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Abstract

Purpose: Little is known about how permanent supported housing influences ambulatory care received by homeless persons. To fill this gap, we compared diagnoses treated in VA Greater Los Angeles (VAGLA) ambulatory care between Veterans who are formerly homeless—now housed/case managed through VA Supported Housing (“VASH Veterans”)—and currently homeless. **Methods:** We performed secondary database analyses of homeless-experienced Veterans ($n = 3631$) with VAGLA ambulatory care use from October 1, 2010 to September 30, 2011. We compared diagnoses treated—adjusting for demographics and need characteristics in regression analyses—between VASH Veterans ($n = 1904$) and currently homeless Veterans ($n = 1727$). **Results:** On average, considering 26 studied diagnoses, VASH (vs currently homeless) Veterans received care for more ($P < .05$) diagnoses (mean = 2.9/1.7). Adjusting for demographics and need characteristics, VASH Veterans were more likely ($P < .05$) than currently homeless Veterans to receive treatment for diagnoses across categories: chronic physical illness, acute physical illness, mental illness, and substance use disorders. Specifically, VASH Veterans had 2.5, 1.7, 2.1, and 1.8 times greater odds of receiving treatment for at least 2 condition in these categories, respectively. Among participants treated for chronic illnesses, adjusting for predisposing and need characteristics, VASH (vs currently homeless) Veterans were 9%, 8%, and 11% more likely to have 2 or more visits for chronic physical illnesses, mental illnesses, and substance use disorder, respectively. **Conclusion:** Among homeless-experienced Veterans, permanent supported housing may reduce disparities in the treatment of diagnoses commonly seen in ambulatory care.

Keywords

homelessness, supported housing, Veterans, ambulatory care, health disparities

Introduction

Permanent supported housing (PSH) provides subsidized community-based housing and supportive services for homeless-experienced consumers.¹⁻³ Though these programs improve housing tenure and lessen hospitalizations,⁴ we know little about associations between PSH and ambulatory care use.

The Veterans Affairs Supported Housing (VASH) program is the linchpin of VA homeless services,^{5,6} having facilitated housing without treatment mandates^{7,8} for >70,000 consumers.⁹ We previously found that homeless (vs housed) consumers at the VA Greater Los Angeles (VAGLA) underused many VA services; we suggested that VASH may address this disparity through housing, case management, and primary care referrals.¹⁰ Here, we describe diagnoses (chronic physical illnesses, acute physical illnesses, mental illnesses, and substance use disorders [SUD]) treated in VAGLA ambulatory care among homeless-experienced

Veterans. Specifically, among homeless-experienced Veterans who received VAGLA ambulatory care from October 1, 2010 to September 30, 2011, we compare diagnoses treated during this year between: formerly homeless Veterans, now housed and case managed through VASH (“VASH Veterans”); and currently homeless Veterans. These analyses can help health systems estimate PSH’s impact and plan for consumers’ improved ambulatory care.

We used the “behavioral model for vulnerable populations,”¹¹ which identifies factors that *predispose* individuals to access services, which interplay with factors

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enabling service use, and *needs* to influence *health behaviors*. Adjusting for predisposing (demographics) and need (medical complexity and disability) characteristics, we identified differences in health service utilization behaviors (diagnoses treated) between VASH and currently homeless Veterans.

Methods

The VAGLA Institutional Review Board approved this study as “quality improvement.” We detail VASH and VAGLA homeless services elsewhere.¹⁰ We used the Veterans Health Administration Outpatient Medical SAS Database to identify Veterans with at least 1 VAGLA outpatient visit between October 1, 2010 and September 30, 2011. Homeless-experienced Veterans ($n = 4496$) were identified by a V60.0 (homeless) ICD-9 code and/or VAGLA homeless service use during the study period. We excluded Veterans without a diagnostic cost group (DCG) score ($n = 865$, 19.2%), a medical complexity measure derived from demographics and diagnoses from the past year (a continuous variable, calculated to predict future health care costs).^{12,13} VASH Veterans were identified from a January 2011 roster ($n = 1904$); remaining Veterans ($n = 1727$) were designated currently homeless.¹⁴

Measures

In the *predisposing domain*, we examined age, gender, race/ethnicity, marital status, and housing status (currently homeless vs VASH)

We considered case management an *enabling* characteristic. All VASH Veterans have case managers; currently homeless persons do not routinely have case managers.

Need was estimated by 2 measures: (1) DCG,^{10,12,13} and (2) service-connection (SC): disabilities deriving from or worsened by military experiences.¹⁵ We assessed if individuals had SC (yes/no) and its severity (0%-100%). An SC = 0 encompasses persons without SC and those with an SC rated as “0,” the latter group is more disabled than the former. We considered the presence/absence of SC disabilities and the severity measure as distinct variables.

Our *health behavior* outcome variables were primary diagnoses associated with VAGLA outpatient visits. We categorized diagnoses as chronic physical illness, acute physical illness, mental illness, or SUD (the appendix lists diagnoses/ICD-9 codes), identifying common outpatient diagnoses and causes of homeless adult mortality.¹⁶⁻¹⁹

Exploratory Hypotheses

With VASH’s subsidized housing (*predisposing* characteristic) and case management (*enabling* variable) as the presumed intervention, we explored 3 hypotheses:

Hypothesis 1 (H1): Currently homeless Veterans had more need than VASH Veterans, given substandard housing (predisposing characteristic).¹¹

Hypothesis 2 (H2): VASH Veterans (more comprehensive care leading to diagnosis of more conditions) had more total diagnoses treated/person and were more likely to receive treatment for diagnoses in each category (chronic physical illness, acute physical illness, mental illness, and SUD) than currently homeless Veterans.

Hypothesis 3 (H3): VASH Veterans (with more comprehensive care) received more follow-up care (multiple visits) for treated chronic illnesses than currently homeless Veterans.

Analyses

To compare between-group predisposing variables and test H1 (comparing between-group need characteristics), we used the χ^2 test and 2-tailed t tests. To test H2, we did not code repeat visits for the same primary diagnosis over our year of interest; Veterans with ≥ 2 visits for a diagnosis were coded as treated for that diagnosis, that is, present, while Veterans without visits for that diagnosis were coded as not treated for that diagnosis, that is, absent. That is, the unit of analysis was the Veteran himself or herself. We used a test of homogeneity of Poisson means to assess differences in the average number of total diagnoses treated; we used the χ^2 test to identify differences in specific diagnoses treated and rates of treatment for at least one diagnosis in each category. We adjusted for predisposing and need variables in multivariate logistic regression analyses. For H3, ambulatory care visits from October 1, 2010 to September 30, 2011 ($n = 117892$ visits) were our unit of analysis. We used the 2-tailed t test to identify differences in the proportion of Veterans receiving ≥ 2 visits for chronic illnesses; adjusting for predisposing and need variables, we used ordinary least square regression analyses. Analyses were conducted in Stata/SE 12.1.²⁰

Results

VASH and currently homeless Veterans were of similar ($P = .07$) age (mean = 53.3 and 54.0 years, respectively). More ($P = .00$) VASH than currently homeless Veterans were female (8.6% and 5.3%, respectively). There were between-group differences ($P = .00$) in race/ethnicity; more VASH Veterans were African American than currently homeless (57.1% and 46.7%, respectively) and fewer were white than currently homeless (26.2% and 33.4%, respectively).

H1 was partially supported. There was no difference ($P = .95$) in the presence of SC (27.4% and 27.3%). SC severity was higher ($P = .00$) among the currently homeless (mean = 10.8% vs 7.0% in VASH Veterans) and DCG was higher ($P = .00$) for VASH Veterans (mean = 0.8 vs 0.6 in the currently homeless).

Table 1. Diagnoses Treated at VAGLA Among Participants^a by Housing Status.

Diagnoses ^b	Unadjusted			P Value ^d	Adjusted ^c	
	VASH Veterans (n = 1904) (% treated)	Currently Homeless Veterans (n = 1727) (% treated)	Total (N = 3631) (% treated)		VASH Veterans, Adjusted Odds Ratio	95% Confidence Interval
<i>Chronic physical illness</i>						
At least 1 listed chronic physical illness	71.3	48.6	60.5	.000	2.5	2.1-2.9
Arthropathies	25.5	12.0	19.1	.000	2.4	2.0-2.8
Asthma	1.9	1.0	1.5	.026	1.7	1.0-3.1
Benign neoplasms	3.9	2.2	3.1	.003	1.7	1.2-2.6
Cancer	4.4	2.7	3.6	.005	1.9	1.3-2.8
Chronic pain	41.4	22.9	32.6	.000	2.2	1.9-2.6
Congestive heart failure ^{e,f}	1.4	0.6	1.0	.029	2.6	1.2-5.8
Chronic obstructive pulmonary disease	5.6	2.7	4.2	.000	2.2	1.5-3.1
Coronary artery disease	5.6	3.7	4.7	.007	1.6	1.1-2.3
Diabetes	13.8	10.9	12.4	.009	1.4	1.1-1.7
Glaucoma	5.3	2.9	4.1	.000	1.9	1.3, 2.7
Hepatitis C	10.2	5.9	8.2	.000	1.8	1.4-2.3
HIV/AIDS ^e	2.2	0.9	1.6	.003	2.2	1.2-4.0
Hypertension	24.6	16.4	20.7	.000	1.6	1.3-1.9
Obesity	9.0	3.5	6.4	.000	2.6	1.9-3.6
Tuberculosis	1.9	0.9	1.4	.009	1.9	1.0-3.5
<i>Acute physical illness</i>						
At least 1 listed acute physical illness	17.3	10.0	13.8	.000	1.7	1.4-2.1
Acute upper respiratory infection	6.3	2.8	4.6	.000	2.1	1.5-2.9
Injuries	7.0	4.3	5.7	.000	1.6	1.2-2.2
Skin/subcutaneous infections	5.9	3.8	4.9	.002	1.5	1.1-2.1
<i>Mental illness</i>						
At least 1 listed mental illness	53.8	34.6	44.7	.000	2.1	1.8-2.4
Anxiety disorders (excluding PTSD)	6.6	4.0	5.3	.001	1.7	1.3-2.3
Bipolar disorders	9.9	5.6	7.8	.000	1.8	1.4-2.3
Depression	26.2	14.1	20.4	.000	2.0	1.6-2.3
Psychotic disorders	11.6	10.0	10.9	.124	1.1	0.9-1.4
PTSD	20.7	10.7	16.0	.000	2.4	1.9-2.9
<i>Substance use disorders</i>						
At least 1 listed substance use disorder	30.9	18.4	25.0	.000	1.8	1.5-2.1
Alcohol-related disorders	15.7	9.0	12.5	.000	1.8	1.5-2.3
Drug-related disorders	24.7	13.7	19.5	.000	1.9	1.6, 2.3
Tobacco use disorder	9.7	5.4	7.6	.000	1.8	1.4-2.4
<i>Multimorbidity</i>						
At least 1 listed multi-morbidity	51.6	27.9	40.3	.000	2.6	2.2-3.0
At least 1 listed chronic physical illness and mental illness	42.7	21.7	32.7	.000	2.6	2.2-3.0
At least 1 listed chronic physical illness and SUD ^g	25.5	11.4	18.8	.000	2.4	2.0-2.9
At least 1 listed mental illness and SUD ^g	23.7	11.4	17.8	.000	2.3	1.9-2.8
Trimorbidity (at least 1 listed chronic physical illness, mental illness, and SUD ^g)	20.1	8.3	14.5	.000	2.6	2.1-3.2

Abbreviations: PTSD, posttraumatic stress disorder; SUD, substance use disorders; VAGLA, VA Greater Los Angeles; VASH, VA Supported Housing.

^aAmong homeless-experienced Veterans with at least 1 VAGLA ambulatory care visit between October 1, 2010 and September 30, 2011.

^bAll statistical tests of differences are significant at $P < .05$ with the exception of psychotic disorders.

^cMultivariate logistic regression, with reference group of currently homeless Veterans (n = 1727), adjusting for predisposing (age, gender, race/ethnicity, marital status) and need (diagnostic cost group [DCG], presence of a service connected disability, and severity of service connected disability) characteristics.

^dP values were calculated using the chi-square test

^eNo females received treatment for these diagnoses, so females were dropped from the regression model, resulting in a smaller sample size (N = 3376).

^fIn regression analyses, marital status and race/ethnicity categories were collinear and thus collapsed.

^gIn multimorbidity analyses, SUD was defined as alcohol or drug use disorder only, excluding tobacco use disorder.

Table 2. Proportion of Participants^a Treated for Diagnoses With at Least One Follow-up Visit,^b by Diagnostic Category.

Diagnoses	Unadjusted			P Value ^d	Adjusted ^c	
	HUD-VASH Veterans (% Treated for Diagnoses With at Least One Follow-up Visit)	Currently Homeless Veterans (% Treated for Diagnoses With at Least One Follow-up Visit)	Total (% Treated for Diagnoses With at Least One Follow-up Visit)		HUD-VASH Veterans, With Currently homeless Veterans as a Reference Group (Coefficient) ^e	P Value ^d
Chronic physical illnesses	54.1	45.6	50.9	.000	0.09	.000
Mental illnesses	73.7	66.5	71.0	.007	0.08	.000
Substance use disorders	68.4	57.5	64.6	.005	0.11	.001
All listed diagnoses in the above categories	60.2	52.2	56.9	.000	0.08	.000

Abbreviations: HUD, Housing and Urban Development. VAGLA, VA Greater Los Angeles; VASH, VA Supported Housing.

^aAmong homeless-experienced Veterans with at least one VAGLA ambulatory care visit between October 1, 2010 and September 30, 2011.

^bFollow-up visits reflect ambulatory care use at VAGLA between October 1, 2010 and September 30, 2011.

^cOrdinary least square regression, with reference group of currently homeless Veterans ($n = 1731$), adjusting for predisposing (age, gender, race/ethnicity, marital status) and need (diagnostic cost group [DCG], presence of service connection, and percent service connection) characteristics.

^dP values were calculated using 2-tailed *t* tests.

^eCoefficients represent the increased likelihood of VASH Veterans receiving follow-up care (vs currently homeless Veterans).

H2 was supported. Considering all 26 studied diagnoses, VASH Veterans received treatment for an average of 2.9 diagnoses, more ($P = .00$) than the currently homeless (1.7). More ($P < .01$) VASH Veterans received treatment across diagnostic categories (Table 1), that is, chronic physical illness (71.3% and 48.6%), acute physical illness (17.3% and 10.0%), mental illness (53.8% and 34.6%), SUD (30.9% and 18.4%), and multimorbidities (51.6% and 27.9%). Table 1's adjusted (for predisposing/need variables) columns present the odds of receiving treatment for diagnoses. Except for psychotic disorders, VASH Veterans had significantly greater odds of receiving treatment for all diagnoses. Across multimorbidities, VASH Veterans had 2.3 to 2.6 times greater odds of receiving care.

H3 was supported (Table 2). Among Veterans treated for chronic illnesses (chronic physical illnesses, mental illnesses, and SUD (limited to alcohol/drug use disorders), significantly ($P < .5$) more VASH versus currently homeless Veterans had ≥ 2 visits for chronic physical illnesses (54.1% and 45.6%, respectively), mental illnesses (73.7% and 66.5%), and SUD (60.2% and 52.2%). Adjusting for predisposing and need characteristics, VASH Veterans were 9%, 8%, and 11% more likely to receive follow-up care for chronic physical illnesses, mental illnesses, and SUD, respectively.

Limitations

Data are from VAGLA alone; we must use caution in extrapolating these findings to other facilities or healthcare systems. We lacked data about some important predisposing/enabling/need characteristics, especially comprehensive

need measures. The DCG employs the past year's VA use^{12,13} to estimate need and predict future costs of care. As VASH Veterans use the VA more than currently homeless Veterans, they may have relatively higher DCG,¹⁰ contributing to the mixed findings of our hypotheses.

Given disparate provider coding behaviors and our resultant analyses of only primary diagnoses, these analyses do not capture multimorbidity treated in single visits; however, we would not expect between-group findings to change if secondary diagnoses were considered. Moreover, as homeless Veterans were selected (not randomly assigned) to VASH, we have limited ability to attribute between-group differences to VASH. As these analyses are cross-sectional, we cannot attribute causality in the treatment of diagnoses to VASH. However, we adjusted analyses for predisposing and need characteristics to make more plausible the possibility that remaining differences in treated diagnoses might be attributable to VASH.

Implications of Findings

Our findings suggest that VASH—by linking consumers to housing, case management, and primary care—may predispose and enable outpatient treatment for diverse diagnoses. Below, we detail implications by hypothesis.

Hypothesis 1: Our inconclusive findings regarding between-group need differences suggest the utility of more comprehensive measurement of need among homeless-experienced Veterans. VASH is intended for the most “needy” homeless Veterans^{1,2} and has limited

enrollment capacity. Preference *and* need should be used to refer Veterans to VASH; without standardized, comprehensive need measures, preference often takes precedent and particularly vulnerable Veterans with the greatest need for VASH may not receive its services.

Hypothesis 2: This work bolsters our prior finding that VASH Veterans use significantly more ambulatory care than currently homeless Veterans¹⁰; we highlight between-group disparities in *every* major diagnostic category and specific diagnosis except psychotic disorders (for which higher treatment rates may reflect currently homeless Veterans' greater need). It is unclear if VASH addresses disparities in the treatment of diagnoses through case management, housing, and/or linkages to primary care; though there are more homeless Veterans than VASH can accommodate, the VA recently implemented homeless-focused

medical homes ("Homeless Patient–Aligned Care Teams [HPACT]") that integrate primary care, mental health, SUD treatment, and case management in a "one-stop" model.^{21,22} Homeless-experienced Veterans who are not in VASH may benefit from HPACT. Future analyses should consider HPACT empanelment as an enabling characteristic.

Hypothesis 3: Based on rates of follow-up care for treated chronic illnesses, VASH provides more "comprehensive care." Our implicit assumption was that multiple visits for a given diagnosis are better than a single visit. However, multiple visits/year are appropriate for some patients/conditions but not others, which may explain the small between-group difference (VASH Veterans were 8% more likely to get follow-up care). More refined future analyses should include reasons for follow-up visits.

Appendix

Diagnoses and Associated ICD-9 (International Classification of Diseases–Ninth Revision) Codes.

Diagnosis	ICD-9 Codes
Chronic physical illnesses	
Arthropathies	710.xx-719.xx
Asthma	493.xx
Benign neoplasms	210-229, 235-239
Cancer	140.xx-208.xx
Chronic pain	84, 202, 203, 204, 307.89, 720.0-724.9, 729.1, 737-737.9, 738.4-738.5, 739.3-739.4, 756.1-756.19, 805.00, 805.1-806.9, 839-839.5, 846.0-847.9, 996.4
Coronary atherosclerosis and other heart disease	411.0-414.01, 414.2, 414.3, 414.4, 414.8, 414.9, V4581, V4582, 78650, 78651, 78659
Chronic obstructive pulmonary disease (COPD) and bronchiectasis	490.xx-492.xx, 494, 494.x, 496
Congestive heart failure (CHF)	428.xx, 398.91
Diabetes	250.xx, 648.0x, 775.1x
Glaucoma	365.00
Hepatitis C	070.20, 070.22, 070.30, 070.32
HIV/AIDS	042.xx, 079.53, V08
Hypertension	401.xx-405.xx
Tuberculosis	010.xx-018.xx
Acute physical illnesses	
Acute upper respiratory infections	460.xx-461.xx, 463.xx-466.xx
Fractures/open wounds/sprains/other injuries	800.xx-829.xx, 840.xx-844.xx, 845.1, 846.xx- 848.xx, 870.xx-897.xx, 920.xx-924.xx
Skin/subcutaneous infections	680.xx-686.xx, 692.xx
Mental illness	
Anxiety disorders excluding posttraumatic stress disorder	300.0x, 300.2x, 300.3, 308.3
Bipolar disorder	296.00-296.16, 296.40-296.99
Depression	293.83, 296.20-296.36, 300.4, 301.13, 311.xx
Posttraumatic stress disorder	309.81
Schizophrenia and other psychotic disorders	293.81, 293.82, 295.xx, 297.x-298.x
Substance use disorders	
Alcohol-related disorders	291.xx, 303.xx, 305.0x, 357.5x
Drug-related disorders	292.1x-292.8x, 304.xx, 305.2x-305.9x, 357.6x, 648.3x
Tobacco use disorders	305.10

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