Original Investigation

Effect of Scattered-Site Housing Using Rent Supplements and Intensive Case Management on Housing Stability Among Homeless Adults With Mental Illness
A Randomized Trial

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IMPORTANCE Scattered-site housing with Intensive Case Management (ICM) may be an appropriate and less-costly option for homeless adults with mental illness who do not require the treatment intensity of Assertive Community Treatment.

OBJECTIVE To examine the effect of scattered-site housing with ICM services on housing stability and generic quality of life among homeless adults with mental illness and moderate support needs for mental health services.

DESIGN, SETTING, AND PARTICIPANTS The At Home/Chez Soi project was an unblinded, randomized trial. From October 2009 to July 2011, participants (N = 1198) were recruited in 4 Canadian cities (Vancouver, Winnipeg, Toronto, and Montreal), randomized to the intervention group (n = 689) or usual care group (n = 509), and followed up for 24 months.

INTERVENTIONS The intervention consisted of scattered-site housing (using rent supplements) and off-site ICM services. The usual care group had access to existing housing and support services in their communities.

MAIN OUTCOMES AND MEASURES The primary outcome was the percentage of days stably housed during the 24-month period following randomization. The secondary outcome was generic quality of life, assessed by a EuroQoL 5 Dimensions (EQ-5D) health questionnaire.

RESULTS During the 24 months after randomization, the adjusted percentage of days stably housed was higher among the intervention group than the usual care group, although adjusted mean differences varied across sites.

Study City	Adjusted % (No. of Days Stably Housed/No. of Days With Housing Data)		Adjusted Mean Difference, % (95% CI)
	Intervention Group	Usual Care Group	
A	62.7 (417.3/683.0)	29.7 (189.2/621.6)	33.0 (26.2-39.8)
B	73.2 (491.5/653.4)	23.6 (157.0/606.8)	49.5 (41.1-58.0)
C	74.4 (506.7/658.1)	38.8 (255.2/626.2)	35.6 (29.4-41.8)
D	77.2 (520.4/651.5)	31.8 (223.1/649.1)	45.3 (38.2-52.5)

The mean change in EQ-5D score from baseline to 24 months among the intervention group was not statistically different from the usual care group (60.5 [95% CI, 58.6 to 62.5] at baseline and 67.2 [95% CI, 65.2 to 69.1] at 24 months for the intervention group vs 62.1 [95% CI, 59.9 to 64.4] at baseline and 68.6 [95% CI, 66.3 to 71.0] at 24 months for the usual care group, difference in mean changes, 0.10 [95% CI, −2.92 to 3.13], P=.95).

CONCLUSIONS AND RELEVANCE Among homeless adults with mental illness in 4 Canadian cities, scattered site housing with ICM services compared with usual access to existing housing and community services resulted in increased housing stability over 24 months, but did not improve generic quality of life.

TRIAL REGISTRATION isrctn.org Identifier: ISRCTN42520374

JAMA. 2015;313(9):905-915. doi:10.1001/jama.2015.1163

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H omelessness affects large numbers of people in many countries and is associated with enormous personal and societal costs.[1,2] One-year prevalence estimates indicate there were at least 150 000 homeless people in Canada in 2009[3] and 1.5 million in the United States in 2012.[4] Large numbers of homeless adults have mental illness, with or without substance use disorders,[5] and cognitive impairment.[6] These individuals are at high risk of chronic homelessness, frequent use of acute care services, and premature mortality.[1,7]

Traditional approaches to ending homelessness require homeless individuals to move in a stepwise manner through treatment, rehabilitation, and transitional housing before accessing permanent housing.[8] In contrast, more recent interventions, often referred to as "Housing First," offer rapid access to permanent housing and mental health support services, typically via Assertive Community Treatment (ACT), without preconditions such as engagement in psychiatric treatment or sobriety.[9,10] Both scattered-site and single-site supportive housing programs have been described in the literature, and there is increasing evidence of their effectiveness.[9,11-13] Although ACT provides support via a resource-intensive interdisciplinary team (including a psychiatrist and nurses) and small caseloads, Intensive Case Management (ICM) is a less-intensive intervention in which individual case managers broker necessary services to other supports in the community. Intensive Case Management may be an appropriate and less-costly treatment option for homeless individuals not requiring ACT service intensity.[12] However, to date, the trial evidence for scattered-site supportive housing with ICM services has been limited.[12] The At Home/Chez Soi study aimed to address this gap by testing the effectiveness of scattered-site supportive housing with ICM services compared with usual care for homeless adults with mental illness in 4 Canadian cities.

Methods

Design and Setting
The study protocol has been described previously and was approved by the research ethics board at all participating institutions (Supplement 1).[14] This unblinded randomized trial was conducted in 5 Canadian cities (Vancouver, Winnipeg, Toronto, Montreal, and Moncton). Sites did not wish to be identified; hence, site-specific results are presented using letters A through E.

Participants were enrolled from October 2009 to July 2011. Before randomization to the intervention or usual care groups, participants were stratified based on their clinical and service use profiles into high needs and moderate needs groups. This article examines outcomes among participants from only 4 study cities (A through D) because participants at Site E with moderate needs randomized to the intervention group received scattered-site supportive housing with ACT.

Participants
Participants were recruited from community agencies and institutions serving homeless individuals, including shelters, drop-in centers, criminal justice programs, and hospitals. Study inclusion criteria (eTable 1 in Supplement 2) were (1) legal age of majority; (2) absolutely homeless or precariously housed; and (3) presence of a mental illness, with or without a concurrent substance use disorder, as evaluated using the Mini International Neuropsychiatric Interview (MINI).[15] Individuals were excluded if they were not legally residing in Canada or were a current client of an ACT or ICM team (Figure and eTable 2 in Supplement 2).

Initial Assessment and Randomization
Following verbal consent to screen for eligibility, research interviewers obtained demographic, housing, and service use history from potential participants and administered the MINI[15] and the Multnomah Community Ability Scale (MCAS),[16] which assesses community functioning in adults with serious mental illness. Participant race/ethnicity and gender were assessed using self-report. Individuals who met inclusion criteria were assessed for capacity to consent. Written informed consent was obtained from all participants.

An algorithm, informed by Canadian ACT eligibility criteria,[17] was used to classify participants as high needs (requiring ACT services) (eTable 3 in Supplement 2),[14] if they met all of the following criteria: (1) a current psychotic disorder or bipolar disorder based on the MINI, (2) an MCAS score of 62 or lower, indicating at least moderate disability, and (3) at least 1 of the following: 2 or more hospitalizations for mental illness in any 1 of the last 5 years, recent arrest or incarceration, or comorbid substance use based on the MINI. All other participants were classified as having moderate needs and were randomized to supportive housing with ICM services or usual care.
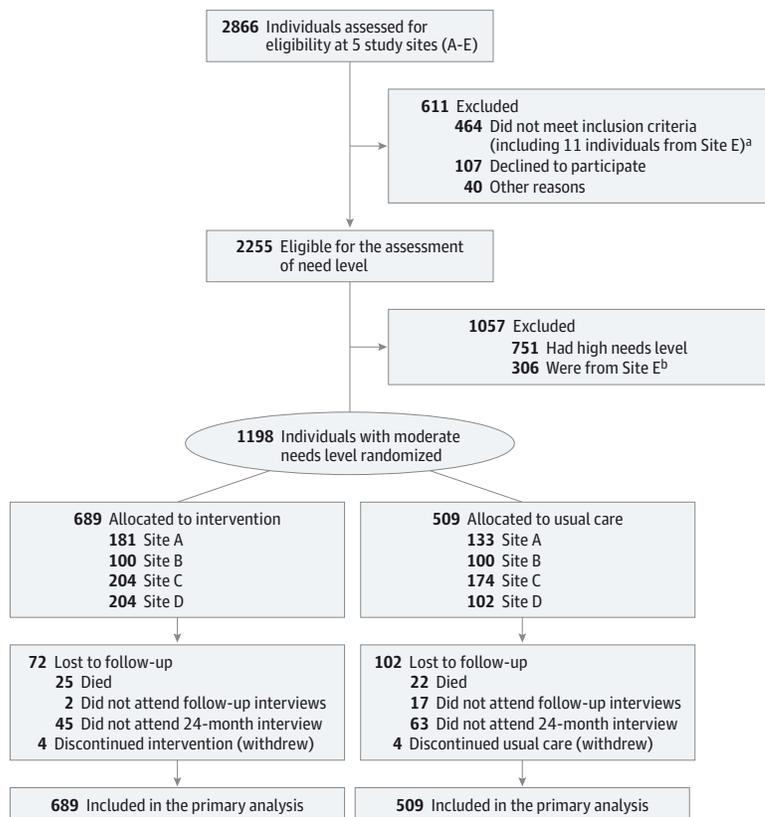
Randomization, using adaptive techniques, was automated by the central data collection system with concealment of the allocation algorithm from researchers and participants.[14] Adaptive randomization was used to continually adjust the probability of being assigned to intervention or usual care based on the number of participants already assigned, to increase the likelihood of achieving a balanced number of participants between groups.[14,18] Participants assigned to the intervention group were immediately referred to a case manager. Participants assigned to the usual care group had access to housing and support services through other programs in their respective communities, such as group homes, congregate supportive housing, and mental health support services, including other ICM programs.

Intervention
The intervention was scattered-site supportive housing with mobile, off-site ICM services,[14] offering rapid, low-barrier permanent housing in independent units with supports fostering participant empowerment, choice, personalized goals, hope, and resilience. Participants paid up to 30% of their income toward rent, with a monthly rent supplement of CaD $375 to CaD $600 (dependent on study city; to convert to US dollars, multiply by 0.984) paid by the program directly to landlords. Details of study planning and implementation have been published elsewhere.[19,20]

Participants were required to have weekly contact with a case manager. Client:case manager ratios ranged from 16:1 to

Figure. Flow of Participants Through the Study

2866 Individuals assessed for eligibility at 5 study sites (A-E)

611 Excluded
    464 Did not meet inclusion criteria (including 11 individuals from Site E)[a]
    107 Declined to participate
    40 Other reasons

2255 Eligible for the assessment of need level

1057 Excluded
    751 Had high needs level
    306 Were from Site E[b]

1198 Individuals with moderate needs level randomized

689 Allocated to intervention
    181 Site A
    100 Site B
    204 Site C
    204 Site D

509 Allocated to usual care
    133 Site A
    100 Site B
    174 Site C
    102 Site D

72 Lost to follow-up
    25 Died
    2 Did not attend follow-up interviews
    45 Did not attend 24-month interview
    4 Discontinued intervention (withdrew)

102 Lost to follow-up
    22 Died
    17 Did not attend follow-up interviews
    63 Did not attend 24-month interview
    4 Discontinued usual care (withdrew)

689 Included in the primary analysis

509 Included in the primary analysis

[a] Participants were excluded from the study if they did not meet the study inclusion criteria with respect to (1) age, (2) homelessness status, and (3) the presence of a mental disorder based on the Mini International Neuropsychiatric Interview, or (4) if they were currently served by an Assertive Community Treatment (ACT) or Intensive Case Management team or (5) lacked legal status in Canada. Data for exclusions by category are not available.

[b] Site E was excluded because all participants randomized to the intervention group received services via ACT.

18:1. Participants were not required to accept psychiatric treatment or achieve sobriety. Intensive Case Management teams at each site received training and underwent fidelity assessments to ensure adherence to program principles.[19,21,22]

In 3 study cities, participants randomized to the intervention were assigned to 1 of 2 moderate-needs groups, either the model described above or a minor site-specific adaptation, with the additional feature of ICM with Aboriginal peer support, ethnoracial ICM,[23] and hospital-led ICM. These minor adaptations met program fidelity standards at each of 2 fidelity visits[24] and, therefore, all ICM study groups at each site have been included in this analysis.

Follow-up Procedures

Interviews were scheduled every 3 months (face-to-face every 6 months and by telephone at other time points). Follow-up procedures have been described elsewhere.[14] Briefly, participants provided contact information for themselves and others who could assist in locating them. Interviewers used active outreach to locate participants and, with participant consent, asked benefit-administering institutions and agencies for participant contact information.

Outcomes

Outcome measures[14] are summarized in eTable 3 in Supplement 2, which includes corresponding references.

The primary study outcome was housing stability, defined as the percentage of days stably housed, and was ascertained using the Residential Time-Line Follow-Back Inventory, using prompts to collect information about housing history, moves, and type of residence. The Residential Time-Line Follow-Back Inventory has high test-retest reliability and good concurrent validity in homeless populations.[25] Stable housing was defined as living in one's own room, apartment, or house, or with family, with an expected duration of residence of 6 months or more or tenancy rights. The following housing situations were considered unstable: living on the street and other places not intended for human habitation, temporary residences (expected duration of residence of <6 months and no tenancy rights), emergency shelters, crisis units, and institutions. For all participants with at least 1 follow-up interview, percentage of days stably housed during the 24-month period following randomization was calculated as the total number of days stably housed divided by the number of days for which any type of residence data (stable or unstable) were available over the 24-month period (eTable 3 in Supplement 2).

The secondary study outcome was generic quality of life, as assessed by the EuroQoL 5 Dimensions (EQ-5D) health questionnaire every 6 months. The EQ-5D is a 5-item, self-administered, standardized measure of health status that provides a measure of health for clinical and economic studies.[26]

This study used the visual analogue scale of the EQ-5D, which records the respondent's self-rated health on a vertical scale ranging from "worst imaginable health state" (score of 0) to "best imaginable health state" (score of 100).

Additional exploratory outcomes, described in greater detail in eTable 3, included

1. Self-rated physical and mental health status, assessed by the physical component summary (PCS) and mental component summary (MCS) scores of the Short Form 12 (SF-12) survey,[23,24] both of which range from 0 to 100, with greater values corresponding to better health status;

2. Past month psychiatric symptoms, evaluated via the total score of the 14-item modified Colorado Symptom Index,[27] which ranges from 14 to 70 with higher values indicating greater symptom severity (values greater than 30 have been proposed as the clinical cutoff score warranting further assessment);

3. Severity of substance use problems in the past month, assessed using the 5-item Substance Disorder Screener of the Global Assessment of Individual Needs Short Screener.[13,14] Substance use severity was derived by counting the number of substance-related problems in the past month (range, 0-5), with higher values corresponding to greater problem severity;

4. Condition-specific quality of life was measured by the Lehman Quality of Life Interview 20 (QoLI-20) index, widely used with the target population.[28] This 20-item instrument uses a 7-point Likert scale and measures quality of life across 6 subscales including family (range, 4-28), finances (range, 2-14), leisure (range, 5-35), living situation (range, 1-7), safety (range, 4-28) and social (range, 3-21). In addition, overall quality of life (range, 1-7) is used as a marker of global quality of life. The values from these 6 subscales and the overall quality of life are summed to generate a total score. We report on the total score (range, 20-140), as well as each of the 6 subscales and the global marker. In each component, larger values corresponded to greater quality of life;

5. Community functioning, determined using the total score of the MCAS,[16] which measures community functioning within the domains of health, adaptation, social skills, and behavior. The total MCAS score ranges from 17 to 85, with higher values indicating higher functioning. Score ranges have been proposed to indicate level of disability: severe disability (range, 17-47), moderate disability (range, 48-62), and little disability (range, 63-85);

6. Physical (range, 0-7) and psychological (range, 4-20) community integration, assessed using the Community Integration Scale, with higher values corresponding to greater community integration;

7. Recovery, assessed using the total score of the Recovery Assessment Scale,[29] with higher values indicating greater recovery (range, 22-110);

8. The total number of self-reported police arrests in the past 6 months;

9. The total number of self-reported emergency department visits in the past 6 months; and

10. The self-reported incidence of 1 or more hospitalizations during the study period, derived from the Residential Time-Line Follow-Back Inventory, and defined if the number of days hospitalized was greater than or equal to 1.

All exploratory outcomes were assessed every 6 months, with the exception of the PCS and MCS scores of the SF-12 survey (measured at baseline, 12 months, and 24 months), recovery (measured at baseline and 24 months), and the number of days hospitalized (assessed every 3 months).

Statistical Analyses

Sample sizes of at least 100 participants per group, per site, provided 80% power to detect a medium effect size (Cohen $d = 0.5$)[30] for the primary outcome at 24 months using a 2-sided t test, assuming an attrition rate of 40% over the follow-up period. Such magnitude of effect size is consistent with that observed in a previously published study,[12] which reported that homeless veterans with mental illness or substance use problems or both participating in a trial of scattered-site housing and ICM services spent an average of 66% of days housed in the intervention group and 53% of days housed in the standard care group in the past 90 days, with an estimated common group standard deviation of 26%, yielding an effect size of $d = 0.5$.

Primary Outcome

The effect of the intervention on the percentage of days stably housed over the entire study period was analyzed by fitting an analysis of covariance model that included the main effects of treatment group, study city, indicators of ethnoracial and Aboriginal status, and a treatment × site interaction, as it was of interest to determine whether treatment effects varied by site. For each site, the differences between group means and 95% CIs were estimated from the model using linear mixed models (PROC MIXED) in SAS (SAS Institute), version 9.4.

Secondary and Exploratory Outcomes

The linear mixed models framework was applied to perform repeated measures analysis of generic quality of life and other longitudinal continuous outcomes. Generalized estimating equations (PROC GENMOD) were applied to repeated counts assuming the negative binomial distribution when the outcomes were overdispersed (emergency department visits, arrests, and severity of substance use-related problems) or the Poisson distribution (physical community integration). The main fixed effects of treatment group, time, study city and Aboriginal and ethnoracial status were tested, as well as the treatment × time interaction. The effectiveness of the intervention was assessed by the treatment × time interaction: if statistically significant, this interaction implied different trajectories for intervention and usual care groups. The treatment × time interaction was assessed via the model-estimated difference in mean changes from baseline for continuous outcomes or ratio of rate ratios for counts at the 6-, 12-, 18-, and 24-month time points (ie, rate ratio at follow-up relative to baseline in the intervention group divided by rate ratio at follow-up relative to baseline among the usual care group)[31] and 95% CIs. The unstructured covariance matrix for repeated

measures was used in all models. Although the treatment × site interaction was initially tested in all models, it was not kept because this interaction did not achieve statistical significance for any of the outcomes, except for the family subscale of the condition-specific quality-of-life instrument, for which we present the results of a 3-way interaction (treatment group × time × study city).

A generalized linear model with binomial distribution and log link (PROC GENMOD) was fitted for the outcome of incidence of 1 or more hospitalizations during the 24-month study period, and included the main effect of treatment group, study city, Aboriginal and ethnoracial status, as well as a treatment × site interaction. For each site, the adjusted risk ratio and 95% CI were estimated.

Multiple Imputation

Missing data occurred due to withdrawal, loss to follow-up, skipped interviews, nonresponse on specific items, or lack of interviewer confidence in participant response. Data on percentage of days stably housed and number of days hospitalized were missing for only 48 participants (4.0%); thus, no imputation was necessary for these outcomes.[32] The level of missingness was substantially higher for other outcome variables (range at baseline, 1.3% to 8.6% for the intervention group and 1.2% to 10.8% for the usual care group; range at 24 months, 11.0% to 20.5% for the intervention group and 20.8% to 33.4% for the usual care group). Secondary and all exploratory outcomes (except for PCS and MCS of the SF-12 survey) were imputed using the sequential regression multivariate imputation approach.[33] This method allows for efficient imputation by fitting a model to each variable, conditional on all or a subset of all others, and imputing 1 variable at a time.[34] The multiple imputation model included variables considered in the analysis models (ie, outcomes at baseline, 6, 12, 18, and 24 months; study city; ethnoracial status; and Aboriginal status), and auxiliary variables associated with missingness (ie, age at enrollment, gender, number of baseline comorbidities, and lifetime years homeless). Imputations were stratified by treatment group because our analysis models considered interactions between treatment group and time and between treatment group and study city.[34]

Forty imputed data sets were created using the multiple imputation by chained equations (MICE) approach in STATA (StataCorp), version 13, implemented by the "mi impute chained" command, and results were analyzed and combined using SAS (SAS Institute), version 9.4 (PROC MIANALYZE). Statistical significance was set at a P value of .05 or less (2-tailed) for all analyses. All analyses were performed on an intention-to-treat basis. No adjustments for multiple comparisons were applied.[35]

Costing

The economic analyses were conducted from the point of view of society. Service use and residential questionnaires enabled us to assess quantities of a wide range of services used, as well as of income from various sources. We estimated unit costs (eg, the average cost of an emergency department visit, of a police arrest, of a night in a shelter) for each city using the

best available data. Nearly 400 distinct unit costs were estimated. In many cases, case managers were contacted to obtain their financial and activity reports and to help interpret them. When a program's expenditures included contributions by private donors as well as government sources, we included the value of private contributions as this represents the full cost of service delivery from the point of view of society. Welfare and disability payments were included as they represent costs that society must incur to enable individuals who are homeless to participate in, and benefit from, Housing First programs and other existing housing programs. Income from employment was subtracted from overall costs as this represents the value of a contribution to society by the individual. Estimates of capital costs were included in all services. All costs were expressed in fiscal year 2010/2011 Canadian dollars. Due to the short follow-up period (2 years), we did not apply discounting.

Results

A participant flow diagram is shown in the Figure. A total of 1198 individuals with moderate needs were randomized to the intervention group or the usual care group. Of this number, 52 participants (4.3%) were veterans. Participant baseline characteristics are presented in **Table 1**. Interviews were completed with 1104 participants (92.2%) at 12 months and 1016 participants (84.8%) at 24 months. There were 47 known deaths (25 participants [3.6%] in the intervention group and 22 participants [4.3%] in the usual care group) during the follow-up period. Four participants from each group withdrew from the study. In addition, data were considered missing and imputed for 55 interviews across the 5 time points based on an assessment by interviewers of no confidence in participant responses. Imputed data for deceased participants were used up to the date of their death.

Primary Outcome

During 24 months following randomization, the percentage of days stably housed was higher among the intervention group than the usual care group, although adjusted mean differences varied across the 4 sites (Site A, 33.0% [95% CI, 26.2% to 39.8%]; Site B, 49.5% [95% CI, 41.1% to 58.0%]; Site C, 35.6% [95% CI, 29.4% to 41.8%]; and Site D, 45.3% [95% CI, 38.2% to 52.5%]; P < .01 for interaction) (Table 2). In addition, the proportion of participants never housed during the study period was significantly lower in the intervention group (5.0%) compared with the usual care group (31.5%), corresponding with a difference of −26.5% (95% CI, −31.0% to −22.0%). In the second year of the study, 78.0% of the intervention group (n = 645) and 39.3% of the usual care group (n = 433) were stably housed 50% of the time or more, a difference of 38.7% (95% CI, 33.1% to 44.3%).

Secondary Outcome

The mean change of the EQ-5D score from baseline to 24 months among intervention participants was not statistically different from usual care participants (60.5 [95% CI, 58.6 to

Table 1. Baseline Characteristics of Participants, Stratified by Randomization Group[a]

Characteristics	Intervention Group (n = 689)	Usual Care Group (n = 509)
Age, mean (SD), y	42.2 (11.1)	42.1 (11.3)
Median (IQR), y	43.5 (33.4-50.2)	44.0 (33.5-49.8)
Gender, No. (%)		
Women	236 (34.3)	154 (30.3)
Men	449 (65.2)	346 (68.0)
Other[b]	4 (0.6)	9 (1.8)
Marital status, No. (%)		
Married/partnered	25 (3.6)	20 (3.9)
Divorced/separated/widowed	193 (28.1)	144 (28.3)
Single/never married	469 (68.3)	345 (67.8)
Country of birth, No. (%)		
Canada	545 (79.1)	394 (77.4)
Other	144 (20.9)	115 (22.6)
Race/ethnicity, No. (%)		
Aboriginal	172 (25.0)	112 (22.0)
Ethnoracial[c]	188 (27.3)	146 (28.7)
White	329 (47.8)	251 (49.3)
Housing status, No. (%)		
Absolutely homeless	576 (83.6)	428 (84.1)
Precariously housed	113 (16.4)	81 (15.9)
Lifetime duration of homelessness, mean (SD), y	4.7 (5.9)	4.4 (5.1)
Median (IQR)	2.5 (0.83-6.0)	2.5 (1.0-6.0)
Education, No. (%)		
Less than high school	375 (54.4)	251 (49.5)
Completed high school	118 (17.1)	103 (20.3)
Some postsecondary school	196 (28.4)	153 (30.2)
MCAS score, mean (SD)[d]	64.7 (6.2)	64.7 (6.2)
Median (IQR)	65.0 (63.0-68.0)	65.0 (63.0-68.0)
MINI diagnostic categories, No. (%)[e]		
Depressive episode	408 (59.2)	299 (58.7)
Manic or hypomanic episode	60 (8.7)	59 (11.6)
Posttraumatic stress disorder	218 (31.6)	155 (30.5)
Panic disorder	164 (23.8)	137 (26.9)
Mood disorder with psychotic features	83 (12.0)	75 (14.8)
Psychotic disorder	142 (20.6)	117 (23.0)
Dependence		
Alcohol	242 (35.1)	188 (36.9)
Substance	281 (40.8)	208 (40.9)
Abuse		
Alcohol	142 (20.6)	87 (17.1)
Substance	144 (20.9)	101 (9.8)
Suicidality level		
Low	311 (45.1)	211 (41.5)
Moderate	125 (18.1)	109 (21.4)
High	109 (15.8)	92 (18.1)
None	144 (20.9)	97 (19.1)

Abbreviations: IQR, interquartile range; MCAS, Multnomah Community Ability scale; MINI, Mini International Neuropsychiatric Interview.

[a] Numbers do not sum to group totals for the following variables because of missing participant data: marital status, 2; education, 2; lifetime duration of homelessness, 9; MINI diagnosis of posttraumatic stress disorder, 1; MINI diagnosis of mood disorder with psychotic features, 1. This study was conducted at 4 separate sites, and we performed analyses to explore if sites showed statically significant baseline differences for the variables presented in Table 1. Site-adjusted comparisons for categorical characteristics were performed using Cochran-Mantel-Haenszel test. Site-adjusted comparisons for age at enrollment and MCAS scores were examined using linear regression models, and total years homeless was site-adjusted using robust regression. No statistically significant site-adjusted differences were detected.

[b] Other category included transsexual, transgendered, and other; terms used in self-report.

[c] Ethnoracial category includes black, East Asian, Indian Caribbean, Latin American, Middle Eastern, South Asian, Southeast Asian, and mixed ethnicity.

[d] The MCAS has a range of 17 to 85, with higher values indicating greater functioning.

[e] All MINI categories refer to a diagnosis of a current disorder. These values do not add up to 100% because only numbers and percentages for those with the diagnosis are presented.

62.5] at baseline and 67.2 [95% CI, 65.2 to 69.1] at 24 months for the intervention group vs 62.1 [95% CI, 59.9 to 64.4] at baseline and 68.6 [95% CI, 66.3 to 71.0] at 24 months for the usual care group, difference in mean changes, 0.10 [95% CI, −2.92 to 3.13], *P*=.95) (**Table 3**).

Exploratory Outcomes

Table 3 shows the treatment effects for exploratory outcomes at each study visit, eTable 5 in Supplement 2 shows the adjusted absolute values, and eTable 6 in Supplement 2 shows the changes from baseline to subsequent visits. Mean change

Table 2. Percentage of Days Stably Housed for Participants at Each Study City (Primary Outcome)

| Study City | Mean (SD) | | | | Adjusted Percentage of Days Stably Housed, Mean (95% CI)[a] | | Treatment Effect |
| | Raw No. of Days Stably Housed | | Raw Total No. of Days With Housing Data | | | | |
	Intervention Group	Usual Care Group	Intervention Group	Usual Care Group	Intervention Group	Usual Care Group	Mean Difference (95% CI), %
A	417.3 (228.3)	189.2 (215.6)	683.0 (98.0)	621.6 (170.2)	62.7 (57.7-68.0)	29.7 (24.0-35.4)	33.0 (26.2-39.8)
B	491.5 (212.4)	157.0 (177.7)	653.4 (149.8)	606.8 (184.5)	73.2 (67.3-79.1)	23.6 (17.6-29.7)	49.5 (41.1-58.0)
C	506.7 (207.1)	255.2 (234.4)	658.1 (114.4)	626.2 (168.7)	74.4 (69.8-78.9)	38.8 (33.9-43.7)	35.6 (29.4-41.8)
D	520.4 (173.9)	223.1 (229.8)	651.5 (120.2)	649.1 (150.1)	77.2 (72.8-81.6)	31.8 (25.8-37.9)	45.3 (38.2-52.5)

[a] Adjusted percentage of days stably housed means and 95% CIs were generated from an analysis of covariance model examining the effect of treatment group (intervention vs usual care), study city (A through D), Aboriginal status, ethnoracial status as well as the treatment group × study city interaction (P < .01; reference site is Site A) on the percentage of days stably housed over the 24-month follow-up period.

from baseline did not differ significantly between the intervention and usual care groups at 24 months for severity of mental health symptoms (0.57 [95% CI, −0.88 to 2.01]), PCS scores (0.50 [95% CI, −1.01 to 2.00]) and MCS scores (−0.74 [95% CI, −2.57 to 1.10]) of the SF-12 survey, psychological community integration (0.31 [95% CI, −0.25 to 0.86]), or recovery (0.09 [95% CI, −1.53 to 1.71]). Similarly, change in rates from baseline to 24 months for the intervention group compared with usual care groups (ratio of rate ratios), did not show statistically significant results for physical community integration (1.02 [95% CI, 0.92 to 1.14]), substance use problems (0.94 [95% CI, 0.79 to 1.12]), and number of arrests (1.05 [95% CI, 0.62 to 1.80]).

Based on an examination of the treatment group × time interaction, the total score of the condition-specific quality of life showed a statistically significant difference in mean change from baseline to 6 months (5.91 [95% CI, 3.41 to 8.41]) and remained significant through to 24 months (4.37 [95% CI, 1.60 to 7.14]) (Table 3). When examining the subscales of the condition-specific quality-of-life instrument, we observed significant improvement in the mean change from baseline to 24 months in the domains of leisure (1.09 [95% CI, 16 to 2.01]), living situation (0.68 [95% CI, 0.38 to 0.97]), and safety (1.11 [95% CI, 0.27 to 1.96]). Interestingly, the family domain of the condition-specific, quality-of-life instrument showed a significant 3-way treatment × time × site interaction, illustrated by very different treatment effects by site at 24 months (Site A, 0.72 [95% CI, −0.91 to 2.36]; Site B, −0.56 [95% CI, −2.67 to 1.54]; Site C, −0.29 [95% CI, −1.80 to 1.22]; Site D, 2.64 [95% CI, 0.93 to 4.34]).

A statistically significant treatment × time interaction was also observed in community functioning at 18 months: compared with the usual care group, the intervention group showed a statistically significant improvement in the difference in mean change relative to baseline values (1.16 [95% CI, 0.08 to 2.24]), but the improvement was not sustained at 24 months (1.06 [95% CI, −0.004 to 2.13]).

eTable 4 in Supplement 2 shows the distribution of days spent in the hospital by treatment group and site during the study period. Nearly three-quarters of our sample (72.4%) were not hospitalized during the study period. The proportion of participants reporting at least 1 hospitalization during the 24-month follow-up was 28.9% for the intervention group and 25.6% for the usual care group, which corresponds to a difference of 3.30 (95% CI, −1.90 to 8.51%) (P = .22). During the 24-month study period, the risk of 1 or more hospitalization for the intervention group compared with the usual care group varied by site (risk ratio for Site A, 0.99 [95% CI, 0.67 to 1.45]; Site B, 0.57 [95% CI, 0.31 to 1.03]; Site C, 1.67 [95% CI, 1.08 to 2.59]; Site D, 1.02 [95% CI, 0.77 to 1.36]; P = .03 for interaction) (Table 4). At 24 months, the intervention did not lead to significant reductions in emergency department visits from baseline (ratio of rate ratios, 0.73 [95% CI, 0.49 to 1.07]; P = .11).

Costs

On average, the cost of supportive housing with ICM services was CaD $14 177 per participant annually, approximately 30% less than the cost of supportive housing with ACT (CaD $22 257), and resulted in an average net cost offset of CaD $4849 per participant per year, or 34% of the cost of the intervention. The most important cost offsets emerged from reduced use of emergency shelters and single-room occupancy with support, whereas the costs of office visits with other nonstudy medical (physicians) and clinical community (eg, social workers and nurses) providers rose. A representative list of site-specific unit costs is found in eTable 6 in Supplement 2.

Discussion

Scattered-site supportive housing using rent supplements and ICM services led to significantly greater housing stability for homeless adults with mental illness and moderate support needs compared with usual care in 4 cities across Canada over the 24-month follow-up period. The intervention did not result in significant improvements in generic quality of life, however additional exploratory analyses suggest significant gains in condition-specific quality of life among the intervention group compared with the usual care group, from baseline to 24 months. Similar to this study, a previous single-site randomized trial by the US Departments of Housing and Urban Development and Veteran Affairs Supportive Housing (HUD-VASH) concluded that the combination of rent supplements and ICM services led to greater housing stability and in-

creased social networks for homeless veterans with a psychiatric or substance use disorder when compared with standard care or ICM services alone, at modest cost.[12] However, unlike this latter study, which focused exclusively on homeless veterans, only 4% of our participants were veterans, all met criteria for a diagnosis of severe mental illness (vs 45% in the previous study) and a third of the participants (33%) were women (vs 4% in former study).

Another single-site randomized trial from New York City examining the effectiveness of a scattered-site supportive housing program with ACT found that intervention participants were more likely to be housed, and were housed more rapidly, than individuals treated with traditional approaches.[9,36-38] The prevalence of psychosis among New York study participants was 53% and nearly all participants (90%) had a diagnosis or history of alcohol or substance use disorders compared with 22% of participants with psychosis and 62% of participants with a diagnosis or history of alcohol or substance use disorders among our sample served by ICM services.

Table 3. Secondary and Exploratory Outcomes for Participants During the Follow-up Period

	Treatment Effect							
	6 Months		12 Months		18 Months		24 Months	
Outcomes[a]	Difference in Mean Changes From Baseline (95% CI)	P Value[b]	Difference in Mean Changes From Baseline (95% CI)	P Value[b]	Difference in Mean Changes From Baseline (95% CI)	P Value[b]	Difference in Mean Changes From Baseline (95% CI)	P Value[b]
Secondary Outcome[c]								
Generic quality of life	2.11 (−1.00 to 5.23)	.18	0.91 (−2.18 to 4.00)	.56	0.06 (−3.18 to 3.3)	.97	0.10 (−2.92 to 3.13)	.95
Exploratory Outcomes								
Mental illness symptom severity	−0.96 (−2.29 to 0.37)	.16	−0.51 (−1.87 to 0.84)	.46	0.18 (−1.19 to 1.56)	.79	0.57 (−0.88 to 2.01)	.44
Condition-specific quality-of-life total score	5.91 (3.41 to 8.41)	<.001	4.11 (1.43 to 6.79)	.003	4.21 (1.56 to 6.86)	.002	4.37 (1.6 to 7.14)	.002
Family[d]								
Finances	0.34 (−0.06 to 0.74)	.10	0.23 (−0.2 to 0.65)	.29	0.32 (−0.11 to 0.74)	.14	0.37 (−0.04 to 0.78)	.08
Leisure	0.71 (−0.18 to 1.59)	.12	1.21 (0.3 to 2.12)	.009	1.19 (0.27 to 2.11)	.01	1.09 (0.16 to 2.01)	.02
Living situation	1.47 (1.17 to 1.78)	<.001	0.99 (0.69 to 1.29)	<.001	0.79 (0.49 to 1.08)	<.001	0.68 (0.38 to 0.97)	<.001
Safety	1.93 (1.12 to 2.75)	<.001	1.14 (0.28 to 1.99)	.009	0.74 (−0.08 to 1.55)	.08	1.11 (0.27 to 1.96)	.01
Social	0.66 (0.07 to 1.24)	.03	0.55 (−0.04 to 1.13)	.07	0.55 (−0.02 to 1.12)	.06	0.33 (−0.23 to 0.9)	.25
Overall quality of life	0.16 (−0.07 to 0.38)	.18	0.28 (0.04 to 0.52)	.02	0.18 (−0.06 to 0.42)	.15	0.18 (−0.06 to 0.41)	.14
Community functioning	1.33 (0.45 to 2.22)	.003	1.38 (0.38 to 2.38)	.007	1.16 (0.08 to 2.24)	.03	1.06 (0 to 2.13)	.051
Physical health component summary			0.41 (−1.02 to 1.84)	.57			0.50 (−1.01 to 2)	.52
Mental health component summary			−0.7 (−2.51 to 1.11)	.45			−0.74 (−2.57 to 1.1)	.43
Psychological community integration	0.85 (0.31 to 1.38)	.002	0.29 (−0.26 to 0.84)	.30	0.18 (−0.36 to 0.72)	.51	0.31 (−0.25 to 0.86)	.28
Recovery							0.09 (−1.53 to 1.71)	.92
Count Outcomes, Ratio of Rate Ratios (95% CI)								
Physical community integration[e]	1.03 (0.93 to 1.13)	.55	0.99 (0.89 to 1.1)	.86	0.96 (0.86 to 1.06)	.39	1.02 (0.92 to 1.14)	.67
Severity of substance use problems[e]	1.04 (0.89 to 1.21)	.66	1.00 (0.85 to 1.17)	.96	1.08 (0.92 to 1.28)	.35	0.94 (0.79 to 1.12)	.50
No. of emergency department visits	0.55 (0.39 to 0.77)	.001	0.76 (0.54 to 1.07)	.11	0.89 (0.61 to 1.31)	.55	0.73 (0.49 to 1.07)	.11
No. of arrests	1.42 (0.83 to 2.44)	.20	0.98 (0.56 to 1.72)	.94	1.75 (0.98 to 3.11)	.06	1.05 (0.62 to 1.8)	.84

[a] Differences in mean changes from baseline estimated from linear mixed linear models for continuous variables, ratio of rate ratios estimated from generalized estimating equations with negative binomial or Poisson link for count variables. Models included treatment group, time (month of visit), study city, Aboriginal status and ethnoracial status, and treatment × time interaction. Reference categories for categorical variables were as follows: treatment group = usual care; month of visit = baseline; study city = Site A; Aboriginal status = non-Aboriginal; ethnoracial status = non-ethnoracial. See Methods section for measurement instrument acronyms and scale ranges.

[b] Because of multiple imputation, it was not possible to estimate an overall combined P value for interaction, therefore we only report P values corresponding to the treatment × time interaction at each time point contrasting change from baseline in the intervention group with change from baseline in the usual care group.

[c] Mean (95% CI) values for generic quality of life at baseline were 60.5 (58.6 to 62.5) for the intervention group and 62.1 (59.9 to 64.4) for the usual care group.

[d] We are not presenting the difference in mean changes from baseline to subsequent visits for this outcome because we observed a significant treatment × site interaction. Specifically, at 24 months, treatment effects varied by site: (Site A, 0.72 [95% CI, −0.91 to 2.36], P = .39; Site B, −0.56 [95% CI, −2.67 to 1.54], P = .60; Site C, −0.29 [95% CI, −1.80 to 1.22], P = .71; Site D, 2.64 [95% CI, 0.93 to 4.34], P = .003).

[e] This instrument generates a total count of the number of instances of particular events and not a total summary score; therefore they were modeled as count outcomes using Poisson and negative binomial distributions, respectively.

Table 4. Raw Number of Days in Hospital and Participants With 1 or More Hospitalizations Over the 24-Month Period at Each Study City

| | Raw No. of Days in Hospital | | | | No. of Participants With ≥1 Hospitalizations Over 24-Mo Period, No. (%) | | |
| | Mean (SD) | | Median (IQR) | | | | |
Study City	Intervention Group	Usual Care Group	Intervention Group	Usual Care Group	Intervention Group	Usual Care Group	Risk Ratio (95% CI)[a]
A	5.3 (17.5)	9.0 (35.1)	0 (0-1)	0 (0 to 1)	46 (26.0)	33 (26.2)	0.99 (0.67-1.45)
B	10.7 (50.3)	12.4 (42.4)	0 (0-0)	0 (0 to 2)	14 (14.3)	24 (26.1)	0.57 (0.31-1.03)
C	11.9 (45.1)	3.6 (13.6)	0 (0-2)	0 (0 to 0)	51 (25.5)	24 (15.1)	1.67 (1.08-2.59)
D	20.9 (65.6)	13.6 (40.7)	0 (0-13)	0 (0 to 12)	84 (42.2)	41 (41.4)	1.02 (0.77-1.36)

Abbreviation: IQR, interquartile range.

[a] Risk ratio estimated from a generalized linear model with binomial distribution and log link for the outcome of incidence of 1 or more hospitalizations during the 24-mo study period, and included the main effect of treatment group, study city, Aboriginal and ethnoracial status, as well as a treatment × site interaction (P value for interaction = .03). Reference site is Site B.

Our findings highlight that scattered-site housing with ICM services is effective in reducing homelessness among a broader spectrum of the homeless population who may have a severe mental illness but do not require ACT support, best reserved for a smaller group of homeless adults with high needs for mental health and other support services. The annual costs of the ICM intervention examined in the current study (CaD $14 177) are similar to those accrued by HUD-VASH (US $36 524/3 years), considering differences in currency and inflation rates,[12] and are approximately 30% less than the cost of supportive housing with ACT offered to participants with high needs in the At Home/Chez Soi study. Cost offsets for the intervention participants in our study were mostly generated from reduced use of emergency shelters and single-room occupancy residences with supports. However, these offsets occurred simultaneously with increased use of visits to health and other services providers, likely resulting from participants being linked to needed services they had not been able to access before the study began.

Although we observed consistently significant improvements in housing stability across all 4 study cities, the magnitude of the treatment effect showed statistically significant site differences. Additional site variation was observed in hospitalization outcomes and the family subdomain of the condition-specific quality-of-life instrument. These site differences may have arisen from variation in program fidelity across sites and resource availability in the respective communities, including site differences in available affordable housing units and the existing basket of mental health and other support services. Future work examining fidelity to program standards and the use of additional services may shed light on how site differences resulted in differential treatment effects between sites.

In addition to housing stability, condition-specific quality of life as measured by the QoLI-20 index total score, an exploratory outcome, showed significant improvement among the intervention group compared with the usual care group throughout the study. In particular, at study end, gains in the total quality-of-life score, as well as the subscales pertaining to leisure, living situation, and safety continued to be significant among the intervention group compared with the usual care group. Significant improvements in domains of quality of life were also observed among HUD-VASH participants com-

pared with those receiving standard care over 3 years of follow-up.[12] Furthermore, a recent observational study noted significant improvements in satisfaction with their living situation, frequency of contact with others, and adequacy of monthly income among participants who spent 1 year in a permanent supportive housing program,[39] highlighting condition-specific quality of life as a key outcome for individuals with histories of homelessness and mental and substance use disorders.

We did not observe a reduction in emergency department visits or a decrease in risk of 1 or more hospitalizations among participants in the intervention group compared with the usual care group during the follow-up period. One previous randomized trial examining the effect of providing housing and case management for chronically ill, homeless adults upon discharge from hospital in the United States demonstrated reductions in both emergency department visits and hospitalizations over an 18-month follow-up period.[40] However, all participants in the previous study had been recruited at the point of discharge from the hospital[40]; unlike this former study and clients typically served by ACT teams, our study participants had lower levels of hospitalizations at baseline, and nearly three-quarters of our sample had no hospital admission during the study period. Furthermore, the current study was conducted in a country with a system of universal health insurance, and thus our findings may be different from those that might be observed in a jurisdiction without such coverage.

This study had several limitations. Researchers and participants were not blinded to treatment assignment; the nature of the intervention prohibiting blinding. The secondary and exploratory outcomes should be considered hypothesis generating, because they were not adjusted for multiple comparisons. Outcomes were assessed up to 24 months; it is possible that longer periods are required for the full beneficial effects to manifest. It is also possible that the benefits observed may be short-lived. Future studies should examine which domains are most likely to capture meaningful change in this population, and allow for longer follow-up periods. Although all study cities had excellent fidelity to the program model, we cannot discount that some heterogeneity in the intervention existed between sites. Health and justice service use were determined on the

basis of self-report, which may be subject to recall error. Furthermore, we were not able to distinguish between psychiatric and medical hospitalizations or precisely determine the change in the number of days spent in hospital due to the intervention. Administrative data, which could confirm actual service use, could not be used in these analyses because privacy regulations did not allow for individual-level data to be combined across provinces.

Conclusions

Among homeless adults with mental illness in 4 Canadian cities, scattered-site housing with ICM services compared with usual access to existing housing and community services resulted in increased housing stability over 24 months, but did not improve generic quality of life.

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