Housing First Is Associated with Reduced Use of Emergency Medical Services

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Abstract

Objective—Chronically homeless adults with severe alcohol problems are disproportionately burdened with healthcare problems and are high utilizers of emergency medical services (EMS). Single-site Housing First (HF), which provides immediate, permanent, low-barrier, nonabstinence-based, supportive housing, has been associated with reduced publicly funded service utilization. The aims of the current study were to determine whether time spent in single-site HF predicted decreases in EMS contacts 2 years subsequent to single-site HF move-in, and to describe medical conditions and injuries associated with EMS contacts in a sample of chronically homeless individuals with severe alcohol problems.

Methods—Participants were 91 chronically homeless adults with severe alcohol problems who were enrolled in a single-site HF program between December 2005 and March 2007 in Seattle, Washington. We obtained administrative data on exposure to HF and EMS utilization for the 2 years prior to and the 2 years subsequent to participants' move-in date. EMS utilization variables included patient type (i.e., primary presenting problem), trauma/injury mechanism (i.e., EMS classification of the cause of the trauma or injury), level of care (i.e., basic life support, advanced life support), and transport destination.

Results—After controlling for baseline EMS contacts, participants evinced 3% fewer EMS contacts for each additional month of single-site HF exposure. From the baseline to follow-up period, the mean number of EMS contacts declined from 15.85 (SD = 22.96) to 9.54 (SD = 15.08), representing a 54% reduction in the number of EMS contacts. Most calls were responded to by EMTs providing basic life support, and the majority resulted in transport to a local level I trauma center. The most common presenting difficulties were medical illness and trauma. Substance use and psychiatric difficulties were infrequently documented as the primary problem.

Conclusions—Our findings support recent assertions that housing is health care and indicate that the amount of time spent in single-site HF is associated with significant reductions in EMS utilization for at least 2 years subsequent to move-in. These findings also underscore the high levels of medical illness and trauma exposure among chronically homeless adults with severe alcohol problems.

Keywords

homelessness; Housing First; emergency medical services

Alcohol dependence is associated with both acute harm (e.g., unintentional injuries, victimization) and chronic, alcohol-related medical conditions (e.g., liver disease, cancer, cardiovascular disease).[1,2] It has also been linked with injuries among individuals utilizing emergency medical (i.e., ambulance) services.[3] According to the Centers for Disease Control and Prevention (CDC), alcohol is responsible for over 80,000 deaths annually,[4] making alcohol consumption the third leading cause of preventable death in the United States.[5]

The homeless population is disproportionately affected by alcohol-related injuries and medical conditions, and more than 60% of homeless adults acknowledge a history of alcohol-related problems.[6] A meta-analysis of studies conducted in the United States and worldwide showed that alcohol dependence affects a mean of 38% of homeless adults,[7] which exceeds the prevalence in the U.S. general population by more than 10-fold.[8] Homeless individuals are also often affected by comorbid psychiatric conditions, other substance use (e.g., drug abuse and dependence), and/or medical disorders that may exacerbate alcohol-related problems.[7,9,10]

Chronically homeless individuals make up a subset of the larger homeless population. According to the Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act, individuals are considered chronically homeless if they have been homeless for a year or more (or have experienced four or more episodes of homelessness in the preceding 3 years) and have a substance-use, medical, psychiatric, and/or developmental disorder.[11] Given their high rates of medical and psychiatric comorbidity, chronically homeless people with severe alcohol dependence have a high need for health care.[12] Unfortunately, this population has difficulty accessing routine and preventive care. Many homeless individuals lack health insurance, have difficulty accessing transportation, must attend to immediate survival demands (e.g., food and shelter), and struggle to keep track of healthcare appointments.[13] For these reasons, individuals often seek medical care in emergency departments (ED) of safety-net hospitals,[14–16] which may then serve as a de facto source of primary care.[17,18] Moreover, the circumstances associated with homelessness may yield acute injuries or illness that warrant immediate medical care,[19] thereby necessitating ED treatment.

Homeless adults are among the most common repeat visitors to EDs.[15,20,21] In 2010, an estimated 552,000 ED visits (71.8 visits per 100 persons) were made by individuals who reported being homeless, a rate nearly double that of individuals who live in private residences.[22] Homeless individuals are also more likely than housed individuals to present for ED care via emergency medical service (EMS) transport. Thus, while EMS does not

necessarily transport all patients to hospitals, EMS is often homeless individuals' first point of contact with the healthcare system.[14,23,24] One study found that 308 homeless individuals in San Diego, California incurred 2,335 EMS transports over a 4-year period.[25] In recent years, interventions to reduce EMS use among individuals who consume a disproportionate amount of services have shown promise, including a case management and referral program[26] and a 6-month outpatient treatment program.[25]

The single-site Housing First (HF) model has been used to address the needs of chronically homeless people with alcohol dependence and has garnered empirical support.[27–31] Single-site HF entails the provision of immediate, permanent, low-barrier, nonabstinence-based, supportive housing units within a single building.[29] The first study that focused exclusively on single-site HF showed significantly reduced publicly funded service utilization, including EMS, ED visits, and inpatient hospital admissions one year after housing provision.[29] Subsequent studies have also demonstrated that over 75% of homeless adults with severe alcohol problems remain housed over 2 years[32] and that time spent in HF is associated with reduced jail time and bookings.[31] Similarly, a recent study with medically vulnerable individuals also showed significant reductions in ED and inpatient hospital use after 1 year for individuals in single-site HF compared to a no-treatment control group.[28]

Despite these promising initial findings, no studies to date have examined longer-term associations between single-site HF and EMS contacts. Such studies could have important implications for reducing healthcare costs and improving health-related quality of life among homeless individuals with severe alcohol problems. Further, no studies have examined the types of injuries and illnesses that precipitate EMS contacts among chronically homeless individuals with severe alcohol problems.

The objective of the current study was to fill these gaps in the literature. The first aim was to build on the 1-year findings from Larimer et al.[29] by extending the follow-up period to 2 years. As shown in that study, we expected that time spent in single-site HF would predict significant decreases in EMS contacts from the 2 years prior to the 2 years subsequent to move-in. The second aim was to describe injuries and medical conditions associated with EMS contacts in a sample of chronically homeless individuals with severe alcohol problems.

Methods

Participants

The current study was an extension of a larger, non-randomized controlled trial of single-site HF in Seattle, Washington.[29] Participants in this secondary, within-subjects study were chronically homeless adults with severe alcohol problems who 1) moved into a single-site HF program between December 2005 and March 2007, and 2) provided written informed consent for researchers to collect administrative data on publicly funded service utilization for the 2 years prior and subsequent to their move-in date.

Procedure

As described by Larimer et al.,[29] participants were drawn from two sources: (1) a rank-ordered list of individuals who had incurred the highest public costs for alcohol-related use

of EMS, a local safety-net hospital (i.e., ED and inpatient), shelters, a sobering center (i.e., local sleep-off facility), and the county jail in 2004; and (2) a list of eligible individuals suggested by community providers familiar with the target population. Interested participants provided written, informed consent and attended a baseline interview. Participants completed subsequent interviews at 3, 6, 9, 12, 18, and 24 months, for which they were paid $20 each. Parent study procedures were approved by the institutional review boards at the University of Washington and the King County Mental Health, Chemical Abuse and Dependency Services Division.

Measures

Demographic information (e.g., gender, age, race, ethnicity, relationship status) was gathered during the baseline interview. Data on participants' single-site HF utilization, including enrollment date and time spent in single-site HF, were extracted from agency records. Exposure to single-site HF was based on the total number of months housed during the 2-year follow-up period. Mortality data were obtained from agency records and Washington State death records.

We obtained administrative data on EMS utilization for 2 years prior and subsequent to participants' move into single-site HF from King County Medic One at Public Health Seattle and King County. Four EMS variables were considered in descriptive and/or inferential analyses: patient type code (i.e., EMS personnel's classification of the patient's primary problem or most significant condition which led to the management), patient mechanism code (i.e., EMS personnel's classification of the cause of the trauma or injury), level of care assigned by EMS dispatch (i.e., basic life support, advanced life support), and transport destination.

The Alcohol Dependence Checklist was administered at the baseline interview to assess for alcohol dependence according to *Diagnostic and Statistical Manual of Mental Disorders,* 4th ed., text revision (DSM-IV-TR) criteria.[33] A question from the Addiction Severity Index (ASI) was utilized to assess total number of drinking days in the past month.[34] Two quantity-frequency questions were used to establish participants' alcohol consumption on typical and peak drinking days in the 30 days preceding the initial interview.

Data Analysis

We conducted descriptive analyses in Predictive Analytics SoftWare 18.0 (PASW; SPSS, 2009) to establish frequencies of patient type and mechanism. We conducted additional data analyses to describe the sample, to determine the distribution of the outcome variable (i.e., follow-up EMS contacts), and to assess for outliers and missing data. The outcome variable was positively skewed, overdispersed, and zero-inflated. We therefore used a nonparametric test (i.e., Wilcoxon signed-rank test) to analyze differences in EMS contacts from the baseline to follow-up. Zero-inflated negative binomial (ZINB) models were conducted in STATA 11.2 (Statacorp, 2009) to test the relative contributions of baseline EMS contacts and single-site HF exposure (in months) in predicting number of follow-up EMS contacts. ZINB is a type of generalized linear model that may be used when a count-based outcome variable is found to be overdispersed, positively skewed, and zero-inflated (i.e., comprising more

zero responses than would be expected given the negative binomial distribution). ZINB models two processes: 1) a Bernoulli trial to determine the probability that an observation is a consistent zero, and 2) a negative binomial regression. Effect sizes are reported as incident rate ratios (IRRs). The full sample ($n = 91$) was included in descriptive analyses. Participants who died during the follow-up period ($n = 10$) were excluded from inferential analyses because death was statistically confounded with the primary predictor of interest, time spent in single-site HF, as well as the primary outcome variable, EMS contacts during the follow-up period.

Results

Baseline Sample Characteristics

Participants were 91 (6.6% female) chronically homeless adults with severe alcohol problems who ranged in age from 26 to 75 years ($M = 48.4$, SD = 9.6). Participants resided in single-site HF for an average of 18.1 months (SD = 8.3) during the follow-up period. See Table 1 for sample characteristics.

Frequency and Description of EMS Contacts

During the 2-year baseline period, EMS contacts were documented for 87% (79/91) of participants and, overall, participants had a total of 1,576 EMS contacts. During the 2-year follow-up period, 86% (78/91) of participants had at least one contact with EMS. These individuals amassed 852 EMS contacts. Twelve percent of the sample accounted for 50% of the total number of EMS contacts during both the baseline and follow-up periods. Across the baseline and follow-up periods, EMS dispatched emergency medical technicians to provide basic life support for most calls (75%), with far fewer (25%) paramedics dispatched to provide advanced life support (see Table 2). Across time points, the majority of EMS contacts (61%) resulted in transport to a local level I trauma center that provides care to indigent populations (Table 2).

Medical illness and trauma were the most common primary problems during both the baseline and follow-up periods (Table 3). Concerning trauma, falls (50%) and assault (23%) were the leading mechanisms of injury both before ($n = 320$) and after ($n = 199$) single-site HF enrollment (Table 4). Conversely, substance use and psychiatric symptoms were infrequently documented by EMS personnel as the primary difficulties (see Table 3).

Changes in Frequency of EMS Contacts from Baseline to Follow-up

We conducted a Wilcoxon signed-rank test which indicated that EMS contacts decreased significantly from baseline to follow-up, $Z(N = 81) = 3.40$, $p < .001$, with the mean number of EMS contacts decreasing from 15.9 ($SD = 23.0$) to 9.5 ($SD = 15.1$), respectively.

The ZINB model was significant, χ^2 (2, $N = 81$) = 41.2, $p < .001$, Nagelkerke pseudo $R^2 = 0.47$. After controlling for baseline EMS contacts, single-site HF exposure was associated with 3% fewer EMS contacts for each additional month of single-site HF exposure (IRR = 0.97, 95% CI 0.94, 0.99).

Discussion

The objective of this study was to describe the frequency and nature of EMS contacts in a sample of chronically homeless adults with severe alcohol problems and to explore the associations between exposure to a single-site HF program and number of EMS contacts. We found that the majority of participants utilized EMS services at least once during the 2 years prior and subsequent to moving into single-site HF. The majority of EMS contacts were documented as medical illness or trauma. Our finding aligns with recent research that shows chronic illness to be widespread among new single-site HF residents[35] and traumatic injuries to be prevalent in this population.[36,37] On the other hand, substance abuse and psychiatric conditions were recorded relatively infrequently as the primary problem prompting contact with EMS. That said, prior research has found that alcohol use is commonly associated with emergency department utilization among homeless populations.[14,24] Although this study did not involve data directly addressing its role, alcohol use likely precipitated or contributed to a large proportion of the medical illness and traumatic injury documented in this study.

Participants reduced their use of EMS services from the 2 years prior to the 2 years subsequent to moving into single-site HF. This finding was not solely due to regression to the mean: actual time spent in single-site HF also significantly predicted reductions in EMS use. Specifically, each month spent in single-site HF was associated with a 3% decline in the total number of EMS contacts during the follow-up period, yielding a 54% reduction in EMS contacts across the full sample. This study thereby extended the 1-year findings of Larimer and colleagues[29] by demonstrating that decreases in EMS utilization were maintained over a 2-year period.

Our findings provide additional support for recent assertions from researchers, clinicians, and agencies working with homeless individuals that "housing is healthcare."[38–41] Homeless individuals have high rates of chronic psychiatric and medical conditions[7,9,10,42,43] and elevated rates of mortality.[44] The circumstances surrounding homelessness complicate management of both acute and chronic conditions. Our findings corroborate prior research, which has suggested the provision of low-barrier, permanent supportive housing may provide the stability needed to manage these chronic conditions.[45] Further, housing appears to be protective against illness or injury that might otherwise precipitate EMS utilization.[38,40] Housing may also be protective against victimization, which is endemic among homeless individuals, and thereby reduce traumatic injuries due to assault.[46–48] Finally, single-site HF has also been associated with reductions in alcohol consumption and alcohol-related problems,[27] which may lead to fewer injuries (e.g., falls) or interpersonal difficulties (e.g., physical fights) associated with injury, since the involvement of alcohol may precipitate those difficulties.[49,50]

Limitations

The current study has several limitations that warrant discussion. First, data describing EMS contacts were obtained from local county records, and administrative data may include typographic errors or inaccurate information (e.g., spelling errors, errors introduced during electronic data entry, missing EMS contacts). In order to optimize data completeness and

accuracy, variations on spelling of identifying information were searched, and study authors independently reviewed the data. Questionable data points were discussed and removed from analyses, as appropriate.

Patient type and mechanism of injury data points were based on EMS personnel classifications, which are made swiftly in the field. Further, diagnostic codes were not available. As a result, these data points may not reflect formal diagnoses made subsequently in clinical settings.

Seattle approaches chronic public intoxication as a public health problem and provides resources that may not be available in other cities. Thus, our findings may not extrapolate to communities whose approach criminalizes such behavior. For instance, King County operates the Emergency Service Patrol, a van service that can transport intoxicated persons to safe places (e.g., a sobering center). Emergency Service Patrol utilization was not measured in the current study, and it is possible that this resource impacted rates of EMS utilization.

Finally, this study was conducted with a specific segment of the homeless population: those with histories of chronic homelessness and severe alcohol problems. It was also conducted within one, single-site HF program in the U.S. Pacific Northwest. As a result, these findings may not generalize to other subgroups of the larger homeless population, other geographical locations, or other types of housing (e.g., scattered-site HF, continuum-of-care housing).

Conclusion

Our findings add to the burgeoning body of research supporting single-site HF as a public health intervention to reduce emergency health-care utilization among chronically homeless adults with severe alcohol problems. We found that use of EMS significantly decreased from 2 years prior to 2 years subsequent to moving into single-site HF and that the observed decrease was a function of time spent in housing. More research is necessary to establish whether the association between single-site HF exposure and reduced EMS utilization is causal and to test mediating factors of the observed reductions in EMS utilization. Clarifying the pathways through which single-site HF may improve health and reduce injury has important implications for improving health and quality-of-life among this population.

Acknowledgments

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Table 1

Baseline sample description

Variable	n (%) or M (SD)
Race/ethnicity (n = 91)	
American Indian/Alaska Native	26 (29)
Asian	1 (1)
Black/African American	7 (8)
Hispanic/Latino(a)	7 (8)
Native Hawaiian/Pacific Islander	3 (3)
White/European American	36 (40)
Multiracial	9 (10)
"Other"	2 (2)
Relationship status (n = 90)	
Single, never married	47 (52)
Married	1 (1)
Considers self to be married	1 (1)
Separated	7 (8)
Divorced	30 (33)
Widowed	4 (4)
Highest education level (n = 90)	
Some high school	35 (39)
High school graduate	17 (19)
GED	9 (10)
Vocational school	8 (9)
Some college	16 (18)
College graduate	3 (3)
Some graduate school/advanced degree	2 (2)
Alcohol consumption in past 30 days	
Alcohol dependence[a] (n = 87)	78 (90)
Frequency (days; n = 80)	23.8 (10.4)
Typical day (standard drinks/day; n = 83)	24.5 (22.1)
Heaviest drinking day (standard drinks/day; n = 76)	40.4 (39.8)

Percentages may not sum to 100% due to rounding. M, mean; SD, standard deviation; GED, General Educational Development diploma.

[a]Based on the Alcohol Dependence Checklist; derived from Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision.

Table 2

Level of care and transport destination

Destination	Baseline period (N = 1,576) n (%)	Follow-up period (N = 852) n (%)
Level of care		
BLS	1,198 (76)	630 (74)
ALS	378 (24)	222 (26)
Trauma hospital		
Level I	990 (63)	487 (57)
Level II[a]	NA	NA
Level III	16 (1)	12 (1)
Level IV	46 (3)	14 (2)
VA hospital	7 (0)	1 (0)
Other hospital	180 (11)	162 (19)
Detoxification center	162 (10)	53 (6)
Jail	5 (0)	0 (0)
Morgue	0 (0)	3 (0)
Other	4 (0)	10 (1)
EMS response without transport	130 (8)	96 (11)
Unknown location	36 (2)	14 (2)

Percentages may not sum to 100% due to rounding. BLS, basic life support; ALS, advanced life support; EMS, emergency medical services.

[a]No level II trauma hospitals in King County.

Table 3

Characteristics of the EMS service episodes for the participants with at least one episode

Variable	Baseline period n (%)	Follow-up period n (%)
Trauma or injury	**320 (20)**	**199 (23)**
Head	78 (5)	54 (6)
Face	46 (3)	29 (3)
Neck/back	25 (2)	16 (2)
Chest	22 (1)	3 (0)
Extremities	106 (7)	78 (9)
Abdomen	7 (0)	2 (0)
Pelvis/hips	10 (1)	5 (1)
Multisystem	21 (1)	11 (1)
Trauma with unknown specifics	5 (0)	1 (0)
Substance use	**160 (10)**	**77 (9)**
Withdrawal	2 (0)	1 (0)
Overdose	4 (0)	2 (0)
Intoxication	27 (2)	9 (1)
Other alcohol/drug	127 (8)	65 (8)
Psychiatric	**79 (5)**	**32 (4)**
Anxiety	4 (0)	5 (1)
Depression	18 (1)	3 (0)
Hallucination/bizarre behavior	17 (1)	2 (0)
Agitation/combative behavior	5 (0)	7 (1)
Other psychiatric	35 (2)	15 (2)
Medical illness	**762 (48)**	**437 (51)**
Abdominal/genito-urinary	45 (3)	56 (7)
Anaphylaxis/allergy	2 (0)	0 (0)
Cardiovascular	40 (3)	16 (2)
Metabolic/endocrine	14 (1)	1 (0)
Neurological	205 (13)	105 (12)
Respiratory	121 (8)	75 (9)
Other medical[a]	335 (21)	184 (22)
Other	**255 (16)**	**107 (13)**
No injury or illness	157 (10)	53 (6)
False alarm	2 (0)	0 (0)
Fire standby	0 (0)	1 (0)
Canceled en route	5 (0)	2 (0)
Patient refusal	7 (0)	8 (1)
Special service/interfacility transport	21 (1)	12 (1)
Missing	63 (4)	31 (4)
Total	**1,576 (100)**	**852 (100)**

Numbers represent the frequency of primary problems during the baseline and follow-up periods and are organized within subcategories (e.g., trauma, substance use). The corresponding percentages represent the proportion of diagnoses in each subcategory and may not sum to the total due to rounding. EMS, emergency medical services.

[a]"Other medical" includes fever/infection, noncardiac pain, undefined musculoskeletal pain, postoperative complication, dehydration, hypothermia, heat illness.

Table 4

EMS Classification of trauma or injury mechanism

Mechanism	Baseline period (N = 320) n (%)	Follow-up period (N = 199) n (%)
Accident	10 (3)	5 (3)
Alcohol/drug	14 (4)	8 (4)
Animal	0 (0)	2 (1)
Assault	75 (23)	45 (23)
Blunt instrument	3 (1)	2 (1)
Burn	1 (0)	0 (0)
Fall	157 (49)	104 (52)
Motor vehicle	2 (1)	5 (3)
Other alarm	2 (1)	1 (1)
Pedestrian vs. vehicle	4 (1)	2 (1)
Psychiatric	2 (1)	1 (1)
Sexual assault	2 (1)	0 (0)
Sharp instrument	13 (4)	6 (3)
Sports injury	2 (1)	2 (1)
Unknown	7 (2)	7 (4)
Missing	26 (8)	9 (5)

Percentages may not sum to 100% due to rounding. EMS, emergency medical services.