



Effectiveness of Housing First for Homeless Adults with Mental Illness Who Frequently Use Emergency Departments in a Multisite Randomized Controlled Trial

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Abstract

Frequent emergency department (ED) users experiencing homelessness are associated with high costs for healthcare systems yet interventions for this group have been minimally investigated. This study used 24-month data from a multisite randomized controlled trial of Housing First (HF) to examine how effective the intervention is in helping frequent ED users with a mental illness to achieve housing stability, improve behavioural health and functioning, and reduce their ED use. Findings showed that HF is effective in stably housing frequent ED users despite their complex health needs. Reductions in ED use and substance use problems, and improvements in mental health symptoms and community functioning were found for frequent ED users in both the HF and treatment as usual conditions.

Keywords Homelessness · Mental illness · Emergency departments · Service use · Housing first

Introduction

Rates of mental illness, problematic substance use, and chronic medical conditions are high in homeless populations (Beijer et al. 2012; Fazel et al. 2014). Despite their acute and prevalent health problems, people experiencing homelessness frequently encounter barriers to accessing treatment and managing their conditions (Hwang et al. 2011; Krausz et al. 2013). The consequences of health service inaccessibility are not limited to homeless people who need care

but also manifest in healthcare systems through inefficiencies and higher costs. Greater use of emergency departments (EDs) by people experiencing homelessness compared to the general population is among the most common, systemic burdens associated with this issue (Hwang et al. 2013; Ku et al. 2010; Mitchell et al. 2017; Salhi et al. 2018). People experiencing homelessness also have higher rates of returns to EDs within 72 h and ED visits within seven days of hospital discharges (Ku et al. 2010). These service use patterns suggest that received treatment and care does not meet their healthcare needs, possibly contributing to the “revolving door syndrome.”

As in the general population, a small proportion of people experiencing homelessness accounts for the majority of ED use. In a Canadian 4-year prospective cohort study of homeless adults, the top decile of ED users had 60.3% of the total ED visits in the sample (Chambers et al. 2013). Similar patterns have been observed in U.S. studies, with 7.9% of homeless and marginally housed people accounting for 55% of all ED visits in a sample from San Francisco (Kushel et al. 2002) and 21% of people experiencing homelessness having 73% of ED visits in a Boston sample (Lin et al. 2015). Poorer health status is most consistently associated with frequent ED use, though unmet mental healthcare needs, psychiatric hospitalization histories, substance use problems, hepatitis C virus, and recent arrests have also been linked to frequent

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ED visits among the homeless population (Chambers et al. 2013; Kushel et al. 2002; Lin et al. 2015; Thakarakar et al. 2015). Overall, frequent ED users who are homeless represent a highly marginalized population with complex health needs, which may not be adequately addressed by ambulatory healthcare services despite repeated use.

Given the health risks and systemic burden associated with homelessness, the provision of permanent housing with support can be considered a health intervention (Doran et al. 2013; Henwood et al. 2013; Kuehn 2019). Housing First (HF) is one model that has been the focus of considerable research in recent years. HF involves the provision of rent supplements to access scattered-site housing in the community with delinked, recovery-oriented supports (Aubry et al. 2015). Because housing and supports are separate, tenants are able to retain their clinical services in the event of a move or housing loss. Consumer choice and harm reduction are also foundational values of HF, giving people the opportunity to receive the intervention without requiring sobriety or psychiatric treatment compliance (Padgett et al. 2016). Once housed, tenants can access as much or as little support as they choose.

HF is effective in stably housing a large majority of homeless people with mental illness (Baxter et al. 2019; Padgett et al. 2016; Richter and Hoffmann 2017; Woodhall-Melnik and Dunn 2016). As for behavioural health outcomes, there is some evidence that HF yields greater improvements in quality of life, mental health symptom severity, and social functioning when compared to standard care. However, other studies have shown that improvements in mental health and substance use problems following receipt of HF are comparable to standard care conditions (Baxter et al. 2019; McPherson et al. 2018; Richter and Hoffmann 2017; Woodhall-Melnik and Dunn 2016).

The service use patterns of homeless people with mental illness change as they become stably housed in HF (Kerman et al. 2018). Though the evidence is unequivocal that HF is associated with reduced use of emergency shelters (Ly and Latimer 2015), the effects of the intervention on acute health service use are less clear. Several studies have shown that receipt of HF yields reductions in ambulance use (Mackelprang et al. 2014) and hospitalization rates (Baxter et al. 2019; Brown et al. 2016; Culhane et al. 2002; Gulcur et al. 2003; Martinez and Burt 2006; Sadowski et al. 2009). In contrast, Larimer et al. (2009) did not find that HF led to significant reductions in use of ambulances or other acute health services for people with alcohol use disorders. Similarly, in a pre-post study by Henwood et al. (2015), HF was not associated with reductions in psychiatric hospitalizations for people with severe alcohol use disorders.

As for use of EDs, studies using primarily administrative healthcare data have found that HF is associated with service use reductions (Basu et al. 2012; Martinez and Burt

2006; Russolillo et al. 2014; Sadowski et al. 2009; Srebnik et al. 2013). Henwood et al. (2015) also found a reduction in psychiatric ED visits in the 12 months before and after access to housing among people without alcohol use disorders, whereas no significant change was observed for those with alcohol dependence. In contrast, a large trial of HF in Canada did not find that the intervention yielded reductions in ED use based on self-report data (Aubry et al. 2016; Stergiopoulos et al. 2015).

Despite the high costs associated with frequent ED use among the homeless population, interventions to help frequent ED users to exit homelessness have been minimally examined. To our knowledge, only one nonrandomized pilot study has been conducted, which examined a case management intervention for 20 frequent ED users who were homeless (McCormack et al. 2013). Results were promising as the intervention was associated with increased housing placement and decreased ED use. Similarly, in non-homeless samples, case management has been shown to have positive impacts on housing stability of frequent ED users (Althaus et al. 2011). No study has examined the effectiveness of a housing intervention for frequent ED users who are homeless. By providing permanent housing and support, HF may be an effective intervention for addressing this homeless subpopulation's complex health needs and reducing burden on healthcare systems. Accordingly, we conducted a subgroup analysis using 24-month data from a multisite randomized controlled trial (RCT) of HF to examine the research question: How effective is HF in improving housing stability, improving behavioural health and functioning, and reducing use of hospital services for homeless frequent ED users with mental illness?

Method

The At Home/Chez Soi demonstration project was a RCT conducted in five Canadian cities (Moncton, Montreal, Toronto, Vancouver, and Winnipeg) that examined the effectiveness of HF compared to treatment as usual (TAU) for homeless people with mental illness. Data were collected from 2009 to 2013. The trial was approved by the research ethics board of the Centre for Addiction and Mental Health and 11 local institutions affiliated with the lead investigators at each of the five sites. Additional information about the trial and protocol is available online (Goring et al. 2011; ISRCTN42520374).

Sample

Participants were recruited from community agencies serving people experiencing homelessness (e.g., emergency shelters, hospitals, community mental health programs), as

well as directly from the street. At the time of recruitment, all participants were over the age of 18 years (19 years or older in Vancouver), were either: [a] absolutely homeless or [b] precariously housed (i.e., living in a rooming house, single room occupancy, or hotel/motel) with two or more episodes of homelessness in the past year, and met diagnostic criteria for a mental disorder (as determined by the Mini-International Neuropsychiatric Interview [MINI] or written documentation of a recent diagnosis). Of the 2255 participants who were eligible for the trial, 2111 were included in our analysis (Fig. 1 shows the flow diagram for the trial and our analysis).

Interventions

Housing First

The HF intervention consisted of the provision of scattered-site apartments with accompanying rent subsidies in combination with either Assertive Community Treatment (ACT) or Intensive Case Management (ICM) support. ACT teams were interdisciplinary (staffing included psychiatry, nursing, social work, peer support, and other clinicians), had caseload ratios of 1:10 or less, and provided 24/7 support to participants. As for ICM, caseload ratios did not exceed 1:20 and services were available 12 h per day, seven days per week.

Participants who had high needs received support via ACT, whereas those with moderate needs were provided with ICM. The Moncton site was an exception, as only ACT was available. Participants were considered to have high needs if they had a score within the medium or severe disability range (≤ 62) on the Multnomah Community Ability Scale (MCAS; Barker et al. 1994); a MINI diagnosis of a bipolar or psychotic disorder, or observation of a psychotic disorder on the eligibility screening questionnaire; and one of: [1] a comorbid substance use disorder, [2] two or more hospitalizations within a single year during the past 5 years, or [3] involvement with the criminal justice system within the previous 6 months.

Treatment as Usual

Participants randomized to the TAU condition had access to all of the existing housing and support options available in the community, with the exception of the services provided in the HF intervention. As such, it is possible that some TAU participants accessed services in the community that had similar components to the HF intervention (Goering et al. 2011). As this RCT was conducted in five different cities, the systems of care that were available to TAU participants differed by region. Moncton was the smallest of the five sites and had the fewest community mental health services available, including no ACT teams (Goering et al. 2014).

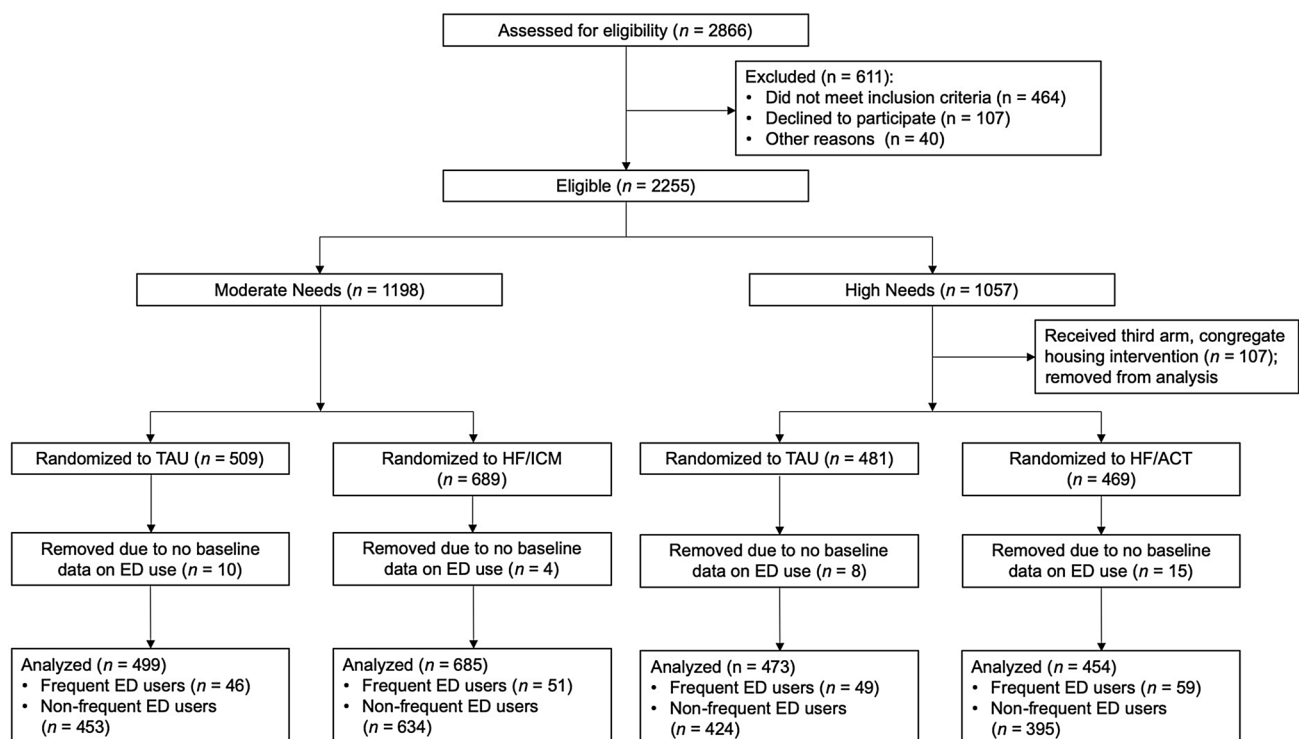


Fig. 1 Flow diagram for the trial and analysis of this study

Access to ACT and ICM was also limited in Montreal, Winnipeg, and Vancouver, though a range of emergency shelter, housing, and mental health services was available in each of these cities. Toronto was the largest of the five sites and had the greatest availability of mental health services, including ACT (Hwang et al. 2012). For additional details on the available services in each city, see Latimer et al. (2017).

Measures

Housing Stability

The Residential Timeline Follow-back (RTFLB; Tsemberis et al. 2007) was administered every 3 months to assess the number of days that participants spent in stable housing in each prior 3-month period. Types of stable housing included apartments or houses belonging to participants or family members with intended stays of 6 months or more, boarding or group homes, transitional housing programs with intended stays of 6 months or more, or single room occupancy hotels.

Behavioural Health and Functioning

A modified version of the Colorado Symptom Inventory (Shern et al. 1994) was used to measure severity and frequency of mental health symptoms in the past month. Problematic substance use in the past month was measured using the Global Appraisal of Individual Needs–Substance Problem Scale (Dennis et al. 2006). The MCAS (Barker et al. 1994) was used to measure community functioning across the domains of health, adaptation, social skills, and behaviour. Only total scores were examined in this analysis. All three measures were administered every 6 months.

Service Use

ED visits in the past 6 months were assessed using the Health, Social, and Justice Service Use Inventory (HSJSU; Mental Health Commission of Canada [MHCC], 2010). The self-report HSJSU was administered every 6 months. The tool was developed for the At Home/Chez Soi trial based on a composite of other service use instruments because no suitable measures had been identified in the literature for people experiencing homelessness (Goering et al. 2011). The HSJSU underwent pretesting to ensure its recall items did not pose issues for the study population (Adair et al. 2012). Although the scale's psychometric properties have not been extensively examined, the self-report data from the HSJSU have been found to have moderate to high levels of agreement with administrative data sources (Lemieux et al. 2017; Somers et al. 2016). The RTFLB was also used to collect information on the number of nights spent in hospital

in the prior 3 months. Two types of hospitalizations were assessed: psychiatric and medical.

Frequency of Emergency Department Use

To investigate the effectiveness of HF for frequent ED users, it was necessary to identify the small number of participants who would account for the majority of the ED visits within the sample. Consistent with past approaches for determining frequent ED users (Chambers et al. 2013; Hwang et al. 2013), participants whose ED use in the past 6 months at baseline was in the top decile (≥ 5 visits) were classified as frequent ED users. All other participants were categorized as non-frequent ED users.

Data Analysis

Independent samples *t*-tests and chi-squared tests were used to examine baseline differences between frequent and non-frequent ED users. To explore the primary research question, linear mixed models (LMMs) with three factors of time (baseline to 24 months), intervention (HF or TAU), and ED use (frequent or non-frequent) were conducted using restricted maximum likelihood estimation. All interaction effects involving ED use were examined. Outcomes of intervention by time interaction effects are not presented, as these findings were the primary focus of the trial and are published elsewhere (Aubry et al. 2016; Stergiopoulos et al. 2015). Main effects were examined in the absence of significant interactions. Significant effects were explored further using pairwise comparisons with analytic software-adjusted Bonferroni corrections. Cohen's *d* was used to measure the effect sizes of the differences between groups and over time. Outcomes examined in the LMMs were percentage of nights in stable housing in the past 3 months, emergency department visits in the past 6 months, percentage of nights hospitalized for psychiatric reasons in the past 3 months, percentage of nights hospitalized for medical reasons in the past 3 months, frequency and severity of mental health symptoms in the past month, substance use problems in the past month, and community functioning. All analyses were performed using SPSS 25.

Results

Characteristics of the sample at baseline, comparing frequent and non-frequent ED users, are presented in Table 1. Altogether, participants had 4151 visits to EDs within the past 6 months at baseline ($M = 1.97$, $SD = 4.46$). Using the 90th percentile criterion, 205 participants were classified as frequent ED users whereas 1906 were non-frequent users. Of the total visits to EDs at baseline, frequent users had 2262

Table 1 Characteristics of sample at baseline ($N=2111$)

Characteristic	Frequent ED Users		Non-frequent ED Users		<i>p</i>
	M / n	SD / %	M / n	SD / %	
Gender, male	127	62.0	1289	67.6	
Age	39.15	10.12	41.17	11.30	**
Indigenous	54	26.3	399	20.9	
Single/never married	141	68.8	1348	70.7	
Lifetime length of homelessness (months)	55.88	61.10	58.39	71.03	
High level of support need	108	52.7	819	43.0	**
Behavioural health problem					
Major depressive episode	115	56.1	987	51.8	
Manic/hypomanic episode	42	20.5	227	11.9	***
Major mood disorder with psychotic features	47	23.0	300	15.7	**
Psychotic disorder	69	33.7	663	34.8	
Panic disorder	57	27.8	438	23.0	
Posttraumatic stress disorder	84	41.0	534	28.0	***
Alcohol abuse or dependency	117	57.1	823	43.2	***
Drug abuse or dependency	116	56.6	989	51.9	
Chronic medical conditions	5.64	3.77	4.63	3.40	***
2+ psychiatric hospitalization in past 5 years	122	60.1	645	34.6	***
Arrest/imprisonment/probation in past 6 months	85	41.7	658	34.8	*

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

(54.5%) of the visits. Frequent ED users were younger; were more likely to have current diagnoses of a manic/hypomanic episode, major mood disorder with psychotic features, post-traumatic stress disorder, and alcohol abuse or dependency; had more chronic medical conditions; and were more likely at baseline to have multiple psychiatric hospitalizations in the past 5 years and recent involvement with the criminal justice system than non-frequent ED users. Frequent ED users were also significantly more likely to be categorized as having high needs at baseline than non-frequent ED users. Among the outcomes examined in the LMMs, frequent ED users had significantly greater substance use problems, and more severe and frequent mental health symptoms at baseline than did non-frequent ED users. No baseline differences were found in days spent in stable housing, medical hospitals, and psychiatric hospitals in the past 3 months between the two groups of ED users.

Housing Stability

Frequent ED users in HF spent 66.4% (95% CI 63.5% to 69.2%) of their nights in stable housing post-randomization, whereas frequent ED users in the TAU condition were stably housed 34.7% (95% CI 31.5% to 37.8%) of the time. An interaction effect was found in the LMM predicting housing stability between intervention and ED use ($p < 0.001$; see Table 2 and Fig. 2). Within the HF condition, frequent ED users had significantly fewer days spent in stable housing

than did non-frequent ED users ($d = 0.17$; $p < 0.001$). Follow-up post hoc analyses showed that frequent ED users in the HF condition had lower housing stability rates from the 15-month time point onwards compared to non-frequent ED users in HF (all p 's ≤ 0.01). Housing stability of frequent and non-frequent ED users in the TAU condition did not significantly differ.

Service Use

Emergency Departments

The LMM estimated means of service use at baseline, 12 months, and 24 months are presented in Table 2. A three-way interaction effect was found for rates of ED use ($p < 0.01$; see Fig. 3). Two follow-up LMMs were then conducted separately for frequent and non-frequent ED users. For frequent ED users, there was a significant reduction in ED use from an average of 10.97 (95% CI 9.82 to 12.12) visits at baseline to 4.42 (95% CI 3.18 to 5.66) visits at 6 months ($d = 0.78$; $p < 0.001$), after which scores remained stable. No significant differences were found between frequent ED users who received HF compared to TAU. As for non-frequent ED users, an interaction effect between intervention and time was found ($p = 0.01$). Pairwise comparisons showed that there was an increase in ED use from baseline to 6 months among participants in the TAU condition

Table 2 Estimated housing stability, behavioural health and functioning, and service use outcome means at baseline and post-randomization

Outcome	Housing First						Treatment as Usual					
	Frequent ED users			Non-frequent ED users			Frequent ED users			Non-frequent ED users		
	M	95% CI		M	95% CI		M	95% CI		M	95% CI	
Housing stability ^{a,g}												
Baseline	8.64	1.06	16.22	9.202	6.72	11.68	9.54	0.92	18.15	8.36	5.60	11.13
12 Months	76.37	68.68	84.07	79.55	77.10	82.00	37.20	28.69	45.70	32.14	29.36	34.91
24 Months	62.97	54.76	71.18	76.79	74.20	79.39	43.10	34.07	52.12	43.76	40.73	46.79
Mental health symptoms ^{b,h}												
Baseline	43.41	41.21	45.61	38.68	37.97	39.40	43.87	41.51	46.22	39.66	38.88	40.44
12 Months	37.01	34.55	39.47	32.14	31.37	32.91	36.83	34.19	39.46	33.21	32.30	34.12
24 Months	35.65	33.17	38.14	31.61	30.83	32.39	32.82	30.10	35.55	31.30	30.39	32.21
Substance use problems ^{c,h}												
Baseline	2.37	2.03	2.70	1.62	1.50	1.73	2.10	1.73	2.46	1.78	1.66	1.90
12 Months	1.87	1.49	2.25	1.41	1.29	1.53	1.49	1.08	1.89	1.56	1.42	1.70
24 Months	1.73	1.35	2.11	1.27	1.15	1.39	1.42	1.01	1.84	1.37	1.23	1.51
Community functioning ^{d,h}												
Baseline	57.56	55.96	59.15	60.78	60.26	61.30	59.01	57.30	60.72	59.62	59.06	60.19
12 Months	63.20	61.40	65.00	64.75	64.19	65.31	62.29	60.38	64.19	62.54	61.88	63.20
24 Months	63.52	61.73	65.31	64.99	64.43	65.55	61.49	59.51	63.48	63.34	62.69	64.00
Emergency department visits ^{e,h}												
Baseline	11.89	11.24	12.54	0.96	0.74	1.17	10.04	9.34	10.74	1.03	0.80	1.26
12 Months	3.47	2.76	4.18	0.75	0.52	0.97	3.62	2.84	4.39	0.95	0.69	1.21
24 Months	2.56	1.83	3.29	0.73	0.50	0.96	2.66	1.86	3.46	0.75	0.49	1.02
Psychiatric hospitalizations ^{f,g}												
Baseline	5.58	3.04	8.12	4.33	3.50	5.16	5.74	2.86	8.63	4.06	3.13	4.98
12 Months	2.02	-0.56	4.60	1.59	0.77	2.41	3.63	0.79	6.48	2.17	1.24	3.10
24 Months	3.74	0.99	6.49	1.23	0.36	2.10	0.93	-2.09	3.95	2.09	1.08	3.11
Medical hospitalizations ^{f,g}												
Baseline	0.64	-0.47	1.76	0.84	0.48	1.21	1.36	0.10	2.62	0.66	0.26	1.07
12 Months	1.32	0.20	2.45	0.52	0.16	0.87	0.58	-0.67	1.83	0.74	0.33	1.14
24 Months	0.47	-0.74	1.67	0.71	0.33	1.09	0.34	-0.99	1.66	0.41	-0.04	0.85

^aPercentage of days spent in stable housing in the past 3 months

^bPossible scores range from 14 to 70, with higher scores indicating more severe and frequent mental health symptoms in the past month

^cPossible scores range from 0 to 5, with higher scores indicating more substance use problems in the past month

^dPossible scores range from 17 to 85, with higher scores indicating greater adaptive functioning

^eIn past 6 months

^fPercentage of days spent in hospital in the past 3 months

^gData from 3, 6, 9, 15, 18, and 21 months not shown

^hData from 6 and 18 months not shown

($d=0.10$; $p=0.05$); however, this was followed by a significant decrease at 12 months ($d=0.12$; $p=0.01$) that was sustained over the remainder of the study period. No changes in ED use were found among non-frequent ED users in the HF condition.

Hospitalizations

Two main effects were found for psychiatric hospitalizations. First, all groups had a decrease in days spent in hospital for psychiatric reasons from baseline to 24 months ($d=0.13$; $p<0.01$). Second, frequent ED users spent more days in hospital for psychiatric reasons than did non-frequent ED users ($d=0.08$; $p<0.01$). Medical

Fig. 2 Mean (95% CI) percentage of nights in stable housing at baseline and post-randomization. ** $p \leq .01$, *** $p \leq .001$ (post hoc comparisons between frequent and non-frequent ED users in the HF condition)

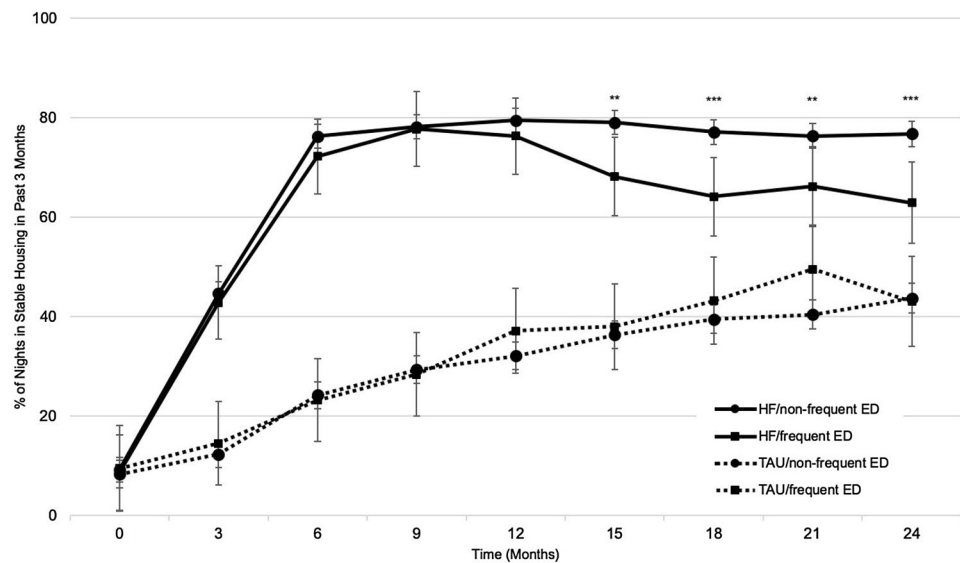
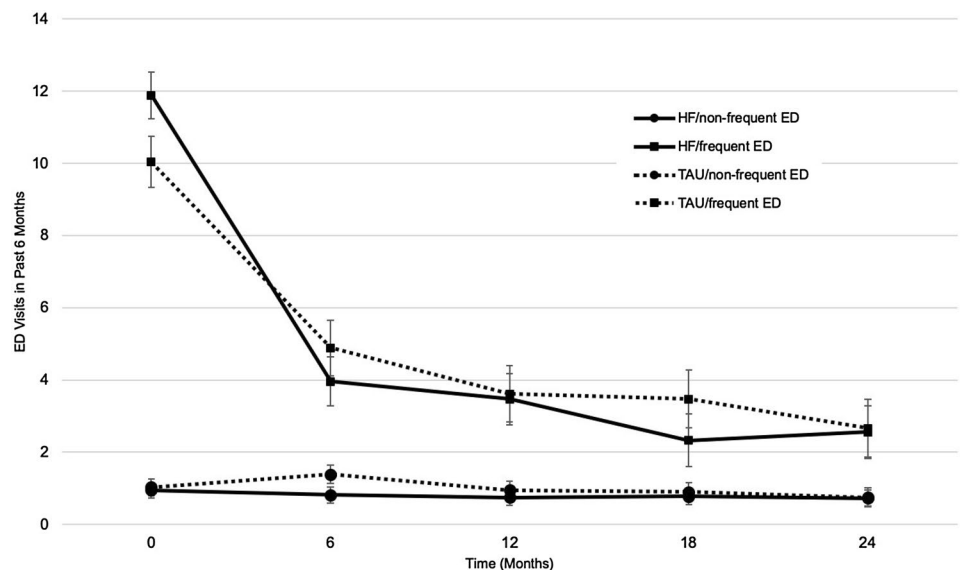


Fig. 3 Mean (95% CI) emergency department use at baseline and post-randomization



hospitalizations were also higher among frequent ED users than non-frequent ED users ($d=0.06$; $p=0.02$). No significant changes in medical hospitalizations were found over time.

Behavioural Health and Functioning

The LMMs predicting community functioning and substance use problems each had significant main effects of time ($p < 0.001$ in both models), and interaction effects between intervention and ED use ($p=0.02$ and $p < 0.001$, respectively; see Table 2). Community functioning ratings improved between baseline and 6 months ($d=0.23$; $p < 0.001$), after which scores remained stable. As for the interaction effect, among participants in the HF condition, frequent ED users had

lower community functioning than did non-frequent ED users over 24 months ($d=0.25$; $p < 0.001$). The findings were similar for substance use problems, with gradual improvements from baseline to 24 months ($d=0.17$; $p < 0.001$) and frequent ED users in the HF condition having more substance use problems than non-frequent ED users in HF ($d=0.32$; $p < 0.001$). No significant differences in community functioning and substance use problems were found between frequent and non-frequent ED users in the TAU condition. Finally, all groups had improvements in severity and frequency of mental health symptoms over 24 months ($d=0.43$; $p < 0.001$); however, frequent ED users reported more severe and frequent symptoms than did non-frequent ED users ($d=0.32$; $p < 0.001$).

Discussion

This study examined the effectiveness of HF for people experiencing homelessness and mental illness who frequently use EDs. The results indicate that HF is an effective intervention for stably housing this population. Housing stability rates of frequent ED users who received HF were higher than those of frequent ED users in the TAU condition. However, rates of housing stability were lower among frequent ED users in the HF condition than non-frequent ED users, with a small effect size. The findings suggest that the support needs of frequent ED users are not too complex to be housed in HF but, after 1 year, the effects of the intervention become attenuated, suggesting a latent cluster of tenants who have additional needs.

The baseline differences between groups may explain some of the support needs of frequent ED users that HF programs need to consider after tenants' 1st year in housing. Our analysis is consistent with past research (Chambers et al. 2013; Kushel et al. 2002) showing that frequent ED users at baseline were more likely to have a range of mental health problems, multiple psychiatric hospitalizations, and involvement with criminal justice systems than non-frequent ED users. Further, frequent ED users also had more medical comorbidities than non-frequent ED users. Although significant improvements were found in community functioning and problematic substance use for all groups over the 24-month period, frequent ED users in the HF condition had greater impairment in both domains than non-frequent ED users throughout the study period. Similarly, frequent ED users in HF and TAU had more severe and frequent mental health symptoms than non-frequent ED users over the 24-month period. Early identification of frequent ED users and their health needs may be beneficial for adapting HF support styles to best support this group. One consideration is the provision of integrated primary and behavioural health care within HF to address the high rate of chronic medical conditions among frequent ED users. As noted by Weinstein et al. (2011), the ACT model is well positioned to provide integrated care through the development of nursing and primary care partnerships. In addition to delivering care, HF can also serve as an ideal platform for connecting tenants with complex needs to much-needed health services (Henwood et al. 2013).

In terms of change over time, there was a substantial reduction in ED use during the first 6 months followed by gradual, nonsignificant decline over the subsequent 18 months for frequent ED users in both conditions. The observed changes in ED use are likely the result of regression to the mean—a pervasive phenomenon among treatment studies (Finney 2007). As ED use was measured over the past 6 months at baseline, frequent ED users may have

been experiencing episodic effects of a mental illness or other health problem, which led to repeated contact with EDs during that time. Further, their use of EDs may have led to healthcare service providers referring them to the RCT. Future studies of interventions for frequent ED users can reduce the effects of regression to the mean by retroactively measuring ED use over a period of 1 year or longer at baseline.

Adding to the mixed evidence on whether HF yields reductions in ED visits (e.g., Aubry et al. 2016; Basu et al. 2012; Henwood et al. 2015; Martinez and Burt 2006; Russolillo et al. 2014; Srebnik et al. 2013; Stergiopoulos et al. 2015), we did not find any differences in ED use changes among frequent ED users between the HF and TAU groups. Further, Russolillo et al. (2014) used a one-site subsample of the one in our analysis and found an increase in ED visits among participants in the TAU condition. This was not replicated in our analysis with a larger sample. Methodological and contextual variation between the studies may have contributed to the differing results. Russolillo et al. (2014), like several other studies, measured service use over a 12-month period pre- and post-intervention using administrative data, whereas our analysis, like Aubry et al. (2016) and Stergiopoulos et al. (2015), used multi-site, self-report data and examined ED use over a longer period post-intervention. Given that geographic and systemic factors affect ED use by people experiencing homelessness (Ku et al. 2010), future research on the effects of HF on ED use should consider the context in which the intervention is being implemented. As for medical and psychiatric hospitalizations, frequent ED users spent more nights in hospital over the 24-month period than did non-frequent ED users, though the effect sizes were very small. Nevertheless, these findings are further evidence that frequent ED users have more complex healthcare needs following exits from homelessness that should be anticipated and identified by HF programs.

There are several limitations to this study. First, like other subgroup analyses of the At Home/Chez Soi project (e.g., Chung et al. 2018), hypotheses were not tested, as the trial was not designed with the intention of examining the effectiveness of HF for frequent ED users who are homeless. Accordingly, our results should be considered hypothesis-generating as opposed to hypothesis-testing. Second, service use was self-reported by participants using a new measure developed for the trial. However, research using a subsample of the one in our analysis found substantial agreement between self-report and administrative data of ED visits (Somers et al. 2016), which provides confidence in the accuracy of the self-reported service use data. Third, analyses of participants receiving HF with ACT compared to ICM were not conducted. Although the around-the-clock support available via ACT may be beneficial to the frequent ED user group given their more complex needs and the availability of

immediate support in the context of a crisis, future research should examine whether the impacts of the support models differ to determine how to best support frequent ED users in HF. Fourth, the reasons for ED use were not measured. As there is no evidence that inappropriate use of EDs is greater among people experiencing homelessness than in the general population (Doran 2015), it is possible that, despite even frequent use, participants were visiting EDs for appropriate reasons but not benefitting. Moreover, given that our analysis highlighted the complex support needs of frequent ED users, it is unreasonable for interventions to aim to reduce ED use to zero. Because ED use among people experiencing homelessness may be the result of poor physical or mental health, injury, victimization, arrests, barriers accessing other healthcare services, or survival (Kushel et al. 2002; McCallum et al. 2019), frequent ED users who are homeless may be a heterogeneous group that requires further examination to determine their health and housing support needs. Nonetheless, there is value in connecting frequent ED users to HF programs in the future to reduce burden on healthcare systems, as well as identifying frequent ED users within HF programs and seeking ways to help address gaps in the provision of services and supports that might prevent or reduce frequent ED use.

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Compliance with Ethical Standards

Conflict of interest The authors do not have any conflicts of interest to declare.

Ethical Approval This research was approved by the research ethics board of the Centre for Addiction and Mental Health and 11 local institutions affiliated with the lead investigators of the trial.

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