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Housing Instability Results in Increased Acute Care Utilization in an Urban HIV Clinic Cohort

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Background. People living with HIV (PLWH) who experience homelessness and unstable housing (HUH) often have fragmented health care. Research that incorporates granular assessments of housing status and primary care visit adherence to understand patterns of acute care utilization can help pinpoint areas for intervention.

Methods. We collected self-reported living situation, categorized as stable (rent/own, hotel/single room occupancy), unstable (treatment/transitional program, staying with friends), or homeless (homeless shelter, outdoors/in vehicle) at an urban safety-net HIV clinic between February and August 2017 and abstracted demographic and clinical information from the medical record. Regression models evaluated the association of housing status on the frequency of acute care visits—urgent care (UC) visits, emergency department (ED) visits, and hospitalizations—and whether suboptimal primary care visit adherence (<75%) interacted with housing status on acute care visits.

Results. Among 1198 patients, 25% experienced HUH. In adjusted models, unstable housing resulted in a statistically significant increase in the incidence rate ratio for UC visits (incidence rate ratio [IRR], 1.35; 95% confidence interval [CI], 1.10 to 1.66; $P < .001$), ED visits (IRR, 2.12; 95% CI, 1.44 to 3.13; $P < .001$), and hospitalizations (IRR, 1.75; 95% CI, 1.10 to 2.77; $P = 0.018$). Homelessness led to even greater increases in UC visits (IRR, 1.75; 95% CI, 1.29 to 2.39; $P < .001$), ED visits (IRR, 4.18; 95% CI, 2.77 to 6.30; $P < .001$), and hospitalizations (IRR, 3.18; 95% CI, 2.03 to 4.97; $P < .001$). Suboptimal visit adherence differentially impacted UC and ED visits by housing status, suggesting interaction.

Conclusions. Increased acute care visit frequency among HUH-PLWH suggests that interventions at these visits may create opportunities to improve care.

Keywords. emergency room visits; HIV; homelessness and unstable housing; hospitalizations; urgent care; visit adherence.

Homelessness and unstable housing (HUH) are associated with poor health outcomes for people living with HIV (PLWH), including worse retention in HIV care and inadequate virologic suppression [1–6]. In addition, HUH is associated with increased acute care utilization in the form of urgent care (UC) visits, emergency department (ED) visits, and inpatient hospitalizations. PLWH with HUH often experience fragmented care because these urgent settings can be siloed by lack of communication and because these health systems can be difficult to navigate, resulting in poor follow-up at primary care appointments [7]. However, research on HUH and acute care utilization has been limited by imprecise categorizations of housing, such as combining living in temporary housing with living on the street. A more granular assessment of housing status could help determine, for example, whether temporary housing confers a benefit over being street homeless and whether this benefit is on par with that of being stably housed. In addition, examinations of PLWH with HUH and acute care utilization do not always separate out urgent care visits, which may play an important role in care delivery. Finally, research to date has not considered how HUH and HIV primary care visit adherence might simultaneously impact the frequency of acute care visits [8], which is important because being well retained in HIV primary care may be associated with decreased acute care utilization. In conceptualizing this study, we hypothesized that increasing housing stability across a continuum of housing status would be associated with decreased acute care utilization, including emergency room visits, hospitalizations, and urgent care visits, and that being well retained in HIV primary care would be associated with decreased acute care utilization within strata of housing status. Therefore, our objective was to examine the impact of housing status and HIV primary care visit adherence on acute care utilization among patients in a large safety-net HIV clinic in San Francisco.

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METHODS

Study Setting, Population, and Measurements

The Ward 86 HIV Clinic at San Francisco General Hospital (SFGH) is funded by the San Francisco Department of Public Health (SFDPH) to serve publicly insured and uninsured patients. From February 2017 to August 2017, we asked patients checking into the clinic to complete a pictorial housing status survey in which they circled their current housing status from 1 of 6 different living arrangements: (1) rent/own, (2) treatment/transitional program, (3) hotel/single room occupancy (SRO), (4) staying with friend ("couch surfing"), (5) homeless shelter, (6) outdoors/in vehicle. For this convenience sample of patients, demographics were abstracted from the electronic medical record (EMR), along with information on care utilization from 90 days before completion of the housing status survey until November 2017 (90 days after the last survey was administered). Care utilization data included primary care visit attendance (kept and missed appointments), drop-in visits to Urgent Care at Ward 86 (held 5 days a week), visits to the emergency department at SFGH, and SFGH inpatient hospitalizations. We included EMR data from 90 days before the housing status survey, given that many HUH-PLWH experience episodes of homelessness or unstable housing lasting >90 days or cycle through multiple unstable and homeless living situations, suggesting that a point-in-time evaluation of housing status may be indicative of housing status over a period of time, including before housing status assessment [9]. Because CD4 cell counts may only be measured biannually and can change slowly, we chose a longer window from which to abstract CD4 counts from the EMR, that is, +/-120 days of the housing status survey (July 2016 to December 2017) to reduce missing data. This study was approved by the Committee on Human Research at the University of California San Francisco.

Variables

Primary and Secondary Outcomes

The primary outcome was number of acute care visits, stratified into urgent care visits, emergency department visits, and hospitalizations, over the study period.

Primary Predictor

Housing status was categorized as homeless (outdoors/in a vehicle or in a homeless shelter), unstably housed (staying with a friend or in a treatment/transitional program), or stably housed (living in a place that they rent/own or a single room occupancy or hotel). We categorized people living in SROs/hotels as "rent/own," because in San Francisco SROs/hotels are typically long-term living arrangements for PLWH (E. D. Riley, E. Vittinghoff, K. Christopoulos, unpublished data) [10].

Covariates

Scheduled primary care visits were categorized as attended or missed, and optimal primary care visit adherence was defined as having attended ≥75% of total scheduled primary care appointments, given the strong association with poor clinical outcomes for visit adherence <75% and use in prior research [11–13]. We excluded patients without any scheduled primary care visits during the study period. Race/ethnicity was categorized as white, black, Latino, or other. Baseline virologic suppression was defined as serum viral load <200 copies/mL +/-90 days of housing status survey completion. CD4 cell count measurements were dichotomized as <200 cells/mL vs ≥200 cells/mL.

Statistical Analysis

We tabulated descriptive statistics for the study population. To evaluate the association between housing instability and the frequency of acute care utilization, we first tabulated the incidence rates of each acute care visit type by housing status. We then calculated unadjusted and adjusted incidence rate ratios for each acute care visit type using separate negative binomial regression models given overdispersion of the outcome variable (variance: mean > 1). There were 130 patients with missing CD4 cell counts. To include all subjects in the models, we assumed these values to be "missing at random" and imputed these values based on other available predictor and outcome variables. We then fit regression models using 20 imputed data sets, adjusting for age by decade (<30, 30–40, 41–50, >50 years), race/ethnicity (black, white, Latino, other), sex (male or female), baseline CD4 <200 cells/mm^3, baseline HIV viral load <200 copies/mL, and optimal primary care visit adherence (≥75% visit adherence). We combined the results from the imputed data sets and calculated standard errors that accommodated the uncertainty in imputation using the approach of Rubin [14]. The time exposure variable for each subject was calculated by using the difference (in days) between the last day of data abstraction (November 21, 2017) and 90 days before the housing status intake. Models were repeated with a zero-inflated negative binomial regression model. Of note, a goodness-of-fit test using Aikeke's and Bayesian information criteria favored the negative binomial regression model [15].

To quantify the differential impact (ie, interaction) of primary care visit adherence on acute care visits at each level of housing instability, we then repeated these models using an interaction term between housing status and suboptimal primary care visit adherence, adjusting for the same confounders. This model allowed us to evaluate for the presence of a combined effect of housing status and primary care visit adherence on acute care visits above and beyond each variable alone. Evidence of an interaction between primary care visit adherence and housing status would suggest that changes in visit adherence might have a differential impact on acute care visits within different categories of housing instability. Although statistical software commonly includes multiplicative interaction, testing on the multiplicative scale alone can miss statistically significant interactions on the additive scale. Moreover, tests for additive interactions have become a routine part of reporting for interactions [16, 17] and have important public health implications in terms of allowing examination of effect differences within subgroups. Hence, we calculated additive interaction using the relative excess risk due to interaction (RERI), which compared within-group rate differences in acute care visits by primary care visit adherence across levels of housing status. Comparisons were made between homeless and stably housed and between unstably housed and stably housed. The comparator value for multiplicative interactions was stably housed patients with visit adherence ≥75%. *P* values <.1 were considered statistically significant for interactions.

RESULTS

Characteristics of Study Participants

A total of 1213 patients completed the housing status survey; 15 patients did not have a scheduled primary care visit during the study period and therefore were excluded from the study population. None of these 15 patients had an acute care visit during the time frame of interest. In the final sample of 1198 patients, which represented about half of the active clinic population (Table 1), the median age (interquartile range [IQR]) was 50 (41–57) years; 13% were female; 41% were white, 24% were black, and 26% were Latino; 19% had unstable housing, and 6% were homeless; and 83% had a viral load <200 copies/mL. Of the 1068 patients with measured CD4 counts, 12% had CD4 counts <200 cells/mL. The median number of scheduled primary care visits (IQR) was 5 (4–8), and the percentage of patients with suboptimal visit adherence during the study period was 49%.

Acute Care Visit Frequency

During the study period, which included a total of 1089 person-years of observation time, there were 1249 urgent care visits among 49% (n = 592) of patients, 637 emergency room visits among 25% (n = 298), and 177 total hospitalizations among 11% (n = 132). No acute care visits of any type were recorded in 48% (n = 578) of patients. The frequencies of visits/person-year were as follows: 1.15 for UC visits, 0.58 for ED visits, 0.16 for hospitalizations. Within each stratum of acute care visit type, there was a monotonic increase in UC visits, ED visits, and hospitalizations with increasing housing instability (Figure 1).

Variables Associated With Acute Care Visit Frequency

In both unadjusted regression models and those adjusting for age, race/ethnicity, sex, baseline viral load, baseline CD4 cell count <200 cells/mm^3, and primary care visit adherence, housing instability (eg, unstable housing and homelessness) demonstrated the strongest statistically significant association with acute care visit frequency, regardless of acute care visit type (Table 2). In both unadjusted and adjusted models, optimal primary care visit adherence was associated with lower emergency room visit frequency (adjusted incidence rate ratio [aIRR], 0.59; 95% confidence interval [CI], 0.43 to 0.81; *P* = .001) and hospitalizations (aIRR, 0.57; 95% CI, 0.37 to 0.88; *P* = .01). Women had increased urgent care use in both unadjusted and adjusted models (aIRR, 1.31; 95% CI, 1.05 to 1.65; *P* = .02) and emergency room visits in adjusted models (aIRR, 1.71; 95% CI, 1.13 to 2.57; *P* = .01).

Table 1. Baseline Demographic and Clinical Characteristics in Sample (n = 1198)

Category	% n(N)
Housing status	
Stable housing	75% (896/1198)
Unstable housing	19% (230/1198)
Homeless	6% (72/1198)
Female sex	13% (160/1198)
Age, median (IQR), y	50 (47–57)
Age, y	
<30	6% (69/1198)
30–40	17% (204/1198)
41–50	26% (310/1198)
>50	51% (618/1198)
Race/ethnicity	
White	42% (500/1198)
Black	24% (286/1198)
Latino	24% (293/1198)
Other	10% (119/1198)
CD4 cell count < 200 cells/mL[a]	12% (132/1068)[a]
Viral load < 200 copies/mL	83% (997/1198)
Suboptimal visit adherence	49% (536/1198)
Scheduled clinic visits, median (IQR)	5 (4–8)
Missed clinic visits, median (IQR)	1 (0–3)

Stable housing = rent/own or in a single room occupancy; temporary housing = staying in a rehabilitation facility or with friends; homeless = living on the streets, in a vehicle, or in a shelter. Suboptimal visit adherence = proportion of scheduled visits that were attended <75%.

Abbreviation: IQR, interquartile range.

[a]One hundred thirty missing values for baseline CD4 values.

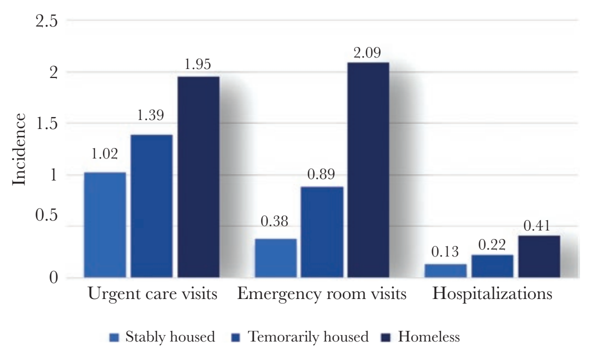

Figure 1. Rates* for acute care visits by housing status and visit type. Stably housed = rent/own or in a single room occupancy; temporarily housed = staying in a rehabilitation facility or with friends; homeless = living on the streets, in a vehicle, or in a shelter. *Rates are calculated per person-year.

Table 2. Unadjusted and Adjusted Incidence Rate Ratio for Type of Acute Care Visit (n = 1198)

Category	Urgent Care Visits		Emergency Room Visits		Hospitalizations	
	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)	Unadjusted IRR (95% CI)	Adjusted IRR (95% CI)
Housing status						
Stable	**Reference**	Reference	Reference	Reference	Reference	Reference
Temporary	**1.39 (1.13 to 1.69)**	**1.35 (1.10 to 1.66)[a]**	**2.37 (1.62 to 3.46)[a]**	**2.12 (1.44 to 3.13)[a]**	**1.38 (1.12 to 2.82)**	**1.75 (1.10 to 2.77)**
Homeless	**1.88 (1.37 to 2.56)[a]**	**1.75 (1.29 to 2.39)[a]**	**5.46 (3.71 to 8.04)[a]**	**4.18 (2.77 to 6.30)[a]**	**3.32 (2.13 to 5.19)[a]**	**3.18 (2.03 to 4.97)[a]**
Female sex	**1.29 (1.02 to 1.62)**	**1.31 (1.04 to 1.65)**	1.27 (0.87 to 1.88)	**1.71 (1.13 to 2.57)**	1.29 (0.72 to 2.31)	1.33 (0.74 to 2.36)
Age, y						
<30	Reference	Reference	Reference	Reference	Reference	Reference
30–40	0.90 (0.65 to 1.26)	0.94 (0.68 to 1.31)	0.86 (0.40 to 1.85)	1.79 (0.65 to 4.93)	1.68 (0.61 to 4.67)	1.69 (0.62 to 4.59)
41–50	1.00 (0.73 to 1.37)	1.12 (0.81 to 1.53)	0.95 (0.45 to 1.99)	2.39 (0.93 to 6.11)	2.31 (0.91 to 5.89)	**3.04 (1.14 to 8.09)**
>50	0.74 (0.55 to 1.01)	0.88 (0.65 to 1.20)	0.54 (0.26 to 1.13)	1.59 (0.62 to 4.06)	1.53 (0.60 to 3.90)	2.46 (0.92 to 6.58)
Race/ethnicity						
White	Reference	Reference	Reference	Reference	Reference	Reference
Black	1.08 (0.87 to 1.35)	1.09 (0.83 to 1.27)	1.51 (1.02 to 2.22)	1.30 (0.82 to 2.06)	1.31 (0.82 to 2.07)	1.11 (0.69 to 1.78)
Latino	1.05 (0.85 to 1.29)	1.04 (0.81 to 1.29)	0.72 (0.49 to 1.06)	0.97 (0.59 to 1.59)	0.97 (0.60 to 1.59)	1.04 (0.63 to 1.70)
Other	0.84 (0.62 to 1.14)	0.82 (0.65 to 1.10)	0.88 (0.50 to 1.53)	1.03 (0.50 to 2.14)	0.98 (0.46 to 2.11)	1.09 (0.48 to 2.40)
CD4 cell count <200 cells/mL[a]	1.14 (0.87 to 1.45)	1.03 (0.79 to 1.36)	**1.68 (1.11 to 2.54)**	1.21 (0.79 to 1.87)	**2.43 (1.54 to 3.83)[a]**	**2.03 (1.24 to 3.33)**
Viral load <200 copies/mL[a]	0.86 (0.70 to 1.06)	1.01 (0.81 to 1.25)	**0.53 (0.38 to 0.73)[a]**	0.77 (0.53 to 1.12)	**0.64 (0.43 to 0.96)**	1.09 (0.74 to 2.36)
Optimal visit adherence	**0.83 (0.70 to 0.98)**	0.92 (0.77 to 1.09)	**0.43 (0.32 to 0.60)[a]**	**0.59 (0.43 to 0.81)**	**0.48 (0.33 to 0.72)**	**0.57 (0.37 to 0.88)**

Stable housing = rent/own or in a single room occupancy; temporary housing = staying in a rehabilitation facility or with friends; homeless = living on the streets, in a vehicle, or in a shelter. Optimal visit adherence = proportion of scheduled visits that were attended ≥75%. Boldface indicates *P* value <.05.

Abbreviations: CI, confidence interval; IRR, incidence rate ratio.

[a] $P < .001$.

Evaluation of the Impact of Primary Care Visit Adherence and Housing Status on Acute Care Visit Frequency

Annual rate differences in ED visits between suboptimal and optimal visit adherence were greatest at higher levels of housing instability (eg, homeless): there were an estimated 1.47 fewer annual ED visits per person among homeless patients with optimal primary care visit adherence compared with homeless patients with suboptimal visit adherence (95% CI, −2.61 to −0.34), 0.35 fewer annual ED visits per person among unstably housed patients with optimal primary care visit adherence compared with unstably housed patients with suboptimal primary care visit adherence (95% CI, −0.90 to 0.21), and only 0.20 fewer annual ED visits per person among those with stable housing (95% CI, −0.35 to −0.06). Moreover, our models demonstrated evidence of a synergistic effect of primary care visit adherence and housing instability on acute care utilization. Suboptimal primary care visit adherence and housing instability demonstrated a statistically significant negative synergistic effect on urgent care visits on both the multiplicative (ratio of IRRs, 0.63; 95% CI, 0.41 to 0.97; $P = .04$) and additive scales (RERI, −0.59; 95% CI, −1.11 to −0.07; $P = .03$). Suboptimal primary care visit adherence also showed a negative synergistic effect with housing instability among homeless patients on the frequency of emergency department visits when compared with those with stable housing, indicating that the combined effect of homelessness and suboptimal visit adherence impacted emergency department visits above and beyond each variable alone (RERI, −1.26; 95% CI, −2.40 to −0.14; $P = .03$) (Table 3).

DISCUSSION

In this retrospective analysis of PLWH in an urban HIV clinic, we found that unstable housing and homelessness were monotonically associated with a higher frequency of acute care visits of all types, including urgent care visits, ED visits, and hospitalizations. Our analysis also demonstrated that optimal primary care visit adherence (ie, ≥75% kept/scheduled visits) was strongly associated with decreased frequency of ED visits. Moreover, there was a significant negative synergistic effect of suboptimal visit adherence and housing instability on the frequency of urgent care visits and emergency room visits that was above and beyond the impact of each individual factor alone. For example, our models estimated that among the 75 homeless patients in our cohort, having primary care visit adherence <75% compared with ≥75% was associated with an estimated 25 to 190 fewer total emergency room visits. These findings suggest that while there is a gradient of populations along the continuum of housing instability who could benefit from interventions to improve retention in care and reduce acute care visits, homeless patients are a top priority.

Our general findings that HUH have increased emergency room utilization and suboptimal connection to primary care are similar to those in other large single-center studies [18, 19].

Table 3. Predicted Means of Incidence Rates, Rate Difference and Interaction between Housing Status and Primary Care Visit Adherence on Acute Care Visits

	Urgent Care Visits					
	Housing Status					
	Stably Housed		Unstably Housed		Homeless	
	Mean Predicted Rate (95% CI)	Rate Difference (95% CI)	Mean Predicted Rate (95% CI)	Rate Difference (95% CI)	Mean Predicted Rate (95% CI)	Rate Difference (95% CI)
≥75% primary care visit adherence	**0.99 (0.86 to 1.13)[a]**	0.02 (–0.18 to 0.22)	**1.04 (0.72 to 1.38)[a]**	**–0.57 (–1.04 to –0.09)**	**1.42 (0.57 to 2.28)[a]**	–0.51 (–1.59 to 0.57)
<75% primary care visit adherence	**1.02 (0.87 to 1.16)[a]**		**1.61 (1.25 to 1.96)[a]**		**1.92 (1.29 to 2.57)[a]**	
Measure of interaction on the additive scale:	Stably Housed and Unstably Housed RERI (95% CI), 0.59 (–1.10 to –0.08); *P* = .024; Unstably Housed and Homeless RERI (95% CI), –0.53 (–1.62 to 1.12); *P* = .34					
Measure of interaction on the multiplicative scale:	Stably Housed and Unstably Housed Ratio of IRRs (95% CI), 0.63 (0.41 to 0.97); *P* = .04; Unstably Housed and Homeless Ratio of IRRs (95% CI), 0.72 (0.37 to 1.48); *P* = .37					
	Emergency Department Visits					
	Housing Status					
	Stably Housed		Unstably Housed		Homeless	
	Mean Predicted Rate (95% CI; *P* Value)	Rate Difference (95% CI)	Mean Predicted Rate (95% CI)	Rate Difference (95% CI)	Mean Predicted Rate (95% CI)	Rate Difference (95% CI)
≥75% primary care visit adherence	**0.29 (0.22 to 0.37)[a]**	**–0.20 (–0.35 to –0.06)**	**0.67 (0.27 to 1.06)[a]**	**–0.35 (–0.90 to 0.21)**	**0.77 (0.16 to 1.38)[a]**	**–1.47 (–2.61 to –0.34)**
<75% primary care visit adherence	**0.50 (0.37 to 0.62)[a]**		**1.01 (0.61 to 1.42)[a]**		**2.24 (1.31 to 3.18)[a]**	
Measure of interaction on the additive scale:	Stably Housed and Unstably Housed RERI (95% CI), –0.14 (–0.72 to 0.42); *P* = .62; Unstably Housed and Homeless RERI (95% CI), –1.26 (–2.40 to –0.14); *P* = .03					
Measure of interaction on the multiplicative scale:	Stably Housed and Unstably Housed Ratio of IRRs (95% CI), 1.11 (0.51 to 2.44); *P* = .79; Unstably Housed and Homeless Ratio of IRRs (95% CI), 0.58 (0.23 to 1.50); *P* = .26					
	Hospitalizations					
	Housing Status					
	Stably Housed		Unstably Housed		Homeless	
	Mean Predicted Rate (95% CI; *P* Value)	Rate Difference (95% CI)	Mean Predicted Rate (95% CI)	Rate Difference (95% CI)	Mean Predicted Rate (95% CI)	Rate Difference (95% CI)
≥75% primary care visit adherence	**0.09 (0.06 to 0.13)[a]**	**–0.07 (–0.13 to –0.001)**	**0.17 (0.04 to 0.29)[a]**	**–0.12 (–0.29 to 0.05)**	**0.17 (–0.03 to 0.36)[a]**	**–0.30 (–0.59 to –0.01)**
<75% primary care visit adherence	**0.16 (0.11 to 0.22)[a]**		**0.29 (0.17 to 0.41)**		**0.47 (0.26 to 0.67)**	
Measure of interaction on the additive scale:	Stably Housed and Unstably Housed RERI (95% CI), –0.06 (–0.24 to 0.13); *P* = .53; Unstably Housed and Homeless RERI (95% CI), –0.23 (–0.52 to 0.06); *P* = .12					
Measure of interaction on the multiplicative scale:	Stably Housed and Unstably Housed Ratio of IRRs (95% CI), 0.97 (0.36 to 2.61); *P* = .96; Unstably Housed and Homeless Ratio of IRRs (95% CI), 0.62 (0.16 to 2.43); *P* = .49					

Incidence rate ratio controlled for sex, age by decade, race/ethnicity, CD <200 cells/mL, VS >200 copies/mL. *P* values for interaction <.1 were considered statistically significant. Multiplicative interactions were based on comparison with stably housed patients with visit adherence ≥75%. RERI estimated confidence intervals for comparing rate differences in acute care visit frequency within each level of housing status by primary care visit adherence between adjacent levels of housing status. Boldface indicates a *P* value <.05.

Abbreviations: CI, confidence interval; IRR, incidence rate ratio; RERI, relative excess risk due to interaction.

[a]*P* < .001.

We also identified increased acute care utilization for women, which has been previously reported [20, 21]. However, our findings expand on the understanding of care utilization among in HUH-PLWH in several ways. First, the association between suboptimal primary care visit adherence and a higher frequency of acute care visits suggests that alternate ways to provide primary care to those who are unstably housed may be necessary to decrease acute care visits [22–24]. Second, by calculating incidence rate ratios of acute care utilization patterns among HUH-PLWH, we have provided concrete estimations of the real-world burden of HUH on health care systems among PLWH. Third, our findings provide evidence that, rather than completely dropping out of care, many HUH-PLWH interface frequently with the health care system, but in clinical settings that are poorly equipped to provide care coordination and administer routine provisions of primary care, such as adherence counseling, case management, needs assessments, etc., that may improve long-term virologic suppression.

Although providing housing has been shown to reduce emergency department visits and hospitalizations [25–27] and should be the ultimate public policy goal, our findings suggest that potential cost-saving and downstream health improvements could be realized by improving primary care visit adherence for HUH-PLWH. In our cohort, a high frequency of urgent care visits for HUH-PLWH also raises the possibility of developing novel strategies to "flip" urgent care visits into primary care visits, allowing for more comprehensive care to be delivered in the context of these acute care visits, or via a drop-in setting, a model that has shown some success [22, 28]. Patient navigation has also demonstrated efficacy in improving retention in care for patients recently released from prison, specifically among patients reporting homelessness, but the effects were modest [23, 29]. Enhanced patient contact [30] and text messaging [31] have shown no effect on retention in care in patients with high levels of unmet needs. Lastly, financial incentives have led to some improvements in re-linkage to HIV care in patients with a history of substance abuse, but the effects were not sustained once incentives were withdrawn [32]. Given the limited impact of single interventions, it is likely that improving retention in care for HUH-PLWH will require resource-intensive, multilevel strategies [22, 33, 34].

There are limitations to this study. The generalizability of these findings may be limited by the fact that our data were obtained from a single center in an urban setting with substantial resources available to PLWH compared with other regions. However, this limitation likely underestimates the association between housing and the frequency of acute care visits compared with regions with fewer resources for HUH-PLWH. Further, emergency department visits and hospitalizations were obtained only from the San Francisco General Hospital, which limits the ability to fully assess the impact of housing status on care utilization patterns. Moreover, convenience sampling to ascertain the housing status predictor likely excludes the patients who are the most disengaged from care, but again this would likely underestimate the observed association. We also acknowledge that there is no gold standard method to measure retention and that a limitation of primary care visit adherence is that it does not account for the number of visits scheduled [35]. Furthermore, we could not assess the mediating effects of psychiatric disease, substance use, and stigma, which are not always well captured in the EMR but are likely factors in the causal pathway between HUH and acute care utilization [36, 37]. Lastly, there are limitations related to model calculations of incidence rate differences, particularly for non–normally distributed data, that may lead to inaccurate marginal rate estimations [38].

In conclusion, we observed increases in the frequency of acute care utilization as the degree of housing instability increased and found that improvements in primary care visit adherence may result in substantial reductions in acute care utilization for those with the most severe housing instability. Interventions to improve primary care visit adherence among HUH-PLWH are desperately needed. The frequency of urgent care visits among HUH-PLWH emphasizes the need to explore novel ways to provide primary care—even at urgent care visits—to ultimately improve treatment outcomes.

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