Mental Health, Concurrent Disorders, and Health Care Utilization in Homeless Women

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Purpose. **This study assessed lifetime and current prevalence rates of mental disorders and concurrent mental and substance use disorders in a sample of homeless women. Current suicide risk and recent health service utilization were also examined in order to understand the complex mental health issues of this population and to inform the development of new treatment strategies that better meet their specific needs.** ***Methods.*** **A cross-sectional survey of 196 adult homeless women in three different Canadian cities was done. Participants were assessed using DSM-IV-based structured clinical interviews. Current diagnoses were compared to available mental health prevalence rates in the Canadian female general population.** ***Results.*** **Current prevalence rates were 63% for any mental disorder, excluding substance use disorders; 17% for depressive episode; 10% for manic episode; 7% for psychotic disorder; 39% for anxiety disorders, 28% for posttraumatic stress disorder; and 19% for obsessive-compulsive disorder; 58% had concurrent substance dependence and mental disorders. Lifetime prevalence rates were notably higher. Current moderate or high suicide risk was found in 22% of the women. Participants used a variety of health services, especially emergency rooms, general practitioners, and walk-in clinics.** ***Conclusion.*** **Prevalence rates of mental disorders among homeless participants were substantially higher than among women from the general Canadian population. The percentage of participants with moderate or high suicide risk and concurrent disorders indicates a high severity of mental health symptomatology. Treatment and housing programs need to be accompanied by multidisciplinary, specialized interventions that account for high rates of complex mental health conditions.** (*Journal of Psychiatric Practice* **2012;18:349–360**)

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Homelessness is an immense social and public health concern in Canada.[1] Individuals who spend over 30% of their income on housing are at high risk of struggling with economic challenges[2] and becoming homeless.[3] Although the majority of homeless individuals are men,[4] a recent report on the psychosocial situation of women in Canada revealed that 57% of single women spent more than one third of their income on housing compared to 46% of single men.[2] Furthermore, homelessness is increasing among women, with single women representing 10%–25% of the homeless population in Canadian cities.[5] The proportion of women among the homeless may even be underestimated because they tend to have less contact with support systems and be less integrated into society.[6] Epidemiological studies have found high rates of mental disorders among the homeless.[7,8]

While a substantial number of studies have assessed mental disorders and suicidal behavior in homeless men,[9–13] less scientific attention has been dedicated to studying the situation of homeless women and their mental health. However, there is evidence that homeless women and men have unique characteristics and needs, and that findings and conclusions derived from research among men may not be applicable to women. For example, several studies have found that homeless women were more likely to be younger, live with children, report shorter periods of homelessness, and report less criminal involvement than homeless men.[14–17] Research suggests that homeless women and men may also differ in education, ethnicity, and perceived reasons for home-

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lessness.[14,15] In terms of their mental health, homeless women were less likely than men to report substance abuse problems[14–17]; however, they reported more childhood sexual abuse[15] and greater psychological distress than men,[16] and had higher rates of non-substance related mental disorders.[18]

Unfortunately, many researchers have not used standardized diagnostic instruments to estimate prevalence rates for mental disorders in homeless populations, which compromises the validity of the diagnoses and impedes replicability and comparisons of the results across studies. Even among those studies that used assessments based on the *Diagnostic and Statistical Manual of Mental Disorders* (DSM), prevalence rates of mental disorders among homeless women vary widely. Current overall prevalence rates range from 35.4%[19] to 94%[20]; lifetime prevalence rates range from 48.6%[21] to 100%,[20] although many studies were limited by small sample sizes. These variations may be attributable in part to differences in recruitment procedures and populations, time frames used in assessing symptoms, and the range of disorders included in the assessment. In fact, the majority of studies recruited female participants from homeless shelters. Only a few studies[20,22,23] included homeless women living on the street in their sample, and recruitment was often confined to a small geographic scope (e.g., a narrowly defined area in one particular city). In addition, even among studies using DSM-based interviews, the time frame for assessing current psychiatric symptoms varied from 1 to 6 to 12 months depending on the measure used.

Furthermore, there are several other challenges in terms of reliability and comparisons of results. First, not all researchers assessed the full range of psychiatric disorders. For example, information regarding anxiety disorders was often not provided[22–27] and only a few researchers reported detailed prevalence rates for individual subtypes of anxiety disorders. For mood disorders, information on bipolar disorder and/or differential diagnoses distinguishing bipolar from unipolar disorders was often lacking.[24–28] Second, little is known about concurrent disorders among homeless women, an issue related to both differential diagnostics and severity of mental health problems. The authors of a recent meta-analysis comparing different housing models for homeless individuals with mental disorders found poorer outcomes for persons with concurrent substance use disorders across interventions.[29] Thus, information on the prevalence of concurrent disorders may help to tailor treatment and housing interventions for homeless women. Although the psychiatric assessment included substance use disorders in most studies, the rates of concurrent substance use and mental disorders were usually not reported. Moreover, although methodological challenges in the assessment of mental disorders in individuals with current substance abuse are well described in the general psychiatric literature,[30,31] researchers generally did not discuss the accuracy of mental health diagnoses among homeless individuals who use substances. This may pose a challenge for the psychiatric clinician when faced with the complex diagnostic process involved in working with homeless individuals.

Another indicator for the severity of mental health problems is suicidality. Unfortunately, only a few studies have examined suicide histories and current suicide risk among homeless women. Burt and Cohen[14] interviewed 242 women, 26% of whom reported a lifetime suicide attempt. In another study, 56.8% of the female participants reported a lifetime suicide attempt and 78.4% reported suicidal ideation.[32] Finally, among 310 female homeless veterans with substance use disorders, 48.7% reported suicidal ideation and 36.5% reported a lifetime suicide attempt.[33]

Despite high rates of acute and chronic psychiatric problems, research suggests that few homeless women access the mental health care system and receive tailored treatment. For example, Koegel et al.[22] reported that, among those homeless women with a current mental disorder, only 27% had received any psychiatric treatment (i.e., either residential, outpatient, or medication) in the past 60 days. Utilization of addiction treatment services appeared to be similarly low.[22,34,35] On the other hand, Lim et al. reported that 89% of their female participants had at least one medical ambulatory or emergency visit and 92% had one or more health screens in the preceding year.[36] In another study of homeless individuals, Verlinde et al. reported that 75% of the women had had recent contact with a general practitioner.[37] The populations being sampled in the studies mentioned above might account, at least in part, for these differences in rates. Lim et al. assessed women who were using homeless shelters and homeless centers, while Verlinde et al. focused

on recruiting homeless women for their research in shelters and meal programs. In summary, detailed information on the health care utilization of homeless women is lacking, although such information is critical for improving access to specialized care.

In view of the current state of research, studies are urgently needed that provide a comprehensive and differential assessment of psychiatric disorders, suicidal behavior, and health care utilization among homeless women. The present study addresses some of the limitations of previous studies by examining a large sample of homeless women from three cities representing both the street and the shelter populations, and conducting a comprehensive psychiatric assessment using structured clinical interviews. The objectives of the study were

a) to determine the prevalence rates of mental and substance use disorders in a sample of homeless women and compare them with those of the general female Canadian population,
b) to examine the co-occurrence of these disorders and discuss the diagnostic challenges associated with the complex characteristics and problems of homeless women,
c) to explore the current risk of suicide among the women,
d) to assess their health service utilization and discuss treatment implications.

METHODS

Participants

Inclusion criteria, recruitment, and procedures have been described in detail elsewhere.[38] Briefly, we sampled the homeless population in three cities in British Columbia: Vancouver, Victoria, and Prince George. Participants were at least 19 years old, willing and able to give informed consent, able to communicate in English, and identified as being homeless during the month prior to study participation. The proportion of recruited participants at each site was based on the results of the most recent homeless counts in the three cities. Purposeful sampling was used to recruit a significant proportion of women, young people 19–25 years of age, individuals living on the street, and Aboriginals. Of the 500 individuals in the total sample, 196 were women and were included in the current study. The prevalence rates of mental health diagnoses in the general Canadian female population for comparison were obtained from the Canadian Community Health Survey "Mental Health and Well-being."[39]

Procedure

In order to recruit individuals living on the streets, research interviewers visited streets and locations where homeless people were known to be present. Existing homeless outreach and drop-in center teams were contacted with a request to help with recruiting. To recruit individuals living in shelters, research assistants visited all available homeless shelters in Victoria and Prince George, and selected shelters in Vancouver. Recruitment was usually carried out Monday to Friday during the daytime and on occasional early nights and weekends. After giving written informed consent, eligible individuals attended a single session structured clinical interview. Research assistants who had received training in conducting the assessment by a senior researcher administered the interviews; most of the research assistants had previous experience surveying this population. Participants received a $30 reimbursement for their time at the end of the interview session. All details that might disclose the identity of the participants were omitted from all documents. Ethical approval for this project was obtained from the Behavioral Research Ethics Board of the University of British Columbia and the Providence Health Care Research Institute.

Measures

Demographic information collected included age, marital status, housing situation, education, source of income, and social contacts. Participants were also asked whether they had ever been in prison, jail, or juvenile detention overnight or longer. They were also asked to identify which ethnic group/descent they belonged to. The list of options included European/Caucasian, Aboriginal, African, Asian, Hispanic/Latin American, and Other. The Aboriginal peoples who participated in this study represented nations throughout British Columbia and included Cree, Carrier, Dene, Gitksan, Sekani, Ojibway, Coast Salish, and Metis.

Lifetime and current mental and substance use disorders were derived from the MINI International Neuropsychiatric Interview Plus, version 5.0.0.[40]

The MINI Plus is a structured clinical interview based on the diagnostic criteria in the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition* (DSM-IV)[41] and the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* (ICD-10).[42] It was designed to assess Axis I substance use disorders and mental disorders as well as Axis II antisocial personality disorder. For the current study, we included information regarding the following diagnoses: drug dependence, alcohol dependence, depressive, manic, and hypomanic episodes, psychotic disorders, panic disorder, social anxiety disorder, posttraumatic stress disorder (PTSD), and obsessive-compulsive disorder (OCD). The time frames used to assess current mental disorders were 4 weeks for psychotic disorder, panic disorder, social anxiety disorder, PTSD, and OCD; 12 months for alcohol dependence and drug dependence; 2 weeks for depressive episodes; and "current" for manic and hypomanic episodes. The MINI Plus has been shown to be reliable and valid in several studies in the United States and Europe.[40]

Current suicide risk was also assessed using the MINI Plus. The suicidality scale assesses current suicide risk using 11 self-report items related to current and past suicidal ideation, plans, attempts, and self-injury. The responses are summed to result in an overall score between 0 and 52. Suicide risk severity was calculated according to the developer's instructions: none (0 points), low (1–8 points); moderate (9–16 points); and high ($\geqslant$ 17 points) risk. The MINI Plus suicidality scale has been used in previous studies to assess suicide risk in clinical populations.[43–45]

Health care utilization was examined using a modified version of the "National Survey of Homeless Assistance Providers and Clients (NSHAPC)–Health Chapter."[46] This questionnaire was specifically designed for use with homeless populations. Information on utilization of multiple specific health services was assessed with single items and two response options (i.e., yes/no). For the current study, we were only interested in service use behavior during the 12 months prior to the interview.

Statistical Analysis

The sociodemographic characteristics of the sample were described using frequencies and means with standard deviations (SD) for continuous variables and using numbers and percentages for categorical variables. Prevalence rates for mental health disorders, substance use disorders, suicide risk, and health care utilization were calculated using numbers and percentages. All statistical analyses were conducted using SAS 9.1 (SAS Institute Inc., Cary, NC).

Canada's and British Columbia's General Population Data

Comparison data from the general female population in Canada and the province of British Columbia (if available) are presented in Table 1. These data were obtained from the Mental Health and Well-being Chapter of the Canadian Community Health Survey (CCHS).[39] The CCHS was conducted by Statistics Canada in 2002 in each province and updated in 2004. It included over 130,000 respondents 12 years of age and older. To increase comparability with our sample, only CCHS participants 15 years of age and older were included in the comparisons for our current study. People living in the three territories, on Indian Reserves, and on Crown lands, residents of institutions, full-time members of the Canadian Armed Forces, and residents of certain remote regions were not included in the CCHS. The CCHS reported 12-month prevalence rates of major depressive episode, manic episode, panic disorder, agoraphobia, social phobia, alcohol and drug dependence, suicidal thoughts and use of mental health care services. Mental disorders were assessed using a modified version of the DSM-IV based World Mental Health Composite International Diagnostic Interview (WMH-CIDI).[47] Bootstrapping techniques were used to produce the coefficient of variation (CV) and 95% confidence intervals. CVs for prevalence rates of manic episodes, panic disorder, agoraphobia, alcohol dependence, and substance dependence in the province of British Columbia ranged from 16.6% to 33.3%, and the CCHS researchers recommended interpreting these data with caution. Therefore, the overall Canadian prevalence rates may provide more reliable information.

RESULTS

Of the total sample of 196 women, three did not complete the MINI Plus interview and were excluded from the statistical analysis. Therefore, the prevalence rates of mental health disorders and disorder

Table 1. Prevalence rates of mental health disorders in the homeless sample (N = 193) in comparison with the general population of women in Canada and British Columbia (BC)

Diagnoses	*Homeless sample lifetime n (%)*	*Homeless sample current[a] n (%)*	*General population Canada current[b] %*	*General population BC current[b] %*
Mood disorders				
Depressive episode	56 (29%)	33 (17%)	5.9%	5.9%
Manic episode	53 (28%)	20 (10%)	1.0%	1.0%
Hypomanic episode	18 (9%)	10 (5%)		
Psychotic disorders	51 (26%)	14 (7%)		
Anxiety disorders	81 (42%)	76 (39%)		
Panic disorder		18 (9%)	2.0%	1.9%[c]
Social anxiety disorder		38 (20%)	3.4%	4.2%[c]
PTSD		54 (28%)		
OCD	120 (62%)	37 (19%)		
Substance use disorders				
Drug dependence	153 (79%)	136 (71%)	0.5%	0.9%[c]
Alcohol dependence	135 (70%)	73 (38%)	1.3%	2.2%[c]
Any mental disorder		122 (63%)		
Any substance use disorder	177 (92%)	159 (82%)		
Concurrent disorders[d]		112 (58%)		

PTSD: posttraumatic stress disorder, OCD: obsessive-compulsive disorder

[a]Time frames used to assess current mental disorders were 4 weeks for psychotic disorder, panic disorder, social anxiety disorder, PTSD, and OCD; 12 months for alcohol dependence and drug dependence; 2 weeks for depressive episodes; and "current" for manic and hypomanic episodes.

[b]12-month prevalence rates

[c]These data should be interpreted with caution since they have a coefficient of variation ranging from 16.6% to 33.3%.

[d]Concurrent mental and substance use disorders

episodes are based on data from 193 (98.5%) of the participants.

Sociodemographic Characteristics

Participants ranged in age from 19 to 57 years; the mean age was 35.3 years (SD = 10.51 years). Of the 196 women, 54% (n = 105) were currently living in a shelter and 46% (n = 91) were living on the streets; 54% (n = 105) of the women identified as Aboriginal, 43% (n = 85) identified as Caucasian, and 3% (n = 6) belonged to other ethnicities. More than half of the sample (65%, n = 128) did not graduate from high school, 16% (n = 31) had a high school diploma, 11% (n = 22) of the participants had some college/university education, 7% (n = 13) had a college, university, or trade school degree, and 1% (n = 2) had some other type of formal education. Of the 196 women, 95% (n = 186) were unemployed at the time of the survey, and 86% (n = 169) received governmental financial support; 21% (n = 41) reported working in the sex trade and 13% (n = 26) engaged in other illegal activities to derive or supplement their income.

Mental Disorders

Prevalence rates of current and lifetime mental disorders and episodes in the surveyed homeless sample are presented in Table 1. This table also presents the available prevalence rates from the general pop-

ulation in Canada and British Columbia. Of the 193 homeless women who completed the MINI Plus, 63% (n = 122) met DSM-IV criteria for at least one current mental disorder or disorder episode and 82% (n = 159) had a substance use disorder; 58% (n = 112) met the criteria for a current mental disorder and a concurrent substance use disorder.

Suicidality, Suicide Attempts, and Self-harming Behavior

Of the 193 women who completed the MINI Plus, 50% (n = 97) of the women reported at least one suicide attempt in their lives and 26% (n = 50) had had suicidal thoughts in the past 12 months. With regard to suicide risk, 22% (n = 43) had current high or moderate suicide risk, and 45% (n = 87) and 33% (n = 63) had low or no suicide risk, respectively. Prevalence rates for suicidal thoughts in the past 12 months in the general female population in Canada and British Columbia were 3.8% and 4.2%, respectively.

Service Utilization

Rates of health care and support services utilization are shown in Table 2. Participants used a variety of health services, especially emergency rooms, general practitioners, and walk-in clinics.

Table 2. Health care service utilization (N = 196) in the past 6–12 months

Type of service used	*n (%)*
Currently having a regular medical doctor[a]	140 (71%)
Health care institutions[b]	
Emergency room	121 (62%)
Hospital (not emergency room)	51 (26%)
General health professional[b]	
Family doctor/general practitioner	130 (66%)
Walk-in clinic	91 (46%)
Street nurse	62 (32%)
Nurse practitioner	55 (28%)
Specialized mental health services[b]	
Mental health team	27 (14%)
Psychiatrist	25 (13%)
Crisis intervention service	8 (4%)
Substance abuse treatment services[b]	
Detoxification[c]	81 (41%)
Counseling	65 (33%)
Residential therapy	63 (32%)
Methadone maintenance	61 (31%)
Self-help group	60 (31%)
Outpatient therapy	34 (17%)

[a]*No timeframe specified*

[b]*Past 12 months (except for detoxification)*

[c]*Past 6 months*

DISCUSSION

Mental Health

This paper presents detailed information on mental health diagnoses including suicidality and the utilization of health services in a sample of homeless women from three Canadian cities. Estimates of current mental disorder prevalence rates from studies with homeless women in North America and other Western countries range from 35.4%[19] to 94%.[20] Previous studies have found that mental disorders are a risk factor for becoming homeless in the general population[48] and for long-term homelessness among newly homeless individuals.[49] In our study, 63% of the participants met diagnostic criteria for at least one current mental disorder or disorder episode, not including substance use disorders. These results confirm the prevalence rates for mental disorders in homeless women previously reported in the literature. They also reveal a notable disparity between the mental health of homeless women compared with that of women in the general Canadian population. The prevalence rates for the individual diagnoses in our sample were also multiple times higher than those reported in the CCHS.[39]

The most common current diagnosis in our sample was drug dependence, followed by alcohol dependence, PTSD, and other anxiety disorders. The high prevalence rates of alcohol and especially of drug dependence exceeded those reported in other studies of homeless women, a finding discussed in detail elsewhere.[38] However, the prevalence rates of other mental health diagnoses were similar to those reported in other samples of homeless women, with

the exception of PTSD, current manic episode, and concurrent disorders.

Mood disorders and schizophrenia: Of the 193 participants who completed the MINI Plus, 7% met diagnostic criteria for current psychosis; this result is at the lower end of previously reported prevalence rates for schizophrenia among homeless women, which ranged from 2% to 34%.[20–23] Seventeen percent of our participants met the criteria for a current depressive episode. Reported rates of depressive disorders in other female homeless populations varied between 9.6%[19] and 40%,[20,50] but were mainly approximately 20%.[21–23,28] In contrast, the prevalence of current manic episodes in our sample (i.e., 10%) was at the higher end compared with other studies, where a prevalence of 0% to 9% was reported.[19–22,34] Perhaps other disorders such as adult attention-deficit/hyperactivity disorder (ADHD) and the effects of stimulant use, which was particularly frequent in our sample, resulted in behaviors mimicking or overlapping with manic symptoms that were difficult to diagnose conclusively.

Anxiety disorders: The rate of current anxiety disorders (39%) in our sample was comparable to previously reported rates of anxiety disorders, which varied between 28% and 45.5%.[20,28,50] PTSD is reported separately, and 28.0% of our participants met criteria for current PTSD. Although this rate considerably exceeds the PTSD rates observed in other samples,[19,21,28] it should be considered in the context of the high rates of childhood trauma in these subjects. As described in detail elsewhere,[51] more than 80% of our participants had experienced at least one type of moderate or severe childhood trauma. OCD is reported separately, and the current prevalence rate of OCD in our sample was 19%. We are aware of only one other study that assessed OCD in homeless women; in that study, the authors reported that, among 220 mothers using homeless shelters, OCD lifetime and current prevalence rates were 2.3% and 0.9%, respectively.[19]

Most of the lifetime prevalence rates for mental disorders in our study were substantially higher than the current prevalence rates of these disorders. This difference may reflect the fact that a substantial number of our participants were in different stages of remission, although perhaps not fully recovered, from their mental disorders at the time of the assessment. Alternatively, homeless individuals may have remarkable abilities and competencies in recovering from mental illness that have not yet been fully examined and described. Clearly, more studies are needed to examine how homeless individuals recover from mental and substance use disorders and how the psychiatric clinician can support the recovery process.

Concurrent Disorders

The finding that 58% of the entire sample met diagnostic criteria for both current substance use and for at least one other mental disorder is striking; this rate by far exceeds rates of concurrent disorders reported elsewhere in the literature, which have ranged from 16% to 31%.[22,34] For example, Koegel et al.[22] reported that 16% of the 387 women in their Los Angeles sample met criteria for dual diagnosis, and Breakey et al.[34] found that 22% of the women in their sample had a major mental illness with a comorbid alcohol disorder and 10% had a major mental illness with a comorbid drug use disorder. The high number of concurrent disorders in our sample was driven by high rates of substance use disorders: 85.2% of those participants who had a current mental disorder also had concurrent substance dependence, which means that individuals with a single mental health diagnosis were rare in our sample. The co-occurrence of substance use and mental disorders has not yet been explored in sufficient depth in the homeless literature and we are not aware of any other study that provides a picture of the overlap of diagnoses by reporting prevalence rates for both "mental disorders" and "concurrent substance use disorders."

The high rates of concurrent disorders in our sample may partly be explained by regional differences. In a survey in the general Canadian population, individuals from British Columbia had higher rates of concurrent disorders than individuals from other Canadian provinces.[52] In contrast to other studies among homeless women which were typically carried out with shelter users, half of our participants lived on the streets. These women may be more compromised by mental illness and more prone to substance use than their sheltered counterparts. Furthermore, we included a substantial group of women who identified as Aboriginal. This population has higher rates of substance use and mental disorders than the non-Aboriginal population.[53,54] Hence, our participants may represent a group with particularly severe psychopathology compared with other homeless samples.

Methodological Considerations in the Assessment of Concurrent Disorders

The high rate of concurrent disorders is of concern because of their association with more severe psychiatric problems, poorer social adjustment, and less clinical improvement following interventions in homeless individuals.[55–57] Although mental health and substance use disorders frequently co-occur, behaviors related to substance intoxication and withdrawal, as well as the neurobiological effects that occur following drug administration, may mimic symptoms of a mental disorder and impede the interpretation of symptoms. In the late 1980s, Susser and colleagues identified and described important methodological challenges in the assessment of mental health in homeless individuals, and these difficulties still exist today.[58] Although challenges in assessing concurrent disorders in the general psychiatric population have been discussed,[30,31,59] the literature on the homeless provides little discussion of these issues. The majority of researchers who have reported on mental disorders in homeless samples did not comment on the reliability of the diagnoses nor about how confident they were with the observed rates of independent mental disorders, substance use disorders, and concurrent disorders, nor did they discuss the challenges they faced during the psychiatric assessment of their homeless participants. Nevertheless, the accuracy of the diagnostic assessment, especially in terms of complex concurrent disorders, may have important implications for the clinician in the diagnosis and treatment of homeless individuals.

Drug use and mental health symptoms are often strongly intertwined—particularly in individuals who have longstanding experiences with both—which makes it difficult, if not impossible, to disentangle the multiple symptoms and behaviors such individuals exhibit. In DSM-IV-based diagnostic algorithms, specific guidelines are used to distinguish independent mental disorders, substance-related disorders, and concurrent disorders.[30] In identifying an independent mental disorder, it is important for the psychiatric clinician to exclude the possibility that the observed/reported symptoms are the direct result of substance use. A substance-related disorder is diagnosed in cases where criteria for a specific mental disorder are met, but the symptoms occur solely during periods of substance use or withdrawal and exceed the expected severity of intoxication or withdrawal symptoms. During the diagnostic process, an assessment of the temporal relationship between psychiatric symptoms and substance use is highly recommended. However, this information may be subject to recall bias, especially in participants who are older, intoxicated, or experiencing an acute episode of mental illness. Given the high rates of current substance use and dependence in our sample and in homeless samples in general, many of the participants may not have been abstinent for any length of time. Hence, they may not have been able to reliably respond to diagnostic questions related to the occurrence of psychiatric symptoms outside of periods of substance use. The scoring algorithm of the MINI Plus assessment excludes substance-related mental disorders by asking the participants whether they "were taking any drugs or medicines just before these symptoms began." This question may not be sufficient to reliably discriminate independent mental disorders from those related to substance use. Similar limitations have been discussed for other DSM- and ICD-based diagnostic interviews.[30] In addition, homelessness per se may have an impact on the assessment, since an individual's unusual behavior could be driven by the person's specific living situation on the street. Furthermore, the MINI Plus is typically used as a one-time assessment, which may not be sufficient to account for the rapid fluctuation of both mental health symptoms and neurobiological effects caused by substances. Complications during the assessment of mental illness and concurrent disorders using the MINI Plus in marginalized populations have been discussed in previous research,[45,60,61] and further discussion with regard to homeless individuals specifically is desirable and necessary. Despite these methodological challenges, prevalence rates for mental disorders in our population were multiple times higher than in the general female population, although they may only reflect an approximation of the true rates. This finding has important implications for developing and improving services for homeless individuals.

Suicidality

While the MINI Plus assesses mental disorders categorically rather than dimensionally, the high rates of concurrent disorders, lifetime suicide attempts, and current suicide risk can be regarded as an indi-

cator of high illness severity. The high rates of suicide attempts in our sample are of concern but are also consistent with data previously reported in the literature. For example, in a sample of homeless people with mental illness, 51.3% percent reported a lifetime suicide attempt.[62] A recent literature review on sexual assault victimization and suicidal behavior in women concluded that sexual victimization is as important a risk factor for suicidal behavior in homeless women as are living circumstances and substance use.[63] Hence, the high rates of suicidal behaviors in our sample may be interpreted in the context of high rates of childhood sexual abuse, PTSD, substance use disorders, and the fact that all participants have been living in substandard conditions. Nevertheless, there is a lack of suicide prevention and suicide intervention programs for the homeless, and the services that exist (e.g. crisis phone lines) do not seem to be utilized, perhaps because they do not meet the specific needs of a homeless person in an acute crisis.

Health Care Service Utilization

The utilization of general and non-specific health services was higher than expected: over 70% of the women reported having a regular medical doctor or nurse practitioner, and two-thirds had visited their general practitioner in the previous 12 months. The rate of participants in our sample who indicated having a regular medical doctor was higher than reported in other studies.[34,36] However, substantially fewer individuals than in other studies[22,62,63] reported having recently visited a medical doctor. The differences in health care utilization rates need to be considered in the context of the differences in health care systems, as most comparable studies on health care utilization have been based in the United States, where the homeless population is often uninsured.

Regarding specific substance abuse treatment services, one third of the participants had attended residential addiction treatment and a significant number of individuals had recently received other types of addiction services or detoxification treatment. The large proportion of women using specific substance abuse treatment services was unexpected and exceeds the rates reported in previous studies, which have reported that 8%–34% of female participants received specific substance abuse treatment.[14,22,34,35] The percentage of participants involved in substance abuse self-help groups was 31%, which was comparable to percentages found in other studies in which 23% and 38% of participants reported being engaged in such groups.[22,64] The higher rates of inpatient treatment may reflect a greater severity of illness in our sample, since inpatient treatment is typically provided to those who are more compromised by their illness.

The utilization of specific mental health services such as psychiatrists or mental health teams was low: 14% of the participants reported having seen a mental health team and 13% reported having seen a psychiatrist in the recent past. The psychiatrist was often part of the same mental health team, which may explain why prevalence rates of those two services are almost identical. These low rates of mental health service use contravene the high rates of mental disorders observed in our sample, which indicate that the health of our participants is compromised in many aspects and needs special attention. In addition, although more than one fifth of the participants were at high or moderate suicide risk at the time of assessment, only a small number of participants had had contact with a crisis or suicide intervention service in the past 12 months.

Utilization rates for specialized mental health care services ranged from 16% to 34% in other studies,[22,65] although assessment time frames differed greatly. When the rates of mental health care utilization in our sample were compared with those in the general population, the difference was smaller than expected: 12% of the female general Canadian population and 15% of the female population in British Columbia had utilized services for problems concerning emotions, mental health, or substance use in the past 12 months. Our findings also imply that homeless women are interested in actively seeking primary health services. Regardless, the majority had current mental health disorders. Apparently, their complex and specific health needs have not been sufficiently identified or addressed in the primary health care system. Access to specialized care is often more regulated and less available than access to primary health care. Homeless women may prefer low-threshold programs due to their specific living conditions that make it difficult to plan in advance or adhere to appointments. Furthermore, access to mental health services may be precluded for homeless individuals. There may also be a lack of specialized services for homeless mentally ill indi-

viduals that are adapted to their specific needs and have a proactive or low-threshold model of care, such as psychiatric drop-in clinics or practices.

Limitations

A few limitations should be considered in evaluating the findings of this study. First, this study was carried out in British Columbia and, as noted above, the findings may not be representative of homeless individuals in other Canadian provinces or other countries. Second, the data were obtained through a cross-sectional study, which poses challenges in assessing drug use and mental health symptoms, since both tend to fluctuate quickly. To increase the quality of our data, we used measures with established psychometric properties.[66] However, as discussed earlier, they may have limitations with regard to their application in a homeless population. Finally, all retrospective self-reports may be affected by recall bias. Nevertheless, our study also had clear strengths: We recruited and assessed a fairly large sample of homeless women from a broad geographic area, including both street and shelter-based individuals, and used comprehensive and standardized measures to assess substance use, mental conditions, and service utilization.

CONCLUSIONS

Clinical Considerations

High rates of mental disorders, concurrent disorders, lifetime suicide attempts, and current high suicide risk among our sample of homeless women indicate a high severity of mental problems which needs to be considered in both assessment and treatment. Our findings suggest that homeless women accessing the system of care should receive a thorough psychiatric assessment, including an evaluation for concurrent disorders and suicidality. Service providers should also receive specialized dual-diagnosis training in order to provide effective interventions for this population. Only a small number of our participants had recently received specialized mental health care and crisis intervention, which indicates that there is also a need to improve access to mental health services among the homeless population. Housing programs that follow the "Housing First" approach provide homeless individuals with permanent housing without requiring mandatory enrollment in a mental health treatment program or requiring abstinence, with the goal of lowering the threshold for accessing such housing services. Such programs have been shown to reduce costs associated with the care of homeless individuals.[67] Nevertheless such housing programs need to be associated with comprehensive, integrated, multidisciplinary yet specialized prevention and treatment programs that are adapted to meet the needs of the homeless women involved and take into account the high rates of mental disorders, complex conditions, and crisis situations, such as acute suicidality, present in this population.

Research Considerations

It would be helpful for researchers in this area to consider modifying the techniques used to assess psychiatric disorders in future studies. Any selected assessment should include a timeline to record the chronology and relationship between the occurrence of mental health symptoms and substance use. Furthermore, at least two sessions should be scheduled for the psychiatric assessment of homeless individuals. Future studies could also use a longitudinal design to obtain more detailed knowledge of the chronological sequence of mental health symptoms and substance use and recovery from these conditions, in order to achieve an enhanced understanding of the trajectories that lead to and maintain homelessness.

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Setting the stage for chronic health problems: cumulative childhood adversity among homeless adults with mental illness in Vancouver, British Columbia

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Abstract

Background: It is well documented that childhood abuse, neglect and household dysfunction are disproportionately present in the backgrounds of homeless adults, and that these experiences adversely impact child development and a wide range of adult outcomes. However, few studies have examined the cumulative impact of adverse childhood experiences on homeless adults with mental illness. This study examines adverse events in childhood as predictors of duration of homelessness, psychiatric and substance use disorders, and physical health in a sample of homeless adults with mental illness.

Methods: This study was conducted using baseline data from a randomized controlled trial in Vancouver, British Columbia for participants who completed the Adverse Childhood Experiences (ACE) scale at 18 months follow-up (n = 364). Primary outcomes included current mental disorders; substance use including type, frequency and severity; physical health; duration of homelessness; and vocational functioning.

Results: In multivariable regression models, ACE total score independently predicted a range of mental health, physical health, and substance use problems, and marginally predicted duration of homelessness.

Conclusions: Adverse childhood experiences are overrepresented among homeless adults with complex comorbidities and chronic homelessness. Our findings are consistent with a growing body of literature indicating that childhood traumas are potent risk factors for a number of adult health and psychiatric problems, particularly substance use problems. Results are discussed in the context of cumulative adversity and self-trauma theory.

Trials registration: This trial has been registered with the International Standard Randomized Control Trial Number Register and assigned ISRCTN42520374.

Background

Research into the causes of homelessness suggests complex interactions between structural and individual factors, both of which are often present long before the onset of first homelessness [1,2]. The childhoods of homeless adults are disproportionately characterized by persistent poverty, residential mobility, school problems, and other stressful and/or traumatic experiences [3-5] particularly among homeless individuals with mental illness [2]. In fact, the childhoods of homeless people with mental illness have been described as a "double dose" of disadvantage in the form of poverty as well as violence and family instability [2].

A large body of evidence suggests that adverse childhood experiences, which typically include physical, sexual, and emotional abuse, neglect, dysfunctional family environments, and unstable family structure, are linked to later psychological functioning and may affect multiple domains of health and well-being [6-8]. Moreover, it appears that adverse childhood experiences tend to cluster together [9,10] and the *number* of adverse experiences may be more predictive of negative adult outcomes than particular categories of events. Using a sample of adults served by a

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large health maintenance organization in California, a growing body of research has established a strong dose–response relationship between the number of adverse childhood experiences and poor health outcomes in adulthood including alcohol and drug use, mental health, physical illness, and a variety of risk behaviours [6-8]. However, this sample includes individuals with private health insurance and, therefore, is not generalizable to people with histories of chronic homelessness and mental illness.

Few studies to date have looked at the accumulation of adverse childhood experiences and their effect on the adult lives of individuals who are homeless. Recently, Tsai, Edens and Rosenheck [11] examined the childhood profiles of 738 homeless adults and found three clusters: numerous childhood problems (21%); disrupted family structure (44%); and few childhood problems (35%). Participants with numerous childhood problems were significantly younger when first homeless and engaged in more severe drug use than other participants. Tam, Zlotnick and Robertson [12] examined the long-term effects of adverse childhood experiences on adult substance use, social service use, and employment among 397 homeless adults in Oakland. Adverse childhood experiences were positively correlated with consistent substance use over 15 months of follow-up as well as social service use. Further, consistent substance use was negatively associated with employment and social service use.

No studies to our knowledge have examined the cumulative impact of adverse childhood events on the adult lives of homeless people with mental illness. However, evidence suggests that adults with mental disorders report greater exposure to adverse childhood experiences compared to the general population [13] and that exposure may be related to symptom severity and course of illness [14,15]. Furthermore, studies have found that cumulative exposure to adverse childhood events was related to homelessness in the past 6 months among adults with severe mood disorders [14] and with psychotic disorders [15].

How are adverse childhood experiences linked to health risk behaviors and illness in adulthood? Research to date has focused on behaviors such as alcohol or drug use, smoking, or other behaviors that have immediate psychological or pharmacological benefit as coping strategies in the face of consistently high levels of stress [6-8]. However, few studies have examined the use of alcohol and other drugs in detail; for example, what frequency and type of substance use is associated with chains of risk? The current study further examines the relationship between adverse childhood events and a variety of adult health outcomes among a sample of homeless adults with mental illness in Vancouver, British Columbia. More specifically, we aim to explore the relationship between adverse childhood events, substance use disorders (including frequency, severity and type of substance), mental illness, duration of homelessness, and vocational functioning. In identifying early indicators for problematic substance use and/or homelessness, we are posing a larger question about how we might prevent or attenuate a myriad of negative health and social outcomes in adulthood.

Methods

The Vancouver At Home Study is a randomized controlled trial involving homeless adults with mental illness in Vancouver, British Columbia. Study design and sample size were determined by the At Home/Chez Soi National Research Team which monitored activities at five different study sites [16]. Details related to the trial protocol such as CONSORT have been reported elsewhere [16,17]. The current study focuses on baseline data from one study site (Vancouver) prior to randomization and does not incorporate any longitudinal findings.

Eligibility criteria included legal adult status (19 years and older), current mental disorder on the MINI International Neuropsychiatric Interview (MINI) [18], and being absolutely homeless or precariously housed. Absolute homelessness was defined as living on the streets or in an emergency shelter for at least the past seven nights with little likelihood of obtaining secure accommodation in the upcoming month. Precariously housed was defined as living in a rooming house, hotel or other transitional housing; in addition, individuals must have experienced at least two episodes of absolute homelessness in the past year, or one episode lasting for at least four weeks in the past year.

Participants were recruited through referral from over 40 agencies available to homeless adults in Vancouver; the majority was recruited from homeless shelters, drop-in centres, homeless outreach teams, hospitals, community mental health teams, and criminal justice programs. We specifically targeted organizations that serve women, youth, aboriginal peoples, and gay/lesbian individuals in order to obtain as diverse and representative a sample as possible. Referral was typically initiated by service providers and a preliminary screening for eligibility (e.g., duration of homelessness, mental health and substance use problems), was conducted via telephone with the referral agent. All participants met face-to-face with a trained research interviewer who explained procedures, obtained informed consent, and confirmed study eligibility. A cash honorarium of $5 was provided to the participant for the screening process. Institutional ethics board approval was obtained through Simon Fraser University and the University of British Columbia.

If the individual met all study criteria, they were enrolled as a participant and the baseline interview commenced, consisting of a series of interviewer-administered questionnaires including socio-demographic characteristics, psychiatric symptoms, substance use, physical health, service use, and quality of life [17]. Participants received a

further cash honorarium of $30 upon completion of the baseline interview which typically took 90 minutes to complete. The following analyses are based upon data from the baseline questionnaires of 497 participants recruited from October 2009 to June 2011 and data from the Adverse Childhood Experiences scale [19], which was administered 18 months after baseline.

Variables of interest

Childhood events were assessed 18 months after the baseline interview using the Adverse Childhood Experiences (ACE) scale [19], which consists of 17 questions pertaining to age 18 or younger. The ACE includes three categories of childhood abuse: psychological abuse (2 questions), physical abuse (2 questions), contact sexual abuse (2 questions); and two categories of neglect: emotional (2 questions) and physical (2 questions). In addition, the ACE inquires about four categories of exposure to household dysfunction during childhood: parental separation or divorce (1 question), exposure to substance abuse (1 question), mental illness (1 question), violent treatment of mother or stepmother (3 questions), and incarceration (1 question) in the household. Participants received a positive score for a category if they responded "yes" to one or more of the questions in a particular category, for a maximum score of 10. Response options included Yes, No, Don't know or Decline. Only a response of "yes" was recorded as a positive endorsement of items on the ACE. The response "don't know" was recorded as a negative response and declining to respond was considered as missing data.

With regard to mental disorders, Severe Cluster includes at least one of current Psychosis, Mood Disorder with Psychotic Features, and Hypomanic or Manic Episode, as identified through the MINI or documented physician diagnosis. Less Severe Cluster includes at least one of current Major Depressive Episode, Panic Disorder, and Post-traumatic Stress Disorder. Suicidality, Alcohol Dependence, and Substance Dependence were also identified using the MINI. Frequency and type of substance use over the past month were recorded using the Maudsley Addiction Profile (MAP) [20]. Physical illness was assessed by self-report using a checklist of 30 chronic health conditions (lasting longer than six months). Bloodborne infectious disease consisted of positive self-report diagnosis of HIV, Hepatitis B or Hepatitis C. Vocational functioning included two variables: (1) have you ever had a job that lasted for at least one year? (yes/no) and (2) are you currently employed in paid work? (yes/no) Psychometric properties for all measures are provided in previous manuscripts [16,17].

Statistical analyses

Comparisons of categorical data between participants who completed or did not complete the ACE were conducted using Pearson's chi-square or Fisher's exact test. Comparisons of numeric variables (e.g., age at enrolment) between groups were conducted using the Student t test and Wilcoxon's rank-sum test. Univariate and multivariable logistic regression analyses were used to model the independent associations between ACE total score and a series of a priori outcome variables. Each outcome variable was modeled in both univariate and multivariate settings using ACE total score as an independent risk factor. Outcome variables that were significant at the $p \leq 0.10$ level were considered for the multivariable logistic regression analyses using the same set of controlling variables (age at enrolment, gender, ethnicity, educational attainment, and level of need) chosen based on previous literature [7,8,11,12]. Both unadjusted and adjusted odds ratios and 95% confidence intervals (CI) are reported as effect sizes and all p-values are two-sided. SPSS-21 was used to conduct these analyses. Missing values ranging from zero to 2% for all outcome and controlling variables in the regression analysis were excluded.

Results

In total, 497 participants completed the baseline questionnaire. Of the total sample, 413 participants (83%) were located for the 18 month follow-up interview and 364 of these participants (88%) provided a valid response on all ACE items. Declined items ranged from 9.2% (physical abuse) to 10.9% (maternal violence) and "don't know" responses ranged from 2.2% (psychological and physical abuse) to 9.7% (household mental illness). Table 1 presents the baseline characteristics for the full baseline sample (n = 497) and for participants who completed the ACE (n = 364). At baseline, the majority of participants who responded to the ACE was male (71%) and White (55%); the mean age at enrollment was 41.0 (SD = 10.6) years; and the mean age when first homeless was 29.0 (SD = 13.1) years. The median duration of lifetime homelessness was 36 months (IQR: 12–84 months). Compared to the baseline sample, participants who completed the ACE were more likely to be categorized as "moderate" than "high" needs ($p \leq 0.05$), based on an algorithm that considered type of mental disorder, history of psychiatric hospitalization, substance dependence and/or criminal justice involvement, and community functioning [17]. Otherwise, there were no significant differences at baseline between the full sample and participants who completed the ACE.

The proportion of positive responses for the ten categories included in the ACE ranged from 20% for a household member being incarcerated to 54% for psychological abuse (often experiencing an adult in the household swear, insult or humiliate the participant, or act in a way that made the participant afraid that they might be physically hurt; see Table 2). Only 12% of participants did not

Table 1 Socio-demographic, mental disorder, and substance use-related characteristics for Vancouver At Home study participants (n = 497)

Variable	Total sample (n = 497)	Participants with valid ACE total score (n = 364)	Participants with missing or declined responses (n = 133)	P value
	N (%)	N (%)	N (%)	
Need level (High)	297 (60)	208 (57)	89 (67)	0.049*
Gender (Male)	359 (73)	255 (71)	104 (78)	0.103
Age at enrolment visit				
Youth	36 (7)	24 (7)	12 (9)	0.344
25-44 years	281 (57)	202 (56)	76 (59)	
> 44 years	180 (36)	138 (38)	42 (32)	
Ethnicity				
Aboriginal	77 (15)	62 (14)	15 (11)	0.251
White	280 (56)	199 (55)	81 (61)	
Other	140 (28)	103 (28)	37 (28)	
Incomplete high school	280 (57)	210 (58)	70 (53)	0.270
Marital status (Single)	343 (70)	250 (69)	93 (72)	0.570
Precariously housed	109 (22)	76 (21)	33 (25)	0.544
Duration of homelessness				
Lifetime (>36 months)[1]	234 (48)	173 (48)	61 (46)	0.697
Longest single period (>1 yr)[2]	245 (50)	184 (51)	61 (47)	0.373
First homeless prior to age 25 yrs	214 (44)	152 (42)	62 (47)	0.313
Overall health (Poor)	67 (13)	53 (14)	14 (10)	0.240
Type of mental disorder				
Less severe	264 (53)	202 (56)	62 (47)	0.079+
Severe	363 (73)	258 (71)	105 (79)	0.073+
Multiple (≥2) mental disorders	240 (48)	180 (49)	60 (45)	0.392
Alcohol dependence	121 (24)	91 (25)	30 (23)	0.574
Substance dependence	288 (58)	218 (60)	70 (53)	0.126
High suicidality	87 (17)	69 (19)	18 (13)	0.159
Blood-borne infectious disease	157 (32)	118 (33)	39 (30)	0.540
Multiple (≥3) physical illness	344 (69)	253 (70)	91 (68)	0.817
Age first drunk (≤13 yrs)	164 (47)	51 (40)	215 (46)	0.153
Age of first drug use (≤13 yrs)	140 (42)	43 (35)	183 (40)	0.178
Daily substance use	143 (29)	105 (29)	38 (29)	0.952
Daily drug use	93 (25)	33 (25)	126 (25)	0.867
Injection drug use	88 (18)	64 (18)	24 (19)	0.834
Poly-substance use				
Two or more	257 (52)	193 (53)	64 (49)	0.397
Three or more	148 (30)	113 (31)	35 (27)	0.345
Poly-drug use				
Two or more	188 (38)	145 (40)	43 (33)	0.150
Three or more	108 (22)	84 (23)	24 (18)	0.253

Table 1 Socio-demographic, mental disorder, and substance use-related characteristics for Vancouver At Home study participants (n = 497) *(Continued)*

Weekly alcohol use	111 (22)	85 (23)	26 (20)	0.394
Daily alcohol use	26 (5)	20 (5)	6 (5)	0.678
Daily marijuana use	70 (14)	49 (13)	21 (16)	0.509

[1]Dichotomized based on median score (3 years).
[2]Dichotomized based on median score (1 year).
*$p \leq 0.05$.
+$p \leq 0.10$.

endorse any of the ACE items and 42% positively endorsed five or more items. The mean ACE total score was 3.9 (SD = 2.8) (see Table 2).

Bivariate comparisons by ACE total score are summarized in Table 3. Participants with higher ACE scores were significantly more likely to share certain socio-demographic characteristics (i.e., Aboriginal ethnicity, incomplete high school, having children under age 18), and were significantly more likely to report a number of negative health outcomes related to physical health (i.e., blood-born infectious diseases, rating overall health as "poor"), mental health (i.e., less severe cluster of mental disorders, multiple mental disorders) and substance use (i.e., alcohol and/or substance dependence, early initiation of alcohol and/or drug use, daily alcohol and/or drug use).

Table 2 Prevalence of adverse childhood experiences (ACE) among Vancouver At Home study participants

	N (%)
Overall score (n = 364)	
0	43 (12)
1	45 (12)
2	50 (14)
3	41 (11)
4	33 (9)
5-10	152 (42)
Mean (SD)	3.9 (2.8)
Median (range)	4 (0–10)
Child abuse	
Emotional abuse (n = 374)[1]	203 (54)
Physical abuse (n = 375)	186 (50)
Sexual abuse (n = 370)	104 (28)
Emotional neglect (n = 369)	168 (45)
Physical neglect (n = 371)	106 (29)
Household dysfunction	
Parental separation or divorce (n = 371)	197 (53)
Mother treated violently (n = 368)	90 (24)
Substance abuse (n = 373)	196 (53)
Mental illness (n = 370)	134 (36)
Incarceration (n = 370)	76 (20)

[1]Number of participants who provided a valid response to each item on the ACE.

Unadjusted (UOR) and adjusted odds ratios (AOR) and 95% CI for variables included in the univariate and multivariable analyses are presented in Table 4. Results from the multivariable logistic regression analyses indicate that ACE total score independently predicted meeting criteria for the less severe cluster of mental disorder(s) (AOR: 1.13), Alcohol Dependence (AOR: 1.11), Substance Dependence (AOR: 1.09), high risk of suicidality (AOR: 1.11), and two or more mental disorders (AOR: 1.15); positive self-report of infectious disease (AOR: 1.09), three or more chronic physical illnesses (AOR: 1.15), and "poor" overall health (AOR: 1.12); early initiation (prior to age 14 years) of alcohol (AOR: 1.17) and/or drugs (AOR: 1.20), current daily substance use (AOR: 1.10), daily drug use (AOR: 1.14), and daily marijuana use (AOR: 1.16). Further, a significant positive trend was observed between ACE total score and a longest single episode of homelessness of one year or more (AOR: 1.07) and past month use of three or more substances (AOR: 1.07).

Discussion

Among our sample of homeless adults with mental illness, we found a strong relationship between the breadth of exposure to abuse or household dysfunction during childhood (ACE total score) and a number of indicators of poor mental and physical health as well as problematic substance use in adulthood. ACE total score independently predicted meeting criteria for a current mental disorder in the less severe cluster (i.e., major depressive episode, panic disorder or post-traumatic stress disorder), multiple mental disorders, and high risk of suicide; infectious disease, three or more chronic physical conditions, and poor self-rated health; alcohol and/or substance dependence, early initiation of alcohol and/or drug use, and daily use of any substance, illicit drugs, and marijuana. These findings suggest that the impact of adverse childhood experiences on adult health and social functioning is strong and cumulative among homeless individuals with mental illness.

Of concern was the very high rate of adverse events reported by our sample: 65% reported personally experiencing abuse, 53% reported experiencing neglect, and 79% reported

Table 3 ACE total score by socio-demographic, physical health, mental disorder and substance use variables (n = 364)

Variable	Mean (SD)	P value
Socio-demographic variables		
Need Level		
High	3.8 (2.8)	0.423
Moderate	4.0 (2.8)	
Gender		
Male	3.7 (2.8)	0.071^{+}
Female	4.3 (2.8)	
Age at enrolment		
19-24 years	3.5 (2.7)	0.672
25-44 years	4.0 (2.8)	
> 44 years	3.8 (2.8)	
Ethnicity		
Aboriginal	4.8 (3.0)	0.004**
White	3.9 (2.7)	
Other	3.4 (2.7)	
Education		
Completed high school	3.3 (2.6)	0.001***
Incomplete high school	4.3 (2.8)	
Marital status		
Single (never married)	3.8 (2.6)	0.204
Other	4.2 (3.1)	
Housing status		
Precariously housed	3.9 (2.8)	0.570
Absolutely homeless	3.7 (2.8)	
Duration of homelessness (lifetime)		
> 36 months	3.8 (2.7)	0.711
≤ 36 months	3.9 (2.8)	
Duration of homelessness (longest single episode)		
> 12 months	3.6 (2.7)	0.032*
≤ 12 months	4.2 (2.8)	
Age of first homelessness		
< 25 years	3.8 (2.8)	0.413
≥ 25 years	4.0 (2.8)	
Physical health		
Blood-borne infectious disease		
No	3.6 (2.7)	0.008**
Yes	4.5 (2.9)	
Multiple (≥3) physical illness		
No	3.1 (2.7)	<0.001***
Yes	4.2 (2.8)	
Overall health		
Fair/good/excellent	3.7 (2.7)	0.029*
Poor	4.6 (3.1)	
Mental disorders (past month)		
Less severe cluster		
No	3.4 (2.6)	0.001**
Yes	4.3 (2.9)	
Severe cluster		
No	4.1 (2.6)	0.314
Yes	3.8 (2.9)	
Multiple (≥2) mental disorders		
No	3.4 (2.6)	<0.001***
Yes	4.4 (2.9)	
Alcohol dependence		
No	3.7 (2.7)	0.005**
Yes	4.6 (2.8)	
Substance dependence		
No	3.7 (2.7)	0.005**
Yes	4.6 (2.8)	
Suicidality		
High	3.7 (2.7)	0.038*
No/low/moderate	4.5 (2.9)	
Substance use (past month)		
Age first drunk		
Before 14 years	4.6 (2.7)	<0.001***
14 years or after	3.3 (2.7)	
Age first used drugs		
Before 14 years	4.8 (2.7)	<0.001***
14 years or after	3.5 (2.7)	
Frequency of substance use (including alcohol)		
Less than daily/none	3.6 (2.7)	0.006**
Daily	4.5 (2.9)	
Frequency of drug use		
Less than daily/none	3.6 (2.7)	0.001***
Daily	4.7 (2.9)	
Frequency of marijuana use		
Less than daily/none	3.8 (2.7)	0.015*
Daily	4.8 (3.0)	
Frequency of alcohol use		
Less than weekly/none	3.8 (2.8)	0.089^{+}
Weekly or more	4.3 (2.8)	
Injection drug use		

Table 3 ACE total score by socio-demographic, physical health, mental disorder and substance use variables (n = 364) *(Continued)*

No	3.8 (2.8)	0.148
Yes	4.3 (2.8)	
Poly-substance use		
Two or less	3.7 (2.8)	0.056^{+}
Three or more	4.3 (2.7)	
Poly-drug use		
Two or less	3.8 (2.8)	0.122
Three or more	4.3 (2.6)	

*p ≤ 0.05.
+ p ≤ 0.10.
**p≤0.01.
***p≤0.001.

household dysfunction. The mean number of adverse childhood experiences reported was 4. Only 24% of participants reported 1 or zero adverse childhood experiences, 34% reported 2 to 4 events, and 42% reported 5 to 10 events. Rates of adverse childhood experiences in our study were two to nine times higher than those reported by Dube et al. [7] using a large HMO sample. Our findings are similar to those reported by Wu et al. [21] who administered the Life Stressor Checklist-Revised to adults with concurrent mental illness and substance dependence in a residential drug treatment program: 16% of participants reported 1 or zero adverse childhood experiences, 49% reported 2 to 4 events, and 34% reported 5 or more events. Sullivan et al. [2] reported that about one-quarter of their sample of homeless adults with mental illness experienced residential instability as children and over one-third witnessed violence in the home or personally experienced abuse. These authors concluded that homeless people with mental illness appear to receive a "double dose" of disadvantage in the form of poverty as well as family instability and violence. Our findings suggest that childhood adversity among homeless adults with mental illness is much more pervasive and cumulative, and likely contributes to a number of chronic health problems in adulthood.

Consistent with other studies, multiple adverse childhood experiences predicted a variety of adult health problems including physical illness [22,23], mental illness [24] and substance use problems [12,25,26]. As expected, ACE score is predictive of depressive and anxiety disorders, including post-traumatic stress disorder, rather than disorders that are typically characterized as "severe" such as psychotic and bipolar disorders. However, the relationship between ACE score and physical illness and substance abuse suggests a complex syndrome that can be very severe in terms of its impact and duration. ACE total score independently predicted a range of substance use problems in our adult sample, including early initiation of drug and/or alcohol use (before age 14). Along with other studies, our findings suggest that daily drug use is a common mediator for a range of early risk factors [27]. Thus, it appears that abuse of alcohol and other drugs places an individual at greater risk of homelessness, but is not a direct causal factor [28]. Previous research using our sample of homeless adults with mental disorders found that daily drug use significantly predicts the duration of homelessness [29] as well as the severity of mental health symptoms [30].

Cross-sectional, retrospective data cannot disentangle the unique predictors of homelessness and mental illness, but it is likely that negative childhood experiences have both direct and indirect effects on participants' history of homelessness. Documentation of these underlying common factors points to a broad range of vulnerabilities for homelessness and mental illness. These common factors increase the complexity of personal problems as well as the duration of homelessness [29]. Therefore, substance dependence, especially when concurrent with mental illness among homeless populations, is not only a clinical problem but also a critical indicator for a range of other social and psychological problems that may need to be addressed before homelessness can be resolved.

According to Briere's [31] self-trauma model, beyond its initial negative effects, early and cumulative childhood trauma interrupts normal child development, conditions negative affect to abuse-related stimuli, and interferes with the usual acquisition of self-capacities such as affect regulation skills. Reduced affect regulation places an individual at risk for being more easily overwhelmed by emotional distress associated with memories of trauma, and increases the likelihood of using dissociation and other avoidant coping strategies in adolescence and adulthood. In this way, impaired affect regulation leads to reliance on avoidance strategies which, in turn, further prevent the development of self-regulation capacities. This negative cycle is exacerbated by the individual's tendency to repetitively re-experience cognitive-emotional memories of the traumatic event in an effort to process conditioned emotional responses and distorted cognitive schema – a process that can further overwhelm self-regulation and produce distress. Therefore, in addressing the long-term impact of adverse childhood experiences, the role of family context and environment (e.g., parenting and attachment) must be considered alongside avoidance strategies such as substance use.

Implications

Children who have experienced trauma are more likely to experience trauma and abuse in the future [32]. Furthermore, victims of childhood trauma often engage in post-victimization behavior in the form of violence against self or others and poor personal and occupational functioning [33]. The experience of homelessness

Table 4 Logistic regression analysis for socio-demographic, mental illness, and substance use-related outcomes based on ACE total score (n = 364)

Outcome[1]	Unadjusted OR (95% CI)	p value	Adjusted OR (95% CI)[2]	p value
Duration of homelessness				
Cumulative lifetime (>3 years)	1.10 (0.94, 1.09)	0.710		
Longest single episode (>1 year)	1.09 (1.01, 1.17)	0.032*	1.07 (0.99, 1.16)	0.108+
Age first homeless (<25 years)	1.03 (0.96, 1.11)	0.412		
Mental disorder				
Less severe cluster	1.14 (1.05, 1.23)	0.001**	1.13 (1.04, 1.23)	0.004**
Severe cluster	0.96 (0.88, 1.04)	0.313		
Alcohol dependence	1.13 (1.04, 1.23)	0.006**	1.11 (1.01, 1.21)	0.030*
Substance dependence	1.11 (1.02, 1.19)	0.012*	1.09 (1.00, 1.19)	0.040*
High suicidality	1.10 (1.01, 1.21)	0.039*	1.11 (1.01, 1.23)	0.032*
Multiple (≥2) mental disorders	1.15 (1.07, 1.24)	<0.001***	1.15 (1.06, 1.24)	0.001**
Physical health				
Blood-borne infectious diseases (HIV/HCV/HBV)	1.11 (1.03, 1.21)	0.008**	1.09 (1.01, 1.19)	0.039*
Multiple (≥3) physical illness	1.17 (1.07, 1.27)	0.001**	1.15 (1.05, 1.26)	0.015*
Overall health (poor)	1.12 (1.01, 1.25)	0.030*	1.12 (1.00, 1.25)	0.047*
Substance use				
Age first drunk (<14 years)	1.19 (1.10, 1.29)	<0.001***	1.17 (1.08, 1.28)	<0.001***
Age of first drug use (<14 years)	1.20 (1.10, 1.30)	<0.001***	1.20 (1.10, 1.31)	<0.001***
IV drug use	1.07 (0.98, 1.18)	0.149		
Daily substance use	1.12 (1.03, 1.22)	0.007**	1.10 (1.01, 1.20)	0.027*
Daily illicit drug use	1.15 (1.06, 1.25)	0.001**	1.14 (1.04, 1.25)	0.005**
Daily hard drug use (no marijuana)	1.09 (0.98, 1.20)	0.104+	1.05 (0.95, 1.17)	0.349
Weekly alcohol use	1.08 (0.99, 1.18)	0.089+	1.06 (0.97, 1.16)	0.191
Daily marijuana use	1.14 (1.02, 1.27)	0.017*	1.16 (1.04, 1.31)	0.010*
Poly-substance (≥3) use	1.08 (1.00, 1.17)	0.057+	1.07 (0.99, 1.17)	0.099+
Poly-drug (≥3) use	1.07 (0.98, 1.17)	0.123		
Poly-drug (≥2) use	1.05 (0.97, 1.13)	0.257		

*p ≤ 0.05 **p ≤ 0.01 ***p ≤ 0.001 + p ≤ 0.10.
[1]Separate binary logistic regression analyses (univariate and multivariable) were conducted for each outcome using ACE total score (continuous measure) as an independent variable.
[2]Each multivariable model was controlled for age (continuous), gender (male vs. female), ethnicity (Aboriginal, Caucasian, Other), need level (High vs. Moderate), and education (completed vs. incomplete high school).

increases the likelihood that an individual will witness or experience trauma, and homelessness itself is considered as a traumatic experience that interrupts routines and damages social networks [34]. Among homeless populations, having a mental illness and bearing witness to multiple violent events are predictive of increased severity of trauma symptoms [35], placing the individual at higher risk for social and functional difficulties including reduced social support and impaired work performance [12].

Research on early indicators of risk for homelessness has important implications for the prevention of homelessness as well as intervention and service provision. Given the high prevalence and long-term negative consequences associated with adverse childhood experiences (in general as well as homeless populations), increased attention to primary, secondary and tertiary prevention strategies is needed. Primary prevention of adverse events will ultimately require societal changes that improve the quality of family and household environments during childhood, particularly for poor households. Longitudinal evaluations of early intervention programs (secondary prevention) such as Head Start [36] and the Nurse Family Partnership [37] have documented the prevention of a range of health, social and justice related problems with vulnerable groups (e.g., low income children and first-time mothers).

Prevention also requires increased recognition of the effects of childhood trauma as well as a better understanding of the behavioral coping strategies that are commonly adopted to reduce the emotional impact of these experiences. However, psychological assessment and treatment

for children and adolescents is often grossly inadequate. Where psychosocial interventions are available, improved coordination between mental health professionals, general practitioners, child protection and public health workers, and families is greatly needed in order to better understand how social, emotional, and medical problems are linked throughout the lifespan.

Limitations

A potential weakness of studies with retrospective reporting of childhood experiences is recall bias. Longitudinal follow-up of adults whose childhood abuse was documented has shown that their retrospective reports of such abuse are likely to underestimate actual occurrence [38]. Therefore, difficulty recalling childhood events likely results in misclassification (classifying people who truly were exposed to ACEs as unexposed) that would bias our results toward the null hypothesis. Also, substance use is likely under-reported by participants particularly given that the baseline questionnaires were administered prior to randomization to supported housing or usual care. In addition, the number of participants who declined to respond to items on the ACE was relatively high, and suggests an attempt to avoid thinking about distressing past events. If this is the case, it would result in further under-reporting of adverse events in our sample. Other than level of need, we found no significant differences between participants who completed vs. those who did not complete the ACE. Finally, there may be mediators of the relationship between childhood experiences and adult health status other than the risk factors we examined such as childhood conduct problems or foster care placement.

The retrospective and cross-sectional nature of our data preclude the kind of modeling required to identify the primary adult outcomes related to adverse childhood events. Further longitudinal research is required to more fully understand the developmental and social sequelae related to childhood adverse events. Further research is also needed to understand how social factors regulate behaviours or distribute individuals into risk groups and how those social factors push individual trajectories towards or way from adverse outcomes.

Conclusions

Our research, along with others', shows that the problems experienced by the majority of homeless adults with mental illness have longstanding histories dating back to childhood. Poverty, family instability, damaging psychological experiences, and general household distress are all disproportionately present in the childhood backgrounds of our participants. These early experiences likely work both directly and indirectly to produce risk for homelessness in various ways, shaping, influencing and constraining the intra- and interpersonal resources that children can draw from adults [4].

Competing interests

This research was funded by Health Canada and the Mental Health Commission of Canada. The views expressed herein solely represent the authors. The authors declare no competing interests.

Authors' contributions

MLP drafted the manuscript and oversaw data collection; AM conducted the statistical analyses; JMS contributed to study design and critical editing of the manuscript. All authors reviewed the final draft. All authors read and approved the final manuscript.

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TRIALS

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Vancouver At Home: pragmatic randomized trials investigating Housing First for homeless and mentally ill adults

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Abstract

Background: Individuals with mental illnesses are overrepresented among the homeless. Housing First (HF) has been shown to promote positive outcomes in this population. However, key questions remain unresolved, including: how to match support services to client needs, the benefits of housing in scattered sites versus single congregate building, and the effectiveness of HF with individuals actively using substances. The present study aimed to recruit two samples of homeless mentally ill participants who differed in the complexity of their needs. Study details, including recruitment, randomization, and follow-up, are presented.

Methods: Eligibility was based on homeless status and current mental disorder. Participants were classified as either moderate needs (MN) or high needs (HN). Those with MN were randomized to HF with Intensive Case Management (HF-ICM) or usual care. Those with HN were randomized to HF with Assertive Community Treatment (HF-ACT), congregate housing with support, or usual care. Participants were interviewed every 3 months for 2 years. Separate consent was sought to access administrative data.

Results: Participants met eligibility for either MN (n = 200) or HN (n = 297) and were randomized accordingly. Both samples were primarily male and white. Compared to participants designated MN, HN participants had higher rates of hospitalization for psychiatric reasons prior to randomization, were younger at the time of recruitment, younger when first homeless, more likely to meet criteria for substance dependence, and less likely to have completed high school. Across all study arms, between 92% and 100% of participants were followed over 24 months post-randomization. Minimal significant differences were found between study arms following randomization. 438 participants (88%) provided consent to access administrative data.

Conclusion: The study successfully recruited participants meeting criteria for homelessness and current mental disorder. Both MN and HN groups had high rates of substance dependence, suicidality, and physical illness. Randomization resulted in no meaningful detectable differences between study arms.

Trial registration: Current Controlled Trials: ISRCTN57595077 (Vancouver at Home study: Housing First plus Assertive Community Treatment versus congregate housing plus supports versus treatment as usual) and ISRCTN66721740 (Vancouver At Home study: Housing First plus Intensive Case Management versus treatment as usual).

Keywords: Housing First, Homelessness, Mental illness, Concurrent disorders

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Background

Individuals who are homeless and mentally ill are heterogeneous in their health and social challenges. Effective models of service must be responsive to individual needs, which may vary across time and space, and are constrained by pragmatic factors, including local standards of care, housing availability, and funding. The Vancouver At Home (VAH) project has implemented two randomized controlled trials (RCTs) involving homeless mentally ill adults in Vancouver, BC, Canada. VAH is collaborating with similar projects in four other Canadian cities [1]. Each collaborating center has incorporated a common methodology, with pragmatic adaptations in each site. Site-specific adaptations were influenced by the characteristics of each local population (for example, ethno-racial services in Toronto, ON, Aboriginal focus in Winnipeg, MB), as well as the structural features of each locale (for example, rural service models in Moncton, NB, congregate housing in Vancouver, BC). The purpose of the present article is to describe the unique features of VAH, including measures, interventions, and sample characteristics in accordance with the Consolidated Standards of Reporting Trials (CONSORT) statement for the reporting of pragmatic trials.

We briefly describe the physical setting of Vancouver, the local population who are both homeless and mentally ill, and the Housing First (HF) program. These factors influenced both the design and implementation of VAH with the goal of maximizing the effectiveness and relevance of the project.

For decades, the city of Vancouver has struggled to meet the needs of a visibly homeless and inadequately sheltered population in a central downtown neighborhood. The same neighborhood has been afflicted by high crime rates, an open market for illicit drugs, infectious diseases, and premature mortality [2]. For many years, the most affordable housing in the neighborhood has consisted of single room occupancy (SRO) hotels, many of which earned a reputation for hazards ranging from bed bugs to criminal predation [3,4]. Individuals with mental illness are prominent among the homeless, particularly following 'deinstitutionalization', whereby regional psychiatric facilities were downsized as promises to implement community-based support, such as Assertive Community Treatment (ACT), were unfulfilled. A diverse array of services emerged over time to support individuals in the neighborhood, including outreach services, meal programs, shelters, drug-related services (for example, needle exchange, supervised injection site [5]), and varied forms of supported housing.

The City of Vancouver has implemented a plan with the goal to 'end street homelessness' by 2015. A key element of the plan involves the construction of apartment buildings to provide housing and support for the homeless. However, key questions remain unresolved regarding the appropriate mix of occupants in these buildings and the type of support that would be required to promote stable occupancy and recovery among individuals who are leaving homelessness and who have differing needs.

Prior to VAH, no study had systematically examined the health and housing status of individuals who were homeless and mentally ill in Vancouver. A considerable amount of anecdotal and descriptive information was available from sources, such as shelter operators, street outreach clinicians, police, and from research involving samples that included homeless individuals (for example, patients with HIV/AIDS, survival sex workers [4,6,7]). The available evidence suggests that the local population of homeless mentally ill individuals struggles with complex social and medical problems, including infectious diseases, frequent polysubstance use, cognitive impairment, trauma, victimization, and poor food security [4,8]. It had also been reported that homeless individuals were using emergency and hospital services due to inadequate community care, and were frequently involved with the justice system [7,9]. Based on these considerations, it was anticipated that VAH would extend the HF model to clients with more complex needs than those described in previous trials, including participants with concurrent substance use disorders.

A growing literature supports the effectiveness of the HF model for individuals who are both homeless and mentally ill. HF emphasizes the value of client choice and has been shown to promote residential stability [10,11], community integration [12], and high levels of client satisfaction [13]. Originating from the Pathways model in New York City, NY, USA, HF involves building a portfolio of rental accommodations (typically apartments) scattered throughout different neighborhoods, thereby providing clients with meaningful choices concerning the location and setting of their residence [14]. Clients are then supported in their homes by either an HF with Assertive Community Treatment (HF-ACT) team or HF with Intensive Case Management (HF-ICM), depending on their level of needs. ACT was originally created to constitute a 'hospital without walls' enabling individuals who might otherwise have been admitted to psychiatric facilities to instead pursue recovery in community settings [15]. ACT teams are available 24/7, and include varied expertise across multiple disciplines. The effectiveness of ACT has been well established among individuals who reflect the original target population (that is, individuals with psychotic disorders or bipolar disorder), including specific outcomes, such as reductions in hospital admissions and criminal justice involvement [16,17]. However, the effectiveness of HF-ACT is

less well known among sub-populations who also have cognitive impairments, complex addictions, or multiple physical and mental illnesses.

The majority of studies examining HF have followed participants for up to 24 months (for example, Gulcur [11], Tsemberis and Eisenberg [14]). Longer-term research involving diverse residential interventions for homeless individuals in New York City found that housing stability decreased after 1, 2, and 5 years (75%, 64%, and 50%, respectively) [18]. Several studies have reported that substance use disorders are predictive of lower housing stability regardless of residence type [19,20]. Preliminary evidence suggests that congregate HF (that is, a single supported building) may achieve housing stability and cost savings among homeless men who are alcohol dependent [21]. However, it is not known whether these results would be replicated among mentally ill users of illicit (or multiple) substances and who receive scattered site HF.

Compared to ACT, the effectiveness of ICM has received less empirical attention in the context of supported housing for individuals with mental illness, and its definition varies widely [22]. Unlike HF-ACT, which provides a broad range of specialized services directly to clients, HF-ICM operates as a liaison connecting clients with community services based on their expressed needs. The success of HF-ICM is therefore a function of the complexity of client needs, as well as the availability and appropriateness of relevant community resources. HF-ICM may be appropriate for clients with less severe mental illness or as a step-down from HF-ACT following successful stabilization. For example, as part of a multicenter trial, the Boston McKinney study [22] randomized homeless adults with mental illness to independent apartments or small group homes, both of which received 'comprehensive case management'. Findings indicated that housing availability, regardless of type, was the primary predictor of subsequent ability to avoid homelessness, while enhanced services reduced the risk of homelessness if housing was also available. Substance abuse was the strongest single predictor of days homeless [22,23].

The primary objectives of this article are:

1. To report study details including measures and interventions that are unique to VAH.
2. To present details of recruitment and follow-up rates for participants in VAH including primary data collection and administrative data.
3. To present baseline characteristics and examine potential non-equivalence between randomization arms in each trial.
4. To examine differences in the complexity of needs between participants in the two trials.

Methods

Community engagement

Development of the research protocol was preceded by several community meetings and by six focus groups with individuals who had experienced homelessness and mental illness in the Vancouver area. In total, 58 individuals were convened with the assistance of community agencies, and met privately with an experienced academic facilitator who took notes and prepared reports of proceedings. Focus group participants were asked to advise on procedures to enhance the relevance of the research, to minimize risks and maximize benefits to participants, and ways to incorporate the expertise of individuals with direct experiences of homelessness in the research project. Narrative feedback from respondents (for example, amounts of honoraria, the need to include individuals who had experienced homelessness as members of service teams and on the research team) were included in the grant application and later implemented as part of the project. Service provider representatives were consulted extensively during the design of the research and were invited to respond to a request for proposals to implement the major services that comprised the interventions tested in the study: HF-ACT, HF-ICM, scattered site housing portfolio management, and congregate housing with support.

Recruitment

Participants were recruited through service providers and agencies serving individuals who are homeless and mentally ill in Vancouver, including shelters, drop-in centers, street outreach workers, hospitals, police, and courts. An effort was made to locate individuals throughout Vancouver, while recognizing that the majority of visible homelessness and related services were concentrated in one area.

Eligibility and level of needs

Eligible participants were Canadian citizens at least 19 years of age who met criteria for homelessness or precarious housing and current mental disorder status. Informed consent required that individuals were made aware that randomization would involve assignment to either a pre-specified intervention that included housing or to usual care consisting of existing services and support. Participants and interviewers were therefore not blinded to the results of randomization.

Operational definitions

Homelessness was defined as having no fixed place to sleep or live for more than 7 nights and little likelihood of obtaining accommodation in the coming month. Precarious housing was defined as currently residing in marginal accommodation, such as a SRO hotel, and having two or

more episodes of homelessness (as defined above) during the past 12 months. These were minimal criteria, and participants with more long-standing homelessness were eligible for inclusion. Current mental illness was assessed using the Mini-International Neuropsychiatric Interview (MINI) [24] for the following: major depressive episode, manic or hypomanic episode, post-traumatic stress disorder, mood disorder with psychotic features, and psychotic disorder. Where possible, mental disorder status was corroborated by physician diagnosis. Participants were categorized as moderate needs (MN) or high needs (HN). Inclusion in the HN study was based on Multnomah Community Ability Scale (MCAS) [25] score of 62 or lower and current bipolar or psychotic disorder, as well as one of the following: legal involvement in the past year, substance dependence in the past month, and two or more hospitalizations for mental illness in any one of the past 5 years. All other eligible participants were included in the MN study.

Retention strategies

A team of full-time and part-time field interviewers was recruited to follow participants at 3-month intervals. Interviewers received in-depth training and supervision in the administration of measures, and scales and items were pre-tested with a sample of participants. Interviews were considered 'on time' if they occurred within 2 weeks of the designated anniversary date. Participants were paid C$35 for the baseline interview and approximately C$30 for each subsequent interview. Scales were administered verbally and responses entered immediately on laptop computers. Major interviews conducted at 6-month intervals required between 90 to 180 minutes to complete in most cases. A field research office was open daily throughout the study period, and participants were encouraged to drop-in regardless of their interview schedule. Interviewers obtained periodic updates regarding participants' routines and typical whereabouts, and collateral contact information was sought in order to aid with relocation. Interviews were conducted in various locations based on randomization arm and participant preference, including participants' homes, field research office, and public settings, such as restaurants, parks, and drop-in centers.

Randomization

After establishing eligibility for either the MN or HN study, a computerized adaptive randomization procedure was followed to assign participants to study arms. Interviewers used laptop computers with secure live connections to upload data and receive randomization results prior to notifying participants of the outcome. Sample sizes of 100 participants in each study arm were derived based on effect size estimates of 0.5 for the major outcome variables, power of 0.80 ($\beta = 0.20$), an attrition rate of 40%, and significance levels of 0.05 (two-tailed). Additional details of sample size estimates are reported separately [1]. Based on their first 30 clients, the HF-ACT team determined that they would be able to support no more than 90 clients, and the upper limit of this arm was revised accordingly.

Measures

VAH researchers collaborated with investigators in four other study centers and the study funder to develop a common battery of repeated measures. In addition, a number of site-specific measures were implemented at different intervals during the study (Table 1). Both shared and site-specific measures were selected based on the review of existing literature and toward addressing major gaps in knowledge. Measures were administered at single time points if their results were historical or highly stable (for example, adverse childhood events). Repeated measures (for example, quality of life, community integration) were hypothesized to be subject to variation over time based on the randomization arm, with superior outcomes in experimental conditions compared to treatment as usual (TAU). We similarly hypothesize that the models of service introduced through the study would cause superior outcomes when compared to TAU on measures of hospitalization, emergency department visits, and justice system involvement.

The domains addressed by the cross-site scales are: housing and vocational status, psychiatric and physical health, level of independent community integration and functioning, quality of life, and use of community services. The following questionnaires were administered at baseline and at 6-month intervals: health service access items (ACC) [26,27]; community integration scale (CIS) [33]; Colorado Symptom Index (modified) (CSI) [36]; EuroQol 5D (EQ-5D) [45]; Global Appraisal of Individual Needs, Substance Problem Scale (GAIN-SPS) [50]; SF-12 Health Survey (SF-12) [72]; Quality of Life Index, 20-item (QoLI-20) [65]; social support items and food security (FS); health, social, and justice service use inventory (HSJSU); and MCAS [25]. Two instruments were administered at 3-month intervals, Residential Time-Line Follow-Back (RTLFB) [71] and Vocational Time-Line Follow-Back (VTLFB) [75], to produce a continuous timeline of housing status and vocational status, respectively. The Recovery Assessment Scale, 22-item (RAS-22) [68] was administered at baseline and 24 months, and the Adverse Childhood Experiences (ACE) questionnaire [28] was administered once at 18 months after baseline. A number of other measures were implemented at a single time-point: comorbid conditions list (CMC) [41], landlord relations (LR), Observer-rated Housing Quality Scale (OHQS), mobility history (MH), and core service

Table 1 Vancouver At Home (VAH) questionnaire details

Acronym	Full name	Timeline	Key domain/topics	References
ACC	Health service access items	BL, 6, 12, 18, 24	Use of community services: regular family physician or health clinic use, and perceived unmet healthcare needs.	[26,27]
ACE	Adverse Childhood Experiences	18	Psychiatric and physical health, traumatic early life events.	[28]
CI	Cognitive impairment	6, 24	Level of independent community functioning, psychiatric and physical health: Hopkins Verbal Learning Test, Trail Making Test, and Digit Symbol Test.	[29-32]
CIS	Community integration scale	BL, 6, 12, 18, 24	Level of independent community functioning, quality of life: community participation and sense of belonging.	[33-35]
CSI	Colorado Symptom Index (modified)	BL, 6, 12, 18, 24	Psychiatric and physical health: frequency of past month's psychiatric symptoms.	[36-39]
CTS[1]	Conflict tactics scale	24	Level of independent community functioning: frequency and severity of interpersonal conflict.	[40]
CMC	Comorbid conditions list	BL	Psychiatric and physical health: presence of chronic and infectious diseases.	[41]
C-SSS	Core service satisfaction scale	24	Quality of life, use of community services: participant satisfaction with services provided by Vancouver At Home (VAH) intervention teams.	[42,43]
DSHH	Demographics, housing, vocational, and service use history	BL	Housing status, use of community services: sociodemographic details, lifetime duration of homelessness, long-term health, social and justice service use, and vocational history.	[44]
EQ-5D	EuroQol 5D	BL, 6, 12, 18, 24	Psychiatric and physical health, health-related quality of life.	[45-47]
FS	Social support items and food security	BL, 6, 12, 18, 24	Use of community services, psychiatric and physical health: type, quality, availability and source of food, and recent history of food insecurity.	[48,49]
GAIN-SPS	Global Appraisal of Individual Needs, Substance Problem Scale	BL, 6, 12, 18, 24	Substance-related problems.	[50,51]
HSJSU	Health, social, and justice service use inventory	BL, 6, 12, 18, 24	Use of community services, psychiatric and physical health: nature and frequency of health, social, and justice system services.	[42,52-57]
III	Interviewer impression items	BL, 3, 6, 9, 12, 15, 18, 21, 24	Level of independent community functioning: interviewer assessment of validity and reliability of self-report data.	
LR	Landlord relations	18	Housing status: specific to landlord relationship.	
PHQL	Perceived housing quality	6, 12, 18, 24	Housing status: subjective housing quality assessed by participants.	[58,59]
MCAS	Multnomah Community Ability Scale	BL, 6, 12, 18, 24	Level of independent community functioning: interviewer assessed level of functioning across range of domains.	[25,60]
MINI	Mini-International Neuropsychiatric Interview	BL	Psychiatric and physical health: current major Axis I disorders and suicidality.	[24,61-63]
MH	Mobility history	21	Housing status: geographic mobility.	
MoCA[1]	Montreal Cognitive Assessment	21	Level of independent community functioning: assessment of cognitive domains indicated for the screening of neurological deficits.	[64]
OHQS	Observer-rated Housing Quality Scale	24	Housing status: objective ratings of physical characteristics of participant dwellings.	
PAIN[1]	Chronic pain screener	21	Quality of life, psychiatric and physical health.	
QoLI-20	Quality of Life Index, 20-item	BL, 6, 12, 18, 24	Quality of life, psychiatric and physical health: subjective quality of life across range of domains.	[65-67]
RAS-22	Recovery Assessment Scale, 22-item	BL, 24	Quality of life, psychiatric and physical health.	[68-70]
RTLFB	Residential Time-Line Follow-Back	3, 6, 9, 12, 15, 18, 21, 24	Housing status: detailed chronology of housing status, including frequency of moves, type of accommodation, and household composition.	[39,71]

Table 1 Vancouver At Home (VAH) questionnaire details *(Continued)*

SCNR	Eligibility screening instrument	BL	Housing status, psychiatric and physical health: determines participation eligibility based on legal adult status (>19 years in British Columbia (BC)), absolute homelessness or precarious housing status, and current mental illness.	[24,61-63]
SF-12	SF-12 Health Survey	BL, 6, 12, 18, 24	Psychiatric and physical health, level of independent community functioning: assessment of the extent of impairment caused by both physical and mental illness.	[45,72,73]
VFC[1]	Foster care history	12	Quality of life, psychiatric and physical health: details early life involvement in the child welfare system.	
VMAP[1]	Maudsley Addiction Profile	BL, 6, 12, 18, 24	Psychiatric and physical health: past month's substance use, including drug type, mode of administration, frequency of use, and drug-related harms.	[74]
VTLFB	Vocational Time-Line Follow-Back	3, 6, 9, 12, 15, 18, 21, 24	Level of independent community functioning: detailed chronological recent history of paid work and educational or skills training. Quantifies income and income sources.	[75]
WAI-PAR WAI-PRO	Working Alliance Inventory, participant Working Alliance Inventory, provider	6, 12, 18, 24 12	Use of community services and quality of life: participant (WAI-PAR) and service provider (WAI-PRO) assessment of working relationship with key service provider. Assessment of perception of client-provider relationship, support, confidence, and trust.	[76-80]

[1]Vancouver site-specific scales. Timeline: BL, baseline; 3, 3-month visit; 6, 6-month visit; 9, 9-month visit; 12, 12-month visit; 15, 15-month visit; 18, 18-month visit; 21, 21-month visit; 24, 24-month visit.

satisfaction scale (C-SSS) [42,43]; or at other intervals: cognitive impairment (CI) (Hopkins Verbal Learning Test, Trail Making Test, Digit Symbol Test) [29-32], perceived housing quality (PHQL) [58,59], and Working Alliance Inventory (WAI) [76-80]. Semi-structured narrative interviews were scheduled at baseline and 18-month time points with approximately fifty participants (10 from each study arm in the two VAH trials).

Site-specific measures were selected based on study hypotheses and the anticipated characteristics of the Vancouver homeless population. Major areas of hypothesis testing were: addictions, cognitive impairment, and psychiatric severity would negatively influence housing stability; HF would result in superior outcomes when compared to TAU, including reduced use of crisis services and justice system encounters, superior housing stability, and quality of life; and HF would produce superior health outcomes compared to TAU.

The Maudsley Addiction Profile (MAP) [74] is a multidimensional instrument assessing alcohol and drug use and related harms, administered at 6-month intervals. The Montreal Cognitive Assessment (MoCA) [64] assesses several cognitive domains and is indicated for the screening of neurological deficits in younger populations (for example, traumatic brain injury, brain tumors, vascular cognitive impairment). The foster care history (VFC) was administered once at 12 months after baseline. The MoCA, conflict tactics scale [40], and pain scales (assessing acute and chronic pain; Schutz, unpublished) were administered at 21 months only.

Ten participants in each study arm (n = 50) were invited to participate in open-ended, qualitative interviews planned for baseline and 18 months after recruitment. Participants were selected purposively in order to represent differences across gender, ethnicity, duration of homelessness, and degree of functional impairment. Interview questions were organized around the following themes: pathways into and out of homelessness; high, low, and turning points in life; and challenges and enabling factors related to recovery.

In addition, fifty participants were asked to provide consent to undergo physical health examinations involving basic physician assessment and blood analysis (for example, hepatitis B/C, HIV/AIDS). These assessments were included to examine the possibility of undetected illness among members of the study cohorts. Finally, all participants were asked to provide consent for the researchers to send their identifying details to public agencies in order to then receive administrative data regarding their use of health, justice, and social welfare services (separate consent was sought for each category of agency). An inter-agency data sharing protocol was created by a prior project and was used as the basis for the current data extract. The fields of data specified for inclusion were: physician services; hospital services; pharmaceutical services; community mental health and substance use services; vital statistics; justice events, including convictions and sentences; and financial assistance.

Interventions

Participants in both the MN and HN studies were randomized to either an intervention based on the principles of HF or to TAU. In both studies, TAU participants did not receive any housing or support services through

the study, but were able to access existing services and support for individuals who are homeless and mentally ill in Vancouver. The resources comprising TAU include shelters, SRO hotels, and community services described earlier. No research has previously examined the responsiveness and effectiveness of these services by following a cohort of homeless individuals prospectively. Coincident with this study, the City of Vancouver and the provincial housing authority were in the process of expanding services for the homeless [81]. The quality and type of housing received by participants in TAU will be carefully documented alongside the receipt of services and support attendant to housing. In addition to TAU, HN participants were randomized to either HF-ACT or Congregate Housing with Support (CONG). MN participants received either TAU or HF-ICM.

Service providers for each intervention were selected through a competitive request for proposals. Applications were reviewed by a panel of senior individuals drawn from homelessness research, management of services, and community granting agencies. The criteria for assessment included the delineation of organizational experience, plans for implementation, and budget. Each selected service provider received specific training in the delivery of HF, and underwent fidelity assessments by external review teams at two points during the study (see below). Services were based on the model defined by Pathways to Housing [82], including expertise that anticipated the needs of local clients (for example, addiction severity), and configured to support participants in both scattered and congregate housing configurations. Participants randomized to HF were transitioned to a case manager within 2 days of study recruitment.

An inventory of apartments was developed in a variety of neighborhoods throughout the city. These apartments were drawn from private market rentals with numerous landlords. In order to promote community integration, a maximum of 20% of the units in any building could be allocated to program participants. Consistent with the principles of HF, participants were provided with a choice of housing units [82]. A housing portfolio manager was responsible for building and maintaining relationships with landlords, including relocating participants to more suitable locations when needed. Participants in the scattered site conditions (HF-ACT and HF-ICM) received support in their homes and were expected to meet with program staff on a weekly basis. The CONG condition was mounted in a single vacant hotel with the capacity to house approximately 100 occupants in independent suites but without full kitchens. The building was located in a mixed residential and commercial neighborhood, adjacent to numerous amenities. The building was equipped with a number of facilities to support residents and to promote the development of a positive community culture, including: central kitchen and meal area, medical examination room and formulary, and recreational areas (yoga, basketball, road hockey, lounge). Tenants were provided with opportunities to engage in part-time work both within the building (for example, meal preparation, laundry) and in the community (for example, providing a graffiti removal service). A reception area and front desk were staffed 24 hours a day. Tenancy in any of the experimental housing conditions was not contingent on compliance with specific therapeutic objectives (for example, addiction treatment). Program staff in each intervention condition participated in a series of training events in person in order to enhance consistency in practices. Subsidies were provided through the study to ensure that participants paid no more than 30% of the total income on rent. Fidelity assessments were conducted by an external team, with representatives from Pathways to Housing, the study funder, and individuals who had experienced homelessness. Assessments were conducted at two time points (12 and 24 months after implementation) using a HF fidelity scale [82], and involved meetings with staff as well as participants in each of the HF interventions. The assessment team provided verbal and written feedback to the staff at each intervention.

VAH outcomes

The primary outcome domains for both trials are: housing stability, health status, quality of life, and service use. Secondary outcome domains are: cost avoidance and cost effectiveness. Primary outcomes will be compared between HF and TAU, including examination of similarities and differences between congregate and scattered site configurations of HF in the HN sample. Previous research has reported greater reductions in homelessness with group housing than with placement in independent apartments [22]. Particular attention will be paid to the role of substance use in relation to primary outcomes. Service use outcomes and economic analyses will be conducted using administrative data sources as specified.

Data collection and analysis plan

Repeated measures (3- and 6-month scales) were collected over 24 months. Based on previous studies and the results reviewed above, approximately 2 years of follow-up was regarded as sufficient to detect changes in the major outcome domains. Fifteen months after commencing recruitment, the cross-site protocol was shortened from 24 to 21 months. Following this change, VAH revised the composition of the 21-month interview in order to provide more complete data for cross-site end point analyses; however, VAH continued to collect data through to 24 months and preserved the original protocol as specified in the trials' registration. Differences between sites in the protocol change were primarily due to differences in financial resources between study centers. Preserving the

original slightly longer follow-up in Vancouver was deemed important owing to the high levels of comorbidity, substance dependence, and chronicity of homelessness within the sample.

Descriptive statistics (such as mean, median, standard deviation, and proportions) were calculated for all quantitative instruments administered at baseline. Comparisons of variables between groups were conducted using parametric tests (*t*-tests or one-way analysis of variance (ANOVA) for continuous variables) and non-parametric tests (Mann–Whitney or Kruskal–Wallis test for continuous variables; Pearson's chi-squared or Fisher's exact tests for categorical variables), as appropriate. All reported *P* values were two-sided.

Longitudinal analyses of VAH data were planned for 12 and 24 months using several analytic methods, such as hierarchical linear modeling (HLM), generalized estimating equations (GEE), and time-to-event analysis (such as Cox regression and negative binomial regression), as appropriate. All longitudinal analyses are based on intention-to-treat. The major domains of longitudinal analysis examine the overall robustness of interventions to promote health and recovery among groups of participants, and investigate individual characteristics that may predict different responses to interventions. Planned analyses also include examination of service use and cost outcomes using administrative data in combination with interview results. Sensitivity analysis will be conducted to evaluate the effect of missing data using several methods, including mean substitution, multiple imputations, and last observation carried forward.

The results of narrative interviews will be analyzed according to the organizing themes of pathways into and out of homelessness, and high, low, and turning points in life. These thematic analyses are expected to complement results from questionnaires. *Post hoc* analyses will be informed by qualitative findings, and will also examine the characteristics of individuals who appear to exhibit better (and worse) outcomes regardless of randomization

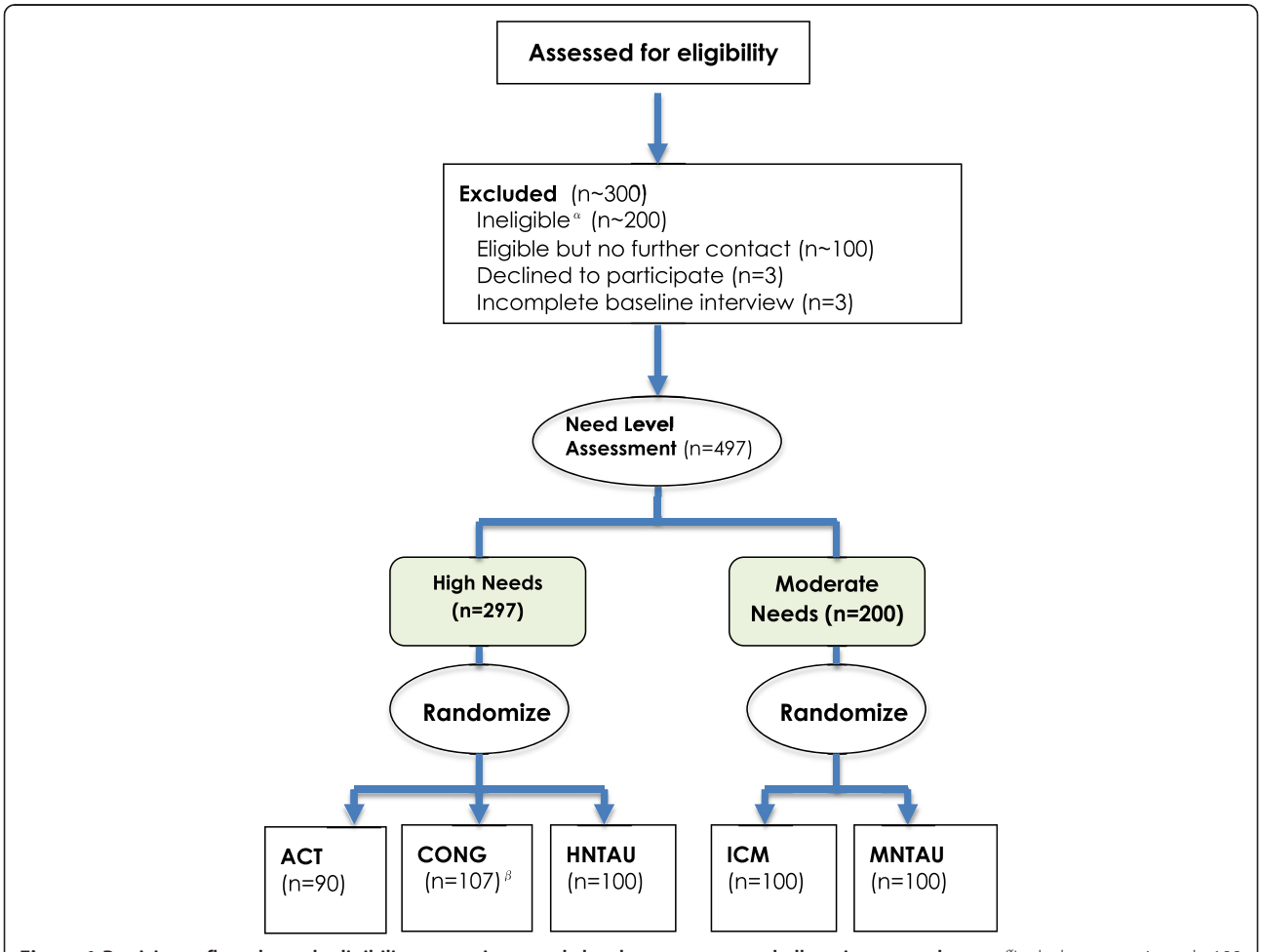

Figure 1 Participant flow through eligibility, screening, needs level assessment, and allocation to study arm. [α]Includes approximately 100 participants deemed ineligible via an informal telephone screen, and 94 participants who were ineligible after formal in-person screening. [β]Includes 11 participants who were unable to be located after assignment or left within 1 month of entering.

arm. In a related vein, ideographic analyses will be performed to examine whether CONG, HF-ACT, and TAU may be associated with better outcomes for differing subpopulations.

Administrative data will be analyzed to provide long-term (that is, up to 15 years prior to randomization) historical perspectives on trajectories of service use prior to and following homelessness. Administrative data will also be used as key outcome measures (for example, changes in hospitalization) and to validate specific items also collected via self-report (for example, hospitalized in past 6 months).

Data derived through the shared cross-site protocol are owned by the study sponsor. Data that are specific to VAH (unique instruments, administrative data) will be retained at the host institution (Simon Fraser University, Burnaby, BC, Canada). The use and storage of provincial administrative data are governed by Information Sharing Agreements between the Government of British Columbia and Simon Fraser University. The research protocol underwent institutional ethics review and was approved by Simon Fraser University.

Results

Recruitment was carried out between October 2009 and April 2011. Follow-up interviews were completed on a schedule following each individual's anniversary and were completed by May 2013. Approximately 800 individuals were screened by telephone. Referral sources (n = 40) represented about thirteen different types of services available to homeless adults with mental illness. The majority of potential participants were referred from homeless shelters, drop-in centers, homeless outreach teams, hospitals, community mental health teams, and criminal justice programs. Approximately 100 individuals were excluded via telephone due to clear ineligibility. A further 200 were excluded through the baseline interview procedure due to ineligibility (n = 94), unable to contact for baseline interview (n = 100), declining to participate (n = 3), or incomplete interview (n = 3) (Figure 1). Of the total number of participants randomized (n = 497), 200 met criteria for MN and 297 met criteria for HN. Retention rates by study arm after 24 months are illustrated in Table 2. Different rates are indicated in relation to scales administered every 3 months and every 6 months.

The primary reasons for loss to follow-up over 24 months were death (n = 5 for 3-month scales and n = 9 for 6-month scales) or inability to locate the participant (n = 9 for 3-month scales and n = 12 for 6-month scales). Some deaths occurred after participants had completed at least one follow-up interview and these data are eligible for analysis. The overall retention rate through 24 months was 97% (Table 2). No significant differences between study arms were observed in terms of follow-up (6-month scales) completion rates (Fisher's exact *P* values for HN and MN samples were 0.074 and 0.082, respectively). For the 3-month scales, follow-up completion rates between HN study arms were significantly different (CONG, 100%; HF-ACT, 100%; TAU, 94%; Fisher's exact *P* value = 0.002), but no significant difference was observed for the MN

Table 2 Follow-up status for 'At Home' participants after 24 months by need level

Study arm	6 months questionnaire					3 months questionnaire				
	No follow-up[1]				At least one follow up[2]	No follow-up[3]				At least one follow up[4]
	Reason			Total (n = 23)	Total (n = 474)	Reason			Total (n = 16)	Total (n = 481)
	No contact	Death[5]	Withdrew consent			No contact	Death[6]	Withdrew consent		
High Needs	5	5	-	10	287	3	3	-	6	291
CONG (n = 107)	1	1	-	2	105	-	-	-	-	107
ACT (n = 90)	-	1	-	1	89	-	-	-	-	90
HNTAU (n = 100)	4	3	-	7	93	3	3	-	6	94
Moderate Needs	7	4	2	13	187	6	2	2	10	190
ICM (n = 100)	2	1	-	3	97	2	0	-	2	98
MNTAU (n = 100)	5	3	2	10	90	4	2	2	8	92

[1] - No follow-up data collected at any of 6, 12, 18 & 24 months.
[2] - No significant differences between study arms was observed in terms of follow up completion rate (Fishers' exact p values for HN & MN sample were 0.074 and 0.082 respectively).
[3] - No follow-up data collected at any of 3, 6, 9, 12, 15, 18, 21 & 24 months visit.
[4] - In terms of follow up completion rate, significant differences between study arms was observed for the HN sample, but no significant difference was observed for the MN sample (Fishers' exact p values for HN & MN sample were 0.002 and 0.101 respectively).
[5] - Total number of deaths (n = 29) was as follows: CONG-4; ACT-7; HNTAU-5; ICM-6; & MNTAU-7. However, 20 participants completed at least one follow up visit before death and the remaining 9 participants whose follow up data was not available died with seven months of randomization.
[6] - Out of 29 deaths, 5 participants whose follow up data was not available died within five months of randomization and the rest 24 participants completed at least one follow up visit before death.

Table 3 Socio-demographic and mental disorder related characteristics for the 'At Home' participants by need status

Variables	Overall N (%)	HN N (%)	MN N (%)	P value
Socio-demographics				
Age at enrolment visit (years)				
Mean (SD)	40.8 (11.0)	39.7 (11.2)	42.6 (10.5)	**0.004**
Median (IQR)	41 (32–48)	39 (31–47)	44 (36–49)	**0.002**
Male Gender	359 (73)	218 (74)	141 (71)	0.420
Place of birth (Canada)	431 (87)	256 (87)	175 (88)	0.743
Ethnicity				
Aboriginals	77 (16)	44 (15)	33 (16)	0.844
White	280 (56)	170 (57)	110 (55)	
Other	140 (28)	83 (28)	57 (29)	
Incomplete High School	280 (57)	179 (61)	101 (51)	**0.022**
Single (never married)	343 (70)	214 (73)	129 (65)	**0.043**
Have children (under18)	122 (25)	69 (24)	53 (27)	0.483
Native Language (English)	392 (80)	236 (80)	156 (78)	0.696
Homelessness				
Precariously housed	109 (22)	65 (22)	44 (22)	0.976
Lifetime duration of homelessness (months)				
Mean (SD)	60.2 (70.3)	62.0 (67.0)	57.5 (74.9)	0.489
Median (IQR)	36 (12–84)	42 (12–84)	36 (12–84)	0.179
Longest duration of homelessness (months)				
Mean (SD)	30.9 (40.1)	32.2 (40.8)	28.9 (39.1)	0.358
Median (IQR)	12 (6–36)	18 (6–45)	12 (6–36)	0.236
Age of first homelessness (years)				
Mean (SD)	30.3 (13.3)	28.7 (12.5)	32.6 (14.1)	**0.002**
Median (IQR)	28 (19–41)	26 (19–36)	34 (20–44)	**0.003**
Employment				
Currently employed	18 (4)	10 (3)	8 (4)	0.722
Worked continuously (>1 year) in past	323 (65)	185 (63)	138 (69)	0.164
History of any wartime services	27 (5)	17 (6)	10 (5)	0.697
Willingness to have paid job	384 (87)	217 (84)	167 (90)	0.102
Hospitalized for mental illness (last 5 years)*				
Over 6 months	57 (12)	47 (16)	10 (5)	**<0.001**
More than two times	253 (53)	197 (69)	56 (29)	**<0.001**
MINI International				
Neuropsychiatric Interview diagnosis				
Psychotic Disorder/Schizophrenia*	263 (53)	211 (71)	52 (26)	**<0.001**
Major Depressive Episode	199 (40)	95 (32)	104 (52)	**<0.001**
Post Traumatic Stress Disorder (PTSD)	129 (26)	63 (21)	66 (33)	**0.003**
Manic or Hypomanic Episode*	97 (19)	68 (23)	29 (14)	**0.021**
Panic Disorder	104 (21)	59 (20)	45 (22)	0.479
Mood disorder with psychotic feature	84 (17)	56 (19)	28 (14)	0.152
Substance Dependence	288 (58)	183 (62)	105 (52)	**0.043**
Alcohol Dependence	121 (24)	72 (24)	49 (24)	0.948

Table 3 Socio-demographic and mental disorder related characteristics for the 'At Home' participants by need status *(Continued)*

Suicidality (high or moderate)	168 (34)	93 (31)	75 (37)	0.153
Two or more mental disorders	240 (52)	148(53)	92 (51)	0.402
Three or more mental disorders	114 (25)	78 (28)	36 (20)	**0.032**
Referral sources				
Shelter or transitional housing	143 (29)	82 (28)	61 (31)	**<0.001**
Housing Lists	19 (4)	9 (3)	10 (5)	
Outreach	86 (17)	44 (15)	42 (21)	
Hospitals	47 (9)	35 (12)	12 (6)	
Aboriginal groups	15 (3)	6 (2)	9 (4)	
Criminal justice	70 (14)	59 (20)	11 (6)	
Drop-in-centers	65 (13)	33 (11)	32 (16)	
Mental health teams	19 (4)	13 (4)	6 (3)	
Other	16 (3)	6 (2)	10 (5)	
Not specified	17 (3)	10 (3)	7 (3)	

* Variables used to determine eligibility for the HN sample.

sample (HF-ICM, 98%; TAU, 92%; Fisher's exact P value = 0.101). Of the 497 participants randomized, 438 (88%) gave consent to access administrative data from publicly-funded agencies.

Adverse events of all kinds were reported to a monitoring committee as well as to the Research Ethics Board at Simon Fraser University. Apart from mortality, adverse events typically involved episodes of interpersonal conflict, such as abusive language or offensive behavior involving participants.

Sociodemographic characteristics of participants are detailed in Table 3. Most were male (73%), white (56%), never married (70%), had a current medical illness (91%), were substance dependent (58%), and met criteria for 'absolute homelessness' (78%).

A number of significant differences between the MN and HN samples were observed (Table 3 and 4). Several differences were expected based on inclusion criteria for each study and are reflected in the results. HN participants were more likely to have a psychotic disorder, have been hospitalized for psychiatric reasons, meet criteria for substance dependence, and have justice system involvement. HN participants also had lower MCAS scores.

Beyond differences that were directly related to inclusion criteria (indicated with asterisk in Table 3 and Table 4), a number of additional significant differences between MN and HN were observed. MN participants were older at recruitment and when first homeless, were more likely to have been married, and more likely to have completed high school than those in the HN sample. Participants in the MN sample were more likely to report multiple physical illnesses, asthma, and HIV/AIDS than those in the HN sample.

Results of standardized questionnaires indicate broad similarities between the MN and HN samples (Table 4). No significant differences between groups were observed on measures of: community integration (CIS total score), health-related quality of life (EQ-5D), food security (FS), overall health (SF-12, physical or mental health scores), overall quality of life (QoLI-20), and personal recovery (RAS-22). The MN sample reported significantly greater physical integration in the community (CIS physical) and a significantly lower level of externalizing or substance-related needs (GAIN-SPS) than the HN sample.

A series of comparisons tested for potential non-equivalence between randomization arms at baseline. Sociodemographic and diagnostic characteristics for the three HN and two MN study arms are shown in Table 5. Within the HN sample, there were no significant baseline differences of sociodemographics and mental disorders between groups. In the MN sample, those randomized to TAU had longer durations of homelessness ($P = 0.037$) and were more likely to be absolutely homeless ($P = 0.041$) at the time of recruitment. Further comparisons of questionnaire results indicate no meaningful differences between randomization arms in either the MN or HN study, except for several comorbid medical conditions (HIV, hepatitis B, cancer). HN participants randomized to CONG had a significantly higher prevalence of HIV and hepatitis B, but when all blood-borne diseases (HIV, hepatitis B and C) were combined, no significant differences were observed between groups (Table 6).

Discussion

As expected, inclusion criteria led to a number of significant differences between the MN and HN samples.

Table 4 Questionnaire related characteristics for 'At Home' participants by need status at enrolment visit

Questionnaire	Overall mean (SD)	HN mean (SD)	MN mean (SD)	P value
Community Integration Scale (CIS)				
Physical subscale score	2.1 (1.7)	1.9 (1.7)	2.4 (1.8)	**<0.001**
Psychological subscale score	10.9 (3.5)	11.0 (3.5)	10.7 (3.6)	0.368
Colorado Symptom Index (CSI)				
Total score	37.2 (12.5)	38.0 (13.1)	36.0 (11.7)	*0.098*
Comorbid Conditions List (CMC)[1]	**N (%)**	**N (%)**	**N (%)**	
Asthma	103 (21)	50 (17)	53 (26)	**0.009**
Hepatitis C	139 (30)	78 (28)	61 (31)	0.302
HIV/AIDS	43 (9)	18 (6)	25 (12)	**0.012**
Hepatitis B	25 (5)	13 (5)	12 (6)	0.412
Blood-borne infectious diseases[2]	157 (32)	87 (30)	70 (35)	0.224
Epilepsy or seizure	67 (13)	49 (16)	18 (9)	**0.016**
Stroke	27 (5)	19 (6)	8 (4)	0.248
Cancer	18 (4)	14 (5)	4 (2)	0.117
Head Injury	324 (65)	191 (64)	133 (67)	0.563
Presence of any physical illness	453 (91)	268 (90)	185 (93)	0.384
Multiple (≥ 2) physical illness	402 (81)	231 (78)	171 (86)	**0.032**
Multiple (≥ 3) physical illness	344 (69)	189 (64)	155 (78)	**0.001**
EuroQuol 5D (EQ5D)				
Overall health	61.0 (22.5)	61.8 (23.1)	60.0 (21.5)	0.382
Food Security (FS)				
Total score	4.6 (2.6)	4.5 (2.5)	4.8 (2.7)	0.214
Global Assessment of Individual need –Substance Problem Scale (GAIN-SPS)				
Total score (last month)	2.1 (2.0)	2.3 (2.0)	1.8 (2.0)	**0.007**
Age of first alcohol use	14.1 (6.3)	14.2 (5.0)	14.1 (4.9)	0.751
Age of first drug use	15.7 (5.0)	15.5 (5.6)	16.0 (7.2)	0.438
Health Service Access Items (ACC)				
Have a regular medical doctor	320 (65)	177 (60)	143 (72)	**0.008**
Place to go when you are sick	395 (81)	231 (79)	164 (83)	0.342
Needed health care, but didn't receive it	209 (43)	129 (45)	80 (40)	0.269
Health, Social Justice Service Use Inventory (HSJSU)				
Seen by a health/social service provider	389 (79)	216 (74)	173 (89)	**<0.001**
Visited psychiatrist	134 (27)	89 (30)	45 (22)	*0.066*
Talked with a health/social service provider	112 (29)	58 (20)	54 (27)	*0.065*
Emergency room visit	281 (58)	163 (56)	118 (60)	0.483
Ambulance	195 (40)	118 (40)	77 (39)	0.748
Contacts with police (no arrest)	254 (52)	154 (53)	100 (51)	0.573
Held in a police cell (≤24 hours)	112 (23)	80 (28)	32 (16)	**0.002**
Arrested	173 (36)	128 (44)	45 (23)	**<0.001**
Court appearance	174 (36)	123 (43)	51 (26)	**<0.001**
Interviewer Impression Items (III)	**N (%)**	**N (%)**	**N (%)**	
Signs of difficulty in reading response card (a lot)	20 (4)	17 (6)	3 (1)	**0.019**
Signs of drug or alcohol intoxication (a lot)	10 (2)	7 (2)	3 (1)	0.505

Table 4 Questionnaire related characteristics for 'At Home' participants by need status at enrolment visit *(Continued)*

Signs of psychiatric symptoms (a lot)	66 (13)	58 (19)	8 (4)	**<0.001**
Validity of information (no confidence)	14 (3)	13 (4)	1 (<1)	**0.010**
Multnomah Community Ability Scale (MCAS)*				
Total score	56.1 (9.6)	50.7 (6.8)	64.1 (7.3)	**<0.001**
SF-12 Health Survey (SF-12)				
Physical health	45.9 (12.3)	46.5 (12.4)	45.1 (12.2)	0.233
Mental health	35.4 (13.7)	35.8 (13.6)	34.8 (13.9)	0.445
Quality of Life Index 20 Item (QOLI-20)				
Total score	73.6 (21.9)	74.4 (21.5)	72.5 (22.4)	0.337
Recovery Assessment Scale 22 item (RAS-22)				
Total score	79.5 (12.0)	79.2 (11.5)	79.9 (12.8)	0.563
Maudsley Addiction Profile (MAP)	**N (%)**	**N (%)**	**N (%)**	
Use of alcohol	225 (46)	142 (48)	83 (42)	0.174
Use of heroin	96 (19)	59 (20)	37 (19)	0.732
Use of Cocaine	83 (17)	57 (19)	26 (13)	0.074
Use of Cocaine-crack base	160 (32)	97 (33)	63 (32)	0.805
Use of Amphetamine	61 (12)	44 (15)	17 (7)	**0.035**
Use of Cannabis	205 (45)	133 (47)	72 (42)	0.256
Injection drug use	88 (18)	54 (18)	34 (17)	0.727
Daily drug use (excluding alcohol)	126 (25)	82 (28)	44 (22)	0.159
Poly drug (≥ 3) use (excluding alcohol)	108 (22)	72 (24)	36 (18)	0.065

[1] - Response 'Do not know' was considered as no.
[2] - Included HIV, Hepatitis C & Hepatitis B.
* Variables used to determine eligibility for the HN sample.

Compared to those in MN, members of the HN cohort were significantly more likely to meet criteria for psychosis or mania/hypomania, have multiple recent psychiatric hospitalizations, and be severely compromised in their community functioning. Other significant differences between MN and HN were not directly related to the inclusion/exclusion criteria. Members of the HN cohort had lower educational achievement and were more likely to have multiple mental disorders than those assigned to the MN study. In numerous other respects, participants assigned to MN and HN did not differ significantly. Overall, participants were white, male, 'absolutely homeless', physically ill, and met criteria for substance dependence and alcohol dependence.

Participants assigned to MN were significantly more likely to meet criteria for post-traumatic stress disorder, major depression, and report having HIV/AIDS than those assigned to HN. Thirty percent of the MN cohort had been homeless for more than 60 months in their lifetime and 26% met criteria for a psychotic disorder. These results suggest that the descriptor 'moderate' is a misnomer that understates the complexity of needs within the MN cohort. As hypothesized, the profile of both study cohorts (MN and HN) included level of needs (for example, substance dependence, physical illness) that have not been included in previous studies of HF. VAH is therefore capable of generating new knowledge regarding the effectiveness of HF-ICM and HF-ACT for clients with a broad range of presenting characteristics.

Randomization successfully minimized differences between study arms. We tested for differences on sociodemographic and mental health-related variables, as well as all other measures (total score or subscale score or individual item) administered at baseline. In the MN study, those assigned to the TAU arm were significantly more likely to be 'absolutely homeless' and to have lower lifetime duration of homelessness. No other significant differences were observed in either study, except for several comorbid medical conditions (HIV, hepatitis B, cancer) with very low prevalence. HN participants randomized to CONG had a significantly higher prevalence of HIV and hepatitis B, but when all blood-borne diseases (HIV, hepatitis B and C) were combined, no significant differences were observed between groups. Despite differences between groups, the low prevalence of these conditions in the sample is not expected to influence results. However, tests will be designed to control for relevant differences identified at baseline. Previous research has indicated that homeless mentally ill individuals may have a preference for independent

Table 5 Comparisons of Socio-demographic and mental disorder related characteristics between study arms

Variable	High need (n = 297)				Moderate need (n = 200)		
	CONG (n = 107) N (%)	ACT (n = 90) N (%)	TAU (n = 100) N (%)	P value[1]	ICM (n = 100) N (%)	TAU (n = 100) N (%)	P value[2]
Socio-Demographics							
Age at randomization (years)							
Mean (SD)	40.0 (11.6)	39.5 (10.8)	39.5 (11.2)	0.910	42.1 (10.4)	43.1(10.6)	0.475
Median (IQR)	41 (30–48)	38 (31–47)	39 (32–48)	0.920	43 (34–50)	45 (36–49)	0.610
Male gender	82 (77)	66 (74)	70 (71)	0.696	71 (71)	70 (71)	0.964
Ethnicity							
Aboriginals	21 (20)	11 (12)	12 (12)	0.469	19 (19)	14 (14)	*0.060*
Caucasian	60 (56)	53 (59)	57 (57)		60 (60)	50 (50)	
Mixed/Other	26 (24)	26 (29)	31 (31)		21 (21)	36 (36)	
Incomplete high school	70 (66)	47 (53)	62 (62)	0.192	56 (56)	45 (45)	0.120
Single/Never married	76 (72)	63 (70)	75 (77)	0.591	66 (66)	63 (63)	0.658
Birth country (Canada)	94 (88)	80 (89)	82 (83)	0.417	90 (90)	85 (85)	0.285
Have children (under18)	24 (23)	21 (24)	24 (25)	0.938	28 (28)	25 (25)	0.692
Native Language (English)	87 (81)	76 (84)	73 (73)	0.125	13 (13)	16 (16)	0.733
Homelessness							
Absolutely homeless	88 (82)	72 (80)	72 (72)	0.179	72 (72)	84 (84)	**0.041**
Lifetime duration of homelessness (months)							
Mean (SD)	52.2 (63.5)	61.5 (69.1)	67.6 (69.0)	0.541	68.5 (92.1)	46.4 (50.7)	**0.037**
Median (IQR)	36 (12–72)	42 (12–84)	48 (13–109)	0.575	48 (14–93)	24 (12–72)	**0.051**
Longest duration of homelessness (months)							
Mean (SD)	32.9 (39.3)	30.5 (42.7)	33.0 (41.0)	0.901	31.7 (43.7)	26.0 (33.9)	0.304
Median (IQR)	20 (7–48)	12 (6–40)	12 (6–48)	0.623	48 (6–40)	12 (5–34)	0.321
Age of first homelessness (years)							
Mean (SD)	29.9 (13.1)	28.0 (11.9)	28.0 (12.4)	0.474	30.8 (13.8)	34.3 (14.3)	*0.083*
Median (1QR)	27 (20–39)	26 (19–35)	24 (18–36)	0.463	29 (18–42)	35 (21–45)	0.118
Employment							
Currently employed	5 (5)	1 (1)	4 (4)	0.368*	6 (6)	2 (2)	0.279*
Worked continuously (>1 year) in past	66 (62)	58 (69)	61 (61)	0.773	66 (66)	72 (72)	0.987
Wartime services in past	4 (4)	7 (8)	6 (6)	0.448	5 (5)	5 (5)	0.987
Willingness to have paid job	79 (82)	68 (90)	70 (82)	0.353	80 (89)	87 (91)	0.696
Hospitalized for mental illness (last 5 years)							
Over 6 months	14 (13)	18 (20)	15 (15)	0.406	4 (4)	6 (6)	0.506
More than two times	73 (70)	57 (68)	67 (71)	0.927	25 (25)	31 (32)	0.299
MINI International Neuropsychiatric Interview diagnosis							
Major Depressive Episode	35 (33)	31 (34)	29 (29)	0.710	52 (52)	52 (52)	1.00
Manic or Hypomanic Episode	25 (23)	23 (26)	20 (20)	0.654	11 (11)	18 (18)	0.160
Post-Traumatic Stress Disorder	27 (25)	17 (19)	19 (19)	0.445	34 (34)	32 (32)	0.802
Panic Disorder	20 (19)	15 (17)	24 (24)	0.418	19 (19)	26 (26)	0.236
Mood Disorder with psychotic feature	20 (19)	17 (19)	19 (19)	0.997	16 (16)	12 (12)	0.415
Psychotic Disorder	79 (74)	59 (66)	73 (73)	0.385	25 (25)	27 (27)	0.747
Alcohol dependence	28 (26)	19 (21)	25 (25)	0.695	25 (25)	24 (24)	0.869

Table 5 Comparisons of Socio-demographic and mental disorder related characteristics between study arms *(Continued)*

Substance dependence	67 (63)	55 (61)	61 (61)	0.965	51 (51)	54 (54)	0.671
Suicidality (moderate or high)	34 (32)	28 (31)	31 (31)	0.992	33 (33)	42 (42)	0.189
Two or more mental disorders	53 (49)	41 (46)	54 (54)	0.507	44 (44)	48 (48)	0.547
Three or more mental disorders	34 (32)	22 (24)	22 (22)	0.250	17 (17)	19 (19)	0.713
Referral sources							
Shelter or transitional housing	31 (29)	26 (29)	25 (25)	0.468	31 (31)	30 (30)	0.250
Housing Lists	3 (3)	4 (4)	2 (2)		6 (6)	4 (4)	
Outreach	13 (12)	15 (17)	16 (16)		21 (21)	21 (21)	
Hospitals	11 (10)	11 (12)	13 (13)		4 (4)	8 (8)	
Aboriginal groups	2 (2)	2 (2)	2 (2)		6 (6)	3 (3)	
Criminal justice	27 (25)	14 (16)	18 (18)		5 (5)	6 (6)	
Drop-in-centers	15 (14)	9 (10)	9 (6)		20 (20)	12 (12)	
Mental health teams	4 (4)	3 (3)	6 (6)		0 (0)	6 (6)	
Other	0 (0)	1 (1)	5 (5)		4 (4)	6 (6)	
Not specified	1 (1)	5 (6)	4 (4)		3 (3)	4 (4)	

[1] - Bold indicates p value ≤ 0.05 and Italic indicates p value between > 0.05 and ≤ 0.1.
[2] - Bold indicates p value ≤ 0.05 and Italic indicates p value between > 0.05 and ≤ 0.1.
* - P value from Fisher's Exact Test.

apartments over group housing when offered a choice [83], and that these preferences may change based on experiences after the initiation of housing [84]. In the present study, individuals randomized to HF-ACT had a choice of apartments, but those randomized to CONG were limited to selecting from among the available units in one building. Narrative interviews will be examined in order to assess whether participants experienced meaningful differences concerning their choice of housing in either of these two settings, and whether the experience of choice was related to outcomes of interest.

A high percentage of participants in each study arm (92% to 100%) were successfully followed through 24 months of interviews. Twenty-nine participants died during the 24 months following randomization. Unsurprisingly, participants assigned to TAU were most likely to be lost to follow-up during the 24 months post-randomization. However, the differences were not statistically significant. Differences in follow-up for the 3-month scales were significant in the HN study only. Despite statistically significant differences, the high overall follow-up rate in each group (94% in one arm, 100% in two others) is expected to yield valid and generalizable results. This high follow-up rate is attributable to diverse strategies, including extensive outreach, a welcoming field office, relationships with service providers in the field, and maintaining updated information regarding collateral contacts and daily routines. More generally, the recruitment and retention of a knowledgeable and committed team of interviewers is a critical factor.

VAH shares several important methodological features with studies in four other Canadian sites, primarily: inclusion/exclusion criteria, randomization to HF or usual care, a common battery of cross-site measures, and semi-structured qualitative interviews with a subset of participants [1]. At the same time, the current study has a number of important site-specific elements. VAH is the only RCT to compare different configurations of HF (congregate and scattered sites) alongside TAU. The results of this comparison will offer guidance to many cities, including Vancouver, that include congregate variations of HF as part of their strategies to address homelessness [85]. In addition, this trial has recruited samples with a broader range and severity of symptoms than those reflected in previous studies. For example, the high prevalence of substance use disorders in this study will help to fill a specific gap in knowledge regarding the robustness of HF for individuals with concurrent disorders [86].

A number of unique measures were incorporated in the protocol based on their expected relevance to the local population, including measures of addiction frequency and severity, neuropsychological functioning, and physical examinations. In addition, VAH incorporates a large array of administrative data spanning diverse publicly-funded services and interventions across time. These data generate opportunities to study the trajectories of service involvement over 10 years prior to recruitment in VAH, and enable follow-up of participants after the completion of the intervention. The inclusion of longitudinal data from multiple relevant sectors (justice, health, financial assistance) provides a unique opportunity for cost-based analyses.

This study combines models of housing with support in each of the intervention conditions. This may make it

Table 6 Comparisons of questionnaire related characteristics between study arms at enrolment visit

Questionnaire	High need (n = 297)				Moderate need (n = 200)		
	CONG (n = 107) N (%) or Mean (SD)	ACT (n = 90) N (%) or Mean (SD)	TAU (n = 100) N (%) or Mean (SD)	P value[1]	ICM (n = 100) N (%) or Mean (SD)	TAU (n = 100) N (%) or Mean (SD)	P value[2]
Community Integration Scale (CIS)							
Physical subscale score	2.1 (1.8)	1.6 (1.5)	1.8 (1.7)	0.148	2.5 (1.8)	2.4 (1.7)	0.884
Psychological subscale score	10.6 (3.7)	11.3 (3.5)	11.1 (3.2)	0.384	10.4 (3.5)	11.0 (3.6)	0.241
Colorado Symptom Index (CSI)							
Total score	37.1 (13.0)	36.4 (13.4)	40.2 (12.6)	*0.093*	36.1 (12.2)	36.0 (11.2)	0.954
Comorbid Conditions List (CMC)[3]	**N (%)**	**N (%)**	**N (%)**		**N (%)**	**N (%)**	
Asthma	18 (17)	14 (16)	18 (18)	0.904	27 (27)	26 (26)	0.873
Hepatitis C	26 (24)	23 (26)	29 (29)	0.732	32 (32)	29 (29)	0.645
HIV/AIDS	12 (11)	2 (2)	4 (4)	**0.025***	16 (16)	9 (9)	0.134
Hepatitis B	9 (8)	1 (1)	3 (3)	**0.039***	7 (7)	5 (5)	0.552
Blood-borne infectious diseases[4]	33 (32)	23 (26)	31 (32)	0.572	37 (37)	33 (33)	0.553
Epilepsy or seizure	20 (19)	10 (11)	19 (19)	0.256	5 (5)	13 (13)	*0.081**
Stroke	11 (10)	2 (2)	6 (6)	0.069	2 (2)	6 (6)	0.279*
Cancer	4 (4)	1 (1)	9 (9)	**0.036***	0 (0)	4 (4)	0.058*
Head Injury	66 (62)	62 (69)	63 (63)	0.544	61 (61)	72 (73)	*0.079*
Presence of any physical illness	98 (92)	81 (90)	89 (89)	0.818	90 (90)	95 (95)	0.179
Multiple (≥ 2) physical illness	82 (77)	69 (77)	80 (80)	0.806	84 (84)	87 (87)	0.547
Multiple (≥ 3) physical illness	69 (65)	52 (58)	68 (68)	0.334	78 (78)	77 (77)	0.866
EuroQuol 5D (EQ5D)							
Overall health	59.5 (23.7)	64.2 (22.9)	62.0 (22.5)	0.361	58.4 (23.4)	61.5 (19.5)	0.325
Food Security (FS)							
Total score	4.3 (2.6)	4.4 (2.6)	4.8 (2.4)	0.454	4.7 (2.8)	4.8 (2.7)	0.799
Global Assessment of Individual need – Substance Problem Scale (GAIN-SPS)							
Total score (last month)	2.4 (2.0)	2.1 (1.9)	2.3 (2.0)	0.591	1.8 (2.0)	1.8 (2.0)	0.842
Age of first alcohol use	14.3 (6.5)	14.2 (3.8)	14.2 (4.0)	0.979	13.8 (4.8)	14.3 (4.9)	0.523
Age of first drug use	15.6 (6.5)	15.3 (5.0)	15.7 (5.0)	0.892	15.4 (6.3)	16.5 (7.9)	0.304
Health Service Access Items (ACC)							
Have a regular medical doctor	64 (60)	53 (59)	60 (61)	0.971	71 (71)	72 (72)	0.876
Place to go when you are sick	82 (80)	72 (81)	77 (79)	0.913	83 (84)	81 (82)	0.706
Needed health care, but didn't receive it	45 (43)	36 (41)	48 (51)	0.371	39 (39)	41 (41)	0.817
Health, Social Justice Service Use Inventory (HSJSU)	**N (%)**	**N (%)**	**N (%)**		**N (%)**	**N (%)**	
Seen a health/social service provider	70 (66)	67 (75)	79 (80)	*0.075*	84 (84)	89 (90)	0.217
Visited psychiatrist	28 (26)	27 (30)	34 (34)	0.470	20 (20)	25 (25)	0.397
Talked a health/social service provider	12 (20)	18 (20)	19 (20)	0.992	31 (31)	23 (23)	0.218
Emergency room visit	59 (57)	51 (57)	53 (54)	0.912	64 (64)	54 (55)	0.202
Ambulance	47 (44)	33 (37)	38 (38)	0.535	35 (35)	42 (38)	0.282
Contacts with police (no arrest)	53 (52)	42 (47)	59 (60)	0.226	45 (45)	55 (56)	0.118
Held in a police cell (≤24 hours)	25 (24)	27 (31)	28 (30)	0.556	14 (14)	18 (19)	0.386
Arrested	50 (48)	32 (36)	46 (48)	0.152	19 (19)	26 (27)	0.179
Court appearance	51 (50)	34 (38)	38 (40)	0.189	22 (22)	29 (30)	0.222

Table 6 Comparisons of questionnaire related characteristics between study arms at enrolment visit *(Continued)*

Interviewer Impression Items (III)	**N (%)**	**N (%)**	**N (%)**		**N (%)**	**N (%)**	
Signs of difficulty in reading card (a lot)	6 (6)	6 (7)	5 (5)	0.883	2 (2)	1 (1)	1.00*
Signs of drug or alcohol intoxication (a lot)	1 (1)	2 (2)	4 (4)	0.349*	1 (1)	2 (2)	1.00*
Signs of psychiatric symptoms (a lot)	25 (23)	11 (12)	22 (22)	0.108	4 (4)	4 (4)	1.00*
Validity of information (no confidence)	7 (6)	4 (4)	2 (2)	0.287*	1 (1)	0 (0)	1.00*
Multnomah Community Ability Scale (MCAS)							
Total score	49.9.0 (6.7)	51.6 (6.5)	50.6 (7.0)	0.195	64.1 (7.6)	64.1 (7.1)	0.962
SF-12 Health Survey (SF-12)							
Physical health	47.4 (13.1)	46.7 (12.3)	45.3 (11.6)	0.466	43.9 (12.1)	46.4 (12.9)	0.140
Mental health	34.8 (15.1)	36.9 (13.0)	35.8 (12.6)	0.551	35.7 (13.0)	33.9 (14.8)	0.371
Quality of Life Index 20 Item (QOLI-20)							
Total score	72.6 (21.7)	76.2 (21.3)	74.7 (21.4)	0.497	72.2 (21.6)	72.8 (23.3)	0.851
Recovery Assessment Scale 22 item (RAS-22)							
Total score	78.2 (12.1)	80.7 (11.5)	79.1 (10.7)	0.308	80.3 (11.3)	79.5 (14.1)	0.685
Maudsley Addiction Profile (MAP)	**N (%)**	**N (%)**	**N (%)**		**N (%)**	**N (%)**	
Use of alcohol	50 (47)	44 (49)	48 (49)	0.936	37 (38)	46 (46)	0.240
Use of heroin	24 (22)	13 (14)	22 (22)	0.295	18 (18)	19 (19)	0.909
Use of Cocaine	24 (22)	14 (16)	19 (19)	0.476	12 (12)	14 (14)	0.715
Use of Cocaine-crack base	36 (34)	26 (29)	35 (36)	0.596	36 (37)	27 (27)	0.141
Use of Amphetamine	12 (11)	17 (18)	15 (15)	0.346	10 (10)	7 (7)	0.421
Use of Cannabis	46 (45)	40 (48)	47 (49)	0.848	35 (42)	37 (42)	0.960
Injection drug use	19 (18)	16 (18)	19 (20)	0.944	18 (18)	16 (16)	0.682
Daily drug use (excluding alcohol)	31 (29)	19 (21)	32 (32)	0.227	27 (27)	17 (17)	*0.088*
Poly drug (≥ 3) use (excluding alcohol)	30 (28)	17 (29)	25 (25)	0.318	20 (20)	16 (16)	0.421

[1] -Bold indicates p value ≤ 0.05 and Italic indicates p value between > 0.05 and ≤ 0.1.
[2] -Bold indicates p value ≤ 0.05 and Italic indicates p value between > 0.05 and ≤ 0.1.
[2] -Response 'Do not know' was considered as no.
[4] -Included HIV, Hepatitis C & Hepatitis B.
* -P value from Fisher's Exact Test.

difficult to isolate the relative contribution of distinct components (for example, housing alone) that best account for any observed differences or improvements. Each of the data sources included in the VAH protocol is subject to sources of bias. Several questionnaires have not been well validated with homeless mentally ill samples, and a small number were adapted or developed for the present study. Narrative interviews with selected participants may yield findings that are unrepresentative. Administrative data sources are subject to limitations that include the ability to match all subjects across all databases, and the accuracy and completeness of the resulting extracts. However, the combination of administrative data, narrative interviews, and questionnaires enables the application of mixed-methods approaches that enrich understanding beyond the scope of each individual data type. Finally, while other sites abbreviated their study durations to 21 months, VAH maintained the original 24-month protocol, and therefore preserved a greater opportunity to detect changes that may require a longer period of observation.

Conclusions

The present results confirm that VAH has successfully implemented experimental protocols that promise to generate new knowledge regarding interventions for individuals who are both homeless and mentally ill. Participants were successfully recruited and retained through the follow-up period, and randomization effectively minimized differences between study arms in each trial. Diverse data sources and relatively long follow-up provide opportunities for multimethod approaches to longitudinal data analysis. VAH adds to previous research on HF by including a sample with complex comorbidities and concurrent substance use disorders, and is the first experiment to include congregate housing alongside scattered site HF.

Abbreviations

ACC: Health service access items; ACE: adverse childhood experiences; ACT: Assertive community treatment; ANOVA: Analysis of variance; CI: Cognitive impairment; CIS: Community integration scale; CMC: Comorbid conditions list; CONG: Congregate housing with support; CONSORT: Consolidated standards of reporting trials; CSI: Colorado symptom index (modified); C-SSS: Core service satisfaction scale; CTS: Conflict tactics scale; EQ-5D: EuroQol 5D; FS: Social support items and food security; GAIN-SPS: Global appraisal of individual needs, substance problem scale; GEE: Generalized estimating equation; HF: Housing first; HLM: Hierarchical linear modeling; HN: High needs; HSJSU: health, social, and justice service use inventory; ICM: Intensive case management; LR: Landlord relations; MAP: Maudsley addiction profile; MCAS: Multnomah community ability scale; MH: Mobility history; MINI: Mini-international neuropsychiatric interview; MN: Moderate needs; MoCA: Montreal cognitive assessment; OHQS: Observer-rated housing quality scale; PHQL: Perceived housing quality; QoLI-20: Quality of life index, 20-item; RAS-22: Recovery assessment scale, 22-item; RCT: Randomized controlled trial; RTLFB: Residential time-line follow-back; SF-12: SF-12 health survey; SRO: Single room occupancy; TAU: Treatment as usual; VAH: Vancouver at home; VFC: Foster care history; VTLFB: Vocational time-line follow-back; WAI: Working alliance inventory.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

JMS is lead investigator of the study, and drafted and finalized the manuscript. MLP oversaw field research and wrote sections of the manuscript. AM conducted statistical analyses and prepared results for the manuscript. LC administered interviews and prepared sections of the manuscript. SNR contributed to data analysis and prepared sections of the manuscript. AP contributed to the design of the study and edited the manuscript. KF contributed to the design and implementation of the study. All authors read and approved the final manuscript.

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Housing First: exploring participants' early support needs

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Abstract

Background: Housing First has become a popular treatment model for homeless adults with mental illness, yet little is known about program participants' early experiences or trajectories. This study used a mixed methods design to examine participant changes in selected domains 6 months after enrolment in a Canadian field trial of Housing First.

Methods: The study sample included 301 participants receiving the Housing First intervention at the Toronto site of the At Home/Chez Soi project. This study used a pre-post design to compare quantitative 6-month outcome data to baseline values in key domains and multivariate regression to identify baseline demographic, clinical or service use variables associated with observed changes in these domains. In addition, qualitative data exploring participant and service provider perspectives and experiences was collected via stakeholder interviews and focus groups, and analyzed using thematic analysis.

Results: The majority (60 to 72%) of participants followed the expected trajectory of improvement, with the remaining experiencing difficulties in community integration, mental health symptom severity, substance use, community functioning and quality of life 6 months after program enrolment. Diagnosis of psychotic disorder was associated with a reduction in quality of life from baseline to 6-months, while substance use disorders were associated with reduced mental illness symptoms and substance use related problems and an improvement in quality of life. Participants housed in independent housing at 6-months had greater improvements in community integration and quality of life, and greater reduction in mental illness symptoms, compared to those not independently housed. The quality of the working alliance was positively associated with improvements in physical and psychological community integration and quality of life. Qualitative data provided a unique window into the loneliness and isolation experienced by Housing First participants, as well as problems related to substance use and a need for life skills training and support.

Conclusions: Additional strategies can help support Housing First participants in the early stages of program participation and address potential causes of early difficulties, including lack of life skills and social isolation. This study highlights the importance of early and ongoing evaluation, monitoring and program adaptations to address consumer support needs.

Trial registration: Current Controlled Trials ISRCTN42520374

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Background

Homelessness is an ongoing social and economic problem that affects thousands of Canadians. In 2009, there were approximately 500 shelters, with a total of more than 17,000 beds, serving homeless individuals and families across Canada [1,2]. In Toronto, Canada's most populous city [3], more than 5,000 individuals are homeless on any given night [4] and in 2008 approximately 28,000 unique individuals used homeless shelters over the course of the year [5].

Interventions for homeless individuals with mental illness have traditionally focused on a treatment first approach, in which program participants typically progress in a stepwise fashion from emergency shelters to transitional housing before they access permanent supportive housing, often after meeting strict requirements of sobriety and acceptance of psychiatric treatment [6,7]. More recently, Housing First (HF), developed by Pathways to Housing, has emerged as a popular treatment option for meeting the unique needs of this population [8-10]. Rooted in the belief that housing is a basic human right, HF provides individuals with immediate housing, client choice is emphasized in every aspect of treatment, housing is separated from treatment, and a harm reduction approach is followed [8,10].

Previous studies on HF and related programs demonstrate that within one or two years after program entry, a majority of participants experience significant improvements in housing stability [11-13], mental health functioning [14], consumer choice [11], quality of life [13,15] and reductions in health service (emergency and inpatient) use [13], as well as self-reported justice system use [13]. Although reductions in alcohol use have been reported by one study [16], others have found no improvements in either substance or alcohol use after program enrollment [11,17]. In addition to improved participant outcomes, several studies also report on the reduced costs of HF in comparison to traditional housing programs [11,13,14,16,18-20], although some have questioned these cost-savings [21].

Although HF has become a popular treatment option for homeless adults with mental illness, to date the program has only been assessed by a few randomized controlled studies and has not been widely evaluated outside the United States [11,12,20,22,23]. Funded by the federal government through the Mental Health Commission of Canada (MHCC), At Home/Chez Soi (AH/CS) is a 4-year, 5-site demonstration project evaluating the Pathways to Housing HF model and its adaptations in urban and rural settings [23]. The project aims to assess the effectiveness and cost-effectiveness of HF in the Canadian context, and describe the key ingredients necessary for the program's success and the programs' theory of change.

Study goals

Pathways to Housing HF program theory suggest that individuals will experience improvement in several domains over the first and second year of program participation (Figure 1) [10,24]. Despite the growing literature on longer-term outcomes of HF, little has been documented about participants' early experiences or trajectories [25,26]. Furthermore, the literature on the small number of participants who do not benefit from HF, a target population for alternative interventions and supports, is scant. In response to these knowledge gaps this study uses a mixed-method design to address the following research questions:

1. What proportion of HF participants follow expected trajectories of change in physical and psychological community integration, mental health symptomatology, substance use, community functioning and quality of life 6 months after program enrolment?
2. What baseline demographic, clinical or service use variables are associated with changes from baseline to 6-months in these domains?
3. Are changes from baseline to 6-months in key outcome domains associated with housing and the quality of the relationship between participant and service provider (working alliance)?
4. What are the perspectives of program participants and service providers on early experiences with the program?

These results can guide program planning and resource allocation across jurisdictions striving to improve care and outcomes for homeless adults with mental illness.

Methods

This study was approved by the Research Ethics Board of St. Michael's Hospital and is registered with the International Standard Randomized Control Trial Number Register (ISRCTN42520374).

At Home/Chez Soi study design

The study design, protocol and recruitment process of the AH/CS project, and the Toronto site specifically, have already been described in detail elsewhere [23,27]. Briefly, AH/CS is a randomized controlled trial testing the effectiveness of HF in 5 sites across Canada. Prior to randomization, all eligible participants were stratified into either a "high needs" or a "moderate needs" service group based on their level of need for mental health services [23]. Participants were classified as having high needs if they met all the following 3 criteria: (1) diagnosis of psychotic disorder or bipolar disorder based on the Mini International Neuropsychiatric Interview 6.0

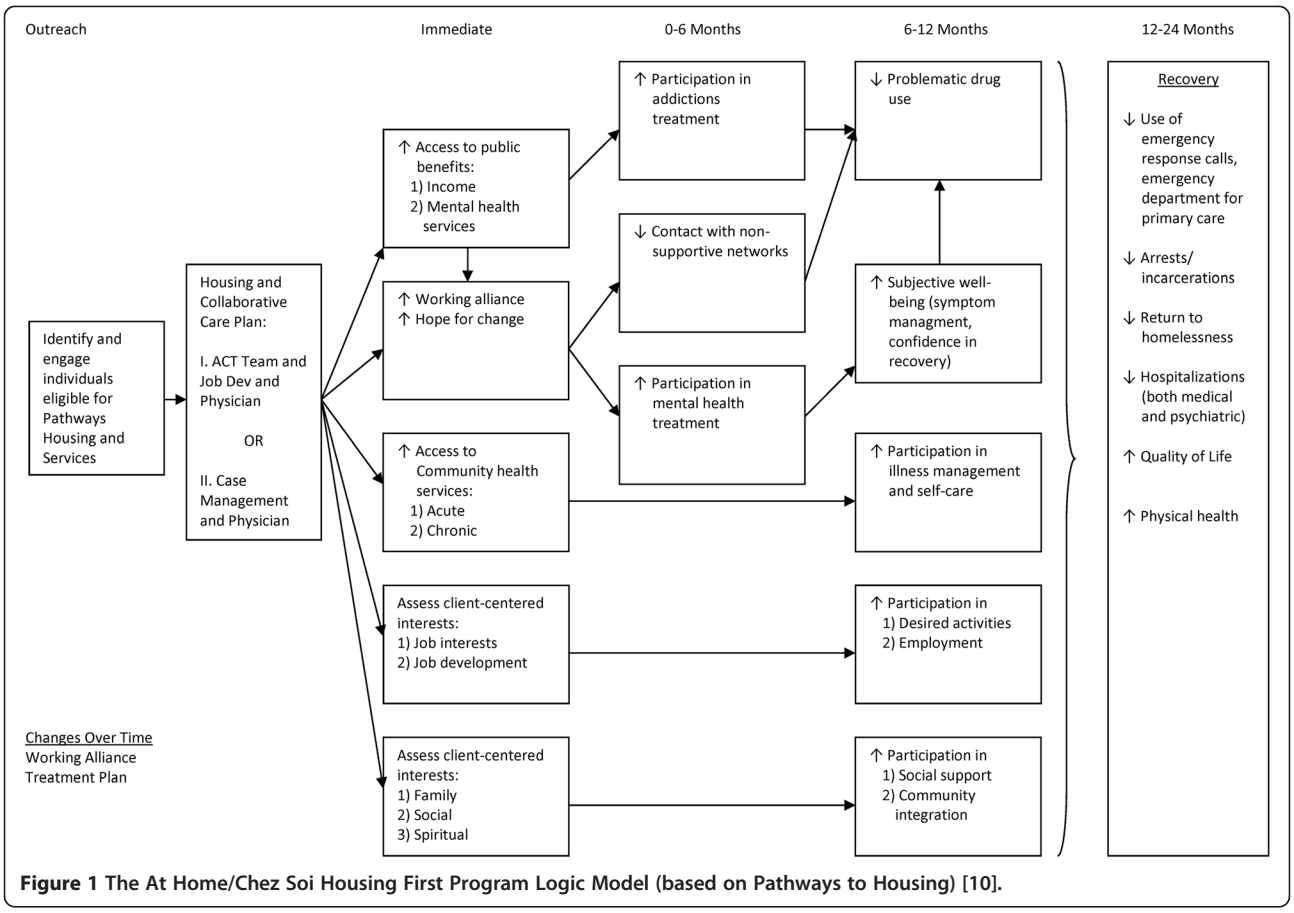

Figure 1 The At Home/Chez Soi Housing First Program Logic Model (based on Pathways to Housing) [10].

(MINI, see description below); (2) a Multnomah Community Ability Scale (MCAS, see Table 1) score ≤ 62; and (3) at least one of the following: ≥ 2 hospitalizations for mental illness in the past 5 years, recent arrest or incarceration, or comorbid substance use on the MINI [23]. High needs participants randomized to treatment were offered HF with Assertive Community Treatment (HF-ACT). All other participants were considered moderate needs and those randomized to the intervention group received HF with Intensive Case Management (HF-ICM).

Mini International Neuropsychiatric Interview 6.0 (MINI 6.0)

The MINI 6.0 is a short, structured diagnostic interview used for psychiatric evaluation [43] that has been validated against several much longer diagnostic interviews, including the Structured Clinical Interview for DSM Diagnoses (SCID-P) and the Composite International Diagnostic Interview for ICD-10 (CIDI). It shows good concordance and high sensitivity for most diagnosis, with high degree of reliability [43-46].

Participants

Participants in this study were those randomized to the intervention (HF) arms (HF with ACT or HF with ICM) at the Toronto site of the AH/CS project (N = 301). Briefly, eligibility for the AH/CS project included 1) legal adult age (> 18 years); 2) demonstration of absolute homelessness or being precariously housed; and 3) demonstration of a serious mental disorder with or without a concurrent substance use problem [23]. Participants were excluded if they were currently receiving assertive community treatment (ACT) or intensive case management (ICM), if they were relatively homeless or if they did not have legal status in Canada [23]. Only data collected from the intervention group (HF) of the AH/CS study (N = 301) were utilized for the purpose of this analysis, and participants randomized to the usual care group (N = 274) were excluded. All participants provided written informed consent.

Quantitative data

This study uses a pre-post design to examine the changes from baseline to 6-months in six outcome domains among participants enrolled in a HF program at the Toronto site of the AH/CS project.

Missing data analysis

Missing data in the main outcome domains occurred due to several reasons, including withdrawal, death, loss

Table 1 Domains of Change from Baseline to 6-months and Operationalization of "Experiencing Difficulties" vs. "Expected Trajectories"[1]

Domain	Instrument	Details	Operationalization of expected trajectories and experiencing difficulties	Missing at Baseline	Missing at 6 Months
Community Integration - Physical	Community Integration Scale (CIS) - Physical subscale	▪7 item subscale of the full 11-item CIS instrument; examines a person's physical (community presence) integration in the community ▪Responses are summed for a total score, with higher scores indicating greater community integration ▪References: [28-30]	**Expected trajectory:** Movement to a higher count, compared to baseline OR no change from baseline **Experiencing difficulty:** Movement to a lower count, compared to baseline	47 (15.6%)	47 (15.6%)
Community Integration - Psychological	Community Integration Scale (CIS) - Psychological subscale	▪4 item subscale of the full 11-item CIS instrument; examines a person's psychological (sense of belonging) integration in the community ▪Responses are summed for a total score, with higher scores indicating greater community integration ▪References: [28-30]	**Expected trajectory:** Movement to a higher quintile, compared to baseline OR no change from baseline **Experiencing difficulty:** Movement to a lower quintile, compared to baseline	6 (1.99%)	54 (17.9%)
Mental Illness Symptomatology	modified Colorado Symptom Index (CSI)	▪14-item scale that measures the frequency of symptoms of psychiatric illness in the past month ▪Sum of all 14 items produces the overall CSI score; higher scores indicate greater psychiatric symptomatology; a score greater than 30 indicates the presence of a probable disorder ▪References: [31-34]	**Expected trajectory:** Movement to a lower quintile, compared to baseline OR no change from baseline **Experiencing difficulty:** Movement to a higher quintile, compared to baseline	27 (8.97%)	64 (21.3%)
Substance Use	Global Appraisal of Individual Need – (GAIN-SS) Substance Problem Subscale	▪5-item subscale with individual items scored on a 4-point scale for a given period of time (lifetime or past year or past month or never) ▪Number of responses with a particular value is counted (depending on time frame under examination) ▪Higher count values indicating higher substance use symptoms ▪References: [35,36]	**Expected trajectory:** Movement to a lower count compared to baseline OR no change from baseline **Experiencing difficulty:** Movement to a higher count, compared to baseline	2 (0.66%)	43 (14.3%)
Community Functioning	Multnomah Community Ability Scale (MCAS)	▪17-item instrument that measures the degree of functional ability ▪Total MCAS score is sum of all 17 questions. Categories of ability based on total score: –17 to 47 indicates low level of ability –48 to 62 indicates some disability - > 63 indicates little disability ▪References: [37-39]	**Expected trajectory:** Movement to a higher quintile, compared to baseline OR no change from baseline **Experiencing difficulty:** Movement to a lower quintile, compared to baseline	0 (0%)	75 (24.9%)
Quality of Life	Quality of Life Inventory (QoLI20)	▪20-item scale that assesses the life circumstances of people with severe and persistent mental illness	**Expected trajectory:** Movement to a higher quintile, compared to baseline OR no change from baseline	26 (8.64%)	71 (23.4%)

Table 1 Domains of Change from Baseline to 6-months and Operationalization of "Experiencing Difficulties" vs. "Expected Trajectories"[1] *(Continued)*

	▪A total sum of all items produces a score ranging from 20 to 140, with higher scores indicating greater satisfaction with life	**Experiencing difficulty:** Movement to a lower quintile, compared to baseline
	▪References: [40-42]	

[1]The last two columns on the right side summarize the extent of the missing data in each of the domains, prior to multiple imputation.

to follow-up, or participant non-response on specific study instruments, and ranged from 0% to 25% depending on the outcome measured (Table 1). We pursued multiple imputation because complete case analysis (after case deletion) can lead to bias when the data is not missing completely at random (MCAR) [47]. Multiple imputation procedures can improve the plausibility of the missing at random (MAR) assumption when a greater number of observed variables that account for, or are associated with, the reason for missing-ness are incorporated into the model [48,49]. We implemented multiple imputation using the sequential regression multivariate imputation approach (SRMI), also referred to as Fully Conditional Specification (FCS) and Multiple Imputation by Chained Equations (MICE): this method allows for efficient imputation by fitting a model to each variable, conditional on all others, and imputing one variable at a time [50,51]. The multiple imputation model included 1) outcome variables collected at baseline, 6 months, and 12 months); 2) study site; 3) age at enrollment; 4) gender; 5) ethno-racial status and 5) Aboriginal status. Imputed values were restricted to the theoretical range of the original variables by use of bounds. Twenty imputations were stratified by treatment arm and site. Imputations were implemented using IVEware software (http://www.isr.umich.edu/src/smp/ive/), and imputation results were combined using PROC MIANALYZE (SAS 9.3, SAS Institute Inc., Cary, NC).

Statistical analyses

All statistical analyses were conducted using IBM SPSS Statistics, version 21 (IBM Corporation, Chicago, IL). A p-value < 0.05 was considered statistically significant.

I. Describing early trajectories

To assess improvement in health and social functioning during the early stages of the HF intervention, we examined changes from baseline to 6-months in the following domains:

i) physical community integration using the Community Integration Scale (CIS-physical subscale);
ii) psychological community integration using the Community Integration Scale (CIS-psychological subscale);
iii) mental health symptom severity using the modified Colorado Symptom Index (CSI);
iv) substance use problems using the Global Assessment of Individual Need – Short Screener (GAIN-SS) substance use subscale;
v) community functioning using the Multnomah Community Ability Scale (MCAS);
vi) quality of life using Quality of Life Interview 20 (QoLI20).

See Table 1 for further details on the domains and their associated instruments.

For four of the domains for which the total scale scores were normally distributed (psychological community integration, mental illness symptomatology, community functioning and quality of life), movement between quintiles was used to evaluate trajectories from baseline to 6 months. For each scale examined, participants who moved from their reference baseline quintile to a quintile indicating lower functioning at the 6-month visit were classified as experiencing difficulties. All participants who remained in the same quintile or moved to a quintile indicative of improved functioning were grouped into the expected trajectory group (Table 1).

Two of the domains we examined used scales for which counts, rather than total scores were calculated (physical community integration and substance use). The physical community integration instrument asks if the participant has engaged in seven specific activities in the community in the past month, and the total count corresponds to the number of "Yes" answers. In the GAIN instrument, the counts correspond to how many times a participant has answered "past month" to a series of five questions describing specific problems related to substance use. For both these instruments, change in counts from baseline to 6 months was used to assess differences between the two time points, rather than movement between quintiles (Table 1).

Factors associated with early trajectories

We used multivariate regression to assess the relationship between demographic, clinical and service-use variables with changes from baseline to 6-months in each of the outcome domains. In total, ten variables representing select demographic, clinical, or service use domains collected at baseline were examined in each regression

model. Demographic variables included: age (years), sex (male or female), years of school completed, ethnicity (ethno-racial or not) and total length of homelessness (years). Clinical variables included the presence of psychosis or an alcohol or substance abuse or dependence diagnosis based on the MINI International Neuropsychiatric Interview (MINI, described above). Finally, service use variables included the type of support service team participants were assigned to at baseline (ACT or ICM), and the self-reported number of emergency department visits in the 6-months prior to baseline. The residuals from multivariate regression analyses for all outcome domains were checked for normality.

Associations with housing and participant-reported working alliance

We also examined if the length of time to access housing, housing status and participant's relationship with their case manager (working alliance) at 6-months were associated with changes from baseline in each of the outcome domains.

Length of time to first being housed (number of days from program assignment to move-in day) was collected by the support service provider agencies. We first performed correlation analysis to examine if the number of days to first being housed was associated with the degree of change from baseline to 6-months in each of the outcome domains, and secondly used t-tests to examine if the mean changes from baseline to 6-months differed among participants who took longer than average to be housed compared to those who were housed in less than or the average length of time.

Furthermore, housing status was derived from the Residential Time Line Follow Back instrument [23,52]. Participants were asked for their current residence at the time of their 6-month interview. Based on this data, we created a dichotomized variable that identified those who were stably housed in independent housing (own apartment, house or home) from those who were living in any other type of housing. Stable independent housing is a goal of Housing First and is often cited as the preferred housing option among individuals experiencing homelessness and/or mental illness [53-55]. We performed t-tests to examine if the amplitude of change from baseline to six-months differed between those who attained independent housing at 6-months compared to those who had not, in each of the six outcome domains.

Finally, the participant-rated working alliance was based on the summary score of the Working Alliance Inventory–Participant Short Form (WAI-PAR) questionnaire [56,57]. The WAI-PAR consists of a total of 12 questions, which ask the participant what they think and feel about the relationship with their service provider, including with respect to therapy goals and tasks. A total score is tabulated, with a greater score indicating a stronger alliance or agreement between the participant and their service provider. We performed correlation analysis to examine if the WAI-PAR score was associated with the degree of change from baseline to 6-months in each of the outcome domains.

Qualitative data and analysis

Qualitative data for this study were collected as part of the Toronto site's early Implementation Evaluation as well as consumer narrative interviews with a subset of study participants.

Implementation evaluation

Interviews with key informants and focus groups with service providers and program participants were conducted between December 2010 and January 2011. One research team member, who was not involved in the project implementation, conducted all interviews and focus groups. Both key informants and focus group members were selected in consultation with the AH/CS site governance team and the site's principle investigators, based on their knowledge of the local implementation process and their integral role in the project.

In total, nine key informants were interviewed, including: the Toronto site coordinator, one principal investigator, three support services team leaders (one from each of the support service teams) and four agency directors (one from each of the support service agencies and the housing agency director).

Seven focus groups were conducted with a total of 44 participants: three focus groups were held with the support team case managers (n = 18); one with the housing tem members (n = 4), and three with consumer participants (n = 22).

All key informant interviews and focus groups participants provided written informed consent. All audio-recordings were transcribed and data was analyzed by a three-member research team comprised of the interviewer, a research coordinator and a study principal investigator. First, transcripts were coded independently by the study interviewer and the principal investigator, and compared for consistency. Once consensus was achieved, the interviewer proceeded to code the remainder of the transcripts. The qualitative team would meet to discuss the codes, their resulting higher-order themes and to condense/consolidate the number of themes emerging from the data. All transcripts were analyzed using NVIVO 9.2 software.

Consumer narratives

A sampling strategy was implemented where every 10^{th} participant randomized to the treatment arm was approached for participation in the consumer narratives.

This approach was employed to achieve a representative sample. A total of 84 participants from the intervention arm were sampled, 57 were contacted and 36 were interviewed. Interviews took place between March 2010 and June 2011. All participants provided written informed consent. The research team consisted of three research staff with training in conducting in-depth interviews. The interviews were semi-structured, and participants were questioned on their history of homelessness and mental health problems, in addition to daily activities, experiences with mental health and social services, and hopes for the future.

Analysts double coded six interview transcripts, compared the reliability of their codes, and met regularly to compare accuracy of codes and to address discrepancies. Discrepancies in coding were discussed and resolved in consultation with the research team. For more information please see [58].

Analytic approach

For the purposes of this manuscript, transcripts from the sources described above were analyzed using thematic analysis [59]. Thematic analysis in analytic approach that identifies, reviews and defines the themes or patterns found in the dataset, by searching across the data for repeated patterns of meaning [59]. Of particularly interest to this study were themes relating to participant experiences during the transition from homelessness to becoming a Housing First participant.

Results

In total, imputed quantitative data were available for 299 participants both at baseline and 6-months (2 participants had passed away since the baseline interview). We first present changes in the domains of physical and psychological community integration, mental health symptoms, substance use, community functioning and quality of life (Figure 2 and Additional file 1: Table S1), as well as baseline predictors of these changes (Table 2) and their associations with housing status and working alliance at 6-months (Additional file 2: Table S2 and Additional file 3: Table S3). Qualitative data exploring early experiences

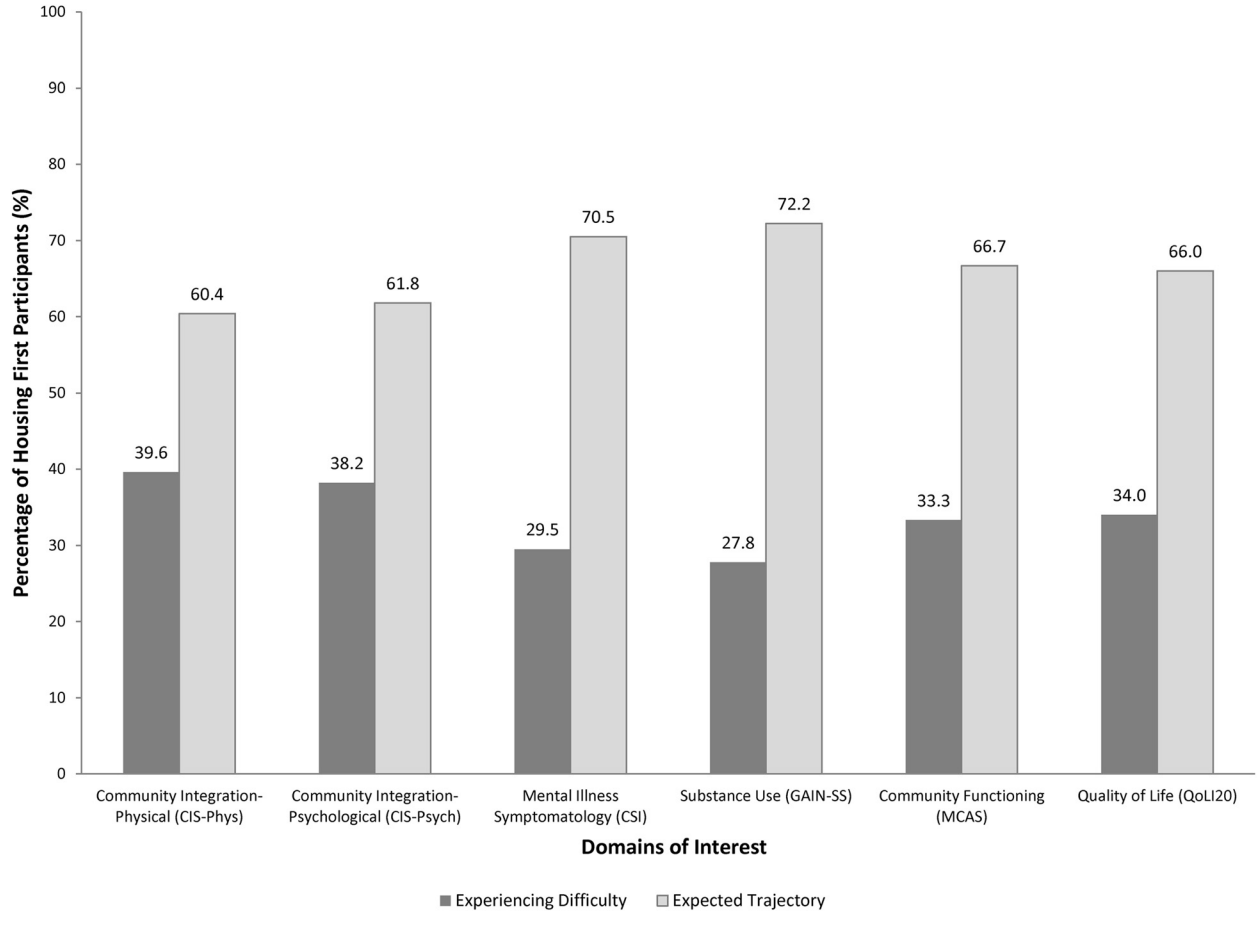

Figure 2 Housing First participant status at 6 months compared to baseline in key outcome domains (N = 299). Percentages of participants experiencing difficulties and expected trajectories are based on pooled estimates from 20 imputed datasets.

from the perspective of participants and service providers follows the quantitative findings.

Early trajectories

Although almost two thirds of participants followed the expected trajectory of improvement for physical (60%) and psychological (62%) community integration, which capture the individuals' physical presence in the community and individual's sense of belonging to a community, respectively, the remainder experienced a decrease in their physical (40%) and psychological (38%) community integration from baseline to 6 months (Figure 2). In addition, almost a third (30%) of the participants reported increased mental health symptom severity and more than a quarter of participants (28%) experienced increased problems due to substance use from baseline to six-months. Although two thirds of the participants followed the expected trajectory of improvement in community functioning and quality of life (67% and 66%, respectively), a third (33%) experienced a decrease in community functioning and 34% a decrease in their quality of life at the 6-month interview, compared to the baseline.

Factors associated with "early difficulties"

Additional file 1: Table S1 shows the means at baseline and 6-months for each of the outcome domains, in addition to the changes in these means between these two time-points. Table 2 shows the results of the multivariate regression examining the relationship between participant baseline factors with changes from baseline to 6-months in each of the domains.

Demographic variables

None of the baseline demographic variables were associated with the amount of change from baseline to 6-months in any of the outcome domains.

Clinical variables

Diagnosis of psychotic disorder was associated with negative changes from baseline to 6-months in the quality of life domain scores ($p = 0.011$), indicating a worsening of quality of life among participants with this diagnosis, but was not associated with other outcome domains. Diagnosis of alcohol or substance abuse or dependence was associated with a positive change from baseline in quality of life ($p = 0.018$) (corresponding to an improvement in quality of life from baseline to 6-months), and a negative change in both mental illness symptomatology ($p = 0.005$) and substance use ($p = 0.034$) domains, corresponding to a decrease in both mental health symptom severity and problems associated with alcohol and/or substance use from baseline to 6-months.

Service use variables

Compared to ICM participants, ACT participants saw a greater positive change from baseline in community functioning ($p < 0.001$). The number of emergency department visits in the six months prior to study start was not associated with changes from baseline in the six domains examined.

Early changes and associations with housing and participant-reported working alliance

The mean length of time from the date of program assignment to being first housed (move-in date) was 68.8 ± 79.3 days, for those participants who remained in the program and were successfully housed at least once ($n = 283$).

The length of time to housing was negatively correlated with changes from baseline to 6-months in both the community functioning ($r = -0.162$, $p = 0.011$) and quality of life ($r = -0.127$, $p = 0.042$) domains. A positive correlation was observed between the change from baseline to 6-months in the mental illness symptoms domain and length of time to housing ($r = 0.144$, $p = 0.025$) (Additional file 3: Table S3). However, if we only examined data for participants who had been housed within 180 days of randomization (approximately 6 months; $n = 264$), the length of time to housing was not associated with changes from baseline to 6-months in any of the outcome domains.

None of the domains showed a difference in the mean change from baseline to 6-months in t-tests that compared those who took longer than average length of time to be housed (> 69 days) to those who took the average length of time or less (≤ 69 days) (Additional file 2: Table S2).

Compared to participants who were not independently housed at 6-months, participants who had achieved independent housing experienced greater improvement from baseline in psychological community integration (mean change from baseline: −0.82 vs. 1.79, $p = 0.001$) and quality of life (mean change from baseline: 4.03 vs. 13.70, $p = 0.011$). Furthermore, these participants experienced a greater reduction in mental illness symptom severity (mean change from baseline: −2.56 vs. -6.26, $p = 0.043$) (Additional file 2: Table S2).

The participant-rated working alliance score was positively associated with changes from baseline in three of the outcome domains, including physical community integration ($r = 0.165$, $p = 0.020$), psychological community integration ($r = 0.142$ and 0.044) and quality of life ($r = 0.164$, $p = 0.021$) (Additional file 3: Table S3).

Exploring participant and service provider perspectives

The main themes identified by study participants and service providers in the qualitative interviews and focus groups discussing early program experiences include

Table 2 Multivariate regression examining the association between participant baseline factors and changes from baseline to 6-months in each of the outcome domains[1,2,3]

	Community Integration-Physical				Community Integration-Psychological				Mental Illness Symptomatology				Substance Use				Community Functioning				Quality of Life			
	B	*S.E.*	*t*	*sig*	*B*	*S.E.*	*t*	*sig*	*B*	*S.E.*	*t*	*sig*	*B*	*S.E.*	*t*	*sig*	*B*	*S.E.*	*t*	*sig*	*B*	*S.E.*	*t*	*sig*
Constant	−0.59	0.62	−0.95	0.345	2.00	1.42	1.41	0.160	−4.01	3.34	−1.20	0.231	0.16	0.55	0.29	0.773	1.24	2.39	0.52	0.605	2.02	7.28	0.28	0.782
Demographic Variables																								
Age, years	0.01	0.01	0.64	0.522	0.01	0.03	0.18	0.858	0.00	0.06	−0.02	0.982	0.00	0.01	0.23	0.822	0.01	0.04	0.27	0.785	0.17	0.13	1.33	0.185
Gender	0.13	0.27	0.47	0.641	−1.03	0.61	−1.70	0.09	1.59	1.33	1.19	0.232	0.42	0.22	1.89	0.058	−0.60	0.92	−0.65	0.519	1.12	3.03	0.37	0.711
Years of School	0.00	0.00	−0.53	0.599	0.01	0.01	1.04	0.298	0.00	0.01	−0.09	0.926	0.00	0.00	−0.05	0.959	0.01	0.01	1.35	0.178	0.01	0.03	0.53	0.595
Ethnicity	0.25	0.26	0.96	0.338	−0.50	0.62	−0.80	0.422	−0.83	1.40	−0.59	0.553	−0.27	0.24	−1.15	0.250	−0.02	0.98	−0.02	0.986	3.05	3.10	0.98	0.326
Total Years of Homelessness	0.01	0.01	0.99	0.325	−0.04	0.03	−1.61	0.108	0.06	0.05	1.11	0.269	0.00	0.01	0.27	0.791	0.00	0.04	−0.11	0.911	−0.15	0.12	−1.17	0.243
Clinical Variables																								
Psychotic Disorder	−0.24	0.27	−0.88	0.381	−0.94	0.61	−1.52	0.128	0.54	1.38	0.39	0.696	0.03	0.22	0.13	0.894	−0.44	0.91	−0.48	0.629	−7.76	3.05	−2.54	0.011
Alcohol or Substance Dependence or Abuse	−0.17	0.26	−0.65	0.515	0.61	0.61	1.01	0.314	−3.72	1.33	−2.80	0.005	−0.47	0.22	−2.13	0.034	0.20	0.93	0.21	0.832	7.03	2.98	2.36	0.018
Service Variables																								
Level of Support Service	0.28	0.29	0.97	0.333	−0.84	0.68	−1.23	0.219	0.58	1.51	0.38	0.702	−0.12	0.24	−0.51	0.609	4.63	1.08	4.30	<0.001	−3.15	3.18	−0.99	0.321
Number of Emergency Department Visits	−0.01	0.03	−0.32	0.751	0.04	0.07	0.56	0.577	0.07	0.17	0.41	0.683	−0.03	0.03	−1.02	0.307	−0.03	0.16	−0.21	0.838	0.34	0.37	0.92	0.360

[1]The dependent variable was the calculated change from baseline to 6-months for each of the six outcome domains. Values are pooled from 20 multiply imputed datasets.
[2]Final sample size for the regression analyses was (N = 297) due to some missing data for non-imputed variables, including Gender (N = 2) and Years of School (N = 1).
[3]The categorical variables were as coded as follows: Gender (1 = Female, 0 = Male); Ethnicity (1 = ethno-racial ethnicity, 0 = white ethnicity); Psychotic Disorder (1 = Diagnosis present; 0 = Diagnosis absent); Alcohol or Substance Dependence or Abuse (1 = Diagnosis present; 0 = Diagnosis absent), Level of Support Service, after randomization (1 = Assertive Community Treatment, ACT; 0 = Intensive Case Management, ICM). Zero (0) was the reference category for all categorical variables.

social isolation, substance misuse and life skills training and support.

Social isolation

Participant isolation was the most prominent theme discussed by both service providers and participants. Service providers noted that participants' move to independent housing often resulted in a change from an environment where they were surrounded by people (e.g. in a shelter or on the street) to one where they are on their own, necessitating early focused efforts to build and/or maintain social networks. One service provider noted that for participants to improve, the program had to "*get* [*the participants*] *a home and then give them a reason to get out of it*".

Some participants described their feelings of isolation in their narrative interviews. One participant who had recently been housed stated:

> "*I have friends in the AA program and kind of a few guys on the streets…but I don't do very much anymore, I have been staying right in my apartment.*"

Service providers noted that some participants seemed to react to their isolation by "*bringing the streets into their homes*" to replicate the activity they were used to. As one service provider commented:

> "*For some participants, in the first few months of being housed, their contact with non-supportive networks actually goes up…because they are in a unit and the hustle and bustle of life on the street is not there and they are lonely, so they bring it into their unit*".

For other participants, this initial isolation was an impetus to reconnect with former social networks and family. However, service providers noted that trying to build robust social networks for all participants might be unreasonable, as social isolation is common for residents of Toronto who are housed and who are not mentally ill. One key informant noted:

> "*A lot of people in Toronto who aren't homeless or mentally ill are not very well integrated into the community…there's a lot of social isolation in general. I am not sure if we're going to achieve better community integration than what the average Torontonian has.*"

Substance misuse

Service providers noted that, for some participants, substance use did not improve in the first few months in housing, and for others it actually increased. One service provider noted that

> "*It seems like there's so much almost inner emptiness that [the participants] have to fill so the problematic drug use, which I think in the long run does go down, I think actually it increases often when they first move in.*"

Service providers were also skeptical that the intervention would be able to reduce participant's substance use over time. One service provider stated that

> "*The [outcome] that I am a little bit uncertain about is decreased problematic drug use. I'm not sure how the model actually, whether the model actually achieved that, and I am not sure the literature is as strong to suggest that we should expect it.*"

Some participants, on the other hand, described a strong desire to reduce or eliminate substance use. Some participants noted that being housed enabled them to reduce substance use by decreasing their exposure to drugs/alcohol and allowing them to leave unsupportive environments, and just "be alone". However, when being alone turned into being lonely, a few participants acknowledged that their substance use increased. As one participant stated,

> "*When I was living in a shelter I always had people to talk to, so I didn't really drink when I was in the shelter.*"

Life skills training and support

Adjusting to a new environment once housed was seen as a factor that could potentially delay participant's subjective and objective improvement. The need to learn or re-learn basic living skills following many years of living in institutions or on the street was highlighted by service providers. One provider commented on the need to provide extra support to participants to teach these skills:

> "*On the street you knew where to get the food, and now you're in the west end, like you, you would find somebody in their unit sitting going "What the hell am I doing?"….You have to show them where the garbage is…there's a lot of stuff they had to be taught.*"

One participant, who was waiting for housing at the time of interview, described his fears of moving:

> "*You know, if you go from being in a shelter to going… it's a big change you know?…I just won't have anyone to talk to, I won't have anyone to help me you know, like if I need help doing something or I want to talk to somebody, or I just want to hang out with somebody, I'm going to have to leave my house and go somewhere…I just don't want to fall back into a depression because of that.*"

Discussion

Previous studies of HF and supported housing interventions for homeless adults with mental illness have demonstrated that a large majority of participants (typically > 80%) are successfully housed and may improve in other outcomes after 1 or more years [11,12,25,26,60-63]. However, the literature on the transition from being homeless to getting housed in a HF program is sparse. Furthermore, little is known about the group of participants that do not benefit from HF. Exploring participant experiences during the early adjustment period in a HF program can help guide future approaches to address challenges during the transition period from being homeless to becoming housed, as well as inform program adaptations and resource allocation in the growing number of jurisdictions adopting HF.

To inform local planning efforts, this study draws from qualitative and quantitative data to highlight early participant and service provider observations with HF as well as examine early experiences among HF participants 6 months after program enrolment. Although based on the HF program model, approximately two thirds of program participants followed the expected trajectories of improvement at 6-months, the remainder experienced difficulties in community integration (physical and psychological), mental health symptoms substance use, community functioning and quality of life.

Neither the demographic nor the service use variables examined were associated with changes from baseline to 6-months in any of the six domains of interest. Participants diagnosed with psychotic disorder at baseline experienced a reduction in the quality of life domain from baseline to 6-months, compared to those who did not have this diagnosis. Interestingly, participants with diagnosis of alcohol or substance abuse or dependence had greater improvement in quality of life and greater reductions in both mental health symptom severity and substance use problems from baseline to 6-months, compared to participants without these diagnoses. These observations are novel and important because to date there is limited evidence that HF programs can improve substance use or related symptoms [11,64]. These observations may have resulted from compromised quality of life at baseline among individuals with a substance use disorder. Housing and the harm reduction philosophy of Housing First may have offered a welcome respite for this group of participants with concurrent disorders, who are typically ill-served by the service systems designed to support them. These observations will need to be further examined when longer-term outcome data from the project is available.

Individuals receiving HF with ACT experienced greater improvements in community functioning from baseline to 6-months, compared to those receiving HF with ICM, suggesting perhaps that the team structure and resource intensity of ACT may have advantages over ICM at the early stages of program enrolment. To circumvent strict ACT admission criteria, which many homeless people with mental illness do not meet, and optimize use of resources, consideration in the future should be given to HF programs adopting flexible models of community support, such as FACT, capable of ACT intensity, but easier to titrate to consumer needs over time [65]. FACT typically has much higher caseloads than ACT, making it an attractive alternative for consideration for both high and moderate needs participants.

It is promising that participants who had achieved stable independent housing by their six-month interview showed greater positive improvements along the psychological community integration, mental health symptom severity, and quality of life domains. Several Canadian studies report that individuals who are homeless and/or have a mental illness prefer to be housed in independent housing rather than congregate settings [55,66,67]. Immediate access to independent housing of their choice and case management support, grounded in a program philosophy of participant empowerment and choice, form the foundation of the HF approach [10], leading to positive housing and health outcomes in a growing number of studies [12,18,25,34,62,63]. Nonetheless, studies have not consistently found that this community placement leads to community integration among program participants [68].

The association of length of time to housing with changes from baseline to 6-months in the outcome domains of interest is more complex. Although a longer time to housing was associated with lower community functioning and quality of life, and increased mental health symptom severity, these associations were not upheld once participants for whom it took longer than 6-months to be housed were excluded. It is therefore likely that any associations between the outcome domains of interest and length of time to housing were driven by a small number of individuals who experienced significant delays in housing (beyond six months). Longer times to housing may have been influenced by both external factors (such as Toronto's housing market), as well as participant-specific characteristics (participant's particular choice of neighborhood and/or unit, factors associated with their mental and physical health, etc.). The subject of housing delays and the participants who experienced them in our sample are the topic of another forthcoming paper [69].

The importance of the therapeutic relationship in achieving positive consumer outcomes has been examined extensively in the psychotherapy literature [70,71] and has also been observed in several studies of homeless adults who experience severe mental illness [72-74], although these findings are not universal [75,76]. We observed that those with a stronger working alliance with

their case manager were more likely to have improved outcomes in the community integration (both physical and psychological) and in quality of life domains. Similar to our findings, previously chronically homeless adult participants in a supported housing program who rated their therapeutic alliance in the top 75th percentile (at 3 months post study entry) had the highest subjective quality of life and perceived social support, although no association with other key outcomes, including housing, mental health and substance use was found [75].

Our qualitative findings provided insightful observations into the loneliness and isolation experienced by HF participants, which is difficult to capture using quantitative measures alone. Previous studies have also highlighted that some individuals with mental illness living in community settings report feeling isolated, lonely, lack social supports and do not "fit in" [53,77-80] and in comparison to their non-disabled neighbors, experience decreased levels of community integration, particularly social integration [29,81]. Consistent with these findings, some HF participants in this study describe difficulties transitioning into living alone, noting a sense of loss for those they had known in the shelters or hospitals, and difficulty re-learning life skills.

We anticipate that enhancements in service provision, particularly in the areas of life and social skills training, housing and peer support and opportunities to establish positive social networks, may mitigate some of the challenges that some participants experience in the early stages of a HF intervention. As in the general population, social supports provide an important buffer against stressful life events [82,83] and lack of supportive social networks or reduced social functioning in this population can adversely affect both physical and mental health outcomes [84-87]. Similarly, teaching life skills is important for independent living and housing retention among homeless individuals [88-90] and life skills training provides an effective intervention for previously homeless individuals [91-94].

This study brings to light the importance of early program evaluation to identify the challenges participants face in their early adjustment from homelessness to housing and inform interventions and program enhancements to help mitigate them.

A key challenge emerging from our findings is the difficulty in identifying program participants who may require additional services or supports. The lack of clear "predictors" of early difficulties in this study indicates a need to develop new strategies to help identify participants who may experience challenges. Ensuring staff receive adequate training and supervision to identify and address early difficulties may be helpful. Increased attention to the process of participant engagement and the service provider–participant working alliance may also further support the transition process from homelessness to housing and community reintegration.

This study has some limitations. Some of our variables had considerable level of missing-ness at the 6 month interview which we addressed using multiple imputation approaches supported by the literature. Regression to the mean may be a potential cause of some our observations, however, it is important to note that while a longer time frame for the intervention may have helped address this, it would not allow us to investigate how participants fare in the early transitions in a Housing First intervention, which is the focus of this paper. Although all efforts were made to ensure that this sample was representative of the sample of homeless individuals with mental illness residing in Toronto, a small number of individuals who were recruited refused consent to participate in a randomized trial (54 of 726 who were assessed for eligibility declined consent [27]). However, this is a limitation shared with most studies of homeless and/or other vulnerable populations. Another potential limitation is that quantitative and qualitative baseline data for study participants may have been collected on different dates, although the window of capture for the quantitative data would have covered the qualitative data collection period; it is of note, however, that qualitative data include not only the perspectives of program participants captured by our quantitative analyses, but those of their service providers, adding a rich perspective and understanding of the transition from homelessness to housing. While we selected 6-months as our point of focus, it is possible that earlier or later evaluation would highlight additional key elements to participant's outcomes. Furthermore, this study focused on selected outcomes based on the program's proposed theory of change. It is possible that examination of other domains would expose other trajectories and relationships.

Conclusion

This study demonstrates how an early program evaluation can highlight opportunities for program adaptations to better support participants' trajectories of improvement. Housing First programs should consider strategies to identify participants in need of additional supports early upon program entry, in conjunction with early focused interventions to increase life skills, address substance use and promote social and community integration.

Additional files

Additional file 1: Table S1. Means (standard errors) for each of the domains at both baseline and 6 months, in addition to the mean change from baseline to 6 months[1].

Additional file 2: Table S2. Mean change from baseline to 6-months in outcome domains by length of time to housing and housing status at 6 months[1,2].

Additional file 3: Table S3. Correlation coefficients between changes from baseline to 6-months for each outcome domain and time to housing and the participant-reported Working Alliance total score[1].

Competing interests
The authors declare that they have no competing interests.

Authors' contributions
VS conceived of the study, interpreted results, contributed to the drafting of the manuscript and read and revised all drafts of the manuscript. AG developed the analysis plan, analyzed the quantitative data, interpreted the findings and drafted the manuscript. PO helped interpret the results and contributed to drafting of the manuscript. AH analyzed the qualitative data and contributed to the drafting of the manuscript. JJ analyzed the qualitative data and contributed to the drafting of the manuscript. ST interpreted the results and contributed to drafting of the manuscript. All authors read and approved the final manuscript.

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