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Housing first: unsuppressed viral load among women living with HIV in San Francisco

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Abstract

While poverty is an established barrier to achieving success at each step of the HIV care continuum, less is known about specific aspects of poverty and how they overlap with behavior in exceptionally low-income individuals who live in well-resourced areas. We considered unsuppressed viral load over three years among women living with HIV in San Francisco who used homeless shelters, low-income hotels and free meal programs. One-hundred twenty study participants were followed; 60% had ≥1 unsuppressed viral load and 19% were unsuppressed at every visit. Across six-month intervals, the odds of unsuppressed viral load were 11% higher for every 10 nights spent sleeping on the street (Adjusted Odds Ratio [AOR] =1.11, 95% CI:1.02-1.20); 16% higher for every 10 nights spent sleeping in a shelter (AOR/10 nights= 1.16, 95% CI: 1.06-1.27); 4% higher for every 10 nights spent sleeping in a single-room occupancy hotel (AOR/10 nights= 1.04, 95% CI: 1.02-1.07); and almost four-fold higher among women who experienced any recent incarceration (AOR=3.56, 95% CI: 1.84-6.86). Violence and recent use of outpatient health care did not significantly predict viral suppression in adjusted analysis. While strategies to promote retention in care are important for vulnerable persons living with HIV, they are insufficient to ensure sustained viral suppression in low-income women experiencing homelessness and incarceration. Results presented here in combination with prior research linking incarceration to homelessness among women indicate that tailored interventions, which not only consider but prioritize affordable housing, are critical to achieving sustained viral suppression in low-income women living with HIV.

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Keywords

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INTRODUCTION

In an era when antiretroviral therapy (ART) is recommended for all people living with HIV (PLWH) regardless of CD4+ T-cell count, best clinical practices and high-impact interventions emphasize retention in care [1] and ART adherence [2]. Achieving and maintaining viral suppression (< 200 copies/mL) is crucial to optimizing health outcomes and substantially reducing the risk of onward HIV transmission [3, 4]. At the same time, consistent evidence indicates that economic disparity is a driving force of the HIV epidemic and undermines these efforts in regions throughout the world [5–7], including Africa, Asia, Europe and North America [8–24].

Poverty is a major barrier to receiving care and achieving success at each step of the HIV care continuum for PLWH in countries across the spectrum of income and resource availability [24]. Even in well-resourced settings, in which infrastructure exists to provide facilities, clinicians, laboratory, and supply chain management for various types of health care, a number of factors associated with poverty act as barriers to care. Recognition of such barriers has led to specific models for understanding health services use, including the *Behavioral Model for Vulnerable Populations* [25]. This model posits that, in addition to factors limiting health services use in the general population, such as age, income and health insurance, there are factors uniquely common in vulnerable populations that act as additional barriers to care, including violence, incarceration, substance use and homelessness [26–28].

Homelessness can result from a variety of conditions and co-occurring predictors that are often associated with poverty, and it stands out as a strong predictor of poor HIV outcomes. In Canadian and U.S. cities, where resources exist to provide HIV care for low-income individuals, homelessness predicts a failure to use ART [29], housing eviction predicts unsuppressed viral load (VL≥200 copies/mL) [30], and becoming housed predicts viral suppression [31, 32]. International guidelines for improving ART adherence recognize housing instability as a barrier to adherence and provide recommendations for homeless individuals that emphasize the need for retention in care as well as case management [33]. The degree to which recent care and case management influence viral suppression among low-income and homeless persons is unclear. Their influences are particularly uncertain when considered alongside factors known to predict VL in low-income individuals, such as food insecurity, substance use and inconsistent health insurance [34, 35]. Similarly, their influences are uncertain among low-income women living with HIV (WLWH), in whom substance use and violence are both disproportionately common and act synergistically to negatively influence health outcomes (a condition known as the “substance abuse, violence and AIDS” [SAVA] syndemic) [36, 37], particularly in the context of urban poverty [38–40].

Issues of poverty and homelessness are important because homelessness is increasing around the world, including in resource-rich areas across Europe and North America [41, 42]. In fact, civil emergencies due to homelessness have been increasing in U.S. cities [43–

45], and clinics caring for PLWH in resource-rich areas report that the degree of housing instability affects population-level rates of viral suppression [46]. However, factors unique to the health of homeless and unstably housed persons are still routinely overlooked. In addition, while homeless women have different –often more severe –needs and patterns of morbidity and mortality compared to men [47–52], women are often under-sampled in homeless research, including HIV-specific homeless research [53]. Moreover, while prior research points to any homelessness as a risk factor for negative health outcomes, data on exposure levels ("dose") of various housing conditions, such as the number of nights spent sleeping in a given venue, and its impact on virologic outcomes among women, are lacking.

We conducted one of the first longitudinal studies to determine independent associations between factors uniquely common in low-income women living in a well-resourced urban environment and unsuppressed viral load, with an emphasis on housing and SAVA syndemic factors. Prior research in this population suggests that different types of living conditions beyond "homeless," including various types of homelessness and residence in low-income single room occupancy (SRO) hotels, contribute to health status [54], but the impact of these factors on viral load has not previously been assessed. Informed by *the Behavioral Model for Vulnerable Populations* [25], we hypothesized that multiple types of living conditions would be associated with unsuppressed VL. Our goal was to inform programs and interventions aimed at decreasing detectable viremia in low-income WLWH.

METHODS

We conducted the current study among all HIV-positive women participating in the San Francisco-based "Shelter, Health and Drug Outcomes among Women" (SHADOW) study. We used a longitudinal approach to understand the overlapping clinical, social and structural factors influencing VL, which are specific to an extremely low-income population with multiple unmet needs. We assessed the effect of study factors collected during research interviews conducted between July 2008 and July 2012 on subsequent VLs assessed at routine clinic visits within three months after each study interview. Study visits were independent of health care visits and electronic medical record VL data were obtained after the study ended.

Study Environment

San Francisco is a resource-rich city where the cost of living is the second highest in the U.S. [55], and where universal ART and integrated services are standard practice [56]. Rates of viral suppression measured in San Francisco are estimated to be between 72% [57] and 88%, which is significantly higher than other comparable U.S. cities [58].

Study Sample

We analyzed data from all HIV-positive participants of the SHADOW Study. The SHADOW study was designed to obtain a probability sample of women transitioning through various living conditions, including homelessness, and to oversample HIV-positive women through systematic recruitment methods previously described [59] (Figure 1). Inclusion criteria were female sex at birth, age ≥ 18 years and a history of housing instability (slept in a public area,

a homeless shelter or a battered women's shelter, or stayed with a series of acquaintances because there was no other place to sleep, [i.e., "couch-surfed"]). Participants were not necessarily homeless or unstably housed at the time of study enrollment.

Data Collection

Participants provided written informed consent for all study activities, including medical record review. Reimbursement of $15 was given for each study interview and $5 per month was given to update contact information. The Institutional Review Board at the University of California, San Francisco approved all study procedures.

Participants completed interviews at enrollment and every six months for up to three years. Interviews were conducted in a private space by a trained interviewer. Socially sensitive questions, including those regarding drug use and violence, were administered by audio computer-assisted self-interviewing (ACASI); all other questions were interviewer-administered.

Conceptual Model

The study was heuristically informed by the *Behavioral Model for Vulnerable Populations* [25]. In accordance with this model, the predisposing domain included age, race/ethnicity, housing type/living conditions, incarceration, violence and substance use. The enabling domain included income, health insurance, food security, and social support; for the purposes of the current study, we also included a variable to indicate whether data for each study visit occurred before or after universal ART was introduced in San Francisco (≥January 1, 2010). The health services domain included outpatient health care visits, HIV case management and general health case management. We did not include a need domain, which accounts for health conditions that necessitate care and treatment, because all participants were HIV-infected and assumed to have a similar level of need with regard to suppressed viral load.

Measures

The dependent variable in the current analysis was unsuppressed VL (≥200 copies/mL), measured during routine clinical care independent of the study. Only VLs measured within three months following a study interview were included in the current analysis. Participants who had data available from at least one interview and one subsequent VL assessment were included. We obtained San Francisco HIV surveillance system VL data, which included electronic medical records from Department of Public Health (SFDPH) clinics, as well as clinics affiliated with the University of California, San Francisco (UCSF).

Independent variables included whether each VL measure was assessed after the introduction of universal ART (January 1, 2010), a SFDPH policy recommending ART for all infected persons regardless of CD4+ T-cell count. Outside of race/ethnicity, independent variables were time-dependent and based on conditions during the six months prior to each interview. Independent variables represented factors specific to low-income women which have influenced health outcomes in prior studies [26, 40, 54, 59, 60]. They include age; income; incarceration (i.e., any nights in jail or prison); food insecurity [61]; instrumental

social support (someone who would give the respondent money or a place to sleep) [62]; intimate partner violence (i.e., physical, sexual or emotional violence perpetrated by a primary intimate partner) or non-intimate partner violence (i.e., physical, sexual or emotional violence perpetrated by someone who was not a primary intimate partner [e.g., exboyfriend, neighbor or family member]) [59]; uninterrupted health insurance [63]; any outpatient health care visits or case management; any use of cocaine, methamphetamine, heroin, alcohol, cannabis or opioid analgesics [59]. In addition, we measured the number of nights in the 6 months prior to each study visit that the participant spent sleeping in a public place, a shelter or a low-income single-room occupancy (SRO) hotel as continuous variables. The current study did not implement an intervention and the outcome of interest was current VL, not change in VL. We therefore did not adjust for prior VL as doing so would adjust for the effect of interest [64]. In addition, to avoid over-adjustment bias, we did not control for other measures of HIV disease status with potential reciprocal relationships (e.g., CD4+ T-cell count) [65].

Analysis

We compared baseline characteristics of study participants by the presence of at least one unsuppressed VL over the follow-up period using chi-square and Wilcoxon tests as appropriate. Logistic models were used to assess correlates of unsuppressed VL. We used generalized estimating equation (GEE) models with robust standard errors to account for within-participant correlation of repeated measures over time, and independence working correlation [66]. Following the theoretical framework of the *Behavioral Model for Vulnerable Populations*, a series of models sequentially added variables in each of the three domains (predisposing, enabling and health services), beginning with predisposing factors (Figure 2). At each step, backward selection was used to remove variables in the most recently added domain with p-values >0.1. All analyses were done using Stata Version 15.0 (Stata Corp., College Station, TX).

RESULTS

Within a sample of 150 WLWH, 120 (80%) had at least one VL measurement within three months following a study visit and a total of 508 VL measures were obtained from the electronic medical record within the study window. A median of three VL assessments was obtained for each participant (IQR=2-6). Comparing baseline characteristics of individuals included in the analysis (N=120) to study participants who had no VL measurements available for the three-month study window (N=32), those included in the analysis were more likely to have an HIV case manager (71.4% vs 50.0%, p=0.026). We observed no other statistically significant differences by study factors presented here.

The mean participant age was 47 (SD=8.5) and 72% of participants were women of color (i.e., ethnic minorities) (Table 1). Only two participants were newly diagnosed (i.e., HIV diagnosed within one year of any study interview). During the six months prior to baseline, 17% of individuals were incarcerated, almost 70% reported food insecurity, 85% had uninterrupted health insurance, 60% had ≥1 outpatient health care visit and 71% had an HIV case manager. Violence perpetrated by someone who was not a primary intimate partner was

experienced more than twice as often as violence perpetrated by a primary intimate partner (48% vs. 22%). Almost half of participants used cocaine, alcohol or cannabis, while approximately 20% reported use of methamphetamine, heroin or painkillers.

In the 6 months prior to the baseline study visit, the mean number of nights spent sleeping on the street or in a public place was 12.6 (SD=36.4); the mean number of nights spent sleeping in a shelter was 5.2 (SD=18.0); and the mean number of nights spent sleeping in an SRO hotel was 62 (SD= 73.6). There was less than 20% correlation between the number of nights spent sleeping on the street, in a shelter or in an SRO hotel. We therefore analyzed the effects of these conditions separately.

Unsuppressed VL was detected in 60% of participants during the study period and 19% were unsuppressed at all visits. Among 262 VL measurements followed by at least one subsequent VL measurement, 14.5% were unsuppressed. Adjusted analysis showed that only factors from the predisposing domain were significantly associated with subsequent unsuppressed viral load in the next 3 months (Table 2). Specifically, the odds of unsuppressed VL decreased 26% for every 10 years of age (Adjusted OR [AOR]=0.74; 95% CI:0.58-0.95), translating to higher VL suppression with increasing age. Unsuppressed VL increased 11% for every 10 nights spent sleeping on the street (AOR=1.11; 95% CI:1.02-1.20), 16% for every 10 nights spent sleeping in a shelter (AOR= 1.16; 95% CI:1.06-1.27) and 4% for every 10 nights in an SRO (AOR=1.04; 95% CI:1.02-1.07). Odds were almost four-fold higher among individuals who experienced any recent incarceration (AOR=3.86; 95% CI:2.02-7.40) and 54% higher among cannabis users (AOR=1.54; 95% CI:1.01-2.33). Race/ethnicity, income, social support, violence, other drugs and recent use of outpatient health care did not reach statistical significance in adjusted analysis.

DISCUSSION

In a well-resourced U.S. city where 72-88% of HIV-positive patients achieve viral suppression [57, 58], only 40% of women with a history of housing instability achieved viral suppression at all time points during the three-year study period. The high proportion of viremic individuals has implications for patient health and for compromising “Treatment as Prevention” (TasP) efforts, which rely on viral suppression to curb new infections. Most participants received recent outpatient health care and case management, and neither form of care predicted viral suppression. In addition, several enabling factors known to predict VL in other HIV populations, including income, consistent health insurance and food insecurity were not significant predictors of viremia in this sample. Consequent to the absence of significant associations, there was no evidence to suggest that enabling factors or health care mediated the effects of predisposing factors on detectable viremia in this population. On the other hand, multiple types of living conditions and incarceration significantly predicted future unsuppressed VL. While case management and other strategies to promote retention in care are important for persons living with HIV [1, 2], results presented here indicate that they are insufficient to ensure sustained viral suppression among women who sleep in public areas, shelters or SROs, or who have recently been incarcerated.

Findings presented here are complementary to research indicating that disparities in ART use and adherence are largely explained by social and structural issues associated with poverty [24, 67]. They are also consistent with a recent nationwide U.S. study that not only implicates the broad problem of poverty, but spotlights homelessness as a key predictor of unsuppressed VL [58]. Taken together, the existing research suggests that studies failing to account for housing type as an important predictor of viral suppression in low-income WLWH are incomplete, and interventions as well as health care delivery that fail to integrate housing needs are unlikely to achieve optimal results. Collectively, the existing evidence shows a critical need for comprehensive services to address the underlying context of poverty [38, 68, 69]. However, comprehensive services will not be enough until risks across various living conditions are acknowledged and stable housing in achieved.

Considered together with prior studies showing that the strongest correlate of incarceration among unstably housed women is homelessness [70], and the strongest predictors of ART non-use include homelessness [29], results presented here confirm the centrality of homelessness in HIV outcomes and associated factors. Results further extend this existing knowledge by indicating several important points about housing instability and living conditions. First, we saw a dose-response between the number of nights spent sleeping on the street and unsuppressed viral load, and similar associations for number of nights spent in a shelter or SRO. This means that it is not only the initial impact of becoming homeless or the state of being homeless that influences this relationship, rather every additional night spent in these venues continues to increase the odds of detectable viral load. Our estimates therefore suggest that, while the odds of detectable viremia increase by 11% for a women who spends a single night sleeping on the street, they increase by 77% for a women who spends a week sleeping on the street. Second, sleeping on the street and sleeping in a shelter are not highly correlated in this sample. While our data do not allow an analysis of pathways or mechanisms, results may suggest that low-income WLWH are unsheltered in different ways, and the different ways women are unsheltered carry their own unique risks for unsuppressed viral load. Third, on average, women spend twice as long seeping on the street as sleeping in a shelter, suggesting the importance of street-based services. Fourth, while the magnitude of association is lower, nights spent in a low-income SRO hotel also significantly increase the odds of unsuppressed VL. This finding is consistent with prior research showing high rates of poor health outcomes linked to SROs [54, 71]. Collectively, findings emphasize the importance of considering different housing types and living conditions beyond a simple assessment of homeless vs. not homeless. Considering results in the context of increases in U.S. homelessness over the past five years [43–45] makes our findings especially concerning and indicates a critical need to implement interventions that target multiple types of living conditions.

The finding that recently incarcerated participants were more likely to present with an unsuppressed VL extends research regarding HIV-positive, justice-involved persons. The evidence to date suggests that U.S. jails are important sites for HIV care engagement [72, 73], increasing the likelihood of HIV-positive individuals achieving viral suppression during incarceration [74, 75]. However, despite high rates of viral suppression during incarceration, research also shows that many individuals do not fill prescriptions following release [76], and become disconnected from care or non-adherent to medications during reentry to

community life [77]. This is especially concerning for women because our prior work with low-income women shows that homelessness has a strong association with incarceration [70]. Thus, women experiencing homelessness or incarceration may be likely to experience both, and the combination may exacerbate barriers to viral suppression. Among the few studies regarding HIV and justice-involved individuals to report gender-specific results, Beckwith et al. show that fewer women receive HIV medications during incarceration than men [78]. The current study did not obtain information on viral suppression during incarceration, but results suggest that, even after adjusting for homelessness, unsuppressed VL was more common among recently incarcerated women. This finding may reflect the low rate of HIV medication use during women's incarceration reported by Beckwith et al. [78]. Considered alongside prior research, it may also signal effect modification. For example, although our data do not permit a test of this hypothesis, incarceration may improve HIV clinical care and outcomes among women who are not consistently engaged in care before detention, but may be detrimental to those who are consistently engaged in care due to disruptions from incarceration. Further clinical research is needed to mitigate the risk of detectable viremia among recently incarcerated WLWH.

Results presented here are similar to those from a study by Anderson et al. of low-income WLWH in Baltimore, Maryland [79]. While approximately half of participants from both study samples reported experiencing recent violence, violence did not predict unsuppressed VL in either study. In combination, results may suggest differential effects of violence on women's HIV outcomes in low-income populations where competing factors like homelessness and incarceration outweigh or otherwise obscure violence effects.

Prior evaluations by the WHO of HIV clinical effectiveness in resource-limited regions led to the realization that HIV clinical guidelines developed in resource-rich areas were neither feasible nor realistic for resource-limited areas [80]. Consequently, large-scale efforts were launched to develop public-health approaches specific to providing ART in resource-limited areas, taking into account the realities of lower-capacity health systems (e.g., few specialty clinicians and fewer resources for advanced laboratory monitoring) [80]. Findings presented here suggest that translating clinical findings from resource-rich regions back to the same geographic area may not be feasible or realistic for populations experiencing severe disparity relative to the general population of PLWH. Analogous to taking the realities of lower-capacity health systems into account, our results suggest that program development in high-income areas must take the realities of disparity into account with interventions that not only consider housing and living conditions of extremely low-income individuals, but also prioritize them. Promising examples of such programs include several developed by the San Francisco Department of Public Health. For example, the "Linkage, Integration, Navigation, Comprehensive Services" (LINCS) program provides field-based navigators who offer short-term "intensive case management" (ICM) to link homeless PLWH to HIV primary care [57]. In addition, the "HIV Homeless-Health Outreach Mobile Engagement" (HHOME) program provides stabilization and out of clinic health care to PLWH who have complex needs and are not engaged in care [81]. Examples also include community-based programs that address the overall well-being of people living on the street such as "Lava Mae," a program that uses an approach known as "radical hospitality" to provide services, including mobile showers, toilets, clothing, food and employment assistance. Results presented here

suggest that additional novel programs for WLWH following incarceration may further address unsuppressed VL in this population.

There are several limitations regarding this study. First, VL data were obtained from public and UCSF-affiliated clinics, which may have left out individuals receiving care from private physicians outside of UCSF. However, only 8% of persons receiving HIV care were excluded based on the absence of VL data, likely making potential effects small. Second, participants for whom VL data within three months of a study visit did not exist and were therefore excluded were less likely to have an HIV case manager than participants who were included. Therefore, participants with case management and/or frequent clinic visits may have inflated results. While these individuals had more opportunity for their information to be inside the three-month window of time to assess VL following a study visit, we minimized potential bias from multiple measures by the use of robust standard errors, which down-weighted data for participants with relatively frequent results. We tested this assumption and confirmed that the number of observations was indeed not significantly associated with unsuppressed VL ($p=0.28$). In addition, while only two participants were newly diagnosed, time in care may be an unmeasured confounder in this study. Finally, study data came from one geographic location and focused on a high-risk population, which may limit generalizability. Future studies in different geographic areas that include more participants and multiple types of housing instability may contribute to a better understanding of variations in viral suppression.

Study strengths include a community-based probability sample of women with a history of housing instability; assessment of recent substance use and victimization at multiple time points; inclusion of multiple living conditions and a focus on the specific needs of extremely low-income women. Finally, study assessments were made in a resource-rich city where universal ART and integrated services were standard [56] and viral suppression rates were high [58], which reduced unmeasured confounding due to service limitations.

CONCLUSION

While comprehensive services including primary care and case management are important for optimal HIV outcomes [82–85], results presented here indicate that they are insufficient to overcome the barriers and concomitant problems presented by housing instability in low-income women. Housing is central to achieving sustained viral suppression in this population, which has strong implications for improving health outcomes and reducing new HIV infections. Tailored interventions that target multiple housing types and living conditions, and prioritize housing are critical for low-income women living with HIV.

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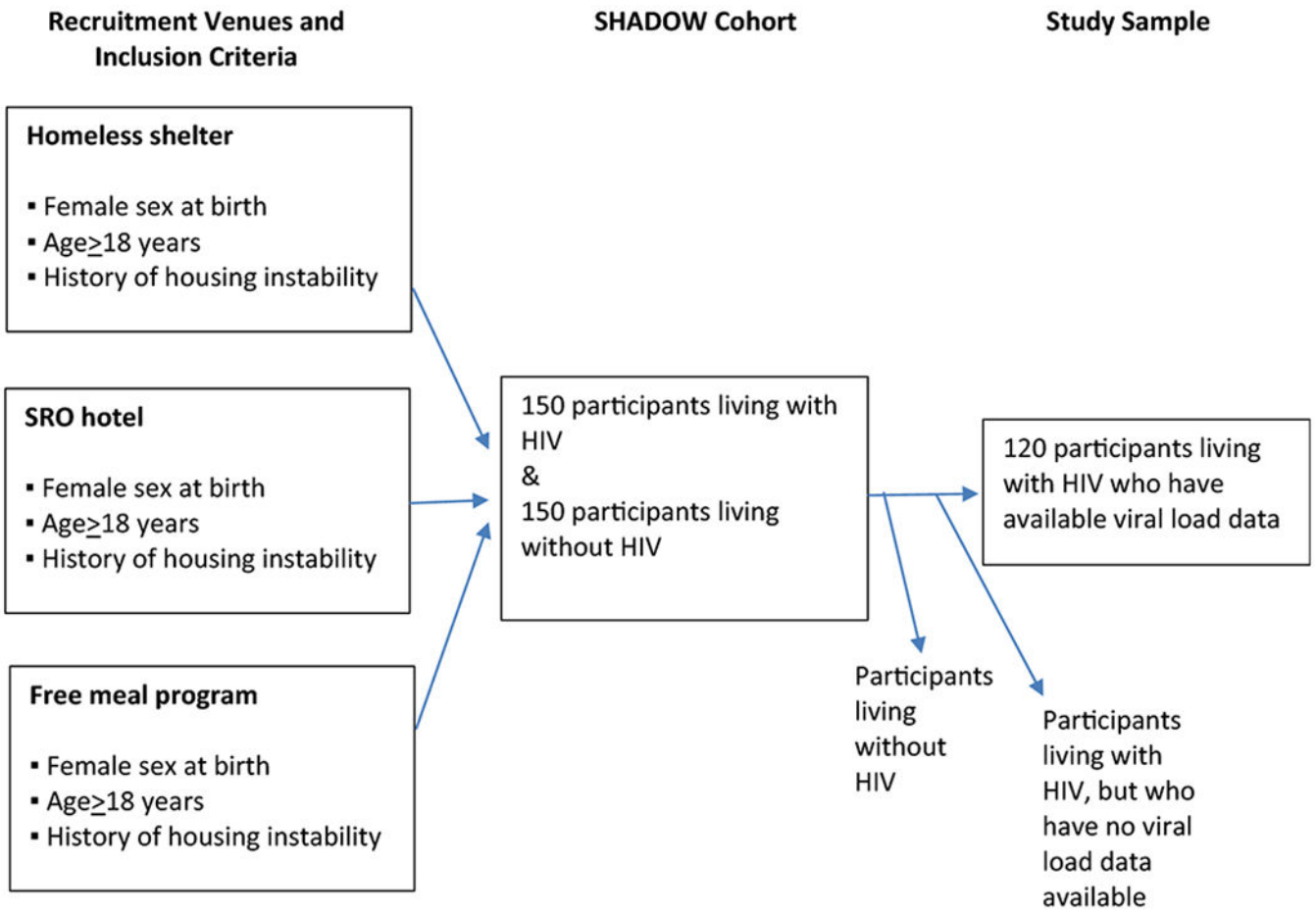

Figure 1.

Conceptual Model for suppressed viral load in women living with HIV recruited from homeless shelters, low-income hotels and free meal programs

Figure 2.

Sampling of women living with HIV recruited from homeless shelters, low-income hotels and free meal programs (N=120)

Table 1.

Baseline assessment of study factors experienced during the prior 6 months among women living with HIV recruited from homeless shelters, low-income hotels and free meal programs (N=120)

	Overall Prevalence	Prevalence among participants with ≥1 unsuppressed viral load assessments during the study	Prevalence among participants with 0 unsuppressed viral load assessments during the study	*P*-value
PREDISPOSING FACTORS				
Age	Mean=47 (SD= 8.5)	Mean=46.6 (SD= 8.7)	Mean=47.6 (SD= 8.3)	0.51
Race/Ethnicity Caucasian African-American Latina Other Mixed-race	 28.1% 48.8% 4.1% 1.7% 17.4%	 26.4% 47.2% 4.2% 1.4% 20.8%	 30.6% 51.0% 4.1% 2.0% 12.2%	0.79
# nights slept on the street or in a public place	Mean=12.6 SD= 36.4	Mean=15.2 SD= 39.8	Mean=8.7 SD= 30.7	0.33
# nights slept in a shelter	Mean=5.2 SD= 18.0	Mean=4.3 SD= 16.5	Mean=6.7 SD= 20.0	0.47
# nights slept in a single-room occupancy hotel	Mean=62.0 SD= 73.6	Mean=74.5 SD= 73.5	Mean=43.5 SD= 70.4	0.02 *
Incarceration (any nights in jail or prison)	16.7%	19.4%	12.5%	0.32
Intimate partner violence (physical, sexual or emotional)	22.3%	25.0%	18.4%	0.39
Non-Intimate partner violence (physical, sexual or emotional)	47.9%	54.2%	38.8%	0.10
Any cocaine use	46.3%	58.33%	28.6%	<0.01 *
Any methamphetamine use	19.8%	25.0%	12.2%	0.08
Any heroin use	18.2%	22.2%	12.2%	0.16
Any alcohol use	47.1%	56.9%	32.7%	0.01 *
Any cannabis use	49.6%	55.5%	40.8%	0.11
Any painkiller use	23.1%	26.4%	18.4%	0.30
ENABLING FACTORS				
Monthly income	Mean=$1,200 SD=$1,400	Mean=$1,000 SD=$400	Mean=$1,400 SD=$2,200	0.12
Uninterrupted health insurance	85.1%	83.3%	87.8%	0.50
Food Insecurity	69.0%	74.3%	60.5%	0.12
Any instrumental social support ≠	79.2%	76.1%	83.7%	0.12
Viral load measured after Jan. 1, 2010 (post-universal ART)	91.7%	93.1%	89.8%	0.52
HEALTH SERVICES USE				
Any outpatient health care visits	60.3%	58.3%	63.3%	0.59
Case manager for HIV care	70.8%	70.8%	70.8%	1.00
Case manager for general health care	65.3%	69.4%	59.2%	0.24

* *P*-value<0.05;

[≠]Had someone who would loan money or provide a place to stay

Table 2.

Longitudinal associations between study factors (assessed during the 6 months prior to each study visit) and subsequent unsuppressed viral load among women living with HIV recruited from homeless shelters, low-income hotels and free meal programs (N=120)

	Unadjusted Odds Ratio (95%CI)	**Adjusted Odds Ratio (95%CI) Sequential Backward-Selected Models**		
PREDISPOSING FACTORS		**Model 1 Predisposin g**	**Model 2 Predisposing + Enabling**	**Model 3 Predisposin g + Enabling + Health Services**
Age (per 10 years)	**0.67 (0.54-0.84)** *	**0.77 (0.60-0.99)** *	**0.74 (0.58-0.95)** *	**0.74 (0.58-0.95)** *
Race/Ethnicity: Caucasian (ref) African-American Latina Other Mixed-race	1.00 1.38 (0.88-2.18) 0.40 (0.11-1.42) **7.97 (1.54-41.24)** * 1.48 (0.83-2.64)			
# nights slept on the street or in a public place (per 10)	**1.11 (1.02-1.20)** *	**1.12 (1.03-1.21)** *	**1.11 (1.02-1.20)** *	**1.11 (1.02-1.20)** *
# nights slept in a shelter (per 10)	**1.15 (1.06-1.26)** *	**1.17 (1.07-1.27)** *	**1.16 (1.06-1.27)** *	**1.16 (1.06-1.27)** *
# nights slept in a single-room occupancy hotel (per 10)	**1.04 (1.02-1.07)** *	**1.05 (1.02-1.08)** *	**1.04 (1.02-1.07)** *	**1.04 (1.02-1.07)** *
Incarceration (jail or prison)	**4.56 (2.48-8.37)** *	**3.61 (1.88-6.94)** *	**3.56 (1.84-6.86)** *	**3.56 (1.84-6.86)** *
Intimate partner violence (physical, sexual or emotional)	1.14 (0.73-1.79)			
Non-Intimate partner violence (physical, sexual or emotional)	1.37 (0.95-1.99)			
Any cocaine use	**2.37 (1.62-3.46)** *			
Any methamphetamine use	**2.73 (1.58-4.72)** *			
Any heroin use	**3.77 (2.08-6.85)** *	**1.82 (0.94-3.51)** *	1.88 (0.97-3.64)	1.88 (0.97-3.64)
Any alcohol use	**2.15 (1.47-3.14)** *			
Any cannabis use	**1.88 (1.29-2.75)** *	1.50 (0.99-2.28)	**1.54 (1.01-2.33)** *	**1.54 (1.01-2.33)** *
Any painkiller use	**1.67 (1.04-2.68)** *			
ENABLING FACTORS				
Monthly income (per $1,000)	1.09 (0.91-1.30)			
Uninterrupted health insurance	**0.31 (0.15-0.67)** *			
Food Insecurity	**1.13 (1.04-1.22)** *			
Any instrumental social support‡	0.69 (0.44-1.06)		0.65 (0.40-1.07)	0.65 (0.40-1.07)
Viral load measured after Jan. 1, 2010 (post-universal ART)	1.19 (0.81-1.76)			
HEALTH SERVICES USE				
Any outpatient health care visits	0.63 (0.38-1.04)			

	Unadjusted Odds Ratio (95%CI)	**Adjusted Odds Ratio (95%CI) Sequential Backward-Selected Models**		
PREDISPOSING FACTORS		**Model 1 Predisposin g**	**Model 2 Predisposing + Enabling**	**Model 3 Predisposin g + Enabling + Health Services**
HIV case manager	0.83 (0.55-1.25)			
General health case manager	0.83 (0.86-1.25)			

*95% CI does not include 1;

‡Had someone who would loan money or provide a place to stay