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UNIVERSITY OF CALIFORNIA, SAN DIEGO

SAN DIEGO STATE UNIVERSITY

Self-Reported and Performance-Based Functioning in Middle-Aged and Older
Outpatients with Schizophrenia

A dissertation submitted in partial satisfaction of the requirements for the Degree

Doctor of Philosophy in

Clinical Psychology

by

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2006

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University of California, San Diego

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2006

DEDICATION

In recognition of his unwavering support throughout this process,
this dissertation is dedicated to Neil Dutcher.

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ACKNOWLEDGMENTS

The following individuals are acknowledged for their valuable assistance: Colette Smart, Jody Delapena, and Susan Evans. Many thanks to Professor Eric Granholm and the dissertation committee members for their feedback.

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Granholm, E., Verney, S., Perivoliotis, D., & Miura, T. (In press). Pupillary response measures of invested effort and resource overload on the Span of Apprehension Task in schizophrenia. *Biological Psychiatry*.

Perivoliotis, D., Granholm, E. & Patterson, T. (2004). Functional outcome on the Independent Living Skills Survey in older outpatients with schizophrenia. *Schizophrenia Research*, 69, 307-316.

FIELDS OF STUDY

Major Field: Psychology

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ABSTRACT OF THE DISSERTATION

Self-Reported and Performance-Based Functioning in Middle-Aged and Older
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by

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Doctor of Philosophy in Clinical Psychology

University of California, San Diego, 2006

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The number of older patients with schizophrenia and their demand on the healthcare system are growing. Treatment of the disorder is expanding from symptom reduction to improvement of everyday functioning, but functioning is a complex construct and little is known about the validity of its assessment methods in middle-aged and older patients with schizophrenia. Performance-based measures test the ability to demonstrate functional skills such as financial management and shopping in a laboratory setting and have been proposed as an alternative to self-reports, which may be more susceptible to confounds such as cognitive impairment, depression, or poor insight. The purpose of this study was to evaluate the relationship between these measures and determine how well they correspond to indicators of “real-world” functioning in a group of 77 middle-aged and older outpatients with chronic

schizophrenia. Symptoms were assessed with the Positive and Negative Syndrome Scale (PANSS) and Hamilton Rating Scale for Depression. A composite neuropsychological (NP) ability score was calculated from a group of tests that measured executive functioning, verbal memory, processing speed, and attention. Insight was measured with the Birchwood Insight Scale and self-reported and performance-based functioning were measured with the Independent Living Skills Survey (ILSS) and UCSD Performance-Based Skills Assessment (UPSA), respectively. An index score consisting of living situation, driving status, employment, and marital status was created as a measure of “real-world” functional outcome. Path analyses revealed that NP ability significantly predicted both self-reported ($\beta = .35, p < .05$) and performance-based ($\beta = .60, p < .01$) functioning and indirectly predicted real-world functional outcome through its effect on performance-based functioning. The self-report and performance-based measures were weakly correlated ($r = .08, ns$). The relationship between self-reported functioning and real-world outcome was weak ($r = .06, ns$) and not confounded by NP ability, depression, or insight. The results suggest that performance-based functioning is strongly determined by NP ability and that it is a better predictor of functional outcome than self-reported functioning in middle-aged and older patients with schizophrenia. Additional research is needed to clarify the construct of functioning and to develop more valid measures for it in this population.

I. Introduction

There is no single, clearly conceptualized and well-accepted definition of daily functioning in schizophrenia—instead, various overlapping constructs are defined in the literature, including *psychosocial functioning*, *social functioning*, and *quality of life*, among others. This conceptual confusion reflects the fact that functioning is a multidimensional construct with little current agreement about how it should be operationalized and measured.

There is a growing need for reliable and valid measures of functioning for several reasons. Recent attempts to reduce healthcare expenses have necessitated an objective demonstration of treatment effectiveness in terms of functional outcome in many areas of the healthcare industry. Mental illness is often characterized by a deterioration of functioning, so measures of this outcome domain could be instrumental in evaluating the overall effectiveness of treatments for any mental disorder, especially schizophrenia (Atkinson, Zibin, & Chuang, 1997). Psychiatrists and other mental health practitioners are frequently confronted with the great responsibility of determining whether their patients are capable of living independently, driving, or being employed. Psychometrically sound measures of functioning would serve as valuable tools for practitioners making these important decisions, particularly since assessment of symptoms alone does not provide an adequate representation of patient functioning. Furthermore, functional assessment instruments can facilitate diagnostic decisions because evidence of functional impairment is usually required for the diagnosis of a mental disorder. Measures of

functioning can also provide valuable information about the course of mental disorders, and this information can further facilitate treatment development (Loewenstein et al., 1989; Patterson et al., 1998).

Within the past two decades, targets of treatments for serious mental illness have expanded from symptom reduction to improvement of functioning in social and instrumental role domains (National Institute of Mental Health, 1991). This is especially relevant in schizophrenia, which has potentially debilitating effects in several domains of everyday functioning and is the most expensive mental disorder in terms of direct costs, loss of productivity, and public assistance (Rice & Miller, 1996). Functional disability in schizophrenia is associated with cognitive impairment, and this too has recently become a focus of considerable attention. In an effort to stimulate the development of new drugs to treat cognitive dysfunction in schizophrenia, the National Institute of Mental Health established the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) initiative. The FDA is expected to make approval of new medications conditional on a demonstration of their ability to improve everyday functioning, as well as cognitive impairment (Green et al., 2004). In order to identify reliable and valid measures of functioning, its multidimensional nature needs to be better understood. Attempts to clarify the construct and to validate functional assessments would be instrumental in helping to achieve this goal.

Types of Functioning Measures

There is no gold standard by which to measure functioning in patients with schizophrenia and other psychiatric disorders. Most functional assessments are often at least partially subjective because they measure an individual's perception of their skills and abilities, so a gold standard may be unattainable (Ostbye, Tyas, McDowell, & Koval, 1997). Several categories of functioning measures have been developed. Self-report instruments are straightforward measures that rely on a patient's responses to items designed to tap various functional domains. They are relatively quick, inexpensive, and easy to administer, which explains their proliferation. Another strength of the self-report format is that patients' perception of their own quality of life is an important and central component of the quality of life concept (Voruganti, Heslegrave, & Awad, 1997).

The self-report format, however, has been the subject of increasing criticism due to its vulnerability to potential measurement confounds. Results from self-report measures of functioning often do not corroborate findings from other measures that measure functioning differently (e.g., rated by a clinician) (Atkinson, Zibin, & Chuang, 1997). Some have interpreted this to mean that self-reports do not measure the intended construct and hence are invalid under certain circumstances (Bedard et al., 2003; Ostbye et al., 1997). Others posit that they measure a different construct than intended but still provide valuable information that should not be ignored. For example, self-reports of patients' functioning represents their perception of their abilities and can be compared against a more objective assessment of those same

abilities in order to identify impairment or reassure patients that their functional status is better than they had expected (Daltroy, Larson, Eaton, Phillips, & Liang, 1999; Khatri, Romney, & Pelletier, 2001).

It is difficult to know exactly what patients mean when they respond a certain way on a self-report measure, because their evaluations and judgments of different facets of their lives are relative to their own unique set of experiences and situational events. According to Adaptation Level Theory (Helson, 1964), patients with chronic illnesses like schizophrenia tend to report their experiences as less extreme over time because they accommodate to their illness (Atkinson, Zibin, & Chuang, 1997; Fitzgerald et al., 2001; Hoeymans, Feskens, van den Bos, & Kromhout, 1996). Patients' reports of their self-perceived level of disability are vulnerable to response shift, which can occur when evaluation of oneself on a measured construct like functioning changes due to a change in the respondent's internal standards of measurement, a redefinition of the measured construct, or a change in the respondent's values about the construct (Sprangers & Schwartz, 1999; Daltroy et al., 1999).

Social comparisons are an important factor that may influence self-reported functioning. For example, a patient's subjective sense of well-being may be increased when they compare themselves to someone perceived to be worse off. Such "downward comparisons" are likely to operate when a patient is faced with a physical or mental threat that they feel is unchangeable, like chronic severe mental illness (Franz, Meyer, Reber, & Gallhofer, 2000). Self-reports are also especially sensitive to measurement bias and error, which can be introduced by the effects of evaluative sets,

response bias, and coercive distortion. For example, cognitively impaired individuals tend to respond ‘yes’ regardless of the question asked during questionnaires and interviews, especially when they are interviewed by people they perceive as higher in status (e.g., a doctor)—a response bias known as acquiescence (Heal & Sigelman, 1995). For psychiatric patients, psychopathology itself can significantly influence patients’ judgments of their quality of life and functioning. Self-reported functioning can be influenced by depression (Casten, Rovner, Pasternak, & Pelchat, 2000; Morgado, Smith, Lecrubier, & Widlocher, 1991), lack of insight (Doyle et al., 1999), and cognitive impairment (Ostbye et al., 1997).

Despite their limitations, self-reports of functioning are attractive to researchers and clinicians because they are easy to use, efficient, and affordable. Atkinson and colleagues (1997) suggest that if self-report measures are used, the effects of moderating factors such as patient affect and cognitive impairment should be isolated by statistical control or reduced through more innovative instrument designs. Similarly, Patterson, Semple, et al. (1997) recommend that self-report measures be accompanied by measures of insight and collateral reports of patient functioning obtained from caregivers.

Clinician-rated assessment of patient behavior occurs in many symptom assessments commonly used in the mental health field, like the Brief Psychiatric Rating Scale (BPRS) (Overall & Gorham, 1962). Several functional measures have been developed that use this approach as well, including the Global Assessment of Functioning scale (American Psychiatric Association, 2000). These types of

assessments are relatively easy and inexpensive to administer but they rely on the clinician's ability to rate the patient's functioning based solely on the patient's self-report and behaviors observed during the brief course of an interview that may or may not be related to their daily functioning (Patterson, Goldman, McKibbin, Hughs, & Jeste, 2001). Due to their reliance on a patient's or clinician's perception of a patient's functioning, self-report and clinician-rated instruments may be considered *subjective* measures of functioning.

A newer approach to functional assessment is performance-based measures. These measures directly assess a range of abilities through simulated daily activity tasks (e.g., check-writing, using a telephone). They offer an advantage over traditional methods because they rely less on patient insight and assess higher-order life skills that can be addressed by interventions (e.g., planning appropriately for recreational activities). Performance-based measures may be less susceptible to potential confounds like insight, symptomatology, and cognitive functioning (Patterson et al., 2001).

Despite their advantages, performance-based measures are not necessarily superior to self-report measures (Myers, Holliday, Harvey, & Hutchinson, 1993). A potential disadvantage is that they are often conducted in artificial settings, which may have an impact on the quality of functioning demonstrated. For example, patients with dementia have been shown to score lower on functional outcome measurements when they are tested in unfamiliar environments versus familiar ones (Nygard, Bernspang, Fisher, & Winblad, 1994). Whereas self-reported assessments reflect a patient's

average functioning over a period of time, performance-based assessments only test functioning at a single point in time and, therefore, do not reflect adaptations made in a patient's daily life (Kivinen, Sulkava, Halonen, & Nissinen, 1998). They are considered "proxy measures" of functioning, because they measure whether or not an individual can perform functional behaviors in situations that are somewhat controlled and contrived.

While self-reports ostensibly measure actual *execution* of functional skills in an individual's daily life, performance-based assessments may instead measure functional skill *capacity* (Patterson, 2003), and little is known about the relationship between the two in older patients with schizophrenia. For example, just because a patient can demonstrate effective check-writing ability on a performance-based measure does not mean that they actually do this at home. Also, factors outside of patients' control may restrict their ability to demonstrate their functional capacity in the real world, outside of the laboratory. Patients who reside in board-and-care facilities, for example, are usually not allowed to cook for themselves or administer their own medications, even if they are capable of doing so. Consistent with this, Zanetti et al. (1999) found that dementia patients were able to display more functional behaviors in a laboratory than they were allowed to perform at home with their caregivers. This issue may be relevant to patients with schizophrenia, as well. A patient who is experiencing positive symptoms may avoid using public transportation because he or she fears harm from imagined persecutors, while a patient with negative symptoms may avoid leaving the house and using the bus due to a lack of motivation

and energy. In a laboratory setting however, both of these patients may perform adequately on a performance-based measure of functioning that assesses their ability to interpret a bus schedule in a role-play situation. Unfortunately the relationship between performance-based measures of functional skills and real-world functional outcome has not been well studied, and the criterion-related validity of these instruments is not well established (Keefe, Poe, Walker, & Harvey, 2006).

Despite these potential disadvantages of performance-based measures, their ability to assess functional capacity makes them useful tools for treatment planning. Given the complementary strengths and weaknesses of self-report and performance-based methods, an effective approach may be to use both types of assessments together (Kivinen et al., 1998; Casten et al., 2000). A comparison of results from the two methods can highlight a patient's unrealized functional capabilities, and this information can be used to set realistic treatment goals (Evans et al., 2003).

Although more objective than self-report, performance-based measures still do not directly reflect what patients do at home (Evans et al., 2003). Studies that involve direct observation of patient functioning in naturalistic environments for sufficiently long periods of time would provide extremely valuable information that could serve as a criterion against which the validity of self-report and performance-based functioning measures could be established. However, few such studies exist, due to the extremely expensive and time-consuming nature of this type of assessment, and also because such close observation may influence patient's behavior due to demand characteristics. Instead, researchers sometimes rely on objective, observable indicators of functioning

as a criterion against which to compare findings from other assessments. Examples of such indicators include level of independence in living situation (e.g., alone in house/apartment, with others, open board-and-care, locked board-and-care, skilled nursing facility) (Twamley et al., 2002) and driving status (e.g., whether a patient possesses a driver's license and whether they currently drive) (Palmer et al., 2002). Due to their reliance on observed patient performance, performance-based, direct observation, and objective indicator assessments may be considered *objective* measures of functioning.

Functioning Findings: Subjective vs. Objective Assessment

Although it is often assumed that they measure the same construct, there frequently is a discrepancy between the findings from subjective and objective measures of functioning, and these findings vary depending on the specific aspect of functioning studied. Quality of life typically includes objective aspects of functioning such as living situation, health, and social/interpersonal functioning, as well as subjective aspects, including degree of satisfaction with various domains of functioning. Patients with schizophrenia commonly report better subjective aspects of quality of life than would be expected given the degree of disability evidenced in objective indicators of their functioning (e.g., income, marital status, employment). (Dickerson, Ringel, & Parente, 1998; Fitzgerald et al., 2001; Carpiniello, Lai, Pariante, Carta, & Rudas, 1997; Atkinson, Zibin, & Chuang, 1997). Schizophrenia patients have also reported greater life satisfaction than patients with depression and anxiety disorders (Koivumaa-Honkanen, Honkanen, Antikainen, Hintikka, & Viinamaki,

1999). Authors have speculated that these findings may be due to disease processes like negative symptoms or poor insight that may cause patients to minimize the impact of their illness (Dickerson et al., 1998). Alternatively, patients that have been living with schizophrenia for many years may accommodate to their illness and, therefore, report their experiences as less extreme over time (Atkinson, Zibin, & Chuang, 1997). Franz and colleagues (2000) found that long-term hospitalized patients with schizophrenia compare themselves to fellow patients and report higher life satisfaction than short-term stay patients, who compare themselves to people outside the hospital, like family and friends—suggesting that the adaptation process is coupled with a shift in social comparisons over time. Gender also appears to play a role, as female patients have been shown to appraise their life circumstances in a manner that is more congruent with objective indicators of their functioning than male patients do (Roder-Wanner & Priebe, 1998). Despite the lack of agreement between patients' life circumstances and their subjective appraisals of those circumstances, self reports are considered an important component of quality of life assessment (Voruganti et al., 1997; Voruganti, Heslegrave, Awad, & Seeman, 1998), and it has been recommended that they be used in combination with objective indicators of functioning for a more complete assessment of quality of life (Ruggeri, Bisoffi, Fontecedro, & Warner, 2001).

Studies that have assessed activities of daily living (ADLs) have also found discrepancies between subjectively and objectively assessed functioning. In nonpsychiatric elderly individuals, the rate of agreement between self-reported and

performance-based ADLs varies. For example, one study found it to be $-.08$ (Sager et al., 1992), while another showed a correlation of $.60$ (Merrill, Seeman, Kasl, & Berkman, 1997). In a rare example of real-world validation of functional assessment, Burns and colleagues (1992) compared self-reported ADL data to judgments of disability based on objective medical record review in a large sample of hospitalized elderly. They found a large degree of disagreement between the two measures, and only the medical record data was associated with nursing home placement after hospitalization. These findings call into question the validity of self-reported functional assessment (at least as a predictor of independence in living situation) and suggest that patient functioning should not be solely assessed with self-report instruments.

Schizophrenia Disease Processes & Functioning

Several disease processes in schizophrenia have been shown to interact with everyday functioning in patients with the disorder, including symptoms, cognitive impairment, and insight.

Symptom severity.

Although positive and negative symptoms have been found to predict various types of functioning, the findings are inconsistent and symptom-specific. For example, studies that assess symptomatology with global measures like the BPRS that collapse across positive, negative, affective and anxiety symptoms often find associations between general symptomatology and functioning (Bengtsson-Tops & Hansson, 1999; Voruganti et al., 1998; Heslegrave, Awad, & Voruganti, 1997).

However, when solely comparing positive vs. negative symptoms, a number of studies have found that negative symptoms alone predict functioning. This relationship has been identified for quality of life (Ho, Nopoulos, Flaum, Arndt, & Andreasen, 1998), objective indicators of current functioning (employment, driving, living situation) (Palmer et al., 2002), and more general everyday functioning assessed with both performance-based measures (Twamley et al., 2002) and self-reports obtained by clinical interviewers (McGurk et al., 2000; Karow, Moritz, Lambert, Schoder, & Krausz, 2005; Van der Does, Dingemans, Linszen, Nugter, & Scholte, 1996). Positive symptoms are rarely found to be independently predictive of functional outcome (Racenstein et al., 2002). These findings are consistent with those in a review of the literature by Green (1996), who concluded that negative symptoms were associated with certain domains of functioning, while positive symptoms were not.

To summarize, negative symptoms predict both subjectively and objectively assessed functioning. Positive symptoms do not appear to substantially predict functioning, and this lack of a relationship appears consistent across different types of functional assessments. Taken together, these findings suggest that positive and negative symptoms do not differentially affect reporting on one type of instrument versus another. That is, if negative symptoms interfered with patients' ability to reliably self-report their functioning, we would expect reduced reliability and/or validity of self-reported, but not performance-based, functioning in patients with more severe negative symptoms. This does not appear to be the case, but surprisingly little attention has been paid to this question and more studies are needed to address it.

In addition to negative symptoms, more severe depressive symptoms have also been associated with more impaired functioning, at least in non-psychotic populations (Kivinen et al., 1998). The relationship between depression and functioning in schizophrenia is less clear and appears to vary depending on the type of functional assessment used. More severe depressive symptoms have been associated with worse functioning on self-reports (Sciolla, Patterson, Wetherell, McAdams, & Jeste, 2003; Karow et al., 2005; Jin et al., 2001; Carpiniello et al., 1997), but not on performance-based measures (Patterson et al., 2001; Klapow et al., 1997; Twamley et al., 2002). This suggests that depression may not only be related to functioning itself, but may also influence *assessment* of functioning in a potentially confounding manner.

There is substantial evidence that severity of depressive symptoms may affect the reliability of self-reported functional assessment. Morgado et al. (1991) questioned hospitalized depressed patients about their functioning during the four months preceding hospitalization twice—once during their hospitalization and the second time after remission of symptoms, about three weeks later. The self-report measure assessed patients' functional behaviors and the level of distress caused by their functional impairment. Patients reported significantly fewer functional behaviors and greater distress while actively depressed, compared to when they were in remission. Furthermore, depression has been found to reduce the degree of agreement between self-reported functioning and functioning assessed with other methods that rely less on patient's impressions (e.g., performance-based, clinician-rated, caregiver-rated) in a variety of populations, including the frail elderly (Kempen, Steverink,

Ormel, & Deeg, 1996), elderly primary care patients (Sinclair, Lyness, King, Cox, & Caine, 2001), patients with chronic lower back pain (Wittink, Rogers, Sukiennik, & Carr, 2003), older inpatients with major depression (Casten et al., 2000), and elderly nonpsychiatric males (Kivinen et al., 1998).

According to cognitive theory (Beck, 1963, 1987), depression is characterized by negative thinking, which is maintained in part by cognitive biases such as a tendency to interpret neutral or ambiguous events in a negative way. Depressed mood has also been shown to bias memory such that negative memories are recalled more easily than positive ones (McDermut, Haaga, & Bilek, 1997; Dalglish & Watts, 1990). When applied to functional assessment, these findings would suggest that a depressed respondent may be less likely than a non-depressed respondent to recall instances of positive functional behavior (e.g., socializing, working on hobbies, shopping, etc.) and therefore would appear more functionally impaired on a self-report instrument than is actually the case. Consistent with this hypothesis, little relationship has been found between severity of depressive symptoms and level of functioning on performance-based measures (Patterson et al., 1998, 2001). When taken together with the previously described findings on self-reported functional assessment, this suggests that depressive symptoms are associated with self-reported but not objectively measurable functional impairment. If this is indeed the case, two explanations are possible. The first is that more objective functional assessments (e.g., performance-based measures, observable indicators of functional status like living situation and employment) do not rely on a patient's impression of their functioning and are,

therefore, less vulnerable to the kind of response bias that accompanies depression. This possibility has led some to advise against sole reliance on self-reported measures of functional outcome (Kivinen et al., 1998; Casten et al., 2000). Alternatively, depressive symptoms may interfere with patients' ability to motivate or organize themselves enough to perform functional behaviors on a routine basis at home, but they may be able to overcome this obstacle and display more appropriate levels of functioning when prompted by an examiner during a performance-based task.

The influence of depression on self-reported functioning in schizophrenia has not received much attention until recently. Fitzgerald et al. (2001) compared self-reported functioning and quality of life with more objective clinician-rated functioning in patients with schizophrenia and found that depression was negatively associated only with the self-report measures. Clearly, more work is needed to clarify the influence of depression on different types of functional assessment in schizophrenia.

Neuropsychological functioning.

In two reviews, Green and colleagues (Green, 1996; Green, Kern, Braff, & Mintz, 2000) investigated the relationship between neuropsychological deficits and functional outcome in schizophrenia. They classified studies based on the kind of functional outcome assessed—community outcome, social problem solving, and social skill acquisition. They found that verbal memory was associated with all three types of outcome, attention was related to social problem solving and skill acquisition, and executive functioning was associated with community functioning. The relationships among these three domains of neuropsychological functioning and functional outcome

were highly significant, with medium to large effect sizes. Indeed, neuropsychological impairment has been found to account for 40-50% of the variance in everyday functioning (Harvey et al., 1998; Velligan et al., 1997; Dickinson & Coursey, 2002). More recently, processing speed has been suggested as an important domain relevant to functioning. Dickinson and Coursey (2002) found that processing speed accounted for 28% of the variance in functional outcome, and Milev et al. (2005) found it to be one of the strongest longitudinal predictors of functioning seven years later, along with verbal memory, attention, and negative symptoms. The predictive strength of neuropsychological impairment has received support throughout the literature and has been consistently shown to be the best predictor of functional outcome in schizophrenia (Harvey et al., 1998; Voruganti et al., 1998; Velligan et al., 1997; Harvey et al., 1999). Since Green's reviews, evidence for a relationship between neuropsychological and functional impairment has continued to accumulate and has been replicated across different types of functional assessment, including self-report (Sciolla et al., 2003; Penades et al., 2003), performance-based (Twamley et al., 2002; Evans et al., 2003), clinician-rated (Harvey et al., 2003; Addington & Addington, 2000; Velligan, Bow-Thomas, Mahurin, Miller, & Halgunseth, 2000b; Dickinson et al., 2002), and objective indicators (Palmer et al., 2002).

Although Green and others have found that a certain degree of specificity exists in the relationships between specific domains of neuropsychological functioning (e.g., verbal memory, attention, executive functioning) and everyday functioning (e.g., social problem solving, community functioning), more recent evidence has challenged

the specificity of these relationships and suggests that *global* neuropsychological deficit may be more predictive of functional impairment than impairments in specific neuropsychological domains (Dickinson et al., 2002; Evans et al., 2003; Velligan et al., 2000b; Twamley et al., 2002). This is not surprising, given that even simple functional behaviors appear to be neuropsychologically multidetermined—for example, effective grocery shopping requires that an individual plan and initiate the task (executive functioning), focus during the shopping trip (attention), and remember a list of items to buy (memory) (Velligan et al., 2000b). The lack of specificity between neuropsychological and functional domains may be further due to the significant overlap that exists between neuropsychological test scores. For example, even a simple task, such as digit span, requires patients to not only access working memory, but also to focus their attention on the task (Bellack, 1992; Velligan et al., 2000b).

As is the case for depression, there is evidence that neuropsychological impairment may reduce the reliability and validity of self-reported measures of functioning as well, and most of this evidence comes from research on elderly patients with dementia. In one study that compared self-reported ADLs to direct observation in nonpsychiatric elderly inpatients, impaired performance on a measure of global cognitive functioning was shown to be a significant predictor of the poor agreement between the two measures (Sager et al., 1992). Similarly, other studies have found that agreement between self-reported functioning and functioning measured with more

objective methods like caregiver reports (Ostbye et al., 1997; Kiyak, Teri, & Borson, 1994) decreases as severity of global cognitive functioning increases.

Less is known about the influence of neuropsychological functioning on functional assessment in schizophrenia. For example, it is unclear whether patients' ability to reliably and accurately self-report their functioning is compromised by cognitive impairment. Given the prevalence of cognitive impairment in schizophrenia, more research is needed on its influence on functional assessment.

Insight.

Many patients with schizophrenia have limited insight into the nature of their disorder, and between 50% and 80% of patients do not believe they have a disorder (Amador & Gorman, 1998). Like functioning, insight is a multidimensional concept. It includes: a) awareness of the mental disorder; b) understanding of the social consequences of the disorder; c) awareness of the need for treatment; d) awareness of specific signs and symptoms of the disorder; and e) the attribution of symptoms to the disorder (Amador & David, 1998). According to the neuropsychological model of insight etiology, low insight stems from cognitive impairments characteristic of schizophrenia. Consistent with this, poor insight has repeatedly been associated with worse neuropsychological performance (Keshavan, Rabinowitz, DeSmedt, Harvey, & Schooler, 2004; Young, Davila, & Scher, 1993; Smith, Hull, Israel, & Willson, 2000). In a meta-analysis examining the relationship between insight and symptom severity, Mintz et al. (2003) found small but statistically significant negative relationships

between insight and global, positive, and negative symptoms, suggesting that insight is multi-determined.

Poor insight in schizophrenia has been associated with deficits in general everyday functioning (Platek, Keenan, Gallup, Jr., & Mohamed, 2004; Andelman, Zuckerman-Feldhay, Hoffien, Fried, & Neufeld, 2004; Jurado, Junque, Vendrell, Treserras, & Grafman, 1998), quality of life (Lysaker, Bell, Bryson, & Kaplan, 1998), social functioning (i.e., social skills) (Altman, Hedeker, Peterson, & Davis, 1997; Magaziner, Zimmerman, Gruber-Baldini, Hebel, & Fox, 1997), and work performance (Morgado et al., 1991). These findings do not appear to be an artifact of the method of functional assessment used, because insight has also been found to predict functioning based on objective and observable indicators of functional outcome, including degree of independence in living situation (Kjaer, Nowak, & Lou, 2002) and compulsory treatment (Upthegrove, Oyebode, George, & Haque, 2002). Some studies, however, have failed to find a relationship between insight and functioning (Baier et al., 2000; Browne et al., 1998; Schwartz, 1998). These inconsistent findings suggest that insight may play a role in functioning but may not be as strong a predictor as neuropsychological impairment, which has demonstrated a more consistent relationship in the literature. It does, however, appear to be an important factor in treatment, because lower levels of insight have been associated with poorer treatment compliance and symptom outcomes (Husted, 1999; Lysaker et al., 1994; Smith et al., 1999).

Accurate and reliable self-reporting of functioning is dependent on an individual's ability to consciously reflect on his or her own sense of self, which includes his or her perceived functional abilities (Johnson et al., 2002). Stuss and colleagues (1991) found that brain-damaged patients with impaired self-reflection reported levels of functioning that were different from those observed by others, including their caregivers and clinicians. It appears face valid, therefore, that mentally ill patients who have little understanding of the nature of their illness are likely to not fully recognize, and possibly underreport, symptoms and associated impairments on self-reported measures relative to more objective measures. There has been mixed support for this hypothesis. Altman and colleagues (1997) administered a self-report assessment for mania to patients with various psychiatric disorders and found that patients without insight reported levels of symptom severity similar to those with insight. Liraud et al. (2004) compared self-reported and clinician-rated assessments of symptoms in inpatients with psychotic disorders and found that patients were able to accurately self-report most of their positive and negative symptoms regardless of their level of insight, but patients with less insight did not accurately report their level of depressive symptoms.

The potential influence of insight on assessment in schizophrenia has remained relatively unexamined. Jensen et al. (2004) compared performance on traditional neuropsychological tests to patients' perception of their cognitive abilities and found that poor insight was associated with decreased reliability of self-rated cognitive ability. Only one study has examined the role of insight in functional assessment in

schizophrenia—Doyle et al. (1999) compared subjective, clinician-rated quality of life ratings that were primarily based on the self-report of outpatients with schizophrenia to objective, external indicators of their quality of life and found that the two categories of measures were related for insightful patients only. In a study of first episode patients (Whitty et al., 2004), level of insight did not moderate the relationship between self-reported and clinician-rated quality of life when using a regression analysis, but a subgroup of patients with the lowest insight was less reliable in rating their quality of life than a subgroup of the most insightful patients. In summary, the effect of insight on self-reported functional assessment is unclear, but there is some evidence that diminished insight may compromise the reliability and/or accuracy of patients' self-reported functioning, relative to more objective measures that do not rely on patients' own report. Clearly, additional work needs to be done to clarify the potentially confounding role of insight on self-reports. This is especially important for functional assessment in schizophrenia, due to the prevalence of poor insight in patients with this disorder and the degree of functional impairment they often exhibit.

In summary, more severe negative symptoms, neuropsychological impairment, poor insight, and possibly more severe depressive symptoms all appear to be significant predictors of poorer functioning in schizophrenia. The implications of these findings for treatment planning are substantial. Interventions aimed at reducing severity of negative and/or depressive symptoms, for example, could help improve functional outcome; alternatively, rehabilitation of functional living skills may lead to decreased symptomatology (Jin et al., 2001).

Furthermore, there is reason to believe that the reliability and validity of self-reported functioning may be more vulnerable to disease processes in schizophrenia—including depressive symptomatology, neuropsychological impairment, and poor insight—than more objective assessments. Further investigation of the impact of these disease processes in patients with schizophrenia is important because it can lead to more reliable and valid functional assessments that are essential for measuring treatment outcome and guiding rehabilitative efforts for patients with the disorder.

Measurement of Functioning in Middle-Aged and Older Adults

Studies of functioning in schizophrenia have concentrated largely on younger patients. These patients tend to be impaired across a variety of independent living skills, including financial management, decision-making, and homemaking (Hintikka, Saarinen, Tanskanen, Koivumaa-Honkanen, & Viinamaki, 1999). They also appear to be more impaired than similarly-aged patients with bipolar disorder, major depression, and anxiety disorders across areas of social functioning, especially involvement in pro-social behavior and recreational activities (Addington, Addington, & Gasbarre, 2001; Birchwood, Smith, Cochrane, Wetton, & Copestake, 1990; Dickerson, Parente, & Ringel, 2000). Although functional deficits clearly persist throughout the course of schizophrenia, less is known about the specific nature of this course. Like younger patients, middle-aged and older patients typically display greater functional disability than age-matched controls in their ability to perform daily activities (Klapow et al., 1997; Patterson et al., 1998), medication adherence (Fenton, Blyler, & Heinssen, 1997), and social functioning (Patterson, Moscona, McKibbin, Davidson, & Jeste,

2001; Patterson et al., 1997). Current antipsychotic medications reduce positive symptoms in older schizophrenia patients but functional deficits often still remain (Perivoliotis et al., 2004). Aging has also been associated with further deterioration of functioning in schizophrenia patients, especially in late life (Friedman et al., 2001). Dickerson et al. (1999) demonstrated that younger age was associated with better functioning at the end of a longitudinal investigation of schizophrenia. Functional deficits also strongly discriminate older patients in nursing homes from community-dwelling patients (Harvey et al., 1998). In order to better elucidate the relationship between aging and functioning in schizophrenia, additional information is needed on the functional status of middle-aged and older patients.

It is important to study functioning in middle-aged and older patients with schizophrenia for several other reasons as well. The number and proportion of older Americans is expected to rapidly increase in the coming years. By 2011, the oldest members of the baby-boom generation will turn 65, which raises the possibility of an upcoming crisis in geriatric mental health care (Palmer, Heaton, & Jeste, 1999). Better everyday functioning predicts higher subjective life satisfaction longitudinally in patients with schizophrenia (Salokangas, Honkonen, Stengard, & Koivisto, 2006) and middle-aged and elderly outpatients place high priority on improving their functioning (Auslander & Jeste, 2002). The aging of America, taken together with the recent increased emphasis on functioning as a target of treatment, highlights the importance of developing reliable and valid measures of functioning in middle-aged and older patients with schizophrenia.

Focusing on older patients is also important because age-related cognitive decline, which may be abnormally accelerated in schizophrenia (Granholm, Morris, Asarnow, Chock, & Jeste, 2000), may exacerbate functional decline in older patients (Friedman et al., 2001; Harvey et al., 1999). In addition to cognitive impairment, depression is also a highly relevant factor in older patients. Depressive symptoms tend to be more frequent and more severe in patients with schizophrenia and depression is often underdiagnosed in the elderly (Zisook et al., 1999; Crystal, Sambamoorthi, Walkup, & Akincigil, 2003). Both cognitive functioning and depressive symptomatology have been shown to influence functioning and its assessment. According to Adaptation Level Theory, older patients who have lived with chronic schizophrenia for several decades have likely adapted to the consequences of the illness and view their experiences as less extreme, which suggests that self-reported functioning in these patients may be especially inaccurate and discrepant from objectively assessed functioning (Atkinson et al., 1997).

Model & Study Hypotheses

The main goal of this study was to examine the concurrent and criterion-related validity of self-reported and performance-based assessments of functioning in middle-aged and older patients with schizophrenia by examining their degree of association with each other and their relationship with three illness factors (general symptomatology, neuropsychological functioning, and insight) and observable indicators of “real-world” functional outcome. In order to pursue this goal, a model was constructed to represent the expected relationship between clinical,

neuropsychological, and functional domains (see Figure 1). Based on the current understanding of the determinants of functioning in schizophrenia, three illness factors—greater severity of general symptomatology, impaired neuropsychological functioning, and poor insight—were hypothesized to negatively influence real-world functional outcome. Given that functional assessment instruments purportedly measure real-world functional outcome, these same three illness factors were expected to influence scores on self-reported and performance-based assessments as well. General symptomatology and neuropsychological functioning were both expected to influence insight, based on evidence that poor insight is associated with greater general symptom severity (Mintz et al. 2003) and neuropsychological impairment (Young et al., 1993; Keshavan et al., 2004) in schizophrenia. Depression, insight, and neuropsychological functioning were predicted to compromise self-reported functioning by moderating its relationship with real-world functional outcome. Consequently, insight was expected to function as both a mediator (of the relationship between both symptoms and cognition and self-reported and performance-based functioning) and a moderator (of the relationship between self-reported functioning and real-world outcome; i.e., a “nuisance variable”) in the hypothesized model. Finally, due to the predicted susceptibility of self-reported functioning to the compromising effects of depression, poor insight, and neuropsychological impairment, the relationships between self-reported and performance-based and real-world functioning were hypothesized to be weak. Specific hypotheses are summarized below.

Hypothesis 1. Better real-world functional outcome will be predicted by better neuropsychological performance, less severe level of general symptomatology, and higher insight.

Hypothesis 2. The relationship between self-reported and performance-based assessment will be weak, with a small effect size of $\leq .10$.

Hypothesis 3. Neuropsychological functioning (3a), depressive symptomatology (3b), and insight (3c) will moderate the relationship between self-reported, but not performance-based, functioning and real-world functional outcome.

Hypothesis 4. The relationship between self-reported functioning and real-world functional outcome will be weak, with a small effect size of $\leq .10$.

II. Method

All analyses were conducted on existing data that were collected for a rehabilitation study that has since been completed (Granholm et al., 2005). The University of California San Diego Human Research Protections Program approved both the parent study and present study, and the San Diego State University Institutional Review Board also approved the latter. Seventy-seven participants ranging in age from 42 to 72 were recruited from the Advanced Center for Interventions and Services Research for Psychosis in Older Adults (ACISR; Dr. Dilip Jeste, PI) at the University of California, San Diego. Participants were recruited from treatment and residential settings in San Diego County from 1999 to 2003. Exclusionary criteria were disabling medical problems that would interfere with testing, absence of medical records to inform diagnosis, and diagnosis of dependence on substances other than nicotine or caffeine within the past 6 months.

Written informed consent was obtained for all participants. Relevant demographic data and extensive medical history were obtained to record information about pertinent medical illnesses (e.g., hyperthyroidism, stroke), alcohol and other substance abuse, smoking, and medications (especially antipsychotic medications). Patient diagnoses were based on the Structured Clinical Interview for DSM-IV (First, Spitzer, Gibbon, & Williams, 1995) administered by trained interviewers using DSM-IV criteria (American Psychiatric Association, 2000). The functional assessment battery, neuropsychological testing battery, insight assessment, and psychiatric rating scales described below were administered in testing sessions that lasted approximately

four to six hours, usually split over two sessions on separate days, depending on individual differences in rest breaks and time required to obtain reliable data.

Functional Assessment Battery

Independent Living Skills Survey (ILSS).

The ILSS (Wallace, 2000) is a 70-item clinician-administered self-report measure of ten domains of basic functional living skills designed for individuals with severe and persistent mental illness. *Personal Hygiene* (12 items) measures hygiene and self-care behaviors, *Appearance and Care of Clothing* (9 items) assesses the extent to which clothes are kept clean and stored appropriately, *Care of Personal Possessions* (6 items) measures the performance of common everyday household chores, *Food Preparation/ Storage* (7 items) measures whether the respondent obtains and cooks simple, nutritional foods and maintains a clean cooking space, *Health Maintenance* (7 items) assesses how well the respondent takes care of their health, *Money Management* (5 items) assesses performance of common financial chores, such as paying bills and cashing checks, *Transportation* (5 items) reflects the use of public transportation or automobile travel, *Leisure and Community* (12 items) measures the extent to which respondent engages in recreational activities, *Job Seeking* (4 items) assesses the execution of job-seeking behaviors, and *Job Maintenance* (3 items) assesses the quality of the current or previous job experience.

Original published data on the ILSS indicated that internal reliability on the ten domains ranged from .44 to .78 (mean $\alpha = .63$), and 6-month test-retest reliability ranged from .42 to .90 for the domains and was .79 for the total score. The ILSS has

demonstrated adequate concurrent validity compared to the Global Assessment Scale (Endicott, Spitzer, Fleiss, & Cohen, 1976), which is another measure of functioning. It has also shown sensitivity to the effects of skills training and is a strong predictor of competitive employment (Wallace et al., 2000). It has been used previously in patients with schizophrenia (Pratt, Mueser, Smith, & Lu, 2005) and one study found that middle-aged and older outpatients with schizophrenia scored significantly lower on eight out of the nine domains, compared to an age-matched sample of non-psychiatric individuals (Perivoliotis, Granholm, & Patterson, 2004).

The ILSS was administered and scored according to standard procedures outlined by Wallace and colleagues (2000). Participants were read each item aloud and the examiner recorded their response for each one. Each domain was scored by summing and then averaging its responses over the number of items answered “yes” or “no” in that domain (0 = No, 1 = Yes); items answered “not apply” were ignored. A domain was not scored if there were less than four “yes” or “no” responses except for the 3-item Job Seeking section, which was not scored unless all three responses were either “yes” or “no.” In order to obtain an overall summary score of functioning, all scored functional domains on the ILSS were averaged into a total functioning score that ranged from 0 to 1, where a higher score indicates better functioning. Coefficient alphas for the total score could not be computed because too few subjects entered the analysis due to the not applicable ignore rule, but the coefficient alphas for the 10 individual ILSS domains ranged from .23 to .75 (mean $\alpha = .57$) and were comparable to the findings of Wallace et al. (2000).

UCSD Performance-Based Skills Assessment (UPSA).

The UPSA (Patterson et al., 2001) is a performance-based measure that utilizes props and standardized role-play situations to assess five domains of everyday functioning. These include *Comprehension/ Planning*, *Finance*, *Communication*, *Mobility*, and *Household Management*. The role-play tasks are designed to be similar in complexity to situations that an older person is likely to encounter. For example, in the comprehension and planning portion, patients are asked to read descriptions of the zoo and the beach and are later asked to use that information to plan an outing. Financial ability is assessed in a role-play in which patients are instructed to count out change and write a check for a mock bill. During the mobility role-play, patients' ability to interpret actual bus schedules is assessed. Finally, household management is assessed in a role-play in which patients are asked to "shop" from a selection of actual grocery store items. The instrument was administered and scored according to the directions provided by Patterson et al. (2001). Domain scores range from 0 to 20 points, total scores range from 0 to 100 points, and higher scores indicate better functioning.

Patterson and colleagues (2001) demonstrated strong internal reliability for the UPSA, ranging from .86 for Finance Check Writing to .90 for Comprehension/Planning, and $\alpha = .89$ for the total score. One-week test-retest reliability for the total UPSA scale has been shown to be high (.94). The coefficient alphas for the UPSA domains in the present study ranged from .63 to .76 and were

lower than the published data, yet still adequate. The total score alpha was .86, which was comparable to the published value.

Real-world functioning.

In order to determine the degree to which self-reported and performance-based assessments of functioning reflect observable indicators of real-world functioning (i.e., to determine criterion-related validity of the ILSS and UPSA), an index consisting of independence in living situation, employment, marital status, and driving status was designed. The terms “real-world functioning” or “real-world functional outcome” will refer to this index score henceforth. The score was calculated by summing the following:

Living Situation. Patients were rated 0 if they lived in a professionally staffed assisted living setting (e.g., board-and-care, skilled nursing facility, nursing home) and 1 if they lived in unassisted living. This coding scheme is similar to earlier studies of middle-aged and older outpatients with schizophrenia that have used level of independence in living situation as an indicator of functioning (Twamley et al., 2002; Auslander et al., 2001).

Employment. Patients were interviewed to determine their employment status at the time of assessment and were rated 0 if they were unemployed or 1 if they were in paid part-time or full-time employment.

Marital Status. Patients were interviewed to determine their marital status at the time of assessment, and were rated 0 if they were not married or 1 if they were married.

Driving Status. One item from the ILSS that asks patients whether or not they have a current, valid California driver's license was used to rate patients' driving status as 0 if they did not have a driver's license or 1 if they did.

Neuropsychological Battery

The neuropsychological domains selected for analysis included verbal learning and memory, attention, executive functioning, and processing speed, because they have been shown to be strong cognitive predictors of functioning (Green, 1996; Dickinson et al., 2002; Milev et al., 2005; Green et al., 2000). Neuropsychological tests were administered according to published standardized procedures according to the references cited in the list below. Each raw test score was transformed into an age- and, when possible, education-corrected *T*-score as described after each test below. For tests with no published norms (span of apprehension task and degraded stimulus continuous performance task), *T*-scores were computed based on the mean and standard deviation of scores obtained from 111 non-psychiatric participants of comparable age and education level on that test. Mean domain *T*-scores were calculated for each of the four domains, and a global neuropsychological functioning *T*-score was calculated for each subject by averaging the four domain *T*-scores. This global score had good internal reliability (alpha based on 4 domain scores = .74) and served as the primary neuropsychological performance variable used in all analyses. The global score was used in order to limit the complexity of the path analytic model that will be tested, given the relatively small sample size. Global neuropsychological functioning scores have been used previously in studies of functional outcome in

schizophrenia (Siegel et al., 2006; Evans et al., 2003). Tests and scores that were included in each domain are listed below.

1. Verbal learning and memory (age- and education-corrected *T*-scores were computed according to Norman et al. (2000)):
 - a. *California Verbal Learning Test (CVLT)* (Delis, Kramer, Kaplan, & Ober, 1987): Trials 1-5 Total
 - b. *CVLT* Discriminability
 - c. *CVLT* Long-Delay Free Recall
2. Attention:
 - a. The *Degraded-Stimulus Continuous Performance Test (DSCPT)* (Nuechterlein, Parasuraman, & Jiang, 1983) is a rapidly paced visual discrimination task that tests the ability to sustain focused attention over time (approximately 10 minutes). A series of blurred single digits are briefly flashed with a fixed exposure duration and fixed interval between the stimuli (1000 milliseconds) and the participant is instructed to press a button when a specific target (the number zero) is presented. The DSCPT has been used in many studies of schizophrenia. Based on errors of omission (missed targets) and errors of commission (false alarm responses to non-targets), d' , an index of sensitivity, was calculated.
 - b. The *Digit Span Distractibility Task* (Oltmanns & Neale, 1975) consists of seven audiotaped trials given under two conditions, with and without auditory distraction. In the condition without distraction, participants listen

to a female voice reciting six digits and repeat the digits after the series is completed. In the distraction condition, the female voice recites five target digits, but four distracter digits spoken by a male voice are presented between each of the target digits. Subjects are instructed to repeat the digits spoken by the female voice and to ignore those spoken by the male. The total number of correct responses in the non-distraction condition was used as an index of attention for this measure.

- c. The *Span of Apprehension Task* (Asarnow, Granholm, & Sherman, 1991) is an information processing task where participants were briefly (70ms) presented with letters on a screen and are told to press a joystick button marked “T” or “F” depending on which of the two letters (target stimuli) appears. The target stimulus was presented in displays containing either 2 (3-letter condition) or 9 (10-letter condition) distracter letters. Detection rate (% correct target detections) for the 10-letter array condition was used as an index of attention for this task.

3. Executive functioning:

- a. *Wisconsin Card Sorting Test (WCST; 64-card version)* (Heaton, 1998) perseveration errors. The WCST manual was used to compute age- and education-corrected *T*-scores.
- b. *Stroop Color-Word Interference Test* (Golden, 1978) interference score. The Stroop manual was used to compute age-corrected *T*-scores.

- c. *Trail-Making Test* (Reitan & Wolfson, 1985) B time. Age- and education-corrected *T*-scores were computed as described in Heaton et al. (2004).
 - d. *Letter Fluency*: Total number of unique words generated. Age- and education-corrected *T*-scores were computed as described in Gladsjo et al. (1999).
4. Processing speed:
- a. *WAIS-III Digit Symbol* (Wechsler, 1997). The WAIS-III manual used to compute age-corrected *T*-score.
 - b. *Stroop Color-Word Interference Test*: Color score. The Stroop manual (Golden, 1978) was used to compute age-corrected *T*-scores.
 - c. *Stroop Color-Word Interference Test*: Word score. The Stroop manual (Golden, 1978) was used to compute age-corrected *T*-scores.
 - d. *Trail-Making Test*: A time. Age- and education-corrected *T*-scores were computed as described in Heaton et al. (2004).

Insight

The *Birchwood Insight Scale* (BIS; Birchwood et al., 1994) is an eight-item self-report assessment that measures three dimensions of insight: a) awareness of illness (2 items), b) awareness of the need for treatment (4 items), and c) attribution of symptoms to a mental disorder (2 items). Each dimension is scored and then scaled to a range of 0 to 4, yielding a total score that ranges from 0 to 12, where higher score indicates greater insight. A score of 9 or higher represents “good” insight. The total score has previously been shown to have good internal reliability ($\alpha = .75$), and

this was also true in the present study ($\alpha = .78$). The BIS scores have been shown to improve during the course of symptom remission, suggesting that the measure has good criterion validity.

Psychiatric Symptom Rating Scales

The following well established schizophrenia and depression rating scales were used:

The *Positive and Negative Syndrome Scale (PANSS)* (Kay, Fiszbein, & Opler, 1987) is a 30-item clinician-rated symptom assessment instrument for patients with psychotic disorders. It includes 16 general psychopathology symptom items (e.g., depression and anxiety), seven positive-symptom items (e.g., hallucinations and delusions), and seven negative symptom items (e.g., emotional withdrawal, blunted affect). Items are scored on a seven-point scale ranging from 1 (absent) to 7 (extreme) according to specific anchoring criteria, and are summed to yield a total score that ranges from 30 to 210. Clinical trials for patients in an active phase of schizophrenia typically require a total PANSS score of 60 or higher (e.g., Citrome et al., 2001; Czobor, Volavka, & Meibach, 1995; Daniel et al., 1999). The PANSS total score ($\alpha = .84$) was the main variable for the present study, but PANSS factor scores were also computed according to a factor analytically derived five factor model of schizophrenia symptoms, which consists of positive, negative, cognitive, depression/anxiety, and excitability factors (Lindenmayer, Bernstein-Hyman, Grochowski, & Bark, 1995).

The *Hamilton Rating Scale for Depression (HAM-D)* is a commonly used clinician-rated measure of depression severity with demonstrated reliability and

validity (Hamilton, 1967). The 28-item was used in the present study, which includes the original 17 items as well as additional items that measure atypical symptom features (anergia, hypersomnia, increased appetite, and rejection sensitivity). Most items are scored on a 5-point scale ranging from 0 (absent) to 4 (severe), but some are rated on a 3-point scale ranging from 0 (absent) to 2 (severe). All items are summed to produce a total score that ranges from 0-84, where a higher score indicates more severe depression. A total HAM-D score of 20 or higher is often required for inclusion in clinical trials for depression and a score of 10 is sometimes used as an index of remission (e.g., Rush et al., 2000). Internal reliability for the HAM-D total score in the present study was very good ($\alpha = .81$).

Data Analysis

SEM software EQS 6.1 (Bentler, 1995) was used to examine the hypotheses. Fit statistics and standardized path coefficients were examined to determine the appropriateness of the hypothesized model (Figure 1). Previous findings have indicated that better real-world functional outcome is predicted by better neuropsychological performance, higher insight, and less severe level of general symptomatology. Therefore, it was expected that the standardized path coefficients for the paths from neuropsychological performance and insight to real-world functioning would be significant and positive, while the coefficients for the path for symptoms would be significant and negative (Hypothesis 1). The covariance between self-reported and performance-based functioning was expected to be non-significant and .10 or less (Hypothesis 2). Next, neuropsychological functioning, depression, and

insight were expected to moderate the relationship between self-reported (but not performance-based) functioning and real-world functional outcome (Hypothesis 3).

Finally, the standardized path coefficient for the path between self-reported functioning and real-world functional outcome was expected to be non-significant and .10 or less (Hypothesis 4).

III. Results

Assumptions

The assumptions of univariate and multivariate normality and linearity were evaluated with SPSS 14 (2005). The Birchwood Insight Scale total score was negatively skewed, so a reflected square root transformation was performed to correct this. The real-world functioning score was positively skewed and a logarithmic transformation was performed to correct this. Four participants had no functioning data because they withdrew from the study before these assessments could occur. Eight participants had unreliable neuropsychological data due to factors such as poor vision, neurological problems, or color-blindness. One participant did not have any neuropsychological data. All data from these 13 individuals were deleted from the analysis, reducing the effective sample size to 64. The omitted participants had significantly greater level of general symptomatology (PANSS total) and less insight but did not differ on any other demographic or clinical variable. Of this sample, two participants had missing self-reported functioning data, one had missing insight data, and two were missing driver's license possession data needed for calculation of the real-world functional outcome variable—these 5 missing data points were replaced with mean substitution (this method was considered appropriate due to the low, <5% incidence of missing data on each of the affected variables). There were two univariate outliers (one scored unusually high on self-reported functioning and the other had unusually high insight; both scored approximately 3 SDs above their respective means), and these were replaced with values equal to the next highest score

plus 5% of the observed range of the variable, in order to minimize their impact. No multivariate outliers were identified using Mahalanobis distance. Finally, Mardia's normalized coefficient estimate was 1.02, which indicated that the data were free from multivariate non-normality.

Descriptives and correlations

As indicated on Table 1, participants were predominantly male (75%) and Caucasian (78%), and were very chronic, with an average duration of illness of almost three decades (27.8 years). On average, patients had a high school education, and most were currently unmarried (92.2%) and unemployed (96.9%). More than half (60.9%) lived in a professionally assisted living facility.

Participants had a mild-moderate level of overall symptomatology with little variation, as measured by the PANSS total score (see Table 2). For example, the mean PANSS total score of patients in the present study was 51.8 (SD=13.2), compared to 75.6 (SD=15.8) for a different sample of stable outpatients that was on average 10 years younger (Dickerson et al., 1999) and 98.2 (SD=17.5) for a sample of treatment-resistant patients enrolled in a drug trial almost 20 years younger on average (Breier & Hamilton, 1999).

The mean BIS score was 8.9 (SD = 2.2), which is classified as approximately “good” insight (defined by Birchwood et al. (1994) as ≥ 9). Birchwood and colleagues (1994) found that a group of psychotic patients scored 6.0 (SD = 4.4) upon admission to a psychiatric facility and 8.9 (SD = 3.8) upon discharge—the latter score is equivalent to the patients in the present study. HAM-D depression scores were

relatively low; the mean score of 12.8 (SD = 8.0) was much lower than the score of 20 or greater typically required for inclusion in clinical trials of depression treatments, but closer to what is usually considered a “remission” score (≤ 10).

The mean global neuropsychological functioning composite *T*-score of 35.3 corresponds to a percentile rank of 7, indicating that the current sample of middle-aged and older patients with schizophrenia performed worse than 93% of similarly aged (and for most tests, similarly educated) individuals in the normative sample groups, on average.

Participants had a mean score of 62.3 (SD = 16.3) on the UPSA, which indicates some degree of functional impairment (maximum possible score = 100), but they scored higher than a recent sample of similarly aged chronic outpatients (mean = 38.1, SD = 9.2) (Bowie et al., 2006), and much higher than a sample of younger inpatients (mean = 16.18, SD unavailable) (Keefe et al., 2006). The ILSS mean score of .67 (SD = .10) also indicates less than “perfect” functioning (maximum score = 1.0), and is lower and more variable than a sample of similarly aged non-psychiatric participants who scored .87 (SD = .06) (Perivoliotis et al., 2004).

Table 3 lists bivariate correlations for all variables in the model. Older age was significantly associated with better real-world functional outcome but not with self-reported or performance-based functioning. Notably, neuropsychological performance, as defined by our aggregate score of four domains relevant to functioning (attention, verbal memory, processing speed, and executive functioning) was significantly positively correlated with both self-reported ($r = .37, p < .01$) and

performance-based ($r = .60, p < .001$) functioning. However, it failed to significantly correlate ($r = .18$) with real-world functional outcome, as measured by four indicators (independence in living situation, possession of driver's license, employment, and marital status), although the small effect was in the expected direction. The two measures of functioning were significantly correlated with each other ($r = .29, p < .05$), yet only performance-based functioning was associated with real-world functioning ($r = .33, p < .01$ vs. $r = .14$). As these are bivariate correlations, they measure the degree of association between each pair of variables without taking into account (controlling for) other potentially related variables and therefore may be spurious. One of the benefits of SEM is that it allows for the identification of independent effects, allowing for a more specific test of effects.

SEM Analyses

The hypothesized path model is presented in Figure 1, where rectangles represent measured variables (there were no latent variables) and straight arrows represent hypothesized independent relationships between variables (i.e., the effect of one variable on another while controlling for all other preceding variables in the model). The curved arrow represents a covariation between two variables.

Model estimation.

All models were estimated using maximum likelihood estimation procedures. Three model fit indexes were calculated and examined to evaluate the appropriateness of the models tested for the current sample. These included the likelihood model chi-square, comparative fit index (CFI), and the root mean-square error of approximation

(RMSEA). A chi-square value associated with a p -value greater than .05 is optimal and suggests that the model is a good fit for the data. Also, as the value of χ^2 increases, the fit of the model becomes increasingly worse. For CFI, values range from 0 to 1.00, with values greater than .90 suggesting a well-fitting model. For RMSEA, values less than .08 suggest good fit (Kline, 2005).

The path model tested was over-identified, meaning that the number of variances and covariances was greater than the number of parameters that were estimated; overidentification is a necessary condition for interpreting the χ^2 likelihood ratio, CFI, and RMSEA indexes, followed by the statistical and practical significance of the path coefficients.

The hypothesized model was tested and it showed a good fit to the data, $\chi^2(1, N = 64) = .41, p = .52, CFI = 1.0, RMSEA = <.001$. As indicated by the standardized coefficients in Figure 2, contrary to Hypothesis 1, neuropsychological performance did not directly predict real-world functioning. Instead, it directly predicted scores on both the self-reported ILSS ($\beta = .35, p < .05$) and the performance-based UPSA ($\beta = .60, p < .001$), but its influence on real-world functional outcome was indirect through (i.e., mediated by) performance-based functioning on the UPSA. In general, symptom severity and insight showed small, non-significant effects throughout the model.

The lack of a direct relationship between neuropsychological functioning and real-world functional outcome was not expected, and it is possible that it was not found here because the UPSA was absorbing much of the variance in neurocognition. In order to test this, the model was re-estimated after the UPSA was removed from it.

The model fit was still good ($\chi^2(1, N = 64) = .41, p = .52, CFI = 1.0, RMSEA = <.001$) but again no significant direct influence of neuropsychological functioning on real-world outcome emerged ($\beta = .18, p = .18$), indicating that the effect of neuropsychological functioning on real-world functional outcome was only indirect in this sample of patients (i.e., mediated by performance-based functioning).

In order to determine whether the strength of neurocognition's influence on the UPSA was statistically greater than its influence on the ILSS, the two paths were constrained to be equal and a χ^2 difference test was conducted to test the hypothesis that this constrained model was not significantly different than the unconstrained one. The result indicated that the two models were not significantly different, $\chi^2_D(1, N = 64) = 2.8, p = .09$, which means that although the strength of the effect of neurocognition on UPSA performance is over one and a half times that of the effect on the self-reported ILSS, the difference is not statistically significant.

Contrary to Hypothesis 1, general symptomatology as measured by the total PANSS score showed small and insignificant associations with both self-reported and performance-based functioning. Of note, however, although it did not reach significance, the magnitude of the relationship between symptoms and self-reported functioning ($-.16$) was more than twice that of performance-based functioning ($-.07$).

Consistent with Hypothesis 2, the degree of independent association between self-reported (ILSS) and performance based (UPSA) functioning was small ($.08$), indicating minimal shared variance between these two measures.

Consistent with Hypothesis 4, self-reported functioning on the ILSS was not significantly associated with real-world functional outcome, but previous evidence suggests that the relationship between self-reports and more objective measures may be moderated by factors such as neuropsychological impairment, depression, and poor insight (as predicted in Hypothesis 3). In order to test for the potential moderating effect of neurocognition, a moderator test was conducted by centering the composite neuropsychological score and the ILSS score (to minimize collinearity), creating a product interaction term using the centered variables (neurocognition X ILSS), inserting this term into the path model, and testing the path that leads from the interaction term to real-world functional outcome—a significant result would indicate the presence of a moderating effect (i.e., interaction) independent of any main effects that may be present. The process was repeated for symptoms and insight.

When the interaction term for neurocognition was tested, the model fit became poor ($\chi^2(6, N = 64) = 8.8, p = .18, CFI = .94, RMSEA = .09$), indicating that it is not a significant moderator of the relationship between self-reported functioning and real-world outcome. The same effect occurred when testing insight ($\chi^2(6, N = 64) = 14.0, p < .05, CFI = .83, RMSEA = .15$). In order to test for a moderating effect of depression, PANSS Total was replaced with Hamilton Depression Inventory total score and the Depression X ILSS interaction term was tested in this model so that any main effects of depression can be controlled. (Ideally we would have simply added depression to the hypothesized model but due to sample size and degree of freedom constraints, this would compromise power.) Adding depression as a moderator

resulted in poor model fit ($\chi^2(6, N = 64) = 9.5, p = .15, CFI = .92, RMSEA = .10$). These results indicate that none of the hypothesized factors moderated the effect of self-reported functioning on real-world outcome.

Since Hypotheses 3 also stated that the UPSA would not be moderated by these three factors, the moderator tests were performed for the UPSA as well. As predicted, none of the three factors moderated the relationship between UPSA and real-world functional outcome—when the interaction terms for neurocognition and then insight were tested, the model fit became poor (neurocognition: $\chi^2(6, N = 64) = 9.3, p = .16, CFI = .92, RMSEA = .09$; insight: $\chi^2(6, N = 64) = 14.0, p < .05, CFI = .83, RMSEA = .15$). Although model fit remained good when depression was tested ($\chi^2(6, N = 64) = 8.5, p = .20, CFI = .94, RMSEA = .08$), no significant moderating effect for it was found ($\beta = -.02, p = .85$). In summary, contrary to Hypothesis 3, the three hypothesized factors (neuropsychological functioning, insight, and depression) did not appear to moderate the relationship between self-reported functioning and real-world functional outcome. In other words, the poor agreement between self-reported functioning and real-world outcome was not likely due to a detrimental effect of these three factors on patients' ability to self-report their functioning.

In order to examine the criterion-related validity of self-reported and performance-based functioning, the two paths leading from these indicators to real-world functioning were compared. Only performance-based functioning significantly predicted real-world outcome ($\beta = .40, p < .01$). Consistent with Hypothesis 4, scores on the self-reported ILSS only weakly predicted real-world outcome ($\beta = .06, p = .62$).

The influence of the UPSA on real-world functioning independent of the other factors in the model was almost seven times as strong as the independent effect of the ILSS. This indicates that even after controlling for symptoms, insight, and neuropsychological functioning, the UPSA still independently predicted real-world functioning.

The amount of variance accounted for in the three measures of functioning by the hypothesized model was 15% for self-reported functioning, 36% for performance-based functioning, and 16% for “real-world” functional outcome as measured by a collection of indicators.

Post hoc model modifications were performed in an attempt to develop a better fitting and possibly more parsimonious model. These were guided by theory, and the results are summarized in Table 4, which includes Akaike Information Criterion (AIC) fit indices as well as the previously mentioned ones. The AIC can be used to compare fit of non-hierarchical models—i.e., models that are not simply subsets of each other. Smaller AIC values indicate better model fit (Kline, 2005).

Negative vs. total symptoms.

A number of investigations have identified a more significant role of negative symptoms in functioning, as compared to positive or total symptomatology. Due to the constraints of the hypothesized model (too few degrees of freedom and small sample size), it was not possible to examine the impact of various types of factors simultaneously. Therefore, another *post hoc* modification of the original model was conducted by replacing the PANSS total score with the negative symptom factor score

(Lindenmayer et al., 1995) (see Table 3). The model fit improved somewhat ($\chi^2(1, N = 64) = .13, p = .72, CFI = 1.0, RMSEA = <.01$) but there was minimal change in the standardized path coefficients, with the exception of β for the path from symptoms to self-reported functioning, which decreased from $-.16$ to $-.05$ (ns). This suggests that inclusion of negative symptoms vs. total symptoms does not appreciably improve (or degrade) the hypothesized model and is inconsistent with the literature that shows that negative symptoms predict functioning.

Specific vs. global neuropsychological functioning.

There is controversy surrounding the specificity of cognitive impairment as it relates to functional outcome in schizophrenia. Whereas some have found that neuropsychological functioning on specific domains predicts functioning (Green et al., 1996, 2000), other evidence has challenged the specificity of these relationships and suggests that global neuropsychological deficit may be more predictive of functional impairment (Dickinson et al., 2002; Evans et al., 2003; Twamley et al., 2002; Velligan et al., 2000b). In order to examine this issue, the hypothesized model was re-estimated with the global neuropsychological T -score replaced one at a time with T -scores for executive functioning, attention, verbal memory, and processing speed, respectively (i.e., 4 modified models). The three significant effects found in the hypothesized model remained significant for each of the specific domains, with the exception of attention—when this indicator was used, its effect on self-reported functioning dropped to a non-significant level. However, this may have been due to a reduction in power since 15 participants did not have attention scores due to poor

vision and were, therefore, dropped from this analysis. The model fit parameters are displayed in Table 4. In sum, each model fit the data very well, but the AIC values indicated that the verbal memory model and the attention model had a slight advantage over the processing speed, executive functioning, and composite cognition models in terms of model fit. All of the models (the 4 specific and original global) explained about the same amount of variance in the most important outcome—real-world functioning (16-18%). The models with global cognition and executive functioning explained the most variance in UPSA (36% in both). Overall, neuropsychological performance accounted for 10-36% of functioning, depending on the manner in which both were operationalized.

Premorbid verbal intelligence vs. current neuropsychological functioning.

The robustness of the effects of neuropsychological functioning on self-reported and performance-based functioning necessitates an examination of the effect of premorbid intelligence, since this has been repeatedly shown to account for a significant proportion of the variance in current cognitive functioning. A model was estimated with ANART *T*-score added as an exogenous variable, with one path leading to neuropsychological functioning. The purpose of this post hoc test was to determine whether the neuropsychological functioning effects remained after accounting for premorbid intelligence. The resulting model had poor fit and was therefore uninterpretable (see Table 3). Therefore, the hypothesized model was re-estimated with ANART replacing global neuropsychological functioning. The ANART model fit the data poorly ($\chi^2(1, N = 64) = 3.71, p = .05, CFI = .92, RMSEA =$

.21), suggesting that the effects of current neuropsychological performance seen in the hypothesized model are probably largely unique and unlikely to be spurious due to the effects of premorbid verbal intelligence.

IV. Discussion

Assessment of functioning in schizophrenia is a burgeoning area and there is great interest in accurate assessment of this complex construct. Self-reported and performance-based assessments such as the ILSS and UPSA represent two different categories of instruments presently in use both in clinical and research contexts. The goal of this study was to investigate the concurrent and criterion-related validity of these instruments in middle-aged and older patients with schizophrenia by examining their degree of association, their relationship with illness factors, and their ability to predict indicators of “real-world” functional outcome.

Neuropsychological functioning was associated with both self-reported ($\beta = .35$) and performance-based ($\beta = .60$) functioning. These effects, which were medium and large respectively, are consistent with a meta-analysis that found effect sizes varying from .20 to .40 for the relationship between functioning and different neuropsychological domains (Green et al., 2000). These effect sizes are also approximately similar to a study that found that a global measure of neuropsychological functioning accounted for 41% of the variance on the UPSA (Twamley et al., 2002). Although not statistically different, the strength of the influence of neurocognition on performance-based functioning was almost twice that for self-reported functioning. One possible explanation for this is that the difference is simply due to the nature of the tasks—the UPSA is a cognitively demanding test whereas the ILSS is a simple behavioral checklist that relies on retrospective recall of functional behaviors that may require adequate neuropsychological abilities but also

multiple additional factors. For example, correctly interpreting a bus schedule on the UPSA probably depends largely on attention to filter out distracting stimuli in the room and to focus on identifying bus fare, trolley stops, and other pieces of information required by the UPSA transportation subtest. Having actually “visited friends” on the ILSS likely depends on neuropsychological functioning (e.g., executive functioning) to plan the trip, but is also probably determined by additional factors, including financial resources, social support, physical mobility, social cognition, personality traits, fears about going out, expectations of success, and beliefs about self-efficacy.

A direct, independent effect of neuropsychological performance on real-world functioning was not found in this study. This is inconsistent with studies that have found that better neuropsychological ability predicts various indicators of real-world functional outcome, including greater independence in living situation (Palmer et al., 2002; Wykes, Sturt, & Katz, 1990) and improved work performance (Bellack, Gold, & Buchanan, 1999). Instead, in the present study, neurocognition influenced real-world functioning indirectly through a mediator—performance-based functioning on the UPSA. Of note, the effect size of the relationship between UPSA and real-world outcome was .40, which is statistically medium-sized, but clinically very meaningful, given the importance of the real-world indicators (independence in living situation, employment, marital status, and possession of a driver’s license).

The finding that the UPSA mediated the relationship between neuropsychological functioning and real-world functional outcome is consistent with a

recent investigation (Bowie et al., 2006) in a sample of middle-aged and older outpatients with schizophrenia in which case managers rated real-world functioning in three domains—interpersonal skills, work skills, and community activities. UPSA performance mediated the relationship between neuropsychological functioning and both interpersonal skills and work skills. Neuropsychological functioning had a direct effect only on community activities, but it was weaker than the effect of UPSA on the same. These findings, as well as those from the present study, both suggest that neuropsychological ability may determine an individual's ability to learn functional skills (i.e., their functional capacity), and this in turn may lead to the execution of those skills in daily life. Consequently, neuropsychological ability alone is probably not enough to determine real-world functional outcome—i.e., it is a necessary but not sufficient condition for successful real-world functioning.

A *post-hoc* comparison of specific domains of neuropsychological performance vs. a more general composite score indicated that the amount of variance accounted for in real-world outcome was similar across domains. This is consistent with studies that have found global neuropsychological ability to explain more variance in functioning than ability in discrete domains (Twamley et al., 2002; Velligan et al., 2000b).

The hypothesis that performance-based and self-report measures would be only weakly correlated was supported. When the two were compared using simple correlations they were moderately correlated at .28, but in path analysis, which controls for the overlapping effects of other variables, their association dropped

precipitously to .08. One possible explanation for this finding is that the two tests may measure different constructs, or perhaps more likely, different aspects of a multidimensional construct. For example, the performance-based UPSA may measure functional skill capacity, whereas the self-report ILSS may measure actual execution of functional behaviors (e.g., cleaning, leisure activities, etc.). Assuming this is true, the lack of a significant relationship between the two measures may suggest that the middle-aged and older patients in the present study have difficulty translating existing functional skills into everyday behavior.

If the functional behaviors measured by the ILSS are considered to be the building blocks of real-world functional outcome, one would expect that the ILSS would be positively associated with the indicators of real-world outcome used in the present study, but this was not the case. One possible explanation for this is that the reliability and/or validity of the ILSS was compromised by measurement error since self-report instruments have been criticized for their susceptibility to social desirability and response sets (Daltroy et al., 1999). Factors like social desirability are obvious in the ILSS, in which respondents are asked questions by an interviewer such as, “Did you change your underwear at least twice a week in the last 30 days?” Adding to this problem is the finding that some of the ILSS domain scores had very poor internal reliabilities (as low as .23). The instrument’s author argues that the low reliability is an unavoidable function of the nature of the material the instrument measures—e.g., engaging in one activity leads to not engaging in other activities within the same domain on the ILSS, and therefore a “negative correlation” is introduced, which

reduces internal reliability (Wallace et al., 2000). Therefore, test-retest reliability may be a better index of reliability for the ILSS total score; although this was not measured in the present study, it has previously been shown to be .79 (Wallace et al., 2000). Nevertheless, poor internal reliability may have compromised the instrument's ability to measure functioning in a reliable manner in the current study.

Conceivably, self-reported functioning on the ILSS may not have been a reliable measure of real-world functional outcome in this study due to the interference of nuisance moderator variables, including neuropsychological impairment, depressive symptoms, or insight, as predicted by Hypothesis 3. However, there was no evidence that any of these illness factors confounded the relationship between self-reported functioning and real-world functional outcome. This may be due to a number of factors, including the low severity and variability in depressive symptoms and insight in the sample. The few studies that have examined the role of insight on the reliability of self-reported functioning in schizophrenia (Doyle et al., 1999; Whitty et al., 2004) have mostly focused on quality of life, which usually includes patients' subjective appraisals of their level of satisfaction with their functioning. The ILSS does not require such a subjective evaluation of one's life situation. It only asks for retrospective report of activities performed, which may not rely on the dimensions of insight measured by the Birchwood Insight Scale (awareness of illness, awareness of the need for treatment, and attribution of symptoms to a mental disorder). Other dimensions of insight that are not assessed by the BIS, including understanding of the social consequences of one's disorder and awareness of its specific signs and

symptoms, may be more relevant in determining a patient's ability to reliably self-report his or her functioning.

Regarding the lack of a cognitive moderator on the relationship between self-reported functioning and real-world functional outcome, most of the evidence that cognitive impairment impairs the ability to reliably self-report one's functioning comes from dementia populations. Although the patients in the current study evidenced neuropsychological impairment, they did not meet criteria for dementia. In other words, it is possible that their neuropsychological impairment was not severe enough to interfere with their ability to self-report their functioning.

Contrary to our hypothesis, the influence of symptoms and insight on functioning in the current study was minimal. Neither symptom severity nor insight appeared to be significantly associated with functioning in this sample of chronic, stable older outpatients with mild to moderate symptom severity and good insight. Furthermore, replacing a general symptom measure with negative symptom severity did alter the results. This finding contradicts studies that have found functioning to be predicted by general symptomatology (Bengtsson-Tops et al., 1999) and negative symptoms (Green, 1996), but is in line with research that has shown cognitive functioning to play a larger role than symptoms in determining functional capacity, especially in middle-aged and older patients (Evans et al., 2003). Neuropsychological functioning and negative symptoms have been shown to overlap substantially, so one possible explanation for the lack of a relationship between negative symptoms and functioning is that when this relationship was tested with path analysis, the variance

due to cognition was removed and hence the effect for negative symptoms that remained was minimal (Milev et al., 2005).

The pattern of results highlights the importance of construct validation in functional assessment. Two measures that both ostensibly measure functioning did not significantly correlate when the other factors in the model were taken into account, and only one of the measures (the performance-based UPSA) demonstrated good criterion-related validity by its association with observable indicators of real-world functioning. This suggests that the two instruments measure different constructs or different aspects of the same multidimensional construct. These findings illustrate the complexities of functional assessment in schizophrenia. A review of the literature indicates that there is little consensus even on the appropriate terminology. Measures of “quality of life,” which ostensibly reflects a person’s subjective appraisal of their life satisfaction, often include measures of instrumental role functioning including financial management (e.g., Oliver, Huxley, Priebe, & Kaiser, 1997). Measures of “social functioning,” which ostensibly assess interpersonal aspects of functioning, often include items about instrumental living skills as well (e.g., Birchwood et al., 1990). The current emphasis on targeting functional domains for improvement through medications and interventions in people with severe mental illness, as evidenced by the development of MATRICS, creates an impetus to create and validate measures of functioning. Barlow (2005) stressed that the development of evidence-based treatments should be met with development of evidence-based assessments to match. This is highly relevant in schizophrenia, given current efforts to develop more

effective pharmacological (Green et al., 2004) and psychosocial (Warman, Grant, Sullivan, Caroff, & Beck, 2005) interventions to help treat cognitive and functional impairment in people with the disorder.

It is important to note that the proportion of variance in functioning accounted for by the multiple factors in the examined model was not high. It ranged from medium for self-reported functioning to large for performance-based functioning, yet even the latter had 64% unexplained variance. More importantly, our model explained only 16% of the variance in real-world functioning. This begs the question, as Green (1996) asked, “Are we measuring the right stuff?” Although we included multiple clinical factors that have been identified as relevant for functioning, there are clearly other variables. Some additional factors that have been shown to impact functioning include level of premorbid functioning, social support, socioeconomic status, motivation, facilitation from caregivers, availability of friends or family, social cognition, metacognition, and self efficacy (Green et al., 2004; Bowie, Reichenberg, Patterson, Heaton, & Harvey, 2006; Pratt et al., 2005).

The present study is the second to demonstrate that performance-based functioning may mediate the relationship between neuropsychological functioning and real-world functional outcome, and there is a growing interest in identification of additional mediating variables. For example, social cognition includes the cognitive processes (e.g., emotion perception) involved in the processing of social information. It is related to, yet distinct from, neurocognition (as measured in the current study) and may also contribute to functioning. Although it is not surprising that social cognition

plays an important role in social aspects of functioning, it has recently been found to influence other domains of functional outcome as well, including independent living (Brekke, Kay, Lee, & Green, 2005). Social cognition appears to play a significant mediating role between neurocognition and functional outcome, so it may serve as an important target of assessment and treatment (Brekke, Kay, Lee, & Green, 2005).

Learning potential, defined as the ability to learn, may also serve as an important mediator between cognition and functional outcome (Sergi, Kern, Mintz, & Green, 2005). Koren et al. (2006) described “metacognition” as the combination of monitoring (subjectively assessing the correctness of one’s knowledge; e.g., knowing you might be wrong) and control (directing one’s behavior to respond appropriately; e.g., seeking out corrective information) and posit that this process may also serve as a mediator between neuropsychological ability and functional outcome. In a dramatic finding, they showed that metacognition accounted for an additional 62% of the variance in functioning after accounting for traditional cognitive functioning, and that the two predictors together accounted for 75% of the variance in functioning. Further elucidation of these factors could translate to the development of more reliable and valid functional assessment and more effective treatments.

Lysaker et al. (2006) recently found that a sense of “agency,” the degree to which people believe they can enact change in their lives, predicted better everyday functioning and quality of life. This is very relevant for treatments aimed at improving functioning in schizophrenia because without agency, even the most rigorous and evidence-based treatment will fail to translate to functional gains.

The effect of neuropsychological functioning on the performance-based UPSA, coupled with the association between the latter and real-world functioning, may lead some to wonder why we should not simply measure neuropsychological ability with our already established and well-validated assessments of this domain and use this as a proxy measure of functional outcome. It is important to remember, however, that the UPSA predicted real-world functioning even after accounting for neuropsychological functioning in the model. This suggests that performance-based functional assessment is important and that it likely measures something unique about the potential for real-world functioning that cognitive tests do not.

Aging

The study contributes to our understanding of functioning in middle-aged and older outpatients with schizophrenia. Symptom severity was in the mild to moderate range and not highly variable, which is consistent with studies that have found aging to be associated with decreased psychopathology in schizophrenia (Jeste et al., 2003). Level of insight was relatively good, and equivalent to patients who are not acutely symptomatic (Birchwood, 1994). After nearly three decades of illness, this sample of people with schizophrenia had achieved a good understanding of their illness. Neuropsychological functioning emerged as a more salient factor than either symptoms or insight in the prediction of functioning for this group of patients, consistent in part with reports that neurocognition is more important in determining functional capacity in older patients with schizophrenia (Evans et al., 2003). Interestingly, older age was associated with better real-world functional outcome,

suggesting that as patients age, their functioning improves. This is inconsistent with the finding that aging in schizophrenia is accompanied by functional deterioration (Friedman et al., 2001) or stabilization (Jeste et al. 2003). Instead, it is consistent with a report by McGlashan (1987), who estimated that approximately 20% of patients with schizophrenia have improved outcome in later life.

The findings have important implications for the treatment of middle-aged and older patients with schizophrenia. They suggest that although neuropsychological function is a determinant of functional capacity, it does not by itself determine real-world functional outcome and instead does so indirectly through functional capacity. This suggests that rehabilitative efforts can be aimed at one of several intervention points. Cognitive remediation strategies can be employed to help improve the neurocognitive abilities required for acquisition of functional skills (Bellack, Gold, & Buchanan, 1999) and can be supplemented with compensatory strategies training to help cognitively impaired patients better adapt to their environment (Velligan et al., 2000a). Moreover, functional adaptation treatment (Patterson et al., 2003) and daily problem-solving skills training (Revheim et al., 2006) can help supply missing functional skills. Finally, cognitive behavioral therapy (Cather et al., 2005; Granholm et al., 2005) may help target dysfunctional beliefs and behaviors that interfere with deployment of learned skills (Bowie et al., 2006).

Strengths, Limitations, and Future Directions

This study is one of the few to investigate functional outcome in middle-aged and older, very chronic patients with schizophrenia and to compare self-reported

functioning with performance-based functioning in schizophrenia. Its most significant strength is that despite the limitations imposed by the small sample size, model complexity, low symptom variability, and limited selection of indicators of real-world functional outcome, effects of medium to large magnitude were still detected, which reflects the robustness of these effects. The finding that the better UPSA performance was positively associated with improved real-world functional outcome is notable because of the importance and magnitude of the indicators, including degree of independence in living situation, employment, marital status, and possession of a driver's license.

Moreover, in a recent similar study, Bowie and colleagues (2006) found very similar findings; particularly, that performance-based functioning on the UPSA mediated the relationship between neuropsychological ability and most domains of real-world functional outcome, as assessed by case managers' reports. The relative strengths of the current study are that it included more objective indicators of real-world functioning. Although some were obtained via patient report, they were simple, straightforward indices that were less likely to be contaminated by respondent factors (memory, mood effects, social desirability, etc.) than clinician-reported functional behaviors. Furthermore, the current study examined an additional dimension of functioning by including a self-report instrument. Studies that simultaneously examine self-reported functioning, performance-based functioning, and indicators of real-world functional outcome in schizophrenia are unfortunately very rare. Finally, the present study employed a desirable multi-trait multi-method assessment approach

to better understand the nature of functioning in patients with chronic schizophrenia (Campbell & Fiske, 1959).

The study includes several important limitations. First, the measure of real-world functioning was not completely objective because it included indicators that were in essence, self-reported. Patient's living situation, employment, marital status, and driver's status were ascertained through self-report; consequently, it is possible that patients misrepresented their functional status. Future studies should verify such information—for example, with patients' consent, the DMV can be called to verify driver's license status and employers can be contacted to verify employment. Second, two of the indicators on the real-world measure (employment and marital status) were highly skewed since the vast majority of patients was unemployed (98%) and unmarried (92%). Replacing these indicators with other, more variable ones, may have improved the ability to detect relationships between real-world functioning and the other variables in the model, yet variability alone is not sufficient for a good indicator of functioning. For example, although there was greater variability in living situation, a multitude of factors other than functioning determine where a patient lives (e.g., financial resources, social support, etc.)

Unfortunately the problems just described with the real-world functional outcome measure reflect a significant obstacle in research on functioning in schizophrenia. The selection of observable indicators in patients with the disorder is difficult, because they tend to be too rare to be useful (Keefe et al., 2006). There is also the more qualitative problem of determining indicators that patients agree are

reflective of adequate functioning. For example, Salokangas and colleagues (2006) found that lower functioning patients were actually quite satisfied living in group homes, which raises an important concern about who is the best judge of functioning—the patients themselves or researchers/clinicians? These observations highlight the need for development of objectively assessed functioning in schizophrenia.

The lack of concordance between the domains on the self-reported and performance-based measures examined is an additional limitation of this study. The observed weak association between self-reported (ILSS) and performance-based (UPSA) functioning may have been due to the differences in the functional domains measured in the two instruments. Specifically, the personal hygiene, appearance and care of clothing, job seeking, and job maintenance domains of the ILSS have no analogue on the UPSA.

The study contains several statistical limitations. The small sample size likely resulted in limited power. Although this highlights the robustness of the findings that were observed, it also makes it more likely that weaker but important effects were missed. Despite the fact that several of the tested models “fit the data well,” this does not necessarily indicate the models are correct. Most of the standardized path coefficients in the hypothesized model were not statistically significant and the proportion of variance accounted for in functioning was low, but the indices often indicated “perfect fit,” and this was most likely due to the large number of paths in the model. Also, it is possible that some parts of the model poorly fit the data even if the

fit indices indicated otherwise (Klein, 2005). The fact that the majority of hypothesized paths was non-significant suggests that despite good fit, the model is not entirely theoretically meaningful and likely does not have optimum predictive ability. The three significant relationships that did emerge appeared robust, had medium to large effect sizes, and are clinically meaningful. However the rest of the model as it stands should be modified in future replications with larger sample sizes. SEM also makes the weighty assumption that all inputted indicator variables have no measurement error but it is almost impossible to not violate this assumption when studying abstract, complex constructs like functioning. Presence of measurement error, therefore, may have either concealed additional effects or overestimated observed ones.

The generalizability of this study is limited due the low sample size and power. The patients were middle-aged and older, very chronic, and reported symptoms in the mild to moderate range. It is not known how well the results can be generalized to younger patients or those with more severe symptomatology.

Suggestions for future work can be separated into research and clinical categories. Regarding the current study, future elaborations should include a larger sample size. This will enable more complex models to be estimated—for example, a larger sample size would allow for the testing of a structural regression model that includes a latent variable for neuropsychological functioning and its constituent domains in the same model. Larger sample sizes will also allow for inclusion of additional variables and comparison across groups—for example, there is some

evidence that females with schizophrenia have better functional outcome than males (Siegel et al., 2006), yet the sample size was too small to test this in the present study. Future replications should include measures of social desirability along with the ILSS, in order to identify any moderating influences it may have on the relationship between self-reported and real-world functioning. Furthermore, it is important to remember that significant effects in SEM do not necessarily imply causation. Klein (2005) suggests that such an inference can only be made after replication of the model across independent samples, elimination of plausible equivalent models, corroborating evidence from experimental studies of variables in the model that are manipulable, and the accurate prediction of the effects of interventions, all of which can take many years to complete and may not be possible due to ethical considerations.

Research efforts in this area should be focused on clarification of the functioning construct. This may require qualitative research followed by increasingly quantitative investigations such as factor analyses and their replications, in order to develop sound, valid functioning assessments. Researchers would be wise to follow the steps for construct validation proposed by Smith (2005). The current findings are mixed yet also optimistic in that they suggest that measures of functioning can predict useful outcomes (as the UPSA did here). Future work in this area would benefit by development of models that will elucidate the complex nature of functioning in schizophrenia (e.g., Eklund & Backstrom, 2005; Brekke et al., 2005; Naber & Vita, 2004). More longitudinal studies and development of innovative functional

assessment techniques such as computerized experience sampling method (ESMc) (Kimhy et al., 2006) may also be beneficial.

In summary, the main findings of this study are that performance-based functioning is strongly determined by neuropsychological functioning and is a better predictor of real-world functional outcome (as measured by a collection of indicators) than self-reported functioning in middle-aged and older patients with chronic schizophrenia. Self-reported functioning did not effectively measure real-world outcome and this did not appear to be due to the effect of depression, neuropsychological impairment, or poor insight, but may have been due to another nuisance variable such as social desirability. The findings highlight the complexities of functional assessment and the difficulties involved in identifying purely objective measures of real-world outcome in schizophrenia.

Table 1:

Demographic characteristics of the sample

	Mean	(SD)
	-----	-----
<i>Age (years)</i>	53.1	(6.9)
<i>Education (years)</i>	12.3	(2.5)
<i>Years of Illness</i>	27.8	(9.7)
	<u><i>N</i></u>	<u>(%)</u>
<i>Gender</i>		
Male	48	(75.0)
Female	16	(25.0)
<i>Ethnicity</i>		
Caucasian	50	(78.1)
African-American	8	(12.5)
Latino	4	(6.3)
Asian-American	1	(1.6)
<i>Marital Status</i>		
Married	5	(7.8)
Single/Never Married	31	(48.4)
Divorced	17	(26.6)
Widowed	6	(9.4)
Separated	5	(7.8)
<i>Living Situation</i>		
Assisted	39	(60.9)
Unassisted	25	(39.1)
<i>Employment</i>		
Employed	2	(3.1)
Unemployed	62	(96.9)
<i>Driver's License</i>		
Yes	16	(25.0)
No	46	(71.9)
Unknown	2	(3.1)

Table 2:

Clinical, neuropsychological, and functioning means and standard deviations for a sample of 64 middle-aged and older outpatients with schizophrenia

	Mean	(SD)
<i>Clinical Measures</i>		
Positive & Negative Syndrome Scale (PANSS) total	51.8	13.2
Hamilton Rating Scale for Depression total	12.8	8.0
Birchwood Insight Scale (BIS) total	8.9	2.2
<i>Neuropsychological Measure</i>		
Neuropsychological functioning composite <i>T</i> -score	35.3	6.5
<i>Functioning Measures</i>		
Independent Living Skills Survey total (ILSS) ¹	.67	.10
UCSD Performance Based Skills Assessment (UPSA) ²	62.3	16.3
Real-world functioning index score ¹	.76	.95

¹Theoretical range: 0-1

²Theoretical range: 0-100

Table 3:

Pearsons correlations between clinical, neuropsychological, and functioning scores in middle-aged and older patients with schizophrenia

	Insight (BIS)	Neuropsychological functioning composite score	Self-reported functioning (ILSS)	Performance-based functioning (UPSA)	Real-world functioning index score
Age	.04	.15	.15	.03	.31*
General symptomatology (PANSS)	-.12	-.08	-.19	-.12	.02
Insight (BIS)		.12	.14	.11	-.13
Neuropsychological functioning composite score			.37**	.60**	.18
Self-reported functioning (ILSS)				.29*	.14
Performance-based functioning (UPSA)					.33**

* $p < .05$

** $p < .01$

Table 4:

Comparison of modifications to hypothesized path model examining relationships between symptoms, cognition, insight, and functioning in middle-aged and older outpatients with schizophrenia

Model	χ^2 *	CFI*	RMSEA*	AIC*	Functioning R ²		
					ILSS ¹	UPSA ¹	Real-world ¹
<i>Original Model</i>	.41, $p = .52$	1	<.01	-1.59	.15	.36	.16
<i>Replaced General Symptomatology with Negative Symptoms</i>							
	.13, $p = .72$	1	<.01	-1.87	.14	.36	.16
<i>Replaced composite neuropsychological functioning score with specific domains</i>							
Executive functioning	.74, $p = .39$	1	<0.01	-1.26	.09	.36	.18
Processing speed	.31, $p = .58$	1	<0.01	-1.69	.10	.13	.16
Verbal memory	<.01, $p = .97$	1	<0.01	-2.00	.14	.21	.16
Attention	.06, $p = .81$	1	<0.01	-1.94	.12	.26	.18
<i>Added estimated premorbid verbal intelligence as exogenous variable that predicts neuropsychological functioning</i>							
	15.6, $p = <.01$.80	.26	9.57	.14	.41	.16

(Table 4 continued...)

<i>Replaced neuropsychological functioning with estimated premorbid verbal intelligence</i>							
3.7, $p = .05$.92	.21	1.71	.07	.33	.17	

* Parameter values that suggest good fit: $\chi^2 = 0$, $p > .05$; CFI > .90; RMSEA < .08; low AIC.

¹ *ILSS* = Self-reported functioning, Independent Living Skills Survey; *UPSA* = Performance-based functioning, UCSD Performance Based Skills Assessment; *Real-world* = Real-world functioning index score (living situation, employment, marital status, driver's license)

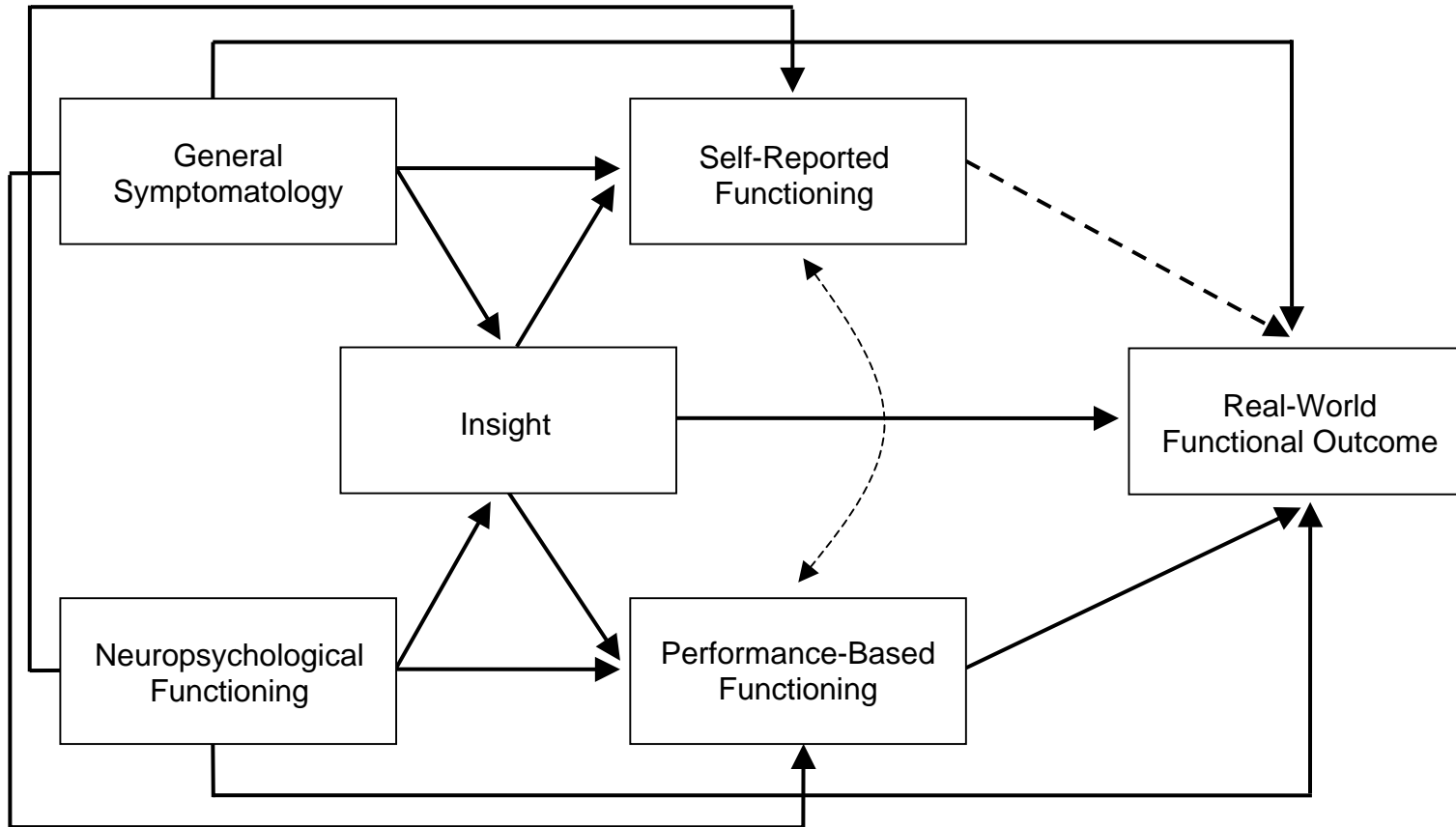


Figure 1:

Hypothesized path model depicting predicted relationships between symptoms, cognition, insight, and functioning in middle-aged and older outpatients with schizophrenia.

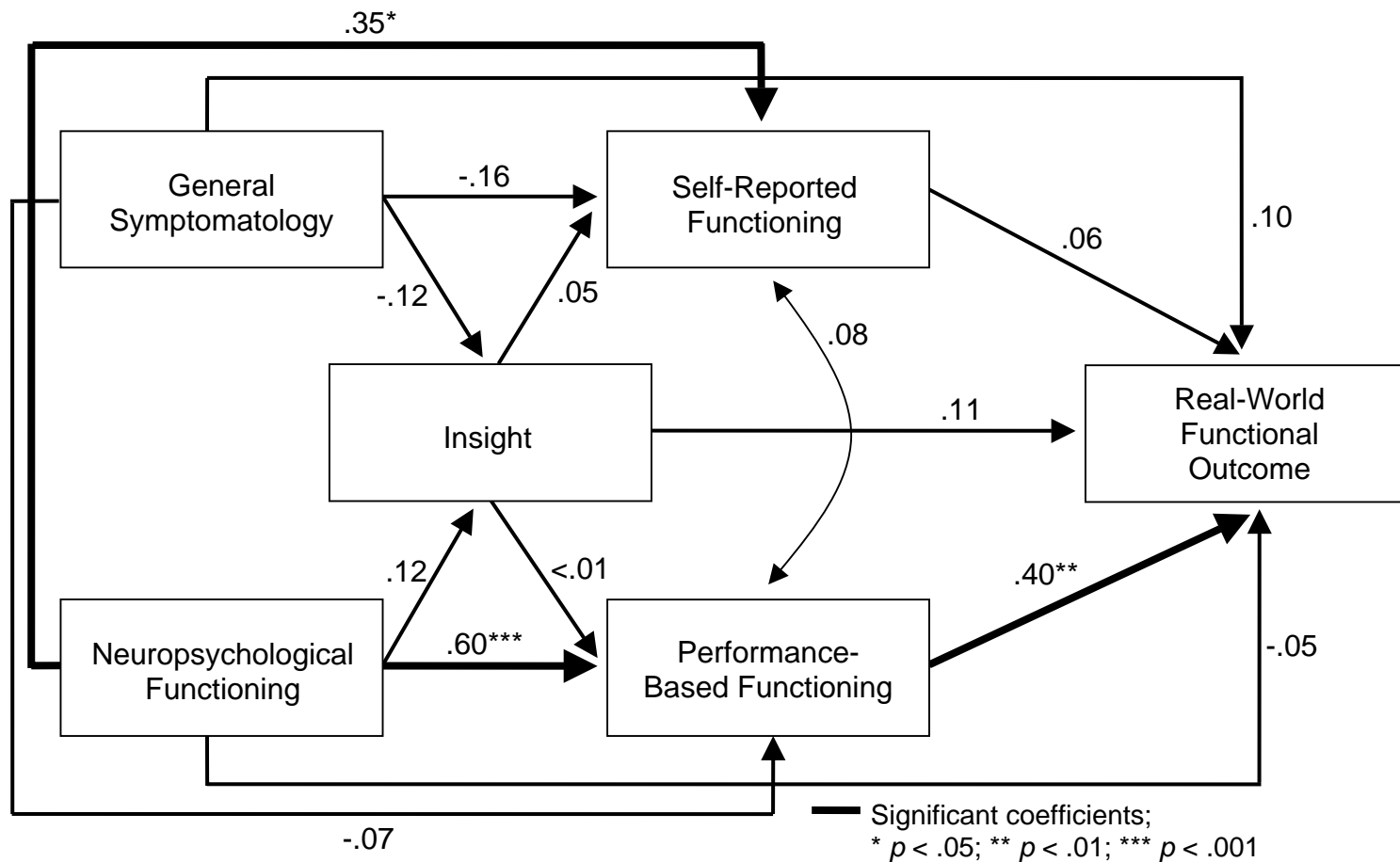


Figure 2: Standardized path coefficients for hypothesized path model depicting relationships between symptoms, cognition, insight, and functioning in middle-aged and older outpatients with schizophrenia.

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