ORIGINAL RESEARCH

Changes in Physical Health After Supported Housing: Results from the Collaborative Initiative to End Chronic Homelessness

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BACKGROUND: The permanent supported housing model is known to improve housing outcomes, but there has been sparse research on the effects of supported housing on physical health. Various organizations including the National Academy of Sciences have called for research in this area.
OBJECTIVE: This observational multi-site outcome study examined changes in physical health among chronically homeless adults participating in a comprehensive supported housing program and the associations between changes in physical health, housing status, and trust in primary care providers.
DESIGN: Data are presented from an observational outcome study analyzed with mixed linear modeling and regression analyses.
PARTICIPANTS: A total of 756 chronically homeless adults across 11 sites were assessed every 3 months for 1 year.
INTERVENTIONS: The Collaborative Initiative to End Chronic Homelessness provided adults who were chronically homeless with permanent housing and supportive primary healthcare and mental health services.
MAIN MEASURES: Days housed, physical health-related quality of life (HRQOL) measured by the Short Form-12 health survey, number of medical conditions, number of treated medical conditions, and number of preventive medical procedures received.
KEY RESULTS: Participants showed reduced number of medical problems and receipt of more preventive procedures over time, but there was no statistically significant change in physical HRQOL. Changes in housing were not significantly associated with changes in any physical health outcomes. Over time, participants' trust in primary care providers was positively associated with increased numbers of reported medical problems and preventive procedures received but not with physical HRQOL.
CONCLUSIONS: Entry into supported housing with linked primary care services was not associated with improvements in physical HRQOL. Improvement in other medical outcome measures was not specifically associated with improved housing status.

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A recent report by the National Academies of Sciences, Engineering, and Medicine on the effect of supported housing on health concluded that there was "no substantial published evidence as yet to demonstrate that [permanent supported housing] improves health outcomes" ([1]; pg. 4). Despite the intuitive link between supported housing and physical health outcomes, more research is needed in this area. While supported housing has been shown to improve housing outcomes in many rigorous studies,[2–4] its impact on physical health has not been well studied.

Studies of supported housing have found minor to moderate effects on mental health, substance abuse, and other psychosocial outcomes beyond housing;[5–8] however, data in these studies on physical health are incomplete or inconclusive. There are reasons to expect greater improvements in physical health than mental health since improved housing can alleviate environmental and physical exposure to harsh weather; lack of sanitary facilities, refrigeration, and cooking facilities; and exposure to victimization, substance abuse, and/or infectious agents. Studies have found that homelessness is associated with increased risk for skin disorders[9] and tuberculosis.[10] Homeless adults have higher rates of chronic health conditions such as asthma, hypertension, diabetes, and chronic obstructive pulmonary disease than adults in the general population.[11,12] In addition, higher mortality rates have consistently been reported among homeless populations compared with the general population.[13,14] However, whether mortality and other chronic illnesses are *caused by* homelessness or by risk factors that long antedated homelessness and may have, themselves, led to homelessness is unknown.

One area where there has been substantial study is the impact of supported housing on the physical health of people living with HIV/AIDS. A systematic review of the literature on this subpopulation found that homelessness and unstable housing were independently associated with worse HIV-related health outcomes but the few randomized trials that have been conducted have not found significant impact of supported housing on viral load or in improvements in physical health.[15]

The current study used data on chronically homeless adults participating in a longitudinal demonstration program of a coordinated service package to address three issues. First, we examined the association between a measure of clients' trust in their primary care providers and their physical health at the time of program entry. Second, we observed changes in physical health, days housed, and relationships with primary care providers over a 1-year follow-up period. Third, we evaluated the potential impact of supported housing on health by examining the association between changes in days housed, changes in trust in primary care providers, and changes in measures of physical health.

METHODS

Program Description

Data were gathered as part of the evaluation of Collaborative Initiative to Help End Chronic Homelessness (CICH), a demonstration program implemented by the US Interagency Council on Homelessness from 2004 to 2009. Eleven sites participated in CICH to provide adults who were chronically homeless with permanent housing and supportive primary healthcare and mental health services. The 11 CICH sites included Chattanooga, TN; Chicago, IL; Columbus, OH; Denver, CO; Fort Lauderdale, FL; Los Angeles, CA; Martinez, CA; New York, NY; Philadelphia, PA; Portland, OR; and San Francisco, CA. Eligibility criteria included being chronically homeless, defined as having been continuously homeless for 1 year or more or at least four episodes of homelessness in the past 3 years (consistent with the federal definition) and having either physical or mental health problems by self-report. Homeless adults were recruited by clinical and research staff at each site through a variety of methods, including community outreach and contacts with shelters, hospitals, and other mental health agencies. Each site developed a comprehensive plan to provide permanent supported housing to clients with clinical supports and increased access to integrated mental health and primary care services, along with plans to ensure the sustainability of these efforts after program funding ended. Outcome assessments were conducted by research assistants every 3 months for 12 months. Other details of the program have been described elsewhere.[16] Participation in the evaluation was voluntary, did not influence any services, and all participants provided written informed consent. This study was approved by the Institutional Review Boards of the VA Connecticut Healthcare System and Yale Medical School.

Measures

Housing. Participants were asked how many nights they spent during the past 3 months staying in each of various settings. The categories used in this study were nights in own place (i.e., own apartment, room, or house) or nights homeless (i.e., shelters, outdoors, in vehicles, or abandoned buildings).

Physical Health Status. The Short Form-12 Health Survey (SF12; [17]) consists of 12 items which are used to calculate mental health and physical health component summary scores. The SF-12 is one of the most widely used measures to assess overall functioning and health-related quality of life (HRQOL) both mentally and physically. Scores range from 0 to 100 for each component summary score, and a score of 50 representing the normal level of functioning in the general US population with each 10-point interval representing one standard deviation. The SF-12 has been validated as an outcome measure in homeless populations.[18]

Medical Conditions. The number of medical conditions participants currently reported out of a list of 25 conditions (e.g., high blood pressure, diabetes, asthma) was summed for a total score. The number of these conditions for which participants had received treatment in the past 3 months was also summed to represent a "treated conditions" score. The number of preventive medical procedures participants had received in the past year out of a list of 14 procedures (e.g., cholesterol blood test, urine test, flu vaccination) was also documented and summed.

Relationship with Medical Provider. Participants were first asked to identify a particular provider they see when they are sick or need advice about their medical health. Then, participants were asked to complete the Trust in Physician Scale[19] in reference to that provider. The Trust in Physician Scale is an 11-item measure that is commonly used and has been found to be valid and reliable in assessing the quality of the patient-physician relationship.[19] Participants are asked to rate statements like "I doubt that my health care provider really cares about me as a person" or "I trust my health care provider's judgements about my medical care" on a 5-point Likert scale from 1 (Totally disagree) to 5 (Totally agree).

Mental Health Status. The Psychoticism, Depression, and Anxiety subscales of the Brief Symptom Inventory (BSI; [20]) were used to measure subjective distress. Participants were asked to rate from 0 (never experience symptom) to 4 (very often experience symptom) 16 items like "nervousness or shakiness inside" and "the idea that someone else can control your thoughts." In this study, the BSI showed excellent

internal consistency with alpha = 0.92, and the BSI score presented is the mean value of the three subscales.

Substance Abuse. The Addiction Severity Index (ASI; [21]) was used to document alcohol and drug use and expenditures in the past month. The ASI consists of 6 items on an alcohol subscale and 13 items on a drug subscale. Items are used to calculate a composite score ranging from 0 to 1 for each subscale with higher scores reflecting more serious substance use.

Relationship with Mental Health Provider. A 7-item therapeutic alliance scale was used to measure the strength of the relationship experienced by participants with their primary mental health or substance abuse provider.[22] Participants were asked to identify a primary provider and to rate on a 7-point scale statements like "how often does your provider perceive accurately what your goals are?" and "how often are the goals of your work with your provider important to you?" from 0 (never) to 6 (always). The mean of the items was calculated for a scale score. In this study, this scale demonstrated good internal consistency (alpha = 0.94).

Data Analysis

First, descriptive statistics were used to characterize the sample and *t* tests and chi-square tests were used to compare participants and non-participants. Second, multiple regression analyses were conducted to examine the baseline association between client's trust in their primary care provider and their physical health at baseline. Third, mixed linear modeling was used to observe changes in housing, physical health, trust in physician, and therapeutic alliance outcomes over time including baseline, 3, 6, 9, and 12 months with participants as a random effect, time as a fixed effect, and intercepts included. Mixed linear models are used to analyze longitudinal data with repeated measures and are particularly useful for handling missing data and varying measurement times. A first-order autoregressive covariance structured was specified since it was assumed that correlations between repeated measurements decreased as they became farther apart in time. In the models, baseline variables of dependent variables were entered as covariates to adjust for potential regression to the mean. Fourth, a separate set of mixed linear models were used to examine the association between changes in housing, trust in primary care providers, and therapeutic alliance with mental health providers with changes in physical health outcomes over time. In these models, time-varying independent and dependent variables were entered and site, client's age, gender, race, education, marital status, days homeless, and SF-12 Mental Component Summary, Brief Symptom Inventory, and Addiction Severity Index scores were controlled for. To manage Type I error rate in the analyses, we set the significance level at 0.01 for all analyses (which approximates a Bonferroni adjustment with a familywise error rate of 0.05 for most sets of analyses). All analyses were conducted with SPSS 23.0 software.

RESULTS

Of the 1242 clients who enrolled in CICH, 756 (60.87%) participants across 11 sites participated in the evaluation. As shown in Table 1, the majority of the study sample was male, in their 40s, non-white, with at least a high school education, and reported their first time homeless was when they were in their 30s. Compared with clients who did not agree to participate, clients who did agree to participate were generally older, more likely to be male and Black, and more likely to have a self-reported medical or mental health disorder.

At baseline (i.e., at the time of program entry), multiple regression analyses revealed that Trust in Physician Scale scores were significantly associated with total preventive procedures received, beta = .24, $p < .001$ and with the therapeutic alliance with mental health provider (beta = .26, $p < .001$) at baseline. The Trust in Physician Scale scores were not significantly associated with the SF-12 HRQOL Physical Component Summary scores (beta = .05, $p = .27$); total medical conditions (beta = − .05, $p = .33$); or total medical conditions treated (beta = .05, $p = .37$).

When multiple regression analyses were repeated to examine the association between client's therapeutic alliance with their mental health provider and their physical health at baseline, alliance scores were not significantly associated with any physical health measures.

As shown in Table 2, mixed linear models were then conducted to observe changes in outcomes over time, revealing that CICH participants had significant improvements in housing outcomes over time with increased nights in own independent housing and fewer nights homeless (Table 1). Participants also showed significant reductions in the number of medical problems reported and increases in the number of preventive procedures they received. However, there were no significant changes in trust in primary care providers, therapeutic alliance with mental health providers, SF-12 HRQOL Physical Component Summary scores, or number of medical problems treated.

As shown in Table 3, the longitudinal analysis revealed that increases in number of days in own housing were not significantly associated with improvement in the SF-12 HRQOL

Table 1 Sociodemographic characteristics of the study sample

	Study sample
Mean age (sd)	45.71 (9.35)
Gender—male	(75.79%)
Race—White	(41.47%)
Marital status—never married	(44.67%)
Years of education	11.81 (2.58)
Age first time homeless	32.64 (12.27)

Table 2 Housing and physical health measures over time among chronically homeless adults in supported housing

	Baseline ($n = 756$)	3 months ($n = 682$)	6 months ($n = 649$)	9 months ($n = 618$)	12 months ($n = 583$)	Time effect[a]
# of days in own housing, past 3 months	5.89 (15.49)	65.20 (30.86)	78.47 (25.41)	79.82 (24.08)	79.32 (24.61)	1397.22**
# of days homeless, past 3 months	55.81 (37.08)	12.83 (22.82)	3.29 (13.74)	2.39 (12.09)	2.33 (11.57)	954.64**
Therapeutic alliance with mental health provider[b]	4.59 (1.21)	4.48 (1.35)	4.49 (1.38)	4.48 (1.28)	4.45 (1.33)	.96
Trust in Physician Scale[c]	3.81 (.72)	3.93 (.69)	3.89 (.66)	3.87 (.67)	3.88 (.69)	2.45
SF-12 Physical Component Scale[d]	45.01 (10.18)	45.11 (10.44)	44.86 (10.27)	44.60 (10.28)	44.71 (10.00)	.68
# of medical problems, past 3 months	3.85 (2.98)	3.60 (2.77)	3.51 (2.70)	3.52 (2.78)	3.58 (2.95)	4.97*
# of medical problems treated, past 3 months	2.03 (2.26)	2.15 (2.25)	2.15 (2.12)	2.18 (2.17)	2.19 (2.25)	2.11
# of preventive procedures received, past 3 months	6.95 (3.17)	7.40 (3.06)	7.66 (3.00)	7.81 (3.08)	7.79 (3.17)	14.80**

*$p < .01$; **$p < .001$
[a]*Adjusting for baseline values to account for regression to the mean*
[b]*Therapeutic alliance scores ranged from 0 to 6 with higher scores reflecting greater alliance*
[c]*Trust in Physician Scale scores ranged from 1 to 5 with higher scores reflecting greater trust. There were smaller sample sizes for the scale over time, n = 277 at baseline, n = 312 at 3 months, n = 314 at 6 months, n = 329 at 9 months, and n = 291 at 12 months*
[d]*SF-12 Physical Component Summary Scale scores range from 0 to 100, with higher scores reflecting greater health-related quality of life*

Physical Component score, the number of medical problems, the number of medical problems treated, or the number of preventive procedures received.

Evaluation of the association between changes in trust in primary care providers as well as changes in the therapeutic alliance with mental health providers, physical health status, and medical service use over time (Table 3) revealed that changes in trust in the primary care provider was significantly and positively associated with an increase in the number of medical problems reported (suggesting either poorer heath or possibly more thorough reporting) as well as the number of preventive procedures received but not HRQOL. The coefficient values can be interpreted as a one-point increase on the therapeutic alliance scale resulting in a .23 decrease in number of medical problems and a .34 increase in number of preventive procedures received. Change in therapeutic alliance with mental health providers was also significantly and positively associated with an increased number of preventive procedures.

DISCUSSION

In this multi-site study, outcome data from the evaluation of a comprehensive supported housing program that included linked funding for primary care and mental health services for chronically homeless persons showed no significant improvement in physical HRQOL, although there were reduced number of medical problems and receipt of more preventive procedures. This finding contributes to the sparse research on supported housing and physical health,[1] particularly the surprising finding of no effect on physical HRQOL. The positive effects on medical outcomes that were observed cannot be attributed to

Table 3 Coefficients of the association between changes in housing, trust in medical providers, and physical health measures

	SF-12 Physical Component Scale	# of medical problems $F=$	# of medical problems treated $F=$	# of preventive procedures $F=$
Days in own housing, past 3 months	< 0.00[a]	< − 0.00[b]	< − 0.00[c]	< 0.00[d]
Days homeless, past 3 months	0.01	< 0.00[e]	< − 0.00[f]	< − 0.00[g]
Therapeutic alliance with mental health provider[h]	0.26	0.02	0.04	0.16*
Trust in Physician Scale[i]	− 0.06	− 0.23*	0.05	0.34*

Controlling for site, age, gender, race, education, marital status, and SF-12 Mental Component Summary, Brief Symptom Inventory, and Addiction Severity Index scores
*$p < .01$; **$p < .001$
[a]*0.001*
[b]*− 0.003*
[c]*− 0.002*
[d]*0.0001*
[e]*0.0001*
[f]*− 0.003*
[g]*− 0.0004*
[h]*Therapeutic alliance scores ranged from 0 to 6 with higher scores reflecting greater alliance*
[i]*Trust in Physician Scale scores ranged from 1 to 5 with higher scores reflecting greater trust*

the housing component of the program as we found no significant association between days housed and medical outcomes.

It could be that housing chronically homeless persons with chronic medical and mental health conditions does improve housing, but at that point in their health trajectory, it may be too late to change the course of their chronic health conditions.

It remains possible that the primary care services offered as part of CICH do lead to improved medical outcomes on some measures or specific conditions we did not assess. In fact, homeless programs are increasingly integrated with primary care services and this is now widely considered to be a best practice. The Department of Veterans Affairs has implemented the homeless patient aligned care team (H-PACT) model in hundreds of VAs throughout the country.[23] In H-PACT models, homeless case managers and peer supports are embedded on medical teams and the model has been shown to be effective in engaging homeless veterans in primary care services,[24] although not with improved HRQOL. Outside the VA system, the National Health Care for the Homeless Council which includes over 200 federally funded sites has also incorporated many medical, social, and other healthcare services together in their homeless clinics.[11] Interestingly, we found that clients' relationship with their primary care providers was associated with increased receipt of preventive procedures and increased number of medical problems reported, suggesting the relationship may be important in engagement with healthcare services. Trust is considered a fundamental aspect of medical treatment relationships and previous studies have shown it predicts use of preventive services, treatment adherence, and retention.[25] The importance of building rapport and gaining the trust of homeless individuals is a guiding principle for primary care providers in general and many homeless clinics in particular.[26,27] Many individuals who have been homeless for long periods of time have become distrustful of healthcare systems and are reluctant to seek care because of negative experiences with involuntary hospitalization, incarceration, poor quality care, stigma, etc.[28,29] As a result, many chronically homeless individuals have not received proper primary care services and may have various undiagnosed medical problems. In fact, there is an intrinsic difficulty in evaluating baseline diagnoses affecting chronically homeless individuals who have long been detached from healthcare systems because many of the illnesses which affect them may be undiagnosed. This may explain why we found that chronically homeless adults who developed increased trust in physicians had more medical problems that were identified and reported, consistent with previous studies of primary care in the general population.[25]

Limitations

Housing, medical problems, and other medical outcomes were based on the self-report of clients and further study is needed with objective assessments including use of clinical evaluations, and physiological and other biological-based measures. CICH was a well-funded, comprehensive supported housing and healthcare program and may not be representative of other supported housing programs that do not have concurrently funded primary care or other supportive services. In addition, this study only sampled participants from several selected regions in the country and the results may not generalize to other regions. Further, our 1 year of follow-up may not have allowed for sufficient time to observe improved physical health after receipt of permanent supported housing. Lastly, our sample focused on chronically homeless individuals and may not generalize to non-chronically homeless individuals including families. Nevertheless, this is one of few studies to evaluate the impact of supported housing linked with primary care services on physical health. While we found no significant improvement in HRQOL and that improvement in medical outcome measures was not specifically associated with improved housing status or trust in the primary care physician, we did find trust in physician to be associated with increased illness recognition, which is, no doubt, an essential first step towards improving the health status of homeless adults with longstanding, serious medical problems, whatever their cause. Future research should assess whether housing improves domains of health and well-being that were not measured in this study, and whether housing improves health of homeless persons who are not chronically homeless.

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Compliance with Ethical Standards:

Conflict of Interest: *J. Tsai, L. Gelberg, and R. Rosenheck both do not report any conflicts of interest with this work.*

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