

The health and housing in transition study: a longitudinal study of the health of homeless and vulnerably housed adults in three Canadian cities

Stephen W. Hwang · Tim Aubry · Anita Palepu · Susan Farrell ·
Rosane Nisenbaum · Anita M. Hubley · Fran Klodawsky · Evie Gogosis ·
Elizabeth Hay · Shannon Pidlubny · Tatiana Dowbor · Catharine Chambers

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Abstract

Objectives While substantial research has demonstrated the poor health status of homeless populations, the health status of vulnerably housed individuals is largely unknown. Furthermore, few longitudinal studies have assessed the impact of housing transitions on health. The health and housing in transition (HHiT) study is a prospective cohort study that aims to track the health and housing status of a representative sample of homeless and vulnerably housed single adults in three Canadian cities (Toronto, Ottawa, and Vancouver). This paper discusses the HHiT study methodological recruitment strategies and follow-up procedures, including a discussion of the limitations and challenges experienced to date.

Methods Participants ($n = 1,192$) were randomly selected at shelters, meal programmes, community health centres, drop-in centres, rooming houses, and single-room occupancy hotels from January to December 2009 and are being re-interviewed every 12 months for a 2-year period. **Results** At baseline, over 85% of participants reported having at least one chronic health condition, and over 50% reported being diagnosed with a mental health problem. **Conclusions** Our findings suggest that, regardless of housing status, participants had extremely poor overall health.

Keywords Homeless persons · Vulnerable populations · Housing · Health · Mental health · Quality of life · Longitudinal studies

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S. W. Hwang (✉) · R. Nisenbaum · E. Gogosis · T. Dowbor ·
C. Chambers
Centre for Research on Inner City Health, The Keenan Research
Centre at the Li Ka Shing Knowledge Institute, St. Michael’s
Hospital, 30 Bond Street, Toronto, ON M5B 1W8, Canada
e-mail: hwangs@smh.ca

S. W. Hwang
Division of General Internal Medicine, Department of Medicine,
University of Toronto, Toronto, ON, Canada

T. Aubry · E. Hay
Centre for Research on Educational and Community Services,
University of Ottawa, Ottawa, ON, Canada

A. Palepu · S. Pidlubny
Centre for Health Evaluation and Outcome Studies,
Division of General Internal Medicine, University of British
Columbia, Vancouver, BC, Canada

S. Farrell
Royal Ottawa Health Care Group, Ottawa, ON, Canada

A. M. Hubley
Measurement, Evaluation, and Research Methodology,
Department of Educational and Counselling Psychology,
and Special Education, University of British Columbia,
Vancouver, BC, Canada

F. Klodawsky
Department of Geography and Environmental Studies,
Carleton University, Ottawa, ON, Canada

Introduction

Homelessness, defined as living in a shelter, on the street, in other places not intended for human habitation, or in temporary accommodations with family or friends, is an increasingly visible problem that affects thousands of Canadians (Hwang 2001). On any given night, about 5,000 people in Toronto, 900 people in Ottawa, and 2,700 people in Vancouver are homeless (City of Toronto 2009; Dinning and Davis 2008; SPARC BC et al. 2008). Over the course of a year, an estimated 150,000–300,000 Canadians will experience homelessness (Laird 2007; Human Resources and Skills Development Canada 2010). Less visible, but equally important, are the large number of people in Canada who are ‘vulnerably housed’, a term that includes low-income, socially marginalized individuals living in single room occupancy (SRO) hotels and rooming houses. These individuals often have unstable living arrangements, resulting in frequent transitions between homelessness and vulnerable housing. For many, homelessness is an episodic, often temporary, experience as opposed to a chronic state (Aubry and Klodawsky 2003; Culhane et al. 1994).

Housing is a key social determinant of health. A substantial body of research over the last two decades has shown that single adults who experience episodes of homelessness suffer from high rates of physical and mental illness, substance abuse, injuries and assaults, and mortality (Aubry et al. 2011; Frankish et al. 2005; Hwang and Dunn 2005). A recent longitudinal study of Canadian adults found that mortality rates from all causes were 2.01 times higher among men living in shelters, rooming houses, and hotels compared to men in the general population and 1.79 times higher among women (Hwang et al. 2009).

The majority of studies on housing and health among homeless and vulnerably housed populations have used a cross-sectional design, despite the fact that housing status is a dynamic state with frequent transitions between homelessness and vulnerable housing. We identified a relatively small number of studies that accounted for longitudinal changes in the health and housing status of representative samples of homeless populations over time (Table 1).

Overall, previous research demonstrates that a substantial number of homeless individuals make a transition into some form of housing over follow-up periods ranging from 18 to 60 months. However, most of these studies have been conducted in the United States, and extrapolation of these findings to others settings is problematic for a number of reasons, not the least of which is the different health care systems that operate in the two countries. In Canada, homeless individuals retain their access to health care, in contrast to the United States, where more than half of all homeless people do not have health insurance (Kushel et al. 2001). Other factors that highlight the need for

additional data include the substantial differences between the United States and other countries in terms of ethnicity and race, climate, housing markets, social housing policies, extent of the social safety net, and severity of geographic concentration of extreme urban poverty (Dunn et al. 2005; Ross et al. 2000, 2005). For these reasons, longitudinal research of homeless and vulnerably housed people from settings such as Canada is needed to better understand the complex connections between housing and health.

The health and housing in transition (HHiT) study is a longitudinal cohort study that aims to track the health and housing status of a representative sample of homeless and vulnerably housed single adults in three Canadian cities (Toronto, Ottawa, and Vancouver) over a two-year follow-up period. The specific objectives of this study are:

1. To determine the incidence of housing transitions in these populations, defined as (a) the rate at which homeless individuals exit homelessness, (b) the rate at which vulnerably housed individuals become homeless, and (c) the rate at which vulnerably housed individuals attain residential stability by the end of the follow-up period;
2. To identify risk factors and individual, interpersonal, and community-level resources associated with (a) the attainment of residential stability among homeless individuals, (b) the onset of homelessness among vulnerably housed individuals, and (c) the attainment of residential stability among vulnerably housed individuals; and
3. To ascertain whether changes in housing status are associated with subsequent changes in physical and mental health functioning and major health determinants (including access to health care, alcohol and drug use, food security, and social supports).

Methods

Study setting

Toronto, Ottawa, and Vancouver are large, urban cities in Canada that vary in terms of their climate, geographic location, population size, and housing markets. Vancouver (pop. 2.2 million) is located in the province of British Columbia, on the west coast of Canada. Toronto (pop. 5.4 million) and Ottawa (pop. 1.2 million) are located in the province of Ontario in eastern Canada, approximately 3,500 km from British Columbia. Average monthly rents for a private one-bedroom apartment in these three cities range from \$853 to \$926 CDN, while vacancy rates range from 1.4 to 3.0% (Canada Mortgage and Housing Corporation 2009). Social assistance rates range between \$585 and \$610 CDN per month for a single adult and between

Table 1 Summary of longitudinal studies (follow-up ≥ 12 months) of representative samples of homeless single adults

Author (year)	Citation	City	Population description (n)	Follow-up duration	Follow-up rate	Housing status at the end of follow-up	Observed housing and health associations
<i>U.S. studies</i>							
Buchanan et al. (2009) ^a	Am J Public Health 99 Suppl 3: S675–S680	Chicago, IL	HIV-positive homeless inpatients (n = 105) Race/ethnicity: 88% African-American, 4% Latino, 3% White, 4% Other	12 months	83%	Among the 54 participants in the intervention group, 39 (72%) reached interim housing and 35 (65%) reached permanent housing	Survival with intact immunity was higher among participants receiving permanent housing with intensive case management (vs. usual care) at 12-month follow-up A significantly higher proportion of participants in the intervention group had undetectable viral loads at the end of follow-up
Caton et al. (2005); Schanzer et al. (2007)	Am J Public Health 95:1753–1759; Am J Public Health 97:464–469	New York City, NY	Newly homeless adults (n = 445) Race/ethnicity: 62% African-American, 18% Hispanic, 20% White or Other	18 months	85%	307 participants (81%) returned to community housing during the follow-up period	Younger age, better psychosocial adjustment, recent or current employment, adequate family support, earned income, no current drug treatment, and no arrest history were associated with shorter duration of homelessness Significant improvements in health status (visual, dental, podiatric, and blood pressure) were observed over the follow-up period. The use of health care services was comparable among those who found housing and those who remained homeless
Cohen et al. (1997)	Gerontologist 37:67–74	New York City, NY	Older homeless female adults (n = 237) Race/ethnicity: 51% African-American, 34% White, 10% Hispanic	24 months	85%	94 participants (47%) achieved stable housing	Higher perceived social supports and greater contact with community agencies were associated with achievement of stable housing
Dasinger and Speigman (2007)	AIDS Behav 11:128–139	San Francisco Bay Area, CA	Very low income people with HIV or AIDS and their families (n = 185); eligible controls (n = 218) Race/ethnicity: 60% Black, 28% White, 8% Hispanic, 4% Asian/Pacific Islander, 1% Native American	Max. 4 years, 8 months	Not reported	99% of participants (vs. 65% of controls) maintained rental housing at 6 month follow-up; 99% (vs. 32%) at 1 year follow-up; 96% of participants (vs. 10%) at 2 year follow-up	Adjusted hazard ratio for time spent in independent rental housing was 3.8 times higher among participants vs. controls; time spent in rental housing significantly lower among individuals with mental health issues or hepatitis
Sadowski et al. (2009)	JAMA 301:1771–1778	Chicago, IL	Homeless adults with chronic medical illnesses (n = 405) Race/ethnicity: 78% African-American, 8% Hispanic, 8% White, 5% Mixed or other	18 months	90% for intervention group and 73% for usual care group (excl. deaths)	116 participants (66%) in the intervention group (vs. 10 in usual care group) reached stable housing	Compared to the usual care group, participants receiving housing and case management had reduced hospitalizations, hospital days, and emergency department visits during the follow-up period

Table 1 continued

Author (year)	Citation	City	Population description (n)	Follow-up duration	Follow-up rate	Housing status at the end of follow-up	Observed housing and health associations
Schwarz et al. (2009)	BMC Public Health 9:220	San Francisco, CA	Homeless adults and adolescents (≥ 13 years old) diagnosed with AIDS ($n = 676$) Race/ethnicity: 41% White, 39% Black, 16% Latino, 4% Other	Various (over a 10-year period)	Not reported	70 participants (10%) received stable housing	Obtaining stable housing was associated with an 80% reduction in mortality
Toro et al. (1997) ^a	J Consult Clin Psychol 65:476–484	Buffalo, NY	Homeless adults and families ($n = 202$), of whom 158 were single adults Race/ethnicity: 54% African-American, 34% White, 11% Other	18 months	49%	Controlled study of an intervention (intensive case management). In the control group, number of days homeless in the last 6 months decreased from 95 to 10 days	In the control group, little change was observed in housing quality despite a decrease in number of days homeless In the intervention and control groups combined, significant improvements were observed over time in physical health and stressful life events
Weinreb et al. (2006)	J Health Care Poor Underserved 17:180–199	Worcester, MA	Low-income housed and homeless female adults ($n = 436$) Race/ethnicity: 41% White, 32% Hispanic, 19% African-American	24 months	70%	Not reported	Associations between housing and health status were not reported Poor health status, non-white race, and few social supports were associated with frequent emergency department visits
Wolitski et al. (2010); ^a	AIDS Behav 14:493–503;	Baltimore, MD;	Homeless and unstably housed persons living with HIV/AIDS ($n = 630$)	18 months	85%	82% of participants in the intervention group (rental assistance with case management) were in stable housing in the past 90 days compared to 51% for participants in control group (usual care with case management)	Significantly greater improvements in housing stability in intervention vs. control group. Significant treatment effect observed for depression, perceived stress, and SF-12 physical health
Kidder et al. (2007) ^a	AIDS Behav 11:149–161	Los Angeles, CA	Race/Ethnicity: 78% Black, 22% Other				Being homeless for at least 1 night in the past 90 days was associated with more ER visits, higher perceived stress, and higher detectable viral load
Zlotnick et al. (1999);	J Community Psychol 27:209–224;	Alameda County, CA	Homeless adults ($n = 564$) Race/ethnicity: 68% African-American, 22% White, 9% Other	15 months	70%	80% of participants exited from homelessness at least once, but only 15% obtained stable housing	Shorter duration of homelessness, consistent receipt of entitlement benefits, and obtaining government subsidized housing were associated with obtaining stable housing
Zlotnick et al. (2003)	Subst Use Misuse 38:577–599						
<i>Canadian studies</i>							
Aubry et al. (2003);	City of Ottawa;	Ottawa, ON	Mixed population of homeless youth, single adults, and families ($n = 412$), of whom 160 were single adults	24 months	62%	47% of single men and 73% of single women obtained housing	Physical and mental health did not change significantly among people who obtained housing
Aubry et al. (2007);	University of Ottawa;					Only 10% of housed single men were in subsidized housing	Higher quality of housing, as perceived by respondents at follow-up, was related to positive changes in mental health functioning
Aubry et al. (2011)	Am J Community Psychol 2011 May 10 [Epub ahead of print]						

Table 1 continued

Author (year)	Citation	City	Population description (n)	Follow-up duration	Follow-up rate	Housing status at the end of follow-up	Observed housing and health associations
Palepu et al. (2010)	PLoS One 5:e11697	Vancouver, BC	Homeless and vulnerably-housed injection drug users (n = 992)	Min. 12 months; Max. 48 months	Not reported	211 participants (21%) attained stable housing during the follow-up period	Daily crack use, daily heroine injection use, and current enrolment in addiction treatment at baseline were negatively associated with attaining stable housing
Roy et al. (2003); Roy et al. (2010)	J Urban Health 80:92–105; J Urban Health 87:95–101	Montreal, QC	Cohort 1: Street youth, aged 14–25 years; Cohort 2: Street youth aged 14–23 years (n = 1,687)	Average of 33 months (Cohort 1)	87% completed at least 1 follow-up (Cohort 1)	Not reported	Youths who reported recent homelessness at a follow-up visit had an adjusted mortality hazard ratio of 3.0 during the subsequent observation period for Cohort 1 and 2.8 for Cohort 2. Standardized mortality ratios compared to the general population were 11.6 for Cohort 1 and 3.0 for Cohort 2. Mortality rates were significantly lower among Cohort 2
<i>International studies</i>							
Fichter and Quadffieg (2003); Fichter and Quadffieg (2005)	Subst Use Misuse 38:395–427; Eur Arch Psychiatry Clin Neurosci 255:111–120	Munich, Germany	Homeless male adults (n = 265) Race/ethnicity: Not reported	36 months	75%	103 participants (56%) achieved stable housing	Men with lower education, history of inpatient alcohol treatment, no history of inpatient psychiatric hospitalization, and shorter duration of homelessness were more likely to remain homeless
Solorio et al. (2008); Rosenthal et al. (2007)	J Adolesc Health 42:401–409; AIDS Behav 11:831–841	Los Angeles, CA; Melbourne, Australia	Newly homeless youth aged 12–20 (n = 261 in Los Angeles; n = 165 in Melbourne) Race/ethnicity (Los Angeles data only): 47% Hispanic, 21% African American, 17% White, 15% other ethnicities	24 months	Los Angeles: 70% Melbourne: 79%	59 (32%) youth in Los Angeles and 31 youth (24%) in Australia had experienced ≥5 moves during follow-up	Drug use at the 24 month assessment was associated with an increased number of moves during follow-up Among males, living in a non-family setting was associated with more sexual partners and among females living in a non-family setting was associated with decreased odds of always using condoms (Los Angeles data only)

^a Studies that examined the effects of an intervention

\$906 and \$1,053 CDN per month for a single adult with a disability (City of Toronto 2010; Ministry of Housing and Social Development 2007). As can be seen in these figures, affording a market-rent unit is moderately to extremely difficult for an individual living on social assistance. As a result, many marginalized individuals depend on a limited supply of lower-cost alternative housing, such as SRO hotels (in Vancouver) and rooming houses (in Toronto and Ottawa) to meet their shelter needs.

Target populations

Participants were eligible for the study if they were age 18 years or older and did not live with a partner or dependent child (i.e. were single adults). Participants were considered homeless if they were currently living in a shelter, public place, vehicle, abandoned building, or someone else's place and did not have their own place. Participants were considered vulnerably housed if they reported living in their own room, apartment, or place *and* had been homeless in the past 12 months and/or had two or more moves in the past 12 months. Participants who were temporarily living with friends and family and were paying rent were considered vulnerably housed, while those who were not paying rent were considered homeless. Full-time students and individuals who were visiting the city for less than or equal to 3 months were excluded.

Recruitment strategy

Participants were recruited between January and December 2009. We aimed to recruit 600 homeless and 600 vulnerably housed single adults in total (200 homeless and 200 vulnerably housed participants in each of the three cities); however, due to some participants completing more than one interview (using a different name), our final sample was 1,192 participants. In instances where duplicate interviews were identified, we included the first interview only.

Our sampling plan for recruiting homeless adults was adapted from the design proposed by Ardilly and Le Blanc (2001). Recruitment of homeless adults took place at both shelters and meal programmes. Because the purpose of recruitment at meal programmes was to recruit homeless people who did not use shelters, single adults at meal programmes were eligible if they were homeless but had not stayed at a shelter more than three nights in the last 7 days. The target number of homeless participants recruited at meal programmes was proportional to the approximate number of homeless adults in each city who slept on the street.

Homeless participants were sampled using a two-stage cluster strategy. Primary sampling units included all

shelters and meal programmes in each city. In the first stage of sampling, shelters were randomly selected according to probabilities proportional to the number of shelter beds (Kish 1995). Meal programmes were selected through a similar process based on location and the estimated number of individuals who were served meals each week. At shelters, participants were selected on the basis of their bed number using a random number list. At meal programmes, research and agency staff screened individuals who were in the meal line or had used the meal programme and were in the vicinity of the site and invited those eligible to participate.

The sampling frame for recruiting vulnerably housed participants included all official SROs in Vancouver and licensed rooming houses in Toronto and Ottawa. At SROs and rooming houses where our research team could gain access, we approached all individuals who were living at the site and who were available at the time of the site visit. Due to feasibility challenges associated with sampling at SROs and rooming houses (see 'Discussion'), the target number of vulnerably housed participants (200 in each city) could not be recruited at these sites. Our sampling strategy for recruitment of vulnerably housed participants was therefore modified to include meal programmes, drop-ins centres, and community health centres in the sampling frame.

Selected individuals were told about the nature of the study and assessed for their eligibility and willingness to participate. Individuals who declined to participate or who were not available at the time of recruitment were not re-contacted and were replaced by another randomly selected individual at that site. Duplicate interviews that were identified during the recruitment period were replaced with interviews from another randomly selected individual. All eligible and willing participants provided informed consent and were reimbursed for their time (\$20 CDN) following the baseline interview and at each subsequent interview. Ethical approval for this study was obtained from the Research Ethics Board at St. Michael's Hospital (Toronto), the University of Ottawa, and the University of British Columbia (Vancouver).

Follow-up procedures

At the present time, participants are being re-interviewed approximately every 12 months over the 2-year period following their baseline interview. The goal of our study is to achieve an 80% retention rate, using methods shown to be effective at tracking and retaining homeless and vulnerably housed participants (McKenzie et al. 1999). Efforts were made to establish trust and rapport with participants at first contact and to explain the importance of their participation in follow-up interviews. At the time of enrolment,

participants were asked to provide contact information not only for themselves but also for friends, relatives, service providers, and case workers who were most likely to know their future whereabouts and who could be contacted in order to locate them. Participants were asked to give consent for municipal social services departments, hospitals, homeless shelters, prisons, and treatment centres to disclose their updated contact information to the research team (Aubry et al. 2004, 2007; Aubry and Klodawsky 2003). Tracking efforts were modified during the study period and were further tailored to the individual circumstances in each city.

Survey instrument

Data were obtained using structured in-person interviews, which took approximately 60–90 min to complete. The survey instrument (Table 2) contains validated scales and questions that were selected on the basis of relevance to and previous successful use among homeless and vulnerably housed people, having very good to excellent psychometric properties, being sensitive to change over time, and being easy to administer. Open-ended questions were also included to further probe participants' understandings of causal interactions between homelessness and health. A pilot study conducted in 2007 included 55 participants and demonstrated the feasibility of sampling, recruitment, and survey administration strategies. Based on our experiences during pilot testing, the questionnaire was shortened and revised for greater reliability and ease of administration.

Age was calculated by subtracting the participants' reported date of birth from their date of interview. Health status was assessed using the Short Form 12-item health survey (SF-12), which provided reliable physical and mental health summary measures, according to the publishers' specifications (Ware et al. 1995). SF-12 Summary Component Scores range continuously from 13 to 69 for physical health (PCS) and 10 to 70 for mental health (MCS) and are standardized to the general population in the United States (mean score of 50 and standard deviation of 10) (Ware et al. 1995). Higher scores represent better overall health status. Health conditions, use of health services, and barriers to accessing health care were assessed using self-report items adapted from the National Survey of Homeless Assistance Providers and Clients (Burt et al. 1999) and the Canadian Community Health Survey (Statistics Canada 2010). A history of previous mental health diagnoses was assessed through self-report.

Alcohol abuse was assessed using the Alcohol Use Disorders Identification Test (AUDIT), which is used to identify the preliminary signs of hazardous drinking and mild dependence, and scores were calculated according to

the publisher's specifications (Babor et al. 2001; Piccinelli et al. 1997). AUDIT scores of eight or more were considered indicative of hazardous or harmful alcohol use, as well as possible alcohol dependence. Drug abuse and the degree of problems related to drug use were assessed using the 10-item version of the Drug Abuse Screening Test (DAST-10), and scores were calculated according to the publisher's specifications (Gavin et al. 1989). DAST-10 scores of three or higher were considered indicative of moderate, substantial, or severe drug use problems. The use of injection and non-injection drugs was assessed using items developed by Roy et al. (2004). Smoking was assessed using items from the Canadian Community Health Survey (Statistics Canada 2010).

Quality of life was assessed using two complementary instruments. The Quality of Life for Homeless and Hard to House Individuals (QoLHHI) Instrument addresses general and specific quality of life issues that have been identified as important to homeless people (Hubley et al. 2009; Russell et al. 2008). The EuroQol (EQ-5D) is a standardized health-related quality of life instrument that generates a weighted composite score reflecting the preference value associated with a given health state, and a global rating of current health using a visual analogue scale (VAS) (Krabbe and Weijnen 2003; Rabin and de Charro 2001). EQ-5D scores range between -0.11 and 1.00 for the U.S. general population, where a score of 0.0 represents death and 1.0 represents perfect health (Shaw et al. 2005). VAS scores range from 0 to 100 . Further details regarding participants' perceptions and experiences about various aspects of their lives (e.g. food quality/availability, neighbourhood, etc.) were obtained through open-ended questions.

Social support was assessed using two instruments: (1) the Social Provisions Scale, which examines the provision of social relationships (Cutrona and Russell 1987) and (2) the Social Support Network Inventory (SSNI), a self-report questionnaire that measures the size of a person's social network and perceived social support (Flaherty et al. 1983). Social services utilization in the past 12 months was assessed through self-report.

Housing status over the preceding 2 years was determined using the Housing Timeline Follow-Back Calendar (HTFBC), a validated method that allows for the collection of detailed and accurate information on housing history (Tsemberis et al. 2007). The Housing Quality Score developed by Toro et al. (1995) was used to determine the self-reported quality of the current living environment in terms of comfort, safety, spaciousness, privacy, friendliness, and overall quality. If the participant was housed, we determined whether they were living in market-rent or subsidized rent-g geared-to-income housing using questions developed for the Ontario Community Mental Health Evaluation Initiative (Dewa et al. 2002; Dewa et al. 2004).

Table 2 Components of baseline survey instrument for the health and housing in transition (HHIT) study

Category/variable	Measure(s) utilized	Selected survey question(s)	Values	Scales
<i>Demographics</i>				
Sex	Self-report	Your gender is...?	Male/Female/Transgendered	
Age	Self-report	What is your date of birth?	Years	
Marital status	Self-report	What is your marital status?	Single, never married/Separated, divorced/Widowed/Married, incl. common law/Partnered	
Relationship status	Self-report	Do you have a partner?	Yes/No	
Race	Self-report	To which racial or cultural group(s) do you belong?	White/Black/First Nations/East Asian/South Asian/Southeast Asian/West Asian/Hispanic/Other	
Country of birth	Self-report	What country were you born in?	Citizen/Landed Immigrant/Refugee	
Citizenship	Self-report	What is your citizenship status?	Days/Weeks/Months/Years	
Length of time in [Toronto, Ottawa, Vancouver]	Self-report	How long have you lived in [Toronto, Ottawa, Vancouver]?	English/French/Other	
Language first learned at home	Self-report	What is the language that you first learned at home and still understand?		
<i>Housing</i>				
Proportion of time housed	HTFBC ^a	Tell me where you have been living for the past 2 years	Detailed housing history	
History of homelessness	Self-report	Have you ever been homeless? How old were you the first time you were homeless? Excluding the past 2 years, how many days, weeks, months, or years have you been homeless? Were you homeless with your family?	Yes/No Age Length of time Yes/No	
<i>Individual resources</i>				
Education	Self-report	How much school have you completed? Are you currently enrolled in a school or training programme?	Elementary/Middle school/High school/Post-secondary Full-time/Part-time	
Employment	Self-report	Have you worked at a paid job? Hours/week How many different paid jobs did you have? What are your sources of income?	Yes/No Number of hours Number of paid jobs Type and amount per month	
Income	Self-report			
<i>Interpersonal resources</i>				
Social network size	SSNI ^b	Are there any people with whom you feel at ease and can talk to about personal issues?	Number of persons identified and relationship to individual	Count
Provision of social relationships	SPS ^c (8 items)	If something went wrong, no one would help me	Strongly Agree/Agree/Disagree/Strongly Disagree	Total score (range: 8–32)

Table 2 continued

Category/variable	Measure(s) utilized	Selected survey question(s)	Values	Scales
<i>Community resources</i>				
Social service use	Self-report	Which services did you use?	Type and services used	
Subsidized housing	Self-report Cross-reference municipal list	Is your rent subsidized?	Number of times used Yes/No	
<i>Risk factors</i>				
Physical health	SF-12 ^d (12 items) EQ-5D ^e (5 items)	In general, would you say your health is...? Describe your health in terms of mobility, self-care, usual activities, pain, anxiety	Excellent/Very good/Good/Fair/Poor No problems/Some problems/Unable	Weighted score (range: 13–69) Weighted score (range: –0.11–1.00) Range: 0–100
Overall satisfaction (quality of life)	VAS ^f NSHAPC ^g CCHS ^h	Rate your state of health Do you have any of the following medical conditions? Have you had a...Toothache? Pain in/around the jaw joints? Other pain in the mouth?	Yes/No Yes/No	
Impact of current health	QoLHHI ⁱ (13 items) QoLHHI ⁱ (12 items)	How do you feel about your current health Rate the impact of your physical health on you	Very dissatisfied–Very satisfied Large negative impact–Large positive impact	Average score (range: 1–7) Average score (range: 1–7)
Mental health	SF-12 ^d (12 items) Self-report	How much of the time have you felt down? Have you been diagnosed with a mental health problem? If yes, what was the diagnosis?	All of the time–None of the time Yes/No List of diagnoses	Weighted score (range: 10–70)
Unmet need for care	Self-report	Do you have a regular medical doctor? Have you needed care but were not able to get help? What were the reasons you were unable to get help?	Yes/No Yes/No List of reasons	
Cigarette smoking	CCHS ^h	How often do you smoke?	Daily/Occasionally/Not at all	
Substance use	Self-report	Which drugs have you used/injected?	List of drugs used, frequency of use, and injected use	
Legal and other events	AUDIT ^j (10 items) DAST-10 ^k (10 items) Montreal Street Youth Study Self-report	How often did you have a drink containing alcohol? Did you abuse more than one drug at a time? What types of resources did you use for your alcohol/drug use problems? Were you...Arrested by the police? Incarcerated? Beaten or physically attacked? Forced into unwanted sex?	Never–4 or more times per week Yes/No List of resources and frequency of use Yes/No Number of times	Total score (range: 0–40) Total score (range: 0–10)
Housing and neighbourhood quality	HIST ^l (6 items)	How would you rate the place where you currently live in terms of...Comfort? Safety? Spaciousness? Privacy? Friendliness? Quality?	Very bad/Bad/Somewhat bad/ Neither good nor bad/Somewhat good/Good/Very good	Total score (range: 7–49)

Table 2 continued

Category/variable	Measure(s) utilized	Selected survey question(s)	Values	Scales
Satisfaction with place currently living or staying	QoLHHI ⁱ (14 items)	How do you feel about the place you currently live or stay?	Very dissatisfied–Very satisfied	Total score (range: 0–28)
Impact of place currently living or staying	QoLHHI ⁱ (1 item)	Rate the impact of the place where you live or stay on you	Large negative impact–Large positive impact	Total score (range: 0–10)
Satisfaction with neighbourhood	QoLHHI ⁱ (5 items)	Do you feel safe in your neighbourhood?	Yes/No/Yes and No	Total score (range: 0–10)
Impact of neighbourhood	QoLHHI ⁱ (1 item)	Rate the impact of your neighbourhood on you	Large negative impact–Large positive impact	Total score (range: 0–10)
Satisfaction with food	QoLHHI ⁱ (5 items)	Are you usually able to get food that you like?	Yes/No/Yes and No	Total score (range: 0–10)
Impact of food	QoLHHI ⁱ (1 item)	Rate the impact that the food you eat has on you	Large negative impact–Large positive impact	Total score (range: 0–10)

^a Housing Timeline Follow-Back Calendar

^b Social Support Network Instrument

^c Social Provisions Scale

^d 12-item Short Form Health Survey

^e EuroQoL 5-Dimension Questionnaire

^f EuroQoL 5-Dimension Visual Analogue Scale

^g National Survey of Homeless Assistance Providers and Clients

^h Canadian Community Health Survey

ⁱ Quality of Life for Homeless and Hard-to-House Individuals Instrument

^j Alcohol Use Disorders Identification Test

^k 10-item Drug Abuse Screen Test

^l Toro's Housing, Income, and Services Timeline (HIST) Instrument

Additional open-ended questions were included to explore participants' past experiences of housing and homelessness, and their perception of the links between housing and health.

Statistical analyses

Comparisons were made between participants who were homeless at baseline to those who were vulnerably housed. The two-sample *t* test was used for continuous variables, and Chi-square test was used for categorical variables. In instances where distributions for continuous variables were skewed, the nonparametric Wilcoxon rank-sum test was used. All analyses were performed using SAS statistical software version 9.2 (SAS Institute, Cary, NC).

Results

In total, 1,192 participants were recruited into our study: 396 (33.2%) in Vancouver, 399 (33.5%) in Toronto, and 397 (33.3%) in Ottawa. Our final sample consisted of 595 (49.9%) homeless participants and 597 (50.1%) vulnerably housed participants. Selected baseline comparisons between homeless and vulnerably housed participants are provided in Table 3. Significant differences between the two groups were noted for certain demographic characteristics. Compared to homeless participants in our sample, vulnerably housed participants were more likely to be born in Canada, be of First Nations/Aboriginal ethnicity, and have lower education levels. Vulnerably housed participants were less likely to be female; however, this difference likely results from our sampling design, which over-sampled females at homeless shelters to ensure adequate sample size, rather than a true difference in population characteristics.

Among the vulnerably housed sample, 222 (40.0%) reported living in subsidized housing. Participants who were vulnerably housed reported spending a median of \$388 Canadian dollars per month on rent, which corresponds to approximately 43% of the median monthly income for this sample. However, we expect that, in reality, this proportion is even higher, as many participants may have been unaware that they were living in subsidized housing and/or were unaware of what portion of their income was being put towards their housing subsidies. Both samples reported spending a considerable amount of time without housing in their lifetimes; the median lifetime duration of homelessness among all participants was 2.8 years.

In terms of baseline health status, over 85% of participants reported having at least one chronic health condition, and over 50% reported being diagnosed with a mental

health problem. The mean health composite scores from the SF-12 health survey were 44.5 (standard deviation = 11.3) for physical health and 39.1 (standard deviation = 13.0) for mental health. Vulnerably housed participants had slightly lower SF-12 PCS and were more likely to report a greater number of chronic health conditions than homeless participants, whereas homeless participants reported very slightly lower SF-12 MCS than vulnerably housed participants.

Discussion

Our baseline findings suggest that—regardless of housing status—participants had extremely poor overall health. Compared to the U.S. general population, SF-12 PCS were 0.5 standard deviations lower than expected, and MCS were more than one standard deviation lower than expected (Ware et al. 1995). While substantial prior research has demonstrated the poor health status of homeless populations in Canada (Aubry et al. 2011; Frankish et al. 2005; Hwang and Dunn 2005), minimal research is available regarding the health status of individuals living in socially marginalized, inadequate housing. In our study, we show that vulnerably housed participants had equally poor, and in some cases worse, health status than individuals who had no housing at all.

The HHiT study is an ambitious multi-site study that aims to address a gap in the research around the impact of housing transitions on health. The strengths of this study include the longitudinal design, the multi-site approach, the relatively large sample size, the inclusion of both homeless and vulnerably housed populations, and the use of validated survey instruments and scales. Additionally, we are using recruitment and tracking methods that have been shown to be effective for these populations and that have been used previously by our research team (Ardilly and Le Blanc 2001; Aubry et al. 2004).

However, despite these strengths, a number of challenges have been encountered to date. Among our biggest challenges has been gaining access to SROs and rooming houses to recruit vulnerably housed participants. These challenges include the following: difficulties obtaining up-to-date, accurate lists of SROs and rooming houses from municipal sources; physical barriers such as missing buzzers or inaccurate tenant lists; landlords who would not respond to multiple requests to visit the site for the purpose of recruiting participants; and sites no longer being in operation at the time of recruitment. Furthermore, at sites that were accessible, very few residents were available, willing, or eligible to participate, despite multiple visits on different days and times. Many individuals who were located at SROs and rooming houses had lived at these

Table 3 Characteristics of homeless and vulnerably housed participants at baseline in Vancouver, Toronto, and Ottawa, Canada, 2009

Variable	All participants (<i>n</i> = 1,192)	Homeless (<i>n</i> = 595)	Vulnerably housed (<i>n</i> = 597)	<i>P</i> value
Age group (years), <i>n</i> (%)				0.171
<30	160 (13.5)	91 (15.4)	69 (11.6)	
30–39	295 (24.8)	150 (25.3)	145 (24.3)	
40–49	443 (37.2)	207 (34.9)	236 (39.5)	
≥50	292 (24.5)	145 (24.5)	147 (24.6)	
Gender, <i>n</i> (%)				0.034
Male	781 (65.7)	373 (62.7)	408 (68.8)	
Female	389 (32.7)	215 (36.1)	174 (29.3)	
Transgender	18 (1.5)	7 (1.2)	11 (1.9)	
Marital status, <i>n</i> (%)				0.301
Single/never married	687 (58.0)	339 (57.4)	348 (58.6)	
Divorced/separated	309 (26.1)	164 (27.8)	145 (24.4)	
Widowed	30 (2.5)	18 (3.1)	12 (2.0)	
Married/common law	82 (6.9)	35 (5.9)	47 (7.9)	
Partnered, not married	77 (6.5)	35 (5.9)	40 (7.1)	
Born in Canada, <i>n</i> (%)	1,002 (84.6)	474 (79.8)	528 (89.3)	<0.001
Racial/cultural group, <i>n</i> (%)				<0.001
White	722 (62.5)	358 (62.1)	364 (62.9)	
Black/African–Canadian	106 (9.2)	66 (11.4)	40 (6.9)	
First Nations/Aboriginal	205 (17.7)	74 (12.8)	131 (22.6)	
Mixed ethnicity	64 (5.5)	38 (6.6)	26 (4.5)	
Other	59 (5.1)	41 (7.1)	18 (3.1)	
Highest level of education, <i>n</i> (%)				<0.001
Some high school	529 (44.7)	231 (39.0)	298 (50.5)	
Completed high school or equivalent	277 (23.4)	146 (24.6)	131 (22.2)	
Some post-secondary education or higher	377 (31.9)	216 (36.4)	161 (27.3)	
Employed in past 12 months, <i>n</i> (%)	474 (39.8)	245 (41.3)	229 (38.4)	0.320
Monthly income, (CDN dollars) median (Q1–Q3)	900 (543–1,427)	900 (385–1,600)	900 (600–1,330)	0.078
Current monthly rent, (CDN dollars) median (Q1–Q3)	– ^a	– ^a	388 (343–450)	
Currently living in subsidized housing, <i>n</i> (%)	– ^a	– ^a	222 (40.0)	
Lifetime duration of homelessness (in years), median (Q1–Q3)	2.8 (1.1–6.6)	2.7 (1.1–6.6)	3.0 (1.0–6.6)	0.992
SF-12 PCS, ^b mean (SD)	44.5 (11.3)	45.3 (11.8)	43.7 (10.7)	0.016
SF-12 MCS, ^b mean (SD)	39.1 (13.0)	38.3 (13.1)	39.9 (13.0)	0.040
Number of chronic health conditions, ^c <i>n</i> (%)				<0.001
0	151 (12.7)	94 (15.8)	57 (9.6)	
1	250 (21.0)	138 (23.2)	112 (18.8)	
2	198 (16.6)	91 (15.3)	107 (17.9)	
≥3	593 (49.8)	272 (45.7)	321 (53.8)	
Ever diagnosed with a mental health problem, <i>n</i> (%)	607 (51.7)	288 (49.0)	319 (54.3)	0.066

^a Not applicable

^b On a scale where 50 is the mean and 10 is the standard deviation in the US general population

^c Chronic health conditions include high blood pressure; heart disease; asthma; COPD (includes emphysema and chronic bronchitis); cirrhosis; Hepatitis B or C; intestinal or stomach ulcers; urinary incontinence; bowel disorders; arthritis; problems walking, lost limb, or other physical handicap; HIV/AIDS; epilepsy; foetal alcohol syndrome or foetal alcohol spectrum disorder; head injury; glaucoma; cataracts; cancer, diabetes; or anaemia

residences for numerous years and, in this sense, were stably housed and deemed ineligible for our study. For these reasons, we modified our sampling strategy to include

sampling of vulnerably housed participants at meal programmes, community health centres, and drop-in centres, which proved to be more accessible for our research staff.

Additional challenges included participants not arriving at scheduled interview times, difficulty in finding private and safe locations to conduct interviews, shelter restrictions that limited the times when participants were present at the site, and identification of individuals who completed the interview more than once, as some participants gave false names so that they could participate multiple times. In order to overcome these challenges, whenever possible, we conducted interviews immediately after a participant was recruited and deemed eligible, used nearby community-based locations to conduct interviews, and cooperated with shelter staff to help with random selection of homeless participants at shelters. Thorough checks based on name, sex, date of birth, and health card number were performed each day; however, despite these efforts, we identified 8 individuals who were interviewed more than once following the end of our recruitment period, resulting in a lower sample size than originally planned.

This study has certain limitations that should be acknowledged. Our study design does not sample homeless populations who do not use either shelters, meal programmes, community health centres, or drop-in centres; however, prior research suggests that this subgroup of homeless people is very small (Crowe and Hardill 1993; Hardill 1993). As well, due to the recruitment issues noted above, our study does not include a random sample of vulnerably housed participants. Individuals considered vulnerably housed who do not use meal programmes, drop-in centres, or community health centres and/or who reside in inaccessible or unidentified SROs or rooming houses may have been missed. In this sense, our sampling strategy may have overlooked extremely marginalized or hard-to-reach populations. We also restricted our sample to single adults who were not living with a partner or dependent children. However, as this study was meant to examine the effect of housing transitions on health over time rather than provide an overall assessment of the health status of vulnerably housed populations in Canada, concerns over the generalizability of our sample are lessened. Our sample may be biased towards only those individuals who are fluent in English or French (the two official languages in Canada). Although interpretation services for other languages were available, it was often not possible to determine a potential participants' preferred language and frequently difficult to re-locate the participant when the interviewer returned with an interpreter.

While we made efforts to ensure that participants were unaware of our eligibility criteria, some participants may have lied about their housing status in order to participate. This issue was especially true during recruitment at meal programmes where potential participants were approached within a common area. While this study attempts to explore individual-level factors associated with housing transitions,

contextual factors such as concurrent programmes and policies occurring at the municipal- or provincial-levels that differ across study sites may influence our incidence rate calculations. For example, the 2010 Olympic Games in Vancouver may have resulted in a precipitous loss of low-cost housing options during our follow-up period, as developers sought to provide profitable accommodations for Olympic visitors and gentrify the neighbourhoods where affordable housing was located (Lenskyj 2002). In order to address this issue, we will stratify our incidence rate calculations by study site.

The paucity of longitudinal research on homelessness and health in Canada restricts our understanding of the course of homelessness, the factors that help individuals escape homelessness, and the effectiveness of services and supports to address homelessness. Identification of these factors holds significant promise as a source of information to guide the creation of effective social and health programmes and policies (Hartig and Lawrence 2003). This multi-site longitudinal study of the health and housing status of homeless and vulnerably housed adults in Canada will provide important insights into the role of housing as a social determinant of health for disadvantaged populations. Data from this study will be used to determine the incidence of housing transitions among homeless and vulnerably housed adults over a 2-year period, the resources and risk factors associated with the attainment of stable housing and the onset of homelessness, and whether changes in housing status are associated with changes in health status, quality of life, and major health determinants.

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