

Original Article

Cite this article: Gicas KM, Mejia-Lancheros C, Nisenbaum R, Wang R, Hwang SW, Stergiopoulos V (2023). Cognitive determinants of community functioning and quality of life in homeless adults with mental illness: 6-year follow-up from the At Home/Chez Soi Study Toronto site. *Psychological Medicine* **53**, 362–370. <https://doi.org/10.1017/S0033291721001550>

Received: 11 February 2021
Revised: 1 April 2021
Accepted: 7 April 2021
First published online: 30 April 2021


Key words:

cognition; community functioning; quality of life; homelessness; risk factors; resilience

Author for correspondence:

K. M. Gicas,
E-mail: kgicas@yorku.ca

Cognitive determinants of community functioning and quality of life in homeless adults with mental illness: 6-year follow-up from the At Home/Chez Soi Study Toronto site

K. M. Gicas¹ , C. Mejia-Lancheros², R. Nisenbaum^{2,3}, R. Wang², S. W. Hwang^{2,4} and V. Stergiopoulos^{2,5,6}

¹Department of Psychology, York University, Toronto, Ontario, Canada; ²MAP Centre for Urban Health Solutions, Li Ka Shing Knowledge Institute, St Michael's Hospital, Unity Health Toronto, Toronto, Ontario, Canada; ³Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada; ⁴Division of General Internal Medicine, Department of Medicine, University of Toronto, Toronto, Ontario, Canada; ⁵Centre for Addiction and Mental Health, Toronto, Ontario, Canada and ⁶Department of Psychiatry, University of Toronto, Toronto, Ontario, Canada

Abstract

Background. High rates of physical and mental health comorbidities are associated with functional impairment among persons who are homeless. Cognitive dysfunction is common, but how it contributes to various functional outcomes in this population has not been well investigated. This study examines how cognition covaries with community functioning and subjective quality of life over a 6-year period while accounting for the effects of risk and protective factors.

Methods. Participants were 349 homeless adults (mean age = 39.8) recruited from the Toronto site of the At Home/Chez Soi study, a large Canadian randomized control trial of Housing First. Participants completed up to four clinical evaluations over 6 years. Factor scores were created to index verbal learning and memory (vLM) and processing speed-cognitive flexibility (PSCF). The primary outcomes were community functioning and subjective quality of life. Risk factors included lifetime homelessness, mental health diagnoses, medical comorbidity, and childhood adversity. Linear mixed-effects models were conducted to examine cognition-functional outcome associations over time, with resilience as a moderator.

Results. Better vLM ($b = 0.787, p = 0.010$) and PSCF ($b = 1.66, p < 0.001$) were associated with better community functioning, but not with quality of life. Resilience conferred a protective effect on subjective quality of life ($b = 1.45, p = 0.011$) but did not moderate outcomes.

Conclusions. Our findings suggest a need to consider the unique determinants of community functioning and quality of life among homeless adults. Cognition should be prioritized as a key intervention target within existing service delivery models to optimize long-term functional outcomes.

Introduction

Persons who are homeless experience a high burden of comorbid physical and mental health conditions that intersects with ongoing social and economic disadvantages (Luchenski et al., 2018). Even in high-income nations with availability of universal health insurance, the co-occurrence of psychiatric illness, substance use, infectious diseases, and traumatic brain injury is remarkably common in this population and is associated with premature mortality (Aldridge et al., 2018; Fazel, Geddes, & Kushel, 2014). Cross-sectional studies suggest that a greater number of co-occurring illnesses is also associated with poorer role functioning in homeless youth and adults (Barbic et al., 2018; Vila-Rodriguez et al., 2013) and with greater functional impairment in older adults (Brown, Kiely, Bharel, & Mitchell, 2012). Quality of life (QoL) also tends to be lower among homeless persons and has been linked with higher rates of psychiatric and substance use disorders (Gentil, Grenier, Bamvita, Dorvil, & Fleury, 2019; Hubley, Russell, Palepu, & Hwang, 2014) and viral co-infection (Tsui, Bangsberg, Ragland, Hall, & Riley, 2007).

An underappreciated dimension of illness burden in homeless persons is the consequential cognitive dysfunction or impairment. While an estimated 25% of persons exhibit global impairment (Depp, Vella, Orff, & Twamley, 2015), upwards of 75% of homeless adults exhibit clinically relevant verbal memory impairment in addition to domain-specific difficulties in attention, processing speed, and executive functions (mental flexibility, cognitive control, risky decision making; Gicas et al., 2017; Stergiopoulos et al., 2015). A similar profile of cognitive impairments is also observed in homeless youth (Barone et al., 2019; Fry, Langley, &

Shelton, 2017; Waclawik et al., 2019). Among homeless older adults (≥ 50 years), the rate of cognitive impairment is estimated to be 3–4 times higher than what would be expected for adults aged 70 years and older within the general population (Hurstak et al., 2017). Moreover, emergent longitudinal evidence indicates accelerated cognitive decline (Gicas et al., 2020) and persistent or worsening functional impairment (Brown et al., 2019), raising concern around issues of chronic disability and possible future dementia in this population.

In general, there is a clear relationship between neurocognition and functional outcomes in healthy and patient populations (Morgan & Heaton, 2009). Memory and executive function are critical to managing medications and health appointments, seeking and maintaining gainful employment, and maintaining social relationships (Gorman, Foley, Ettenhofer, Hinkin, & van Gorp, 2009). In a large meta-analysis of persons with schizophrenia spectrum disorders, overall cognitive functioning predicted community functioning, including QoL, with an overall medium effect size, but with the strongest domain-specific effects for verbal learning and memory (vLM), and processing speed (Halverson et al., 2019). Cognition is likely to play an especially important role in community functioning and QoL among homeless persons with significant physical and mental comorbid conditions given the harsh realities of their day-to-day living environment. Everyday activities are apt to be more challenging due to systemic barriers in accessing health care services (Argintaru et al., 2013), ongoing discrimination and stigma faced in relation to perceived cognitive (Backer & Howard, 2007) and mental health status (Mejia-Lancheros et al., 2021), and a general inability to modify one's environment to match level of need (Kushel, 2011).

To date, there are very few studies that have explicitly examined the cognitive determinants of functional outcomes in homeless persons. In a sample of homeless veterans newly enrolled in a supportive housing program, social cognitive ability, but not global cognitive ability, was associated with the level of community integration (role functioning, social connections; Horan et al., 2019). In contrast, impairments in mental flexibility and global cognition were associated with poorer instrumental activities of daily living (taking medications, using public transportation, budgeting finances) in homeless older adults (Hurstak et al., 2017). Among homeless youth, better working memory performance was a predictor of progression to independent living (Fry, Langley, & Shelton, 2020). Further investigations delineating the cognitive contributions to specific functional outcomes will help highlight tangible rehabilitation targets, essential to the success of interventions and service delivery models for this vulnerable population who frequently suffer the double burden of homelessness and mental illness.

The primary aim of the current study is to examine the specific contributions of cognitive functioning to community functioning and subjective QoL within a large Canadian sample of homeless adults with mental illness enrolled in a randomized controlled trial of Housing First (HF) and followed for up to 6 years. Given the dynamic nature of risk factors associated with functional outcomes in homeless persons, this study adopts a more nuanced approach by examining individual cognitive and functional trajectories and their co-variation. A cross-sectional snapshot of these associations may not reveal the full picture because some mental and physical illnesses may naturally ebb and flow in terms of their presence and acuity and transiently dysregulate functioning. An important secondary aim of this study is to evaluate the potential protective effect of resilience on

functional outcomes in the context of cognitive impairment. Resilience is broadly defined as the ability to cope with and adapt to adversity and has been found to be positively associated with community functioning in homeless veterans (Greenberg et al., 2019).

It is hypothesized that better domain-specific cognitive performance (verbal learning and memory [vLM], complex processing speed and cognitive flexibility [PSCF]) will be associated with better community functioning and QoL over time after accounting for the effects of age, early childhood adversity, psychiatric illness, chronic physical health conditions, and resilience. It is further anticipated that resilience may confer a modification effect, whereby higher levels of resilience may enable individuals to maintain better community functioning and QoL despite poorer cognitive functioning.

Materials and methods

This study used data collected at the Toronto site as part of the At Home/Chez Soi (AH/CS) study, a large Canadian multi-city randomized controlled trial of HF for homeless adults with mental illness (Goering et al., 2011). To briefly summarize, individuals who were randomly assigned to receive HF were provided with a rent supplement for their preferred housing within the community, as well as supportive mental health services (intensive case management or assertive community treatment) tailored to their level of need (moderate or high). Individuals assigned to the control group received treatment as usual (TAU), which consisted of the usual supports that were available to them in their community, including housing and mental health support services.

Participants

Phase 1 of the original study enrolled 575 participants at the Toronto, Canada site between October 2009 and June 2011 and followed participants up to April 2013. In an extension of the original Toronto site study (Phase 2), 414 participants re-consented to further follow-up between July 2014 and March 2017. Eligibilities for inclusion in the AH/CS study were (i) being at least 18 years old, meeting criteria for a mental disorder (with or without a substance use disorder); (ii) not currently receiving services by an assertive community treatment or intensive case management program; (iii) and being absolutely homeless or precariously housed. Participants were recruited through local agencies and programs that frequently encounter homeless persons, including shelters, drop-in centres, inpatient programs, community mental health teams, and criminal justice programs. For the current study, participants were eligible for inclusion if they had at least one follow-up visit that involved completion of cognitive and functional outcome assessments.

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All participants provided written informed consent. The Toronto arm of the AH/CS study was approved by St. Michael's Hospital research ethics board and the larger national multi-site study was registered with the International Standard Randomized Control Trial Number Register (42520374).

Cognitive measures

A brief cognitive battery was administered by trained research assistants to participants at 6 and 24 months after the initial interview date for AH/CS, Phase 1, and at 6 and 18 months following enrolment in AH/CS, Phase 2. vLM was assessed with the Hopkins Verbal Learning Test Revised (HVLT-R) using the total immediate recall and delayed recall scores (Benedict, Schretlen, Groninger, & Brandt, 1998). Psychomotor speed and attention were measured with the Digit Symbol Coding subtest of the Wechsler Adult Intelligence Scale Revised (total correct score; Wechsler, 1981); and with the Trail Making Test Part A (total time to completion, truncated to 150 s; Reitan, 1958). Cognitive flexibility, a component of executive functioning, was measured with the Trail Making Test Part B as the total time to completion truncated to a maximum of 300 s (Reitan, 1958). Cognitive scores were considered invalid if examiner notes indicated the presence of any extraneous factors that may have substantially influenced performance, such as difficulty comprehending task instructions, language barriers, extreme fatigue, vision problems, and substance or alcohol intoxication. All cognitive scores across time points were converted to z-score units using the baseline mean and standard deviation of the sample. Total scores on each part of the Trail Making Test were multiplied by -1 so that lower scores represented poorer performance consistent with the other measures. Cognitive z-scores at each time point were averaged to create two factor scores in line with previously identified cognitive factors in the AH/CS data (Stergiopoulos et al., 2019). The vLM factor was composed of the HVLT-R immediate and delayed recall scores, and the PSCF factor was composed of the digit symbol total score, and Trail Making Test total scores from Part A and B.

Functional outcome measures

Proximal to each cognitive testing session, self-report scales assessing community functioning and QoL were administered (98.9% same day, 1.1% within 6 weeks). Community functioning was measured with the total score from the Multnomah Community Ability Scale (MCAS), a 17-item questionnaire that asks participants questions about their community behaviours and social interactions, coping skills, and adaptations (Barker, Barron, McFarland, & Bigelow, 1994). Higher MCAS scores reflect higher levels of community functioning. QoL was measured with the total score from Lehman's 20-item QoL interview that asks participants to rate how they feel about different aspects of their life, organized into six subscales (family, finance, leisure, living situation, safety, social) with an additional final item that assesses overall life satisfaction (Uttaro & Lehman, 1999). All items are measured on a 7-point scale, with a maximum possible score of 140, and higher scores indicating better QoL. The 20 items on this scale are considered to measure *subjective* QoL, which emphasizes an individual's self-evaluation and perception of their life and how their personal expectations and goals intersect with the broader social and cultural value systems they are situated in (Hubley et al., 2014).

Covariates/risk and protective factors

A comprehensive structured interview was carried out at study entry to collect personal demographic information including age, gender (man or woman), education, and lifetime history of

homelessness categorized as < 3 years or ≥ 3 years. At the time of the initial interview, mental health and substance use disorders were assessed using the Mini International Neuropsychiatric Interview (MINI) and included a current diagnosis of major depression, psychotic disorder (including mood disorders with psychotic features), alcohol abuse or dependence, and substance abuse or dependence (Sheehan et al., 1998). Chronic medical comorbidity (CMC) was indexed by summing the presence of self-reported physical health conditions at the initial AH/CS study interview. Physical health conditions included heart disease, stroke, diabetes, asthma, chronic bronchitis/emphysema, ulcers (stomach or intestinal), inflammatory bowel disease, migraine, thyroid problems, arthritis, kidney/bladder problems, liver disease (except hepatitis), and anaemia. Resilience was measured with the Connor-Davidson Resilience Scale-2 (CD-RISC2), a 2-item scale that captures individual ability to cope with adversity (Vaishnavi, Connor, & Davidson, 2007). Childhood adversity was measured at the AH/CS Phase 1, 18-month follow-up using the total score from the adverse childhood experience (ACE) scale that assesses abuse (physical, sexual, emotional), neglect, and household dysfunction that occurred prior to the age of 18 years (Felitti et al., 1998). Initial randomization to either the HF or TAU arm of the parent study was included to control for the effects of an intervention.

Statistical analyses

Descriptive statistics for the overall sample are reported using means (standard deviations) and medians (interquartile range) for continuous variables, and counts (proportions) for categorical variables. Pearson and point biserial correlation coefficients estimated the linear relationships between cognitive variables, functional outcomes, and covariates. A sensitivity analysis was conducted to examine possible differences in demographic and clinical characteristics between participants who were included *v.* excluded, using *t* tests and X^2 tests.

As a first step in the longitudinal analyses, separate linear mixed-effects models with random intercepts and slopes were used to describe the trajectories of change for each domain-specific cognitive factor (vLM, PSCF) and functional outcomes (MCAS, QoL) while adjusting for the effects of demographic variables (age, gender, education) and treatment arm (HF *v.* TAU), entered as fixed effects. Time was calculated as years since the date of initial randomization and re-scaled so that time = 0 at the AH/CS, Phase-1's 6-month follow-up in alignment with the time of the initial cognitive and functional outcome evaluations. The association of demographic covariates with change in cognitive or functional trajectories over time was tested by including the interaction of time \times covariate, one covariate at a time.

To test the association between time-varying cognitive factors (vLM, PSCF) and functional outcomes, separate linear mixed-effects models were run for each combination of cognitive factor and outcome (four models in total), including covariates identified in the screening phase. The main effect of the time-varying cognitive factor, as well as the interaction of the cognitive factor and time, were included in the models. The main effect can be interpreted as the average difference, over time, in the functional outcomes, for one unit of change in the cognitive factor. The interaction examines whether the effect of cognitive factor scores on functional outcomes varies over time. The moderating effect of resilience was evaluated by including an interaction between the cognitive factor score and CD-RISC2 scores. This

interaction examines whether the main effect of the cognitive factors on functional outcomes over time differs by level of resilience (Singer & Willett, 2003; p.171). An *a priori* decision was made to include putative risk and protective factors as covariates in the final models. These factors were selected to reflect physical and mental health conditions and adverse experiences commonly observed in homeless populations (Fazel et al., 2014); lifetime duration of homelessness, MINI diagnoses, ACE scores, CMC total count, and CD-RISC2 scores were included as fixed effects. The Akaike information criterion (AIC) was used to compare goodness-of-fit between models with different time-varying cognitive factors. All models were examined for normality of residuals and for multivariate outliers using Cook's distance and leverage values. Missing data on the outcome variables were imputed using full information maximum likelihood. Only participants with complete case data on the covariates were included. All statistical tests were two-tailed and statistical significance was defined as $p < 0.05$. All analyses were performed in R (R Core Team, 2020) using the *lme4* package for the linear mixed-effects models (Bates, Mächler, Bolker, & Walker, 2015).

Results

Of 575 participants enrolled in the study, 10 participants identified as transgender and were removed from the sample as there were too few individuals to enable subgroup analyses. A total of 456 completed at least two functional outcome assessments and 349 of these participants also had at least two valid cognitive assessments. Compared to participants who were included ($n = 349$) in the current study, those who were excluded ($n = 226$) had on average fewer years of education, a lower frequency of having received the HF intervention, and a lower rate of substance abuse or dependence diagnosis. However, these differences are modest and therefore not considered to meaningfully impact results. The full details of the sensitivity analysis are reported in online Supplementary Table S1. There were modest proportions of missing data on the following covariates: education (2.6%), lifetime homelessness (1.7%), ACE total score (7.2%), CD-RISC2 total score (13.5%), and CMC total count (2.3%). On average, participants completed approximately three out of four evaluations (mean = 3.6; s.d. = 0.7) and were followed for a mean of 4.3 years (s.d. = 1.1). Slightly over half of these participants (56.7%, $n = 198$) received the HF intervention and the remaining 43.3% ($n = 151$) were in the TAU study arm. The full sample characteristics are described in Table 1. At the initial evaluation, the correlation between vLM and PSCF cognitive factor scores was $r = 0.47$, and between outcome scores (MCAS and QoL) was $r = 0.20$. Additional correlations between continuous covariates and cognitive measures are reported in online Supplementary Table S2. The final sample size varied by analysis and is reported separately below for each of the main analyses of interest.

Description of cognitive and functional trajectories

The results for each of the four descriptive trajectory models are summarized in online Supplementary Table S3. Briefly, in the first adjusted linear mixed-effects model, a linear increase in learning and memory performance was observed over time. Younger age, more years of education, and being a woman were associated with better learning and memory at initial cognitive evaluation, but were not associated with a change in cognitive functioning over time. The study intervention arm was unrelated to cognitive

Table 1. Sample characteristics of participants with at least two cognitive and functional outcome assessments ($N = 349$)

Variable	<i>N</i>	Value
Age, mean (s.d.)	349	39.8 (11.9)
Years of education, mean (s.d.)	340	12.0 (3.2)
Gender (man), % (<i>n</i>)	349	68.5 (239)
Ethnicity, % (<i>n</i>)	341	
White		36.4 (124)
Black		36.1 (123)
Indigenous		5.6 (19)
Other		15.5 (53)
Mixed		6.5 (22)
Study intervention group, % (<i>n</i>)	349	
Housing first		56.7 (198)
Treatment as usual		43.3 (151)
Lifetime homelessness, % (<i>n</i>)	343	
≥ 3 years		53.9 (185)
ACE total score, mean (s.d.)	324	4.4 (2.9)
CD-RISC2 total score, mean (s.d.)	302	5.2 (1.8)
CMC total count, median (IQR)	341	3.7 (3.1)
Psychiatric diagnosis, % (<i>n</i>)	349	
Major depression		38.1 (133)
Psychotic disorder		52.4 (183)
Alcohol abuse or dependence		45.0 (159)
Substance abuse or dependence		50.4 (176)

Note. ACE = adverse childhood experience; CD-RISC2 = Connor-Davidson resilience scale-2; CMC = chronic medical comorbidities; IQR = interquartile range.

functioning. Similarly, processing speed and cognitive flexibility showed a linear increase with a significant age-by-time interaction indicating older individuals showed less improvement over time. Additionally, younger age and more years of education were associated with better processing speed and cognitive flexibility at initial evaluation, but gender and study intervention arm were not. The individual-level and average sample trajectories for cognitive measures are provided in online supplementary Fig. S1.

When MCAS total scores were examined as the outcome, a decline in community functioning was observed over time. More years of education, being a woman, and the HF intervention were associated with better community functioning at initial evaluation. In a separate adjusted model examining QoL scores, a significant linear increase in subjective QoL was observed over time. Receiving the HF intervention was associated with better QoL at baseline, but demographic variables were not. None of the covariates were related to change in either of the functional outcomes. Online Supplementary Fig. S2 provides the individual-level and average sample trajectories for each functional outcome.

Co-variation between cognition and functional outcomes over time

The results of the final adjusted models examining associations between time-varying cognitive factor scores and community functioning are summarized in Table 2. Briefly, a significant

Table 2. Linear mixed-effects models examining the effects of cognition on community functioning over a 6-year period among homeless adults

Variable	Learning and memory model <i>N</i> = 275			Processing speed and cognitive flexibility model <i>N</i> = 274		
	Estimate	s.e.	<i>p</i> value	Estimate	s.e.	<i>p</i> value
Time	−0.265	0.127	0.037	−0.239	0.126	0.060
Cognitive factor score ^a	0.787	0.304	0.010	1.66	0.431	<0.001
Age	0.021	0.030	0.486	0.037	0.032	0.249
Gender (man)	−0.236	0.711	0.740	−0.067	0.733	0.927
Education	0.202	0.101	0.046	0.121	0.107	0.259
Study intervention (HF)	0.515	0.632	0.416	0.643	0.653	0.326
Lifetime homelessness (≥3 years)	−0.903	0.707	0.203	−0.983	0.737	0.184
ACE total score	−0.117	0.118	0.323	−0.143	0.121	0.238
Major depression	1.34	0.768	0.082	1.26	0.791	0.112
Psychotic disorder	−0.164	0.737	0.824	−0.213	0.772	0.783
Alcohol abuse/dependence	−0.533	0.732	0.467	−0.239	0.753	0.751
Substance abuse/dependence	−1.32	0.784	0.094	−1.67	0.822	0.043
CMC total count	−0.144	0.113	0.202	−0.130	0.118	0.273
CD-RISC2 total score	0.039	0.176	0.827	−0.045	0.182	0.806
Variance components						
Random effects						
Level 1 (within subjects)	0.43			0.46		
Level 2 (between subjects)	6.85			8.10		
Fixed effects						
Residual	34.48			32.19		
Model AIC	5932.18			5413.33		
Number of observations	885			811		

Note. HF = housing first; CD-RISC2 = Connors-Davidson resilience scale; AIC = Akaike information criterion.

^aCognitive factor scores entered as time-varying predictors in each model.

decline in community functioning was observed. Better learning and memory was associated with better community functioning, and this was consistent across time as evidenced by a non-significant cognition by time interaction. The non-significant interaction term was not included in the final model as reported in Table 2. Only education remained a significant covariate in the model showing a positive association with community functioning at initial evaluation. In a separate model, better processing speed and cognitive flexibility was also associated with better community functioning and remained consistent over time (i.e. no significant cognition by time interaction). Substance abuse/dependence was associated with worse community functioning at initial evaluation, but no other covariates were significant predictors in the final model. When comparing the two cognitive models, the overall fit as measured by the AIC was notably better when the processing speed and cognitive flexibility factor was included as the main predictor.

The results of the final models examining QoL as the primary outcome are summarized in Table 3. There was a significant effect of time showing a linear increase in QoL over 6 years. However, neither vLM nor PSCF factor scores were associated with QoL. Further, cognition did not interact with time and therefore this term was not included in either model. Generally, receiving the HF intervention, less ACEs, and a greater level of resilience

were independently associated with higher QoL at initial evaluation.

For each of the four main models, the level of individual resilience was examined as a moderator of cognitive-functional outcome associations. In contrast to our hypothesis, there were no significant interactions between cognitive factor scores and CD-RISC2 total scores in any of the models. Therefore, interaction terms were not retained in the final adjusted models.

Discussion

In a large Canadian sample of homeless adults with serious mental illness, differential associations between cognition measures and functional outcomes were observed. After adjusting for select risk and protective factors, composite indices of verbal learning and memory as well as processing speed and cognitive flexibility were positively associated with community functioning, but not with QoL, over a 6-year period. While greater individual resilience levels were independently associated with better QoL, resilience did not moderate the association between cognition and functional outcomes as expected. Altogether, cognition was the predominant predictor of community functioning, whereas select risk and protective factors (childhood adversity and resilience, respectively) were specifically associated with QoL, highlighting

Table 3. Linear mixed-effects models examining the effects of cognition on subjective QoL over a 6-year period among homeless adults

Variable	Learning and memory model <i>N</i> = 274			Processing speed and cognitive flexibility model <i>N</i> = 274		
	Estimate	S.E.	<i>p</i> value	Estimate	S.E.	<i>p</i> value
Time	0.719	0.296	0.016	0.610	0.300	0.043
Cognitive factor score ^a	0.673	0.754	0.372	2.06	1.16	0.077
Age	-0.038	0.096	0.691	-0.002	0.102	0.983
Gender (man)	-2.06	2.29	0.370	-0.489	2.35	0.835
Education	-0.335	0.327	0.306	-0.409	0.344	0.235
Study intervention (HF)	4.16	2.04	0.043	3.38	2.10	0.109
Lifetime homelessness (≥ 3 years)	-1.90	2.30	0.410	-2.68	2.39	0.262
ACE total score	-1.83	0.382	<0.001	-1.98	0.393	<0.001
Major depression	-3.98	2.50	0.112	-4.54	0.257	0.079
Psychotic disorder	1.24	2.40	0.606	1.61	2.50	0.520
Alcohol abuse/dependence	-1.32	2.37	0.577	-2.15	2.43	0.378
Substance abuse/dependence	-0.681	2.53	0.788	-0.640	2.64	0.808
CMC total count	-0.385	0.367	0.295	-0.236	0.385	0.541
CD-RISC2 total score	1.45	0.570	0.011	1.39	0.588	0.019
Variance components						
Random effects						
Level 1 (within subjects)	6.33			6.09		
Level 2 (between subjects)	257.92			256.55		
Fixed effects	61.43			63.74		
Residual	137.00			134.98		
Model AIC	7387.99			6765.17		
Number of observations	874			798		

Note. HF = housing first; CD-RISC2 = Connors-Davidson resilience Scale; AIC = Akaike information criterion.

^aCognitive factor scores entered as time-varying predictors in each model.

the need to consider the unique determinants of community functioning and QoL in the context of homelessness and mental illness.

In our study, additional descriptive analyses revealed improvements in cognitive functioning over time, likely attributable to practice effects (Wilson, Li, Bienias, & Bennett, 2006), though older individuals showed less improvement in processing speed and cognitive flexibility, which may signal vulnerability to longer-term decline (Gicas et al., 2020). We also observed that functional trajectories were characterized by a decline in community functioning and improvement in subjective QoL over the same 6-year period, a divergence possibly reflective of the 'disability paradox', which refers to the observation that people with significant and persistent disabilities tend to report experiencing good or excellent QoL (Albrecht & Devlieger, 1999).

Our findings corroborate what is generally seen in stably housed psychiatric populations in that domain-specific cognitive functions are modestly but consistently associated with community functioning and QoL, though previous meta-analyses have combined these outcome domains (Fett et al., 2011; Halverson et al., 2019) making it difficult to parse the unique cognitive contributions to each type of outcome. The current study is among the first to formally evaluate these differential associations

among homeless adults. Our findings of positive associations between cognition and community functioning are similar to those of Schutt, Seidman, Caplan, Martsinkiv, and Goldfinger (2007), who reported that better cognitive functioning was associated with better community functioning at 18 months of follow-up among 112 homeless individuals with severe mental illness who were randomly assigned to independent housing or a group home. Their findings also indicated that the cognitive effects were dependent on the type of housing, highlighting how cognitive strengths may be leveraged to optimize functioning within particular social contexts and housing accommodations. Likewise, our findings are consistent with Stergiopoulos, Burra, Rourke, and Hwang (2011) who reported that better performance on measures of verbal memory, processing speed, and executive functioning predicted functional capacity in a sample of psychiatric inpatients with schizophrenia that included 30 homeless persons and 21 demographic-matched housed controls. The authors found that cognitive flexibility was a particularly strong predictor of functional capacity relative to verbal memory; a pattern that was also observed in the current study. More recently, Mahmood et al. (2021) reported strong associations between domain-specific and global cognition and functional capacity in a sample of 100 homeless adults. In contrast, a report by Horan

et al. (2019) found no association between a global composite measure of cognition and community integration measured with the Role Functioning Scale in a sample of 176 homeless veterans. Heterogeneity in sample compositions and outcome measures are possible explanations for these discrepant findings.

In our study, there was no association between cognition and subjective QoL as initially expected. QoL is a multifaceted construct that is comprised of dissociable objective and subjective components (Fakhoury & Priebe, 2002). The objective component pertains to observable features of individuals and their particular environments (e.g. employment, functional capacity, housing stability) and is apt to be more closely related to concepts of community functioning, whereas the subjective component captures satisfaction with one's experience in those environments (Ruggeri, Bisoffi, Fontecedro, & Warner, 2001). In the context of the broader psychiatric literature, our findings correspond to the pattern of associations between cognition and QoL reported in studies that parsed the objective and subjective dimensions. Indeed, whereas cognition consistently shows a modest, positive association with objective QoL, non-significant or inverse associations with subjective QoL have been reported in persons with schizophrenia (Tolman & Kurtz, 2012). The level of insight has been proposed as an explanation for the discrepancies between objective and subjective QoL ratings in schizophrenia patients (Hayhurst, Massie, Dunn, Lewis, & Drake, 2014) and could explain the lack of association between cognition and subjective QoL in the current study given the high rates of mental disorders in this sample (Tolman & Kurtz, 2012).

Previous work with this sample found resilience to confer a protective effect against poor mental health outcomes in the context of ACEs (Liu et al., 2020). We hypothesized that it would operate similarly in relation to functional outcomes and that it might further interact with cognition to buffer against poor outcomes. While resilience appeared to have a protective effect on QoL, we did not find any modification effects. In a study by Fazeli, Moore, and Vance (2019), resilience was identified as a mediator of the association between cognition and instrumental activities of daily living in persons with HIV, suggesting that erosion of cognitive capacity may diminish one's level of resilience and in turn negatively impact everyday functional abilities. Although it may be worthwhile to explore resilience from this perspective in future studies, our study did not show any substantial correlations between the initial level of cognitive functioning and resilience (see online Supplementary Table S2) suggesting that they may be operating independently in this sample.

One of the main limitations of this study is that the cognitive evaluation was brief and we were, therefore, unable to examine other dimensions of cognitive functioning, such as sustained attention, inhibitory control, and decision making, which are known to be impaired in homeless persons (Gicas et al., 2014). We also did not evaluate social cognition, yet it has been shown to account for more unique variance in functional outcomes (Halverson et al., 2019; Horan et al., 2019) and is positively correlated with resilience among homeless veterans (Greenberg et al., 2019). While our approach aimed to capture the dynamic relationship between cognition and outcomes via longitudinal modelling adjusting for common physical and mental health comorbidities, there are likely a number of other dynamic risk factors that were not measured, such as new incidents of traumatic brain injury or viral infection, states associated with heightened clinical symptomatology (e.g. acute depressive or manic episodes, active psychosis), or protective factors that may enhance

functioning such as community integration. Nonetheless, the magnitude of positive associations between cognition and community functioning, and lack thereof for QoL, remained consistent over time. This suggests it is unlikely there was any substantial impact of unobserved time-dependent variables and instead suggests the impact of cognition on community functioning is likely to be reliable across time. Finally, it should be noted that homeless populations are inherently diverse and complex, and the heterogeneity of the demographic and clinical composition of any one sample will vary by geographic location making it difficult to generalize findings. The complexity of this population also makes it very difficult to recruit an adequate comparison group that has a similar demographic profile and life experience without the presence of psychiatric and physical illness comorbidities. However, this should not negate the value of examining the determinants of functioning within a local homeless community and the extent to which there are commonalities across communities. Given that cognition is a known predictor of functional outcomes across healthy and patient populations (Morgan & Heaton, 2009), our findings within a homeless sample should be considered broadly relevant to the neuropsychological literature.

Overall, cognition is a clear contributor to community functioning in homeless adults. Current interventions for homeless persons offer recovery-oriented programs that mainly address needs in the area of housing, income, mental illness, and substance use (Aubry et al., 2020). Cognitive rehabilitation does not appear to be a core feature of existing models of care, but the findings from the current study support the view that building cognitive capacity could further optimize community functioning, which may, in turn, contribute to community integration and exiting homelessness. We could only locate two studies that have explicitly examined cognitive remediation programs in homeless adults (Medalia, Herlands, & Baginsky, 2003) and youth (Medalia, Saperstein, Huang, Lee, & Ronan, 2017), and although the sample sizes were small, there was evidence for cognitive gains that were greater than expected by chance or for practice effects. Cognitive rehabilitation should be considered a priority for homeless persons. Future research in this area should be oriented around how existing cognitive interventions could be adapted for this population, which would ideally involve randomized control trials to establish treatment efficacy. Importantly, intervention effectiveness studies will also need to be carried out and should be done so within integrated models of health and social care to optimize functioning and overall well-being outcomes. There is also a need to conduct future research that characterizes a broader scope of cognitive functions, such as social cognition and prospective memory, that may offer incremental predictive validity regarding functional outcomes and will better inform the development of cognitive interventions. More broadly, future research should aim to increase the representation of homeless females and youth (<25 years old) to better understand how their unique experiences and vulnerabilities may impact functioning and recovery (Luchenski et al., 2018).

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/S0033291721001550>.

Acknowledgements. The authors wish to thank the study participants for their time and willingness to share their life experiences to make the At Home/Chez Soi study possible. We are also grateful for the At Home/Chez Soi study team, coordinators, and service providers at the Toronto site who contributed to study development, implementation, and follow-up.

Financial support. This study was supported by financial contributions from the Mental Health Commission of Canada, the Canadian Institutes of Health Research (SWH, VS, CIHR MOP-130405), and the Ontario Ministry of Health and Long-term Care (SWH, VS, HSRF #259).

Conflict of interest. None.

References

- Albrecht, G. L., & Devlieger, P. J. (1999). The disability paradox: High quality of life against all odds. *Social Science & Medicine*, 48(8), 977–988. doi: 10.1016/S0277-9536(98)00411-0.
- Aldridge, R. W., Story, A., Hwang, S. W., Nordentoft, M., Luchenski, S. A., Hartwell, G., & Hayward, A. C. (2018). Morbidity and mortality in homeless individuals, prisoners, sex workers, and individuals with substance use disorders in high-income countries: A systematic review and meta-analysis. *Lancet (London, England)*, 391(10117), 241–250. doi: 10.1016/S0140-6736(17)31869-X.
- Argintaru, N., Chambers, C., Gogosis, E., Farrell, S., Palepu, A., Klodawsky, F., & Hwang, S. W. (2013). A cross-sectional observational study of unmet health needs among homeless and vulnerably housed adults in three Canadian cities. *BMC Public Health*, 13(1), 577. doi: 10.1186/1471-2458-13-577.
- Aubry, T., Bloch, G., Brcic, V., Saad, A., Magwood, O., Abdalla, T., ... Pottie, K. (2020). Effectiveness of permanent supportive housing and income assistance interventions for homeless individuals in high-income countries: A systematic review. *Lancet Public Health*, 5(6), e342–e360. doi: 10.1016/S2468-2667(20)30055-4.
- Backer, T. E., & Howard, E. A. (2007). Cognitive impairments and the prevention of homelessness: Research and practice review. *The Journal of Primary Prevention*, 28(3), 375–388. doi: 10.1007/s10935-007-0100-1.
- Barbic, S. P., Jones, A. A., Woodward, M., Piercy, M., Mathias, S., Vila-Rodriguez, F., ... Honer, W. G. (2018). Clinical and functional characteristics of young adults living in single room occupancy housing: Preliminary findings from a 10-year longitudinal study. *Canadian Journal of Public Health*, 109(2), 204–214. doi: 10.17269/s41997-018-0087-9.
- Barker, S., Barron, N., McFarland, B. H., & Bigelow, D. A. (1994). A community ability scale for chronically mentally ill consumers: Part I. Reliability and validity. *Community Mental Health Journal*, 30(4), 363–383. doi: 10.1007/bf02207489.
- Barone, C., Yamamoto, A., Richardson, C. G., Zivanovic, R., Lin, D., & Mathias, S. (2019). Examining patterns of cognitive impairment among homeless and precariously housed urban youth. *Journal of Adolescence*, 72, 64–69. doi: 10.1016/j.adolescence.2019.02.011.
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67(1), 1–48. doi: 10.18637/jss.v067.i01.
- Benedict, R. H. B., Schretlen, D., Groninger, L., & Brandt, J. (1998). Hopkins verbal learning test – revised: Normative data and analysis of inter-form and test-retest reliability. *The Clinical Neuropsychologist*, 12(1), 43–55. doi: 10.1076/clin.12.1.43.1726.
- Brown, R. T., Guzman, D., Kaplan, L. M., Ponath, C., Lee, C. T., & Kushel, M. B. (2019). Trajectories of functional impairment in homeless older adults: Results from the HOPE HOME study. *PLoS One*, 14(8), e0221020.
- Brown, R. T., Kiely, D. K., Bharel, M., & Mitchell, S. L. (2012). Geriatric syndromes in older homeless adults. *Journal of General Internal Medicine*, 27(1), 16–22. doi: 10.1007/s11606-011-1848-9.
- Depp, C. A., Vella, L., Orff, H. J., & Twamley, E. W. (2015). A quantitative review of cognitive functioning in homeless adults. *The Journal of Nervous and Mental Disease*, 203(2), 126–131. doi: 10.1097/NMD.0000000000000248.
- Fakhoury, W. K. H., & Priebe, S. (2002). Subjective quality of life: It's association with other constructs. *International Review of Psychiatry*, 14(3), 219–224. doi: 10.1080/09540260220144957.
- Fazel, S., Geddes, J. R., & Kushel, M. (2014). The health of homeless people in high-income countries: Descriptive epidemiology, health consequences, and clinical and policy recommendations. *Lancet (London, England)*, 384(9953), 1529–1540. doi: 10.1016/S0140-6736(14)61132-6.
- Fazeli, P. L., Moore, R. C., & Vance, D. E. (2019). Resilience attenuates the association between neurocognitive functioning and everyday functioning in individuals aging with HIV in the Deep South. *International Journal of Geriatric Psychiatry*, 34(1), 72–78. doi: 10.1002/gps.4988.
- Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., ... Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The adverse childhood experiences (ACE) study. *American Journal of Preventive Medicine*, 14(4), 245–258. doi: 10.1016/S0749-3797(98)00017-8.
- Fett, A.-K. J., Viechtbauer, W., Dominguez, M.-G., Penn, D. L., van Os, J., & Krabbendam, L. (2011). The relationship between neurocognition and social cognition with functional outcomes in schizophrenia: A meta-analysis. *Neuroscience and Biobehavioral Reviews*, 35(3), 573–588. doi: 10.1016/j.neubiorev.2010.07.001.
- Fry, C. E., Langley, K., & Shelton, K. H. (2017). A systematic review of cognitive functioning among young people who have experienced homelessness, foster care, or poverty. *Child Neuropsychology: A Journal on Normal and Abnormal Development in Childhood and Adolescence*, 23(8), 907–934. doi: 10.1080/09297049.2016.1207758.
- Fry, C. E., Langley, K., & Shelton, K. H. (2020). Executive functions in homeless young people: Working memory impacts on short-term housing outcomes. *Child Neuropsychology*, 26(1), 27–53. doi: 10.1080/09297049.2019.1628930.
- Gentil, L., Grenier, G., Bamvita, J.-M., Dorvil, H., & Fleury, M.-J. (2019). Profiles of quality of life in a homeless population. *Frontiers in Psychiatry*, 10, 10. doi: 10.3389/fpsy.2019.00010.
- Gicas, K. M., Giesbrecht, C. J., Panenka, W. J., Lang, D. J., Smith, G. N., Vila-Rodriguez, F., ... Thornton, A. E. (2017). Structural brain markers are differentially associated with neurocognitive profiles in socially marginalized people with multimorbid illness. *Neuropsychology*, 31(1), 28–43. doi: 10.1037/neu0000304.
- Gicas, K. M., Jones, A. A., Thornton, A. E., Petersson, A., Livingston, E., Waclawik, K., ... Honer, W. G. (2020). Cognitive decline and mortality in a community-based sample of homeless and precariously housed adults: 9-year prospective study. *BJPsych Open*, 6(2), e21. doi: 10.1192/bjo.2020.3.
- Gicas, K. M., Vila-Rodriguez, F., Paquet, K., Barr, A. M., Procyshyn, R. M., Lang, D. J., ... Thornton, A. E. (2014). Neurocognitive profiles of marginally housed persons with comorbid substance dependence, viral infection, and psychiatric illness. *Journal of Clinical and Experimental Neuropsychology*, 36(10), 1009–1022. doi: 10.1080/13803395.2014.963519.
- Goering, P. N., Streiner, D. L., Adair, C., Aubry, T., Barker, J., Distasio, J., ... Zabkiewicz, D. M. (2011). The at Home/Chez Soi trial protocol: A pragmatic, multi-site, randomised controlled trial of a housing first intervention for homeless individuals with mental illness in five Canadian cities. *BMJ Open*, 1(2), e000323. doi: 10.1136/bmjopen-2011-000323.
- Gorman, A. A., Foley, J. M., Ettenhofer, M. L., Hinkin, C. H., & van Gorp, W. G. (2009). Functional consequences of HIV-associated neuropsychological impairment. *Neuropsychology Review*, 19(2), 186–203. doi: 10.1007/s11065-009-9095-0.
- Greenberg, J. M., Wynn, J. K., Lee, J., Hellemann, G., Gabrielian, S., & Green, M. F. (2019). Resilience in homeless veterans: Clinical and cognitive correlates. *Psychiatric Rehabilitation Journal*, 42(3), 314–322. doi: 10.1037/prj0000333.
- Halverson, T. F., Orleans-Pobee, M., Merritt, C., Sheeran, P., Fett, A.-K., & Penn, D. L. (2019). Pathways to functional outcomes in schizophrenia spectrum disorders: Meta-analysis of social cognitive and neurocognitive predictors. *Neuroscience and Biobehavioral Reviews*, 105, 212–219. doi: 10.1016/j.neubiorev.2019.07.020.
- Hayhurst, K. P., Massie, J. A., Dunn, G., Lewis, S. W., & Drake, R. J. (2014). Validity of subjective versus objective quality of life assessment in people with schizophrenia. *BMC Psychiatry*, 14, 365. doi: 10.1186/s12888-014-0365-x.
- Horan, W. P., Wynn, J. K., Gabrielian, S., Glynn, S. M., Hellemann, G. S., Kern, R. S., ... Green, M. F. (2019). Motivational and cognitive correlates of community integration in homeless veterans entering a permanent supported housing program. *American Journal of Orthopsychiatry*, 90(2), 181–192. doi: 10.1037/ort0000420.
- Hubley, A. M., Russell, L. B., Palepu, A., & Hwang, S. W. (2014). Subjective quality of life among individuals who are homeless: A review of current knowledge. *Social Indicators Research*, 115(1), 509–524. doi: 10.1007/s11205-012-9998-7.

- Hurstak, E., Johnson, J. K., Tieu, L., Guzman, D., Ponath, C., Lee, C. T., ... Kushel, M. (2017). Factors associated with cognitive impairment in a cohort of older homeless adults: Results from the HOPE HOME study. *Drug and Alcohol Dependence*, 178, 562–570. doi: 10.1016/j.drugalcdep.2017.06.002.
- Kushel, M. (2011). Older homeless adults: Can we do more? *Journal of General Internal Medicine*, 27(1), 5–6.
- Liu, M., Mejia-Lancheros, C., Lachaud, J., Nisenbaum, R., Stergiopoulos, V., & Hwang, S. W. (2020). Resilience and adverse childhood experiences: Associations with poor mental health among homeless adults. *American Journal of Preventive Medicine*, 58(6), 807–816. doi: 10.1016/j.amepre.2019.12.017.
- Luchenski, S., Maguire, N., Aldridge, R. W., Hayward, A., Story, A., Perri, P., ... Hewett, N. (2018). What works in inclusion health: Overview of effective interventions for marginalised and excluded populations. *Lancet (London, England)*, 391(10117), 266–280. doi: 10.1016/S0140-6736(17)31959-1.
- Mahmood, Z., Vella, L., Maye, J. E., Keller, A. V., Van Patten, R., Clark, J. M. R., ... Twamley, E. W. (2021). Rates of cognitive and functional impairments among sheltered adults experiencing homelessness. *Psychiatric Services*, 72, 333–337. doi: 10.1176/appi.ps.202000065.
- Medalia, A., Herlands, T., & Baginsky, C. (2003). Rehab rounds: Cognitive remediation in the supportive housing setting. *Psychiatric Services*, 54(9), 1219–1220. doi: 10.1176/appi.ps.54.9.1219.
- Medalia, A., Saperstein, A. M., Huang, Y., Lee, S., & Ronan, E. J. (2017). Cognitive skills training for homeless transition-age youth: Feasibility and pilot efficacy of a community based randomized controlled trial. *Journal of Nervous and Mental Disease*, 205(11), 859–866. doi: 10.1097/NMD.0000000000000741.
- Mejia-Lancheros, C., Lachaud, J., Woodhall-Melnik, J., O'Campo, P., Hwang, S. W., & Stergiopoulos, V. (2021). Longitudinal interrelationships of mental health discrimination and stigma with housing and well-being outcomes in adults with mental illness and recent experience of homelessness. *Social Science & Medicine*, 268, 113463. doi: 10.1016/j.socscimed.2020.113463.
- Morgan, E. E., & Heaton, R. K. (2009). Neuropsychology in relation to everyday functioning. In Grant, I., & Adams, K. M. (Eds.), *Neuropsychological assessment of neuropsychiatric and neuromedical disorders* (3rd ed., pp. 632–651). New York, NY: Oxford University Press.
- R Core Team. (2020). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>.
- Reitan, R. M. (1958). Validity of the trail making test as an indicator of organic brain damage. *Perceptual Motor Skills*, 8, 271–276. <https://journals.sagepub.com/doi/10.2466/pms.1958.8.3.271>.
- Ruggeri, M., Bisoffi, G., Fontecedro, L., & Warner, R. (2001). Subjective and objective dimensions of quality of life in psychiatric patients: A factor analytical approach: The south Verona outcome project 4. *British Journal of Psychiatry*, 178, 268–275. doi: 10.1192/bjp.178.3.268.
- Schutt, R. K., Seidman, L. J., Caplan, B., Martsinkiv, A., & Goldfinger, S. M. (2007). The role of neurocognition and social context in predicting community functioning among formerly homeless seriously mentally ill persons. *Schizophrenia Bulletin*, 33(6), 1388–1396. doi: 10.1093/schbul/sbm037.
- Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., ... Dunbar, G. C. (1998). The Mini-international neuropsychiatric interview (M.I.N.I.): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *The Journal of Clinical Psychiatry*, 59(Suppl 20), 22–33.
- Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modelling change and event occurrence*. New York, NY: Oxford University Press.
- Stergiopoulos, V., Burra, T., Rourke, S., & Hwang, S. (2011). Housing status as an independent predictor of functional capacity in patients with schizophrenia. *The Journal of Nervous and Mental Disease*, 199(11), 854–860. doi: 10.1097/NMD.0b013e3182349cfc.
- Stergiopoulos, V., Cusi, A., Bekele, T., Skosireva, A., Latimer, E., Schütz, C., ... Rourke, S. B. (2015). Neurocognitive impairment in a large sample of homeless adults with mental illness. *Acta Psychiatrica Scandinavica*, 131(4), 256–268. doi: 10.1111/acps.12391.
- Stergiopoulos, V., Naidu, A., Schuler, A., Bekele, T., Nisenbaum, R., Jbilou, J., ... Rourke, S. B. (2019). Housing stability and neurocognitive functioning in homeless adults with mental illness: A subgroup analysis of the At Home/ Chez Soi study. *Frontiers in Psychiatry*, 10, 865. doi: 10.3389/fpsy.2019.00865.
- Tolman, A. W., & Kurtz, M. M. (2012). Neurocognitive predictors of objective and subjective quality of life in individuals with schizophrenia: A meta-analytic investigation. *Schizophrenia Bulletin*, 38(2), 304–315. doi: 10.1093/schbul/sbq077.
- Tsui, J. I., Bangsberg, D. R., Ragland, K., Hall, C. S., & Riley, E. D. (2007). The impact of chronic hepatitis C on health-related quality of life in homeless and marginally housed individuals with HIV. *AIDS and Behavior*, 11(4), 603–610. doi: 10.1007/s10461-006-9157-8.
- Uttaro, T., & Lehman, A. (1999). Graded response modeling of the quality of life interview. *Evaluation and Program Planning*, 22(1), 41–52. doi: 10.1016/S0149-7189(98)00039-1.
- Vaishnavi, S., Connor, K., & Davidson, J. R. T. (2007). An abbreviated version of the Connor-Davidson resilience scale (CD-RISC), the CD-RISC2: Psychometric properties and applications in psychopharmacological trials. *Psychiatry Research*, 152(2), 293–297. doi: 10.1016/j.psychres.2007.01.006.
- Vila-Rodriguez, F., Panenka, W. J., Lang, D. J., Thornton, A. E., Vertinsky, T., Wong, H., ... Honer, W. G. (2013). The hotel study: Multimorbidity in a community sample living in marginal housing. *American Journal of Psychiatry*, 170(12), 1413–1422. doi: 10.1176/appi.ajp.2013.12111439.
- Waclawik, K., Jones, A. A., Barbic, S. P., Gicas, K. M., O'Connor, T. A., Smith, G. N., ... Thornton, A. E. (2019). Cognitive impairment in marginally housed youth: Prevalence and risk factors. *Frontiers in Public Health*, 7, 270. doi: 10.3389/fpubh.2019.00270.
- Wechsler, D. (1981). *Manual for the Wechsler adult intelligence scale-revised*. Psychological Corporation.
- Wilson, R. S., Li, Y., Bienias, J. L., & Bennett, D. A. (2006). Cognitive decline in old age: Separating retest effects from the effects of growing older. *Psychology and Aging*, 21(4), 774–789. doi: 10.1037/0882-7974.21.4.774.