

Long-term effects of rent supplements and mental health support services on housing and health outcomes of homeless adults with mental illness: extension study of the At Home/Chez Soi randomised controlled trial



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Summary

Background Housing First is increasingly implemented for homeless adults with mental illness in large urban centres, but little is known about its long-term effectiveness. The At Home/Chez Soi randomised controlled trial done in five cities in Canada showed that Housing First improved housing stability and other select health outcomes. We extended the At Home/Chez Soi trial at the Toronto site to evaluate the long-term effects of the Housing First intervention on housing and health outcomes of homeless adults with mental illness over 6 years.

Methods The At Home/Chez Soi Toronto study was a randomised, controlled trial done in Toronto (ON, Canada). Here, we present the results of an extension study done at the same site. Participants were homeless adults (aged ≥ 18 years) with a serious mental disorder with or without co-occurring substance use disorder. In phase 1, participants were stratified by level of need for mental health support services (high vs moderate), and randomly assigned (1:1) using adaptive randomisation procedures to Housing First with assertive community treatment (HF-ACT), Housing First with intensive case management (HF-ICM), or to treatment as usual (TAU). Participants with moderate support needs were further stratified by ethnoracial status. Considering the nature of the Housing First intervention, study participants and study personnel were not masked to group assignment. Phase 1 participants could choose to enrol in the extension study (phase 2). The primary outcome was the rate of days stably housed per year analysed in the modified intention-to-treat population, which included all randomly assigned participants who had at least one assessment for the primary outcome. Participants contributed data to the study up to the point of their last interview. Multilevel multiple imputation was used to handle missing data. The trial was registered with ISRCTN, ISRCTN42520374.

Findings Between Oct 1, 2009, and March 31, 2013, 575 individuals participated in phase 1 of the Toronto Site At Home/Chez Soi study (197 [34%] participants with high support needs and 378 [66%] with moderate support needs). Of the 378 participants with moderate support needs, 204 were randomly assigned to receive the HF intervention with ICM or with ethnoracial-specific ICM services (HF-ER-ICM; HF-ICM or HF-ER-ICM groups) and 174 were randomly assigned to TAU. Of the 197 participants with high support needs, 97 were randomly assigned to receive the HF intervention with ACT (HF-ACT treatment group) and 100 were randomly assigned to TAU group. Between Jan 1, 2014, and March 31, 2017, 414 (81%) of 575 phase 1 participants participated in the extended phase 2 study. The median duration of follow-up was 5.4 years (IQR 2.1–5.9). Among phase 2 participants, 141 had high support needs (79 participants in the HF-ACT group; 62 participants in the TAU group), and 273 had moderate support needs (160 participants in the HF-ICM or HF-ER-ICM group; 113 participants in the TAU group). 187 high support needs participants (93 participants in the HF-ACT group, 94 participants in the TAU group), and 361 moderate support needs participants (201 participants in the HF-ICM or HF-ER-ICM group, 160 participants in the TAU group) were included in the modified intention-to-treat analysis for the primary outcome. The number of days spent stably housed was significantly higher among participants in the HF-ACT and HF-ER-ICM groups than participants in the TAU groups at all timepoints. For participants with moderate support needs, the rate ratio (RR) of days stably housed in the Housing First group, compared with TAU, was 2.40 (95% CI 2.03–2.83) in year 1, which decreased to 1.13 (1.01–1.26) in year 6. The RR of days stably housed for participants with high support needs, compared with TAU, was 3.02 (2.43–3.75) in year 1 and 1.42 (1.19–1.69) in year 6. In year 6, high support needs participants in the Housing First group spent 85.51% of days stably housed compared with 60.33% for the TAU group, and moderate needs participants in the Housing First group spent 88.16% of days stably housed compared with 78.22% for the TAU group.

Interpretation Rent supplements and mental health support services had an enduring positive effect on housing stability for homeless adults with mental illness in a large, resource-rich urban centre, with a larger impact on individuals with high support needs than moderate support needs.

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Introduction

Homelessness is a persisting social and public health challenge across many jurisdictions.¹ Homeless people have a high burden of acute and chronic health conditions, mental and substance use disorders, poor quality of life, and premature mortality.^{2,3} Housing First, which provides rent supplements and mental health support services, has emerged over the past two decades as an evidence-supported intervention for homeless adults with mental illness, and the implementation of Housing First interventions is increasing, particularly in North America, Australia, and Europe.^{4,5}

Housing First differs from traditional approaches to housing for homeless adults with mental illness, which offer housing contingent on the achievement of sobriety or acceptance of psychiatric treatment. Housing First interventions consider housing a human right and provide immediate access to coordinated housing and recovery-oriented mental health support services, to facilitate a shift away from homelessness, engagement with health services, and enhance health outcomes,

social and community integration and functioning, without preconditions.⁶ Such interventions have been reported to positively impact a number of outcomes, including housing stability, and the non-routine use of health services; however, the effect of the Housing First intervention on short-term mental health, substance use, and quality of life (QOL) outcomes remains unclear.^{7,8} Since previous studies of Housing First have assessed housing and health outcomes during relatively short follow-up periods (eg, 1 or 2 years), and some outcomes might require longer periods of follow-up to observe change, research on the long-term outcomes of Housing First participants has been identified as a priority.^{7,8}

Homeless people with mental illness in Canada face multiple barriers to accessing services, including poor availability and long wait times for intensive services, variable service quality, system fragmentation, stigma, and discrimination.⁹ The At Home/Chez Soi study was a large multicentre pragmatic randomised trial of Housing First, done between Oct 1, 2009, and March 31, 2013, in five cities across Canada (Toronto, Moncton, Montreal, Winnipeg,

Research in context

Evidence before this study

The Housing First model provides homeless adults with mental illness immediate access to housing, without preconditions of sobriety or acceptance of psychiatric treatment, in combination with mental health services such as intensive case management or assertive community treatment. In September, 2013, we searched PubMed, MEDLINE, Embase, CINAHL, PsycINFO, and the Cochrane Central Register of Controlled Trials from database inception to July 31, 2013, for systematic reviews, randomised controlled trials, and controlled before-after studies of Housing First, supportive or supported housing interventions for adults experiencing homelessness, or mental illness, published in English, using the search terms “homeless”, “housing”, “accommodations”, “home”, “evaluation”, “effectiveness”, “mental health”, and “mental illness”. In June, 2018, we updated the search to Feb 28, 2018, using the same databases and search terms. Previous studies, done primarily in the USA and Canada, established Housing First as an effective approach to improve housing stability and other health outcomes after 2 years of follow-up, and highlighted the need for further research on the long-term effects of housing interventions on housing stability, substance use, and quality of life outcomes for homeless adults with mental illness.

Added value of the study

To the best of our knowledge, this study is the first to assess the effects of Housing First, including rent supplements and

mental health support services, on housing stability, quality of life, community functioning, and substance use outcomes among homeless adults with mental illness over 6 years of follow-up. Findings from this study suggest that Housing First is associated with an enduring and significant increase in the number of days spent stably housed per year, especially for individuals with higher needs for mental health services. In addition to housing stability, we examined the effect of Housing First on select health outcomes. Although findings were not significant for quality of life, substance use severity, or community functioning outcomes over 6 years, there was no evidence of harms associated with these outcomes.

Our findings provide robust evidence that Housing First has an enduring positive effect on housing stability, even in service rich settings, especially for adults with higher support needs for mental health services.

Implications of all the available evidence

Our findings provide health policy makers, health professionals, and other stakeholders robust evidence on the long-term effects of Housing First, to guide policy and planning in areas in which homelessness is prevalent, and question the effectiveness of existing support services available for homeless adults with mental illness.

and Vancouver).¹⁰ The study assessed the effect of Housing First on housing stability and other health and social outcomes for homeless adults with mental illness, including subpopulations prevalent in Canada, 24 months after study enrolment.¹⁰ 2255 participants, stratified by high and moderate support need levels for mental health services, were randomly assigned to treatment as usual (TAU) or to Housing First. Participants with moderate support needs who were randomly assigned to receive the Housing First intervention received intensive case management (ICM), and participants with high support needs randomly assigned to the Housing First Intervention received assertive community treatment (ACT). All participants in the intervention groups had access to housing of their choice via rent supplements. Participants in the TAU group had access to a variety of housing and support services available in each city, including primary and specialty ambulatory care, hospital and crisis services, and housing, rehabilitation, and substance use services.^{10,11}

Between 2009 and 2011, 575 participants were recruited at the Toronto site, and at 24 months participants who received the Housing First intervention were found to have improved housing stability and community functioning and modest improvements in select health outcomes when compared with participants who received TAU.^{12,13} Following the completion of the multicentre trial in March 2013,^{14,15} the At Home/Chez Soi study was extended at the Toronto site until March 2017. The aim of the extension study was to assess the long-term effects of Housing First on housing stability and other outcomes such as quality of life, substance use, and community functioning. We hypothesised that participants receiving Housing First would have higher long-term housing stability than those receiving TAU. We also hypothesised that Housing First, by combining timely access to housing with ACT or ICM services, would have a positive impact on quality of life, community functioning, and substance use severity.

Methods

Study design and participants

This study was an extension of the pragmatic, randomised controlled At Home/Chez Soi trial, done in Toronto (ON, Canada).¹⁶ The protocol for the At Home/Chez Soi Toronto site study has been previously published.¹⁶

Potential participants for the At Home/Chez Soi Toronto study and original At Home/Chez Soi trial were referred by shelters, drop-in centres, hospitals, outreach or other homeless services, or were self-referred, and recruited between Oct 1, 2009, and July 31, 2011.^{10,16} The At Home/Chez Soi Toronto study recruited adults (aged ≥ 18 years) who were absolutely homeless (having no fixed place to stay for at least the past 7 nights with little likelihood of finding a place in the upcoming month), or precariously housed (housed in single-room occupancy, rooming house, or lodging in a hotel or motel with a history of two or more episodes of absolute homelessness

in the previous year, or being absolutely homeless for at least 4 weeks in the past year), and had a serious mental disorder with or without co-occurring substance use disorder (determined on the basis of DSM-IV criteria using the Mini International Neuropsychiatric Interview [MINI] version 6.0).^{10,16,17} Adults who were already accessing ACT or ICM services and adults with no legal status in Canada at the time of enrolment were excluded.^{10,16} Potential participants were assessed by an intake coordinator for eligibility and intake assessment.

Toronto site At Home/Chez Soi participants were initially followed up for 2 years, between Oct 1, 2009, and March 31, 2013 (phase 1), as part of the multisite At Home/Chez Soi study.^{12,13,16} Funding from the Canadian Institute of Health Research allowed for an additional 4 years of data collection (phase 2) between Jan 1, 2014, and March 31, 2017, exclusively at the Toronto site.

A detailed description of recruitment, study design, level of need allocation, and clinical and demographic characteristics of the phase 1 sample has been published elsewhere.^{12,13,16} During both the main Toronto At Home/Chez Soi trial (phase 1) and the extension study (phase 2), participants in the intervention groups had access to rent supplements and mental health support services, including individualised treatment and support plans. As in real-world settings, expert clinicians assessed the level of support needed over time and offered services accordingly.

The At Home/Chez Soi Toronto site study received approval from the Research Ethics Board of St Michael's Hospital (Toronto, ON, Canada) and all study participants provided written informed consent to participate in the study.

Randomisation and masking

Eligible participants who consented to participate in the study were stratified according to their level of need for mental health support services (high support needs *vs* moderate support needs) on the basis of the severity of mental health problems and associated disability. Participants who were considered to have high support needs scored less than 62 on the Multnomah Community Ability Scale (MCAS), had a diagnosis of a psychotic or bipolar disorder based on the MINI Neuropsychiatric Interview,¹⁷ and fulfilled at least one of the following criteria: had been admitted to hospital for a mental illness at least twice in 1 year in the past 5 years, had comorbid substance use, or had been arrested or incarcerated within the past 6 months. The remaining participants were classified as moderate support needs.

Participants were randomly assigned (1:1) to the intervention or TAU groups using computer-based adaptive randomisation procedures at the study centre.¹⁰ With this approach, the probability of being assigned to the intervention group continually changes, depending on the number of participants in each group. Treatment allocation for each participant was sent to the interviewer's

laptop at the end of the baseline interview by the central data centre for the study. Participants with high support needs were randomly assigned to receive the Housing First intervention with assertive community treatment (HF-ACT) plus rent supplement (CAN\$600) or to treatment as usual (TAU). Participants with moderate support needs were further stratified by ethnoracial status. Participants who self-identified as not belonging to an ethnoracial group were randomly assigned to receive

the Housing First intervention with intensive case management (HF-ICM) plus rent supplement (\$600) or TAU. Participants who self-identified as ethnoracial and were randomly assigned to receive the intervention had access to either HF-ICM or to Housing First with ethnoracial-specific ICM services (HF-ER-ICM) plus rent supplement (\$600). Considering the nature of the Housing First intervention, study participants and study personnel were not masked to group assignment.

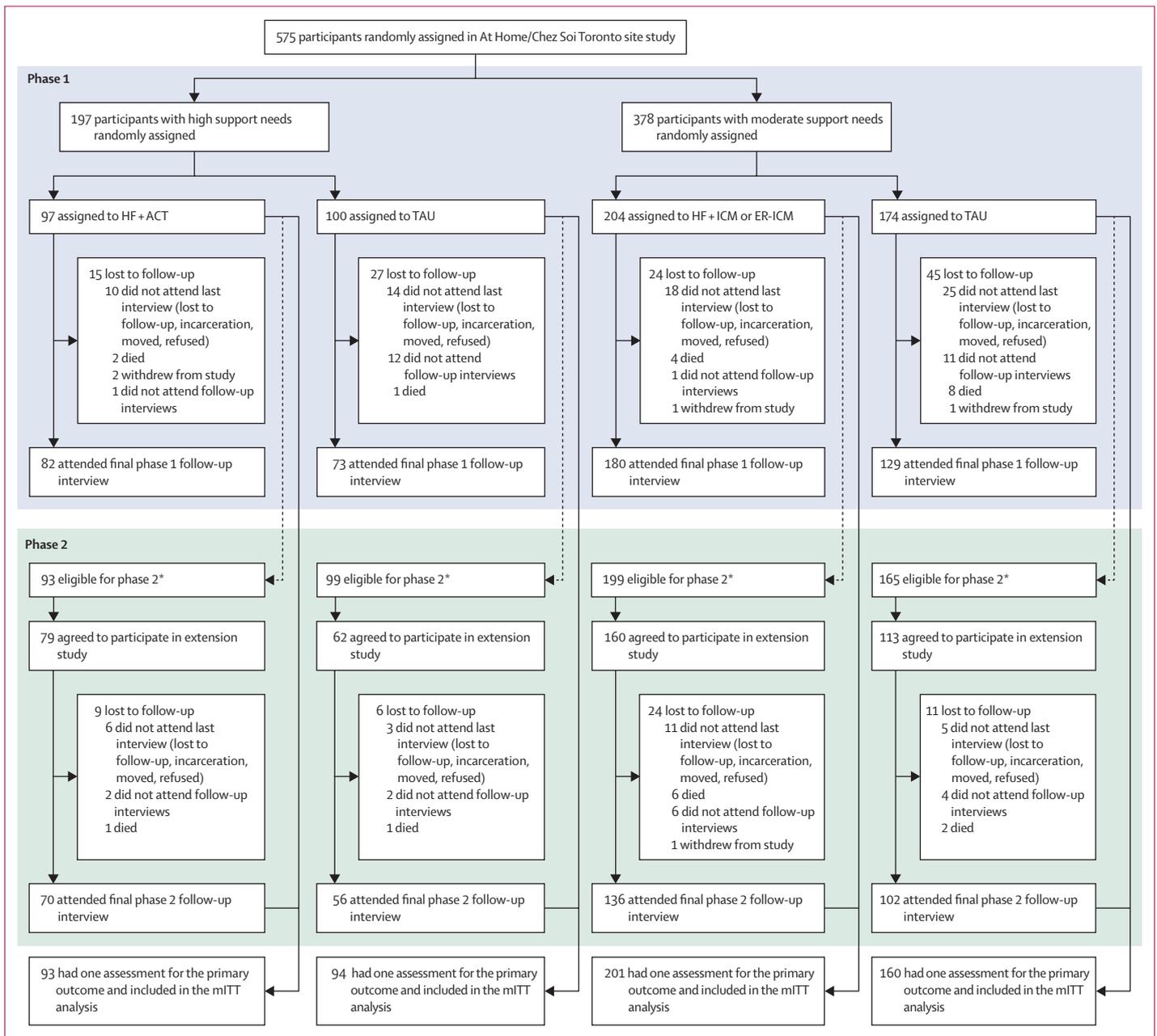


Figure 1: Trial profile
 Participants contributed data to the study up to the point of their last interview or time of death. Multilevel multiple imputation was used to handle missing data. HF=Housing First. ACT=assertive community treatment. TAU=treatment as usual. ICM=intensive case management. ER=ethnoracial. mITT=modified intention-to-treat. *Excludes participants who died or withdrew from the study during phase 1.

Procedures

The HF-ACT team offered multidisciplinary team-based care, available 24 h per day and 7 days per week, and provided services primarily in the community. Both HF-ICM and HF-ER-ICM offered case management support, for up to 12 h per day for 7 days a week, with a case load of 17 participants per case manager. Participants assigned to TAU had access to a variety of housing, health, and social services in the community, including primary, specialty and hospital care, case management, and supportive housing. We used validated instruments to record demographic characteristics, housing stability, physical and mental health, alcohol and substance use, community functioning, and quality of life. Housing stability was measured every 3 months during phase 1 and every 6 months during the phase 2 extension study. Disease-specific QOL and generic QOL were measured every 6 months in phase 1 and 2. Community functioning was assessed every 6 months in both phase 1 and 2. Substance use severity was assessed every 6 months during phase 1 and every 12 months during phase 2. Full details of the instruments and questionnaires used and their administration frequency are presented in the appendix (p 1).

Outcomes

The primary outcome measure was housing stability, defined as the number of accounted for days spent stably housed in yearly (360 days) intervals. Housing history was obtained using the Residential Time-Line Follow-Back (RTLFB) inventory survey, which asked participants about the type and duration of their previous and current residences.¹⁸ Stable housing was defined as an individual living in their own room, apartment, or with family and friends, with an expected duration of residence of 6 months or more or with tenancy rights.

Generic QOL was the secondary outcome of this study. Exploratory outcomes were disease-specific QOL, substance use severity, and community functioning. Disease-specific QOL was assessed using Lehman's 20-item QOL interview.¹⁹ To minimise handling of missing data, only global item 20 representing the global indicator of quality of life ("How do you feel about your life overall as a whole?") was analysed using a seven-point scoring system from 1 (terrible) to 7 (delighted).^{20,21} Generic QOL was measured using the EuroQol-5 Dimensions (EQ-5D) vertical visual analogue scale (range 0–100).²² Higher visual analogue scale scores indicate better quality of life. Community functioning, defined as functional ability in the areas of health, adaptation, social skills, and behaviours, was assessed using the 17-item MCAS.²³ The total functional ability score was obtained by summing the scores for each of 17 items, with greater values denoting a lower level of disability. Substance use severity was assessed using the five-item Global Appraisal of Individual Needs–Short Screener (GAIN-SS).²⁴ GAIN-SS measured the number of

	At Home/Chez Soi Toronto study phase 1 participants (n=575)	At Home/Chez Soi participants who participated in phase 2 (n=414)	At Home/Chez Soi participants who did not participate in phase 2 (n=161)	p value (χ^2)*
Intervention group				
Treatment as usual	274 (48%)	175 (42%)	99 (61%)	0.000
Housing First with ACT or ICM	301 (52%)	239 (58%)	62 (39%)	..
Need level for mental health services				
Moderate	378 (66%)	273 (66%)	105 (65%)	0.87
High	197 (34%)	141 (34%)	56 (35%)	
Age (years)	40.3 (11.8)	40.4 (11.6)	40.2 (12.3)	0.84†
Gender				
Male	394 (69%)	280 (68%)	114 (71%)	0.42‡
Female	171 (30%)	128 (31%)	43 (27%)	..
Other (transgender or transexual)	10 (2%)	6 (1%)	4 (2%)	..
Country of birth				
Other	250/549 (46%)	177 (44%)	73 (50%)	0.21
Canada	299/549 (54%)	226 (56%)	73 (50%)	..
Marital status				
Single or never married	380/547 (69%)	278 (69%)	102 (70%)	0.54
Married or cohabitating	19/547 (3%)	12 (3%)	7 (5%)	..
Divorced or separated	148/547 (27%)	111 (28%)	37 (25%)	..
Self-identified ethnoracial status				
No	237 (41%)	179 (43%)	58 (36%)	0.12
Yes	338 (59%)	235 (57%)	103 (64%)	..
Education				
Less than high school	262 (48%)	189 (47%)	73 (50%)	0.80
Completed high school	104 (19%)	76 (19%)	28 (19%)	..
Some postsecondary school education	184 (33%)	138 (34%)	46 (31%)	..
Time spent homelessness during lifetime (years)				
<3	250/538 (46%)	174 (44%)	76 (54%)	0.039
≥3	288/538 (54%)	223 (56%)	65 (46%)	..
Community functioning (MCAS score)	54.3 (1.5)	54.5 (5.4)	54.0 (5.8)	0.41†

(Table 1 continues on next page)

substance use-related problems over the previous month. This score was used as an indicator of substance use-related problem severity, with higher values denoting higher severity.

See Online for appendix

Statistical analysis

The original At Home/Chez Soi study was powered to detect an effect size of 0.5 between Housing First and TAU groups for the primary outcome and community functioning at each site. Sample sizes of 100 participants per group (HF-ACT, high support needs TAU, HF-ICM, moderate support needs TAU) were considered adequate

	At Home/Chez Soi Toronto study phase 1 participants (n=575)	At Home/Chez Soi participants who participated in phase 2 (n=414)	At Home/Chez Soi participants who did not participate in phase 2 (n=161)	p value (χ^2)*
(Continued from previous page)				
Mental health disorders				
Major depressive episode				
No	369 (64%)	263 (64%)	106 (66%)	0.60
Yes	206 (36%)	151 (36%)	55 (34%)	..
Manic or hypomanic episode				
No	514 (89%)	371 (90%)	143 (89%)	0.23
Yes	61 (11%)	43 (10%)	18 (11%)	0.78
Post-traumatic stress disorder				
No	441 (77%)	319 (77%)	122 (76%)	0.75
Yes	134 (23%)	95 (23%)	39 (24%)	..
Panic disorder				
No	494 (86%)	351 (85%)	143 (89%)	0.21
Yes	81 (14%)	63 (15%)	18 (11%)	..
Mood disorder with psychotic features				
No	456 (79%)	235 (79%)	131 (81%)	0.45
Yes	119 (21%)	89 (21%)	30 (19%)	..
Psychotic disorder				
No	360 (63%)	268 (65%)	92 (57%)	0.09
Yes	215 (37%)	146 (35%)	69 (43%)	..
Substance use and dependence related problems				
No	307 (53%)	213 (51%)	94 (58%)	0.13
Yes	268 (47%)	201 (49%)	67 (42%)	..
Alcohol use and dependence related problems				
No	331 (58%)	232 (56%)	99 (61%)	0.24
Yes	244 (42%)	182 (44%)	39 (39%)	..

Data are n (%), mean (SD), or n/N (%). Some percentages do not equal 100 because of rounding. Participant numbers for individuals included in phase 1 do not add up to 575 for some variables due to missing values because of poor confidence in the participant response (assessed using the Interviewer Impression Instrument) or refusal to answer. ACT=assertive community treatment. ICM=intensive case management. MCAS=Multnomah Community Ability Scale. *Comparison of participants who participated in phase 2 and those who refused participation. †t test. ‡Fisher's exact test.

Table 1: Baseline characteristics of all At Home/Chez Soi Toronto study participants

to detect an effect size of 0.5 for the main outcome variables at 24 months, with 80% power and a significance level of 0.05, assuming an attrition rate of 40%.¹⁰

For the extension study (phase 2), we compared the Housing First and TAU groups for the additional 4 years of follow-up with respect to two key outcomes: housing stability and community functioning (MCAS). For housing stability, on the basis of the preliminary findings from the Toronto site study, we assumed that the observed difference of 42% in the percentage of days stably housed between Housing First and TAU participants at 12 months might remain constant throughout the additional follow-up period, or that it could decline to 20%. For MCAS, we assumed a moderate effect size of 0.5 for all years with a mean difference of 4.5 points between the groups. We also assumed attrition rates of 18%, 20%, and 25% per year for each subsequent year of follow-up. The power to detect differences

between groups, at 0.05 significance level, assuming two-sided tests, varied between 87% and 100% for housing stability, and 96% and 100% for MCAS.

The primary outcome was analysed in the modified intention-to-treat population, which included all randomly assigned participants who had at least one assessment for the primary outcome. Secondary and exploratory outcomes were also analysed in the modified intention-to-treat population, which included all randomly assigned participants who had at least one assessment for the specific outcome being analysed (secondary or exploratory outcomes). The RTLFB was processed to record each participant's housing history in consecutive 90-day intervals starting from 90 days before random assignment. The number of accounted-for days (ie, person-days) in each interval was calculated from the number of days with a reported residence. Starting from baseline, each group of four consecutive 90-day intervals was combined to estimate the number of accounted-for days spent in stable housing in yearly intervals over 6 years.

Since the housing stability endpoint was a count outcome, measured in days stably housed during each yearly interval, it was analysed using a generalised estimating equation model with negative binomial distribution and a log link to account for overdispersion. An autoregressive correlation structure accounted for each participant's repeatedly measured housing history over time. The model included treatment group (Housing First vs TAU), yearly intervals (1–2, 2–3, 3–4, 4–5, 5–6 years vs 0–1 years), the interaction between treatment group and time, need level (moderate vs high), and the interaction between treatment group and need level. To account for each participant's duration of follow-up during the yearly interval and estimate rates per year, we also included an offset equal to the natural log of follow-up years (days divided by 360) during the interval. Interactions between level of need and time, and three-way interaction between level of need, treatment group, and time were assessed, but were not associated with the outcome. To estimate differences in housing stability by need level, we calculated the ratio of rate ratios by dividing the RR of high support needs and moderate support needs participants for each year. The primary analysis was done using SAS software (version 9.4) and included data for up to a maximum of 6 years of follow-up.

For the secondary and exploratory outcomes, predicted trajectories up to 6 years following randomisation were calculated using the estimated regression equations evaluated for each treatment group (coded 0 if TAU and 1 if Housing First), need level (coded 0 if high support needs or 1 if moderate support needs), and ethnoracial status (coded 0 if No or 1 if Yes). Longitudinal graphs of outcomes by years since baseline (appendix pp 2–5) suggested quadratic trajectories and potential interactions of treatment group by time. For EQ-5D and QOL-Global scores, we fitted linear mixed models that specified

random effects for intercepts, slopes, and quadratic terms for time. For the MCAS score, we fitted a linear mixed model with random intercepts and slopes, since a model with quadratic effect did not converge. The models included fixed effects of treatment group (Housing First vs TAU), continuous time and time squared since baseline (in years), the interaction between group by time and group by time squared, need level (moderate support needs vs high support needs), and ethnorracial status (yes vs no). For the GAIN-SS, we used a Poisson mixed-effects model with the same fixed effects as the linear mixed models but only random intercepts, since the model did not converge when including random effects for time. The interaction between treatment group (Housing First, TAU) and need level (high, moderate) was tested in all models but was not included in the final models as it was not associated with any of the outcomes.

Participants who did not agree to continue with the phase 2 study were included in the analysis up to their last interview in phase 1 or time of death. We compared demographic and clinical baseline characteristics of phase 2 participants and participants who refused participation in phase 2 using the χ^2 test or Fisher's exact test for categorical variables and the two-sample *t* test for continuous variables as appropriate. During the 6 year follow-up period, data for secondary and exploratory outcomes were missing due to participants' withdrawal, missing item-responses, refusal to answer or participate in further interviews, loss to follow-up, death, or poor confidence in the validity of participant responses (rated by the interviewer using the Interviewer Impressions instrument). Because participants had different numbers of interviews and variably spaced measurement occasions, multilevel multiple imputation by fully conditional specification was done for EQ-5D, QOL-Global, MCAS, and GAIN-SS, up to the time of the last interview or time of death. We created 20 multiply imputed datasets, following guidelines that suggest that the number of imputations should be at least 20 or equal to $100 \times$ the proportion of missing data in the sample. For EQ-5D, QOL-Global, and MCAS, we imputed missing data using mice, miceadds, and micemd packages in RStudio. For the GAIN-SS, we used BLIMP software. Results based on imputed datasets were pooled using PROC MIANALYZE (SAS version 9.4). For the secondary and exploratory outcomes, data included up to 7 years of follow-up. The statistical programs and analysis approaches used are cited in the appendix (p 6). This study was registered ISRCTN, ISRCTN42520374.

Role of the funding source

The funders had no role in study design, data collection, data analysis, data interpretation, or writing of the report. All authors had full access to all the data in the study, and gave final approval to submit for publication.

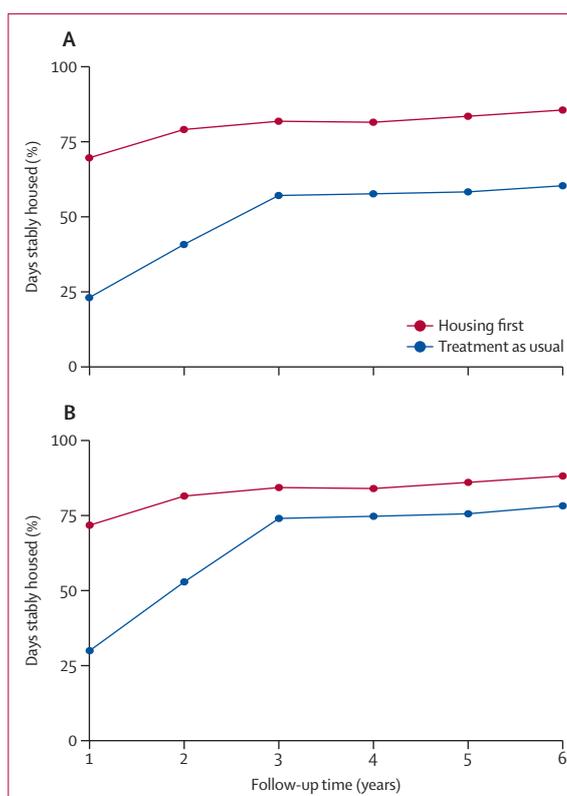


Figure 2: Percentage of days stably housed per year by treatment group and level of need for mental health services for At Home/Chez Soi participants at the Toronto site (n=548)

(A) High need participants. (B) Moderate need participants. A negative binomial generalised estimating equation model with log link was used to estimate rate of days stably housed per person-years. Each person-year was based on 360 days. Percentage of days stably housed was calculated by dividing the rate by 360 and multiplying by 100.

Results

Between Oct 1, 2009, and June 30, 2011, 575 individuals were enrolled in the At Home/Chez Soi study at the Toronto site (phase 1), of whom 197 (34%) had high support needs and 378 (66%) had moderate support needs (figure 1). Of the 378 participants with moderate support needs, 204 were randomly assigned to receive the HF intervention with ICM or ER-ICM (HF-ICM or HF-ER-ICM groups) and 174 were randomly assigned to TAU. Of the 197 participants with high support needs, 97 were randomly assigned to receive the HF intervention with ACT (HF-ACT treatment group) and 100 were randomly assigned to TAU group (figure 1).

Of the 575 participants enrolled in phase 1, 464 (81%) completed the 24 month interview and 414 (72%) consented to participate in the extended follow-up study (phase 2) done between Jan 1, 2014, and March 31, 2017. Of the 414 adults enrolled in the extension study, 141 (34%) had high support needs (79 participants in the HF-ACT group, 62 participants in the TAU group) and 273 (66%) had moderate support needs (160 participants in the HF-ICM or HF-ER-ICM treatment group, 113 participants

	Housing First		Treatment as usual		RR (95% CI)
	Rate (95% CI)	Percentage*	Rate (95% CI)	Percentage*	
Year 1	250.56 (234.18–268.08)	69.60%	83.10 (67.62–102.13)	23.08%	3.02 (2.43–3.75)
Year 2	284.51 (265.18–305.25)	79.03%	146.78 (122.96–175.23)	40.77%	1.94 (1.60–2.35)
Year 3	294.41 (274.69–315.54)	81.78%	205.50 (173.62–243.25)	57.08%	1.43 (1.19–1.72)
Year 4	293.24 (273.04–314.93)	81.46%	207.49 (176.13–244.44)	57.64%	1.41 (1.18–1.69)
Year 5	300.39 (281.13–320.97)	83.44%	209.82 (177.75–247.68)	58.28%	1.43 (1.20–1.71)
Year 6	307.85 (287.98–329.09)	85.51%	217.17 (184.39–255.77)	60.33%	1.42 (1.19–1.69)

RR=rate ratio. *Calculated by dividing the rate by 360.

Table 2: Estimated rate, percentage, and RR of days stably housed by treatment group and year for At Home/Chez Soi participants with high support needs for mental health services at the Toronto site (n=187)

	Housing First		Treatment as usual		RR (95% CI)
	Rate (95% CI)	Percentage*	Rate (95% CI)	Percentage*	
Year 1	258.32 (244.91–272.47)	71.76%	107.75 (92.09–126.07)	29.93%	2.40 (2.03–2.83)
Year 2	293.33 (278.87–308.54)	81.48%	190.32 (168.61–214.82)	52.87%	1.54 (1.35–1.76)
Year 3	303.53 (287.86–320.04)	84.31%	266.46 (240.47–295.26)	74.02%	1.14 (1.01–1.28)
Year 4	302.32 (287.21–318.23)	83.98%	269.04 (244.83–295.64)	74.73%	1.12 (1.01–1.25)
Year 5	309.70 (294.99–325.15)	86.03%	272.06 (248.04–298.41)	75.57%	1.14 (1.03–1.26)
Year 6	317.39 (301.51–334.11)	88.16%	281.58 (255.48–310.34)	78.22%	1.13 (1.01–1.26)

RR=rate ratio. *Calculated by dividing the rate by 360.

Table 3: Estimated rate, percentage, and RR of days stably housed by treatment group and year for At Home/Chez Soi participants with moderate support needs for mental health services at the Toronto site (n=361)

in the TAU group; figure 1). 364 (88%) of 414 phase 2 participants (126 participants with high support needs and 238 participants with moderate support needs) attended the final phase 2 follow-up interview (figure 1), accounting for 63% of the initial Toronto sample. The median duration of follow-up for all At Home/Chez Soi Toronto site participants was 5.38 years (IQR 2.14–5.93). By the end of phase 2, 140 (46%) participants in the intervention groups received rent supplements, and 179 (60%) continued to require intensive mental health support services. Fidelity to the Pathways Housing First model remained high throughout the study period, as assessed by site assessment visits and by using the recently validated tool developed to measure fidelity of Pathways Housing First programmes.^{25,26}

187 high support needs participants (93 participants in the HF-ACT group, 94 participants in the TAU

group), and 361 moderate support needs participants (201 participants in the HF-ICM or HF-ER-ICM group, 160 participants in the TAU group) were included in the intention-to-treat analysis for the primary outcome. 195 high support needs participants (96 participants in the HF-ACT group, 99 participants in the TAU group), and 375 moderate support needs participants (202 participants in the HF-ICM or HF-ER-ICM group, 173 participants in the TAU group) were included in the analysis of secondary and exploratory outcomes.

Key clinical and demographic characteristics of study participants at baseline are presented in table 1. Of the 575 participants included in the original At Home/Chez Soi Toronto site sample, 197 (34%) had high support needs for mental health services, 394 (69%) were men, and the mean age was 40.3 years (SD 11.8) at the time of study enrolment (table 1). More than half of the participants were born in Canada (299 [54%] of 549 participants), were single or never married (380 [69%] of 547 participants), self-identified as ethnoracial (338 [59%]), and had been homeless for 3 or more years during their lifetime (250 [46%] of 538 participants). Alcohol and substance misuse, psychotic disorders, and depressive disorders were the most prevalent mental illnesses (table 1).

No differences were identified between individuals who participated in phase 2 (extension study) and those who did not with regard to level of need for mental services or sociodemographic or clinical characteristics (table 1). A higher proportion of participants in the Housing First intervention group participated in phase 2 than did participants in the TAU group. Additionally, participants who had been homeless for 3 or more years during their lifetime were more likely to participate in the extension study than those with less than 3 years of homelessness.

Days spent stably housed was significantly higher among participants in the HF-ACT and HF-ER-ICM or HF-ER-ICM groups than participants in the TAU groups at all timepoints (figure 2, tables 2, 3). In year 6, the rate ratio (RR) of days stably housed for high support needs participants was 1.42 (95% CI 1.19–1.69), with 85.51% of days spent stably housed for the Housing First group compared with 60.33% for the TAU group. For moderate support needs participants, the RR of days stably housed in year 6 was 1.13 (95% CI 1.01–1.26) with 88.16% of days spent stably housed in the Housing First group compared with 78.22% for the TAU group. Although participants in the Housing First group with high support needs tended to have a lower overall rate of days stably housed than those with moderate support needs, these differences were not statistically significant (RR 0.97, 95% CI 0.90–1.04). Conversely, a statistically significant overall difference in the rate of days stably housed was identified between need level in the TAU groups; the rate of days spent stably housed was 23% lower among TAU participants with high support needs than participants with moderate support needs (RR 0.77, 0.64–0.93).

	EQ-5D		QOL-Global		MCAS		GAIN-SS	
	Estimate (SE)	p value	Estimate (SE)	p value	Estimate (SE)	p value	Estimate (SE)	p value
Fixed effects								
Intercept	63.33 (2.08)	<0.0001	3.88 (0.14)	<0.0001	58.36 (0.56)	<0.0001	0.17 (0.14)	0.24
Group (Housing First vs TAU)	0.50 (1.95)	0.80	0.144 (0.14)	0.32	0.45 (0.52)	0.38	0.003 (0.133)	0.98
Years*	2.45 (1.01)	0.016	0.49 (0.07)	<0.0001	0.94 (0.30)	0.002	-0.12 (0.04)	0.005
Years ²	-0.35 (0.16)	0.026	-0.06 (0.01)	<0.0001	-0.17 (0.05)	0.001	0.014 (0.007)	0.045
Group by Years	-0.11 (1.32)	0.94	0.01 (0.10)	0.94	0.49 (0.41)	0.23	-0.08 (0.06)	0.15
Group by Years ²	-0.06 (0.21)	0.77	-0.01 (0.02)	0.63	-0.08 (0.07)	0.26	0.01 (0.01)	0.16
Need level (moderate vs high)	-4.08 (1.53)	0.008	-0.45 (0.11)	<0.0001	6.23 (0.51)	<0.0001	-0.03 (0.13)	0.80
Ethnoracial status (yes vs no)	4.30 (1.42)	0.002	0.11 (0.11)	0.31	1.25 (0.43)	0.004	-0.71 (0.12)	<0.0001
Variance components								
Residual	263.15 (14.31)	<0.0001	1.46 (0.05)	<0.0001	35.34 (1.49)	<0.0001	..	..
Intercept	259.29 (34.83)	<0.0001	1.80 (0.18)	<0.0001	12.78 (1.93)	<0.0001	1.72 (0.16)	<0.0001
Years	52.67 (14.02)	0.0002	0.34 (0.08)	<0.0001	0.80 (0.13)	<0.0001	..	..
Covariance (intercept, years)	-48.23 (16.52)	0.004	-0.36 (0.10)	0.0002	0.96 (0.36)	0.007	..	..
Years ²	0.97 (0.38)	0.012	0.007 (0.002)	0.001	..	..	..	..
Covariance (intercept, years ²)	5.87 (2.55)	0.022	0.04 (0.01)	0.009	..	..	..	..
Covariance (years, years ²)	-6.84 (2.28)	0.003	-0.05 (0.01)	0.0002	..	..	..	..

Generic QOL was measured using the EQ-5D vertical visual analogue scale,²⁷ disease-specific QOL was assessed using global item 20 of Lehman's 20-item QOL interview,¹⁹ community functioning was assessed using the 17-item MCAS scale,²³ and substance use severity was assessed using the GAIN-SS.²⁴ EQ-5D= EuroQol-5 Dimensions. QOL-Global=Quality of Life Global score. MCAS=Multnomah Community Ability Scale. GAIN-SS=Global Appraisal of Individual Needs-Short Screener. TAU=treatment as usual. *Years since baseline.

Table 4: Post-multiple imputation linear mixed effects models for generic QOL, disease-specific QOL, community functioning, and Poisson mixed-effects model for substance use severity in the past month

The differences in housing stability between the Housing First and TAU groups seemed to decrease over time; the RR for participants with moderate support needs decreased from 2.40 (95% CI 2.03–2.83) in year 1 to 1.13 (1.01–1.26) in year 6 (table 3) and from 3.02 (2.43–3.75) to 1.42 (1.19–1.69) during the same period in participants with high support needs (table 2). A statistically significant overall difference in housing stability was identified between participants with different levels of need in the Housing First group; the RR for participants with high support needs was approximately 26% higher than that for participants with moderate support needs (ratio of RRs 1.26, 95% CI 1.03–1.53).

Post-multiple imputation regression models for secondary and exploratory outcomes are shown in table 4. Peaks were observed between 3 and 4 years since baseline assessment (appendix pp 2–5). Overall, no differences were identified between the Housing First intervention groups and the TAU groups for secondary and exploratory outcomes during the 6 year follow-up period: the interactions of group by years and group by years² were not statistically significant (table 4).

Discussion

This is the first pragmatic randomised controlled study to assess the long-term effects of the Housing First intervention on housing stability and other health outcomes (quality of life, community functioning, and

substance use severity) among homeless adults with mental illness over a period of 6 years.

Earlier findings^{12,13,27} of the Toronto At Home/Chez Soi study were consistent with those of the multicentre At Home/Chez Soi trial,^{14,15} indicating that at 24 months, both participants with high support needs and moderate support needs assigned to receive Housing First achieved higher housing stability than did participants in the TAU group. Among participants with moderate support needs, some additional improvements in community functioning and days with alcohol-related problems were also observed in the intervention group when compared with the TAU group.^{12,27}

In the present study, we found that participants who received the Housing First intervention spent more time stably housed than participants who received TAU during the 6 year study period, although differences between the groups decreased over time. Similar findings have been reported in a Housing First study with 4 years of follow-up²⁸ done in the USA. We also found that differences in housing stability between the Housing First and TAU groups were more marked for participants with high support needs than participants with moderate support needs. This difference might be partly due to variation in the housing trajectories of TAU participants. Participants with high support needs in the TAU group maintained persistent low levels of housing stability during the study period, exposing persisting access barriers to appropriate services for this population.

These findings highlight the unmet needs of homeless adults with mental illness and high support needs, even within a resource rich service delivery context, and the limited effectiveness of usual services in supporting housing stability for this population. The core principles of the Housing First intervention (immediate housing access without preconditions and access to specialised intensive mental health support services for as long as needed), can be an important goal across different countries in which high rates of homelessness among adults with mental illness persist.

We found no significant differences in quality of life, community functioning, and substance use severity outcomes between participants in the Housing First and TAU groups during the 6 year follow-up period. This finding might be partly explained by the persistence of poor health status, poverty, and systemic barriers⁹ faced by this population, including restricted availability and accessibility of high quality health services. TAU participants might also have accessed supportive housing and mental health services during the follow-up period, considering the resource rich service delivery context and universal health insurance available in Toronto. A systematic review of Housing First similarly identified variable short-term impacts of Housing First on health and quality of life outcomes, presumably associated with the heterogeneity of the populations recruited in previous studies, and differences in the service delivery contexts in these study settings.⁷ More targeted health-focused interventions and recovery-oriented supports^{29,30} might be an important adjunct to Housing First services, and lead to improved health and social outcomes in this population.

The study has many strengths, including successful long-term follow-up of homeless participants in a pragmatic field trial, and good fidelity to the Housing First model during the study period.²⁶ Additionally, the primary outcome measure, RTLFB, has good test-retest reliability and concurrent validity in this population.²⁷ The study has some limitations. First, some participants were lost to follow-up or had missing data, which might have affected the observed findings. However, we used advanced statistical techniques (multilevel multiple imputation) to address missing data, and to reduce analysis bias and improve estimates. Second, although we used well-structured and validated instruments to collect and assess different outcome domains, other outcomes important to this population, such as disease-specific symptoms, might not have been captured by these measures. Third, our findings might not be generalisable to other homeless populations or other countries, although they remain consistent with previous research on the short-term and long-term outcomes of Housing First in major urban settings in Canada and the USA.

The aim of this extension study was to address existing knowledge gaps and assess the long-term effects of Housing First on select housing and health outcomes in

a large, well-resourced urban centre with a system of universal health insurance. Considering the persisting high prevalence of homelessness across industrialised countries, and the individual, societal, and financial costs associated with homelessness, evaluating the long-term impact of Housing First can inform policy and planning in many jurisdictions.

Our findings highlight the importance of pairing housing and evidence-based mental health services to support housing stability for this population, especially for those with high support needs for mental health services. Considering the absence of improvements in quality of life, community functioning, and substance use severity in the intervention group compared with usual care, interventions focused on these domains specifically, as adjuncts to Housing First, might be important targets for further research. Examination of additional mental health and substance use outcomes is also warranted. Finally, the intensity of supportive services required to achieve housing stability needs further investigation.

In Canada and other countries, lack of adequate investment in affordable housing and high-quality mental health support services has led to increasing income inequalities and poverty, which negatively affects the most socioeconomically marginalised or unsupported citizens in society. Investing in strategies, programmes, and services that enhance access to high quality, inclusive health care, income, housing, and social services is a priority in all geographical areas with similar challenges.

Contributors

VS, PO, and SWH are the principal investigators of the At Home/ Chez Soi (Toronto site). RN and RW did statistical analysis. CM-L and VS interpreted the data and wrote the first draft of the present manuscript. PO, SWH, RN, RW, and JL assisted in the interpretation of the results and critically revised the first draft of the manuscript. All authors revised and approved the final version of the manuscript.

Declaration of interests

We declare no competing interests.

Data sharing

Anonymised participant data, the study protocol, informed consent forms, survey forms, and statistical analysis plan from the At Home/ Chez Soi Toronto site study will be available to investigators for studies that have received approval from independent research committees or research ethics boards. Data are available from the publication date of this article onwards. Study proposals and data access requests should be sent to Dr Stephen Hwang at HWANGS@smh.ca. All study proposals and data requests will be further reviewed by the At Home/ Chez Soi team at the Toronto site. Data sharing agreements between the requestors and At Home/ Chez Soi principal investigators need to be completed before accessing the data.

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