PSYCHOMETRIC PROPERTIES AND CLINICAL UTILITY OF THE TEXAS FUNCTIONAL LIVING SCALE SHORT FORM IN INDIVIDUALS WITH SCHIZOPHRENIA

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DEDICATION

I would like to thank the members of my Thesis Committee for their continual patience and guidance. I would also like to acknowledge the strength and perseverance The Lord granted me, my husband, and my family for all of their support, prayers, and belief in my ability to complete this project.

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by

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THESIS

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ABSTRACT

BACKGROUND: Schizophrenia is a chronic mental disorder presenting with psychotic and cognitive symptoms that lead to impairments in independent living and psychosocial functioning. Individuals with schizophrenia demonstrate cognitive deficits in areas of attention, executive functioning, memory, and language. Additionally, schizophrenia has been associated with impairments in activities of daily living (ADLs) such as toileting and the ability to feed one's self and instrumental activities of daily living (IADLs) such as taking medication, financial management, communication, and transportation.

METHODS: Twenty-six participants diagnosed with schizophrenia or schizoaffective disorders were recruited from the University of Texas Southwestern Medical Center's Division of Translational Neuroscience of Schizophrenia's IRB approved Database Registry for Psychotic Disorders and completed a neuropsychological test battery which included the Texas Functional Living Scale (TFLS) and University of California San Diego (UCSD) Performance-based Skills Assessment (UPSA). IBM SPSS Statistics (SPSS v. 19.0) was used to perform Pearson correlation coefficients and multiple regression analyses to identify which subscale(s) of the TFLS had the highest predictive ability for examining IADLs to create a possible short form and to identify which subscales of the TFLS long form have the strongest correlation to neurocognitive measures used in the study. The present pilot study used the Type I error rate at .10; a 90% confidence interval.

RESULTS: Results of the analysis indicated that the Time and Money Calculation subscales of the TFLS long form significantly correlated with more neurocognitive measures than the UPSA. Specifically, these two subscales had a higher number of moderate to strong correlations with the

neurocognitive measures compared to the UPSA. Results also indicated the TFLS short form to have a stronger correlation with the UPSA (r =.59, p < .003) compared to baseline correlations of the TFLS long form and the UPSA (r = .34, p < .112), which suggests that the Time and Money Calculations subscales of the TFLS can be used as a valid short form of the TFLS in the assessment of IADLS in schizophrenia.

DISCUSSION: Overall, the short form of the TFLS appears to be a valuable addition to standard neuropsychological assessment batteries given its numerous correlations with neurocognitive measures. Results also suggest that the TFLS short form is a stronger measure for detecting IADL impairments compared to its original long form and the UPSA.

Keywords: schizophrenia, TFLS, ADL, IADL, cognitive functions, executive functions, attention, memory, language

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LIST OF ABBREVIATIONS

ADL- Activities of Daily Living

IADL- Instrumental Activities of Daily Living

SZ- Schizophrenia

TFLS-Texas Functional Living Scale

UPSA- University of California San Diego (UCSD) Performance-based Skills Assessment

CHAPTER ONE

Introduction

Schizophrenia is a chronic and devastating mental illness affecting multiple areas of the brain. Symptoms seen in schizophrenia can be divided into three categories: positive or psychotic symptoms, negative symptoms, and cognitive impairments (Kelly, Sharkey, Morrison, Allardyce, & McCreadie, 2000). Schizophrenia affects approximately 1% of the global population and is among the top four of the ten leading causes of disability in the United States and other developed regions (Murray & Lopez, 1996). Since the turn of the century, there have been vast improvements in the psychiatric treatment of schizophrenia. Despite these improvements, deficits in functional ability and independent living persist, including medication management and self-care.

Impairment in cognition generally is stable over the course of the illness even when other symptoms such as hallucinations, delusions, blunted affect, and disorganized behavior subside. A review by Green (1996) indicated that cognitive deficits in such areas as verbal memory, immediate or working memory, and executive functions have an equal or greater role in predicting functional impairment in individuals with schizophrenia compared to positive or negative symptoms.

One of the primary cognitive deficits seen in schizophrenia is impairment in attention. Individuals who are predisposed to schizophrenia often have inattention and distractibility prior to the onset of their first psychotic episode and by the time of the first episode of psychosis, impairments in attention can be of moderate severity (Cornblatt *et al*., 1985). Working memory, which is considered an area of attention and requires the manipulation of information, is also

often impaired in schizophrenia (Bowie & Harvey, 2006).

Executive functioning includes a wide array of cognitive functions such as goal-directed behavior, inhibition, and cognitive flexibility. In general, individuals with schizophrenia have difficulty with most if not all executive functioning processes, including emotional control, planning, and problem solving (Bowie & Harvey, 2006). Addington and Addington (1999) administered a test battery which included an assessment of executive functioning and found impaired cognitive flexibility was associated with lower scores on the *Quality of Life Scale* which measures independence, social and community activities, and personal fulfillment (Heinrichs, 1984). The ability to plan and organize is another area of executive functioning often found to be impaired in individuals with schizophrenia (Pantelis *et al*., 1999; Bustini *et al*., 1999). Neuroimaging studies have found smaller total brain volumes and frontal lobe volumes, the latter of which are implicated in executive functioning and responsible for integrating information and performing higher cognitive and emotional functioning. Such abnormalities in the frontal lobe may be implicated in executive dysfunction in schizophrenia, such as disorganized thinking (Andreasen *et al*., 1994).

Verbal fluency deficits, demonstrated by impairment in the ability to produce words from phonological or semantic categories, have been implicated in difficulties in social situations and independent living skills (Addington & Addington, 2000). Specifically, individuals with schizophrenia with verbal fluency deficits have been observed to have difficulty in describing a problem, generating a solution to the problem, and enacting the solution in a role-play test (Addington & Addington, 2000).

Moderate to severe impairment in verbal memory is also common in individuals with schizophrenia (Gold *et al*., 1997; McGurk & Twamley *et al*., 2007). Verbal memory dysfunction is one of the predictors of difficulties in independent functioning (Toulopoulou & Murray, 2004). Impairments in retrieval, encoding, and declarative memory are also seen in individuals with schizophrenia (Gold & Harvey, 1993; Ranganath, Minzenberg, & Ragland, 2008; Stone, Gabrieli, Stebbins, & Sullivan, 1998).

Overall, deficits in areas of cognition such as attention, executive functions, language, and memory appear to have the greatest impact on independent living skills in people with schizophrenia. Given that cognitive functioning is a strong predictor of an individual's functional ability, the identification of cognitive deficits in schizophrenia can aid in tailoring treatment in a more focused direction. Therefore, valid and reliable measures that assess cognitive deficits and IADL impairment can be especially useful when assessing individuals with schizophrenia.

The Texas Functional Living Scale (TFLS) is a reliable and valid measure used to assess IADL impairments in individuals with neurological disorders, as is the University of California San Diego (UCSD) Performance-based Skills Assessment (UPSA). Creating a short form of the TFLS with similar psychometric properties to the original long form could serve as a useful and time-saving tool when evaluating individuals with schizophrenia. The present study aims to compare the TFLS long form and short form of the TFLS to the UPSA and explore the utility of each for detecting IADL impairments in schizophrenia.

Purpose of Study

The purpose of the current study is to examine the psychometric properties and clinical utility of the TFLS long form in individuals with schizophrenia. Additionally, the plan is to develop and validate a brief scale derived from the TFLS with similar psychometric properties to the longer version and explore how well the short form of TFLS predicts cognitive impairments of participants clinically diagnosed with schizophrenia or schizoaffective disorder. Brief assessment tools are beneficial to clinicians, patients, and their families given that measures which assess IADLs are often lengthy to administer and can be burdensome to more impaired patients (Spector, 1997). We predict that subscales of the TFLS that are highly correlated with specific cognitive skills in the areas of executive functions, verbal memory, and attention will be the best predictors of IADL impairment.

CHAPTER TWO

Review of the Literature

SCHIZOPHRENIA

HISTORY

The German psychiatrist Dr. Emil Kraepelin first classified schizophrenia as a discrete mental illness in 1887 (Kraepelin, 1921). He referred to the disorder as "dementia praecox" because of deficits in memory, attention, and language seen in this disorder (Andreasen, 1994). Kraepelin's description of schizophrenia identified it as a disease of the brain characterized by intellectual and social decline and emphasized the role of cognitive impairment in the clinical conceptualization of schizophrenia (Fioravanti, Carlone, Vitale, Cinti, & Clare, 2005).

The term 'schizophrenia' meaning *split-mind* was established in 1911 by a Swiss psychiatrist, Dr. Eugen Bleuler, who first characterized this disorder with positive and negative symptoms as well as chronic relapses and remissions (Bleuler, 1950; North & Yutzy, 2010). However, Bleuler's perspective of schizophrenia relied more heavily on the presence of cognitive deficits and negative symptoms. Bleuler studied his patients with schizophrenia by giving them psychological tests, specifically word association tasks which were being administered by Carl Jung in the early 1900's (Ellenberger, 1970). The findings from these word association tasks led to Bleuler's concept of *loosening of associations*, now referred to as *thought disorder* (Moskowitz & Heim, 2011). Primarily, Bleuler considered loosening of associations to be a core deficit which underlies other characteristic symptoms seen in schizophrenia such as disorganized speech and delusions (Moskowitz & Heim, 2011). The emphasis on psychotic symptoms came mainly from the teachings of the German psychiatrist, Kurt Schneider (Fischer

& Carpenter, 2009; Schneider, 1959). Indeed, individuals with schizophrenia typically experience the illness with active symptoms, such as delusions and hallucinations, and multiple and frequent hospitalizations (Maxmen, Ward &, Kilgus, 2009).

Schizophrenia is known to have a neurobiological and genetic basis, as well as impacted by environment. For example, an individual's social network or treatment by parents, is thought to be an additive factor but not the main cause of illness (Lewis and Lieberman, 2000). Adoption, twin, and family studies have identified specific genetic components for schizophrenia with the strongest evidence being linked to chromosomes 6p, 8p, 10p, 22q, with the most likely gene mapping to chromosome 6p (Gottesman, 1991; Hallmayer, 2000; Norton, Williams, & Owen, 2006).

Schizophrenia affects approximately 1% of the global population and has a lifetime prevalence of 1.4 - 4.6 per 1,000 in all populations across the globe, with an annual incidence of between 0.16 - 0.42 per 1,000 (Jablensky, 2000). Patients with schizophrenia occupy close to one quarter of general care hospital beds in the United States (excluding geriatric patients with cognitive disorders) and two-thirds of all psychiatric beds (Maxmen, Ward, & Kilgus, 2009). Women tend to have fewer and shorter stays in the hospital compared to men (Goldstein, 1988). Men tend to experience an earlier onset of the illness, more severe clinical signs, and a more chronic course (Salem & King, 1998). Subsequent episodes of schizophrenia may be less pronounced and can manifest with symptoms of dysphoric mood, decreased energy, and a lack of interest in pleasurable activities in both men and women (Vaillant, 1962 & 1964).

Schizoaffective disorder is an illness which presents with symptoms of schizophrenia as well as symptoms of an affective/mood disorder such as depression or mania. The term

"schizoaffective disorder" was first introduced in 1933 to described patients who presented with both schizophrenic and affective symptoms (Maxmen, Ward, & Kilgus, 2009). Treatment for schizoaffective disorders resembles the treatment for schizophrenia, typically by an antipsychotic alone or in combination with an antidepressant or mood stabilizer (Murru, Pacchiarotti, Nivoli, Grande, & Vieta, 2011). Cognitive functioning in individuals with schizoaffective disorder resembles the impairments seen in schizophrenia rather than those typically shown in individuals with affective/mood disorders. Specifically, individuals with schizoaffective disorder tend to have more pronounced attention, executive functioning, and memory deficits when compared to mood disorders (Glodstein, Shemansky, & Allen, 2004).

Current DSM-IV Conceptualization

The Diagnostic and Statistical Manual of Mental Disorders (*DSM-IV-TR*, 2000) requires an individual to have two or more of the following symptoms to reach a formal diagnosis of schizophrenia: delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behavior, or negative symptoms. These symptoms should be present for a significant amount of time during a one month period and persist for at least six months.

There are five subtypes of schizophrenia according to the *DSM-IV-TR*. The *Paranoid Type* presents with preoccupations with one or multiple delusions and/or auditory hallucinations. The *Disorganized Type* has symptoms of disorganized speech and behavior, along with flat or inappropriate affect but not catatonia. The *Catatonic Type* is diagnosed when the individual has multiple symptoms of motoric immobility, excessive motor activity, extreme negativism or mutism, peculiarities of voluntary movement, and echolalia, which is the imitation of words spoken by another person, or echopraxia, which is the repetition of actions by another person.

The *Undifferentiated Type* meets the criteria for Schizophrenia but not any other subtype. The *Residual Type* does not have symptoms of delusions, hallucinations, disorganized speech, or grossly disorganized or catatonic behavior but does show negative symptoms or the presence of odd beliefs, and unusual perceptual experiences (DSM-IV, American Psychiatric Association, 2000).

Delusions, hallucinations, formal thought disorder, and bizarre and disorganized behavior are considered to be "positive" symptoms and reflect an excess or distortion of normal functioning (Wykes & Steel *et al*., 2008). Thought disorder can be viewed as occurring along a spectrum. At one end, symptoms are severe, such as loosening of associations and word salad, and at the other end, milder symptoms such as tangential and circumstantial thinking (Andreasen, 1995).

Negative symptoms, which entail a decrease or loss of normal functioning, consist of blunted affect, social withdrawal, anhedonia, apathy, and amotivation (Wong & Van Tol, 2003). The presence of negative symptoms is related to a poorer prognosis, greater cognitive deficits, and impaired psychosocial functioning, whereas positive symptoms respond better to medications and have less pronounced memory and processing speed deficits (Andreasen *et al*., 1990; Davidson & MCGlashan, 1997; Tamminga, Buchanan, & Gold, 1998; Wong, Voruganti, Heslegrave & Awad, 1997).

According to the *DSM-IV*, schizoaffective disorder is diagnosed when the individual has a full major depressive, manic or mixed episode with symptoms that meet criteria for schizophrenia. There also must be the persistence of delusions or hallucinations for at least two weeks during a euthymic phase of the affective/mood disorder (APA, 2000).

Neuropathology of Schizophrenia

Structural Abnormalities

Abnormalities in brain structure are commonly found among individuals with schizophrenia, with primary involvement of the frontal and temporal lobes (Andreasen *et al*., 1994; Naugel, Cullum, & Bigler, 1998; Reite *et al*., 1993; Shenton *et al*., 1992). Ventricular enlargement and cortical atrophy (decreased cortical volume) has been observed in certain subgroups of individuals with schizophrenia (Andreasen, *et al*., 1990; Gur *et at*., 1998; Johnstone *et al*., 1976; Pfefferbaum *et al*., 1998 Zipursky *et al*., 1992). In addition, pronounced volume reduction in the hippocampus, which is an area involved in learning and memory, has been reported (Honea, Crow, Passingham, & Mackay, 2005; Steen, Mull, MrClure, Hamer, & Lieberman, 2006). Working memory and executive functioning deficits have been associated with a reduction in frontotemporal connectivity and in prefrontal cortical activity in individuals with schizophrenia (Haenschel, Bittner, & Haertling, 2007; Rissling, Makeig, & Braff, 2010; Spoletini, Cherubini, Di Paola, 2009; Sun, van Erp, & Thompson, 2009).

Neurochemical Abnormalities

Hyperactivity of the dopamine (DA) system is responsible for psychotic symptoms in schizophrenia (Seeman, 1987). Antipsychotic medications reduce psychotic symptoms typically by blocking the absorption of dopamine. Chlorpromazine, known as Thorazine in the United States, is a major tranquilizer and typical antipsychotic (first generation) medication that was used to treat schizophrenia in the early 1950's. Thorazine was revolutionary at that time in the management of positive symptoms such as delusions and auditory hallucinations (Wong & Van Tol, 2003). However, cognitive deficits and negative symptoms such as affective flattening,

alogia, or avolition seen in schizophrenia have not been reported to improve with conventional neuroleptics (Bilder, 1997; Jibson & Tandon, 1995). Presently, the most effective drug for treating schizophrenia is clozapine, an atypical or second generation antipsychotic (Tamminga, 2006), and it has been noted to be effective in treating cognitive deficits such as verbal and visual memory, reaction time, and set shifting as well as both positive and negative symptoms (Breier *et al*., 1994; Lee**,** Thompson, & Meltzer, 1994 Lindenmayer, *et al*., 1994; Manschreck, Redmond, Candela & Maher, 1999).

Cognitive Impairment and Activities of Daily Living (ADLs)

Cognitive impairment is often associated with deficits in the ability to perform daily activities, such as financial planning, transportation, and work performance (Bryson & Bell, 2003; Green, Kern, & Braff, 2000). Cognitive deficits are a core feature in individuals with schizophrenia and are often present throughout the course of the illness. Schizophrenia can manifest with reductions in global intellectual functioning (e.g. IQ scores), attention, executive functioning, language/communication, and memory (Bilder *et al*., 2000; Bowie *et al*., 2006; Cornblatt *et al*., 1999; Keefe & Fenton, 2007; Neuchterlein, Barch, & Gold, 2004; Saykin, Shtasel, & Gur, 1994).

Activities of Daily Living (ADLs) are basic self-care activities that are necessary for an individual to function independently in life. In various psychiatric illnesses, including schizophrenia, ADLs become compromised due to the progressive and disabling nature of the disorders. ADLs are broken down into two groups: basic ADLs and IADLs (instrumental activities of daily living). Basic ADLs include communication, ability to feed and dress oneself, and toileting. IADLs are more multifaceted and require more complex cognitive skills, including

such tasks as cooking, financial and medication management, shopping, and transportation (Dorzdick & Cullum, 2001). Assessment of ADLs and IADLs is considered an evaluation of *everyday competence,* referring to an individual's ability to perform a range of activities needed for independent living (Willis, 1991).

Cognitive ability has been implicated as a predictor of functional skills in numerous studies (Sauvaget, Yamanda, Fujiwara, Sasaki, & Mimori, 2002). A study by McClure *et al*. (2007) examined the relationship between specific neuropsychological domains such as memory, processing speed, language, and executive functions and their relation to social and living skills in individuals with schizophrenia. Results indicated that processing speed, episodic memory, and executive functions were associated with everyday living skills, while social skills were associated with working, episodic memory, and verbal fluency. Goverover and Hinojosa (2002) reported a relationship between impairments in executive functioning and IADLs, impacting such tasks as taking medication, using the phone, and managing finances. Penn *et al*., (1995) found that the degree of social competence (e.g. paralinguistic and nonverbal skills) in individuals with schizophrenia is associated with information processing ability. Green (1996 & 2000) reported that cognitive functioning, particularly in the areas of verbal memory, immediate or working memory, and executive functioning are the best predictors of functional outcomes, such as social problem solving. Executive functions, attention, and verbal fluency deficits were also noted to predict poor social functioning (Breier *et al*., 1991).

IADL Measures and Schizophrenia

Texas Functional Living Scale (TFLS)

The Texas Functional Living Scale (TFLS) is a performance-based measure of functional ability (Cullum, Weiner, & Saine, 2009). The TFLS can be used to assess IADLs in individuals with a variety of neurodevelopmental and neurodegenerative disorders including schizophrenia, traumatic brain injuries, autism, mild or moderate intellectual disability, major depressive disorder, and mild Alzheimer disease (Cullum *et al*., 2001). The TFLS is made up of four subscales: Money and Calculations, Time, Communication, and Memory.

The Money and Calculation subscale assesses an individual's ability to handle money. Tasks vary in degree of difficulty from counting money to making change. The Time subscale is used to examine an individual's ability to tell and predict time and use a calendar. The Memory subscale measures an individual's ability to complete tasks after a time delay. It also examines the use of a nonspecific cue (an alarm) in prompting the recall to perform the activity, such as when to take medication. The Communication subscale examines multiple abilities, such as writing a check, using the phone directory, and the ability to learn and follow written directions. Impairment in these areas causes the individual to be more dependent on others and is also seen as a factor leading to institutionalization (Cullum, Weiner, Saine, 2009).

The TFLS correlated highly (r =.88, p = < 0.001) with the *Mini-Mental State Examination* (MMSE; Folstein, Folstein, & McHugh, 1975) suggesting an association between an individual's ability to perform IADLs and global cognitive functioning (Cullum *et al*., 2001). The TFLS also correlates moderately (r = .43-.49, p < 0.001) with the *Blessed Dementia Rating Scale* (Blessed, Tomlinson, & Roth, 1968) which is an informant rated measure of functional

capabilities. The TFLS was administered to 22 individuals diagnosed with schizophrenia. When compared to normal controls, participants with schizophrenia had lower scores, with significantly more pronounced deficits in the areas of medication management, ability to follow simple directions, and money calculations (Cullum, Weiner, & Saine, 2009).

University of California San Diego (UCSD) Performance-based Skills Assessment (UPSA)

The University of California San Diego (UCSD) Performance-based Skills Assessment (UPSA)is a measure of functional abilities that assess skills in five areas: household chores, communication, finance, transportation, and comprehension and planning. Patterson, Goldman, McKibbin, Hughs, and Jeste (2001) examined the concurrent validity of the UPSA compared to other performance-based measures such as the *Direct Assessment of Functional Status* (DAFS, Loewenstien *et al*., 1989) and the *Quality of Well-Being Scale* (QWB, Kapalan *et al*., 1989) which is a self-report questionnaire. Results indicated a strong correlation between the UPSA and the DAFS ($r = 0.86$, $p < 0.001$), but the correlation between the UPSA and QWB was not significant ($r = 0.28$, $p > 0.05$). The UPSA has been found to have acceptable psychometric properties in a sample of patients with mixed MCI (mild cognitive impairment) and Alzheimer's disease (Goldberg, Koppel, Keehlisen *et al*., 2010; Patterson, Goldman, McKibbin *et al*., 2001). In addition, the UPSA was administered to 50 patients with a diagnosis of schizophrenia and 20 normal controls at the University of San Diego's Intervention Research Center. Results showed the schizophrenia group to be significantly more impaired ($df = 68$, $p = < 0.001$) compared to control group in all areas of functioning (Patterson, Goldman, McKibbin, Hughs, & Jeste, 2001).

Global Cognitive Functioning and ADL/IADL Implications

Many studies have reported that cognitive impairment negatively affects an individual's ability to perform IADLs (Acker & Davis, 1989; Bertrand, Willis, & Sayer, 2001; Burton, Strauss, Hultsch, & Hunter, 2006; Chan-Weiner, Mallory, Boyle, Marran, & Salloway, 2000; Farmer & Eakman, 1995). Weiner, Fields, Hynan, and Cullum (2008) assessed patients with Alzheimer's dementia using the *Test of Everyday Functional Ability* (TEFA) and the MMSE. Results indicated a significant decline in IADLs in individuals with Alzheimer's disease (df = 38, p < .001 at visit 1 and df = 38, p < .001 at visit 2). The total correlation of annualized scores for TEFA and MMSE was r =.46, p < .003.

Wilk *et al*., (2004) evaluated individuals with schizophrenia and schizoaffective disorder using the *Repeatable Battery for the Assessment of Neuropsychological Status* (RBANS) which is a brief, standardized cognitive screening instrument and the *Wechsler Reading Achievement Test- 3* (WRAT-3). Overall, the total RBANS score was two standard deviations below the mean and the WRAT-3 Reading score was one standard deviation below the mean in schizophrenic subjects, reflecting global deficits. Results also indicated significant weak associations with language (r =.14; p < .01) and attention (r =.11; p < .01).

Offord and Cross (1971) found the age at onset of schizophrenia to be positively correlated with individuals having a childhood IQ below 80 (low average). Sheitman *et al*., (2000) examined pre-morbid (M= 93) and post-morbid (M= 83) IQ scores of 27 treatment resistant individuals with schizophrenia. Results indicated that IQ scores were significantly correlated (r = 0.80, p < 0.0001), with pre-morbid scores being predictive of an individual's post-morbid score. Additional studies have suggested that individuals with schizophrenia have lower

IQ scores compared to other individuals their age before the onset of illness, with IQ scores declining after the diagnosis of schizophrenia (Seidman *et al*., 2006). Weickert *et al*., (2000) found 51% (60 of 117) of patients with schizophrenia to have intellectual decline of 10 points or more from estimated pre-morbid IQ levels.

Attention and ADL/IADL Implications

Attention difficulties are often present in individuals with schizophrenia (Bleuler, 1950) and once the first psychotic episode has occurred, attention impairments can be of moderate severity (Caspi *et al*., 2003). In general, individuals with schizophrenia have been reported to have impairments in selective attention (the ability to selectively focus on a task while ignoring distracters), sustained attention (the ability to sustain concentration on an effort demanding task), and reaction time (Mirsky *et al*., 1986). Cullum *et al*., (1993) found similar results indicating significant difficulties with attention in individuals with schizophrenia compared to controls when given the *Digit Vigilance Test* (Lewis & Rennick, 1979), which measures ability to sustain attention and maintain vigilance on a number cancelation task. Braff *et al*., (1993) indicated that sustained concentration was impaired in individuals with schizophrenia when compared to healthy controls. Mirsky *et al*., (1995) found widespread deficits on several attention tasks in individuals with schizophrenia.

Working memory, an aspect of attention, involves the temporary storage of information for use in current mental operations (Baddeley, 1992). A form of nonverbal working memory, object working memory, has been reported to be impaired in schizophrenia (Tek *et al*., 2000). Impairment in object working memory involves perceptual deficits which leads to difficulty encoding and arranging incoming information and can cause problems in how one handles social

and interpersonal situations (Bowie & Harvey, 2006; Tek *et al*., 2000). Bowie *et al*., (2006) evaluated the relationship between cognitive ability and functional impairment by assessing 222 outpatient subjects with schizophrenia. This study used the UPSA for a measure of performance-based function. Cognitive functioning was assessed using a comprehensive neuropsychological battery that included measures of executive functioning, language, visuoconstruction, memory, and attention. Results suggested that attention and working memory were related to an individual's social competence in areas such as maintaining social contacts and communication skills.

Executive Functions and ADL/IADL Implications

Planning, organization, self-control, and inhibition (i.e., executive functions) are all mediated by an individual's frontal brain system. Executive functions also include an individual's ability to manipulate information, initiate and terminate activities, and recognize errors (Goverover, 2004). The ability to organize and create mental frameworks for incoming information which can help an individual to understand vague stimuli is impaired in individuals with schizophrenia (Bowie & Harvey, 2006). Inflexible thinking and poor planning are other aspects of executive dysfunction seen in schizophrenia and has been reported to be associated with difficulties in occupations (Bustini *et al*., 1999; Goldberg *et al*., 1990; Koren *et al*.,1998; Lysaker *et al* 1995; Pantelis *et al*., 1999, Pantelis *et al*., 1997).

Executive dysfunction can be a better predictor of ability to perform ADLs in older individuals compared to other measures of cognitive functioning such as language and psychomotor speed (Cahn-Weiner, Malloy, Boyle, Marran, & Salloway, 2000). Boyle, Paul, Moser, and Cohen (2004) found baseline levels of executive dysfunction as a strong predictor of

future functional impairment in patients with vascular dementia. In general, tasks which measure executive functions are among the best predictors of independent skills in the areas of self-care, interpersonal, occupational, and social functioning in schizophrenia (Evans *et al*., 2004; Lysaker *et al*., 1995; McGurk *et al*., 2003; Velligan *et al*., 2000). Yochim, Lequerica, MacNeill, and Lichtenberg (2008) assessed elderly adults using the Initiation/Perseveration subtest of the *Dementia Rating Scale* (DRS; Mattis, 1988), and found cognitive initiation (semantic fluency and tasks of motor initiation and perseveration), another aspect of executive functioning, to be the strongest future predictor (β =.25, p = < .05) of IADL impairment in elderly adults. In schizophrenia, executive dysfunction was reported to negatively impact the ability to choose items from a menu, as well as shop and cook (Semkovska *et al*., 2004).

Language and its ADL/IADL Implications

Language deficits and thought disorder are characteristics of schizophrenia (DeLisi, 2001). Individuals with schizophrenia may have loose and aberrant speech associations, poverty of speech, and neologisms (Andreasen & Grove, 1986). Bleuler (1950) found disturbances in word association to be fundamental components to thought disorders. Disturbances in communication can be characterized as either "positive" or "negative" (Andreasen, 1979a, b). Positive thought symptoms are characterized by disorganized and disconnected speech. This disorganization is seen when individuals with schizophrenia try to express words or phrases and the communication response is inadequate, tangential or circumstantial (Andreasen, 1979a; Harvey *et al*., 1992). Negative thought symptoms are associated with a generalized reduction of verbal output (Andreasen, 1979b; Harvey *et al*., 1992). Disconnected speech and verbal under-productivity are thought to be stable traits seen throughout the course of illness (Marengo &

Harrow, 1997)

Thought disorder (i.e. disconnected and disorganized speech) has been associated with poorer pre-morbid work adjustment, re-hospitalization, and deficits in adaptive functions such as the ability to hold employment (Harrow *et al*., 1983; Marengo & Harrow, 1997; Racenstein *et al*., 1999). Verbal under-productivity has been associated with fewer friendships and a withdrawal from social interaction (Bowie & Harvey, 2008). Bowie and Holshausen (2011) examined the relationship between verbal under-productivity and disconnected speech. Results indicated a significant relationship between disconnected speech and impairment in the area of social competence, such as saying "hello" to a neighbor ($F_{(1, 84)} = 40.8$, $p < .001$, $R^2 = .32$). The results of verbal under-productivity and its relation to social competence such as resolving a conflict with landlord, was also significant ($F_{(1, 84)} = 18.9$, $p < .001$, $R^2 = .19$). These results indicated that verbal deficits can impair aspects of social functioning in individuals with schizophrenia.

Memory and ADL/IADL Implications

Memory difficulties have been reported in the majority of individuals with schizophrenia when compared to normal controls (Ongur *et al*., 2006; Titone, Ditman, Holzman, Eichenbaum, Levy, 2004). Specifically, deficits have been reported in areas of retrieval, encoding, and recognition (Gold & Harvey, 1993). Declarative memory, which is the ability to store facts relating to memories which can be easily discussed or declared, is another area shown to have impairments in individuals with schizophrenia (Ranganath, Minzenberg, & Ragland, 2008; Stone Gabrieli, Stebbins, & Sullivan, 1998). Intact verbal memory is associated with an individual's success in multiple areas such as adaptive, occupational, and social success (Green *et al*., 2000)

and poor retention of verbal information has been implicated in schizophrenia (Gold *et al*., 1997; McGurk *et al*., 2004, Saykin *et al*., 1991; Saykin *et al*., 1994). Deficits in the ability to encode and retain verbal information has been in implicated in significant functional impairment, typically more that other cognitive domains besides executive functioning (Saykin *et al*., 1991; Saykin *et al*., 1994). Specifically, verbal memory has been implicated in functional domains such as community outcome, social problem solving, and psychosocial skill acquisition (Green, 1996; Green, Kern, Braff, & Mintz, 2000).

Memory impairment has been reported to affect ADLs and IADLs in individuals with schizophrenia. Also, deficits in ADLs are predictive of memory impairment in schizophrenia with either the presence of positive or negative symptoms (Godbout, Limoges, Allard, Braun, & Stip, 2007). Laes and Sponheim (2006) reported that deficits in verbal memory were associated with poor social functioning in patients with schizophrenia. A meta-analysis by Green (2000) subdivided pertinent studies into three areas of functional outcome in individuals with schizophrenia: community outcome (occupational functioning and independent living), social problem solving (solving of interpersonal problems), and social skill acquisitions (conversation skill and medication management). Results indicated that verbal memory correlated with all three areas.

CHAPTER THREE

Methodology

Participants

Twenty-six (26) participants who met *DSM-IV* criteria of schizophrenia or schizoaffective disorder (DSM-IV; American Psychiatric Association, 1994) were recruited from the University of Texas Southwestern Medical Center's Division of Translational Neuroscience of Schizophrenia's IRB approved Database Registry for Psychotic Disorders (DRPD; # 102004-027) to participate in a double-blind medication study. All twenty-six (26) participants used were described as outpatients and considered medically stable, meaning they were currently taking anti-psychotic medication. Participants were 18-58 years old and received diagnoses of schizophrenia or schizoaffective disorders as defined by the *DSM-IV*. Males and females were included, as were all races and ethnicities. Exclusionary criteria included any significant medical or neurological illness; such as multiple sclerosis; Parkinson's disease; uncontrolled diabetes mellitus; uncontrolled hypertension; a diagnosis of *DSM-IV* alcohol or substance abuse within the last month or *DSM-IV* alcohol or substance dependence within the last 3 months; borderline cognitive functioning as determined by medical records and clinical interview; pregnancy or lactation; failure to understand or sign informed consent; history of non-response to atypical antipsychotic medication; and non-English speaking. Participants signed and received copies of consent forms during the first appointment. All assessments were administered by the study personnel.

Functional Measures

The Texas Functional Living Scale (TFLS). The TFLS (Cullum, Saine, & Weiner, 2009) was created to assess an individual's functional competence and instrumental activities of daily living (IADLs) in a variety of clinical disorders. The TFLS contains 24 performance-based items assessing various direct or depicted aspects of IADLs. Tasks include using an analog clock, checkbook, calendar, phone, setting on microwave, calculating time and money, and recall of verbal instructions. Four subscale scores are derived: (a) Time, (b) Money and Calculation, (c) Communication, and (d) Memory. A normed *T*-score is provided for the TFLS Total Score and cumulative percentages are provided for the subscales scores.

The University of California San Diego (UCSD) Performance-Based Skills Assessment (UPSA). The UPSA (Patterson *et al*., 2001) is a performance-based measure of functional capacity that directly assesses everyday functional skills using standardized role-playing situations in five functional domains: comprehension/planning, finance, transportation, household chores, and communication. Total scores from each subscale range from 1-20. The subscale scores are then summed yielding a standardized total score ranging from 0-100.

Intellectual Functioning

Wechsler Adult Intelligence Scale-III (WAIS-III). The WAIS-III (Wechsler, 1997) is a test used to measure intelligence in adolescents and adults ages 16 to 89 and consists of 12 different subtests. The subtests examine verbal comprehension, working memory, perceptual reasoning, and processing speed. From the 12 subtests a Verbal IQ and a Performance IQ is obtained. These two scores create the norm referenced Full Scale IQ (FSIQ). The WAIS-III was standardized on 2,450 adult subjects who were divided into thirteen testing groups. Split-half

reliability coefficients were r =.97, p < .05 for Verbal IQ, r =.94, p < .05 for Performance IQ, and r =.98, p < .05 for FSIQ. Average individual subtest reliabilities ranged from r =.93, p < .05 to r =.70, p < .05 with a median coefficient of r =.85, p < .05 (Sternberg, 2000).

Processing Speed and Working Memory

WAIS-III Coding and Letter Number Sequencing. The WAIS-III Coding subscale is used to examine an individual's visuomotor and psychomotor speed along with attention and working memory abilities. Letter-Number Sequencing also assesses attention and working memory abilities but also examines their ability to perform mental manipulations. Standardized scores were used in the data analysis.

Trails Making Test A (TMTA). The TMTA (Reitan, 1958) measures processing speed, visuomotor speed and scanning and sequencing. Scoring is based on the number of seconds to complete the tasks. The total time raw score of TMTA is converted to a scaled score which is then converted to a normed *T*-Score. Test retest reliabilities are r =.79, p < .05 for TMTA and r =.89, p < .05 for TMT-B (Dikmen *et al*, 1999). Alternate form reliabilities showed a coefficient of r =.89 to r =.92, p < .05 for both Trails A and B (Charter *et al*., 1987). The *T*-scores from TMTA were used in the study.

Memory

Wechsler Memory Scale-Third Edition (WMS-III). The WMS-III (Wechsler, 1997) is a test designed to measure various memory abilities in individuals ages 16 to 90. There are eight subtests which give individual composite scores. The WMS-III has eight Primary Indexes which are used to evaluate memory functioning and four Auditory Process Composites which are supplementary. The WMS-III has an index internal consistency of r = .74 - .93, test retest

reliability of $r = .70 - .93$, $p < .05$, and a subtest internal consistency of $r = .74 - .93$, $p < .05$. The subtest used in this study was Spatial Span, which measures an individual's attention, working memory, and ability to hold and process the visual information being presented. Standardized scores were used in the data analysis.

Hopkins Verbal Learning Test-Revised (HVLT-R). The HVLT-R (Brandt & Benedict, 2001) assesses an individual's verbal learning and recall of a series of 12 words over three learning trials, free recall after a delay, and a recognition trial. The HVLT-R can be used with individuals who are between the ages of 16-92. Raw scores are converted to *T*-scores for Total Recall, Delayed Recall, Retention, and Recognition Discrimination. The HVLT-R has been shown to have acceptable test-retest reliability and its construct, concurrent, and discriminant validity have been established in multiple studies (e.g., Barr, Benedict, Tue, & Brandt, 1992; Benedict, Schreltlen, Groninger, & Brandt, 1998; Brandt, Corwisn, & Krafft, 1992; Rasmusson, Bylsma, & Brandt, 1995; Shapiro, Benedict, Schretlen, & Brandt; 1999). This study used the Total Recall *T*-score which consists of the number of words an individual can immediately recall across three trials after the list is verbally read to a participant.

Brief Visuospatial Memory Test- Revised (BVMT-R). The BVMT-R (Benedict, 1997) measures visuospatial memory and visual learning in individuals ages 18-79. There are three learning trials in which the participant is shown a stimulus card for 10 seconds and is then directed to draw from memory what he/she viewed on the card. A normed *T*-score is derived from the three trials (Total Recall), as well as for a delayed recall and recognition trial. The total recall score was used in the present study. The BVMT-R correlated with the WMS-R (Immediate Recall, $r = .69$, $p < .001$; Delayed Recall, $r = .86$, $p < .001$).

Executive Functions

Trails Making Test B (TMTB). The TMTB (Reitan, 1955) measures all the aspects of TMTA along with set shifting and cognitive flexibility. Scoring is based on the number of seconds to complete the task. The total time raw score of TMTB is converted to a scaled scored which is then converted to a normed *T*-Score. Psychometric properties are described above with TMTA. The *T*-scores derived from the TMTB raw scores were used in the study.

Wisconsin Card Sorting Task (WCST). The WCST (Heaton, 1981) is a card sorting task which measures problem solving ability across changing stimulus, set-shifting, and abstract reasoning. The WCST provides scores in the areas of categories correct, conceptualization, perseverations, and inefficient learning across stages of the test. Perseveration scores on the WCST reflect an individual's ability to inhibit an already expressed response while using the feedback given by examiner. The WCST has shown internal consistency of α =0.87 and test retest reliability of r = .74, p < .05 (Rahimi *et al*., 2011). Another study found test retest reliability to range from r = .34 - .83, p < .05 (Ingram, Greve, Ingram, & Soukup, 1999). The score used in this study was the number of perseverations (*T*-score).

Stroop Color-Word Test-Victoria Version (VST). The VST (Golden & Freshwater, 2002) is a measure designed to assess selective attention, processing speed, response inhibition and cognitive flexibility. The VTS has three different tasks. First, the individual is shown a sheet of paper with groups of the letter X printed in colored ink and asked to say the color of the ink out loud. Secondly, a page is shown with words (blue, red, green) that are printed in black and white ink and the examinee is asked to read the words. The third task has a page of words (red, blue, green) that are printed in a non-matching color (the word 'red' is printed in green ink) and the

examinee is asked to say the color of the ink and not the color of the word. Each subtest yields a score based on the number of items correctly completed in each stimuli, as well as an interference score. The VTS has test retest reliability of r =.71, p < .05 (Jensen, 1965). Internal consistency of r = .71 - .84, p < .05 (Chaftez & Mathew, 2004) and construct validity correlates well with other measures of attention and response inhibition (May & Hasler, 1998). The *T*-scores from all three trials as well as the interference *T*-score was used in this study.

Language

Category Fluency. Category fluency (Animals; Fruits and Vegetables; Rosen, 1980) is a norm referenced test that measures fluency of word production and speed by counting the number of words the individual can generate in 60 seconds when given a category cue. Scores are converted to a normed *T*-score. This study used the *T*-score from the Animals portion of this assessment.

Controlled Oral Word Association Test (COWAT). The COWAT (Benton & Hamsher, 1976) is used to evaluate the production of words beginning with certain letters, such as P, R, and W. The participant is asked to names as many words as they can in one minute that beginning with that letter, excluding proper nouns and the same word ending in a different suffix. The total number of words is added up and matched to a corresponding *T*-score according to age, gender, and years of education. The COWAT shows test retest reliability of r = 84, p < .05 and interrater reliability of r = .9, p < .05 (Ross et al., 2007). The *T*-score (letters PRW) is used in the current study.

Data analysis

The IBM SPSS Statistics (SPSS v. 19.0) was used for all analyses in this study including descriptive statistical analyses of the demographic variables and the measured variables. First, a bivariate correlation was computed to find the correlation between the UPSA total score and the original TFLS (the long form of the TFLS) total score. A second bivariate correlation was run to assess the correlations of each subscale of the TFLS and the long-form TFLS in order to determine the strength of the correlation coefficients. Third, each subscale of the long form TFLS was correlated with all neurocognitive measures (Table 2). This step aims to map out the strength of correlations between each long form TFLS subscale and all neurocognitive functions measured in the present study, and further select the proposed short form that can maintain the significant correlations with as many neurocognitive tests as possible. Logically the validated short form of the TFLS can have comparative validity with the long form TFLS, and further demonstrate that the short form is also a useful IADL measure (Table 4). Fourth, each subscale of the UPSA was correlated with all neurocognitive measures in the present study (Table 3). Thus, the present study compares whether the long-form and short form of TFLS have more significant correlations with all neurocognitive functions measured in the present study than the UPSA. In sum, the present study would demonstrate if the short form TFLS correlated significantly with the long form TFLS, UPSA, as well as multiple neurocognitive measures. Finally, the present study is a pilot study of a limited number of subjects, therefore the confidence interval is at 90%, type one error is at 0.1.

The data from the neuropsychological assessment were put into SPSS to do a multiple regression analysis to find the strongest TFLS domain to correlate with each of the

neurocognitive domains (i.e., measures of attention/working memory, executive functioning, memory, and language). Such steps will be repeated for the three other three areas of cognitive measures in order to find the strength of correlations derived from the first step. Then select TFLS domains which correlate strongly with the neurocognitive test will be examined. Lastly, a clinical short form of the TFLS will be generated and this short form will be correlated with the long form of the TFLS and UPSA. This will provide evidence for the practical usefulness of the TFLS short from.

CHAPTER FOUR

Results

Three participants were not included in the data analysis due to missing scores on the neuropsychological assessments (N = 23). Participants had a mean age of 43.43, *SD* = 8.33 with ages ranging from 27- 57. Mean education level was 13.39, *SD* = 2.48 with years of education ranging from 8-18. There were 14 males (60.9%) and 9 females (39.1%), 11 Caucasians (47.8%), 11African Americans (47.8%), and 1 Hispanic (4.3%). The means, standard deviations, and ranges of the TFLS, UPSA, and all the neurocognitive measures are in Table 1.

Results of the first bivariate correlation between the TFLS long form and the UPSA indicated the TFLS long form total score to have a small correlation ($r = .34$, $p = .112$) with the UPSA total score. Results from the second bivariate correlation showed the subscales of the TFLS to have strong correlations with the TFLS long form total score, with only the Memory subscale showing a moderate to strong correlation (Time $r = .64$, $p < .001$; Money Calculations $r = .60$, $p < .003$; Communication $r = .54$, $p < .008$; Memory $r = .44$, $p < .037$). The Time subscale correlated the strongest with the total score of the TFLS with the Money and Calculations subscale showing the second strongest correlation.

Results from the correlations of the TFLS subscales to the various neurocognitive measures (Table 2) indicated that the Memory ($r = .33$, $p = .123$) and Money Calculations ($r = .36$, $p = .092$) subscales to have a moderate correlation with the Trail Making Test - A and the Memory subscale showed a moderate correlation ($r = .37$, $p = .087$) with Trail Making Test - B. The Time subscale had a moderate correlation ($r = .31$, $p = .146$) with the WAIS-III Coding subtest and the Money ($r = .42$, $p = .044$), and Communication ($r = .42$, $p < .045$) subscales

moderately to strongly correlated to the WAIS-III Coding subtest. The Time (r = .34, p = .114) and Money (r = .38, p = .074) subscales showed moderate correlations with the WAIS-III Letter and Number Sequencing subtests. Results also showed strong correlations of the Money Calculations (r = .55, p = .007) and Memory (r = .51, p = .012) subscales to the WMS-III Spatial Span subtest. The Memory (r = .55, p = .007) subscale showed a strong correlation to the WCST, and the Money Calculations (r = .38, p = .073) subscale only showed a moderate correlation with the WCST. The Time (r = .35, p = .102) and Communication (r = .31, p = .148) subscales showed moderate correlations with the VST- Word and the VST- Interference scores (r = -.40, p = .064, r = -.35, p = .104). The Money Calculations subscale was found to have a moderate correlation with the HVLT-R (r = .36, p = .090). The Time (r = .40, p = .056) and Communication (r = .40, p = .057) subscales showed moderate to strong correlations with the BVMT-R with the Money Calculations subscale having a moderate correlation with the BVMT-R (r = .35, p = .104).

The UPSA, however, did not correlate to as many neurocognitive measures as the TFLS (Table 3). The UPSA Telephone subscale showed a moderate (r = .39, p = .064) correlation and the Transportation subscale showed a moderate to strong (r = .44, p = .037) correlation with the WAIS-III Letter-Number Sequencing subtest. The Telephone subscale of the UPSA showed a moderate to strong correlation (r = .47, p = .002) with the WCST and the Transportation subscale showed a strong (r = .51, p = .014) correlation with the WCST. The Telephone subscale had a moderate to strong correlation to the VST- Word score (r = .46, p = .029) and the VST-Interference score (r = .46, p = .029). The Transportation subscales also showed a moderate correlation to the VST-Word score (r = .42, p = .045). The Shopping subscale of the UPSA

showed a moderate negative correlation to the Trail Making Test- A (r = -.41, p = .052).

Results from the correlations above showed the Time and Money Calculations subscale of the TFLS to have the strongest correlations with the neurocognitive measures (Table 4). Meaning, these two subscales, when administered together as a short form of the TFLS, will include aspects of attention, executive functioning, language/communication, and memory when assessing IADLS in individuals with schizophrenia. Results indicated strong and significant correlations of the TFLS short form (Time and Money Calculations subscales) with the UPSA (r = .59, p < .003) while the TFLS long form only had a weaker correlation of r = .34, p = .112 with the UPSA. The baseline results comparing the TFLS long form to the UPSA showed that the UPSA was accounted for in 11.56% variance of the TFLS long form. The short form results to the UPSA showed a 23.25% increase in variance ($.59^2$; 34.81%). The TFLS short form had a strong correlation with the TFLS long form total score (r = .74, p < .000). Finally, the results also showed the TFLS to correlate with more neurocognitive measures than the UPSA, suggesting that the TFLS is the better scale of the two tests in the assessment of IADLs and cognitive functioning.

CHAPTER FIVE

Discussion

Results of this study provide evidence for the use of the TFLS Time and Money Calculations subscales as a valid short form assessment of IADL skills in individuals with schizophrenia. The short form of the TFLS correlated to more neurocognitive measures than the UPSA, making it a more useful and superior assessment tool for identifying functional deficits in schizophrenia, which presents with multiple areas of cognitive deficits. Also, the short form of the TFLS showed a better correlation to the UPSA ($r = .59$, $p < .003$) compared to the original long form of the TFLS. This finding indicated the short form of the TFLS may be a stronger measure of functional ability compared to other tests which assess IADLs. The Time and Money Calculation subscales also showed moderate to strong correlations with neurocognitive tests which assess visual attention and processing speed (Trails Making Test A), executive functions (Trails Making Test B, WCST, and VTS), and memory (BVMT-R, HVLT-R, & WMS-III Spatial Span), which indicated that the two TFLS subscales would serve as useful instrument to be used when assessing individuals with schizophrenia.

The TFLS Time subscale correlated the highest with the BVMT-R, suggesting that it is sensitive to visuospatial memory deficits. The Time subscale also showed a moderate correlation with the VST- Word score which measures aspects of attention and visual processing speed and a moderate correlation was found for the VTS- Interference score which assesses aspects of cognitive flexibility. Cognitive flexibility is a component of executive functioning and deficits in this area can negatively affect functional ability in areas of self-care and occupational, and social functioning in schizophrenia (Evans *et al*., 2004; Lysaker *et al*., 1995;

McGurk *et al*., 2003; Velligan *et al*., 2000). As previously mentioned, performance on measures of executive functioning can serve as one of the best predictors of functional ability in individuals with schizophrenia (Cullum *et al*., 1993; Evans *et al*., 2004; Lysaker *et al*., 1995; McGurk *et al*., 2003; Mirsky *et al*., 1986; Velligan *et al*., 2000). The Money and Calculations subscale had the highest correlation with the WMS-III Spatial Span subtest, which measures aspects of visuospatial working memory and requires the manipulation and storage of visual spatial information. The Money and Calculations subscale also showed a moderate to strong correlation with the WAIS-III Coding subtest which measures psychomotor speed, accuracy, attention, and learning. The Money and Calculations subscale also showed a moderate relationship to the WAIS-III Letter-Number Sequencing subtest which is a measure of working memory and involves mental manipulations and attention.

Together, the Time and Money Calculations subscales require the use of executive functions, attention and working memory, and memory. Deficits in these cognitive areas have been found to be associated with impairments in ADLs and IADLs in individuals diagnosed with schizophrenia and schizoaffective disorder (Ditman, Holzman, Eichenbaum, & Levy, 2004; Evans *et al*., 2004; Lysaker *et al*., 1995; McGurk *et al*., 2003; Velligan *et al*., 2000; Mirsky *et al*., 1986; Ongur *et al*., 2006). Deficits in the above mentioned cognitive domains have the ability to impact multiple areas of an individual's life such as their ability to hold jobs, use public transportation, medication adherence and management, and social relationships. In sum, when multiple areas of cognition and IADLs are impaired, it is less likely that an individual with schizophrenia will be able to live independently.

Implications

The TFLS appears to be an effective measure in the identification of IADL impairments and it correlated strongly with neurocognitive measures, suggesting that it is a useful tool for assessing individuals with schizophrenia, who often present with pronounced cognitive impairment. Currently, the TFLS long form is a widely used measure for assessing IADLs, but a potential drawback to its use is the time burden that administration of the full instrument can present. However, the results of this study suggest that the short form of the TFLS, which was demonstrated to have even better psychometric properties when compared to the original long from, can serve as a valuable and more time-efficient tool when used to assess IADLS in the schizophrenia population. In other words, the brevity of the short form of the TFLS would present an additional benefit to both patients and practitioners given the potential for fatigue due to the often lengthy nature of neuropsychological batteries. The short form of the TFLS also has the possibility of benefiting the patient and their family by decreasing their financial burdens.

In summary, our results indicate that the short form of the TFLS has the sensitivity necessary for the evaluation of IADL impairments through administration of the Time and Money Calculations subscales. Thus, the TFLS short form can be used as a single tool by clinicians to quickly obtain a snapshot of functional competence in a person with schizophrenia.

Future Directions

Further verification of the soundness of the psychometric properties for the short form of the TFLS is suggested for future research. It is hoped that additional studies will replicate the findings of this study with a larger number of subjects with schizophrenia and schizoaffective disorder in order to increase the reliability and validity of the TFLS short form. It also might be beneficial to run a similar study in a different populations (i.e., depression, mild cognitive impairment, or Alzheimer's disease) to possibly develop multiple short forms of the TFLS in order to expand the clinical utility of the measure for various neurological disorders.

Limitations

There were several limitations to this study. First, this study included a relatively low number of participants (N = 23), and therefore future research should utilize a larger number of subjects for the study to increase the power, which would allow for greater odds of observing the effect of the study (i.e. the usefulness of a short form in assessment of IADLs). Another limitation of the study was the omission of the designation of the specific subtypes of schizophrenia or schizoaffective disorder. This would be another valuable piece of information to have in gaining knowledge on the potential differences in IADL skills and cognitive functioning across the schizophrenia spectrum. A further limitation was the lack of diversity in ethnic groups and gender, as there were a higher number of Caucasian and African American males in the study. This study cohort also had a relatively high education level which could have skewed the results, and thus, a greater range of educational backgrounds would be optimal. Additionally, subjects in this study were relatively young (M = 43.43). Further studies that include older subjects with schizophrenia are needed, particularly given that as people age there

is a greater possibility of cognitive decline (Harvey, Silverman, Mohs, Parrella, White, Powchik, & Davis, 1999). Finally, another limitation was that this study did not record the average time it took the participants to complete the TFLS long form and the UPSA. If this information was available, it could provide more evidence of how efficient the use of the TFLS short form could be to clinicians who work with individuals with schizophrenia.

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Table 1

Descriptive Results of TFLS, UPSA, and Neurocognitive Measures

Measure	Range	M	SD
TMTa	29-66	42.48	9.78
TMTb	24-58	41.52	9.46
WAIS-COD	3-9	6.13	2
WAIS-LNS	3-13	8.61	2.29
WMS-SSpn	2-15	7.97	3.2
WCST	20-69	39.61	12.63
VSTw	15-54	36.26	11.25
VSTc	12-57	34.52	10.72
VSTcw	32-60	42	7.54
VSTint	36-66	49.26	6.66
COWAT	17-61	32.78	11.89
ANIM	21-66	42.26	11.46
HVLT	21-58	38.08	11.5
BVMT-R	20-50	31.08	11.32
UPSA CP/PL	1-14	10.39	2.79
UPSA CC	.00-4	3.17	1.02
UPSA BILLS	2-7	5.96	1.22
UPSA TEL	4-12	8.21	2.17

UPSA TRANS	5-9	6.73	1.39
UPSA SHOP	1-4	3.13	0.76
UPSA MED	3-285	38.87	54.18
UPSA TOT	9-114	85	26.55
TFLS TIME	9-15	13.91	1.93
TFLS MON	8-12	11.04	1.22
TFLS COM	8-12	11.48	1.12
TFLS MEM	2-49	7.96	9.07
TFLS TOT	29-60	43.52	5.63

Note. TMTa= Trails A; TMTb= Trails B; WAIS-cod=WAIS-III Coding; WAIS-LNS= WAIS-III Letter Number Sequencing; WMS-SSpn= WMS-III spatial span; WCST= Wisconsin Card Sorting Task; VSTw= Victoria Stroop Word; VSTc= Victoria Stroop Color; VSTcw= Victoria Stroop Color Word; VSTint= Victoria Stroop Interference; COWAT=Controlled Oral Word Association Test; ANI= Animals; HVLT= Hopkins Verbal Learning Test-R Total Learning; BVMT= Brief Visuospatial Memory Test-R Total Recall; UPSA CP/PL= UPSA Comprehension and Planning; UPSA CC= UPSA Counting Change; UPSA BILLS= UPSA Bills; UPSA TEL= UPSA Telephone; UPSA TRANS= UPSA Transportation; UPSA SHOP= UPSA Shopping; UPSA MED= UPSA Medication; UPSA TOT= UPSA Total; TFLS TIME= TFLS Time; TFLS MON= TFLS Money; TLFS COM= TFLS Communication; TFLS MEM= TFLS Memory; TFLS TOT= TFLS Total

Table 2

Correlations of TFLS and Neurocognitive Measures

	TI	ME	MO	C
TMTa	0.07	.33*	.36*	0.04
TMTb	-0.07	.37*	0.19	-0.1
WAIS-COD	.31*	0.17	.42*	.42*
WAIS-LNS	.34*	0.19	.38*	0.27
WMS-SSpn	0.14	.51*	0.55	0
WCST	0.02	0.55	.38*	0.02
VSTw	.35*	0.2	0.04	.31*
VSTc	0.25	0.12	0.34	0.17
VSTcw	-0.14	0.15	-0.02	-0.17
VSTint	-.39*	-0.13	-0.26	-.35*
COWAT	0.18	-0.01	0.26	0.19
ANIM	-0.08	-0.11	0.06	-0.06
HVLT	0.15	-0.04	.36*	0.25
BVMT	.40*	-0.01	.35*	.40*

*Note. TMTa= Trails A; TMTb= Trails B; WAIS-cod=WAIS-III Coding; WAIS-LNS= WAIS-III Letter Number Sequencing; WMS-SSpn= WMS-III spatial span; WCST= Wisconsin Card Sorting Task; VSTw= Victoria Stroop Word; VSTc= Victoria Stroop Color; VSTcw= Victoria Stroop Color Word; VSTint= Victoria Stroop Interference; COWAT=Controlled Oral Word Association Test; ANI= Animals; HVLT= Hopkins Verbal Learning Test-R Total Learning; BVMT= Brief Visuospatial Memory Test-R Total Recall; TFLS TIME= TFLS Time; TFLS MON= TFLS Money; TLFS COM= TFLS Communication; TFLS MEM= TFLS Memory; TFLS TOT= TFLS Total; *p <.1,** p < .05*

Table 3

Correlations of UPSA and Neurocognitive Measures

	CP/PL	CC	Bills	TEL	TRANS	SHOP	MED	TOT
TMTa	.22	.11	.15	.08	.11	-.41*	-.09	-.04
TMTa	.30	-.05	.23	.30	.13	-.12	.12	.06
WAIS-COD	.28	.10	.09	.67*	.40*	.23	.39*	.42*
WAIS-LNS	.28	-.17	.14	.39*	.44*	.11	.30	.32
WMS-SSpn	.21	.06	.00	.30	.70*	.16	.21	.24
WCST	.20	.09	.17	.47*	.51*	.16	.32	.07
VSTw	-.10	-.08	-.17	.43*	-.01	.18	.01	-.01
VSTc	.13	.09	-.14	.46*	.42*	.27	.13	.33
VSTcw	.02	-.14	-.11	.22	.22	.10	.08	-.02
VSTint	-.08	-.22	-.16	-.20	.03	-.08	.01	-.17
COWAT	.23	-.02	.05	.45*	.12	.10	.34*	.28
ANIM	.36*	.19	.17	.14	-.26	-.50	.02	.23
HVLT	.26	.04	.18	.47*	.32	.12	.23	.44*

BVMT	.34	.16	.31	.56*	.72*	.37*	.43*	.50*

*Note. TMTa= Trails A; TMTb= Trails B; WAIS-cod=WAIS-III Coding; WAIS-LNS= WAIS-III Letter Number Sequencing; WMS-SSpn= WMS-III spatial span; WCST= Wisconsin Card Sorting Task; VSTw= Victoria Stroop Word; VSTc= Victoria Stroop Color; VSTcw= Victoria Stroop Color Word; VSTint= Victoria Stroop Interference; COWAT=Controlled Oral Word Association Test; ANI= Animals; HVLT= Hopkins Verbal Learning Test-R Total Learning; BVMT= Brief Visuospatial Memory Test-R Total Recall; UPSA CP/PL= UPSA Comprehension and Planning; UPSA CC= UPSA Counting Change; UPSA BILLS= UPSA Bills; UPSA TEL= UPSA Telephone; UPSA TRANS= UPSA Transportation; UPSA SHOP= UPSA Shopping; UPSA MED= UPSA Medication; UPSA TOT= UPSA Total;*p <.1, ** p < .05*

Table 4

Correlations of UPSA Total Score, TFLS Long Form Total Score and TFLS Short Form

	TFLS SF	UPSA	TFLS LS
TFLS SF	--		
UPSA	.59**	--	
TFLS LF	.74**	.34*	--

*Note. *p <.1,** p < .05*

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