

Cost-Effectiveness of Housing First With Assertive Community Treatment: Results From the Canadian At Home/Chez Soi Trial

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Objective: The At Home/Chez Soi trial for homeless individuals with mental illness showed scattered-site Housing First with Assertive Community Treatment (ACT) to be more effective than treatment as usual. This study evaluated the cost-effectiveness of Housing First with ACT and treatment as usual.

Methods: Between October 2009 and June 2011, a total of 950 homeless individuals with serious mental illness were recruited in five Canadian cities: Vancouver, Winnipeg, Toronto, Montreal, and Moncton. Participants were randomly assigned to Housing First (N=469) or treatment as usual (N=481) and followed up for up to 24 months. The intervention consisted of scattered-site Housing First, using rent supplements, with ACT. The treatment-as-usual group had access to all other services. The perspective of society was adopted for the cost-effectiveness analysis. Days of stable housing served as the outcome

measure. Retrospective questionnaires captured service use data.

Results: Most (69%) of the costs of the intervention were offset by savings in other costs, such as emergency shelters, reducing the net annual cost of the intervention to about Can\$6,311 per person. The incremental cost-effectiveness ratio was Can\$41.73 per day of stable housing (95% confidence interval=Can\$1.96–\$83.70). At up to Can\$60 per day, Housing First had more than an 80% chance of being cost-effective, compared with treatment as usual. Cost-effectiveness did not vary by participant characteristics.

Conclusions: Housing First with ACT appeared about as cost-effective as Housing First with intensive case management for people with moderate needs. The optimal mix between the two remains to be determined.

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A significant minority of homeless people experience serious mental illness (1). Housing First, which provides immediate access to subsidized housing together with support services, has proven the most effective approach to helping such individuals access and maintain permanent housing (2). Previous analyses have reported significant cost offsets associated with the provision of Housing First (3).

The At Home/Chez Soi trial compared outcomes of the scattered-site variant of Housing First, in which participants receive rent supplements for private-market apartments of their choice (4), to outcomes of treatment as usual. The trial tested, in parallel, both Housing First with assertive community treatment (ACT) (5, 6) for people who had more severe mental illness and functional difficulties (7) and Housing First with intensive case management for those whose needs were less severe (8). A cost-effectiveness analysis of Housing First with intensive case management has recently been published (9). Summary results of a cost

analysis of Housing First with ACT, but not a cost-effectiveness analysis, were included in the main trial

HIGHLIGHTS

- In the At Home/Chez Soi Canadian trial of Housing First with assertive community treatment (ACT), about two-thirds of the costs of the intervention were offset by savings in other costs.
- The net cost of the intervention per additional day of stable housing and the actual cost of the intervention per day are well within the range of the costs of many currently funded housing programs for people experiencing homelessness that do not provide individualized and intensive services such as ACT.
- The intervention appeared cost-effective regardless of participant sex, alcohol or drug abuse or dependence, level of functioning, prior hospitalizations, or recent arrest history.

reports (7, 10). Herein we report on the cost-effectiveness of Housing First with ACT, compared with treatment as usual.

METHODS

The cost-effectiveness analysis conformed to the published protocol of the At Home/Chez Soi study (4) and followed the Consolidated Health Economics Evaluation Reporting Standards (CHEERS) reporting guideline (11). The analysis began in 2013 and ended in 2019. The trial was conducted in Vancouver, Winnipeg, Toronto, Montreal, and Moncton. Ethics approval was obtained from the local ethics review board at each data collection site and from the Centre for Addiction and Mental Health, where the coordinating center was based (4). Participants provided written informed consent after the screening interview. The methods used were the same as those used for the cost-effectiveness analysis of Housing First with intensive case management compared with treatment as usual (9).

Participants

Details on sample recruitment are available elsewhere (4, 7). Briefly, potential participants were referred from various sources or found through street outreach. Inclusion criteria were adult age (≥ 18 years), legal status in province of residence, current mental disorder, and either absolutely homeless or precariously housed with previous episodes of absolute homelessness. Individuals who were currently receiving services from an ACT or intensive case management team were excluded.

Sample Recruitment and Randomization

Following the baseline interview, a computerized algorithm classified individuals as high need or moderate need. To be classified as high need, individuals needed to have a lower level of functioning (score of ≤ 62 on the Multnomah Community Ability Scale [12]); have a current diagnosis of a psychotic disorder or bipolar disorder; and have at least one of the following: two or more hospitalizations for mental illness within a 1-year period at some point during the previous 5 years, comorbid substance use, or one or more arrests or incarcerations in the past 6 months. Others were classified as moderate need. In Moncton, all participants were classified as high need because of the relatively small pool of potential participants (4). High-need individuals were randomly assigned to receive either Housing First with ACT or other services normally available to them (i.e., treatment as usual) (7). An adaptive randomization algorithm with allocation concealment was used (13). From October 2009 through June 2011, 950 individuals who met the criteria to be considered high need were recruited.

Interventions

Participants in the Housing First with ACT group received recovery-oriented supports from an ACT team with about ten participants per case manager (eight per case manager

in Montreal), not counting a psychiatrist, who served most or all of the participants assigned to the team. In Moncton, a family physician with extensive experience working with homeless individuals served as the clinical lead. Each ACT team worked in collaboration with housing specialists, also paid by the project, to help participants find housing of their choice, usually an apartment on the private rental market, and maintain positive relations with landlords. Participants were required to pay 25% or 30% of their income toward the rent, depending on whether the rental amount covered heating costs. The project paid the remainder of the rent, and this supplement ranged from a mean of about Can\$375 in Montreal to Can\$600 in Vancouver. [Hereinafter, all currency is expressed in Canadian dollars.] Two assessments of fidelity of local implementation to the program model, one about 1 year after launch of the program and a second after 3 years of operation, combined with ongoing coaching, aided standardization of the interventions across sites (14).

Participants assigned to treatment as usual had access to services such as shelters, hospitals, and community-based health and housing services (15). A small number of treatment-as-usual participants also were able to access intensive case management or ACT services from other sources after they entered the study.

Data Collection

Participants were followed for up to 21 or 24 months. At baseline and every 6 months thereafter, a battery of standardized self-reported questionnaires was administered (4). Measures included three questionnaires adapted for this study and designed to assess use of services (4). Participants completed the Health Services and Justice Services Use (HSJSU) questionnaire at baseline and every 6 months thereafter. The HSJSU documented all non-overnight health and justice-related services. The Residential Time-Line Follow-Back instrument was administered every 3 months and asked participants where they had spent every night since the previous interview. To enable estimation of costs associated with service use, this instrument allowed coding of simultaneous places of residence—for example, if a participant had an apartment and was hospitalized, costs were associated with both places concurrently. Finally, the Vocational Time-Line Follow-back asked about income received month by month and any regular or casual work obtained during the previous 3 months (16). Because of the nature of the intervention and the inclusion of measures on service use and housing, neither participants nor interviewers could be blinded.

Choice of Outcome Measure

Days of stable housing (as assessed by the Residential Time-Line Follow-Back instrument) served as the outcome measure. Places where people stayed were classified as stable (own apartment, social housing, or with one's parents as long as housing could be maintained for ≥ 6 months) or unstable.

Perspective of the Economic Analysis

As discussed in detail elsewhere (15), cost elements were collected and analyzed from the perspective of society (17). We modified this perspective slightly, following Weisbrod et al. (18), in that we included social assistance and disability benefits as costs. This modified societal perspective may be viewed as consistent with a social cost impact analysis (19, 20).

Calculation of Costs per Individual

We calculated many unit costs at a high level of specificity, distinguishing, for example, among supportive housing providers with different staffing levels. Whenever possible, we used financial statements and activity reports to estimate a fully allocated average cost of a service (21). The unit costs that we used and the methods that we used to derive them have been described elsewhere (15).

Unit costs for the intervention were based on reported expenses of each clinical team and housing provider. Program expenses were distributed among participants on the basis of the time that each had been receiving services from his or her clinical team, as estimated by using the HSJSU questionnaire, and on the basis of the number of nights that each had a subsidized apartment or housing unit provided by the project.

All unit costs were originally in 2011 Canadian dollars or adjusted to 2011 dollars. We used the city-specific Consumer Price Index to convert costs into 2016 Canadian dollars (22). We calculated costs per individual by multiplying frequencies by the corresponding unit cost, including the intervention cost for experimental group participants, and adding to that social assistance and other contributions by society to their income and subtracting income earned (15, 23).

Discounting

For each participant, costs as well as days stably housed were estimated over a 2-year period. Costs and days of stable housing in the second year were discounted at a 3% rate, a common rate for a base case analysis (21).

Statistical Analysis

All analyses employed multiple imputation with chained equations (20 imputations) to account for missing data (24). Mean costs per year after randomization, aggregated across sites but grouped into different categories (15), were compared between the Housing First with ACT and treatment-as-usual groups at baseline and over each of the 2 years after baseline. Mean total costs per year were then compared site by site between the Housing First with ACT and treatment-as-usual groups.

Confidence intervals for incremental cost-effectiveness ratios (ICERs) were computed via bootstrapping, with 500 bootstrap resamples (24, 25). We plotted the bootstrap resamples on the cost-effectiveness plane.

We then used the net-benefit approach to describe further the impact of sampling uncertainty (21). The

intervention is deemed cost-effective if $\lambda\mu_{\Delta E} - \mu_{\Delta C} > 0$, where λ is the threshold ratio (in dollars per additional day of stable housing) above which the decision maker no longer finds the intervention cost-effective, $\mu_{\Delta E}$ is the average difference in effectiveness between the two groups, and $\mu_{\Delta C}$ is the average difference in costs. Using the bootstrap resamples, we plotted the cost-effectiveness acceptability curve, showing the estimated probability that the intervention is cost-effective as a function of λ .

We then regressed, using values of λ ranging from \$0 to \$100, each individual's net monetary benefit ($\lambda e_i - c_i$, where λ has the same meaning as above, e_i is the individual's annualized number of days of stable housing during the 2-year follow-up, and c_i is the individual's annualized cost during the same period) on several variables selected a priori as potentially relevant. These variables included group assignment, site, age, sex, presence of psychotic disorder, Multnomah Community Ability Scale score, duration of longest previous episode of homelessness, and number of hospital days in the year prior to study entry. To evaluate how participant characteristics might mediate the cost-effectiveness of Housing First (21, 26) and in the absence of any strong a priori hypotheses about which characteristics might be relevant, we then tested, one by one, interactions between these variables and the group assignment variable. We retained interaction terms with a two-sided $p < 0.1$ for a final model with interactions. Fitted models were checked for misspecification by plotting the residuals against the fitted value of the dependent variable as well as continuous covariates. The Rubin rule was used to derive 95% confidence intervals (CIs) (24). Statistical analyses were performed with Stata, version 15.

Sensitivity analyses

We tested the robustness of the results to the choice of discount rate by using 5% and 0% instead of 3%. We also checked the effects of adjusting for baseline differences in costs, using a regression-based method (27), and performed a two-way sensitivity analysis on these factors.

RESULTS

A total of 950 individuals were originally randomly assigned: males, $N=649$, 68%; females, $N=291$, 31%; and other, $N=10$, 1%; ages 30–49, $N=555$, 58%. Of these 950, a total of 917 (97%) provided useable data for this analysis. (A chart showing participant flow into and through the trial is included in an online supplement to this article.)

Table 1 provides descriptive statistics for the sample at baseline. Participants' longest single period of homelessness was 33.8 ± 50.2 months. Values for other variables not used in this analysis have been reported elsewhere (7).

Table 2 shows costs at baseline and for the first year and second year, by type of cost, for the Housing First and

TABLE 1. Baseline characteristics of participants, by randomization group

Characteristic	Housing First (N=469)		Treatment as usual (N=481)	
	N	%	N	%
Age group				
<30	110	24	109	23
30–49	280	60	275	57
≥50	79	17	97	20
Sex				
Female	143	31	148	31
Male	320	68	329	68
Other	6	1	4	1
Substance abuse or dependence				
Alcohol	213	45	223	46
Drug	286	61	280	58
Alcohol or drug	333	71	359	75
Hospitalization history ^a	238	51	261	54
Arrest history ^b	201	43	203	42
Homelessness				
Longest period (M±SD months)	35.1±53.6		32.6±46.7	
Median period (interquartile range)	16 (6, 36)		13 (6, 36)	
MCAS ^c				
Score (M±SD)	54.5±7.4		54.4±7.2	
Median (interquartile range)	55.0 (50.0–60.0)		55.0 (50.0–60.0)	
Study site				
Moncton	101	22	100	21
Montreal	81	17	82	17
Toronto	97	21	100	21
Winnipeg	100	21	99	21
Vancouver	90	19	100	21

^a Two or more hospitalizations within 1 year at some point during the 5 years before baseline.

^b One or more arrests or incarcerations during the 6 months before baseline.

^c Multnomah Community Ability Scale. Possible scores range from 17 to 85, with higher values indicating better functioning.

treatment-as-usual groups. During the 2-year follow-up period, meaningful cost offsets (mean reductions in costs attributable to the intervention) were observed for shelters (-\$1,943), supportive housing (-\$1,793), ambulatory visits (-\$4,759), and incarcerations (-\$1,485). For other cost categories, the 95% CIs for offsets included zero, or the point estimate was less than \$1,000. Excluding the intervention cost, the total mean cost offset was -\$14,056. However, after including the mean cost of the intervention (\$20,367, calculated from Table 2), the mean total per person cost for Housing First participants exceeded that for treatment-as-usual participants by \$6,311. Thus 69% of the cost of the intervention was offset, reducing its net cost to \$6,311. For most services, as well as in total, the cost difference was less favorable to Housing First in the second year than in the first.

Table 3 disaggregates costs by site rather than by cost category. The magnitude of the mean net cost, including the cost of the intervention, ranged from -\$4,386 in Toronto to \$14,815 in Moncton. Toronto was the only site where the point estimate was negative, indicating that the intervention

resulted in reductions in costs in other categories that exceeded the cost of the intervention itself. All confidence intervals except that for Moncton included 0.

Days with stable housing were higher by 151.30 days (95% CI=137.67–166.86) in the Housing First group, compared with the treatment-as-usual group, with a cost difference of \$6,310.93 (95% CI=\$309.31–\$12,349.65). Thus the ICER was \$41.73 per additional day of stable housing (95% CI=\$1.96–\$83.70).

A figure in the online supplement shows 500 bootstrap replicates of mean incremental cost and the corresponding mean incremental number of days of stable housing. All but a few points fell into the upper right-hand quadrant, with the others in the lower right-hand quadrant, indicating that taking all sites together, the intervention unambiguously increased days stably housed and almost certainly increased costs as well.

The cost-effectiveness acceptability curve shown in Figure 1 indicates that if, for instance, the decision maker is willing to pay up to \$60 per night stably housed, there is a more than 80% chance that Housing First is cost-effective, compared with treatment as usual. If the decision maker is willing to pay up to nearly \$100 per day of stable housing, then the probability that the intervention is cost-effective increases to 100%.

A table in the online supplement shows the results of net benefit regressions that do not include interactions. As the decision maker’s willingness to pay for an additional day of stable housing (represented by λ) rises from 0 to \$100, the adjusted net benefit of receiving Housing First is initially negative (net benefit of -\$6,147 per person per year) but increases quickly, so that at \$100 the net benefit is positive, reaching \$8,975. Adjusted net benefit was lower in Vancouver, Toronto, and Montreal, compared with Moncton, the more so the greater the value assigned to a day of stable housing. The cost of usual services was less in Moncton to begin with (15), so there was less potential to offset costs in that city. Thus the net cost of the intervention per additional day of stable housing was greater in Moncton. Net benefit was also lower for those who had two or more psychiatric hospitalizations in 1 year over the 5 years before baseline, by about \$10,000 regardless of λ; the cost for these individuals was about that much more than for the others, on average, per year over the 2-year follow-up period of the study. Similarly, a longer previous period of homelessness over the person’s lifetime was associated with greater costs. The coefficient indicates an increase of about \$120 per additional month of homelessness. This amount also hardly varied

TABLE 2. Mean (unadjusted) costs (2016 Can\$) per person per year in the two randomization groups, by cost category and time^a

Cost category and time	Treatment as usual (N=454)		Housing First (N=463)		Difference (Housing First–treatment as usual)	
	M	95% CI	M	95% CI	M	95% CI
Shelters						
Baseline	6,412	5,518, 7,287	6,245	5,347, 7,037	–168	–1,363, 980
First year	4,363	3,751, 5,091	1,840	1,502, 2,247	–2,523	–3,373, –1,821
Second year	2,280	1,819, 2,748	917	664, 1,205	–1,364	–1,891, –853
Mean of first and second years	3,322	2,836, 3,853	1,379	1,125, 1,669	–1,943	–2,554, –1,431
Substance use treatment						
Baseline	1,171	644, 1,822	1,476	828, 2,169	305	–659, 1,139
First year	1,794	1,134, 2,681	604	347, 896	–1,190	–2,085, –416
Second year	1,325	843, 1,813	921	530, 1,346	–404	–1,061, 222
Mean of first and second years	1,559	1,108, 2,109	762	505, 1,018	–797	–1,463, –256
Supportive housing^b						
Baseline	2,146	1,536, 2,916	1,506	992, 2,207	–640	–1,494, 224
First year	2,576	1,977, 3,287	608	412, 830	–1,968	–2,690, –1,370
Second year	2,367	1,814, 3,007	750	497, 1,054	–1,617	–2,288, –955
Mean of first and second years	2,472	1,956, 3,053	679	497, 893	–1,793	–2,437, –1,249
Ambulatory visits						
Baseline	14,755	12,499, 17,150	18,585	15,438, 21,618	3,830	52, 7,725
First year	11,480	9,591, 13,683	5,145	4,460, 5,881	–6,335	–8,714, –4,212
Second year	8,081	6,726, 9,847	4,898	4,053, 5,993	–3,182	–5,092, –1,358
Mean of first and second years	9,780	8,437, 11,488	5,021	4,400, 5,649	–4,759	–6,495, –3,233
ED visits						
Baseline	2,834	2,418, 3,275	3,423	2,729, 4,126	590	–220, 1,378
First year	1,850	1,535, 2,298	1,915	1,467, 2,340	65	–581, 578
Second year	1,529	1,230, 1,920	1,789	1,421, 2,163	260	–273, 712
Mean of first and second years	1,689	1,402, 2,105	1,852	1,466, 2,249	162	–419, 600
Hospitalizations (physical)						
Baseline	1,518	474, 2,842	2,300	875, 4,071	782	–1,374, 2,838
First year	2,498	1,403, 3,881	2,292	1,200, 3,667	–205	–2,081, 1,815
Second year	4,268	2,701, 6,269	3,175	1,969, 4,557	–1,093	–3,535, 1,038
Mean of first and second years	3,383	2,228, 4,657	2,734	1,960, 3,841	–649	–2,109, 950
Hospitalizations (psychiatric)						
Baseline	21,491	16,241, 27,280	25,209	19,442, 31,378	3,718	–4,218, 11,669
First year	13,153	9,270, 16,984	11,096	7,929, 14,175	–2,057	–7,028, 3,366
Second year	11,798	8,353, 15,417	7,689	5,173, 10,586	–4,109	–8,762, 360
Mean of first and second years	12,476	8,982, 16,226	9,393	7,086, 11,811	–3,083	–7,216, 1,275
Other (e.g., help lines, day centers)						
Baseline	3,370	2,937, 3,864	3,198	2,681, 3,691	–172	–846, 471
First year	1,593	1,412, 1,808	1,390	1,170, 1,610	–203	–483, 85
Second year	1,066	909, 1,242	999	813, 1,178	–67	–313, 174
Mean of first and second years	1,329	1,185, 1,483	1,194	1,009, 1,359	–135	–350, 89
Police						
Baseline	12,811	10,920, 15,123	11,077	9,220, 13,032	–1,734	–4,834, 1,246
First year	9,003	7,372, 10,938	7,968	6,530, 9,409	–1,035	–3,561, 1,245
Second year	6,779	5,638, 8,119	6,534	5,301, 7,937	–245	–1,976, 1,566
Mean of first and second years	7,891	6,667, 9,201	7,251	6,096, 8,478	–640	–2,411, 1,117

continued

TABLE 2, continued

Cost category and time	Treatment as usual (N=454)		Housing First (N=463)		Difference (Housing First-treatment as usual)	
	M	95% CI	M	95% CI	M	95% CI
Incarcerations						
Baseline	3,737	2,641, 5,021	3,422	2,305, 4,499	-315	-1,954, 1,349
First year	4,256	3,105, 5,390	2,948	1,971, 3,942	-1,308	-3,001, 257
Second year	4,747	3,487, 6,123	3,084	2,185, 4,085	-1,663	-3,309, -28
Mean of first and second years	4,501	3,423, 5,555	3,016	2,125, 3,851	-1,485	-3,001, -73
Welfare and disability benefits						
Baseline	2,651	2,505, 2,826	2,931	2,766, 3,106	279	36, 531
First year	8,244	7,908, 8,625	8,954	8,574, 9,321	711	159, 1,235
Second year	9,023	8,688, 9,369	9,652	9,281, 10,026	629	117, 1,110
Mean of first and second years	8,633	8,325, 8,965	9,303	8,948, 9,641	670	190, 1,119
Income earned						
Baseline	280	178, 385	121	76, 180	-159	-278, -34
First year	903	613, 1,266	428	306, 584	-474	-858, -159
Second year	1,001	732, 1,322	682	455, 913	-319	-716, 36
Mean of first and second years	952	677, 1,277	555	400-733	-397	-776, -105
Total excluding intervention cost						
Baseline	71,738	65,179, 78,101	78,144	71,198, 85,620	6,406	-2,831, 16,234
First year	59,906	54,486, 65,263	44,332	40,338, 47,822	-15,575	-21,716, -9,225
Second year	52,262	47,354, 57,285	39,725	35,903, 43,701	-12,537	-18,849, -6,396
Mean of first and second years	56,084	51,501, 60,828	42,028	38,750, 45,141	-14,056	-19,823, -8,991
Total including intervention cost						
First year	59,906	54,486, 65,263	65,988	61,727, 69,968	6,081	-592, 12,710
Second year	52,262	47,354, 57,285	58,802	54,073, 63,415	6,540	-467, 12,904
Mean of first and second years	56,084	51,501, 60,828	62,395	58,843, 65,897	6,311	309, 12,350

^a Usable data for 917 of the 950 participants were available for analysis. For days of stable housing, 27 elements (one per month and three before the baseline interview) were included. Missing rates (addressed by using multiple imputation) were 18% for the treatment-as-usual group and 14% for the Housing First group. For costs, 279 elements were included; missing rates were 16% and 13%, respectively.

^b Includes both rooms in buildings with on-site support staff and, notably for Toronto, subsidized rooms in buildings without on-site support staff.

according to λ . Neither age, sex, nor alcohol and drug abuse or dependence were associated with net benefit, regardless of λ , after adjustment for site and the other factors.

Table 4 shows the results of adding interactions between group assignment and the variables selected by using the procedure described above. The results suggest that Housing First may have been more cost-effective in Toronto, the only site where the intervention actually reduced overall costs. The results also suggest that the intervention may have been more cost-effective for people ages 30–49 than for younger participants. None of the other interaction terms meaningfully altered cost-effectiveness at any value of λ .

Sensitivity analyses (shown in a table in the online supplement) indicated that our results were robust to changes in the discount rate and only somewhat sensitive to the adjustment for baseline differences, or a combination of both. Changes in the discount rate had a minimal effect. Adjusting for baseline differences decreased the ICER from \$41.73 to \$33.86. The largest change was obtained by adjusting for

baseline differences, without altering the discount rate: the ICER became \$33.85 (95% CI=cost-saving, \$68.42).

DISCUSSION

Across five Canadian sites, 69% of the cost of scattered-site Housing First with ACT for persons with severe mental illness and high needs (\$20,367 per person per year) was offset by cost reductions. Net program cost was \$6,311 per person per year. An additional day of stable housing cost about \$41.73. Cost-effectiveness seemed to be about the same regardless of participant characteristics, although it may have been higher for participants ages 30–49 than for those who were younger.

In previous reports of the At Home/Chez Soi study, the intervention cost was reported as Can\$22,257 per participant annually (in 2011 dollars), and the mean net cost offset was 96% of the cost of the intervention (7, 10). The numerical estimates presented herein differ from the earlier ones for several reasons. Most important, we did not adjust here for baseline differences in costs (27), whereas the earlier

TABLE 3. Total (unadjusted) annualized costs (2016 Can\$) per person in the two randomization groups, by site^a

Cost category and site	Treatment as usual (N=454)		Housing First (N=453)		Difference (Housing First—treatment as usual)	
	M	95% CI	M	95% CI	M	95% CI
Cost of ACT team ^b						
Moncton			7,205	5,954, 8,797	—	—
Montreal	—	—	16,261	13,739, 19,241	—	—
Toronto	—	—	13,066	10,581, 15,417	—	—
Winnipeg	—	—	12,620	9,592, 15,886	—	—
Vancouver	—	—	15,613	13,506, 18,375	—	—
Cost of housing team and rent supplements						
Moncton			9,603	9,149, 10,111	—	—
Montreal	—	—	5,565	4,839, 6,196	—	—
Toronto	—	—	8,475	7,712, 9,221	—	—
Winnipeg	—	—	4,937	4,355, 5,446	—	—
Vancouver	—	—	9,274	8,571, 9,890	—	—
Total cost without intervention						
Moncton	29,566	24,993, 34,258	27,573	21,184, 35,632	-1,993	-10,572, 7,107
Montreal	70,258	59,501, 80,567	49,857	43,625, 56,715	-20,401	-32,669, -7,594
Toronto	76,960	64,376, 91,223	51,034	43,040, 58,835	-25,926	-41,936, -11,896
Winnipeg	47,947	40,769, 54,586	40,210	35,215, 45,329	-7,737	-16,761, 1,154
Vancouver	59,272	48,895, 70,416	43,738	37,065, 51,032	-15,534	-28,201, -3,463
Total cost including intervention						
Moncton	29,566	25,117, 34,371	44,381	37,542, 51,165	14,815	6,577, 23,074
Montreal	70,258	60,757, 80,724	71,682	65,488, 77,855	1,424	-10,509, 13,195
Toronto	76,960	65,404, 90,379	72,574	63,420, 82,072	-4,386	-22,357, 9,243
Winnipeg	47,947	41,003, 57,103	57,766	51,512, 65,505	9,820	-460, 20,763
Vancouver	59,272	48,814, 69,954	68,625	61,217, 77,118	9,353	-4,815, 21,993

^a Usable data for 917 of the 950 participants were available for analysis.

^b ACT, assertive community treatment.

reports used a relatively simple difference-in-differences method, applied to mean costs per person per site. Second, we allocated the cost of the intervention to individual study participants. Third, we refined several unit cost calculations, compared with the earlier report.

The cost-effectiveness analysis of Housing First with intensive case management from At Home/Chez Soi reported

that the intervention cost \$14,496 per participant per year, or about 71% of the cost of Housing First with ACT (9). Despite the higher cost of Housing First with ACT, the cost per additional day of stable housing in this study was \$41.73, instead of \$56.08 for Housing First with intensive case management (26% less). In part, this is probably a result of the intervention's—Housing First with intensive case management—being no more effective: the mean annual increase in days of stable housing was 140.34 for Housing First with intensive case management, compared with 151.30 days for Housing First with ACT. The reason for the greater cost-effectiveness of Housing First with ACT was mainly the large cost offset of \$14,056 per person per year, compared with \$6,629 for Housing First with intensive case management. Baseline costs among high-need participants were about 50% higher, compared with costs for those with moderate needs: \$74,910 versus \$50,708 (9). This provided greater opportunity to achieve large cost offsets. Indeed, in each of the four cities where both Housing First with ACT and Housing First with intensive case management were tested, the cost offset was greater with the former than with the latter. Further research is needed to determine the ideal mix between the two, considering, on one hand, the higher need of high-need participants but, on the other, the possibility that offering Housing First with intensive case

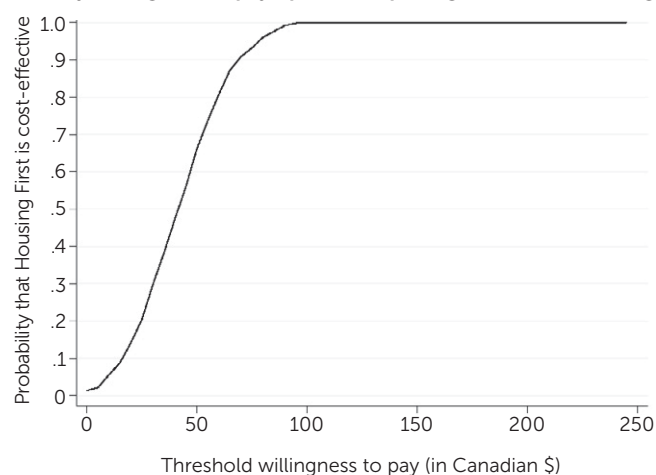
FIGURE 1. Cost-effectiveness acceptability curve for Housing First, by willingness to pay up to \$250 per night of stable housing

TABLE 4. Net benefit regression results for the Housing First intervention for various values assigned to an additional day of stable housing, with interaction terms^a

Variable	$\lambda^b = \$0$		$\lambda^b = \$20$		$\lambda^b = \$40$	
	M	95% CI	M	95% CI	M	95% CI
Housing First	-24,882	-42,142, -7,621	-21,994	-39,457, -4,530	-19,106	-36,807, -1,404
Montreal ^c	-35,023	-49,217, -20,828	-36,087	-50,444, -21,731	-37,152	-51,700, -22,604
Toronto ^c	-38,745	-53,112, -24,378	-39,445	-53,977, -24,913	-40,145	-54,870, -25,419
Winnipeg ^c	-15,066	-28,386, -1,745	-15,894	-29,352, -2,435	-16,721	-30,344, -3,098
Vancouver ^c	-20,034	-34,090, -5,978	-21,061	-35,282, -6,840	-22,088	-36,504, -7,672
Ages 30–49 ^d	-9,010	-19,241, 1,221	-8,911	-19,254, 1,433	-8,811	-19,287, 1,664
Ages ≥50 ^d	3,785	-9,676, 17,246	4,098	-9,511, 17,707	4,411	-9,372, 18,194
Female	-3,278	-9,851, 3,295	-2,970	-9,609, 3,668	-2,663	-9,380, 4,054
Alcohol or drug abuse or dependence ^e	-2,913	-10,123, 4,296	-2,968	-10,262, 4,326	-3,023	-10,415, 4,370
MCAS score ^f	3,313	-1,354, 7,980	3,657	-1,066, 8,379	4,000	-786, 8,786
Hospitalization history ^g	-13,840	-23,075, -4,606	-13,615	-22,954, -4,276	-13,390	-22,851, -3,929
Arrest history ^h	-4,983	-11,111, 1,145	-5,396	-11,592, 800	-5,810	-12,086, 467
Longest period homeless ⁱ	-108	-171, -45	-110	-174, -46	-112	-176, -47
Interaction terms						
Montreal × Housing First	12,542	-7,152, 32,236	12,084	-7,823, 31,991	11,626	-8,529, 31,781
Toronto × Housing First	19,223	-31, 38,477	19,343	-114, 38,800	19,463	-233, 39,159
Winnipeg × Housing First	5,740	-12,217, 23,698	4,744	-13,409, 22,897	3,747	-14,636, 22,130
Vancouver × Housing First	400	-18,649, 19,449	744	-18,519, 20,008	1,089	-18,427, 20,605
Ages 30–49 × Housing First	13,160	-1,136, 27,457	13,480	-976, 27,935	13,800	-843, 28,442
Ages ≥50 × Housing First	3,218	-15,613, 22,050	3,413	-15,632, 22,458	3,607	-15,687, 22,901
Hospitalized × Housing First	5,855	-6,938, 18,647	6,063	-6,875, 19,002	6,272	-6,837, 19,381
Constant	-32,735	-64,498, -971	-31,942	-64,073, 189	-31,150	-63,710, 1,410

Variable	$\lambda^b = \$60$		$\lambda^b = \$80$		$\lambda^b = \$100$	
	M	95% CI	M	95% CI	M	95% CI
Housing First intervention	-16,217	-34,189, 1,754	-13,329	-31,603, 4,944	-10,441	-29,047, 8,164
Montreal ^c	-38,217	-52,983, -23,451	-39,281	-54,292, -24,271	-40,346	-55,626, -25,066
Toronto ^c	-40,845	-55,791, -25,899	-41,545	-56,738, -26,352	-42,245	-57,711, -26,780
Winnipeg ^c	-17,549	-31,362, -3,736	-18,377	-32,403, -4,350	-19,204	-33,468, -4,941
Vancouver ^c	-23,115	-37,756, -8,475	-24,142	-39,036, -9,249	-25,170	-40,343, -9,997
Ages 30–49 ^d	-8,712	-19,339, 1,914	-8,613	-19,409, 2,183	-8,513	-19,497, 2,470
Ages ≥50 ^d	4,724	-9,257, 18,705	5,037	-9,165, 19,240	5,350	-9,096, 19,796
Female	-2,355	-9,163, 4,452	-2,048	-8,958, 4,863	-1,740	-8,764, 5,284
Alcohol or drug abuse or dependence ^e	-3,077	-10,581, 4,427	-3,132	-10,759, 4,495	-3,186	-10,948, 4,575
MCAS score ^f	4,344	-514, 9,202	4,688	-249, 9,624	5,031	8, 10,054
Hospitalization history ^g	-13,165	-22,765, -3,566	-12,940	-22,694, -3,186	-12,715	-22,639, -2,791
Arrest history ^h	-6,223	-12,591, 145	-6,637	-13,107, -166	-7,050	-13,634, -467
Longest period homeless ⁱ	-113	-179, -48	-115	-181, -49	-117	-184, -50
Interaction terms						
Montreal × Housing First	11,168	-9,271, 31,607	10,710	-10,045, 31,465	10,252	-10,851, 31,355
Toronto × Housing First	19,583	-386, 39,552	19,703	-574, 39,980	19,823	-793, 40,439
Winnipeg × Housing First	2,750	-15,897, 21,397	1,754	-17,189, 20,696	757	-18,511, 20,025
Vancouver × Housing First	1,433	-18,372, 21,239	1,778	-18,351, 21,907	2,123	-18,364, 22,609
Ages 30–49 × Housing First	14,119	-737, 28,976	14,439	-657, 29,535	14,759	-602, 30,120
Ages ≥50 × Housing First	3,801	-15,776, 23,378	3,995	-15,898, 23,888	4,190	-16,050, 24,430
Hospitalized × Housing First	6,481	-6,821, 19,783	6,690	-6,828, 20,208	6,899	-6,856, 20,653
Constant	-30,358	-63,405, 2,690	-29,566	-63,157, 4,026	-28,773	-62,962, 5,416

^a Usable data for 917 of the 950 participants were available for analysis. Models estimated with net monetary benefit not adjusted for baseline differences in costs. Dependent variable is $(d_i \cdot \lambda) - c_i$, where λ is the threshold ratio (in Canadian dollars per additional day of stable housing), d_i is participant i 's annualized number of days of stable housing, and c_i is the corresponding total cost.

^b Decision maker's willingness to pay for an additional day of stable housing.

^c Reference, Moncton site.

^d Reference, age <30.

^e Reference, no alcohol or drug abuse or dependence.

^f Multnomah Community Ability Scale. Coefficients indicate partial association with a 10-point increase in MCAS score.

^g Two or more hospitalizations for mental illness during a 1-year period during the 5 years before baseline.

^h One or more arrests or incarcerations in the 6 months before baseline.

ⁱ During lifetime, in months.

management to moderate-need participants may prevent the conditions of some from deteriorating to the point of their needing more intensive services.

The magnitude of the cost offsets exceeded that of the cost of the intervention in one city—Toronto. This may well have been the result of chance, given that the 95% CI for the difference in costs included 0. To the extent that cost offsets were actually greater in Toronto, this may be due to the fact that the usual costs of shelters and ambulatory visits were all especially high in that city (15); the intervention substituted directly for these costs. The costs of contacts with the police were also unusually high in Toronto, but as shown in Table 2, we found no evidence that Housing First resulted in a significant reduction in police costs.

The results of this study may appear disappointing in that the intervention did not generate cost offsets greater than its own cost, except in Toronto—in other words, it did not “pay for itself.” This is consistent with the results of a recent literature review, which found that randomized trials, which are not subject to bias caused by regression to the mean, are much less likely to report net cost savings from Housing First, compared with studies following a before-and-after design (3).

The fact that Housing First with ACT did not prove both more effective and less costly does not mean that it should not be implemented. Most health and social interventions do not pay for themselves. Rather, they yield benefits judged sufficient to merit their cost. The cost of the intervention itself, which was about \$56 per participant per day in the program, is well within the range of the costs of many currently funded forms of emergency shelter and supportive housing with on-site supports (15). Moreover, these forms of shelter do not provide the kind of individualized and intensive support that ACT does.

In this trial, careful attention was paid to implementation fidelity, with the New York City Pathways model serving as reference (28). Fidelity was rated as fair to excellent across sites (14). Other work has reported an association between higher fidelity and improvements in housing stability, quality of life, and community functioning (29), as well as other positive outcomes (30, 31). Not all Housing First implementations are as careful to follow the Pathways model as were those of the At Home/Chez Soi trial; for instance, caseloads may be increased or rent supplements reduced. Although such changes may reduce the cost of the intervention, the magnitude of the cost offsets observed here may not remain the same. It is also possible that the intervention could be rendered most cost-effective by either adjusting the clinical supports or the amount of the rent supplement, or both (32). Further research is needed to address this issue.

Strengths of this study included a carefully defined and implemented intervention, a large and well-defined sample, multiple trial sites, and high retention rates, with low differential attrition. Service use was measured in a more comprehensive way than is typical in cost-effectiveness studies. Unit costs were carefully estimated.

Limitations included a reliance on participant self-reports. Although these are subject to recall biases, the most costly components of costs were gathered at 3-month intervals, increasing their validity (33). The validity of self-reports in the At Home/Chez Soi study has also been corroborated directly (34, 35). The At Home/Chez Soi trial considered any form of housing where a participant could remain 6 months or more as stable housing. This allowed certain forms of transitional housing that participants especially in the treatment-as-usual group accessed to be counted as stable housing. Had a stricter criterion for stable housing been applied, cost-effectiveness would have been even greater. The cost of medications was not included, because of the difficulty of obtaining this information by questionnaire and restrictions on sharing of participant-level administrative data across provinces. Given that ACT teams typically seek to increase adherence to medications, having included medications in the analysis would likely have increased the cost per day of stable housing. Still, even a 15% increase in the cost of the intervention—about \$3,000 per participant per year—would not change the results materially.

The follow-up period was 2 years, and we do not know how cost-effectiveness may change over a longer period. The use of days of stable housing as an outcome measure did not allow comparison of cost-effectiveness with that of other health care interventions; however, as argued elsewhere (9), Housing First is a social care as well as a health care intervention, and thus evaluation of its effectiveness by using quality-adjusted life years would be inappropriate. The study was not designed to test which of the rent supplement or the clinical supports most contributed to cost-effectiveness, as has been done previously (32). Further research is needed to address this issue. Furthermore, our study did not try to capture costs with a more subjective value, such as the empathic distress that many individuals experience when they see people living on the street. Had it done so, the cost-effectiveness of Housing First would likely have increased. Finally, we did not take into account the administrative costs of transfer payments (17); however, because most participants in both groups received social assistance payments, doing so would have had little impact.

CONCLUSIONS

In this multisite trial of Housing First, reductions in the costs of several services offset about two-thirds of the cost of a Housing First intervention. The cost of the intervention per person and the net cost were modest in relation to current expenditures on individuals who are homeless. Furthermore, we found no evidence that cost-effectiveness varied according to participant characteristics, with the possible exception of age. Comparing our results with those from a similar analysis of homeless individuals with moderate needs who were served by an intensive case management team (9), cost offsets were greater for high-need participants,

and the net cost per additional day stably housed was similar. The optimal mix between the two interventions remains to be determined and needs to consider both the higher need of high-need individuals and the risk that without help the conditions of moderate-need individuals may deteriorate and these individuals may themselves become high need.

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