

# Health Outcomes of Obtaining Housing Among Older Homeless Adults

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Over the past 2 decades, the proportion of the homeless population aged 50 years and older has increased substantially. In 1990, only 11% of single homeless adults were aged 50 years and older, but this percentage increased to 32% by 2003<sup>1</sup> and is nearly 50% today.<sup>2</sup> Homeless adults aged 50 years and older have health problems distinct from those of younger homeless adults, including higher rates of medical comorbidities<sup>3</sup> and of geriatric conditions such as functional and cognitive impairment.<sup>4,5</sup> Because homeless adults in their 50s develop medical and geriatric conditions at rates typical of adults 15 to 20 years older in the general population,<sup>4,5</sup> experts consider homeless adults to be elderly at age 50 years, 15 years earlier than housed adults.<sup>4,6</sup>

Among elderly adults who have geriatric conditions, environmental factors play a central role in maximizing and maintaining independence. Older adults who live in a stable housing environment may be able to adapt to geriatric impairments more easily and maintain their independence longer than those who lack these advantages.<sup>7,8</sup> By contrast, older adults who live in shelters or on the street may encounter great difficulty in modifying their environment to accommodate functional impairments and other geriatric conditions.<sup>9</sup> Moreover, adaptive equipment used to cope with impairments—such as glasses, hearing aids, or walkers—may be lost or stolen. This mismatch between older homeless people's environment and their abilities may magnify the negative effect of geriatric conditions on their quality of life and ability to function independently, leading to the premature need for costly long-term care.<sup>9,10</sup>

Experts have hypothesized that access to housing could ameliorate high rates of disability and other geriatric conditions among older homeless people and prevent or delay institutionalization.<sup>9</sup> Studies of the adult homeless population have supported the putative health benefits of housing, having found decreased

**Objectives.** We determined the impact of obtaining housing on geriatric conditions and acute care utilization among older homeless adults.

**Methods.** We conducted a 12-month prospective cohort study of 250 older homeless adults recruited from shelters in Boston, Massachusetts, between January and June 2010. We determined housing status at follow-up, determined number of emergency department visits and hospitalizations over 12 months, and examined 4 measures of geriatric conditions at baseline and 12 months. Using multivariable regression models, we evaluated the association between obtaining housing and our outcomes of interest.

**Results.** At 12-month follow-up, 41% of participants had obtained housing. Compared with participants who remained homeless, those with housing had fewer depressive symptoms. Other measures of health status did not differ by housing status. Participants who obtained housing had a lower rate of acute care use, with an adjusted annualized rate of acute care visits of 2.5 per year among participants who obtained housing and 5.3 per year among participants who remained homeless.

**Conclusions.** Older homeless adults who obtained housing experienced improved depressive symptoms and reduced acute care utilization compared with those who remained homeless. (*Am J Public Health.* 2015;105:1482–1488. doi:10.2105/AJPH.2014.302539)

rates of acute care utilization after housing is received.<sup>11–13</sup> However, little is known about the impact of housing on the unique health concerns of older homeless adults, including the geriatric conditions that play a key role in health and quality of life.

Therefore, we conducted a prospective cohort study of 250 older homeless adults in Boston, Massachusetts. We previously described the high prevalence of geriatric conditions at baseline in this cohort.<sup>5</sup> The goal of this study was to determine whether obtaining housing was associated with subsequent improvements in health status and geriatric conditions and decreased use of acute care.

## METHODS

We conducted a 12-month prospective study of a cohort of older homeless adults living in Boston.<sup>5</sup> We interviewed participants at baseline and 12 months, and we reviewed medical records to determine use of acute care services in the intervening year.

## Setting and Participants

We recruited participants between January and June 2010 from 8 homeless shelters in Boston serving 50 or more single adults daily. We selected shelter clients from bed lists or meal lines using systematic random sampling. Sampled clients were invited to participate if they were at least 50 years old, currently homeless, able to communicate in English, and able to provide written informed consent. We defined homelessness as living in an emergency or transitional shelter, a place not meant for human habitation,<sup>14</sup> or doubled up, that is, forced to stay in another person's housing because of loss of housing or economic hardship. Clients were excluded if they were visibly intoxicated or screened positive for delirium.<sup>15</sup> Participants completed in-person interviews at study enrollment and at 12 months.

We used information provided at baseline to recontact participants for follow-up interviews, including telephone numbers, e-mail addresses, preferred shelters, and case managers. For participants whom we were unable to recontact

at 12 months, we conducted Social Security Death Index reviews.<sup>16</sup> Participants who completed interviews received a \$5 pharmacy chain gift certificate at baseline and a \$10 gift certificate at follow-up.

## Measures

**Primary predictor.** The primary predictor variable was housing status, assessed using information reported at the follow-up interview. Participants reported whether they had obtained housing since the baseline interview, the date on which they moved into their current housing, and whether they had experienced a period of homelessness after obtaining housing. Consistent with federal guidelines, we defined participants as housed at follow-up if they reported that they were currently living in a place of their own that was not part of a transitional housing program.<sup>17</sup>

We did not measure how participants obtained housing or the type of housing obtained. However, each shelter at which we recruited participants offered on-site housing placement assistance, in which representatives of local housing agencies met with interested clients. These agencies offered a range of housing assistance programs, including rental assistance, housing subsidies, and assistance with locating and obtaining affordable housing.

**Outcomes: health status and geriatric conditions at follow-up.** We measured 4 copriary health outcomes, which we chose a priori because we hypothesized that each could be influenced by the interaction between an individual and his or her environment and that housing might provide the stable environment to improve these outcomes. Outcomes included number of Katz activities of daily living (ADLs) that the participant reported difficulty performing independently (bathing, dressing, toileting, transferring, eating; range = 0–5)<sup>18</sup>; number of instrumental activities of daily living (IADLs) that the participant reported difficulty performing independently, measured using the Brief Instrumental Functioning Scale (range = 0–6)<sup>19</sup>; depressive symptoms, measured using the 9-item Patient Health Questionnaire (range = 0–27; higher scores indicate more symptoms)<sup>20</sup>; and symptoms of urinary incontinence, measured using the International Consultation on Incontinence Questionnaire

(range = 0–21; higher scores indicate more symptoms).<sup>21</sup> We measured these outcomes at baseline and follow-up using identical methods.

**Acute care utilization.** We defined use of acute care services as an emergency department (ED) visit or overnight hospitalization during the 12-month follow-up. To describe use of acute care services, we reviewed medical records at all hospitals in Boston that provide emergency medical services (n = 10); participants provided written consent for these reviews at the baseline interview. We searched electronic medical records for each participant by name, date of birth, and social security number. If we found a matching medical record, we completed a review of ED visits and hospitalizations for each participant, including visit dates. ED visits leading to hospital admission were excluded.

**Other measures.** We collected demographic data by self-report, including age, gender, race/ethnicity (African American, White non-Latino, Latino, multiracial, and other), marital status, education, and primary language. Measures of homelessness collected at baseline included self-reported age at first episode of homelessness, total years of lifetime homelessness, and number of months of homelessness during the past year.

Measures of health status included self-rated general health and self-reported medical and psychiatric comorbidities, health-related behaviors, and geriatric conditions. To assess comorbidity burden, we calculated the Charlson Comorbidity Index (scores 0, 1–2, and  $\geq 3$ ; higher scores indicate higher mortality risk).<sup>22,23</sup> We measured self-reported alcohol and drug use problems in the past 30 days using the Addiction Severity Index (range = 0–1)<sup>24</sup> and used cut-off scores developed for homeless adults to define alcohol use problems (Addiction Severity Index score  $\geq 0.17$ ) and drug use problems (Addiction Severity Index score  $\geq 0.10$ ).<sup>14</sup>

We assessed several geriatric conditions in addition to the ADL, IADL, depression, and urinary incontinence measures. Participants reported whether they had fallen to the ground during the previous year<sup>25</sup> and whether they had difficulty walking.<sup>26</sup> Measures of cognition included the Mini-Mental State Examination, which measures global cognitive function,<sup>27</sup> and the Trail Making Test Part B, which measures executive

function, with increasing time required to complete the task indicating worse function.<sup>28</sup> We defined Mini-Mental State Examination impairment as a score less than 24,<sup>29</sup> and Trail Making Test Part B impairment as test duration more than 1.5 standard deviations above population-based norms or as stopping the task early.<sup>30</sup> We measured sensory impairment, including self-reported difficulty hearing despite using a hearing aid<sup>31</sup> and self-reported difficulty seeing despite wearing corrective lenses.<sup>32</sup>

To assess access to health services, we asked participants whether they had health insurance and, if so, what type. Participants reported whether they had a place where they usually obtained medical care and, if so, what type of place (outpatient clinic vs ED); we defined participants who usually obtained medical care at a clinic as having a usual source of care.<sup>33</sup> Participants also reported their acute care utilization during the previous year (number of ED visits and hospitalizations).

## Statistical Analyses

We compared baseline characteristics between homeless and housed participants using the *t* test or Wilcoxon rank-sum test for continuous variables and the  $\chi^2$  or Fisher exact test for categorical variables. To identify participant characteristics at baseline associated with obtaining housing, we used log-binomial regression models to estimate unadjusted and adjusted relative risks. We adjusted models for other variables selected a priori as potential confounders of the association between housing and health outcomes, including demographic characteristics (age, gender, race/ethnicity, education), medical comorbidity (Charlson Comorbidity Index score), history of depression, substance use problems, and usual source of medical care.<sup>34</sup>

To compare health outcomes between those who did and did not obtain housing, we used both linear regression models and more complex linear mixed-effects models with an unstructured covariance matrix; both models used the same approach to predictors and outcomes. The primary predictor was housing status at the 12-month follow-up, modeled as a binary variable. Each of our co-primary outcomes was assessed on an ordinal scale, including number of ADLs that the participant

had difficulty performing (range = 0–5), number of IADLs that the participant had difficulty performing (range = 0–6), depressive symptoms measured using the Patient Health Questionnaire score (range = 0–27), and urinary incontinence symptoms measured using the International Consultation on Incontinence Questionnaire score (range = 0–21). We adjusted models for the baseline value of each primary measure and for potential confounders, including demographic characteristics (age, gender, race/ethnicity, education), medical comorbidity (Charlson score), history of depression, substance use problems, and usual source of medical care. Because the results of the 2 modeling strategies were very similar, we present the results of the simpler linear regression models because they are more clinically interpretable. For ease of interpretation, we present predicted means adjusted for the potential confounders (margins command, Stata version 13; StataCorp, College Station, TX) rather than full linear regression models with parameter estimates.

To determine whether obtaining housing was associated with a lower rate of acute care use, we used mixed-effects Poisson models to estimate incidence rate ratios for acute care use in housed versus homeless participants (xtpoisson command, Stata version 13). The primary predictor was housing status, and the outcome was the number of acute care visits. Because all participants were homeless at baseline and crossed over to being housed at varying times over the follow-up period, we used a time-varying covariate to represent housing status. Analyses accounted for exact move-in dates and acute care visit dates, allowing us to distinguish between acute care visits that occurred while participants were housed versus those that occurred while they were homeless. We accounted for intraparticipant correlation by including a random intercept for each participant. On the basis of these models, we then estimated the predicted rate of acute care visits over 12 months in the housed and homeless groups. Models were adjusted for potential confounders including baseline acute care utilization, demographic characteristics, medical comorbidity, history of depression, substance use problems, and usual source of medical care. Analyses were

conducted using SAS version 9.3 (SAS Institute, Cary, NC) and Stata.

RESULTS

Of the 472 shelter clients screened, 387 were eligible, of whom 250 (65%) were recruited. Eligible clients who declined to participate did not differ from enrolled participants by observed race/ethnicity but were older (mean age = 59.5 and 56.2 years, respectively; *P* = .002) and more likely to be male (90% and 78%, respectively; *P* = .02).

We conducted in-person follow-up interviews at 12 months with 204 (82%) of the 250 participants enrolled at baseline. Of the remaining 46 participants, 14 were contacted but did not complete a follow-up assessment, and 28 could not be contacted. We confirmed that 4 of the 28 participants whom we could not contact had died. Baseline characteristics were similar between participants lost to follow-up and those who were reinterviewed, including demographics, substance use problems, and geriatric conditions. However, participants lost to follow-up were more likely to lack a usual source of medical care (44% vs. 26%; *P* = .01).

Participant Characteristics

The overall mean age of the cohort was 56.5 years (SD = 5.5), 82% were men, and 40% were White. At 12 months, 41% of participants (*n* = 84) reported that they had obtained housing. One participant briefly obtained but subsequently lost housing between baseline and follow-up and was considered to have been homeless throughout the follow-up period. Among participants who obtained housing between baseline and follow-up, the mean number of months housed was 5 (SD = 3). Baseline demographic characteristics were similar in participants who obtained housing and those who remained homeless (Table 1). Baseline values of the 4 primary outcome measures were also similar between the 2 groups (Table 2). Among other measures of health status and health care utilization, having a prior diagnosis of depression and a usual source of health care was more common among participants who obtained housing (Table 2). After multivariable adjustment, the only baseline characteristic associated with obtaining housing was having a usual source of medical care (adjusted relative risk = 1.7; 95% confidence interval [CI] = 1.0–2.8).

TABLE 1—Baseline Demographic Characteristics of 204 Older Homeless Participants by Housing Status at Follow-Up: Boston, MA, January–June 2010

Characteristic at Baseline	Housing Status at Follow-Up		<i>P</i>
	Homeless (n = 120)	Housed (n = 84)	
<b>Demographics</b>			
Age, y, mean (SD)	56.6 (5.2)	56.3 (6.0)	.84
Women, no. (%)	21 (18)	16 (19)	.78
Race/ethnicity, no. (%)			.92
African American	46 (38)	36 (43)	
White	50 (42)	32 (38)	
Latino	13 (11)	8 (10)	
Multiracial or other	11 (9)	8 (10)	
Married or partnered, no. (%)	10 (8)	4 (5)	.33
< high school education, no. (%)	33 (28)	19 (23)	.46
Primary language English, no. (%)	103 (86)	72 (86)	.98
<b>Homelessness</b>			
Age at first episode of homelessness, y, median (IQR)	45 (30–52)	45 (40–51)	.62
Lifetime years homelessness, median (IQR)	5 (2–11.5)	3.5 (2–10)	.19
Homeless for ≥ 1 y, no. (%)	78 (65)	57 (68)	.67

Note. IQR = interquartile ratio.

**TABLE 2—Baseline Health Status and Health Care Utilization of 204 Older Homeless Participants by Housing Status at Follow-Up: Boston, MA, January–June 2010**

Characteristic at Baseline	Housing Status at Follow-Up		P
	Homeless (n = 120)	Housed (n = 84)	
<b>Outcome measures</b>			
ADL difficulties, no. (%)			.6
0	81 (68)	58 (69)	
1-2	29 (24)	22 (26)	
3-5	10 (8)	4 (5)	
No. of IADL difficulties, no. (%)			.33
0	49 (41)	36 (43)	
1-2	52 (43)	29 (35)	
3-6	19 (16)	19 (23)	
Depressive symptoms, mean (SD) <sup>a</sup>	8.5 (7.5)	8.9 (7.3)	.7
Symptoms of urinary incontinence, mean (SD) <sup>b</sup>	4.4 (5.6)	4.5 (5.9)	.88
<b>Previous year health care use</b>			
Self-reported emergency department visits, no. (%)			.66
0	38 (32)	24 (29)	
1-3	49 (41)	39 (48)	
≥ 4	32 (27)	19 (23)	
Self-reported no. of hospitalizations, median (IQR)	0 (0-2)	0 (0-1)	.2
<b>Other measures of health status and health care use</b>			
Self-rated general health good, very good, or excellent, no. (%)	74 (62)	47 (56)	.41
Charlson Comorbidity Index score, no. (%)			.89
0	47 (39)	31 (37)	
1-2	45 (38)	31 (37)	
≥ 3	28 (23)	22 (26)	
Depression, lifetime history	62 (52)	56 (68)	.02
Alcohol use problem, <sup>c</sup> no. (%)	21 (18)	15 (18)	.99
Drug use problem, <sup>d</sup> no. (%)	19 (16)	16 (19)	.54
<b>Geriatric conditions</b>			
Falls during past year, 1 or more, no. (%)	62 (52)	50 (60)	.23
Mobility impairment, <sup>e</sup> no. (%)	50 (42)	37 (44)	.74
<b>Cognitive status</b>			
MMSE score, mean (SD)	26.2 (3.2)	26.3 (3.3)	.8
MMSE impairment, <sup>f</sup> no. (%)	30 (25)	22 (26)	.87
TMT-B mean (SD)	132.9 (67.2)	135.9 (67.3)	.77
TMT-B impairment, <sup>g</sup> no. (%)	39 (35)	24 (29)	.38

Continued

### Housing Status, Subsequent Health Status, and Geriatric Conditions

In analyses adjusted only for baseline depressive symptoms, depressive symptoms at 12-month follow-up were lower, at borderline statistical significance, in participants who had obtained housing than in those who had remained homeless (unadjusted mean Patient Health Questionnaire score at follow-up = 6.2

[housed] vs 7.5 [homeless];  $P = .05$ ). However, after additional adjustment for demographic characteristics, medical comorbidity, history of depression, substance use problems, and usual source of medical care, participants who obtained housing had fewer depressive symptoms than participants who remained homeless at follow-up (adjusted mean Patient Health Questionnaire score at follow-up = 6.0 [housed]

vs 7.6 [homeless];  $P = .02$ ; Table 3). Obtaining housing was not associated with improvement in other health status measures at follow-up, including number of ADL difficulties, number of IADL difficulties, or symptoms of urinary incontinence, either in analyses adjusted only for the baseline value of each measure or in fully adjusted analyses. Because unadjusted analyses for these measures were very similar to adjusted analyses, Table 3 includes only the results of the adjusted analyses.

### Housing Status and Acute Care Use

Over the follow-up period, participants who obtained housing had a lower rate of ED visits and hospitalizations than participants who remained homeless (incidence rate ratio = 0.5; 95% CI = 0.4, 0.6). The association was unchanged after adjusting for baseline characteristics. The unadjusted annualized rate of acute care visits was 2.5 visits per year (95% CI = 1.8, 3.3) among participants who were housed at follow-up and 5.1 visits per year (95% CI = 3.9, 6.2) among participants who were homeless; the adjusted rates were similar (housed = 2.5 visits per year [95% CI = 1.7, 3.3]; homeless = 5.3 visits per year [95% CI = 3.8, 6.7]). The predicted annualized rates were similar to those observed in the chart review (housed = 2.9 visits per year; homeless = 4.9 visits per year).

### DISCUSSION

In this study, older homeless adults who obtained housing experienced improved depressive symptoms and reduced acute care utilization compared with those who remained homeless. Obtaining housing was not associated with fewer difficulties in performing ADLs or IADLs or with improved symptoms of urinary incontinence. These findings suggest that current housing strategies improve key health outcomes among older homeless adults but do not have a substantial impact on these geriatric conditions.

The improvement in depressive symptoms among those who obtained housing is not surprising, given the psychological distress associated with housing instability.<sup>35</sup> The observed reduction in symptoms was relatively modest, consistent with previous research examining the effect of a housing assistance program on depressive symptoms among people

TABLE 2—Continued

Sensory impairment, no. (%)			
Hearing impairment, self-report	42 (35)	23 (28)	.27
Visual impairment, self-report	31 (26)	30 (36)	.13
Health services			
Insurance, <sup>h</sup> no. (%)	112 (94)	81 (98)	.31
Medicare	100 (89)	73 (90)	.85
Medicaid	24 (21)	16 (20)	.78
Military	14 (13)	10 (12)	.97
Private	1 (1)	2 (3)	.57
Usual source of medical care, no. (%)	79 (68)	68 (84)	.009

Note. ADL = activity of daily living; IADL = instrumental activity of daily living; IQR = interquartile ratio; MMSE = Mini-Mental State Examination; TMT-B = Trail Making Test Part B.

<sup>a</sup>Depressive symptoms measured using the 9-item Patient Health Questionnaire (range = 0–27; lower scores indicate fewer symptoms).

<sup>b</sup>Symptoms of urinary incontinence measured using the International Consultation on Incontinence Questionnaire (range = 0–21; lower scores indicate fewer symptoms).

<sup>c</sup>Alcohol use problem defined as an Addiction Severity Index score  $\geq 0.17$ .

<sup>d</sup>Drug use problem defined as an Addiction Severity Index score  $\geq 0.10$ .

<sup>e</sup>Mobility impairment defined as self-reported difficulty walking.

<sup>f</sup>MMSE impairment defined as an MMSE score  $< 24$ .

<sup>g</sup>TMT-B impairment defined as a test duration  $> 1.5$  standard deviations above population-based norms or as stopping the test early.

<sup>h</sup>Percentages for type of insurance add to  $> 100\%$  because some participants had  $> 1$  type of insurance.

with HIV/AIDS.<sup>36</sup> However, a study of a supportive housing intervention for homeless veterans with mental illness did not find a significant reduction in depressive symptoms in those who received housing compared with those who did not.<sup>37</sup> This heterogeneity is not surprising given differing study designs, differing study populations, and the use of differing depression measures with varying sensitivity to

change. Differences in the pathogenesis of depression by age may also contribute; psychosocial and environmental factors appear to play a larger role in the development of depression among older adults than younger adults,<sup>38,39</sup> and previous studies included homeless adults aged 18 years and older.

We hypothesized that disproportionately high rates of geriatric conditions among older

homeless adults might in part reflect the mismatch between their abilities and environment and that access to housing might improve this mismatch. However, obtaining housing was not associated with improvements in self-reported difficulty performing daily activities or symptoms of urinary incontinence. These findings have several possible explanations. The majority of participants in this study were recruited from shelters. Homeless individuals who have geriatric conditions that are influenced by the person–environment interaction may seek the environment that best matches their abilities. For example, an individual who has difficulty bathing may stay in a shelter that has bathing facilities with grab bars. A move from this shelter environment to an apartment that lacks additional modifications might therefore provide only incremental benefits. In the general population, older adults who received a multicomponent intervention including home repair, nursing, and occupational therapy experienced less difficulty performing ADLs and IADLs.<sup>8</sup> Incorporating similar environmental modifications and supportive services into housing programs for older homeless adults who have geriatric conditions has the potential to provide similar benefits. Another potential explanation for our findings is that our sample size was limited, which may have limited our ability to detect small differences in our outcomes between groups, especially because about half of participants were independent in daily activities at baseline.

It is also possible that the move from a shelter to an independent apartment could worsen the functional status of some participants. Executive function, or one's ability to plan and organize information, plays a large role in the ability to perform IADLs.<sup>40</sup> Research conducted among homeless people with mental illness found that executive performance worsened after moving from a homeless shelter to an independent apartment, possibly as a result of the attendant loss of social structure and interaction.<sup>41</sup> Some individuals in this study who obtained housing may have experienced a similar decrement in executive functioning, which could have had a negative impact on their ability to perform IADLs.

Obtaining housing was associated with reduced acute care utilization, a finding consistent with a growing body of research. Studies

TABLE 3—Measures of Health Status at 12-Month Follow-Up in Housed Versus Homeless Participants: Boston, MA, January–June 2010

Measures	Mean Value of Outcome, Adjusted (95% CI) <sup>a</sup>		P
	Homeless	Housed	
No. of ADL difficulties (range = 0–5)	0.4 (0.3, 0.6)	0.6 (0.4, 0.7)	.3
No. of IADL difficulties (range = 0–6)	1.9 (1.5, 2.3)	1.6 (1.1, 2.0)	.27
Depressive symptoms (range = 0–27) <sup>b</sup>	7.6 (6.7, 8.4)	6.0 (5.1, 7.0)	.02
Symptoms of urinary incontinence (range = 0–21) <sup>c</sup>	3.7 (3.0, 4.4)	2.9 (2.1, 3.8)	.17

Note. ADL = activity of daily living; CI = confidence interval; IADL = instrumental activity of daily living.

<sup>a</sup>Multivariable linear regression models adjusted for the baseline value of each primary measure and for potential confounders including demographic characteristics (age, gender, race/ethnicity, education), medical conditions at baseline (Charlson Comorbidity Index score, lifetime history of depression, alcohol use problems, drug use problems), and usual source of medical care. Results of unadjusted analyses were very similar to adjusted analyses and are not presented.

<sup>b</sup>Depressive symptoms measured using the 9-item Patient Health Questionnaire (range = 0–27; lower scores indicate fewer symptoms).

<sup>c</sup>Symptoms of urinary incontinence measured using the International Consultation on Incontinence Questionnaire (range = 0–21; lower scores indicate fewer symptoms).

of housing interventions conducted among chronically homeless people with severe alcohol problems<sup>11</sup> and chronic illness<sup>12</sup> have found significant reductions in the utilization and cost of acute care services; a recent study of homeless older adults found similar reductions in health care use and cost after placement in a permanent supportive housing program compared with the preceding year.<sup>10</sup> Decreased acute care use is thought to result from several factors, including the stabilizing effects of housing coupled with improved access to supportive services such as case management and benefits counseling that may increase timely use of ambulatory care.<sup>12</sup> Some have hypothesized that the reductions in health care utilization and cost associated with housing older homeless adults may exceed those for younger adults because of comparatively higher rates of chronic medical conditions,<sup>3</sup> hospitalizations,<sup>42</sup> and skilled nursing facility stays among older homeless people. Further study is needed to test this hypothesis.

### Limitations

This study has several limitations. Because it was an observational study, it is possible that the differences in depressive symptoms and health care utilization between participants who obtained housing and those who remained homeless reflect baseline differences between these groups that were not controlled for in our analyses. However, the groups were similar at baseline across a wide range of characteristics, including those health outcomes that differed at follow-up. Participants who obtained housing were more likely to have a usual source of medical care at baseline than those who remained homeless. Having a usual source of care may reflect an individual's ability to form and maintain social connections, a characteristic that could potentially confound the relationship between obtaining housing and the health outcomes measured in this study. Although we adjusted for having a usual source of care in all models, residual confounding may exist. We did not examine the effect of different types of housing programs on health outcomes because we did not collect information on the type of housing obtained.

Because of the relatively small sample size, power to detect associations for some variables may have been limited. Although not all

participants completed follow-up interviews, follow-up exceeded 80%. Moreover, baseline characteristics were similar between participants who were reinterviewed and those who were lost to follow-up. Because we limited recruitment to shelters, our results are not generalizable to homeless people who live only on the street, who may have higher morbidity rates and different patterns of acute care use than people in shelters.<sup>43</sup> The study was conducted in Massachusetts, a state with a relatively high investment in social services, including permanent supportive housing programs, and therefore the results may not be generalizable to other states.

### Conclusions

As the number of older homeless adults continues to increase over the coming decades, identifying appropriate interventions to address the complex health and housing needs of this vulnerable older population will gain increasing importance. This study demonstrates that current housing strategies improve key health outcomes among older homeless adults but do not improve geriatric conditions, including difficulty performing ADLs and IADLs and symptoms of urinary incontinence. Next steps include determining how to best promote aging in place and prevent or delay institutionalization among formerly homeless older adults who have high rates of geriatric conditions that may limit independence. ■

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### Contributors

R. T. Brown acquired the data and drafted the article. R. T. Brown and Y. Miao analyzed the data. R. T. Brown, Y. Miao, S. L. Mitchell, M. Bharel, and M. A. Steinman, designed the study, interpreted the analyses, and revised the article. M. Patel, K. L. Ard, L. J. Grande, D. Blazey-Martin, and D. Floru acquired and interpreted the data and revised the article.

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### Human Participant Protection

The study methods were reviewed and approved by the institutional reviews boards of Beth Israel Deaconess Medical Center, Boston Medical Center, Carney Hospital, Hebrew SeniorLife, Lemuel Shattuck Hospital, Partners HealthCare, St. Elizabeth's Medical Center, Tufts Medical Center, and the Veterans Affairs Boston Healthcare System and the University of California, San Francisco, and the San Francisco Veterans Affairs Medical Center.

### References

- Culhane DP, Metraux S, Byrne T, Stino M, Bainbridge J. The age structure of contemporary homelessness: evidence and implications for public policy. *Anal Soc Issues Public Policy*. 2013;13(1):228–244.
- Hahn JA, Kushel MB, Bangsberg DR, Riley E, Moss AR. The aging of the homeless population: fourteen-year trends in San Francisco. *J Gen Intern Med*. 2006;21(7):775–778.
- Garibaldi B, Conde-Martel A, O'Toole TP. Self-reported comorbidities, perceived needs, and sources for usual care for older and younger homeless adults. *J Gen Intern Med*. 2005;20(8):726–730.
- Gelberg L, Linn LS, Mayer-Oakes SA. Differences in health status between older and younger homeless adults. *J Am Geriatr Soc*. 1990;38(11):1220–1229.
- Brown RT, Kiely DK, Bharel M, Mitchell SL. Geriatric syndromes in older homeless adults. *J Gen Intern Med*. 2012;27(1):16–22.
- Cohen CI. Aging and homelessness. *Gerontologist*. 1999;39(1):5–14.
- Wahl HW, Fange A, Oswald F, Gitlin LN, Iwarsson S. The home environment and disability-related outcomes in aging individuals: what is the empirical evidence? *Gerontologist*. 2009;49(3):355–367.
- Szanton SL, Thorpe RJ, Boyd C, et al. Community aging in place, advancing better living for elders: a bio-behavioral-environmental intervention to improve function and health-related quality of life in disabled older adults. *J Am Geriatr Soc*. 2011;59(12):2314–2320.
- Kushel M. Older homeless adults: can we do more? *J Gen Intern Med*. 2012;27(1):5–6.

10. Bamberger JD, Dobbins S. Long-term cost effectiveness of placing homeless seniors in permanent supportive housing. Available at: <http://www.frbsf.org/community-development/files/wp2014-01.pdf>. Accessed August 20, 2014.
11. Larimer ME, Malone DK, Garner MD, et al. Health care and public service use and costs before and after provision of housing for chronically homeless persons with severe alcohol problems. *JAMA*. 2009;301(13):1349–1357.
12. Sadowski LS, Kee RA, VanderWeele TJ, Buchanan D. Effect of a housing and case management program on emergency department visits and hospitalizations among chronically ill homeless adults: a randomized trial. *JAMA*. 2009;301(17):1771–1778.
13. Fitzpatrick-Lewis D, Ganann R, Krishnaratne S, Ciliska D, Kouyoumdjian F, Hwang SW. Effectiveness of interventions to improve the health and housing status of homeless people: a rapid systematic review. *BMC Public Health*. 2011;11:638.
14. Burt MR, Aron LY, Douglas T, Valente J, Lee E, Iwen B. *Homelessness: Programs and the People They Serve*. Washington, DC: Urban Institute; 1999.
15. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegel AP, Horwitz RI. Clarifying confusion: the Confusion Assessment Method. *Ann Intern Med*. 1990;113(12):941–948.
16. Lash TL, Silliman RA. A comparison of the National Death Index and Social Security Administration databases to ascertain vital status. *Epidemiology*. 2001;12(2):259–261.
17. Homeless Emergency Assistance and Rapid Transition to Housing Act of 2009, 42 USC §1001-1505. (2009). Available at: [http://www.hudhre.info/documents/S896\\_HEARTHAct.pdf](http://www.hudhre.info/documents/S896_HEARTHAct.pdf). Accessed August 20, 2014.
18. Katz S, Downs TD, Cash HR, Grotz RC. Progress in development of the index of ADL. *Gerontologist*. 1970;10(1 pt 1):20–30.
19. Sullivan G, Dumenci L, Burnam A, Koegel P. Validation of the Brief Instrumental Functioning Scale in a homeless population. *Psychiatr Serv*. 2001;52(8):1097–1099.
20. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606–613.
21. Avery K, Donovan J, Peters TJ, Shaw C, Gotoh M, Abrams P. ICIQ: a brief and robust measure for evaluating the symptoms and impact of urinary incontinence. *NeuroUrol Urodyn*. 2004;23(4):322–330.
22. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40(5):373–383.
23. Katz JN, Chang LC, Sangha O, Fossel AH, Bates DW. Can comorbidity be measured by questionnaire rather than medical record review? *Med Care*. 1996;34(1):73–84.
24. McLellan AT, Kushner H, Metzger D, et al. The fifth edition of the Addiction Severity Index. *J Subst Abuse Treat*. 1992;9(3):199–213.
25. Cummings SR, Nevitt MC, Kidd S. Forgetting falls: the limited accuracy of recall of falls in the elderly. *J Am Geriatr Soc*. 1988;36(7):613–616.
26. Tinetti ME. Clinical practice: preventing falls in elderly persons. *N Engl J Med*. 2003;348(1):42–49.
27. Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”: a practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975;12(3):189–198.
28. Reitan RM, Wolfson D. *The Halstead-Reitan Neuropsychological Test Battery: Therapy and Clinical Interpretation*. Tucson, AZ: Neuropsychological Press; 1985.
29. Crum RM, Anthony JC, Bassett SS, Folstein MF. Population-based norms for the Mini-Mental State Examination by age and educational level. *JAMA*. 1993;269(18):2386–2391.
30. Heaton RK, Miller W, Taylor MJ, Grant I. *Revised Comprehensive Norms for an Expanded Halstead-Reitan Battery: Demographically Adjusted Neuropsychological Norms for African American and Caucasian Adults*. Lutz, FL: Psychological Assessment Resources; 2004.
31. Bagai A, Thavendirathan P, Detsky AS. Does this patient have hearing impairment? *JAMA*. 2006;295(4):416–428.
32. Chou R, Dana T, Bougatsos C. Screening older adults for impaired visual acuity: a review of the evidence for the US Preventive Services Task Force. *Ann Intern Med*. 2009;151(1):44–58, W11–20.
33. Centers for Disease Control and Prevention. No usual source of health care among adults. Available at: [http://www.cdc.gov/nchs/health\\_policy/adults\\_no\\_source\\_health\\_care.htm](http://www.cdc.gov/nchs/health_policy/adults_no_source_health_care.htm). Accessed August 20, 2014.
34. Cohen CI, Ramirez M, Teresi J, Gallagher M, Sokolovsky J. Predictors of becoming redomiciled among older homeless women. *Gerontologist*. 1997;37(1):67–74.
35. Wong YL, Piliavin I. Stressors, resources, and distress among homeless persons: a longitudinal analysis. *Soc Sci Med*. 2001;52(7):1029–1042.
36. Wolitski RJ, Kidder DP, Pals SL, et al. Randomized trial of the effects of housing assistance on the health and risk behaviors of homeless and unstably housed people living with HIV. *AIDS Behav*. 2010;14(3):493–503.
37. Rosenheck R, Kaspro W, Frisman L, Liu-Mares W. Cost-effectiveness of supported housing for homeless persons with mental illness. *Arch Gen Psychiatry*. 2003;60(9):940–951.
38. Alexopoulos GS. Depression in the elderly. *Lancet*. 2005;365(9475):1961–1970.
39. Fiske A, Wetherell JL, Gatz M. Depression in older adults. *Annu Rev Clin Psychol*. 2009;5:363–389.
40. Cahn-Weiner DA, Malloy PF, Boyle PA, Marran M, Salloway S. Prediction of functional status from neuropsychological tests in community-dwelling elderly individuals. *Clin Neuropsychol*. 2000;14(2):187–195.
41. Seidman LJ, Schutt RK, Caplan B, Tolomiczenko GS, Turner WM, Goldfinger SM. The effect of housing interventions on neuropsychological functioning among homeless persons with mental illness. *Psychiatr Serv*. 2003;54(6):905–908.
42. Brown RT, Steinman MA. Characteristics of emergency department visits by older versus younger homeless adults in the United States. *Am J Public Health*. 2013;103(6):1046–1051.
43. O’Connell JJ, Roncarati JS, Reilly EC, et al. Old and sleeping rough: elderly homeless persons on the streets of Boston. *Care Manag J*. 2004;5(2):101–106.