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Health Care and Public Service Use and Costs Before and After Provision of Housing for Chronically Homeless Persons With Severe Alcohol Problems

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Context Chronically homeless individuals with severe alcohol problems often have multiple medical and psychiatric problems and use costly health and criminal justice services at high rates.

Objective To evaluate association of a "Housing First" intervention for chronically homeless individuals with severe alcohol problems with health care use and costs.

Design, Setting, and Participants Quasi-experimental design comparing 95 housed participants (with drinking permitted) with 39 wait-list control participants enrolled between November 2005 and March 2007 in Seattle, Washington.

Main Outcome Measures Use and cost of services (jail bookings, days incarcerated, shelter and sobering center use, hospital-based medical services, publicly funded alcohol and drug detoxification and treatment, emergency medical services, and Medicaid-funded services) for Housing First participants relative to wait-list controls.

Results Housing First participants had total costs of $8 175 922 in the year prior to the study, or median costs of $4066 per person per month (interquartile range [IQR], $2067-$8264). Median monthly costs decreased to $1492 (IQR, $337-$5709) and $958 (IQR, $98-$3200) after 6 and 12 months in housing, respectively. Poisson generalized estimating equation regressions using propensity score adjustments showed total cost rate reduction of 53% for housed participants relative to wait-list controls (rate ratio, 0.47; 95% confidence interval, 0.25-0.88) over the first 6 months. Total cost offsets for Housing First participants relative to controls averaged $2449 per person per month after accounting for housing program costs.

Conclusions In this population of chronically homeless individuals with high service use and costs, a Housing First program was associated with a relative decrease in costs after 6 months. These benefits increased to the extent that participants were retained in housing longer.

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CONCERNS ABOUT HIGH PUBLIC system costs incurred by chronically homeless individuals have inspired nationwide efforts to eliminate chronic homelessness.[1,2] Homeless people have high barriers to health care access generally but use acute care services at high rates.[3-5] Mortality rates among homeless adults are 3 or more times that of the general population.[6,7]

Chronically homeless people with severe alcohol problems, sometimes referred to as chronic public inebriates, are highly visible on the streets and are costly to the public through high use of publicly funded health and criminal justice systems resources.[8-12] Typical interventions such as shelters, abstinence-based housing, and treatment programs fail to reverse these patterns for this population.[10,13] Health conditions and mortality rates within this population are similar to those found in developing countries.[14,15] Average age at death is estimated to be 42 to 52 years, with 30% to 70% of deaths related to alcohol.[7,16,17]

The provision of housing reduces hospital visits, admissions, and duration of hospital stays among homeless individuals,[5,18,19] and overall public system spending is reduced by nearly as much as is spent on housing.[19] One type

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of supportive housing, called Housing First, removes the requirements for sobriety, treatment attendance, and other barriers to housing entrance.[20] Thus far, Housing First (HF) approaches have primarily targeted homeless people with serious mental illnesses and co-occurring substance use disorders.[20,21]

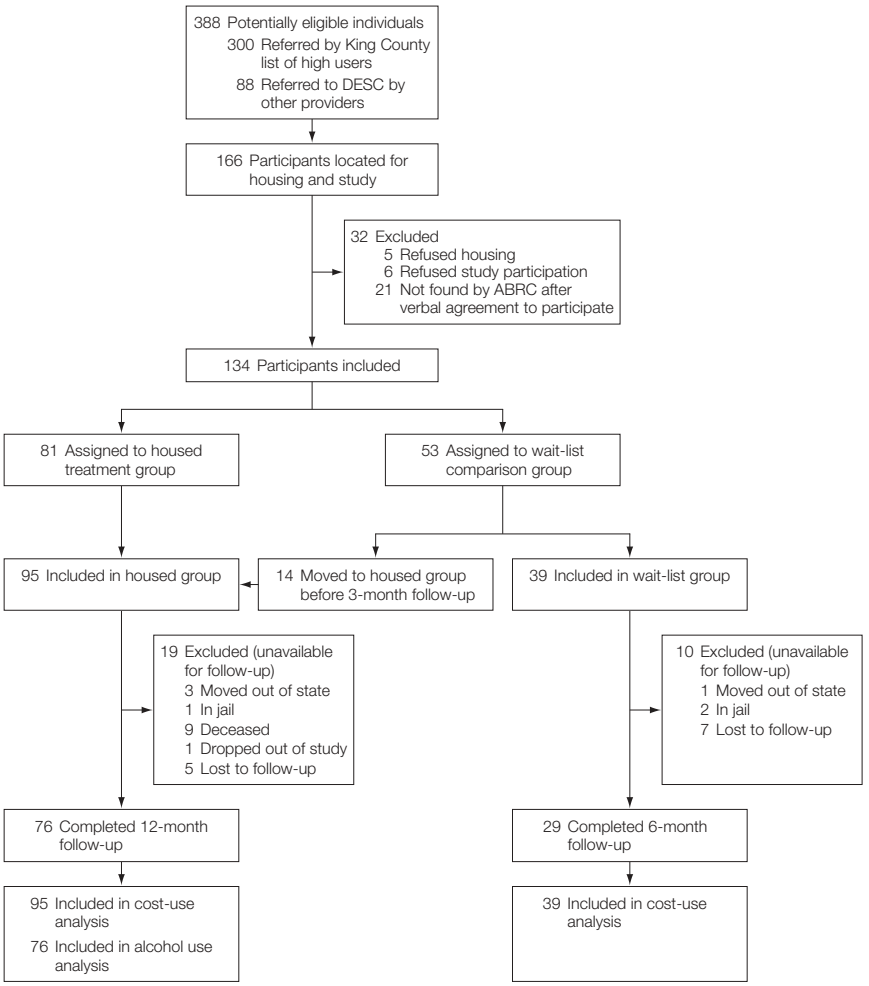
An HF program in Seattle—known as 1811 Eastlake—targets homeless adults with severe alcohol problems who use local crisis services at the highest levels. The project has been controversial because residents are allowed to drink in their rooms. The current study evaluated outcomes of the project on public use and costs for housed participants compared with wait-list controls and secondarily evaluated changes in reported alcohol use for housed participants and the effects of housing duration on service use.

METHODS

Participants and Recruitment Procedures

Participants were drawn from a rank-ordered list of chronically homeless individuals who incurred the highest total costs in 2004 for use of alcohol-related hospital emergency services, the sobering center, and King County jail. Community providers familiar with the population also recommended additional eligible individuals. Because it was considered unethical not to offer housing when available, random assignment to condition was not used. Rather, housing program staff offered housing to each person found from the list on a "first found, first assigned" basis. Once the housing was filled, additional participants were added to a wait-list. Verbal consent for research recruitment was gathered at initial contact, and written consent was obtained at the baseline interview. Eighty-one individuals were offered immediate housing and 14 individuals from the wait-list were housed prior to their 3-month assessment (mean, 44 days). These 95 participants were considered the treated group and compared with wait-list participants (n = 39). Recruitment occurred between November 2005 and March 2007 (FIGURE 1). Because intervention participants were recruited first, data on wait-list controls were only available to 6 months whereas 12-month data were available for housed participants.

Figure 1. Participant Flow Diagram



Individuals were drawn from a list provided by secondary data sources and offered housing on a "first found, first assigned" basis. After 166 participants were located and enrolled in housing or placed on a wait-list, outreach employees discontinued searching for the remaining homeless individuals. DESC indicates Downtown Emergency Service Center; ABRC, Addictive Behaviors Research Center (University of Washington).

Procedure

Residents at 1811 Eastlake have no treatment requirements, but on-site case managers work to engage residents about substance use and life goals. Meals and on-site health care services are also offered. Per-person costs for the housing and services average $1120 per month.

Participants received $5 for attending the study introduction and $20 for each interview. Participants were interviewed at baseline and at 3, 6, 9, and 12 months after enrollment. Institutional review board approval was obtained from the University of Washington and King County Mental Health Chemical Abuse and Dependency Services Division (MHCADSD).

Use Measures

We collected administrative data from the MHCADSD, Washington Depart-

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ment of Social and Health Services, Harborview Medical Center (HMC), King County Correctional Facility, Public Health–Seattle & King County, and Downtown Emergency Service Center. With participants' written consent, specific itemized data were obtained, including days in jail and number of jail bookings; sobering center visits; HMC emergency department, inpatient, and outpatient contacts (date of service, length of stay for inpatient services, and billing amounts); emergency medical services (EMS) calls and transports; use of the Downtown Emergency Service Center shelter; and publicly funded medical detoxification and inpatient drug/alcohol treatment.

We also obtained claims submitted to Medicaid, which were examined for duplication with claims from other medical agencies. Only nonduplicated charges are reported. Medicaid and HMC data were actual billing amounts. Some services maintained data based on type and number of contacts or visits and not based on cost. In these cases, an estimate of the value of those services was provided by the reporting agencies (TABLE 1). The housing cost for individuals in the program was calculated by dividing the sum of all on-site operating (eg, maintenance, utilities, insurance, etc) and services costs by the capacity of the project (75 people housed at 1 time).

Self-report Measures

Self-reported demographic data included age, race/ethnicity, educational level, and marital status. Descriptive information included lifetime episodes of alcohol treatment from the Addiction Severity Index[22] as well as a detailed history of homelessness. A self-report medical health history form assessed chronic and acute illnesses. These data were used to describe the sample and assess comparability of housed with wait-list participants.

Alcohol use (lifetime use and frequency of drinking to intoxication) was assessed using items from the Current Substance Use Assessment of the Addiction Severity Index.[22] A modified version of the form 90-R (based on the Timeline Follow-back[23]) was used to calculate total number of standard drinks per day in the past 30 days.

Statistical Analysis

The present study is quasi-experimental[24] or observational[25] because it lacks random assignment, which can lead to imbalances between treatment groups. We used propensity scores to balance treatment groups on important covariates and strengthen causal inferences.

The primary outcomes are costs or contacts with public services per month, based on use indicators described here. A Poisson generalized estimating equation (GEE)[26] approach with a natural logarithm link function was the primary analytic method, and an offset term of the natural logarithm of months was included to control for varying exposure rates in some analyses. The GEE Poisson model provided a good fit to the marginal distribution of costs and thus was also used for cost data, rounded to the nearest dollar. The Poisson model can be shown to be a multiplicative model, so the exponentiated coefficients (ie, e^B) can be interpreted as relative rates (RRs) or percentage increases or decreases associated with the covariate. An RR of 1 would indicate no association; 95% confidence intervals (CIs) for RRs that include 1 indicate lack of statistical significance at $P < .05$.

There were no known missing data for use and costs. If a service was used, it was included in the archival data provided to researchers. All participants provided consent to access records throughout the study. Use of services outside the catchment area is unknown; however, there is no evidence that individuals in either condition ceased using all services during the follow-up period (which would suggest they had moved outside the catchment area).

In addition to descriptive analyses of use and cost data for HF and control participants, the primary analyses focused on HF vs control differences at 6 months. Secondary analyses focused on length of time in housing as a predictor of outcomes for all participants in 1811 Eastlake at some point in the study and changes in alcohol use for treated participants.

Table 1. Average Unit Costs for Services That Did Not Track Costs by Individual Use

Service	Cost, $	Per Unit
Sobering center	142.50	Day
Detoxification	148.59	Day
Jail	197.23	Booking
Jail	103.17	Day
EMS	714.00	Basic Life Support response
EMS	776.00	Advanced Life Support response
EMS	601.00	Transport to hospital
Shelter	23.71	Bed night

Abbreviation: EMS, emergency medical services.

For between-group analyses, we used propensity scores to balance treatment groups on important covariates.[25,27] Characteristics that are imbalanced across treatment conditions are often entered as covariates, and propensity scores provide a unified approach to treatment imbalance that is appropriate for observational data.[25] A logistic regression model was constructed with treatment condition as the outcome and prior 3 years of all outcomes as predictors, along with demographic variables, alcohol and drug use, and mental health problems. Predicted probabilities of being in the intervention group (propensity scores) were estimated for each individual, which provide a summary of the covariate imbalance across groups. The distributions of propensity scores across the 2 groups were notably different, with some regions of nonoverlap in the tails. We considered the issue of nonoverlap, regression to the mean, and participant death in sensitivity analyses for our primary analyses.

Death can strongly impact cost data in opposing directions, dependent on when the participant dies.[28] A participant who dies shortly after study entry may use few resources, whereas one who is sick for a longer period and then dies during the study may have very

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high cost data. The key issue is whether participant deaths bias observed results, particularly change over time for the treated group. Poisson GEE regressions were run using participant death as a covariate.

Power analyses showed that power of 0.80 could be achieved to detect a standardized mean difference of 0.30 with 60 housed participants and 40 wait-list control participants. Analyses were conducted using R version 2.7.0 (R Foundation for Statistical Computing, Vienna, Austria). All reported *P* values are 2-tailed; significance was set at $P < .05$.

RESULTS

Descriptive Statistics

TABLE 2 presents baseline sample demographics. Participants were predominantly male (94%) with a mean age of 48 years. The sample was ethnically diverse, with 39% identifying as white and 28% as American

Table 2. Baseline Descriptive Statistics for the Full Sample and by Treatment Group[a]

	Full Sample (n = 134)	Treatment Group (n = 95)	Control Group (n = 39)	*P* Value for Tests of Between-Group Differences[b]
Male, No. (%)	126 (94)	89 (94)	37 (95)	.79[c]
Age, mean (SD), y	48 (10)	48 (9)	48 (11)	.68[d]
Ethnicity, No. (%)				
White	52 (39)	38 (40)	14 (36)	.65[c]
American Indian/Alaska Native	38 (28)	26 (27)	12 (31)	
African American	13 (10)	7 (7)	6 (15)	
Hispanic or Latino American	8 (6)	7 (7)	1 (3)	
Native Hawaiian or other Pacific Islander	3 (2)	3 (3)	0	
Asian American	1 (1)	1 (1)	0	
More than 1 ethnic group	14 (10)	10 (11)	4 (10)	
Other	5 (4)	3 (3)	2 (5)	
Marital status, No. (%)				
Legally married or considered oneself married	5 (4)	3 (3)	2 (5)	.94[c]
Widowed	6 (5)	4 (4)	2 (5)	
Divorced or separated	55 (41)	39 (41)	16 (41)	
Never married	68 (51)	49 (52)	19 (49)	
Educational status, No. (%)				
Less than high school graduate or GED	44 (33)	35 (37)	9 (23)	.24[c]
Completed GED	15 (11)	9 (10)	6 (15)	
High school graduate	25 (19)	19 (20)	6 (15)	
Some vocational school	11 (8)	8 (8)	3 (8)	
Some college	31 (23)	17 (18)	14 (36)	
College graduate	6 (5)	5 (5)	1 (3)	
Some graduate school or advanced degree	2 (2)	2 (2)	0	
Serious medical problems in lifetime, No. (%)				
Hepatitis	54 (40)	38 (40)	16 (41)	.97[c]
Tuberculosis	24 (18)	19 (20)	5 (13)	.32[c]
Emphysema	10 (8)	8 (8)	2 (5)	.55[c]
Diabetes	10 (8)	7 (7)	3 (8)	.88[c]
Age first became homeless, mean (SD), y	31 (12)	30 (12)	32 (12)	.39[d]
Stable housing periods since first became homeless, mean (SD), No.	2 (3)	3 (.32)	2 (2)	.78[d]
Most common places to spend the night over past 3 y, No. (%)[e]				
On the street, under a bridge or freeway, in an abandoned car, or in a park	112 (84)	78 (82)	34 (87)	.55[c]
Sobering center	112 (84)	77 (81)	35 (90)	.26[c]
Hospital	100 (75)	72 (76)	28 (72)	.56[c]
Shelter	87 (65)	63 (66)	24 (62)	.55[c]
Motel or hotel	86 (64)	62 (65)	24 (62)	.15[c]
Times treated for alcohol abuse in lifetime, mean (SD), No.	16 (55)	17 (59)	14 (43)	.75[d]

Abbreviation: GED, general equivalency diploma.
[a] Percentages may not sum to 100 because of rounding.
[b] Differences by treatment group (treatment vs control) were examined. There were no significant differences between the 2 groups at baseline.
[c] χ^2 Test.
[d] *t* Test.
[e] All prior to living at 1811 Eastlake.

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Table 3. Medians and Interquartile Ranges for All Use Data on a per-Person per-Month Basis

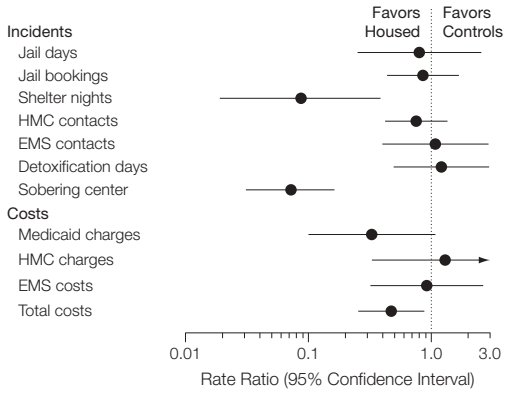
	Median (Interquartile Range)				
	1 Year Prior to Housing		6 Months After Intervention		12 Months After Intervention, Housed[a]
	Housed	Wait-List	Housed	Wait-List	
Contacts/incidents, No.					
Jail days	0.5 (0.2-2.5)	0.6 (0.3-2.3)	0.0 (0.0-1.8)	0.4 (0.0-1.5)	0.0 (0.0-0.3)
Jail bookings	0.2 (0.1-0.3)	0.2 (0.1-0.4)	0.0 (0.0-0.3)	0.2 (0.0-0.3)	0.0 (0.0-0.2)
Shelter nights	0.5 (0.1-3.5)	0.4 (0.1-1.2)	0.0 (0.0-0.0)	0.1 (0.0-0.4)	0.0 (0.0-0.0)
HMC[b]	0.9 (0.3-1.8)	0.7 (0.4-1.3)	0.7 (0.2-1.3)	0.3 (0.0-1.2)	0.3 (0.0-1.2)
EMS	0.4 (0.2-1.4)	0.4 (0.2-1.0)	0.5 (0.0-1.3)	0.3 (0.0-0.9)	0.2 (0.0-0.5)
Detoxification center[b]	0.0 (0.0-0.1)	0.1 (0.0-0.2)	0.0 (0.0-0.2)	0.0 (0.0-0.3)	0.0 (0.0-0.2)
Sobering center	6.1 (1.4-11.7)	4.0 (2.1-6.8)	0.0 (0.0-0.2)	2.1 (0.2-5.5)	0.0 (0.0-0.2)
Costs/charges, $					
Medicaid[b]	612 (31-4493)	345 (0-3173)	204 (0-2356)	107 (0-1965)	122 (0-1625)
HMC	139 (0-855)	743 (0-1616)	0 (0-271)	0 (0-921)	0 (0-117)
EMS	505 (157-1676)	553 (124-1253)	512 (0-1462)	438 (0-1116)	219 (0-460)
Total cost, $[b]	4066 (2067-8264)	3318 (1641-5029)	1492 (337-5709)	1932 (542-6217)	958 (98-3200)

Abbreviations: EMS, emergency medical services; HMC, Harborview Medical Center.
[a] Because intervention participants were recruited first, data for wait-list controls were only available to 6 months.
[b] Significantly different at baseline for the 2 groups.

Indian/Alaska Native. As noted in Table 2, participants reported high rates of acute and chronic medical illness, a mean of 16 alcohol treatment episodes, and minimal periods of stable housing during nearly 2 decades of homelessness.

TABLE 3 contains medians and interquartile ranges for all primary outcomes, in units per month, for the year prior to intervention, up to 6 months after intervention, and 7 to 12 months after intervention. In the year prior to the study, housed participants accrued a median $4066 per month per individual of use costs. Thus, in the year prior to intervention, $8 175 922 in costs were accrued by the 95 individuals who received housing. Individual median costs per month drop notably after 6 months ($1492) and again at 12 months ($958), and total costs for the housed group for the year after enrollment in housing were $4 094 291. Wait-list control participants accrued median costs of $3318 per month per individual in the year prior to the study, dropping to $1932 at 6 months. A similar pattern held up across most outcomes, with the exception of EMS services, which showed a slight increase at 6 months for HF participants before dropping at 12 months.

Figure 2. Rate Ratios and 95% Confidence Intervals for Treatment Differences at 6 Months



Treatment differences were based on Poisson generalized estimating equation regression including propensity score adjustments. HMC indicates Harborview Medical Center; EMS, emergency medical services.

Comparison of HF and Control Participants at 6 Months

Poisson GEE regressions with propensity score adjustments were used for all outcomes, comparing treated vs control participants at 6 months. There were no significant differences between HF and control participants prior to the intervention, controlling for propensity scores. FIGURE 2 presents rate ratios with 95% CIs for the time × treatment interaction, which is a direct test of treatment differences at 6 months. There is a significant difference between HF and control groups in total costs, with HF participants accruing approximately 53% less costs compared with controls over the first 6 months of the study (RR, 0.47; 95% CI, 0.25-0.88).

Cost offsets were calculated using a difference-in-differences approach. Mean per-month total costs were estimated for 1 year prior to intervention and for 6 months of intervention, for housed and control groups separately. Housed participants had $3569 less cost per month during the housed period relative to control participants. Housing costs were $1120 per person per month, yielding a total mean cost off-

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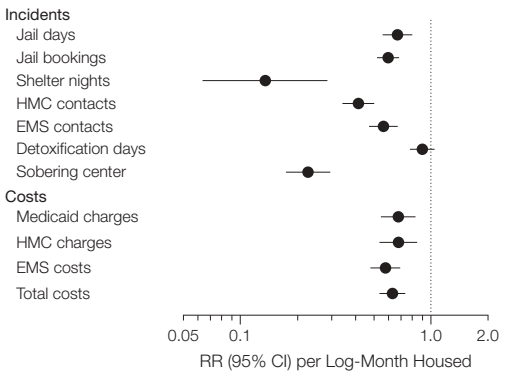
set of $2449 per person per month for HF participants.

Participants were chosen because they had extreme health care use and costs, and thus one concern is regression to the mean (ie, extreme scores will tend to be less extreme in the future). We examined sensitivity of the 6-month treatment differences for the subset of our housed and control samples with overlapping propensity scores (thus, they were highly similar on background characteristics and costs). Results were identical to those reported, providing evidence that observed treatment differences were not purely artifacts of regression to the mean.

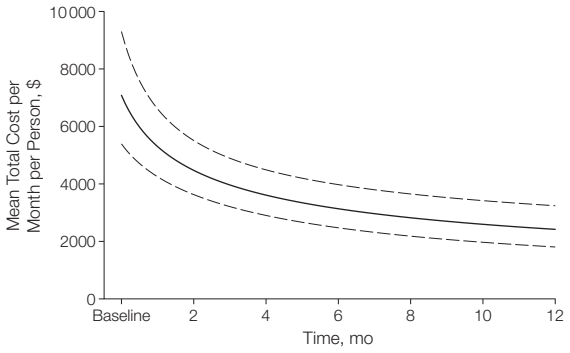
A second concern was that 9 participants died, and all were in the housed condition. Of 388 high-use potential participants originally proposed as eligible for this study, 37 are known to have died prior to or during the study period; thus, the mortality rate in the HF sample was consistent with the broader study population. Five HF residents died from previously diagnosed chronic illness, including liver cancer (1), cardiovascular disease (3), and unspecified natural causes (1). One of these deaths may have been contributed to by cocaine overdose. Two died from blunt-force head trauma (likely due to falling), both outside the house (1 after the resident had left the housing program). One remaining participant died from a suspected heroin overdose. In analyses using participant death as a covariate, those who died during the study had nonsignificantly higher costs prior to housing (RR, 1.66; 95% CI, 0.90-2.97); however, there was no evidence of differential change across time. Further, analyses removing those who died led to identical conclusions as those reported.

Figure 3. Use Reduction With Longer Time in Housing



Based on Poisson generalized estimating equation regression. Time in house was transformed using the natural logarithm to yield a linear relationship with costs. Thus, rate ratios are based on log-month time. HMC indicates Harborview Medical Center; EMS, emergency medical services; RR, rate ratio; CI, confidence interval.

Figure 4. Predicted Mean Total Cost per Participant During Time in Housing



One hundred eleven participants were housed at some point during the study (95 initially assigned to housing and 16 initially assigned to wait-list group). Median time in housing was 17.2 months (interquartile range, 6.4-26.7 months). Solid line indicates predicted mean decrease in total cost per person based on Poisson generalized estimating equation regression. Dashed lines indicate 95% confidence intervals.

Effect of Length of Time in House

Poisson GEE regressions assessed the association between length of time in the house and costs/use for all participants who were housed at some point, regardless of treatment condition (ie, wait-list control participants were housed as spots became available, and 16 of the 39 wait-list participants moved in after the 6-month follow-up and provided data for the present analyses). Two sources of data were used: per-month use for 1 year prior to house entry and total use for the period of time that the participant was in the house. Time was modeled using a natural logarithm transformation. All outcomes except days in the detoxification center showed a significant negative association with the logarithm of time, indicating that use dropped as participants were housed longer. FIGURE 3 shows rate ratios with 95% CIs for reduction in use and costs over time, and FIGURE 4 shows the predicted regression line of drop in total costs. (Note that the baseline costs in Figure 4 appear higher than those reported in Table 3 because Table 3 reported a median whereas the predicted regression line is based on a mean.)

Alcohol Use

Average number of daily drinks was assessed for change from the year prior to intervention to 6, 9, and 12 months in housing. Because a small number of participants reported drinking impossible amounts of alcohol (eg, 100 or more standard drinks per day), data that were more than 70 were reduced and set to 70.[29] Median number of drinks

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dropped steadily, from 15.7 per day prior to housing to 14.0, 12.5, and 10.6 per day at 6, 9, and 12 months in housing, respectively. Poisson GEE with a linear time covariate showed a similar trend to the medians, with an approximate 2% decrease per month in daily drinking while participants were housed (RR, 0.98; 95% CI, 0.96-0.99). Participants also showed a decreasing trend across time in housing for self-reported number of days drinking to intoxication from the Addiction Severity Index, with medians of 28, 15, 20, and 10 days (out of 30 days) at baseline and 6, 9, and 12 months, respectively. Due to severe bimodality in the distribution, a rank-based nonparametric test was used to assess change across time. Kendall coefficient of concordance revealed a significant decrease in days intoxicated (χ^2_3=14.6, P = .003).

COMMENT

The project demonstrated significant cost savings and reductions in alcohol use for housed individuals over the course of the first year. Cost offsets for HF participants at 6 months, in comparison with wait-list controls and accounting for the cost of housing, averaged $2449 per person per month. At 12 months, the 95 housed individuals had reduced their total costs by more than $4.0 million compared with the year prior to enrollment, or $42 964 per person per year, as compared with a cost of $13 440 per person per year to administer the housing program. Finally, length of time in housing was significantly related to reductions in use and cost of services, with those housed for the longest period of time experiencing the greatest reductions.

The study also demonstrated that individuals in the housed group experienced reductions in their alcohol use and likelihood of drinking to intoxication over time. The HF intervention was associated with substantial declines in drinking despite no requirement to abstain from or reduce drinking to remain housed.

As with other studies of supportive housing for mentally ill homeless people, this study showed decreases in the use of expensive crisis-oriented systems like hospitals and jails.[5,19] Additionally, this study showed substantial improvement in overall expenditures for participants even when factoring in the costs of the housing and services provided, in contrast with other cost-offset studies.[19,30] This intervention sought out the individuals with the most severe problems who had consumed the most services prior to housing enrollment, offering more opportunity for cost offsets to be realized.

The current study focused on a primarily alcohol-dependent population brought into a housing environment. Although one prior study demonstrated success in use reductions by enrolling a similar population in treatment in lieu of incarceration, overall acceptance of the treatment intervention was only 58%[31] compared with 95% acceptance of the housing in our study. Another study found that 91% of chronically homeless people with severe alcohol problems identified a need for housing assistance, but only 64% identified a need for alcohol treatment.[32] Moreover, permanent supportive housing programs without treatment requirements have been shown to be preferred among homeless mentally ill people while demonstrating similar retention rates compared with more structured, treatment-based programs.[20,33] Thus, HF is more acceptable to the target population than treatment while resulting in similar benefits.

The effect of housing on alcohol use has also been seen in other HF approaches. Such programs have shown stability or improvement in alcohol use among individuals with primary mental illness.[20,34] Concerns have been raised about the effect of low-demand housing on alcohol and drug treatment acceptance or adherence. A recent study found cocaine-dependent homeless people in treatment were more likely to abstain from drug use when in abstinence-based housing than in other housing.[35,36] Importantly, however, the study also demonstrated that being in any housing resulted in more abstinence than remaining homeless did.[35,36] Thus, the current study is consistent with prior research demonstrating benefits of stable housing on alcohol use despite the fact that participants were neither expected to abstain from alcohol nor required to access treatment as a condition of housing.

The current study has several limitations. Participants were not randomly assigned to condition, and there were differences between groups in costs of services used prior to enrollment. While the propensity score approach statistically controlled for these differences, and sensitivity analyses using only those with similar background characteristics and use at baseline found equivalent results, the potential impact of these differences on the pattern of outcomes cannot be completely dismissed. The current sample was also drawn from a population with extremely high use of publicly funded services, and it is likely that cost offsets would be attenuated in a less-severe sample. Future research using larger and more representative samples and stronger comparative research designs is warranted to address these issues.

Further, the current study relied on archival data from official databases for evaluating use and costs of services. Although this is a strength, limitations to archival databases can include incorrect or inaccurate entries, failure to appropriately match participants between study and archival databases due to spelling or other errors, and delay in entry of records into archival databases. Extensive review of archival records was undertaken to ensure accurate matching of participants. Further, there is no reason to believe these errors would be more apparent at one assessment point than another or between housed and wait-list groups.

An additional limitation is the inclusion of only 1 hospital in the records search. Harborview Medical Center is the most commonly used area hospital for this population, but it is likely that other hospital-based care was provided and may not be reflected in the

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Medicaid data. Because the HF project maintains a close relationship with Harborview, use of outside medical services likely declines more for HF residents than for wait-list controls. Further, HF residents are assisted in obtaining Medicaid, so Medicaid records may also capture more of their true costs. As a result, the current cost comparison between these groups probably represents a conservative estimate of the true advantages of HF.

Although our study population's burden on many public systems was reduced substantially, not all of this translated directly to reduced overall public expenditures. Outside of billed HMC and Medicaid medical services, costs were calculated primarily from average unit costs at the reporting agencies. Using jail as an example, total public costs would not decrease noticeably unless enough incarcerations were avoided to justify decreasing numbers of jail personnel, etc. In the current study, 59.0% of mean per-person per-month cost reductions in the HF group were attributable to billed medical services, and this represented 76.6% of the mean cost offsets for HF participants compared with the wait-list control group at 6 months. In addition to real dollar savings, reduced use of other services by the study population has implications for improved service delivery; greater access to care for other individuals; and increased ability of police, judicial, and jail personnel to focus on issues of higher priority to public safety.

Despite limitations, the current study adds to the body of literature in support of HF. Reductions in health care and criminal justice system use and costs and alcohol consumption support expansion and replication of this low-threshold approach. Repeated unsuccessful participation in traditional programs such as abstinence-based or mandated treatment, and high rejection rates of these programs by chronically homeless individuals with alcohol problems, suggests that less conventional approaches such as HF are also needed.

The large reduction in emergency health care expenses by HF participants has implications for health care systems, particularly health service payers and providers of high levels of uncompensated care. These groups might want to partner with supportive housing providers to care for the highest alcohol-related users of hospital services to reduce expenses.

Additional implications are for the creation of more specific alcohol interventions for this population when they become housed. Residents of HF are offered support and counseling about substance use but have no expectation of treatment engagement or abstinence. The setting is therefore appropriate for future harm reduction interventions for those who want to address their alcohol-related problems. Approaches could include adaptation of skills-building curricula aimed at other heavy-drinking populations[37] or implementation of a managed alcohol administration program such as those programs already showing initial promise for this population in shelter settings.[11,38]

CONCLUSIONS

These findings support the basic premise of Housing First: providing housing to individuals who remain actively addicted to alcohol, without conditions such as abstinence or treatment attendance, can reduce the public burden associated with overuse of crisis services and reduce alcohol consumption. Findings suggest that permanent, rather than temporary, housing may be necessary to fully realize these cost savings, because benefits continued to accrue the longer these individuals were housed. Findings support strategies to retain these individuals in housing, including offering on-site medical and mental health services, supportive case managers, and minimal rules and regulations pertaining to their housing. In sum, HF is associated with improvements in the life circumstances and drinking behaviors of this chronically homeless population while reducing their use of expensive health and criminal justice services.

Author Contributions: Dr Larimer had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Larimer, Malone, Garner, Burlingham, Lonczak, Ginzler, Clifasefi, Hobson, Marlatt.
Acquisition of data: Larimer, Garner, Burlingham, Lonczak, Tanzer, Ginzler, Clifasefi.
Analysis and interpretation of data: Atkins, Larimer, Malone, Garner, Burlingham, Lonczak, Tanzer, Ginzler, Clifasefi, Hobson, Marlatt.
Drafting of the manuscript: Larimer, Malone, Garner, Atkins, Burlingham, Lonczak, Tanzer, Ginzler, Clifasefi, Hobson, Marlatt.
Critical revision of the manuscript for important intellectual content: Larimer, Malone, Garner, Atkins, Lonczak, Tanzer, Ginzler, Clifasefi, Hobson, Marlatt.
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Study supervision: Larimer, Garner, Lonczak, Ginzler, Clifasefi, Marlatt.
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