderate, and low functioning. Whereas, the third cut-off score represented the score at which sensitivity and specificity are the highest and the most comparable (Loeb, 1996).

According to Loeb (1996), for the ILS to be a more clinically useful instrument, validity was established with individuals with diagnoses that involve
cognitive impairment (p. 68). The conditions with cognitive impairments consisted of the following: mental retardation, traumatic brain injury, dementia, and chronic psychiatric disturbance. First, a chi-square was computed to test the interdependency between two factors: level of functioning according to ILS cut-off scores (high, moderate, low) and clinical status (cognitive impaired group) (Loeb, 1996). The chi-square determined any differential distributions across level of functioning. Next, mean differences and a MANCOVA, using Wilks lambda, was first conducted to test for an overall effect due to clinical status followed by univariate ANOVAs for each subscale, both factors and the Full Scale (Loeb, 1996).

*Delis-Kaplan Executive Function System (DKEFS)*

*Sorting Test*

The Sorting Test is one of the nine measures of the Delis-Kaplan Executive Functioning System (D-KEFS), which specifically measures executive functioning abilities. Specifically, the measure assesses the following cognitive functions: initiation of problem-solving behavior, concept-formation skills, modality-specific problem-solving skills (verbal versus non-verbal), the ability to explain the sorting concepts abstractly, the ability to transfer sorting concepts into action, the ability to inhibit previous sorting responses in order to engage in flexibility of behavior, and the ability to inhibit previous description responses in order to engage in flexibility of thinking (Delis, Kaplan, & Kramer, 2001, p.105).

The Sorting Test consists of two testing conditions: Free Sorting and Sort Recognition. On the Free Sorting task, the examinee is presented with six mixed-
up cards that display both stimulus words and various perceptual features (Delis, Kaplan, & Kramer, 2001, p.105). The objective of the measure is to sort the cards into two groups, using three cards per group, in order to determine as many different categorization rules or concepts as possible. Upon figuring out the concepts, the examinee needs to describe the concepts he/she used to generate the sort. Each of the two card sets can be grouped into a maximum of eight sorts: three sorts are based on verbal-semantic information from the stimulus words, and five are based on visual-spatial features or patterns on the cards (Delis, Kaplan, & Kramer, 2001, p.105). On the second condition, Sort Recognition, the examiner places the cards into the eight separate sorts and asks the examinee to identify the concept of each sort. Throughout the process, the examiner is not to reveal whether the examinee is correct or incorrect. The examinee's problem-solving performance is scored in terms of both accuracy of the sorting responses and the descriptions of the sorting concepts (Delis, Kaplan, & Kramer, 2001, p.105).

The internal consistency values for the Sorting Test total scores are the following:

*Age Group 60-69 Condition 1 (Free Sorting) 0.81, Age Group 70-79 Condition 1 (Free Sorting) 0.81, Age Group 80-89 Condition 1 (Free Sorting) 0.77.*

Test-retest reliability for the *age group 58-89* were the following (*r*12):

Condition 1 (Free Sorting) 0.62, Standard Error of Measurements for the *60-69 age group* was the following: Condition 1 (Free Sorting) 1.31, 95% confidence, 2.57. Standard Error of Measurements for the *70-79 age group* was the following: Condition 1 (Free Sorting) 1.31, 95% confidence, 2.57. Standard Error of Measurements for the *80-age group* was the following: Condition 1 (Free Sorting) 1.43, 95% confidence, 2.80 (Delis et al., 2001).
Trail Making Test

The D-KEFS Trail Making Test consists of a series of tasks. The specific Trail Making Test that measures executive functioning abilities is Condition 4, Number-Letter Switching. This task measures assessing flexibility of thinking on a visual-motor sequencing task. The cognitive tasks involve using visual scanning, number sequencing, letter sequencing, and motor speed. There are numbers and letters spread throughout the page. The participant is asked to connect number to letter as quickly as he/she can. This measure further requires the participant to scan the page quickly, integrate data, simultaneously alternate between number and letter, which requires cognitive set shifting. For example, the ability to shift simultaneously two separate ideas as quickly as possible is mediated by the executive/abstractive abilities.

The internal consistency values for the Trail Making Test for the age groups are the following: 60-69: 0.80, 70-79: 0.60, and 80-89: 0.77 (Delis et al., 2001, p. 20). The test-retest reliability was the following: Condition 4: Switching: 0.55, the Standard Error of Measurements were the following: ages, 60-69, 1.33, 95% Confidence Interval 2.61, 70-79 1.89, 95% Confidence Interval 3.71, 80-89, 1.43, 95% Confidence Interval 2.80 (Delis et al., 2001).

Verbal Fluency Test

The D-KEFS Verbal Fluency Test compromises three testing conditions: Letter Fluency, Category Fluency, and Category Switching. The purpose of the Letter Fluency test is to evaluate the spontaneous production of words beginning with a given letter within a limited amount of time (Delis, Kaplan, & Kramer,
2001, p.55). Each participant will be given three separate letters on three separate occasions are asked to think of as many words that begin with the corresponding letter as quickly as he/she can, excluding proper names. The Category Fluency condition, the examinee is asked to generate words that belong to a designated semantic category as quickly a possible (Delis, Kaplan, & Kramer, 2001, p.105).

Internal Consistency values for Verbal Fluency were the following:

Condition 1: Letter Fluency (ages 60-69) 0.85, (ages 70-79) 0.87, (ages 80-89) 0.86. Test-retest reliability for the Verbal Fluency measure is the following: (ages 50-89) Condition 1: Letter Fluency 0.88. The standard error of measurement for Verbal Fluency is the following for the age group of 60-69, Condition 1: Letter Fluency 1.16, 95% confidence interval 2.27. Standard error of measurements for the 70-79 age group: Condition 1: Letter Fluency 1.08, 95% confidence interval 2.12. Standard Error of Measurements for the Verbal Fluency measure for the ages of 80-89: Condition 1: Letter Fluency 1.13, 95% confidence interval 2.22 (Delis et al., 2001).

Tower Test

The Tower Test consists of five disks that vary in size from small to large and a board with three vertical pegs (Delis, Kaplan, & Kramer, 2001). The goal of the measure is to move the disks across the three pegs to build the target tower in the fewest number of moves possible. There are two rules, the examinee must follow: to move only one disc at a time and never to place a larger disc over a smaller disc. On the Tower Test, the minimum number of moves possible for a correct solution varies from 1 move (Item 1) to 26 moves (Item 9) (Delis et al.,
2001). This task measures first-move completion time, total number of moves, item-completion time, final achievement (correct or incorrect tower), and number of rule violations. The Tower Test measures several key executive functions, including spatial planning, rule learning, inhibition of impulsive responding, inhibition of perseverative responding, and establishing and maintaining the instructional set (Delis et al., 2001, p. 20).

The internal consistency coefficients were derived by developing two half tests using an even-odd methodology. The correlation between the half tests was corrected using the Spearman-Brown formula to derive the internal consistency coefficients (Delis et al., 2001, p. 39). The following were the internal consistency coefficients: age 60-69 0.72, age 70-79 0.78, age 80-89 0.61. The test-retest reliability coefficients for the age group of 50-89 were the following (r12): total Achievement Score 0.38. The Standard Error of Measurement for the Tower Test is the following: age 60-69: 1.59, 95% confidence 3.12, age 70-79: 1.41, 95% confidence 2.75, age 80-89: 1.87, 95% confidence 3.67 (Delis et al., 2001).

Design Fluency

The Design Fluency Test is composed of three conditions. For each condition, the examinee is presented rows of boxes each containing an array of dots that the examinee must connect, with four lines only, to make a different design (Delis et al., 2001). Condition 1: Filled Dots, each response box contains five filled dots, and the examinee is asked to draw as many designs as possible in 60 seconds, by connecting those dots.
According to Delis et al. (2001) item interdependence precluded the use of internal consistency procedures, and reliability was investigated with test-retest procedures (p. 24) (Delis et al., 2001).

**Digit Span**

Digit Span is one of the fourteen subtests of the Wechsler Intelligence Scale-Third Edition. The subtest compromises two separate parts: digits forward and digit backward. Digits forward is an immediate attention/concentration measures. The participant is asked to listen to a string of numbers ranging from two to nine. Immediately following the examiners prompt, the participant is asked to repeat the numbers in order. Conversely, Digit Span backwards, is a more complex task, which requires the participant to listen to a series of numbers, however orally repeat the numbers backward. This task assesses more difficult attentional abilities, specifically working memory.

The following are the reliability coefficient for Digit Span:

**Age Group**

a) 65-69  
   b) 70-74  
   c) 75-79  
   d) 80-84  
   e) 85-89

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-69</td>
<td>.93</td>
</tr>
<tr>
<td>70-74</td>
<td>.90</td>
</tr>
<tr>
<td>75-79</td>
<td>.90</td>
</tr>
<tr>
<td>80-84</td>
<td>.87</td>
</tr>
<tr>
<td>85-89</td>
<td>.84</td>
</tr>
</tbody>
</table>

The Standard Error of Measurement for Digit Span is the following:
Age Group

a) 65-69 0.79
b) 70-74 0.95
c) 75-79 0.95
d) 80-84 1.08
e) 85-89 1.20

Procedures

Each participant after voluntarily agreeing to take part in the study will sign a consent form. Initially, each participant will complete a demographics form that will be used primarily for descriptive purposes (see Appendix A). For example, the demographics form will consist of name, gender, age, highest level of education completed, living status (independent, semi-independent, under complete supervision), and medication use. Upon completion of the demographics form, each participant will be administered the Independent Living Scale that will determine his/her ability to live independently. Moreover, each participant will then complete the following executive functioning measures: Sorting Test, Trail Making Test (condition 4), Verbal Fluency (condition 1), Design Fluency (condition 1), Tower Test and Digits Span. The estimated time to complete the seven assessments is approximately 1 hour and 45 minutes.
The research hypotheses are:

1. There will be a positive relationship between scores on the Trail Making Test, Sorting Test, Tower Test, Verbal Fluency, Design Fluency, Digit Span and the Independent Living Scale.

2. The following executive functioning measures, Trail Making Test, Sorting Test, Tower Test, Design Fluency and Digit Span will demonstrate high predictability of living independently, as measured by the Independent Living Scale.

2a. Of all the executive functioning measures, Verbal Fluency will yield the lowest predictability of living independently, as measured by the Independent Living Scale.

Research Hypothesis 1: The six independent variables are the scores from the Trail Making Test (condition 4), Tower Test, Design Fluency (condition 1), and Sorting Test of the Delis-Kaplan Executive Function System as well as Digit Span from the WAIS-III. The dependent variable is the total score from the Independent Living Scale. A correlation analysis will be utilized to examine the relationships between the six independent variables and the total score of the dependent variable. There will be a positive relationship among the independent and dependent variables.
Research Hypothesis 2: The six independent variables are the scores from the Trail Making Test (condition 4), Verbal Fluency (condition 1), Tower Test, Design Fluency (condition 1), and Sorting Test of the Delis-Kaplan Executive Function System as well as Digit Span from the WAIS-III. The dependent variable is the total score from the Independent Living Scale. A simultaneous multiple regression will be used to examine the predictability of the independent variables with the dependent variable.

Research Hypothesis 2a: The independent variable, Verbal Fluency (condition 1), will be examined through the simultaneous multiple regression to determine the predictability of the independent living scale.
Chapter IV

ANALYSIS OF THE DATA

Results

The purpose of the study was to determine whether tests of executive functioning would predict an individual’s ability to live independently. The investigation included six independent variables which were the scores from the following neuropsychological measures: Trail Making Test, Verbal Fluency, Design Fluency, Sorting Test, Tower Test, and Digit Span. The dependent variable was the total score from the Independent Living Scale (ILS). The total score of the ILS was obtained from all five subscale scores, which produced a standard score that represented an individual’s ability to live independently.

Descriptive Statistics

Description of Participants

The participants of the study were each administered the aforementioned executive functioning measures along with the ILS. Ninety-seven participants completed the battery of tests. The participants were recruited through retirement communities, local county organizations, community volunteers, and referrals from other participants. All participants provided written informed consent prior to study participation. The research investigator sat with each individual as he/she completed the battery of tests. It took approximately 1 hour and 35 minutes to administer. To avoid fatigue effect, executive functioning measures were administered first. All of the packets were completed.
Respondents' Gender

Fifty-four respondents were female (55.7%) while 43 respondents were male (44.3%). See Table 1 for means and percentages of the demographic variable of gender.

Table 1

Demographic Characteristic - Gender

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>43</td>
<td>44.3</td>
</tr>
<tr>
<td>Female</td>
<td>54</td>
<td>55.7</td>
</tr>
</tbody>
</table>

Note. N= 97.

Respondents' Age

The participants' age ranged from 65 to 89 years old. The mean age for the male participants was 72.77, while the mean age for the female participants was 74.67. The median for the entire sample was 72.00, with a standard deviation of 6.45. See Table 2 for the means, standard deviations, and percentiles.

Table 2

Demographic Characteristic - Age

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>S. D.</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>72</td>
<td>6.76</td>
<td>44</td>
<td>45.4</td>
</tr>
<tr>
<td>Female</td>
<td>74</td>
<td>6.13</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td>65-71</td>
<td></td>
<td></td>
<td>16</td>
<td>16.5</td>
</tr>
<tr>
<td>72-78</td>
<td></td>
<td></td>
<td>9</td>
<td>9.1</td>
</tr>
</tbody>
</table>

Note. N=97.
Respondents’ Race

Of the total sample of 97, 79 participants (81.4%) indicated they were Caucasian. Eight participants (8.2%) reported their race to be Hispanic. Six participants (6.2%) indicated they were African American. Two participants (2.1%) reported themselves to be Asian and two participants reported to be Native American (2.1%). See Table 3 for frequency and percentages for demographic variable of race/ethnicity.

Table 3

Demographic Characteristics- Race/Ethnicity

<table>
<thead>
<tr>
<th>Race</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>79</td>
<td>81.4</td>
</tr>
<tr>
<td>African American</td>
<td>6</td>
<td>6.2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>8</td>
<td>8.2</td>
</tr>
<tr>
<td>Asian</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Native American</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>100</td>
</tr>
</tbody>
</table>

Note. N=97.

Respondents’ Educational Level

Each participant was asked his/her highest level of education. Forty-three participants (44.3%) had obtained a high school degree, 12 participants (12.4%) had a Bachelor’s degree, 13 participants (13.4%) had completed middle school, 11 participants (11.3%) had completed partial high school, 10 participants (10.3%) had completed some college, 6 participants (6.2%) had completed a Master’s degree, 1 participant (1.0%) had completed a Doctorate, and 1 participant (1.0%) had completed a Juris Doctorate. Table 4 displays the results in detail.
Table 4

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Middle School</td>
<td>12</td>
<td>12.4</td>
</tr>
<tr>
<td>Some high school</td>
<td>11</td>
<td>11.3</td>
</tr>
<tr>
<td>High school degree</td>
<td>43</td>
<td>44.3</td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>12</td>
<td>12.4</td>
</tr>
<tr>
<td>Some college</td>
<td>10</td>
<td>10.3</td>
</tr>
<tr>
<td>Master's degree</td>
<td>6</td>
<td>6.2</td>
</tr>
<tr>
<td>Doctorate</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Juris Doctorate</td>
<td>1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*Note. N=97.*

Respondents' Living Status

Sixty-eight participants (70.1%) reported that they lived with their spouse.

It was not delineated whether participants were aided by a spouse for living purposes. Furthermore, living independently or living with a spouse did not imply normal functioning. Fifteen participants (15.5%) reported that they lived independently without a partner. Ten participants (10.3%) reported that they lived with supervision. Two participants (2.1%) reported that they lived semi-independent, while two participants (2.1%) reported that they lived with others.

Table 5 displays the results in detail.

Table 5

<table>
<thead>
<tr>
<th>Living Condition</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>15</td>
<td>15.5</td>
</tr>
<tr>
<td>Semi-Independent</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>With supervision</td>
<td>10</td>
<td>10.3</td>
</tr>
<tr>
<td>Live with others</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Live with spouse</td>
<td>68</td>
<td>70.1</td>
</tr>
</tbody>
</table>

*Note. N= 97.*
Respondents' Economic Status

Fifty-nine participants (60.8%) reported their economic status as middle class, 25 participants (25.8%) reported working class, 9 participants (9.3%) reported upper class, and 4 participants (4.1%) reported upper middle class.

Table 6 displays the results in detail.

Table 6

Demographic Variable- Economic Status

<table>
<thead>
<tr>
<th>Economic Status</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper class</td>
<td>9</td>
<td>9.3</td>
</tr>
<tr>
<td>Middle class</td>
<td>59</td>
<td>60.8</td>
</tr>
<tr>
<td>Working class</td>
<td>25</td>
<td>25.8</td>
</tr>
<tr>
<td>Upper middle class</td>
<td>4</td>
<td>4.1</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>100</td>
</tr>
</tbody>
</table>

Note. N=97.

Participants' Scores on Measures

The participants completed the Independent Living Scale (ILS) and each of the six measures of executive functioning. The mean for the ILS was 8.9381, with a standard deviation of 3.59. The mean for the TMT was 7.1753, with a standard deviation of 3.44906. The mean for Verbal Fluency was 8.1031, with a standard deviation of 3.21288. The mean for Design Fluency was 8.4227, with a standard deviation of 2.92496. The mean for the Sorting Test was 8.5979, with a standard deviation of 2.92496. The mean for the Tower Test was 7.3608, with a standard deviation of 3.08283. Lastly, the mean for Digit Span was 8.6289, with a standard deviation of 2.73221. See Table 7 for the descriptive statistics of
means, standard deviations and modes for all of the independent variables and dependent variable.

Table 7

Descriptive statistics for independent and dependent variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILS</td>
<td>8.9381</td>
<td>3.59</td>
<td>12.00</td>
</tr>
<tr>
<td>TMT</td>
<td>7.1753</td>
<td>3.44906</td>
<td>10.00</td>
</tr>
<tr>
<td>Verbal</td>
<td>8.1031</td>
<td>3.21288</td>
<td>9.00</td>
</tr>
<tr>
<td>Design</td>
<td>8.4227</td>
<td>2.92496</td>
<td>9.00</td>
</tr>
<tr>
<td>Sorting</td>
<td>8.5979</td>
<td>2.92496</td>
<td>9.00</td>
</tr>
<tr>
<td>Tower</td>
<td>7.3608</td>
<td>3.08283</td>
<td>6.00</td>
</tr>
<tr>
<td>Digit Span</td>
<td>8.6289</td>
<td>2.73221</td>
<td>7.00</td>
</tr>
</tbody>
</table>

*Note. N= 97.*

Correlations

A correlation matrix was conducted to determine the relationship between the executive functioning measures and the ILS. The results suggested there was a positive relationship among all of the executive functioning measures and the ILS. Table 8 displays the results in detail.

Table 8

Intercorrelations for Observed Variables: Pearson Correlation

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMT</td>
<td>.827**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal</td>
<td>.752**</td>
<td>.766**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td>.736**</td>
<td>.812**</td>
<td>.712**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorting</td>
<td>.736**</td>
<td>.813**</td>
<td>.780**</td>
<td>.826**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tower</td>
<td>.767**</td>
<td>.819**</td>
<td>.740**</td>
<td>.786**</td>
<td>.805**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digit Span</td>
<td>.779**</td>
<td>.819**</td>
<td>.738**</td>
<td>.764**</td>
<td>.765**</td>
<td>.773**</td>
<td></td>
</tr>
</tbody>
</table>

*Note. N= 97.*

** p < .01.
**Multiple Regression**

A simultaneous multiple regression analysis was conducted entering the six tests of executive function simultaneously to predict the total ILS score. Trail Making Test was a positive predictor of independent living as measured by the Independent Living Scale (Loeb, 1993), $\beta (6,90) = .373, p < .05, R^2 = .742$. The Trail Making Test was the only variable that accounted for significant unique variance (68%). Summary statistics, beta values, and t values for the tests of executive function are presented in Table 9.

**Table 9**

*Results of Multiple Regression Analysis for Prediction of Independent Living Scale.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>Significance of t</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trail Making Test</td>
<td>.373*</td>
<td>.003</td>
<td>(6,90)</td>
</tr>
<tr>
<td>Verbal Fluency</td>
<td>.173</td>
<td>.070</td>
<td>(6,90)</td>
</tr>
<tr>
<td>Design Fluency</td>
<td>.010</td>
<td>.929</td>
<td>(6,90)</td>
</tr>
<tr>
<td>Sorting Test</td>
<td>.079</td>
<td>.500</td>
<td>(6,90)</td>
</tr>
<tr>
<td>Tower Test</td>
<td>.118</td>
<td>.275</td>
<td>(6,90)</td>
</tr>
<tr>
<td>Digit Span</td>
<td>.187</td>
<td>.072</td>
<td>(6,90)</td>
</tr>
</tbody>
</table>

Note: Beta values are the standardized regression coefficients. * $p < .05$
$R^2 = .742$

**Post-Hoc Analysis**

Condition 4 of the Trail Making Test (TMT) assessed both processing speed and cognitive flexibility of thinking. The latter assesses one’s ability to process two separate ideas simultaneously. A regression analysis was conducted to determine which cognitive task predicted the significant findings of the TMT.
The results concluded that processing speed was significant for predicting independent living, whereas, cognitive flexibility was not ($\beta$ (2, 94) = .738, $p < .05$, R2 = .69). See Table 10 for further details.

Table 10

Regression analysis of the TMT

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMT processing</td>
<td>.328*</td>
<td>(7,89)</td>
</tr>
<tr>
<td>TMT errors</td>
<td>.103</td>
<td>(7,89)</td>
</tr>
</tbody>
</table>

Note: Beta values are the standardized regression coefficients.

* $p < .05$

$R^2 = .69$

Hierarchical Regression

Hierarchical regression analysis was used to assess the predictive effects of the following executive functioning measures (Verbal Fluency, Design Fluency, Trail Making Test, Tower Test, Sorting Test, Digit Span) and the Total Score of the Independent Living Scale. The order of variable entry was purposely determined. For analysis, the Trail Making Test was entered in the first step. The reason for this was due to the significant finding that was noted in the previous multiple regression. The second step was Digit Span and Verbal Fluency. The third and final step was Design Fluency, Tower Test, and Sorting Test. Step two was purposely ordered as these variables were the second greatest predictors in the multiple regression to determine living independently. The results indicated that the Trail Making Test was a positive predictor of living independently as measured by the Independent Living Scale $\beta$ (1, 95) = .827, $p < .05$, R2 = .734. In addition, Trail Making Test accounted for 68% of the unique variance. Lastly,
Trail Making Test, Verbal Fluency and Digit Span accounted for 73% of the unique variance.

Table 11

*Hierarchical Regression Analysis to Predict Independent Living*

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>ΔR²</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trail Making Test</td>
<td>.827**</td>
<td>.684</td>
<td>(1,95)</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trail Making Test</td>
<td>.464**</td>
<td>.05</td>
<td>(2,93)</td>
</tr>
<tr>
<td>Digit Span</td>
<td>.232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Fluency</td>
<td>.225</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trail Making Test</td>
<td>.373**</td>
<td>.008</td>
<td>(3,90)</td>
</tr>
<tr>
<td>Digit Span</td>
<td>.187</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Fluency</td>
<td>.173</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Fluency</td>
<td>.010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tower Test</td>
<td>.118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorting Test</td>
<td>.079</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. N= 97*

**p < .05

**Support of the Hypotheses**

The first research hypothesis, there will be a positive relationship between scores on the Trail Making Test, Sorting Test, Tower Test, Verbal Fluency, Design Fluency, Digit Span and the Independent Living Scale was supported. Specifically, the correlation matrix (see Table 8) demonstrated positive relationships between all six independent variables (Trail Making Test, Tower Test, Design Fluency, Sorting Test, and Digit Span) and the dependent variable (ILS).

The second research hypothesis, tests of executive functioning will predict living independently, supported only one of the six independent variables. Performances on the Trail Making Test predicted the dependent variable of living
independently (see Table 9). The other five independent variables were not significantly predictive of the dependent variable.

Last, this study did not support the second part of research hypothesis number two. Verbal Fluency was not the least predictive of the executive functioning measures (see Table 9).
Chapter V

CONCLUSIONS AND RECOMMENDATIONS

Today, the largest growing age group is those people 65 and older (Clark & Bond, 2000). In fact, the United States Department of Health and Human Services reported that older adults (age 65+) represented 13% of the United States population in 2000 and is expected to reach 20% by 2030. Therefore, the expected rise in population will place a greater demand on health care professionals. Specifically, psychologists, gerontologists and neuropsychologists will play a vital role in assessing functional capabilities. One definitive area of functioning will be determining competency to perform daily living activities.

Determining competency, that is, an individual’s ability to perform autonomous acts, is an essential element in assessing an older adult. Competency assessment is a clinical, ethical, and legal dilemma. The process of making decisions for oneself ultimately defines a person’s autonomy. Therefore, not only does the healthcare professional need to consider what rendering one “incompetent” does to a person’s autonomy, but also consider the ramifications resulting from not identifying an individual’s incompetence. Hence, referral questions aimed at determining an older adult’s capabilities of driving, living independently, managing his or her medication, or financial estate is a difficult endeavor.

Competency concerns an individual’s legal capacity to make certain decisions and to perform certain acts (Marson, 2001). There are several areas of competency. For example, driving a car, participating in research, obtaining
power over one's estate, and consent to medical treatment. This study focused on
the specific competency of living independently.

There are two major difficulties with assessment of competency. The first
difficulty is the changing definition of competency and capacity. The second
difficulty is the fact that various states require different guidelines for determining
competency (Wulach, 1998). One area that has been uniformly accepted is the
fact that courts across the nation recognize that capacity in one area of functioning
does not necessarily imply capacity in other areas of functioning. For example,
the ability to give consent to medical research and drive a car entails the same, but
also very unique cognitive abilities.

The American Psychological Association recommends two areas when
determining practice guidelines for assessing competency. The first area is the
assessment of efficacy. According to the APA (as cited in Baker et al., 1998)
"when conducting neuropsychological assessments, quantifiable clinical
observations are preferred to clinical consensus" (p. 87). Therefore, objective
data is more reliable than information and subjective data. The second area is
concerned with clinical utility. To meet criteria for the APA's clinical utility,
interventions are reviewed for three variables: feasibility, can one generalize the
results, and costs and benefits of using the intervention in actual practice (Baker et
al., 1998).

Traditionally, the method of assessing an individual's functional capabilities
was assessed through administering a variety of neurocognitive measures.
Depending on the individual's performance on the neuropsychological measures,
recommendations would be provided to determine that individual’s functional
capabilities (Kapp & Mossman, 1996). Today, this approach is still utilized and
supported through the works of Kapp and Mossman (1996), Richardson, Nadler,
Reitan and Wolfson (1993) and Bell-McGinty, Podell, Franzen, Baird, and
Williams (2002).

The above authors contend that competency testing or determining an
individual’s functional capabilities cannot solely be measured by one instrument.
Rather, if one uses a variety of cognitive measures that are statistically sensitive
and specific to brain impairments, then one can make the conceptual leap of
performance on standardized tests to real-world functioning (Bell-McGinty et al.,
2002). For example, if there are diffuse impairments with an individual’s
thinking abilities then he or she should not be able to drive, work, and so forth.
However, the question that remains is: are neuropsychological measures sensitive
enough to provide strong enough ecological validity to predict functional/real
world abilities? Robert Sbordone (2001), Spreen and Strauss (1998), Barberger-
Gateau et al. (1999), Thomas Bennett (2001) and Daniel Marson (2002) state that
neuropsychological tests are not able to predict such functional abilities and that it
is a paramount conceptual leap from impaired performances to activities of daily
living. For example, if an individual was diagnosed with mild dementia, does this
mean that he or she cannot drive? Live independently? Make financial decisions
about his/her estate?
The advent of functional assessments began in the early 1990’s. Patricia Loeb (1996) designed the first standardized, objective measure to determine an individual’s functional capability to live independently. Marson (2002), 6 years later developed the first measure to determine an individual’s ability to make financial decisions and estate planning/managing. The need to administer single functional measures is growing due to the increase of the older adult population as well as the paradigm shift with regard to assessing functional capabilities. However, the two-fold inherent problem is first, as alluded to above: are neuropsychological instruments sufficient enough to draw inferences about functional capabilities, and second: will it be practical and possible to design functional assessments for every independent activity? In the future, will neuropsychologists need to obtain each functional test and administer the functional test specified in the referral question as well as a complete battery to determine strengths and weaknesses from a cognitive standpoint?

**Results and General Discussion**

The purpose of this study was to determine whether tests of executive functioning, that is, the area of the brain that dominates self-regulation, abstract/higher-order abilities, planning, and organizing, could predict whether an individual could live independently.

The results of the present study provide support that tests of executive functioning which emphasizes processing speed for complex cognitive tasks predicts an individual’s ability to live independently. The Trails Making Test was the best predictor of ability to perform independent activities of daily living. This
measure accounted for the greatest amount of variance, followed by Verbal Fluency and Digit Span. The significance of Trail Making Test in predicting functional ability suggests the importance of processing complex integrative material. However, the results of the present study did not demonstrate the significant predictive power of the other five executive functioning measures.

The findings did not support Hypothesis 2a. For example, it was originally hypothesized that Verbal Fluency would be the least predictor of living independently. The reason being is that Verbal Fluency is not a task that requires problem-solving, reasoning, or cognitive flexibility of thinking. Therefore, it was assumed that this task would be easier than the other executive functioning measures. However, the results indicated it was the third highest predictor of living independently among the six executive functioning measures. It is hypothesized that the timed component may have negatively affected the participants’ performances.

_How My Study Relates to Past Literature_

The finding from the current study supports that position that measures of executive functioning cannot be used as the sole predictor of living independently. Daniel Marson (2001) argues that neuropsychological tests were not originally designed to determine functional capabilities, rather to determine general organic impairments (p. 268). Marson (2001) has spearheaded the research on developing functional assessments to determine competency in older adults. For example, the Capacity to Consent to Treatment is the first objective test developed by Marson (2002) to determine an individual’s ability to consent to medical procedures.
Marson (2002) reported the need will be for future neuropsychologists to develop tests that are sensitive and specific to individualized competency abilities.

Spreen and Strauss (1998) also reported there are too many limitations of neuropsychological testing as predictors of specific competency abilities. Specifically, they cited the works of Hartje et al. (1991), which assessed the predictive abilities of tests of executive functioning and driving abilities. The results concluded that neuropsychological tests of executive functioning did not accurately predict an individual’s driving abilities. Barberger-Gateau et al. (1999) also supported the study conducted by Spreen and Strauss (1998) by stating neuropsychological tests were not made to predict functional capabilities.

Bennett (2001) hypothesized the only way to truly determine one’s ability to live independently be to observe him/her in their environment. Bennett (2001) emphasized the qualitative approach where health care professionals should assess functional capabilities, such as living independently by observing and testing them within their own home. Specifically, occupational therapists could determine after spending time with individuals in their natural environment whether an individual requires living accommodations.

Robert Sbordone (1998) specifically stated, “while neuropsychological tests have been designed to identify cognitive impairments stemming from a brain insult and their severity, the vast majority of these tests were never designed to predict how these patients were likely to function in real-world settings, live independently, return to work, or maintain competitive employment (p. 121)”.
Sbordone supports the idea that specific tests need to be designed to assess specific competency.

**Opposing Research**

Kapp and Mossman (1996) disagree with Marson's theoretical position in that one measure to assess specific functional abilities cannot be determined. Kapp & Mossman (1996) discussed the term capacitor otherwise known as one unitary test to determine competency. This idea was strongly refuted by Kapp and Mossman. They recommended administering a series of neuropsychological tests which will assess the entire brain of an individual. Moreover, Kapp and Mossman (1996) support the theoretical position of making inferences from the data to real-world functioning.

Richardson, Nadler, and Malloy (1995) demonstrated a strong correlation between impaired performances on neuropsychological measures and impaired abilities to live independently. They utilized a series of neuropsychological tests aimed at assessing global cognitive functioning. Upon completion of the neuropsychological battery, each participant completed a questionnaire that differentiated their living status. The results demonstrated positive correlations between the neuropsychological tests and the living independently questionnaire.

Paul, Cohen, Moser, Zawacki, Ott, Gordon, and Stone (2002) found significant correlations between Global Deterioration Scale (GDS) ratings and performances on cognitive tests. Similar to Richardson et al study, impaired performances on the GDS led to impaired performances on the neuropsychological measures. The strongest predictor was memory abilities.
Bell-McGinty et al. (2002) examined the role of executive functioning as a predictor of living independently. The results demonstrated that tests of executive functioning positively predicted an individual's ability to live independently. Specifically, the measures of cognitive flexibility of thinking and processing speed were both strong predictors of living independently.

**Limitations**

There are several limitations to the current study. First, the population was primarily Caucasian. Though this matched the demographical standardization of the Independent Living Scale, it did not represent the national consensus of race and ethnicity. In addition, there was sampling error (non-stratified) in the sense that all participants were volunteers.

Second, the sample means for the independent variables of executive functioning were generally below the average range (see Table 7). A post-hoc multiple regression analysis of the raw scores was conducted in order to determine whether the norms influenced the below average scaled scores. The raw score regression analysis revealed the same findings as the scaled score regression analysis. Therefore, one factor that may explain the low scaled scores was the educational level of the participants. Specifically, 68% of the sample obtained a high school degree or less. Conversely, only 18% of the sample obtained college or post-graduate degrees. This was a significant difference compared to the stratification of education on the Delis-Kaplan Executive Functioning System. For example, 40% (age 60-65) and 35% (age 70-89) obtained a college degree or higher. Finally, education was not accounted for in
the conversion of raw scores to scaled scores. As a result, education may have been a contributing factor to the low sample means.

Third, the dependent variable, the Independent Living Scale was used as the objective measures to determine accurate living status. As mentioned above, the idea of one instrument that can accurately assess an individual’s ability to live independently has been argued.

Fourth, the Independent Living Scale (ILS) had several limitations. For example, the ILS is a self-report measure. It emphasized over-learned information, or crystallized intelligence. In other words, even with those people who may suffer a mild or moderate dementia, he or she will still be able to recall preserved, over-learned information (Geldmacher & Whitehouse, 1996). The test did not thoroughly assess short-term or incidental memory or learning. Moreover, the ILS was designed to test independent living skills. However, there was a significant absence of timed tests. In addition, the test’s ability to measure functional capabilities or physical activities was also scarce. There were only two items which required hands-on, functional capabilities—writing a check and making a phone call. Otherwise, the questions were asked and answered verbally. This type of format suits the theoretical orientation of neuropsychological tests more accurately than functional capabilities.

Last, one of the greatest limitations to the study is the assessment of one cognitive domain in determining one’s ability to live independently. This study solely focused on executive functioning abilities. This cognitive domain was chosen due to the components of planning, self-regulation, problem-solving, and
working memory. Future studies should incorporate other neuropsychological measures that assess a broader foundation of thinking abilities. For example, measures of short and long term memory, language abilities, visual spatial functioning, and processing speed.

**Implications for Practice and Future Research**

There are several recommendations for future studies. One suggestion is to control for living status. For example, the following living statuses should be separated and controlled for: independent, semi-independent (hours of supervision) and with a spouse. This would increase the sample size as well as enable the investigator to further evaluate the statistical differences between the groups.

Another recommendation is to investigate executive functioning as well as other neuropsychological abilities. Specifically, one should investigate the neurocognitive components of memory and living independently. The memory group could consist of short-term, long-term, verbal and visual memory.

A further research recommendation would be for future studies to focus on obtaining living information through other sources. For example, one can assess an individual’s functional capabilities in his/her home through naturalistic observations. In addition, researchers could utilize other forms of feedback through family members, spouse, friend, living partner, and so forth. Therefore, one could compare subjective check-lists and other naturalistic forms of living assessments versus objective, standardized living assessments, like the Independent Living Scale.
Finally, the sample should reflect the national consensus of the population in order to better generalize the results.

*Conclusion*

As the population for older adults continues to grow, the need to evaluate an individual’s functional capabilities will become more important. There has been a recent development with assessing financial decision-making in the elderly through the use of objective testing. However, the area of determining an individual’s ability to live independently is still emerging. According to the Department of Health and Human Services (2000), about 31% (9.9 million) of all non-institutionalized older persons in 1998 lived alone (7.6 million women, 2.3 million men). They represented 41% of older women and 17% of older men. Living alone correlates with advanced age. Among women aged 85 and over, for example, three of every five lived outside a family setting. While a small number (1.47 million) and percentages (4.3%) of the 65+ population lived in nursing homes in 1997, the percentages increases dramatically with age, ranging from 1.1% for persons 65-74 years to 4.5% for persons 75-84 years and 19.0% for persons 85+ (U.S. Bureau of the Census, p. 515). These staggering statistics confirm the future need to accurately assess one’s ability to live independently.

To date, the Independent Living Scale is the only objective assessment with sound statistical evidence which purports to assess and evaluate an individual’s ability to live independently. Currently, when assessing for competency or activities of daily living, according to Marson (2002) the norm is to administer a series of neuropsychological tests and to determine from the findings the
individual’s ability to live independently (p. 100). Researchers have argued the ecological validity of impaired neuropsychological findings. This argument becomes more difficult when subtle cognitive impairments are noted on neuropsychological tests. The question of whether an individual can live independently is becoming more important to be properly and to be objectively answered.

This study demonstrated that of six executive functioning measures, only one was significant in predicting an individual’s ability to live independently. Therefore, utilizing only tests of executive functioning would not be a good indicator in determining an individual’s ability to live independently. Therefore, future areas of study should focus on incorporating a series of neuropsychological tests as well as an independent living measure. Also, the need to develop and standardize other tests of living independently is important with an emphasis on functional capabilities.
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Demographic Information

Name __________________________

Age __________________________

Date __________________________

Race/Ethnicity:

___ African American            ___ Asian/Pacific
___ African                    ___ Native American
___ Afro-Caribbean             ___ White/Caucasian
___ Hispanic/Latino
___ Other (please indicate) ______________________________________

Economic Status: of your family

___ Upper Class              ___ Upper Middle Class
___ Middle Class             ___ Lower Middle Class
___ Working Class            ___ Lower Class

Highest Grade Completed __________________________

Handedness __________________________

Medication __________________________

Living Status:

___ Independent(alone)______________

___ Others __________________________

___ Semi-Independent _____________  ___ With Spouse

___ With Supervision (hours) __________