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Cognitive Assessment of the Sheltered Homeless

A dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy

in

Clinical Psychology

by

Lea Vella

Committee in charge:

University of California, San Diego

Professor Elizabeth W. Twamley, Chair
Professor David Folsom
Professor Thomas Patterson

San Diego State University

Professor Linda Gallo
Professor Paul Gilbert

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The Dissertation of Lea Vella is approved, and it is acceptable in Quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

San Diego State University

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DEDICATION

To Noelle Byrd, who became my inspiration from start to finish

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VITA

EDUCATION

2014 Doctor of Philosophy, San Diego State University/ University of California, San Diego Joint Doctoral Program in Clinical Psychology
2013 Master of Science, San Diego State University/ University of California, San Diego Joint Doctoral Program in Clinical Psychology
2004 Masters of Public Health, Mailman School of Public Health, Columbia University
2002 Bachelor of Science, University of California, Davis

PUBLICATION

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ABSTRACT OF DISSERTATION

Cognitive Assessment of the Sheltered Homeless

by

Lea Vella

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University of California, San Diego, 2014
San Diego State University, 2014

Professor Elizabeth W. Twamley, Chair

Functional impairments due to cognitive dysfunction may contribute to homelessness. In the few studies of cognitive impairment in homeless individuals, impairment rates vary widely. Investigations measuring general intellectual abilities have found the majority of intelligence quotient (IQ) scores falling in the low average range. We examined the following hypotheses: (1) prevalence of cognitive and functional capacity impairment in the sheltered homeless will be greater than in the general population; (2) lower levels of cognitive functioning will add to psychiatric measures in predicting poorer housing outcomes and lower rates of

compliance with case manager and medical appointments; (3) case managers will overestimate their homeless clients' IQ and ability to live independently.

One hundred consecutively enrolled residents of a large homeless shelter were recruited over 14 months. Participants performed in the average range on measures of premorbid IQ, current IQ, and general cognitive impairment, but scored in the low average range on measures of processing speed and functional capacity. Significant percentages of the sample performed >1 SD below the mean on tests of premorbid IQ (23%), vocabulary (22%), processing speed (30%), and functional impairment (48%). None of the cognitive, functional, or psychiatric predictors were associated with housing outcomes, housing violations, case management appointment attendance or medical appointment attendance. Case managers overestimated their clients' IQs by about 20 points when a client's IQ was low and generally overestimated their clients' ability to live independently. Case managers correctly identified IQs in the intellectually disabled range only one time out of five.

We did not find evidence to support the use of cognitive screening for use in predicting housing outcomes or service utilization. However, we found that a significant percentage of homeless individuals had cognitive, intellectual, and functional impairments that were likely to be unrecognized by shelter staff. Therefore, routine cognitive screening and feedback is recommended to improve the accuracy of staff expectations and to identify individuals for whom disability entitlements should be pursued.

Introduction

Prevalence and Risk Factors of Homelessness in the United States

Homelessness is a major social and financial problem in the United States. A 1990 national household telephone survey (n=1,507) found that the lifetime prevalence of homelessness – defined as staying in shelters, emergency housing, cars, outside, and abandoned buildings and cars – to be 7.4% (Link et al., 1994). In the same sample, 3.1% of respondents had been homeless during the five year period immediately prior to the interview. In the U.S. Department of Housing and Urban Development's (HUD) 2013 Homeless Assessment Report to Congress, it was reported that 610,042 persons were homeless on a single night in January 2013, 8,879 of whom were served by continuums of care responsible for coordinated homelessness services in San Diego city and county (Henry, Cortes, Morris, Khadduri, & Culhane, 2013). In the past century, there have been various surges of homelessness including during the great depression, post-World War-II era ("skid row homeless"), and the 1980's, each having a different economic and socio-demographic makeup (Rossi, 1990). The current economic climate seems to have also caused an increase in homelessness due to the recent global economic crisis, including many foreclosures in the US housing market (Homeless, 2009).

There are various reasons why individuals become homeless and seek shelter, including lack of affordable housing, poverty, unemployment, substance abuse, domestic violence, and mental illness. In a review of risk factors for

homelessness, it was found that males, those between the ages of 30 and 39, non-high school graduates, and African Americans were more likely to be homeless (Susser, Moore, & Link, 1993). An epidemiologic study of young adults aged 18-28 (n=14,888) found that 4.6% of participants were classified as being homeless at one point in their lives (Shelton, Taylor, Bonner, & van den Bree, 2009). Risk factors associated with becoming homeless in this study included older age, Native American ethnicity, parental/caregiver abuse or neglect, family being under investigation by social services by 6th grade, running away or being ordered out of the house, and adoption and fostering placements. Data from the National Comorbidity Study-Replication showed that risk factors for past homelessness included past receipt of welfare payments, incarceration for 27 or more days, exposure to personal violence, a lifetime substance use disorder, and African-American race (Greenberg & Rosenheck, 2010).

Physical and Mental Health

It is also possible that cognitive and functional impairments contribute to homelessness; however, these are not commonly examined in large epidemiological studies. Such impairments could stem from intellectual disabilities, learning disabilities, and acquired brain dysfunction due to traumatic brain injury (TBI), substance use disorders, stroke, dementia, epilepsy, or other neurological conditions. A 2008 study of the prevalence of TBI in urban homeless shelters found that the lifetime prevalence of any type of TBI was 53%, and the lifetime prevalence of moderate to severe TBI (head injury with a loss of consciousness

greater than 30 minutes) was 12% (Hwang et al., 2008). A majority (70%) of these TBIs occurred prior to the onset of homelessness. Compounding these findings, chronic homelessness is related to higher rates of physical trauma (Gelberg & Linn, 1992), as well as higher rates of substance abuse (Gelberg & Linn, 1992; North, Pollio, Smith, & Spitznagel, 1998).

A review of the literature from 1980-1990 found varying rates of substance abuse in the homeless population, with alcohol problems ranging from 4-86% and drug abuse problems ranging from 1-70%, depending on the population sampled (Fischer & Breakey, 1991). A recent meta-analytic study of mental disorders in homeless populations of western countries found pooled previous six-month prevalence rates of 37.0% for alcohol dependence (men only), 24.4% for drug dependence (men only), 11.4% for major depression, and 12.7% for psychotic illness (Fazel, Khosla, Doll, & Geddes, 2008). These mental disorder prevalence rates are all higher than both one-month (Regier et al., 1993) and 12-month prevalence rates (Kessler, McGonagle, Zhao, Nelson, & et al., 1994) found in the general U.S. population.

Psychiatric disorders and substance use disorders are both associated with cognitive impairment, and, as stated above, are more prevalent in homeless populations than in the general public. Individuals with schizophrenia spectrum disorders demonstrate various cognitive deficits, including those in the areas of attention, learning, memory, and executive functioning (Heinrichs & Zakzanis, 1998). Cognitive deficits are also associated with both substance use disorders

(Grant, Gonzalez, Carey, Natarajan, & Wolfson, 2003; Scott et al., 2007) and alcohol use disorders, which are associated with attention, visual-spatial functioning, learning, and memory deficits (Oscar-Berman, Shagrin, Evert, & Epstein, 1997). Homeless individuals with substance use histories have been found to have high rates (21%) alcohol related brain damage (Gilchrist & Morrison, 2005), as well as greater rates of neurological abnormalities in the frontoparietal and cerebellar regions when compared to non-homeless individuals (Douyon et al., 1998)

Cognitive Impairment and Intellectual Ability

Much of the research done on the causes and correlates of homelessness has focused on medical, psychiatric, and socioeconomic factors, but few studies have examined the relationship between cognitive impairment and homelessness. Homeless individuals may qualify for local, state or federal subsidies, including disability payments (e.g., Supplemental Security Income, Social Security Disability Insurance), medical care (e.g., Medicaid, Medicare), vocational rehabilitation, and housing assistance. In order to best serve this population, it would be useful to know if there are any risk factors that may affect their ability to utilize these services, obtain and keep employment, and live independently. Cognitive deficits have been shown to be associated with both employment status (Holthausen et al., 2007; Newnan, Heaton, & Lehman, 1978) and ability to perform tasks related to independent living (Cahn-Weiner et al., 2007; Teng, Becker, Woo, Cummings, & Lu, 2010). A recent review found 22 English-language studies reporting the results

of cognitive screening tests in homeless individuals, of which only 10 were deemed to be of good or fair quality (Burra, Stergiopoulos, & Rourke, 2009). The review found a variety of neuropsychological deficits in homeless populations, including deficits in the domains of verbal and visual memory, attention, processing speed, and executive functioning. The review below reviews the findings from the papers reviewed by Burra, et al., with the addition of more recent literature.

Cognitive Impairment

Many studies examining cognitive impairment in the homeless have used dementia screening measures like the Mini-Mental State Exam (MMSE) (Folstein, Folstein, & McHugh, 1975). In reviewing literature for this study, 11 studies, with non-overlapping samples, were identified that administered the MMSE to homeless individuals. Of the studies that used a cut off of less than 24 on the MMSE, impairment rates ranged from 6.3 to 43% (Bremner, Duke, Nelson, Pantelis, & Barnes, 1996; Buhrich, Hodder, & Teesson, 2000; Fichter et al., 1996; Gonzalez, Dieter, Natale, & Tanner, 2001; Lovisi, Mann, Coutinho, & Morgado, 2003; Munoz, Vazquez, Koegel, Sanz, & Burnam, 1998; Teesson & Buhrich, 1993). Four studies did not state what impairment cut off they used, but most likely used the less than 24 point criteria; those studies had impairment rates that ranged from 0-9.6% (Adams, Pantelis, Duke, & Barnes, 1996; Fischer, Shapiro, Breakey, Anthony, & Kramer, 1986; Heckert, Andrade, Alves, & Martins, 1999; Koegel, Burnam, & Farr, 1988). Impairment rates in studies that sampled from multiple shelters or from those living on the street were generally lower (range 3.4-10%)

than in single shelter samples (Buhrich et al., 2000; Fichter et al., 1996; Fischer et al., 1986; Heckert et al., 1999; Koegel et al., 1988; Munoz et al., 1998), with the exception of one large scale study from Rio de Janeiro, where the impairment rate was 21.3% (Lovisi et al., 2003). The Rio de Janeiro sample had the most stringent definition of homelessness of any of the studies reviewed, requiring participants to be living on the streets for twelve consecutive months, which may account for the higher level of impairment. Impairment rates from studies sampling from a single hostel or shelter, including those specifically for the mentally ill, had a wider range of impairment levels (0-43%) (Adams et al., 1996; Bremner et al., 1996; Gonzalez et al., 2001; Teesson & Buhrich, 1993).

Two studies have administered different cognitive screening tests other than the MMSE. The first study used the Addenbrooke's Cognitive Examination and found an 82% impairment rate in their sample (Gilchrist & Morrison, 2005). This sample had a large percentage of individuals who were currently drinking heavily and met criteria for lifetime alcohol abuse. The second study of shelter residents administered the Neurobehavioral Cognitive Status Examination (Cognistat), and found 80% scored in a range that suggested impaired cognitive functioning (Solliday-McRoy, Campbell, Melchert, Young, & Cisler, 2004).

Unfortunately the MMSE has been found to accurately rule out dementia status, but is not sensitive enough to diagnose mild cognitive impairment (MCI;(Mitchell, 2009). It is therefore an insensitive measure to the full range of cognitive deficits. A few studies assessed cognitive impairment more

comprehensively and found high levels of impairment. In a sample of homeless individuals who were referred for psychological services, 80% were impaired on the abbreviated Halstead-Reitan Battery, with particularly high rates of impairment (50%) on Trail-Making Test B, a test of mental flexibility (Gonzalez et al., 2001). In a sample of homeless individuals with severe mental illness who agreed to participate in a housing placement study, participants were administered 21 neuropsychological tests at study entry and were impaired on 52% of those tests on average (Seidman et al., 1997). In a sample of community mental health clinic patients who were currently homeless or had been homeless in the past, researchers examined the percentage of impairment in different neuropsychological domains using deficit scores (Bousman et al., 2010). They found 52% of participants were impaired on a global deficit score, as well as high levels of deficits in other domains: learning (40%), recall (36%), processing speed (42%), executive functioning (37%), and verbal fluency (34%). When this sample was compared to never homeless clinic patients who were matched on demographic, substance use, psychiatric and premorbid intelligence criteria, they found trend level results in the domains of processing speed ($p=.051$) and executive functioning ($p=0.07$), with poorer performance in the current/past homeless group.

Intellectual Ability

Various studies have also examined general intellectual abilities. In general, these studies have found a majority of intelligence quotient (IQ) scores falling in the average to low average range. Two studies used Ravens Progressive Matrices

to estimate the full scale IQ (FSIQ). The first study examined female shelter residents in London and found that those with a severe mental illness (SMI), as determined using the Structured Clinical Interview for DSM-III-R, had a FSIQ equivalent in the borderline range (IQ=74), whereas those without SMI had a FSIQ equivalent in the low average range (IQ=80) (Adams et al., 1996). The same study found that premorbid IQ, as measured by the National Adult Reading Test (NART), was 97 (average range) for those with SMI and 89 (low average range) for those without. The difference in the IQ decline (premorbid to current IQ) was significantly different between the two groups, with greater decline in the SMI group. The second study examined male shelter residents in London and found the average FSIQ equivalent to be in the low-average range (IQ=83.6) (Bremner et al., 1996). This study also found that average premorbid IQ, as measured by the NART, of the shelter residents was in the average range (premorbid IQ=95.9).

Two studies have used the Wechsler Abbreviated Scale of Intelligence (WASI) to examine FSIQ, verbal IQ (VIQ) and performance IQ (PIQ). The first study examined homeless individuals from a general medical practice and found that participants had a IQs in the average range (FSIQ=91.9, VIQ=90.3, and PIQ=98.6) (Oakes & Davies, 2008). The second study examined homeless individuals from a shelter and found that participants had IQs in the low-average range (FSIQ=83.9, VIQ=83.7, and PIQ=87.0) (Solliday-McRoy et al., 2004). One study performed a full Wechsler Adult Intelligence Scale – Revised (WAIS-R) in homeless male veterans and found that participants had a IQs in the average range

(FSIQ=97.3, VIQ=97.6, and PIQ=98.1) (Foulks, McCown, Duckworth, & Sutker, 1990). One final study of homeless individuals with SMI who agreed to participate in a housing placement intervention used the vocabulary and block design subtest of the WAIS-R to calculate the estimated FSIQ, which was found to be in the low average range (FSIQ=82.8) (Seidman et al., 1997). This study also found that premorbid IQ, as measured by the reading test of the Wide Range Achievement Test – Revised, was in the low-average range (premorbid IQ=81.4). None of these studies presented information on the percentages of individuals falling into the different categories of IQ functioning (i.e., high average, average, low average, borderline, or intellectual disability).

Summary of Cognitive and Intellectual Functioning

While the IQ estimates reviewed were generally in the low average to average range for homeless individuals, general cognitive impairment has been found to be high but more variable. A more recent meta-analysis, which is now under review for publication, reviewed 24 unique studies (n = 2,969) and found the cognitive impairment rates ranging from 16-25% on global cognitive screening measures (Depp, Vella, Orff, & Twamley, submitted). Authors also found that the mean full scale IQ score across studies was in the low average range (mean IQ = 85). These impairment rates may be influenced by each study's inclusion/exclusion criteria (e.g., exclusion of individuals with dementia or neurological disorders, varying definitions of homelessness), mental health characteristics (e.g., percentage with SMI or substance use disorders) and demographic characteristics. The studies

reviewed also had varying definitions of homelessness, ranging from being homeless at least one night in the last three months to spending 24 hours a day on the street for at least one year. The majority of the studies reviewed had large percentages of male participants, with most samples consisting of more than 70% men.

Only one study thus far has examined functional capacity (the ability to function independently, e.g., to communicate and handle finances) in a homeless population. In a sample of psychiatric inpatients with schizophrenia or schizoaffective disorder, housed participants were compared to homeless participants on a measure of functional capacity (Stergiopoulos, Burra, Rourke, & Hwang, 2011). No significant differences were found between the two groups; however, there was "trend toward poorer performance" in functional capacity for the homeless participants, and a significant difference between the two groups on the financial subscale of the measure. Performance on cognitive measures was not found to be significantly different between the two groups. Functional capacity, although highly related to cognitive functioning, does account for unique variance, separate from cognitive ability (McClure et al., 2007; Twamley et al., 2002).

Housing Outcomes and Cognitive Impairment

Literature on predictors of housing outcomes is also limited by sample characteristics and varying housing outcomes. In a study of homeless families in New York City, only receiving subsidized housing predicted residential stability

(Shinn et al., 1998). The vast majority of housing outcome literature for homeless individuals focuses on homeless individuals with psychiatric and substance use disorders. In a sample of homeless individuals in treatment for substance use, 72% of participants improved their residential status after entering treatment; 51% were able to maintain stable housing 24 months after their initial intake into the study (Orwin, Scott, & Arieira, 2005). Assertive community services (i.e., use of community-based mental health treatment teams) have been shown to help individuals gain shelter (Dixon, Friedman, & Lehman, 1993) and receive Section 8 housing vouchers (Dixon, Krauss, Myers, & Lehman, 1994). However, one study found that those who received vouchers had lower levels of psychopathology symptoms and higher rates of schizophrenia, and those with schizophrenia or a payee took longer to apply for housing after receiving a voucher (Dixon et al., 1994). As both schizophrenia and substance use disorders have been associated with cognitive deficits, it is unclear if those deficits contribute uniquely to attainment of housing over and above psychiatric factors. Only one study examined the effect of neuropsychological performance and housing related outcomes. In a housing intervention study for homeless individuals with SMI, poorer baseline cognitive functioning predicted worse self-care and turbulent behavior in participants placed in individual apartments compared to those placed in supportive group homes (Schutt, Seidman, Caplan, Martsinkiv, & Goldfinger, 2007). No published research has examined the effect of cognitive functioning and attainment or stability of housing in the homeless population.

Social and Health Service Utilization

In order for homeless individuals to transition from emergency housing to more permanent housing, they may have to rely on case management services, sometimes provided by a shelter, to obtain employment, disability income, and health services. A homeless individual's ability to navigate and understand these services may impact long range outcomes like obtaining housing, obtaining financial assistance, and living independently. In a group of street dwelling homeless individuals, the type of case management services, specifically vocational assistance and housing assistance, was found to predict entry into homeless shelters, whereas the number of service contacts did not (Min, Wong, & Rothbard, 2004). In a study of homeless individuals without substance use disorders, predictors of contact with physical health services included female gender, veteran status, caring for a child, Medicaid eligibility, and having a chronic physical condition (Bird et al., 2002). In the same study, homeless individuals were more likely to make contact with mental health care services if they had VA disability, were caring for a child, or had a serious mental illness. Utilization of mental health services in a homeless and impoverished Canadian sample was associated with youth, female gender, recent hospitalization, alcohol use disorders, antisocial personality disorder and a larger support network (Bonin, Fournier, & Blais, 2007). None of the reviewed studies examined the association between cognitive impairment and service utilization. Successful navigation of the service system may hinge on intact cognitive abilities such as organization and planning. However, the

relationship between cognitive/functional impairment, service utilization, and real-world housing outcomes has not been formally examined.

Case Manager Perception of Cognitive and Functional Abilities

Effectiveness of case management services may be influenced by how case managers perceive their clients. In schizophrenia populations, case manager assessment of the patient's functional level has been found to be associated with the patient's functional capacity and social skills, as measured by performance-based measures (Bowie et al., 2007). To date, no study has examined how accurate case managers are at evaluating their homeless clients' cognitive and functional abilities. If case managers overestimate their clients' intellectual ability or functional ability, they may not direct their clients to the most appropriate services.

Study Questions

To date, there is inconsistent information on the incidence of cognitive impairment in diverse homeless populations, and there is very limited information about functional capacity or the relationship between cognitive/functional impairment and real-world housing and service outcomes. This study attempted to move the field forward by providing a brief cognitive impairment and functional capacity assessment of a large, representative sample of sheltered homeless individuals. The cognitive and functional battery was designed to be brief, appropriate for the general adult population, and able to address specific cognitive questions directly related to the needs of a homeless population seeking housing

and benefit services. The shelter from which participants were sampled admits women, men and children, requiring only that they are homeless and do not exceed a certain income level. Further, this study attempted to establish how cognitive and functional impairments among the homeless are related to real-world housing and service use outcomes. Finally, we assessed whether homeless shelter case managers can accurately gauge their clients' cognitive and functional capacity, setting the stage for future cognitive and functional screening of homeless shelter residents to aid in long-term social service planning. Early identification of cognitive/functional impairment could lead to relevant improvements in service, like earlier assistance with benefit applications and more assistance with social services. The proposed project attempts to fill these gaps in knowledge and provide the foundation for future larger investigations related to cognitive impairment and social service use among the wide range of homeless populations receiving services at transitional shelters.

Aims and Hypotheses

The overarching goal of this study was to examine level of cognitive and functional impairment in a sheltered homeless population and the effects impairment may have on service utilization.

Aim 1. To examine cognitive impairment and functional capacity in a sheltered homeless population.

Hypothesis 1.1: Rates of cognitive impairment and impaired functional capacity in the sheltered homeless will be greater than those in the general population. Specifically, rates of cognitive and functional capacity performance of the study population will be impaired on average, as determined by conversion of the raw scores to normed scores (i.e., scaled scores [ss], standard scores [SS], z-scores, and T-scores).

Aim 2. To examine the effect of cognitive functioning on housing outcomes and service use.

Hypothesis 2.1: Lower levels of cognitive functioning will add to psychiatric measures in predicting poorer housing outcome (e.g., drop out from the program, occurrence of housing violations) and lower rates of compliance with case manager and medical appointments. Specifically, after controlling for psychiatric symptoms, there will be a positive association between cognitive and functional scores and housing and

service outcomes. Housing outcomes are defined as (1) termination of stay by the shelter or drop-out from the program (unsuccessful leave), and (2) continued residence at the shelter or new housing placement. Service use outcomes are defined as (1) the number of case management meetings attended out of those scheduled and (2) the number of medical meetings attended out of those scheduled.

Aim 3. To examine case managers' perceptions of homeless clients' intelligence quotient (IQ) and functional capacity.

Hypothesis 3.1: Case managers will overestimate their homeless clients' IQ. Specifically, shelter residents' IQ scores, as measured by the two test version of the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999), will be lower than the IQ estimated by their case managers.

Hypothesis 3.2: Case managers will overestimate their homeless clients' ability to live independently as measured by a validated functional capacity measure. Specifically, rates of the shelter residents' ability to live independently, as measured by scoring equal to or higher than a cutoff score of 60 on the functional capacity measure (Mausbach, Harvey, Goldman, Jeste, & Patterson, 2007), will be lower than the case managers' estimates of ability to live independently.

Methods

Participants

Participants included consecutively enrolled clients who were residing at the St. Vincent De Paul Village (SVDPV) during the recruitment period (2/2/12 to 4/1/13). During a point-in-time enumeration of homeless individuals done for the 2000 census, over 50% (969 of 1,643) of the homeless of San Diego were located in the area surrounding SVDPV (Bureau, 2001). SVDPV provides shelter residents with transitional housing, where residents can stay for up to two years. In 2013, SVDPV served 2,014 adults through their transitional housing programs, and the shelter can house 565 single adults and 248 people in families (adults and children) at any one time (K. Kuntz, personal communication, April 2, 2014). After initial intake interview and various psychological and educational assessments, residents are assigned to a team (i.e., Veterans, Supported Income, Employment, and Family) and a track (Employment or Benefits). All those assigned to the Employment team are in the Employment track, which focuses on employment as a means to future housing, and all those assigned to the Supported Income team are in the Benefits track, which focuses on attaining benefit payments as a means to future housing. Individuals assigned to the Veterans and Family team can be in either the Employment or Benefits track. All residents are assigned a case manager, who helps with financial planning, referrals to internal and external social services, vocational rehabilitation, education, and follow-up services; all residents are expected to meet regularly with their case managers.

To be included in the study, individuals had to be 18-89 years old, currently residing at SVDPV, and be able to give voluntary informed consent for participation. Individuals were excluded from the study if they were unable to complete any testing in English or were on a conservatorship and therefore unable to provide legal consent.

Measures

Neuropsychological Measures

Neuropsychological measures were given at the time of assessment. The reading subtest from the Wide Range Achievement Test – Fourth Edition (WRAT-IV) was used to estimate premorbid IQ (Wilkinson & Robertson, 2006). The two test version of the Wechsler Abbreviated Scale of Intelligence (WASI) assessed FSIQ (Wechsler, 1999). The FSIQ from the two test version of the WASI, which includes the vocabulary and matrix reasoning subtests, is highly correlated with the Wechsler Adult Intelligence Scale-III FSIQ (r=0.87) (Strauss, Sherman, & Spreen, 2006). The Montreal Cognitive Assessment (MoCA) was given as a screening test for mild cognitive impairment (Nasreddine et al., 2005). The MoCA has greater sensitivity than the MMSE to detect mild cognitive impairment (Smith, Gildeh, & Holmes, 2007). Finally, the coding subtest from the Wechsler Adult Intelligence Scale - Fourth Edition (WAIS-IV) was given as an estimate of processing speed (Wechsler, 2008). The coding subtest, also known as the digit symbol subtest in previous editions of the WAIS, is particularly sensitive to brain injury and general

cerebral integrity (Lezak, Howieson, Loring, Hannay, & Fischer, 2004; Russell, 1972).

Functional Capacity Measure

The UCSD Performance-based Skills Assessment – Brief (UPSA-B) was administered as a measure of functional capacity (Mausbach et al., 2007). The UPSA-B uses role-play scenarios to demonstrate everyday functioning skills in two domains (finance and communication). A cut off score of 60 on the UPSA-B is associated with the ability to live independently in individuals with schizophrenia (Mausbach et al., 2007). Scaled scores for the UPSA-B were derived from an unpublished manuscript of the normative profile of the UPSA-B (Vella et al.).

Housing and Service Use Outcome Measures

Housing outcomes were collected four months after participants' first case management meetings, as residents generally did not obtain services relating to housing prior to case management. The date and type of new housing placement, the date and reason for dropping out of the shelter, and the date and reason for service ending at the shelter were collected from the shelter's electronic database. This database was also used to collect the number and type of housing rule violations accrued by each participant, as well as the number of case management appointments scheduled and attended. The number of scheduled and attended medical appointments at the on-site medical clinic during the four month follow up period was collected from the medical clinic's electronic medical records.

Case Manager Assessments

Case managers were provided with a description of the different levels of IQ (i.e., very superior, superior, high-average, average, low-average, borderline, intellectual disability, along with the quantitative values for these categories) and were asked to make their best judgment as to what they believed their client's IQ was. Case managers were also asked if they believed their client could live independently. They were asked to answer yes or no to the following question: "Do you believe this client can live independently? (i.e., does not need a skilled nursing facility, assisted living, board and care facility, etc.)."

Other Variables

Results from the shelter's intake interview, which was given at the time of shelter admission, was used to gather information about the following: history of homelessness, military service, educational level, legal history, self-reported physical health status, history of head injury, chronic physical health conditions, developmental disability, current psychiatric medications, psychiatric diagnoses, current psychiatric symptoms, substance use history, employment history, and state/federal benefits.

Two self-report symptom measures are administered by shelter staff to assess level of psychiatric symptoms and possible diagnoses. d

Residents are also administered the Test of Adult Basic Education (TABE) about two months after entry into the shelter (*Tests of Adult Basic Education (TABE) Forms 9 & 10*, 2003). This test assesses academic skill level in the areas of reading, math, and language, and provides grade level equivalents of performance.

Procedures

Recruitment for the study occurred on a rolling basis by consecutive referral from the case managers. Eligible shelter residents were told about the study by their case managers at their first case management appointment, and each resident was given a study flyer at this meeting. The residents often called study staff during their first case management meeting or contacted them soon after, using the contact number on the flyer, to arrange a consent meeting and testing appointment.

Informed consent was obtained by trained study staff, and a post-consent quiz was administered to assess for capacity to consent. In addition to this study's informed consent, the subject was asked to sign a supplementary HIPAA (Health Insurance Portability and Accountability Act of 1996) consent allowing the release of personal health information from the shelter's on site medical records to the research team. Participants consented to study staff obtaining the above-mentioned data from their shelter residential, assessment, case management, and medical records.

Immediately following informed consent, the participants were asked brief questions regarding recent drug use (i.e., time since last use and drug type). The neuropsychological and functional battery was then administered by trained study staff at the shelter. The entire evaluation took 60-90 minutes. After the assessment, participants received a $20 gift card to a local restaurant or coffee shop in consideration of their time.

Case managers were asked to rate their clients' IQ and ability to live independently close to their first case management meeting to assess for initial impressions. Four months after participants' initial case manager visit, the housing outcomes and caseworker meeting attendance rates were collected. Medical and psychiatric diagnoses, as well as medical appointment attendance rates were also collected at this time from the medical clinic.

Data Analytic Plan

Statistical Analyses

Hypothesis 1.1: *Rates of cognitive impairment and impaired functional capacity in the sheltered homeless will be greater than those in the general population.*

For the primary hypothesis, descriptive statistics were used to examine the prevalence of cognitive impairment. Frequency of cognitive impairment is reported, as well as mean raw and standard scores. Cognitive impairment frequencies at >1 standard deviation below the mean (i.e., $T < 40$, $ss < 7$, $SS < 85$, $z < -1$), as well as >1.5 standard deviations below the mean (i.e., $T < 35$, $ss < 5.5$, $SS < 78$, $z < -1.5$) are reported. Normative scores in this sample were compared to 50^{th} percentile normative scores (i.e., $T=50$, $ss=10$, $SS=100$, $z=0$), for each test using one sample t-tests. One sample t-tests were also used to compare mean values on each test to published mean values in the normative samples for the UPSA and MoCA. The mean value from the original normative sample of the MoCA, which included 90 healthy elderly controls (Nasreddine et al., 2005), was used as one comparison group, even though this sample's age range only went up to 66. As the

recommended cutoff score of 26, used widely in clinical practice, was derived from this sample, we wished to compare this sample in comparison to the sample the cut off score was derived from. A second comparison mean was taken from Rossetti, Lacritz, Cullum, and Weiner (2011)'s longitudinal, population-based study of cardiac risk factors, which included a larger age range (18-85, mean age = 50.3). While the original scoring for the MoCA includes a single point adjustment for educational attainment of 12 years or lower (Nasreddine et al., 2005), we used the unadjusted total score in this analysis, unless otherwise specified. The Rossetti, et al. (2011) normative sample used the unadjusted total scores, and z-scores were derived from the Rossetti sample's age and education adjusted means. A cut off score of less than 60 on the UPSA-B was used to examine the rates of individuals that we would not expect to be able to live independently (Mausbach et al., 2007).

Hypothesis 2.1: *Individuals with lower levels of cognitive functioning and functional capacity will have poorer housing outcomes (e.g., drop out from the program) and lower rates of attendance of case management and medical appointments.*

The second hypothesis analysis was examined using logistic regression to examine the effect of cognitive performance and psychiatric symptomatology on the two possible housing outcomes: (1) termination of stay by the shelter or drop-out from the program (unsuccessful leave), and (2) continued residence at the shelter or new housing placement. A new housing placement included: moving to an apartment or house that the client owned/rented or staying with family/friends

permanently. An unsuccessful leave included: dropping out to the street, as well as leaving for an institutional setting (i.e., jail, prison, substance abuse/gambling rehabilitation facility, hospital, etc.) or other temporary destination (i.e., emergency shelter, temporary stay and family/friends, hotel/motel, etc.). Logistic regression was also used to examine the effect of cognitive and functional performance on housing violations. The logistic regression models were evaluated using the Chi-Squared Goodness of Fit test. Multiple linear regressions were used to examine the effect of cognitive and functional performance on rates of compliance with case management and medical appointments. The linear regression models were also evaluated using an F-test. Cognitive and functional capacity raw scores were added as main predictors: premorbid IQ (WRAT-IV Word Reading), Vocabulary, Matrix Reasoning, MoCA total (unadjusted for educational level), Coding, and the UPSA-B total. All adjusted models controlled for psychiatric symptoms (PDSQ total score). Possible cofounding variables (i.e., age, years of education, gender, race, track, veteran status, days from entry to first case management appointment, greater than one episode of homelessness) were examined using bivariate correlation (i.e., Pearson or Spearman), and were only added to the model if they were associated with both the main predictors (cognitive, functional, and/or psychiatric variables) and the outcome.

Nested logistic regression models were compared using the Chi-Squared test. Nested linear regression models will be compared using the F-test of R^2 change. Multicollinearity of the predictor variables was assessed using tolerance

and variance inflation factor (VIF). Tolerance levels less than 0.1 and VIF levels greater than 10 were used to indicate multicollinearity.

Hypothesis 3.1: *Case managers will overestimate their homeless clients' IQ.*

This hypothesis was examined using t-test for dependent measures analysis.

Hypothesis 3.2: *Case managers will overestimate their homeless clients' ability to live independently as measured by a validated functional capacity measure.*

This hypothesis was examined using a 2x2 Fisher's Exact test, as two cell frequencies were less than five.

Continuous variables were evaluated for normal distribution by visual inspection, as well as skewedness and kurtosis. All tests use an alpha level for significance of 0.05, and all tests were two-tailed. All analyses were performed in IBM SPSS (version 22).

Power

All power analyses were conducted using G*Power (version 3.1.9.2) for windows (Faul, Erdfelder, Lang, & Buchner, 2007).

Aim 1. A power analysis for one sample t-tests was conducted for Aim 1, using effect size guidelines from Cohen (1988). Based on the current sample size (n=100), the present study had sufficient power (i.e., $1-\beta > 0.80$) to detect a medium ($d = 0.5$; $1-\beta = 0.998$) or large ($d = 0.8$; $1-\beta = 1.000$) effect size, but not a small ($d = 0.2$; $1-\beta = 0.508$) effect size.

Aim 2. Power analyses for logistic regression and linear multiple regression were conducted for Aim 2, using effect size guidelines from Cohen (1988). For logistic regression models, based on the current sample size (n=94 with complete data) and seven main predictors (cognitive, functional, and psychiatric variables), the present study had sufficient power (i.e., $1-\beta > 0.80$) to detect a large ($w = 0.5$; $1-\beta = 0.965$) effect size, but not a medium ($w = 0.3$; $1-\beta = 0.528$) or small ($w = 0.1$; $1-\beta = 0.087$) effect size. For linear regression models, based on the current sample size (n=94 with complete data) and seven main predictors (cognitive, functional, and psychiatric variables), the present study had sufficient power (i.e., $1-\beta > 0.80$) to detect a large ($f^2 = 0.35$; $1-\beta = 0.992$) effect size, but not a medium ($f^2 = 0.15$; $1-\beta = 0.752$) or small ($f^2 = 0.02$; $1-\beta = 0.124$) effect size.

Aim 3. A power analysis for paired t-tests was conducted for Aim 3, using effect size guidelines from Cohen (1988). Based on the current sample size (n=77 with complete data), the present study had sufficient power (i.e., $1-\beta > 0.80$) to detect a medium ($d = 0.5$; $1-\beta = 0.995$) or large ($d = 0.8$; $1-\beta = 0.999$) effect size, but not a small ($d = 0.2$; $1-\beta = 0.521$) effect size.

Results

Sample Description

During the 14 month recruitment period, 626 individuals were assigned to teams and 175 of those individuals contacted the study (28%). Of the 175 who made contact with study staff, 25 (14%) were not eligible for the study (i.e., not assigned a case manager, no longer lived at SVDPV, were part of non-sheltered programs at SVDPV, etc.) and 24 (14%) never returned staffs return phone calls. Of the 126 residents who were eligible and were scheduled for testing, 18 (10%) cancelled or no-showed to their session and 8 (5%) refused to participate after reviewing the study consent. The 100 study participants represent 16% percent of the residents assigned to teams at the time of recruitment (n=626). Of the 100 participants in the study, almost half came from the Veterans team (49%). The remaining 51% were part of the Supported income team (24%), Employment team (17%), and Family team (10%). Thirty-six percent of the participants were assigned to the Benefits track and 64% to the Employment track.

Participants reported a range of 1 to 25 episodes of homelessness over their lifetime, with 64% of the sample having had more than one episode of homelessness. To be considered chronically homeless by HUD, homeless individuals must have a disabling condition and be either continually homeless for 1 year or have at least four episodes of homelessness in the past three years (Office of Community Planning and Development, 2007). At shelter entry, 31% of the

current sample met the continually homeless and/or the four episodes criteria. Including their current shelter stay, participants had stayed in SVDPV transitional housing from 1-15 times previously (Mean [M] = 2.5 times, SD = 2.8). At shelter entry, residents were also asked to rate their general health, and in the current sample 5% rated their health as excellent, 9% as very good, 76% good, and 10% as fair.

Table 2 presents demographics, history of homelessness descriptors, and clinical descriptors for the full sample. On average, participants were middle-aged, mostly male, and had just slightly less than 12 years of education. Sixty-five percent of the participants were Caucasian (of whom 15% were Hispanic/Latino), 26% were African American, and 2% were Asian. Only 4 participants reported English to be their second language. Twenty-three percent of the sample had greater than 12 years of education. Of the 72 study participants who completed the TABE evaluation, the mean reading grade level equivalent was 10.1 (SD = 3.2; Range: 0.7-12.9), language was 7.8 (SD = 3.9; Range: 0-12.9), and math (computation and applied) was 8.0 (SD = 3.2; Range: 0-12.9). The median number of years participants were employed at their longest held job was 6 years (Range: 0-38 years). Forty-one participants indicated receiving some sort of financial assistance (i.e., General Relief, social security insurance [SSI], social security disability insurance [SSDI], VA benefits, supplemental nutrition assistance program, etc.) at shelter entry. Only one participant reported receiving SSDI and three reported receiving SSI at shelter entry; however, 36 participants indicated that

they were planning to apply for permanent benefits, such as SSI, SSDI, or VA benefits. Of the 66 participants who served time in jail or prison, the average number of times incarcerated was 6.7 (SD=8.8; Range: 1-51). It took, on average, 90 days (SD = 36.7) for residents in the study to have their first case management meeting (Range: 8-202 days). Just over half of the sample (52%) were veterans, with some of the veterans being served by the family team instead of the veteran team.

At the time of shelter entry, the shelter staff recorded both self-reported medical and psychiatric diagnoses at the time of entry, as well as diagnoses confirmed by shelter staff. Forty-five percent of the sample reported psychiatric diagnoses (11% confirmed), 9% developmental disabilities (3% confirmed), 40% alcohol abuse (12% confirmed), 39% drug abuse (15% confirmed), and 52% chronic physical condition (4% confirmed). On the screener for psychiatric diagnoses (PDSQ; n=94), 22% endorsed symptom levels in the average range compared to individuals in clinical psychiatric outpatient settings, while 13% endorsed symptom levels in unusually high range relative to psychiatric outpatients (Zimmerman, 2002). Sixty-five percent of the sample reported fewer symptoms than are commonly experienced by those in a psychiatric outpatient clinic. Table 5 presents the frequencies of exceeding the recommended cutoff scores for psychiatric diagnoses screened for in the PDSQ, with frequencies ranging from 4-26% for the various diagnoses. The PDSQ positive screening frequencies indicated drug and alcohol abuse/dependence rates closer to the percentage confirmed by

shelter staff at the time of shelter entry. Twenty-five percent of the sample reported that they had tried attempted to hurt themselves or end their life at some point during their lifetime. Twenty-one percent of the sample indicated some degree of risk for substance abuse on the SSI-SA. Forty percent of the sample reported they had "ever had a head injury," and 6% of the sample self-reported that they had been diagnosed with a seizure disorder, epilepsy, other neurological disorder, or had a history of seizures.

Track differences in basic demographic and psychiatric symptoms were also examined, along with differences between the veterans and non-veterans (Table 3 and 4). There were a greater percentage of females in the Benefits track (31%) than in the Employment track (13%; $p = 0.035$). Those in the Benefits track had significantly fewer years of education ($p = 0.041$) and years since last use of drugs ($p= 0.042$) than individuals in the Employment track. However, those in the Benefits track had significantly greater report of psychiatric symptoms (PDSQ, $p = 0.001$). Veterans in the sample were all male, were older, had more years of education, and reported lower levels of alcohol abuse ($ps \leq 0.040$) compared with non-veterans.

Hypothesis 1 Results

Tables 6, 7, and 8 present means and standard deviations of each of the cognitive and functional capacity measures used in the study, as well as track and veteran differences. On average, participants performed in the average range on

Word Reading (premorbid IQ), FSIQ, Matrix Reasoning (perceptual reasoning), Vocabulary, and general cognitive impairment (MoCA). Participants scored in the low average range on Coding (processing speed) and UPSA-B (functional capacity), on average. Six percent of the sample had a FSIQ below 70, a previous requirement for a diagnosis of intellectual disability (American Psychological Association, 2013). All but one of those with an FSIQ below 70 were placed in the Benefits track. Those in the Benefits track had significantly lower cognitive and functional capacity performance than those in the employment track across all measures (ps≤0.039). Veterans performed better on Coding and the MoCA, as well as the financial subscale of the UPSA-B, than did non-veterans (ps ≤ 0.042).

Table 9 presents one-sample t-test comparisons of each test to either the 50th percentile normative score or the normative sample mean raw score. While premorbid IQ, measured using the Word Reading test, was significantly less than the average standard score of 100 ($p<0.001$), the sample's average premorbid IQ estimate (92) was still well within the average range. The mean Full Scale IQ (98), measured by the two test WASI IQ equivalent, was also within the average range and not significantly different from the average standard score ($p = 0.155$). The T-scores for both Matrix Reasoning and Vocabulary subtests of the WASI were in the average range, but only the Vocabulary T-score were significantly less than 50, the 50th percentile T-score ($p=0.001$). The test of processing speed, Coding, was in the low average range on average, though just above the cutoff for mild impairment (scaled score < 7) and was significantly less than 10, the 50th percentile scaled score

($p<0.001$).

The present study's mean MoCA total score was significantly lower than the healthy older adult control sample from the Nasreddine, et al. (2005) sample ($p<0.001$). Using Nasreddine, et al.'s recommended mild cognitive impairment cutoff of 26, for the education-corrected MoCA total score, 65% of the current sample would be classified as at least mildly impaired. However, when present study's mean MoCA score is compared to the Rossetti, et al. (2011) sample mean, it is not significantly different ($p=0.465$). This sample's average MoCA z-score, derived from the Rossetti sample's age and education adjusted means, was not significantly different from 0, the 50th percentile z-score ($p=0.147$). Using these z-scores, 13% of the current sample would be classified as impaired below 1 SD, and 5% would be classified as impaired below 1.5 SDs.

Performance on the test of functional capacity, UPSA-B, was in the low average range, though also just above the cutoff for mild impairment (scaled score < 7) and was significantly less than 10, the 50th percentile scaled score ($p<0.001$). Twenty-two percent of the sample scored less than 60 on the UPSA-B, a cutoff score related to non-independent living (Mausbach et al., 2007).

Hypothesis 2 Results

All hypothesis 2 models include psychiatric symptoms (PDSQ Total Score), which were only available for 94 participants. All regressions in this section have a sample size of 94, with the exception of the medical appointment compliance

model, for which only 68 participants had data. Non-linear quadratic effects of the cognitive predictors were evaluated in separate models, and all were found to be non-significant (ps ≥ 0.055). The outcome was coded with successful housing outcome as the highest level of the outcome, therefore an odds ratio less than one indicates greater odds of a unsuccessful outcome, while odds greater than one indicate greater odds of an successful outcome.

Housing Outcomes

During the four month follow-up from the first case-management appointment, 16% of the 94 participants included in this analysis obtained new housing, 64% continued residence at the shelter, and 20% dropped-out from the program or their stay was terminated by the shelter (unsuccessful leave). Logistic regression was used to examine the relationship of cognitive and psychiatric predictors of an unsuccessful leave. None of the variables tested for confounding were found to be related to both the cognitive/functional/psychiatric variables and the main outcome (results not shown). Table 10 presents all model parameter estimates for two separate models: unadjusted (cognitive and functional capacity variables only) and adjusted for psychiatric symptoms. Multicollinearity was not indicated (tolerances ≥ 0.300 and TIFs ≤ 3.332).

The unadjusted logistic regression model was not statistically significant, $\chi^2(6) = 4.599$, $p = 0.596$. The model explained 7.5% (Nagelkerke R^2) of the variance in unsuccessful leave and correctly classified 79.8% of participants. None

of the six predictor variables were significant (ps ≥ 0.227).

The logistic regression model adjusted for psychiatric symptoms was also not statistically significant, $\chi^2(7) = 6.965$, p = 0. 433. The model explained 11.3% (Nagelkerke R^2) of the variance in unsuccessful leave and correctly classified 77.7% of participants. Again, none of the seven predictor variables were significant (ps ≥ 0.116).

When comparing the two models, the unadjusted model was not significantly different compared to the model adjusted for psychiatric symptoms, $\chi^2(1) = 2.366$, p = 0.124.

Housing Violations

During the four month follow-up period, 46 of the 94 participants (49%) included in this analysis received violations (range: 0-6). Logistic regression was used to examine the relationship between cognitive and psychiatric predictors and the occurrence of a housing violation. None of the variables tested for confounding were found to be related to both the cognitive/functional/psychiatric variables and the main outcome (results not shown). Table 11 presents all model parameter estimates for both models: unadjusted (cognitive and functional capacity variables only) and adjusted for psychiatric symptoms. Multicollinearity was not indicated (tolerances ≥ 0.300 and TIFs ≤ 3.332).

The unadjusted logistic regression model was not statistically significant, $\chi^2(6) = 5.016$, p = 0.542. The model explained 6.9% (Nagelkerke R^2) of the

variance in housing violation occurrence and correctly classified only 51.0% of participants. None of the six predictor variables were significant (ps ≥ 0.185).

The logistic regression model adjusted for psychiatric symptoms was also not statistically significant, $\chi^2(7) = 6.407$, p = 0. 493. The model explained 8.8% (Nagelkerke R^2) of the variance in housing violation occurrence and correctly classified 56.4% of participants. Again, none of the seven predictor variables were significant (ps ≥ 0.193).

When comparing the two models, the unadjusted model was not significantly different compared to the model adjusted for psychiatric symptoms, $\chi^2(1) = 1.391$, p = 0.238.

Case Manager Appointment Compliance

During the four month follow-up period, participants attended 89.5% (SD = 12.5%) of case management meetings on average. Linear regression was used to examine the relationship between cognitive and psychiatric predictors and attendance of case management meetings (percent attendance). None of the variables tested for confounding were found to be related to both the cognitive/functional/psychiatric variables and the main outcome (results not shown). Table 12 presents all model parameter estimates for both models: unadjusted (cognitive and functional capacity variables only) and adjusted for psychiatric symptoms. Multicollinearity was not indicated (tolerances ≥ 0.300 and TIFs ≤ 3.332).

The unadjusted linear regression model was not statistically significant, $F(6, 87) = 0.382$, $p = 0.888$. The model explained only 2.6% (R^2) of the variance in case management meeting attendance. None of the six predictor variables were significant ($ps \geq 0.226$).

The unadjusted linear regression model adjusted for psychiatric symptoms was also not statistically significant, $F(7, 86) = 0.337$, $p = 0.935$. The model explained only 2.7% (R^2) of the variance in case management meeting attendance. None of the seven predictor variables were significant ($ps \geq 0.234$).

When comparing the two models, the model adjusted for psychiatric symptoms did not significantly account for greater variance than the unadjusted model (R^2 change = 0.1%), $F(1, 86) = 0.091$, $p = 0.764$.

Medical Appointment Compliance

During the four month follow-up period attendance rates for medical appointments averaged 74.5% (SD = 26.2%) for the 68 participants who both had medical appointments and completed the psychiatric symptom measure. Linear regression was used to examine the relationship between cognitive and psychiatric predictors and attendance of medical appointments (percent attendance). Age was significantly correlated with percentage of medical appointments attended ($r = 0.255$, $p=0.036$), as were three cognitive/functional variables: Word Reading ($r = 0.279$, $p=0.006$), Vocabulary ($r = 0.299$, $p=0.003$), and UPSA-B ($r = 0.293$, $p=0.004$). Age was therefore added to the final model. None of the other variables

tested for confounding were found to be related to both the cognitive/functional/psychiatric variables and the main outcome (results not shown). Table 13 presents all model parameter estimates for both models: unadjusted (cognitive and functional capacity variables only), adjusted for psychiatric symptoms, and adjusted for psychiatric symptoms and age. Multicollinearity was not indicated (tolerances ≥ 0.213 and TIFs ≤ 4.700).

The unadjusted linear regression model was not statistically significant, $F(6, 61) = 2.087$, $p = 0.068$. The model explained 17.0% (R^2) of the variance in case management meeting attendance. None of the six predictor variables were significant (ps ≥ 0.092).

The unadjusted linear regression model adjusted for psychiatric symptoms was also not statistically significant, $F(7, 60) = 1.969$, $p = 0.074$. The model explained 18.7% (R^2) of the variance in case management meeting attendance. None of the seven predictor variables were significant (ps ≥ 0.106).

The final logistic regression model adjusted for psychiatric symptoms and age was again not statistically significant, $F(8, 59) = 1.950$, $p = 0.069$. The model explained 20.9% (R^2) of the variance in case management meeting attendance. None of the eight predictor variables were significant (ps ≥ 0.106).

When comparing the three models, the model adjusted for psychiatric symptoms did not significantly account for greater variance than the unadjusted model (R^2 change = 1.7%), $F(1, 60) = 1.219$, $p = 0.274$. The final model adjusted

for psychiatric symptoms and age did not significantly account for greater variance than the psychiatric symptom adjusted model (R^2 change = 2.2%), F(1, 59) = 1.661, p = 0.203.

Hypothesis 3 Results

To examine whether case managers overestimate their homeless clients' IQs, case managers' estimates of their clients' IQs were compared to their clients' actual IQs, as measured by the WASI, using t-tests for dependent measures. Case managers gave IQ estimates for 77 of the study participants, with estimates ranging from 60-119 (M = 101.5, SD = 12.0). The actual IQs of the 77 participants included in this analysis ranged from 55-129 (M = 98.1, SD = 15.8). There was a statistically significant difference in the mean IQ of participants compared case manager estimated IQ, t(76) = 2.128, p = 0.037, with case managers generally overestimating their clients' IQs (mean difference = 3.5, SD = 14.2). The effect size of this difference (d = 0.24) was relatively small. However, case managers were more likely to misestimate their clients' IQs if the client's IQ was at the lower or higher end of the normative curve. If the participant's actual IQ was 110 or greater (high average and above), case managers estimated these IQs to be an average of 10.7 (SD = 10.3) points lower than they actually were (d = 1.03), t(14) = -3.995, p = 0.001. If the participant's actual IQ was less than 90 (low average to impaired), case managers estimated these IQs to be 19.5 (SD = 12.3) points higher than they actually were, on average (d = 1.59), t(18) = 6.925, p < 0.0001. For those with IQ's in the 90-109 range (average), their case managers estimated their IQs to be only

1.3 (SD = 8.7) points higher on average (d = 0.15), t(42) = 0.986, p = 0.330. Also, for those individuals whose IQ fell in the intellectually disabled range (IQ < 70) and who had a case manager IQ rating (n = 5), only one case manager rated the client's IQ to be under 70, while the rest rated their clients' IQs in the average to low average range.

To examine whether case managers overestimate their homeless clients' ability to live independently, participants' estimated ability to live independently (UPSA-B total score dichotomized at a cutoff of 60) were compared to the case managers' assessment of ability to live independently using a 2x2 Fisher's Exact test. The relationship between UPSA-B prediction and case manager assessment of ability to live independently was statistically significant, $\chi^2(1) = 6.185$, p = 0.031 (Table 14). Case managers correctly classified 95% of the participants who were predicted to be able to live independently by the UPSA-B, but correctly classified only 25% of those who were predicted to not be able to live independently. Of the 16 individuals scoring less than 60 on the UPSA-B, only four were identified by CMs as being unable to live independently. Of the additional three individuals CMs felt were not able to live independently, their UPSA-B scores ranged from 69-80. Thus, case managers generally overestimated their clients' ability to live independently.

Discussion

This study had three major aims: (1) to examine cognitive impairment and functional capacity in a sheltered homeless population; (2) to examine the effect of cognitive functioning on housing outcomes and service use; (3) to examine case managers' perceptions of homeless clients' IQ and functional capacity. In our sample of 100 homeless individuals currently housed in a transitional housing shelter, we found that participants performed in the average range on measures of premorbid IQ, FSIQ, perceptual reasoning, and vocabulary. The sample performed in the low average range on measures of processing speed and functional capacity. Thirty percent of the sample scored within the impaired range on the WAIS-IV Coding test, which is highly sensitive to general cerebral impairment, and 48% scored within the impaired range on the functional capacity measure, UPSA-B. Six percent of the sample had a FSIQ below 70, consistent with a diagnosis of intellectual disability. The sample's performance on a mild cognitive impairment screener was mixed, with impairment rates ranging from 13-65%, depending on which normative sample it was compared to. No significant cognitive, functional, or psychiatric predictors were found for housing outcome, housing violations, case management appointment attendance, or medical appointment attendance. Case managers were more likely to misestimate their client's IQs if their client's IQ fell within the top or bottom ranges of the normal curve (i.e., high average to superior or low average to impaired ranges, respectively). Clients with IQs below 90 were estimated by their case managers to have IQs 20 points higher than they actually

were. Only one in five clients with an IQ below 70 was identified as having an IQ below 70, which is a standard cutoff for intellectual disability (formerly known as mental retardation). Finally, case managers tended to overestimate their clients' ability to live independently when scores on a functional capacity measure were low. The sections below compare the results of this study to the broader literature.

Aim 1: Cognitive Profile of Sheltered Homeless Individuals

In the two existing studies that utilized the WASI to examine FSIQ, one sample's mean IQ was in the average range (FSIQ=92) (Oakes & Davies, 2008) and the other sample's mean IQ was in the low-average range (FSIQ=84) (Solliday-McRoy et al., 2004). Our sample's mean IQ was in a similar range to the Oakes & Davies (2008) sample of homeless individuals in a general medical practice. Similar to this study, the Solliday-McRoy et al. (2004) sample was comprised of homeless individuals in large urban shelter. There are many possibilities for the difference in our findings, but one possible difference is the high number of veterans in our population (52%). The single previous study examining FSIQ in a homeless veteran population also found a mean IQ in the average range (WAIS-Revised FSIQ=97.3) (Foulks et al., 1990). One reason for this finding may be that in order to join the US military, enlistees generally must complete an aptitude test, the Armed Services Vocational Aptitude Battery (ASVAB) ("History Of Military Testing," 2014). In 1974 a subtest of the ASVAB, the Armed Forces Qualification Test, was found to correlate with WAIS IQ in a sample of 200 Air Force Trainees by McGrevy, Knouse, & Thompson (as cited in

(Welsh, Kucinkas, & Curran, 1990), and each branch of the US military has minimum AFQT scores for enlistment ("History Of Military Testing," 2014). As lower levels on the AFQT would possibly disqualify individuals from serving in the military, those with very low IQs were most likely disqualified from military service. Therefore, the high proportion of veterans in this sample may at least partially account for our finding of higher IQ scores compared to the Solliday-McRoy et al. (2004) sample.

While our sample's mean IQ was in the average range, mean performance on a processing speed measure (WAIS-IV Coding) was in the low average range, with 30% of participants scoring in the impaired range, at least one standard deviation below the mean. In a sample of individuals attending an outpatient psychiatric clinic who were either currently homeless or had a history of homelessness, the median WAIS-III Digit Symbol T-score was 44 (average range) (Bousman et al., 2010), a performance range just slightly above this sample's performance on the equivalent WAIS-IV Coding test. However, the Bousman et al. (2010) study used age and education adjusted standard scores, where as our study utilized used age adjusted scores. It is possible that the education correction may account for this slight difference, as their sample had slightly higher education levels (Median = 13 years) than our sample (Median = 12 years).

One particularly notable finding was the discrepancy between the average performance on FSIQ and the low average performance on our measure of processing speed. Certain tests used to calculate FSIQ are generally found to be

stable over an individual's lifespan (Lezak et al., 2004), whereas processing speed performance is more sensitive to brain injury and general cerebral integrity (Lezak et al., 2004; Russell, 1972). It is possible that this discrepancy could represent evidence of higher rates of cerebral insult, occurring after normal development, than would be expected in the general population. Another way to examine the possible occurrence of brain insult is to look at discrepancies between FSIQ and premorbid IQ (Lezak et al., 2004), however our findings do not indicate a difference between the two performances. The difference between the two test performance comparisons (i.e., FSIQ to coding vs. FSIQ to premorbid IQ) could have to do with our use of an FSIQ equivalency measure (WASI two-test FSIQ), which is heavily weighted by tests we would not expect to change with later brain insult (Donders, Tulsky, & Zhu, 2001; Lezak et al., 2004). In a study of individuals with traumatic brain injury (TBI), it was found that Matrix Reasoning was not sensitive to the cognitive sequelae of patients with moderate to severe TBI when compared to demographically matched controls (Donders et al., 2001). The second test comprising our FSIQ estimate is a test of vocabulary, which is considered a "hold" test, and would also not be expected to change with general cerebral insult (Lezak et al., 2004). Use of the full WAIS-IV to derive the FSIQ would have included tests that are more susceptible to insult (i.e., working memory and processing speed measures) (Donders et al., 2001; Lezak et al., 2004), and may have been more likely to capture cerebral insult related changes. It is also possible that this population had lower processing speed since development, and this played

a contributing role in their homelessness. While we are uncertain as to the cause of the discrepancy between FSIQ and processing speed performance, it is possible that cerebral insult played a role, as 40% of the entire sample reported a history of past head injury. The severity or details of these possible head injuries are unknown, but the rates are not unlike those found in other studies. A recent systematic review of the literature examining traumatic brain injury in homeless individuals found rates ranging from 8-53% (Topolovec-Vranic et al., 2012).

Overall cognitive impairment rates in this sample were also found to be elevated. If this sample had impairment rates close to the normative population, we would expect about 15.9% of the sample to perform below 1 SD below the mean, and we would expect about 6.7% to perform below 1.5 SDs below the mean. Impairment rates on premorbid and current IQ measures ranged from 21-23% using a cutoff score of 1 SD below the mean, and 11-15% using a cutoff score of 1.5 SDs below the mean. Using both definitions of impairment, this sample's performances indicate greater than expected rates of impairment on IQ measures. This finding is even more apparent on our test of processing speed, where 30% fell below 1 SD and 19% fell below 1.5 SDs.

This study also included a screener for mild cognitive impairment (i.e., the MoCA), which was used to provide a more sensitive measure of cognitive impairment than the more widely utilized MMSE, a dementia screening instrument. Rates of general cognitive impairment, as measured by the MMSE, ranged from 0%-43% in previously published samples of shelter residents (Adams et al., 1996;

Bremner et al., 1996; Buhrich et al., 2000; Fischer et al., 1986; Lovisi et al., 2003; Teesson & Buhrich, 1993). Using the MoCA, 65% of the current sample is classified as at least mildly impaired using the Nasreddine, et al. (2005) recommended cutoff score of 26. In study of the sensitivity and specificity of the MoCA in a community dwelling sample of older adults, Luis, Keegan, and Mullan (2009) found the specificity of a cutoff score of 26 to only be 35%. They recommend using a cutoff score of 23, which had a sensitivity of 96% and a specificity of 95% for mild cognitive impairment. Using that lower cutoff score, the current study sample's impairment rate was 45%. However, when our sample is compared to a younger demographic sample (Rossetti et al., 2011), only 13% of our sample was found to be at least mildly impaired (scores below 1 SD).

Unfortunately, all of the available comparison samples were not specifically recruited to represent a normative sample with a wide range of age and education levels, and therefore are not ideal for comparison. The Nasreddine, et al. control sample (n = 90) was much older than our population (mean age = 72.8, SD = 7.03, & 48.9, SD = 9.2, respectively), and somewhat more educated (mean years of education = 13.33, SD = 3.40, & 11.7, SD = 2.2, respectively) (Nasreddine et al., 2005). The same was true of the Luis et al. (2008) control sample (n = 74), where the mean age was 78.9 (SD = 3.7), and the mean years of education was 14.2 (SD = 2.5). The Rossetti et al. (2005) sample (n = 2,653) had a similar age profile (M = 50.30, SD = 11.2) to our sample, though their sample also had a slightly greater average years of education (M = 13.35, SD= 2.50). However, the normative z-

scores derived from the Rossetti et al. (2005) sample were age and education corrected, whereas the cutoff score of 26 includes an education correction of a single point added to the total score to account for education levels of 12 years or lower. Another important difference between the samples is that the Nasreddine, et al. (2005) control sample was healthy and had "no memory or cognitive complaints and normal baseline neuropsychological performance" (Nasreddine et al., 2005), and those in the Luis et al. (2008) control sample underwent a neurological and neuropsychological evaluation and were considered "cognitively normal," whereas the Rossetti et al. (2011) sample included healthy participants, but did not screen for normal baseline neuropsychological performance. It is possible that those in the Rossetti et al. (2011) sample had poor performance due to brain insult, degenerative disease, or other factors, that would normally preclude them from participating in a normative sample.

When evaluating this study's impairment findings on the MoCA, it is important to consider that none of the available samples used to derive the impairment levels were specifically sampled to provide normative scores over a wide range of age and education levels. Impairment rates in our sample, using all three available normative comparison studies, range from 13-65%. It is likely that true mild cognitive impairment rates, as measured by a larger neuropsychological battery, lay somewhere in between that, albeit wide, range. As use of cognitive screeners with established normative samples (i.e., MMSE) may be cost prohibitive for shelters that must screen large numbers of potential residents, the MoCA

presents a cost effective alternative, as it is freely available. Our findings underscore the need for normative scores to be derived from a larger, more representative sample than those that exist in the present literature.

Functional capacity, a separate but equally important construct from cognitive functioning, has only been evaluated by only one other study in a homeless population. In that study, a sample of psychiatric inpatients with schizophrenia or schizoaffective disorder was given the full version of the UPSA, which includes three more subtests than the UPSA-B and has a summary score ranging from 0-100 (Stergiopoulos et al., 2011). The total score for both versions is derived as a percentage correct on each subtest (Mausbach et al., 2007; Patterson, Goldman, McKibbin, Hughs, & Jeste, 2001), and the full UPSA and the UPSA-B are highly correlated ($r = 0.91$) (Mausbach et al., 2007). The UPSA was initially developed to measure functional capacity in schizophrenia (Patterson et al., 2001), a population with that often requires some level of assisted living arrangements (Dickerson, Ringel, & Parente, 1999). While the full and brief versions' total scores are calculated in the same metric but are not fully equivalent, the Stergiopoulos et al. (2011) sample and the current study's sample scored in similar ranges ($M=67.5$ & 73.2, respectively). It is noteworthy that the two groups performed in similar ranges, and that, when compared to a normative sample, 48% of our sample performed in the mildly impaired range (less than 1 SD below the mean), and 22% of the sample scored below the recommended cut off for ability to live independently. It is possible that our sample had a greater rate of individuals who

need more supported living environments to maintain stable housing.

Aim 2: Housing and Service Utilization Outcomes

This is one of the first studies to examine cognitive predictors of housing outcomes in individuals housed at transitional housing program in a prospective manner. At the four month follow-up, the majority of participants (64%) remained at the shelter, with only 16% finding new stable housing. We found no significant cognitive, functional or psychiatric predictors of unsuccessful leave from the shelter. It should be noted that it took three months on average for individuals to have their first case manager meeting, and measuring housing outcomes only four months after the initial case management meeting was very likely too late to capture those who might have dropped out of the shelter without individualized support, and too early to capture those who were likely to gain stable housing with more structured support. Cognitive, functional and psychiatric variables were also not significant predictors of housing violation occurrence or service utilization rates.

It should also be noted that our models examining housing outcomes, housing violations and service utilization rates had poor statistical fit, and this aim was underpowered. The effect sizes of the non-significant findings were small, and we did not have enough power to identify significant predictors of small, or even medium effect size. Also, low values of explained variance in the outcomes of these models suggest we did not correctly identify pertinent predictors. For the case

manager attendance analysis, it is also possible that the limited range in appointment attendance, which was generally high, limited our ability to identify relevant predictors.

It was initially thought that psychiatric burden would play a part in housing outcomes, as homeless individuals are more likely than the general population to have a psychiatric diagnosis (Kessler et al., 1994; Regier et al., 1984). It is therefore important to note that level of psychiatric symptoms did not significantly predict housing outcomes or service utilization outcomes in any model.

Aim 3: Case Manager Assessment

This was one of the first studies to examine case manager assessment of their homeless clients' general cognitive ability and ability to live independently. We found that case managers were able to accurately predict their clients' IQ if it was in the average range (90-109); however, they were more likely to misestimate their clients' IQs if the clients' actual IQ was at the lower or higher ends of the normative curve. For clients in the high average and superior range (IQ $\geq$ 110), case managers estimated their clients' IQs to be an average of 10 points lower. For those in the low average to impaired range (IQ < 90), their case managers estimated their clients' IQs to be, on average, 20 points higher than the actual score. Case managers rated their clients' IQs closer to the average range than their clients actually fell. For the five individuals whose IQ fell in the intellectually disabled range (IQ < 70) and for whom we had case manager ratings, only one case manager

rated the client's IQ to be under 70, while the rest rated their clients' IQs in the average to low average range. This finding in particular could significantly affect the financial and functional support clients are offered, as those with significant intellectual disability can be eligible for disability entitlements ("California Welfare and Institutions Code," 2014).

Finally, case managers were better at classifying those who were predicted to be able to live independently by a functional capacity measure, but were less accurate at identifying those who were predicted to not be able to live independently. In general, case managers overestimated their clients' ability to live independently. Residential independence assessment is a central component of services provided to those in transitional housing, and it is possible that a small number of individuals are being incorrectly assessed as more functionally independent than they actually are. This in turn could lead to poorer housing outcomes and possible return to transitional housing if these individuals are placed in non-supported housing. While our finding for prediction of residential independence was significant, the standard case managers were judged against was a functional capacity estimate of residential independence, and not actual historical evidence of a pattern of non-independent living (i.e., residence in a board and care facility, assisted living home, etc.). To support this finding, future research should examine if the case managers' predictions of residential independence are related to historical housing patterns and future housing placement success.

Limitations

Because sampling occurred at a single shelter where residents were able to stay for up to two years, results are mainly generalizable to shelter dwellers at long term facilities and may not extend to homeless individuals currently living on the street, individuals living in short stay emergency shelters, or those being housed by friends or relatives. Also, almost half of the sample was comprised of veterans, and therefore results more strongly represent a homeless veteran population than the general homeless population. This makes our sample less representative of the US homeless population in total, as a 2013 point-in-time count done by HUD found that veterans accounted for only 12% of all adults who were counted on a single night (Henry et al., 2013), compared to our study's 52% veteran sample. This sample also has more than double the amount of veterans that the shelter generally houses (20%; K. Kuntz, personal communication, April 17, 2014). However, ending homelessness among veterans has become a national priority, and the Veterans Administration has set a goal of ending veteran homelessness by 2015 (US Interagency Council on Homelessness, 2010); therefore this sample is particularly relevant to furthering this cause.

In this study we chose not to exclude anyone for current drug or alcohol use or history of traumatic brain injury, or other neurological diseases. We therefore cannot make any conclusions regarding whether the level of cognitive impairment seen in the sample is likely to improve over time (e.g., after abstinence from drug/alcohol use, possible recovery from recent head trauma), remain impaired (e.g., intellectual disability), or possibly decline (e.g., dementia). However, as

service utilization and housing opportunities occur on a short term basis, current level of cognitive functioning, no matter what the cause, is more relevant to that question than long term cognitive functioning. The shelter used in the study maintains a no drug/alcohol use policy, and residents are encouraged to join rehabilitation groups if indicated, but does not force out those who are using unless they require more intensive rehabilitation programs. It is possible that shelter residents under-reported their use of alcohol and drugs. While past alcohol and substance dependence may play a role in their cognitive performance, it is not clear that current use did.

It is also possible that higher functioning individuals who were affected by the current economic climate and foreclosure crisis made up a larger portion of this population than would be expected in homeless populations existing in more financially stable times. This could have diluted the extent of cognitive impairment seen in the sample compared to prior time periods; however, inclusion of such individuals would have provided a wider range of cognitive ability level, which would have benefited the housing outcomes analysis by providing individuals that are more likely to gain outside housing. That being said, only 16% of this sample gained stable housing outside of the shelter during the follow up period, and the majority of the sample remained at the shelter during the four month follow up. While 64% of the sample had more than one episode of homelessness in the past, it is possible that that percentage has been even higher in prior years. It is also possible that those individuals who were likely to drop out of the shelter, due to any

number of reasons, did so before their first case management meeting. On average, it took study participants three months to have an initial case management meeting. Individuals who may have had trouble navigating the system, for cognitive or psychiatric reasons, could have been more likely to drop out before they reached case management assignment. It will be important for future studies of shelter residents, in a facility that allows long term stays, to measure cognitive performance as close to entry as possible, in order to establish whether or not cognition plays a role in all possible housing outcomes, including quick return to the street. Longer periods of follow-up will also be helpful in showing the longer-term housing outcomes across a range of cognitive functioning.

Future Directions

While this study included a large sample size, it was not demographically representative of the national homeless population, with half of the sample being comprised of veterans. Although this sample may have important implications for that specific subsample, future studies should seek to recruit a sample that more accurately reflects the demographic makeup of the national homeless population in order to have more generalizable results. This could include the addition of those who are dwelling on the street but are connected to service organizations, as well as those individuals who are unconnected to such services.

The majority of studies to date that have examined cognitive impairment rates in homeless individuals have relied heavily on cognitive screening

instruments like the MMSE. Although the current study expanded the number and type of tests generally given in these studies, we used a brief battery that did not include more traditional measures of executive functioning (i.e., Trail Making Test, Wisconsin Card Sorting Test). These frontal-executive measures could more precisely capture domains such as cognitive flexibility, problem solving, and planning, which may be directly linked with homelessness, as well as the ability to successfully navigate the service system and to obtain disability benefits, if appropriate. Recruitment of participants at the beginning of their stay, as opposed to at their initiation of case management, would help to clarify whether or not shelter residents are more likely to have unsuccessful housing outcomes before the onset of individually tailored intervention, and if there is any association with cognitive and/or functional capacity. Furthermore, a follow up period that mirrors the allowable stay at the shelter would allow for more accurate assessment of housing outcome. Because we were unable to follow participants through their entire shelter stay, it is unclear if our housing outcome findings were affected by the residents' ability to stay up to two years at the shelter.

Finally, as we found that case managers tended to over-estimate IQ and ability to live independently in residents with low IQs and low functional capacity, future research is necessary to examine possible outcomes of such misestimation on outcomes related to disability benefits, housing, and employment. Over-estimating abilities in individuals with low abilities could lead to inappropriate expectations on the part of shelter staff, as well as missed opportunities to secure permanent

housing via disability entitlements.

Conclusions

In summary, the sheltered homeless sample examined in this study had higher than normal rates of cognitive and functional impairment. Our statistical models did not significantly predict housing and service utilization outcomes. Finally, we found that case managers tended to overestimate the cognitive and functional abilities of low-ability residents. In 2010, a federal strategic plan to prevent and end homelessness was developed with the following goals: "(1) Finish the job of ending chronic homelessness in five years; (2) Prevent and end homelessness among Veterans in five years; (3) Prevent and end homelessness for families, youth, and children in ten years; and (4) Set a path to ending all types of homelessness" (US Interagency Council on Homelessness, 2010). In order to achieve these goals, it is important to establish a clearer understanding of what causes and maintains homelessness, as well as how to best facilitate attainment of housing for those without it. Our results confirm that cognitive and functional impairment rates are higher in homeless people than in the general population, and that these impairments are not usually detected by case managers without standardized cognitive and functional assessment. Undetected cognitive or functional impairment may lead to inappropriate expectations of shelter staff and missed opportunities to pursue disability entitlements for those who need them. Homeless service settings may wish to adopt universal screening policies in order to identify individuals who could benefit from more comprehensive assessment.

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Tables

Table 1 Domain and Source of Neuropsychological, Functional, Educational and Psychiatric Measures

Domain	Source	Measure/Scale
Neuropsychological Measures		
Premorbid IQ	Wide Range Achievement Test 4 (WRAT-4) (Wilkinson & Robertson, 2006)	Word Reading
General intelligence (Language & Perceptual reasoning)	Wechsler Abbreviated Scale of Intelligence (WASI) (Wechsler, 1999)	FSIQ (Vocabulary & Matrix Reasoning)
Processing speed	Wechsler Adult Intelligence Scale IV (WAIS-IV) (Wechsler, 2008)	Coding
General cognitive functioning	Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005)	MoCA Total Score
Functional Measure		
Functional Capacity	UCSD Performance-based Skills Assessment – Brief (UPSA-B) (Mausbach et al., 2007)	UPSA-B Total Score
Educational Measure		
Academic skill level	Test of Adult Basic Education (TABE) (*Tests of Adult Basic Education (TABE) Forms 9 & 10*, 2003) – Reading, Language, and Math	Grade Equivalents
Psychiatric Measures		
Psychiatric Symptom Level	Psychiatric Diagnostic Screening Questionnaire (PDSQ) (Zimmerman & Mattia, 1999)	PDSQ Total Score
Substance Abuse Symptom Level	Simple Screening Instrument for Substance Abuse (SSI-SA) (Winters, Zenilman, & Center for Substance Abuse Treatment (U.S.), 1994)	SSI-SA Total Score

Note. FSIQ = full scale intelligence quotient.

Table 2 Demographics of Full Sample

	All Subjects	
	Range/n	Mean (SD)/%
Age	18-66	48.9 (9.2)
Female	19	19%
Education (Years)	0-18	11.7 (2.2)
Hispanic/Latino	10	10%
Non-Caucasian	35	35%
Ever Married	14	14%
Veteran	52	52%
# Homeless Episodes	1-25	3.4 (3.8)
Greater than 1 time Homeless	64	64%
Transitional Housing within the last 3 years	37	37%
At least 4 episodes in past 3 years	11	11%
Months Homeless (Lifetime)	0.5-300	38.2 (53.1)
Months Homeless (Current Episode)	0.5-238.4	19.1 (36.7)
Head Injury (Self-Reported; n=99)	40	40%
Alcohol - Years since last use	0-39	2.7 (6.6)
Drugs - Years since last use	0-57.7	6.4 (11.1)
SSI-SA Total (n=98)	0-14	2.0 (3.3)
PDSQ Total Score (n=94)	0-113	19.6 (26.5)
Days from Entry to 1st CM Meeting	8-202	90.0 (36.7)

Note. PDSQ = Psychiatric Diagnostic Screening Questionnaire; SD = Standard Deviation; SSI-SA = Simple Screening Instrument for Substance Abuse.

Table 3 Demographics by Track Status

	Benefits (n=36)	Employment (n=64)		
	Mean (SD)	Mean (SD)	Test Statistic	p-value
Age	48.4 (10.4)	49.2 (8.5)	t = 0.398	0.692
Female	11 (31%)	8 (13%)	$\chi^2 = 4.881$	0.035
Education (Years)	11.0 (2.9)	12.1 (1.5)	t = 2.100	0.041
Hispanic/Latino	4 (11%)	6 (9%)	$\chi^2 = 0.077$	0.744
Non-Caucasian	17 (47%)	28 (44%)	$\chi^2 = 0.112$	0.835
Ever Married	24 (67%)	38 (59%)	$\chi^2 = 0.520$	0.525
Veteran	11 (31%)	41 (64%)	$\chi^2 = 10.354$	0.002
# Homeless Episodes	4.0 (4.6)	3.1 (3.3)	t = -1.150	0.253
Greater than 1 time Homeless	25 (69%)	39 (61%)	$\chi^2 = 0.724$	0.516
Transitional Housing within the last 3 years	13 (36%)	24 (38%)	$\chi^2 = 0.039$	0.844
At least 4 episodes in past 3 years	7 (19%)	4 (6%)	$\chi^2 = 4.097$	0.053
Months Homeless (Lifetime)	52.4 (67.9)	30.4 (41.5)	t = -1.742	0.088
Months Homeless (Current Episode)	26.6 (47.3)	15.0 (28.8)	t = -1.340	0.186
Head Injury (Self-Reported; n=99)	16 (44%)	24 (38%)	$\chi^2 = 0.384$	0.671
Alcohol - Years since last use	2.6 (6.8)	2.7 (6.5)	t = 0.054	0.957
Drugs - Years since last use	3.7 (8)	7.9 (12.4)	t = 2.064	0.042
SSI-SA Total (n=98)	2.9 (4.4)	1.5 (2.3)	t = -1.828	0.074
PDSQ Total Score (n=94)	32.8 (31.1)	12.1 (20.3)	t = -3.477	0.001
Days from Entry to 1st CM Meeting	82.0 (22.2)	94.4 (42.2)	t = 1.919	0.058

Note. PDSQ = Psychiatric Diagnostic Screening Questionnaire; SD = Standard Deviation; SSI-SA = Simple Screening Instrument for Substance Abuse.

Table 4 Demographics by Veteran Status

	Veterans (n=52)	Non-Veterans (n=64)		
	Mean (SD)/ N (%)	Mean (SD)/ N (%)	Test Statistic	Sig
Age	51.2 (7.2)	46.3 (10.5)	t = -2.701	0.008
Female	0 (0%)	19 (39.6%)	$\chi^2 = 25.412$	<0.001
Education (Years)	12.2 (1.7)	11.2 (2.4)	t = -2.332	0.022
Hispanic/Latino	4 (8%)	6 (13%)	$\chi^2 = 0.641$	0.514
Non-Caucasian	23 (44%)	22 (46%)	$\chi^2 = 0.026$	0.872
Ever Married	32 (62%)	30 (63%)	$\chi^2 = 0.010$	0.921
Veteran	52 (100%)	0 (0%)	NA	NA
# Homeless Episodes	3.3 (3.7)	3.5 (4.0)	t = 0.294	0.769
Greater than 1 time Homeless	31 (60%)	33 (52%)	$\chi^2 = 0.904$	0.407
Transitional Housing within the last 3 years	15 (29%)	22 (46%)	$\chi^2 = 2.849$	0.101
At least 4 episodes in past 3 years	4 (8%)	7 (15%)	$\chi^2 = 1.211$	0.345
Months Homeless (Lifetime)	33.0 (47.8)	43.8 (58.5)	t = 1.010	0.315
Months Homeless (Current Episode)	15.2 (31.7)	23.4 (41.4)	t = 1.126	0.263
Head Injury (Self-Reported; n=99)	21 (53%)	19 (48%)	$\chi^2 = 0.000$	0.997
Alcohol - Years since last use	2.4 (6.3)	2.9 (6.9)	t = 0.380	0.705
Drugs - Years since last use	6.6 (11.1)	6.2 (11.3)	t = -0.162	0.872
SSI-SA Total (n=98)	1.3 (2.4)	2.7 (3.9)	t = 2.093	0.040
PDSQ Total Score (n=94)	15.4 (24.9)	24.6 (27.8)	t = 1.689	0.095
Days from Entry to 1st CM Meeting	74.7 (21.8)	106.4 (42.3)	t = 4.659	<0.001

Note. PDSQ = Psychiatric Diagnostic Screening Questionnaire; SD = Standard Deviation; SSI-SA = Simple Screening Instrument for Substance Abuse.

Table 5 Percentage of Sample Exceeding Recommended Cutoff Scores for PDSQ Subscales (n=94)

PDSQ Subscale	N	Percentage
Alcohol Abuse/Dependence	16	16%
Drug Abuse/Dependence	10	10%
Psychosis	19	19%
Major Depressive Disorder	21	21%
Post-Traumatic Stress Disorder	21	21%
Generalized Anxiety Disorder	17	17%
Panic Disorder	16	16%
Agoraphobia	17	17%
Social Phobia	26	26%
Obsessive Compulsive Disorder	21	21%
Somatization Disorder	24	24%
Hypochondriasis	23	23%
Bulimia/Binge-Eating Disorder	4	4%

Note. PDSQ = Psychiatric Diagnostic Screening Questionnaire.

Table 6 Cognitive and Functional Performance in Full Sample

	Range	Mean (SD)
Word Reading Raw Score	19-69	56.4 (9.8)
Word Reading Standard Score	55-126	92.4 (13.8)
Matrix Reasoning Raw Score	4-31	21.3 (6.6)
Matrix Reasoning T-Score	13-68	49.9 (11.7)
Vocabulary Raw Score	24-74	53.9 (11.5)
Vocabulary T-Score	20-67	46.1 (11.5)
FSIQ	55-129	97.7 (16.1)
Coding Raw Score	20-95	52.9 (15.2)
Coding Scaled Score	2-17	7.8 (2.8)
MoCA Raw Score	9-29	23.1 (3.8)
MoCA Z-Score	-4.4-2	0.2 (1.1)
UPSA - B		
Financial Subscale Raw Score	9.1-50	40.0 (8.0)
Communication Subscale Raw Score	5.6-50	33.1 (8.9)
Total Raw Score	25.8-100.0	73.2 (13.8)
Total Scaled Score	2-16	7.1 (3.1)

Note. FSIQ = Full Scale Intelligence Quotient; MoCA = Montreal Cognitive Assessment; SD = Standard Deviation; UPSA-B = UCSD Performance-based Skills Assessment – Brief.

Table 7 Cognitive and Functional Performance by Track

	Benefits (n=36)	Employment (n=64)		
	Mean (SD)	Mean (SD)	t-value	p-value
Word Reading Raw Score	52.7 (11.7)	58.4 (7.9)	2.614	0.012
Word Reading Standard Score	86.9 (14.8)	95.5 (12.2)	3.120	0.002
Matrix Reasoning Raw Score	18.7 (7.3)	22.8 (5.7)	2.898	0.005
Matrix Reasoning T-Score	45.1 (13.3)	52.6 (9.7)	2.984	0.004
Vocabulary Raw Score	49.5 (12.9)	56.3 (9.9)	2.739	0.008
Vocabulary T-Score	42.0 (12.6)	48.5 (10.2)	2.637	0.011
FSIQ	91.2 (17.6)	101.3 (14.1)	3.139	0.002
Coding Raw Score	48.0 (15.6)	55.7 (14.3)	2.507	0.014
Coding Scaled Score	6.9 (2.9)	8.3 (2.6)	2.519	0.013
MoCA Raw Score	21.3 (4.6)	24.1 (2.9)	3.280	0.002
MoCA Z-Score	-0.2 (1.3)	0.4 (0.9)	2.248	0.029
UPSA - B				
Financial Subscale Raw Score	37.5 (10.3)	41.5 (6.1)	2.123	0.039
Communication Subscale Raw Score	29.9 (9.1)	34.9 (8.3)	2.763	0.007
Total Raw Score	67.4 (15.4)	76.4 (11.8)	3.022	0.004
Total Scaled Score	5.9 (2.9)	7.7 (3.1)	2.817	0.006

Note. FSIQ = Full Scale Intelligence Quotient; MoCA = Montreal Cognitive Assessment; SD = Standard Deviation; UPSA-B = UCSD Performance-based Skills Assessment – Brief.

Table 8 Cognitive and Functional Performance by Veteran Status

	Veterans (n=52)	Non-Veterans (n=64)		
	Mean (SD)	Mean (SD)	t-value	p-value
Word Reading Raw Score	60.1 (7.1)	52.4 (10.6)	0.008	0.320
Word Reading Standard Score	98.5 (10.9)	86.0 (13.6)	0.022	0.263
Matrix Reasoning Raw Score	22.4 (6.1)	20.2 (7.0)	0.024	0.720
Matrix Reasoning T-Score	52.5 (9.8)	47.1 (12.8)	0.024	0.705
Vocabulary Raw Score	57.6 (9.5)	50 (12.2)	0.77	0.872
Vocabulary T-Score	49.8 (9.7)	42.3 (12)	0.315	0.431
FSIQ	102.5 (14.0)	92.7 (16.8)	0.32	0.729
Coding Raw Score	56.7 (15.1)	48.9 (14.3)	-2.659	0.000
Coding Scaled Score	8.6 (2.8)	6.9 (2.6)	-3.22	0.000
MoCA Raw Score	24.1 (3.0)	22.0 (4.3)	-2.931	0.034
MoCA Z-Score	0.4 (0.9)	-0.1 (1.2)	-2.318	0.034
UPSA - B				
Financial Subscale Raw Score	42.4 (5.3)	37.6 (9.6)	0.706	0.042
Communication Subscale Raw Score	34.6 (8.9)	31.5 (8.7)	0.872	0.095
Total Raw Score	77.1 (11.5)	69.1 (15)	0.872	0.100
Total Scaled Score	7.8 (3.0)	6.3 (3.1)	0.431	0.820

Note. FSIQ = Full Scale Intelligence Quotient; MoCA = Montreal Cognitive Assessment; SD = Standard Deviation; UPSA-B = UCSD Performance-based Skills Assessment – Brief.

Table 9 Cognitive and Functional Capacity Normative Score Comparisons

	Sample		Comparison			% Impaired	
	Mean	**SD**	**Mean**	**t-value**	**p-value**	**1 SD**	**1.5 SD**
Word Reading Standard Score	92.4	13.8	100	-5.533	<0.001	23%	11%
Matrix Reasoning T-Score	49.9	11.7	50	-0.094	0.925	21%	13%
Vocabulary T-Score	46.1	11.5	50	-3.370	0.001	22%	15%
FSIQ	97.7	16.1	100	-1.432	0.155	21%	12%
Coding	7.8	2.8	10	-7.900	<0.001	30%	19%
MoCA Scores							
Uncorrected Raw Score (Nasreddine sample)	23.9	3.8	27.4	-9.384	<0.001		
Corrected Raw Score (Rossetti Sample)	23.1	3.8	23.4	-0.733	0.465		
Z-score (Rossetti Sample)	0.2	1.1	0	1.462	0.147	13%	5%
UPSA-B Scaled Score	7.1	3.2	10	-9.337	<0.001	48%	37%

Note. Uncorrected MoCA scores were compared to scores in the sample of Nasreddine et al. (2005). Corrected MoCA scores have one point added for individuals with less than or equal to 12 years of education and were compared with the sample of Rossetti et al. (2011); FSIQ = Full Scale Intelligence Quotient; MoCA = Montreal Cognitive Assessment; SD = Standard Deviation; UPSA-B = UCSD Performance-based Skills Assessment – Brief.

Table 10 Logistic Regression Results: Unsuccessful Housing Outcome

	Odds Ratio	95% Confidence Interval		Wald Chi-Square	p-value
		Lower	Upper		
Unadjusted					
Word Reading Raw Score	1.03	0.94	1.14	0.393	0.531
Matrix Reasoning Raw Score	1.06	0.94	1.20	0.860	0.354
Vocabulary Raw Score	1.01	0.93	1.09	0.040	0.841
Coding Raw Score	1.02	0.97	1.06	0.514	0.473
MoCA Raw Score	1.01	0.78	1.31	0.007	0.932
UPSA-B Raw Score	0.97	0.92	1.02	1.457	0.227
Adjusted for Psychiatric Symptoms					
Word Reading Raw Score	1.04	0.93	1.15	0.455	0.500
Matrix Reasoning Raw Score	1.07	0.94	1.21	1.041	0.308
Vocabulary Raw Score	1.00	0.92	1.09	0.002	0.966
Coding Raw Score	1.02	0.97	1.06	0.642	0.423
MoCA Raw Score	1.02	0.78	1.33	0.027	0.869
UPSA-B Raw Score	0.97	0.92	1.02	1.586	0.208
PDSQ Total Score	1.02	1.00	1.03	2.474	0.116

Note. MoCA = Montreal Cognitive Assessment; PDSQ = Psychiatric Diagnostic Screening Questionnaire; UPSA-B = UCSD Performance-based Skills Assessment – Brief.

Table 11 Logistic Regression Results: Housing Violations

	Odds Ratio	95% Confidence Interval		Wald Chi-Square	p-value
		Lower	Upper		
Unadjusted					
Word Reading Raw Score	1.04	0.97	1.11	1.038	0.308
Matrix Reasoning Raw Score	1.06	0.96	1.16	1.381	0.240
Vocabulary Raw Score	0.99	0.94	1.06	0.034	0.854
Coding Raw Score	1.02	0.99	1.06	1.429	0.232
MoCA Raw Score	0.87	0.70	1.07	1.753	0.185
UPSA-B Raw Score	1.01	0.97	1.05	0.128	0.721
Adjusted for Psychiatric Symptoms					
Word Reading Raw Score	1.04	0.97	1.11	1.048	0.306
Matrix Reasoning Raw Score	1.06	0.97	1.17	1.636	0.201
Vocabulary Raw Score	0.99	0.93	1.06	0.055	0.814
Coding Raw Score	1.02	0.99	1.06	1.522	0.217
MoCA Raw Score	0.87	0.70	1.07	1.675	0.196
UPSA-B Raw Score	1.01	0.97	1.05	0.089	0.766
PDSQ Total Score	1.01	0.99	1.03	1.359	0.244

Note. MoCA = Montreal Cognitive Assessment; PDSQ = Psychiatric Diagnostic Screening Questionnaire; UPSA-B = UCSD Performance-based Skills Assessment – Brief.

Table 12 Linear Regression Results: Case Management Meeting Attendance

	β	t-value	p-value
Unadjusted			
Word Reading Raw Score	0.08	0.506	0.614
Matrix Reasoning Raw Score	0.04	0.284	0.777
Vocabulary Raw Score	-0.21	-1.220	0.226
Coding Raw Score	0.01	0.064	0.949
MoCA Raw Score	0.09	0.492	0.624
UPSA-B Raw Score	0.08	0.576	0.566
Adjusted for Psychiatric Symptoms			
Word Reading Raw Score	0.08	0.501	0.618
Matrix Reasoning Raw Score	0.04	0.255	0.799
Vocabulary Raw Score	-0.21	-1.199	0.234
Coding Raw Score	0.01	0.054	0.957
MoCA Raw Score	0.09	0.480	0.632
UPSA-B Raw Score	0.09	0.588	0.558
PDSQ Total Score	-0.03	-0.301	0.764

Note. MoCA = Montreal Cognitive Assessment; PDSQ = Psychiatric Diagnostic Screening Questionnaire; UPSA-B = UCSD Performance-based Skills Assessment – Brief.

Table 13 Linear Regression Results: Medical Appointment Attendance

	β	t-value	p-value
Unadjusted			
Word Reading Raw Score	0.12	0.521	0.604
Matrix Reasoning Raw Score	-0.04	-0.234	0.816
Vocabulary Raw Score	0.38	1.713	0.092
Coding Raw Score	-0.08	-0.541	0.590
MoCA Raw Score	-0.06	-0.239	0.812
UPSA-B Raw Score	0.04	0.245	0.807
Adjusted for Psychiatric Symptoms			
Word Reading Raw Score	0.14	0.629	0.532
Matrix Reasoning Raw Score	0.00	-0.017	0.986
Vocabulary Raw Score	0.37	1.643	0.106
Coding Raw Score	-0.06	-0.409	0.684
MoCA Raw Score	-0.09	-0.365	0.716
UPSA-B Raw Score	0.03	0.162	0.872
PDSQ Total Score	0.13	1.104	0.274
Adjusted for Psychiatric Symptoms and Age			
Word Reading Raw Score	0.06	0.266	0.791
Matrix Reasoning Raw Score	0.04	0.242	0.809
Vocabulary Raw Score	0.37	1.642	0.106
Coding Raw Score	-0.02	-0.098	0.922
MoCA Raw Score	-0.07	-0.296	0.769
UPSA-B Raw Score	-0.03	-0.189	0.850
PDSQ Total Score	0.15	1.215	0.229
Age	0.17	1.289	0.203

Note. MoCA = Montreal Cognitive Assessment; PDSQ = Psychiatric Diagnostic Screening Questionnaire; UPSA-B = UCSD Performance-based Skills Assessment – Brief.

Table 14 Prediction of Living Independence

		Case Manager		Total
		Independent	**Non-Independent**	
UPSA-B	**Independent**	58	3	61
	Non-Independent	12	4	16
	Total	70	7	77

Note. UPSA-B = UCSD Performance-based Skills Assessment – Brief.