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Drug use and emotional distress differentiate unstably- versus stably-housed adults living with HIV who engage in unprotected sex

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Abstract

Among adults living with HIV (ALH) unstable housing is a barrier to health. Stably- (SALH) and unstably-housed ALH (UALH) were assessed over 25 months. At baseline, UALH had a more recent HIV diagnosis, higher viral loads, worse physical and mental health, lower rates antiretroviral therapy use and insurance coverage, and higher rates of hard drug use than SALH. At follow-up, the health of both groups was similar, but UALH reported significantly more hard drug use and mental health symptoms compared to SALH. Drug and mental health risks decreased for both groups, but decreases in unprotected sex were greater among UALH.

Keywords

HIV; unstably-housed ALH; high-risk sex; substance use; physical health; mental health

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Introduction

Adults living with HIV (ALH) face the challenges of maintaining their physical and mental health, and reducing HIV transmission by stopping unprotected sexual acts with partners of HIV-negative or unknown serostatus and not sharing needles (Gore-Felton et al., 2005; Rotheram-Borus et al., 2001). These challenges require ALH to make long-term behavioral changes which are difficult to sustain over time. After diagnosis, many ALH are in sero-concordant sexual relationships or are abstinent (Crepaz and Marks, 2002); however, approximately 25% continue to engage in unprotected sex with HIV-negative partners or partners of unknown serostatus (Marks and Crepaz, 2001). Crepaz et al. (2009) note that among those who are HIV positive, the existing research provides little insight into how individuals determine a partners' serostatus which makes harm reduction strategies difficult. It is important to better understand the risk behaviors of these individuals. This study focuses on this group – the 25% of ALH who continue to engage in unprotected sex after diagnosis.

Rates of HIV among homeless individuals are as high as 21.1% (Beijer et al., 2012). Among ALH who receive Medicaid, 24.5% were living with someone temporarily and 6% were homeless (Smith et al., 2000). Meeting health and mental health challenges is particularly difficult for ALH who are unstably-housed (Leaver et al., 2007). Maintaining one's health requires monitoring health on a regular basis and adhering to antiretroviral therapy (ART), which can be affected by the consistency of daily routines, including stability of housing or shelter. This study focuses on perceived physical health and mental health status, as well as sexual and substance use behaviors among unstably-housed (UALH) and stably-housed ALH (SALH) over time.

Past findings suggest that UALH are likely to engage in HIV-related transmission acts at a rate higher than SALH, often under the influence of alcohol and/or drugs (Kidder et al., 2008; Sears et al., 2001). Lack of stable housing may increase the likelihood of trading sex for money, drugs, or shelter in order to survive (Reback et al., 2007; Surratt and Inciardi, 2004). Additionally, sexual assaults occur at higher rates for both men and women without stable housing (Aidala et al., 2005). Stable housing is a top priority among ALH (Mizuno et al., 2003).

Recent research supports the notion that the provision of housing may be considered an intervention that can positively impact a variety of health outcomes. A randomized controlled trial (RCT) found that providing stable housing for chronically ill homeless adults (Sadowski et al., 2009) reduced health care costs; specifically, stable housing reduced hospitalizations and emergency department visits. Providing rent subsidies for UALH increased the likelihood of maintaining stable housing and improved some aspects of health care utilization and physical and mental health outcomes over 18 months (Wolitski et al., 2010). In each of these studies, and in recent reviews of housing patterns among homeless adults, housing status fluctuated over time and was often seen as tenuous (Didenko and Pankratz, 2007). Most importantly, existing research suggests that homelessness may contribute to mortality with exiting homeless to stable housing associated with reduced mortality rates (Metraux et al., 2011).

Most of the previous studies determined an individual's housing status based on a single point in time, typically the housing status at the time of recruitment. In contrast, we defined ALH as unstably-housed if they reported being homeless at any point in a 37-month period, from the 12 months prior to recruitment through the 25-month follow-up period. Our definition of unstable housing reflects housing status that fluctuates over time. We compared ALH who reported being homeless at any time over the 37-month period (UALH) to those who never reported any homelessness (SALH) over time.

Methods

Participants

Participants were ALH who were enrolled in the control condition of a large, multi-city, cluster randomized control trial, the National Institute of Mental Health [NIMH] Healthy Living Project (HLP; Healthy Living Project Team, 2007; Weinhardt et al., 2004).

ALH were recruited from 2000 to 2004 in four cities: Los Angeles, Milwaukee, New York City, and San Francisco. Multiple strategies were used to identify 3818 ALH, including referrals from more than 50 waiting rooms in various health care settings, AIDS Service Organizations, and drug treatment clinics; advertisements; word of mouth; and street outreach. Eligibility criteria included being at least 18 years of age, providing written informed consent and medical documentation of HIV infection, being free of severe neuropsychological impairment or psychosis (as observed by an interviewer), not being currently enrolled in another behavioral intervention study related to HIV (in order to avoid participant involvement in multiple intervention activities), and having engaged in at least one act of unprotected vaginal or anal intercourse in the previous 3 months with any partner of HIV-negative or unknown serostatus, or with a casual, one-time HIV-positive partner. Only 24.5% of ALH met these criteria ($N = 936$).

Among the 936 ALH in the Healthy Living Project (HLP), 469 were in the control condition and comprise the sample for this report. ALH were interviewed at baseline and at 5-month intervals over a 25-month follow-up period, for a total of six assessments (Healthy Living Project Team, 2007).

At each assessment, ALH were asked to specify their current living situation as "homeless" or "not homeless." At baseline, 15-, 20-, and 25-month assessments, ALH also answered whether they had been homeless in the previous 12 months. We defined an ALH as "unstably-housed" if s/he indicated being homeless or living in a shelter or welfare hotel in one of two circumstances: 1) at any of the six assessments conducted over 25 months; or 2) on questions about the last 12-month retrospective period, including at the baseline interview reporting on the 12 months prior to recruitment. "Stably-housed" ALH were defined as ALH who reported having housing at all six assessments, as well as on the retrospective report for the 12 months prior to recruitment. Due to the assessment points, we are unable to identify those who were homeless in the first 3 months after baseline, but had housing at all other times. It was also not possible to identify the specific periods (i.e., dates) of homelessness.

To ensure that we had sufficient information to ascertain housing status, we included only those who had completed at least four of the six possible assessments. Among all 469 ALH in the control condition, the follow-up rates for each of the 5-month follow-up assessments were 88.3%, 83.6%, 82.7%, 79.3%, 80.8%, and 69.5%, respectively. Based on the inclusion criteria, 396 of 469 ALH (84.4%) qualified for this study: 144 in Los Angeles, 35 in Milwaukee, 103 in New York City, and 114 in San Francisco.

Measures

Audio computer-assisted self-interviewing (ACASI) was used to obtain information for measures of a sensitive or personal nature; all other data were gathered utilizing computer-assisted personal interviewing (CAPI) by trained research assistants. Interviews were audiotaped, and 10% of these tapes were randomly audited by the Milwaukee team. ACASI has been found to be highly reliable and effective for decreasing social desirability bias, thereby enhancing the validity of self-report of sensitive information, such as sexual behaviors and substance use (e.g., Gribble et al., 1999). "Recent" sexual risk acts, drug usage, and tests are defined as those occurring in the past three months.

Demographics—Data on age, race/ethnicity, gender, years of education, employment status, criminal history, and medical insurance were collected. Participants were identified based on the Centers for Disease Control and Prevention's (CDC) categorization of transmission risk groups (Lee et al., 2003), in which risk categories are hierarchical and mutually exclusive (i.e., Men who have Sex with Men [MSM], injection drug users [IDU], women, and heterosexual men).

Outcome measures

Physical Health—At baseline, ALH self-reported on the number of years since HIV diagnosis, most recent CD4 count, viral load, and, if prescribed, ART utilization and adherence (defined as 100% adherence). Perceptions of physical health were also measured. The Illness Intrusiveness Score (IIS), a 7-item measure, was used to assess the degree to which illness interfered with the participant's health, diet, financial situation, relationship with partner, sex life, self-expression/improvement, and religious/spiritual expression (Devins, 1994). In addition, self-reported scores on the Physical Component Summary Scale [PCS] of the Medical Outcomes Study (MOS) 36-item Short Form Health Survey were collected to assess overall physical health status in four domains (physical functioning, role function-physical, bodily pain, and general health perceptions; (Cronbach's alphas > 0.80; Ware et al., 1994).

Number of HIV-negative or unknown serostatus partners—ALH were queried on the number of sexual partners of HIV-negative or unknown serostatus with whom they engaged in unprotected penetrative vaginal or anal intercourse over the past three months.[1]

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[1]Study inclusion criteria required having engaged in at least one act of unprotected vaginal or anal intercourse in the previous 3 months with any partner of HIV-negative or unknown serostatus.

Sexual risk acts (Weinhardt et al., 2004)—Sexual transmission risk acts were defined as any recent act of insertive or receptive anal or vaginal intercourse, with partners who were HIV-negative or whose serostatus was unknown, in which neither party used a condom. ALH's sexual behaviors with partners were reported in detail for each of the first five sexual partners of each gender. If an ALH reported having more than five partners, information on the total number of sex risk acts and estimates of condom use (beyond the first five partners) were combined. Number of sexual transmission risk acts could be calculated directly for ALH reporting five or fewer partners per gender, or reporting partners of only one HIV serostatus (positive, negative, or unknown). For the remaining ALH, transmission risk beyond the first five partners was imputed based on the transmission risk data reported with the first five partners. Thus, if you had an average of 20 vaginal and four anal sex acts per partner for the first five partners, the imputed number of sex acts for each partner after the first five would have been 20 vaginal acts and four anal sex acts. In most cases, there was not a uniform type of sex act or number of acts per partner. To ensure that the information was the most reliable, we estimated the risk for all partners after the first five, based on the detailed information reported on the first five partners. Multiple imputations were performed using SAS PROC MI and the final analyses incorporated these imputations (Weinhardt et al., 2004; Healthy Living Project, 2007). Although 9% of the sample reported more than five partners at baseline, only 4% of the unprotected sex risk acts were based on imputed data, and the results from analyses including and excluding imputed values do not differ. Sensitivity analyses show that the reports of sexual behaviors for those with more than five partners are reliable (Healthy Living Project, 2007).

Days of substance use—ALH were asked about the frequency of recent substance use: 1) number of days of alcohol use plus number of days of marijuana use; and 2) number of days of hard drug use for 15 different drugs summed over the past three months. In more detailed analyses of substance use among ALH in this cohort, the number of days of alcohol/marijuana or hard drug use was highly correlated with sexual risk behaviors, responsiveness to intervention, and mental health symptoms (Lightfoot et al., 2005; Wong et al., 2008).

Mental Health—The Beck Depression Inventory (BDI; Beck et al., 1988), a widely used 21-item self-report measure, was used to assess depressive symptoms. The state form of the State-Trait Anxiety Inventory (STAI), a self-report measure of anxiety, tension, and apprehension, was used to measure current anxiety symptoms (Spielberger, 1983). The Positive States of Mind Scale (PSOM) was used to measure perceived ability to attain six positive psychological states (focused attention, productivity, responsible caretaking, restful repose, sensuous nonsexual pleasure, and sharing) (Horowitz et al., 1988). The Perceived Stress Scale (PSS) was used to measure subjective stress (Cohen and Williamson, 1988). Lastly, self-reported scores on the Mental Component Summary Scale [MCS] of the Medical Outcomes Study (MOS) 36-item Short Form Health Survey were collected to assess overall mental health status in four domains (social functioning, mental health, role function-emotional, and vitality; (Ware et al., 1994).

Statistical Analysis

We compared physical and mental health, sexual behavior, and substance use outcomes between UALH and SALH using generalized linear mixed-effects models. We assumed an underlying Poisson distribution for outcomes measured as counts (risky sexual behavior and drug use) and an underlying normal distribution for the mental and physical health scales. Visual inspection and measures of skewness and kurtosis were used to assess the appropriateness of the distributional assumptions. For several of the mental health measures, we estimated additional models using transformed versions of the scales. Results from these models did not differ meaningfully from models using the raw scales, thus we have reported only the findings based on untransformed measures.

Outcomes were modeled for each ALH as the linear slope over time, assessed in weeks from baseline and over the 25-month follow-up period. The models included housing status as a binary variable, and a housing-by-time interaction to allow for varying trajectories between the two housing groups over the follow-up period. Although UALH and SALH differed on a number of demographic and HIV-related characteristics, we did not control for these factors in our analyses, given that we were interested in examining which characteristics cluster by housing pattern over time. Thus, estimated differences between the two housing groups incorporated the influence of these characteristics.

Intercepts for individual ALH were treated as normally distributed random effects. To test for differences in the outcome measures between UALH and SALH over the baseline to 25-month interval, we evaluated the statistical significance of the housing-by-time interaction. We plotted estimated mean values for the outcome measures at each time point, incorporating fixed and random effect estimates. SAS PROC GLIMMIX was used to obtain estimates for the count measures, and SAS PROC MIXED was used for the physical and mental health scales. SAS PROC MIANALYZE was used to combine estimates from the multiple imputations used for sexual transmission risk acts.

Practical significance of outcome changes over time is presented as effect sizes (ES) to supplement statistically significant results that are reported for generalized linear mixed model results. We follow the method of Feingold (2013) and report ES as:

$$ES = \frac{M_{\text{CHANGE- Homeless}} - M_{\text{CHANGE- Housed}}}{SD_{\text{CHANGE- Pooled}}}.$$

Results

Attrition analyses

As noted above, 84.4% of ALH were eligible by completing four or more assessments. At baseline, the ineligible ALH (15.6%) in the control condition were somewhat younger (38 vs. 40.5 years old, $p = 0.01$); had been diagnosed with HIV more recently (8.4 vs. 11.4 years, $p < 0.001$); were less likely to have a viral load of less than 50 copies/mL (5.5% vs. 18.7%, $p = 0.005$); were more likely to report depressive symptoms (BDI = 15.9 vs. 13.4, $p = 0.037$); and more likely to report intrusiveness of illness (IIS = 26.8 vs. 23.8, $p = 0.025$)

than the eligible ALH. Physical and mental health, sexual risk acts, and substance use were similar across the groups at baseline.

As previously reported in Rotheram-Borus et al. (2009), 1.5% of the UALH reported homelessness at all six assessments, 38% reported homelessness at 1–2 assessments, and 18% reported homelessness at 3–5 assessments. At any one of the six assessments, between 20–25% of ALH reported current homelessness.

Baseline Demographics

The eligible ALH were 40% African-American; 18% Latino; 33% White, non-Latino; and 9% were of another race/ethnicity. Approximately 80% were male and 34% were employed. These characteristics were similar to the overall sample and across housing groups.

Table 1 summarizes baseline characteristics of the 396 ALH by housing status. One-third of ALH (133/396) were unstably-housed at some point over the 37-month reporting period. UALH were younger; less educated (high school or less); more likely to have been convicted of a crime; and less likely to have medical insurance. There were also significant differences in behavioral risk group status; UALH were less likely to be MSM and more likely to be IDU than to be women or heterosexuals.

Physical Health

At baseline, UALH were likely to have been diagnosed with HIV more recently, were less likely to have a viral load of <50 copies/mL, were less likely to be ART users, and less likely to be adherent to ART (defined as achieving a 100% adherence rate as assessed by self-reported adherence and self-reported viral loads), if prescribed. There were no significant differences in CD4 counts. Additionally, based on model-estimated differences, UALH reported more illness intrusiveness ($p = .01$) and lower average MOS physical health summary scores ($p < 0.001$) at baseline compared to SALH. However, over time, illness intrusiveness and reports of physical health were similar across housing groups.

Observed mean values for outcome measures at baseline are presented in Table 1 by domain. To examine outcomes over the 25-month follow-up period, model-estimated mean values (intercept and slope) are presented in Table 2. Observed and model-estimated mean levels appear similar at baseline, except when adjusting for differences in overall mean levels across all time points.

Sexual Behaviors

At baseline, there were no significant differences between UALH- versus SALH in terms of number of sexual partners or number of unprotected sexual risk acts with HIV-negative or unknown serostatus partners.

Over 25 months, there were no significant differences in number of sex partners who were HIV-negative or unknown serostatus by housing status. As shown in Table 2, both housing groups demonstrated declines, with model estimates decreasing 48% for UALH and decreasing 58% for SALH. However, for unprotected sex acts, UALH showed greater decreases over time ($p = .036$), compared to SALH (see Figure 1 in Supplement). Trends

over 25 months for both groups showed substantial declines, with model estimates decreasing 61% for UALH and decreasing 41% for SALH. This translates to a small effect size of 0.06 (95% CI = −0.16 to 0.27).

Substance use

Alcohol and marijuana use did not differ at baseline by housing status, and usage was remarkably stable in both groups over time. In contrast, hard drug use was more frequent among the unstably-housed ALH at baseline ($p < 0.001$) and remained so over time. Stably- and unstably-housed ALH did not differ significantly in declines in hard drug use over time.

Mental Health

At baseline, UALH reported more depressive symptoms ($p < 0.001$), more state anxiety ($p < 0.001$), more difficulty achieving positive psychological states ($p < 0.001$), more perceived stress ($p < 0.001$), and lower MOS mental health summary scores ($p = 0.022$). Over time, trends did not differ significantly between SALH versus UALH on any mental health outcomes. Overall, SALH maintained less distressed functioning, in contrast to UALH.

Discussion

Our findings suggest that housing status is associated with sustained hard drug use and mental health symptoms over time. Consistent with previous findings, more frequent hard drug use was found among UALH (Elifson et al., 2007; German et al., 2007; Kipke et al., 2007), but no group differences were found with alcohol and marijuana use. In contrast to past findings, sexual risk acts were not more common over time among UALH compared to SALH. Perceived health was similar across housing groups over time.

ALH who reported unstable housing over time reported significantly more depressive symptoms, state anxiety, perceived stress, and difficulty achieving positive states of mind, compared to SALH at the baseline assessment. Despite initially observed differences in substance use and physical and mental health, these negative outcomes improved slightly or remained stable over time. This observation is similar to findings in two recent RCTs with homeless adults. In Wolitski et al.'s (2010) study of the impact of housing assistance for ALH, although the acquisition of housing increased the likelihood of ALH to maintain stable housing over time, both the intervention and comparison groups improved on a number of health care utilization and physical and mental health outcomes. Similarly, among chronically homeless adults, whether or not housing was provided, improved mental health was reported over time (Sadowski et al., 2009). Our observations of ALH in this study are consistent with these previous findings.

In contrast to other researchers (Elifson et al., 2007; Kipke et al., 2007), we did not find any significant differences between UAHL and SAHL for sexual risk behaviors at baseline. There are two possible explanations for this. We specifically recruited ALH who had recently engaged in unprotected sex with an HIV-negative partner or partner of unknown serostatus. Although these ALH had been diagnosed an average of 10–12 years prior, they continued to engage in high-risk sex acts, typical of only about 25% of ALH (Marks and Crepaz, 2001). Among this sub-population, high-risk sexual behaviors may be so prevalent

that sexual risk does not distinguish between SALH and UALH. Given this study's selection of a sub-sample of ALH defined by their sexual risk behavior, it is not surprising that they continue to engage in sexual risk-taking, regardless of their housing status. Among a different sample of ALH more representative of average levels of risk-taking, it is possible that greater differences may be found between the stably- and unstably-housed ALH. Differences in perceived health and risk behaviors between SALH and UALH are likely a conservative estimate in this study because of our selection criteria.

Another possible explanation for the lack of differences in sexual risk behaviors between housing groups may be due to our definition of "unstably-housed" ALH. We used a low threshold for determining unstably-housed status rather than a more stringent criterion of being chronically homeless. In contrast to previous studies, this study defined unstably-housed status based on housing reports gathered from ALH both in real time and retrospectively over 37 months. To date, most studies of homeless individuals have defined housing status by the living situation reported at the time of recruitment. This study expands this perspective by defining housing status based on multiple reports over time. In the current sample, approximately 38% of UALH reported homelessness at only one or two assessments. And, at any one of the six assessments, between 20–25% of ALH reported current homelessness. Thus, unstably-housed status for many of these ALH would not have been captured by the baseline assessment alone. Future studies of homeless ALH may want to define housing status by assessing housing reports over time, similar to this study, rather than defining homelessness based on a single point in time.

ALH who continue to engage in sexual transmission acts and partnerships are a critical subgroup clinically and the focus of current efforts to eliminate HIV. The ALH in this study were those with multiple comorbid conditions. Adherence rates to ART are the lowest among ALH with substance use and homelessness (Beer et al., 2012). These patients will be the most expensive to treat in clinical settings (Bozzette et al., 1998), as engagement in care will be sporadic and it is likely that these patients will be least likely to be virally suppressed. Our study was mounted prior to the broad diffusion of treatment as prevention (Cohen et al., 2011), therefore, we are not able to document the treatment cascade for UALH. We would hypothesize that UALH will necessarily be engaged and re-engaged in care over time and that they will be those most likely to develop treatment resistant strains of the HIV virus. Housing is a first step that may improve the treatment engagement of ALH, which may lead to improvements not only in their own health, but also the community health as their probability of transmitting the virus decreases.

Limitations

Among this study's strengths is the relatively high retention rate of the ALH over two years, despite periods of homelessness. In addition, more than 84% were eligible for inclusion. Our results are likely representative of this sub-population of ALH who continue to engage in HIV sexual transmission acts after diagnosis. At least one in four ALH continue to engage in risk acts. Another major strength of this study is the longitudinal design with the use of multiple assessments with a high-risk, diverse sample. However, given the number of variables and this repeated measures design, it is possible that issues associated with

statistical power may have impacted our results. Additionally, while our overall sample is quite larger, there are only 133 unstably-housed ALH in this study. While this sample was not recruited to be nationally representative (CDC, 2009), our demographics match the national profile of ALH, however, we selected only those at highest risk of HIV transmission to others. Also, unfortunately, we cannot identify if the UALH changed their sexual behaviors or drug use, or if they experienced changes in their mental health symptoms, during the periods when they were housed versus when they were homeless. In the RCT, the participants in the intervention and the control conditions were highly similar. The participants were similar across condition in age, gender, ethnicity, time since learning of one's infection, transmission risk category, median number of sexual partners and types of substances used. However, there may be many other historical features or characteristics between the groups for which we did not obtain data. We cannot say whether there were differences between the stably-housed and unstably housed which we did not assess. There was also a three month time period after recruitment in which the participant could have been homeless, and we did not assess homelessness during this period. Thus, there may be some participants who are classed as stably-housed who may have been unstably housed during this period.

Conclusion

Our overall findings are consistent with others in documenting the relationship between housing status and some HIV risk behaviors (i.e., hard drug use). However, to obtain reliable results, we must define homelessness in a standardized manner, as has been called for by other researchers (Kidder et al., 2007; Scott et al., 2007). Broadly, these outcomes suggest that high-risk sub-populations of ALH will need on-going case management and may be those most in need to initiate and maintain lifelong adherence to ARV (Grossman et al., 2013).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Baseline demographic characteristics, physical health markers, sexual risk, substance use, and mental health symptoms by housing status

	Unstably housed (N=133)		Stably housed (N=263)		Total (N=396)		
Demographics							
Age, Mean (SD)	38.9	(6.9)	41.3	(7.7)	40.5	(7.5)	**
Male, N (%)	104	(32.7)	214	(67.3)	318	(80.3)	**
Education, N (%)							***
High school or less	39	(29.3)	43	(16.3)	82	(20.7)	
High school graduate	36	(27.1)	47	(17.9)	83	(21.0)	
Some college	49	(36.8)	109	(41.4)	158	(39.9)	
College graduate or more	9	(6.8)	64	(24.3)	73	(18.4)	
Ever convicted of a crime, N (%)	67	(50.8)	95	(36.1)	162	(41.0)	**
Type of medical insurance, N (%)							***
Private	8	(6.0)	66	(25.1)	74	(18.7)	
Public	83	(62.4)	154	(58.6)	237	(59.8)	
None	42	(31.6)	43	(16.3)	85	(21.5)	
Behavioral risk group, N (%)							**
Men who have sex with men	63	(47.4)	171	(65.0)	234	(59.1)	
Injection drug users	22	(16.5)	21	(8.0)	43	(10.9)	
Women	29	(21.8)	49	(18.6)	78	(19.7)	
Heterosexual men	19	(14.3)	22	(8.4)	41	(10.4)	
Physical health							
Years since HIV diagnosis, Mean (SD)	9.9	(5.6)	12.1	(5.7)	11.4	(5.7)	**
CD4 count, Mean (SD)	421.8	(336)	442.2	(254)	435.4	(284)	
Viral load < 50 copies/mL, N (%)	14	(10.5)	60	(22.8)	74	(18.7)	**
% prescribed ART	129	97.0	258	98.1	387	97.7	
Current ART user, N (%)	80	(60.2)	205	(77.9)	285	(72.0)	***
Among ART users: 100% adherent, N (%)	42	(53.2)	128	(63.1)	170	(60.3)	
Illness Intrusiveness Score, Mean (SD)	25.1	(10.8)	23.1	(10.3)	23.8	(10.5)	
MOS physical health summary, Mean (SD)	41.4	(9.8)	44.4	(10.9)	43.4	(10.6)	**

	Unstably housed (N=133)		Stably housed (N=263)		Total (N=396)		
Recent sexual risk acts							
# of HIV-/unknown partners, Mean (SD)	4.1	(6.2)	4.0	(8.5)	4.1	(7.8)	
Number of unprotected sex acts, Mean (SD)	7.4	(17.0)	6.2	(14.7)	6.6	(15.5)	
Substance use							
Days used alcohol or marijuana, Mean (SD)	33.8	(44.8)	27.9	(36.4)	29.9	(39.5)	
Days used hard drugs, Mean (SD)	38.7	(76.3)	23.5	(48.8)	28.6	(59.8)	*
Mental health							
Beck Depression Inventory, Mean (SD)	15.3	(9.6)	12.4	(8.6)	13.4	(9.0)	**
State-Trait Anxiety Inventory, Mean (SD)	39.1	(11.8)	36.1	(11.2)	37.1	(11.5)	*
Positive States of Mind, Mean (SD)	11.9	(3.9)	12.9	(3.6)	12.6	(3.7)	*
Perceived Stress Score, Mean (SD)	20.9	(6.8)	18.4	(7.1)	19.3	(7.1)	**
MOS mental health summary, Mean (SD)	39.8	(12.4)	42.6	(12.5)	41.7	(12.5)	*

Note. P-values are from t-tests for continuous measures and Chi-square tests for categorical measures.

*
$p < .05$

**
$p < .01$

***
$p < .001$

Table 2

Generalized linear mixed-effects models of risk behaviors, substance use, and physical and mental health outcomes over time

	Model-predicted values		Significance tests	
	Baseline	**25-month**	**Difference in intercepts**	**Difference in slopes**
Illness Intrusiveness Score				
Unstably housed	24.7	21.5	t=2.59	t=1.21
Stably housed	22.1	20.0	p=0.010	p=0.225
MOS Physical Health Summary Score				
Unstably housed	41.1	43.1	t=3.70,	t=1.52,
Stably housed	45.0	45.5	p<0.001	p=0.130
# of HIV- or serostatus unknown partners, past 3 months				
Unstably housed	3.51	1.84	t=0.71,	t=1.66,
Stably housed	3.90	1.62	p=0.478	p=0.096
# of unprotected sex acts, past 3 months				
Unstably housed	6.77	2.61	t=1.44,	t=2.10,
Stably housed	5.52	3.23	p=0.151	p=0.036
Days used alcohol or marijuana, past 3 months				
Unstably housed	32.8	31.9	t=1.54,	t=0.36,
Stably housed	27.6	27.1	p=0.125	p=0.718
Days used hard drugs, past 3 months				
Unstably housed	37.6	31.6	t=3.68,	t=1.27,
Stably housed	19.6	13.2	p<0.001	p=0.205
Beck Depression Inventory				
Unstably housed	15.0	12.0	t=3.46,	t=0.74,
Stably housed	12.1	9.7	p<0.001	p=0.458
State-Trait Anxiety Inventory				
Unstably housed	39.4	36.2	t=3.34,	t=1.32,
Stably housed	35.9	34.4	p<0.001	p=0.187
Positive States of Mind				
Unstably housed	11.9	12.4	t=3.39,	t=0.50,
Stably housed	13.0	13.4	p<0.001	p=0.619
Perceived Stress Score				
Unstably housed	20.5	18.6	t=3.54,	t=0.70,
Stably housed	18.1	16.7	p<0.001	p=0.483
MOS Mental Health Summary Score				
Unstably housed	40.3	42.0	t=2.29,	t=0.37,
Stably housed	42.9	44.1	p=0.022	p=0.709