HOUSING INSTABILITY AND HIV: SEXUAL RISK, SUBSTANCE ABUSE, AND MENTAL HEALTH

by

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(Under the Direction of Su-I Hou)

ABSTRACT

Housing and health are inextricably linked. Extensive research has concluded that social determinants of health—such as wealth, education, and housing instability—impact health outcomes. HIV is an idyllic example of how structural drivers influence risk, and housing acts as an ideal intermediary through which to guide outcomes.

This dissertation aims to highlight important ideas in structural interventions and HIV-related outcomes: 1) to establish covariation of cause and effect by grouping housing participants based on severity of housing insecurity; 2) to compare sexual risk, substance use and abuse, and depression and trauma outcomes of each housing group; 3) to control for alternate explanations by comparing differentially housed groups in a randomized controlled trial; 4) to consider a housing instability continuum that asserts risk outcomes increase as housing instability increases; and 5) to determine the effects of cohabitants on sexual risk, depression, and substance use outcomes.

Results from this research confirm there is a relationship between housing instability and risk. Compared to housed respondents, unstably housed participants had greater odds of having: unprotected sex with a known-serostatus partner, STI-positive status, concurrent partners, recent incarceration history, alcohol and drug dependence, injecting and other illegal drug use, recent inpatient drug treatment history, depression, traumatic experiences, and poorer quality of life after controlling for possible confounding factors. Also, women were also at greater risk for unprotected sex, partner concurrency, and HIV-positive serostatus. Though the unstably housed were most at-risk across all outcomes, the hypothesized housing continuum did not follow the postulated order; further research must be conducted. The results support cohabitants also affect risk, but identifying persons who generate 'most risk' across all outcomes may not be feasible.

This research may provide insight about strengths or barriers to care for PLWH to service providers and equip future housing interventions to create better outcomes for PLWH and the unstably housed.

INDEX WORDS: Housing Instability; Homelessness; Doubled Up; HIV; Sexual Risk; Sexually-Transmitted Infections; Substance Use; Mental Health; Depression

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DEDICATION

I would like to dedicate this dissertation work to God— Who has loved, helped, graced, and instructed me through all—and my family: James Lawrence Daniel, Jr., Anaiah Mariama Daniel, Josiah James Daniel, and Gabrielle Layson Daniel. You all have supported me tirelessly through this effort, and we have earned recognition of this work together! Without Him and without you, none of this would be possible. I am grateful that God equipped each of you to walk this journey with me—all to His Glory. I am eternally excited about the work He continues to do in each of us and His Future Plans.

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INTRODUCTION

The HIV Pandemic

Globally, more than 33 million persons are estimated to be living with HIV/AIDS (WHO, UNAIDS 2009). The pandemic gravely affects low- and middle-income countries in Sub-Saharan Africa and Asia, but amongst high-income countries, the United States ranks first in both prevalence and incidence of HIV/AIDS cases (CIA Worldbook, 2010). In 2010, more than 1.5 million persons were living with HIV/AIDS in the US and new infections totaled more than 56,000 (ONAP, 2012; Avert paper, UNAIDS, 2010). In the US, those *infected* with HIV traverse all demographic lines—notwithstanding age, race/ethnicity, gender, and SES—and those *affected* by HIV intersect all populations. Even so, some groups are disproportionately affected by HIV and should receive additional preventive and therapeutic resources in order to lessen new infections, reduce HIV health-related disparities, and achieve improved health outcomes for people living with HIV (ONAP, 2012).

Disproportionately Affected Groups

In the US, 2012 reports show unprotected heterosexual sex is the leading transmission cause for African-American women and the second leading cause for African-American men. Due to heightened behavioral and structural risk factors for people of color (to be discussed later), it is estimated that the rate of new HIV infections

is six times more likely for black than white men and 15 times higher for black than white women in the US (Centers for Disease Control and Prevention, 2011). Morbidity and mortality rates also disproportionately affect these groups; African-Americans represent the deceased majority dying at rates 20 times that of non-Hispanic whites (Centers for Disease Control, 2010).

Risk Factors

Scientific understanding of HIV transmission as an infectious disease has increased considerably over the past thirty years (Coates, Richter, & Caceres, 2008; De Cock, Jaffe, & Curran, 2011; El-Sadr, Mayer, & Adimora, 2010; Merson, O'Malley, Serwadda, & Apisuk, 2008). Previously, HIV/AIDS was understood as an infectious disease with strict individual, behavioral underpinnings. Now, both personal and structural factors are known to increase HIV infection and transmission rates at individual and community levels (Bauermeister, Tross, & Ehrhardt, 2009; Centers for Disease Control and Prevention, 2011; Gupta, Parkhurst, Ogden, Aggleton, & Mahal, 2008; Kidder et al., 2007).

Individual HIV risk behaviors for both men and women include unprotected or inconsistent condom use during sex with a man, penetrative anal sex, substance use or abuse, having sex with more than one person, current STI infection, and exchanging sex for money, drugs, or shelter (Culhane, Gollub et al. 2001; Kidder, Wolitski et al. 2008; Noar 2008; Hayes, Kapiga et al. 2010). HIV-related structural factors are defined as community-level mechanisms that encourage or deter an individual's ability to avoid HIV transmission or infection. Structural factors that lead to increased HIV infectivity and transmission include demographic strata such as gender, age, ethnicity, and education;

socioeconomic factors including poverty, unemployment, discrimination, and housing stability and affordability; and psychosocial issues such as violence, HIV stigma, social support, lack of access to healthcare, and incarceration rates (Adimora and Schoenbach 2005; Aidala, Cross et al. 2005). Each of these risk factors interacts to exponentially increase the amount of risk persons or communities have.

Prevention Efforts

US policy-makers have supported research designed to reduce HIV transmission amongst disproportionately affected groups, and a number of behavioral and structural interventions have proven to be effective. Persons are encouraged to know their status, be aware of their partner's status, address mental and physical health concerns (such as increasing use of social support services, and, if positive, HIV medication adherence), know how to correctly use condoms and employ them each time they have sex, and if sexually active, test for HIV every 6 months (Crepaz, 2006). Structural examples include syringe exchange programs, condom distribution, and recently, housing interventions (discussed in more detail later). The Centers for Disease Control lists a compendium of effective behavioral and structural HIV-risk reduction interventions for use by AIDS service organizations and trains public health practitioners worldwide to deliver them.

The Housing Epidemic

People experiencing homelessness or housing instability are a vulnerable population whose negative social stigma and adverse health outcomes pervade every community. In the US, over 3.5 million people experience homelessness annually, and the numbers are steadily increasing (Centers for Disease Control, 2008; HUD AHAR,

2010). Of these persons, 100% suffer adverse health outcomes, including but not limited to: extreme poverty, malnourishment, unemployment or underemployment, lack of access to healthcare, lack of familial and community support, loss of housing and inability to secure affordable housing, domestic violence, physical and sexual abuse, mental illness, HIV/AIDS, and addiction disorders, including drug and alcohol abuse (National Coalition for the Homeless, 2007a). The impact that homelessness has on our nation's health outcomes—particularly HIV transmission and infectivity—is gravely underestimated, due largely to the inability to accurately count cases and catalogue homeless persons' experiences. For instance, while 3 – 15% of homeless persons self report living with HIV/AIDS, statisticians estimate 33 – 50% of all persons living with HIV/AIDS (PLHA) are currently homeless or expecting to experience homelessness in the near future (Song, 1999; Song, Safaeian et al. 2000; Bucher, Thomas et al. 2007).

In addition, the recent US economic downturn categorized millions as "unstably or marginally housed" and "doubled up" with friends or family members (Better Homes Fund 1999; National Coalition for the Homeless 2008). These classifications—simply defined as living with family members or friends paying low or no rent— merely increase homeless statistics to staggering numbers. Low-income individuals and families who are unable to afford a place to stay on their own are forced to board with other persons and may move frequently based upon the home's physical environment (size of home, size of family, available space) and social relationships (family, partner) of those they board with (Center for American Progress, 2011). Due to the high level of instability of individuals and families when in this position, the Department of Housing and Urban Development (HUD) included "doubled up" persons in the larger, current definition of

homelessness. These additional, transient persons increase homelessness estimations to more than 10 million US persons per year, making it even more difficult to definitively document trends and reduce health inequities of the homeless. An increase in rates of homelessness increases the likelihood of pervasive, negative health outcomes for generations.

Disproportionately Affected Groups

Lack of housing, choice, or affordability disproportionately affects some groups in the US. In urban areas, the sheltered and unsheltered homeless are predominately African-American. National samples reveal single, individual homeless are more likely to be male, but more than 70% of homeless families are female-headed. Persons with severe mental illness represent 33% of the homeless population. Behavioral research reflects that those who are marginally housed will soon become homeless without proper interventions.

Risk Factors

In a meta-analysis describing risk factors for homelessness, Susser, Moore and Link (1993) summarized homelessness is influenced by individual and structural factors (Table 1.1). Structural influences include social, socioeconomic and childhood/adulthood factors. Poverty and limited education are highly correlated with homelessness (Landrigan et al., 2006) (Susser, 1993); equally, living in an institutional setting such as rehabilitation, foster care, or jail contributes to housing instability. Persons who receive little to no social support from friends, community members, and access to social services are more likely to be homeless.

Individual risk factors include propensity for or diagnosis of psychiatric disorders,

specifically schizophrenia, bipolar disorder, and depression. These are significant risk factors for homelessness and the lifetime prevalence for each of these mental health disorders is more than twice as likely among the homeless. Also, persons who have experienced domestic, physical or sexual abuse are more likely to be unstably housed. Domestic violence is a key contributing factor to causes of homelessness; consequently, women and children are adversely affected by housing instability. Zorza (1991) found that half of all women and children experiencing homelessness were fleeing domestic violence. Lastly, prevalence of alcohol and other substance abuse is relatively high among the homeless population. Studies vary in reporting of addiction disorders among homeless adults. Figures fluctuate between 30 – 65% of homeless experiencing addictive disorders. In 2005, a national survey reported 38% reported an alcohol problem, while 26% reported problems with additional substances.

Prevention Efforts

In the United States, social protection programs are in place to prevent homelessness for those who are unstably housed or provide reintegration and housing for those living on the street. The federal government provides “tenant-based” subsidy programs such as Housing Choice (previously known as Section 8) and public housing developments with units that have low or no rent required. Unfortunately, subsidized housing for low-income households, emergency shelters, and rapid re-housing programs garner less than five percent of the federal housing assistance budget administered by HUD and are inadequate to meet the needs of this population (AHAR, 2010). The number of low-income renters exceeds the number of available units by at least 5 million, and the average wait time for a subsidized housing unit is more than two

years. In order to meet their housing needs, most individuals or families choose to double up instead of remaining unsheltered.

The Link between Housing and HIV

The link between housing and HIV is not coincidental; HIV researchers and economic and policy analysts have concluded that wealth—or lack of it—is a substantial driver in both the HIV and housing epidemics (Parkhurst, 2010). In the US, poverty, housing instability, and poor healthcare access and outcomes are closely tied. “Poor housing is both an indicator of poverty and a common target for interventions to improve public health and reduce health inequalities” (Thomson, 2010). For example, the WHO Knowledge Network on Urban Settings and the WHO Commission on the Social Determinants of Health have highlighted the need to create healthy housing and healthy neighborhoods for future health (Thomson & Petticrew, 2007). Within public health more generally, housing policy is regularly cited as both a determinant of health and health inequalities (Shaw, 2004; Thiele, 2002) and a means by which inequalities may be tackled (Thomson, 2010). PLHA generally live below poverty level and those who are unstably housed are more likely to have poorer health outcomes due to their need to divide limited resources between healthcare (medication, clinic visits) and basic sustenance (food, shelter).

Disproportionately Affected Groups: HIV Transmission Among the Homeless and Unstably Housed

Research shows the association between HIV and homelessness is both cause and effect— specifically, those who are homeless are more likely to seroconvert, and PLHA are more likely in the course of their disease to experience homelessness. The

homeless are known to demonstrate high-risk HIV behaviors, such as injection drug use, transactional sex, unprotected vaginal and anal sex, and partner concurrency at rates 4 – 6 times that of their housed peers—which perpetuates HIV transmission among the homeless and the general, housed population.

Risk Factors

People who are homeless or unstably housed are more likely to be exposed to HIV infection and transmission due to high individual and community-level vulnerability. Homeless persons are more likely to have recently engaged in substance abuse (including needle sharing), risky sexual practices (including a greater number of concurrent sex partners coupled with inconsistent condom use), and live on resources below poverty level with inadequate support and access to care (Kidder, Wolitski et al. 2007; Kipke, Weiss et al. 2007; Kidder, Wolitski et al. 2008; Marshall, Kerr et al. 2009; Wolitski, Pals et al. 2009). Table 1.2 describes similarities in risk factors across unstably housed and HIV-propensive populations.

Mechanisms of Housing Stability that Influence Health Outcomes: Prevention Efforts

Similar to the aforementioned changes in HIV risk, the definition of and theoretical pathways that contribute to general "health" have changed over time as well. Health is known to be shaped by macrosocial causes such as economic, political, and social drivers that lessen or increase a person's health risk and housing acts as an ideal intermediary in which "health" and health outcomes are embedded (Aidala, Lee et al. 2007; Kidder, Wolitski et al. 2007). While there are a number of effective behavioral interventions aimed at lowering HIV risk factors and incidence, structural HIV prevention interventions have been found to have great efficacy at both individual and community

levels (Herbst, Kay et al. 2007; Lyles, Kay et al. 2007). Evidence shows that targeting contextual factors that health behaviors occur in is more effective than addressing individual behaviors alone (Adimora and Schoenbach 2002; Adimora and Schoenbach 2005; Riley, Gandhi et al. 2007; Kim, Pronyk et al. 2008; Rotheram-Borus, Swendeman et al. 2009; Adimora and Auerbach 2010; Williams, Wyatt et al. 2010; Reed, Gupta et al. 2011). Successful examples of structural programs include comprehensive sex education, male and female condom availability, syringe exchange programs, health care availability, and—most recently—housing stability programs (Rotheram-Borus, Swendeman et al. 2009; Rotheram-Borus, Rhodes et al. 2010; Wolitski, Kidder et al. 2010). Unlike other structural interventions, modifications to housing affects individual, familial and community social networks; increases access to care and optimizes health outcomes among people living with HIV/AIDS; and reduces HIV-related disparities (Aidala, Cross et al. 2005; Aidala and Sumartojo 2007; Millett, Crowley et al. 2010). Recent evidence shows stable housing is an effective strategy in HIV prevention, increasing health outcomes for those who are seronegative and positive (Aidala, 2006; Wolitski, 2010; National AIDS Housing Coalition, 2005; Adimora, 2010). Housing instability and homelessness is a major public health concern affecting millions of US families each year and researchers agree providing stability would decrease morbidity from HIV/AIDS and numerous other chronic diseases (Adimora, 2010; Wolitski, 2010).

Gaps in Current Research

While housing interventions may clearly represent a laudable response to HIV prevention, research contributing to housing interventions as a prevention measure is few. Gaps in current research include the limited number of studies that clearly define

three points in reasoning: 1) temporal precedence between housing instability and poor health outcomes (specifically, that housing instability occurs prior to poor health outcomes), 2) covariation of cause and effect (specifically, the greater the severity of housing instability, the greater likelihood and severity of poor health outcomes), and 3) identifying and controlling for plausible alternate explanations by employing stably housed control groups that are similar to the experimental group in other factors (i.e. race/ethnicity, socioeconomic status, sexual behaviors, etc). Trials geared to answer these gaps will help determine if there are causal relationships between housing stability and health outcomes, and if so, what level of housing instability may lead to more severe health implications.

Dissertation Aims

In the literature gaps described above, it proves problematic to define and measure temporality and causality; in essence, no persons are left homeless to measure likelihood of HIV infection, infectious disease or poor health outcomes. However, current RCTs suggest that provision of stable housing is an effective strategy for both reducing HIV-associated risk behaviors and increasing access to care and adherence to antiretroviral medications. This research seeks to clarify the relationship between housing status and HIV transmission risks or health-related outcomes by determining the effects of varying levels of housing instability (exposure variable) on sexual risk, depression, and substance abuse (outcome variables). Specifically, this dissertation has the following aims:

1. To establish a covariation of cause and effect by grouping participants based on severity of housing insecurity (homeless, doubled up, and stably housed) and amongst these groups—

a. To describe gender and socioeconomic inequities, if any;

2. To compare sexual risk, depression and substance use outcomes of each group;
3. To control for alternate explanations by comparing differentlally housed groups in a randomized controlled trial; and
4. To consider a housing instability continuum that asserts risk outcomes increase as housing instability increases.

Significance of the Research

For nearly two centuries, housing has been widely documented as having great influence on health outcomes (Saegert, Klitzman et al. 2003). This dissertation will provide further context to whether prevention efforts targeting housing stability are essential to lessen HIV risk and transmission rates among those who are homeless or unstably housed. Also, In the US FY2013 budget, more than $22 billion is earmarked for domestic HIV-specific programs (ONAP, 2012). A thorough understanding of the effects of housing stability on HIV and HIV-related risk factors is needed to determine if there are stability levels that are harmful or protective against HIV transmission for PLHA and the larger community. Such data will provide information regarding whether public health resources should be aimed towards housing structural interventions for better overall, long-term health outcomes.

Limitations of the Research

Homelessness and living with HIV are conditions that clearly exacerbate each other, yet limited research has investigated the interrelationships of both health threats (Henny, 2007). A limitation is that this research is cross-sectional and cannot

successfully investigate temporal or causal relationships. With a cross-sectional design, data cannot measure temporal precedence and is limited in measure of covariation of cause and effect. A second limitation is that we measure one housing timepoint; as such, we are unable to ascertain the effects of transience or movement within or outside of households (by the participant or cohabitants) over time. Lastly, we do not have qualitative interviews to triangulate the quality of housing environments (cohabitants) or, for HIV-seropositive persons, qualitative information regarding previous housing environments in relation to knowledge or onset of HIV status.

Though necessary for future prevention efforts, housing interventions are expensive and may require a significant amount of time to demonstrate efficacy (Bauermeister, Tross et al. 2009). This research is promising, though, because housing is one of the few evaluated interventions that actually speaks to other contextual factors such as poverty, discrimination, and education that directly influence sexual behaviors and networks. If research continues to prove efficacious, government and policy objectives should earmark funds to implement such interventions to lower infectious disease in its most disadvantaged communities.

Table 1.1. Factors Associated with Housing Instability

CHILDHOOD FACTORS	ADULTHOOD FACTORS
Sexual abuse, physical abuse	Poverty and unemployment
Being expelled from school	Low educational level
Being away from home • Foster care • Runaway or throwaway	Lack of social support • Break up of relations: divorce, death of a spouse • Family or interpersonal conflicts • Few social networks
Variables related to the parent/guardians • Father living away from home • Problems related to substance abuse • Divorce • Low educational level	Health • Physical health problems, hospitalizations • Mental health problems: mental health disorders, psychiatric hospitalizations • Substance abuse
	Demographic • Gender • Age • Ethnic minority, particularly African-American
	Other • Low identification with a religious group • Being the oldest member of a very large family

Table 1.2. Risk Factors Affecting the Unstably Housed and those at Risk for HIV

Factor	Homeless	Unstably Housed	HIV Seropositive Persons	At Risk HIV Seronegative Persons
Low or no housing choice	√	√	√	√
Sexual abuse	√	√	√	√
Sexual risk (i.e. low or no condom use, concurrent partners)	√	√		√
Physical abuse/ Domestic violence	√	√	√	√
Low educational attainment	√	√	√	√
Poverty	√	√	√	√
Unemployment	√	√	√	√
Lack of social support	√	√	√	√
Poor physical health	√	√	√	√
Mental health concerns/ Depression	√	√	√	√

Addiction disorders	√	√	√	√
Institutionalized (foster care, jail, rehabilitation facilities)	√	√	√	√
Gender disparity	√	√		√
Race/ethnicity disparity—particularly African-American	√	√	√	√

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CHAPTER 2

LITERATURE REVIEW

Overview: HIV Risk-Reduction and Prevention Methodology

Over the past 25 years, the HIV pandemic has had global implications; every country has been affected by HIV and maintains national and local HIV transmission and infection rates (Merson, O'Malley, Serwadda, & Apisuk, 2008) (Merson, 2008; UNAIDS, 2010). A longheld belief is that poverty and social inequities are the drivers of the epidemic; in 2001, UNAIDS stated that “poverty, underdevelopment, the lack of choices and the inability to determine one’s own destiny fuel the HIV epidemic (Parkhurst, 2010) (Parkhurst, 2010; Joint United Nations Programme on HIV/AIDS, 2001). Recent research touts that globally, understanding both wealth and poverty and the contexts in which both can lead to either risky or protective behaviors, is the best way to combat the disease with preventive efforts (Parkhurst, 2010).

Likewise, over the years, funding support for prevention has included behavioral (both individual and community) interventions, biomedical approaches (including pre- and post-exposure ART), and structural programs (Blankenship, Bray, & Merson, 2000; Merson et al., 2008; Sumartojo, Doll, Holtgrave, Gayle, & Merson, 2000). While behavioral and biomedical approaches have proven effective in the prevention landscape, structural approaches are lauded as a “diagonal” approach—one that meets individual, community, and societal factors that have a great impact on HIV disease and

transmission (Merson et al., 2008) (Merson, 2008; Sepulveda, 2006; Ooms, 2008). While review of all intervention paradigms is appropriate, El-Sadr states "…great disparities remain in access to care and treatment for racial/ethnic minorities with HIV (particularly African-Americans). How to address these dispararities is the immediate challenge. The underlying theme is that HIV is spread in diverse communities, influenced by multiple biological, behavioral, cultural, societal, economic, and structural factors, and that curbing the epidemic will require an extensive variety of tactics carefully titrated to the needs of communities and individuals" (El-Sadr, Mayer, & Adimora, 2010).

Behavioral and Biomedical Interventions

Historically, behavioral intervention approaches are based on social-cognitive theory, communications theory, peer education, or diffusion of innovation (Coates, Richter, & Caceres, 2008). Behavioral models show efficacy for the intervention itself (what it is designed to achieve) and not necessarily for reduced STI or HIV infections. There are only a few behavioral interventions with HIV as an endpoint (Coates et al., 2008; El-Bassel et al., 2010). In order to determine the efficacy of a program to reduce HIV infections in the US, the program must: 1) have a large, identifiable target population that is at risk for HIV exposure; 2) the intervention must be known to have established effectiveness within the target population; and 3) delivery and uptake of the intervention must be administered and received by a substantial amount of the target population (Donnell, Hughes, & Fleming, 2010).

In summary, behavioral interventions are necessary, but not sufficient to reduce HIV transmission (Coates et al., 2008). Biomedical interventions—such as vaccine trials and antiretroviral administration as a preventive measure—are also programs that are

earmarked to lessen HIV proliferation. Similar to behavioral interventions though, biomedical programs cannot work solely to reduce HIV transmission, and they do not instigate behavior change at any level (Padian, Buve, Balkus, Serwadda, & Cates, 2008).

Structural Interventions

In the world of HIV prevention, structural interventions appear to provide a synergy between individual, community, and societal design. By definition, structural interventions speak to social determinants of health—which are the conditions and circumstances in which people are born, live, interact, work, grow older, and die; in turn, social determinants are shaped by policy, power (individual and community), money, and resources (physical and social) (Adimora & Auerbach, 2010). As it relates to HIV, ecological approaches are a paradigm shift to understanding the epidemic from a perspective that goes beyond individual behavior change to one that catalyzes social, political, and economic change. It is understood that structural drivers leading to HIV infection must be operationalized—meaning, the discussion must move from the importance of underlying structures to documenting *how* particular structural factors influence transmission (Parkhurst, 2010). Ecological efforts seek to change policy- and social-level determinants of health which are broader, long-term initiatives; but in so doing, these programs reach a far greater number of persons than individually-based interventions. Ecological interventions provide long-term assistance that is desperately needed instead of short-term means of behavior change. Structural approaches differ from individually-oriented behavior change because it addresses factors leading to or affecting individual behavior rather than targeting the behavior itself. Structural factors

that increase HIV vulnerability include poverty and socioeconomic status, neighborhood structure, familial and community social support, shelter, healthcare, educational systems, violence, and childcare (Adimora & Auerbach, 2010). Structural factors also include increased community and social support, higher self-esteem, safer harm reduction methods, cost-saving medical outcomes (i.e. ART adherence, decreased use of emergent care), and decreased individual risk behaviors, such as increased condom use and less transactional sex (Blankenship et al., 2000; Friedman, Cooper, & Osborne, 2009). New treatment paradigms must be accepted as evidence shows that "[global] prevention services currently reach less than 10% of individuals at risk worldwide [and that] expansion of these services could avert more than half the HIV infections projected to occur by 2015 and save $24 billion in treatment costs" (Merson et al., 2008) (Global HIV Prevention Working Group, 2007).

There is also the question of sustainability for all HIV prevention programs. While behavioral programs have short-term implications (generally sustained as long as program is in place, and after removed, for 6 – 12 months post-intervention), housing as an intervention has the ability to maintain long-term effects (Fitzpatrick-Lewis et al., 2011; Schwarcz et al., 2009; Thomson & Petticrew, 2007).

Housing: An Effective Structural Intervention

Effectively addressing HIV risk and health care disparities requires attention to structural factors. "Lack of housing and HIV are powerfully linked [and housing] occupies an important place in the causal chains linking poverty and inequality, and HIV risk and outcomes of infection" (Aidala & Sumartojo, 2007). A large body of evidence now proves that housing interventions are an essential and cost-effective component of HIV

prevention and health care for unstably housed and PLHA. PLHA whose housing status favorably changed were more likely to report HIV primary and continued care, medication adherence, and better HIV related health status altogether.

For seronegative persons, housing is protective against HIV risk behaviors as well. Over time, those who improved housing status reduced risk behaviors by half; conversely persons whose housing status worsened over time were four times as likely to engage in transactional sex. Access to housing also increases access to appropriate care and antiretroviral medications, which lowers viral load and reduces risk of transmission. Overall, housing status was found to be more significant than individual characteristics as a predictor of HIV health care access and outcomes (Reed, Gupta, Biradavolu, Devireddy, & Blankenship, 2011).

Exposure Variable: Causes of Homelessness and Housing Instability

Overarching causes of homelessness stem from poverty and lack of affordable housing. The Interagency Council implemented an overarching Continuum of Care program that links emergency shelters, transitional housing and permanent housing and related social services targeted for citizens who are homeless (Hoch, 2000). Guided by the objectives of the Continuum of Care and its accompanying resources, nonprofit developers, and state and local governments have created scores of supportive housing developments across the country. Some have as few as 20 units, while others successfully maintain more than 600. Successful models use 'blended management' which incorporates managerial oversight and social services with mixed-income/payment option communities.

Definition of Homelessness and Housing Instability

The McKinney-Vento Homeless Assistance Act of 1986 (Pub. L. 100-77; July 22, 1987) is the first federal legislation written to respond to the educational and provisional needs of the homeless in the US. Within the Act, mandates support counting and characterizing the homeless to ensure their human rights are protected and agencies are appropriately funded to meet their needs. Yet, local and national tallies remain inaccurate due to the transitory nature of homelessness and the varying definitions maintained by federal agencies.

Homeless statistics differ based upon the circumstances included in the definition. The McKinney-Vento Homeless Assistance Act Amendment (1990) defines homelessness as:

> "[a person who] lacks a fixed, regular, and adequate night-time residence; and…has a primary night time residency that is: (a) a supervised publicly or privately operated shelter designed to provide temporary living accommodations… (b) an institution that provides a temporary residence for individuals intended to be institutionalized, or (c) a public or private place not designed for, or ordinarily used as, a regular sleeping accommodation for human beings…(d) does not include any individual imprisoned or otherwise detained pursuant to an Act of Congress or a state law." 42 USC 11302(c)

Although similar, the Department of Housing and Urban Development (HUD) has a slightly broader definition. HUD defines someone as homeless if the person resides in an emergency shelter; in transitional or supportive housing for homeless persons; in a place not meant for human habitation, such as cars, parks, sidewalks, abandoned

buildings, encampments, and dilapidated buildings; or as a person who faces imminent eviction (within a week) from a place of habitation and has no further recourse to secure housing (US Department of Housing and Urban Development, 2005). Finally, the Department of Education (DOE), which provides services to meet the needs of homeless youth, has an even broader description. DOE classifies the homeless as people who are doubled up with family or friends due to economic condition; those who may be living in motels, cars, parks, public spaces, abandoned buildings, substandard housing, bus or train stations, camp grounds, trailer parks, or similar settings for lack of other suitable housing; children who are abandoned in hospitals or awaiting foster care placement; and includes migrant farmers and workers (McKinney-Vento Act Sec. 725(2); 42 U.S.C. 11435(2)).

Similar to federal agencies, epidemiologic researchers have diverse definitions for the homeless as well. The homeless are generally identified as those currently living in shelters or unsheltered on the streets (Bassuk & Rosenberg, 1988; Bassuk et al, 1997; Shinn et al, 1998; Shlay & Rossi, 1992; Koegel, Melamid & Burnam, 1995), although timeframes necessary to be constituted as homeless differ considerably. Persons can have been sheltered or unsheltered at least once within a particular timeframe— such as the past 30, 60 or 90 days (Bassuk & Rosenberg, 1988; Bassuk et al, 1997; Shinn et al, 1998) — or as much as at least once within a 37-month time period (Rotheram-Borus, Swendeman, & Chovnick, 2009) (Rotheram-Borus et al, 2009) or have had a history of homelessness within one's lifetime (Clatts, Goldsamt, Yi & Gwadz, 2005). Study inclusion criteria may not require shelter or street living and may have a broader definition of homelessness inclusive of other subsets within the population

(Slesnick & Kang, 2007). For instance, Sadowski and colleagues (2009) constituted homelessness as a "[lack of] housing for which a person has adequate resources and for which there are no time limits" with an immediate timeframe of 30 days prior to study participation (Sadowski, Kee, VanderWeele, & Buchanan, 2009). Equally, Fertig and Reingold (2008) researched families who are 'doubled up' or living with family members and friends, while others specifically seek this group's exclusion in their definition of homelessness (Fertig & Reingold, 2008) (Koegel, Melamid & Burnam, 1995).

Interestingly, some studies do not actually confirm that persons are homeless or unstably housed, but may make assumptions about the population based on other demographic information. For instance, Koegel and colleagues defined homelessness as persons who access services and programs generally defined for the homeless, but may not actually be confirmed as living sheltered or unsheltered currently or in the past (Koegel, Melamid & Burnam, 1995). With this data, Koegel, Melamid, and Burnam may actually describe attributes and outcomes for other groups, such as the poor, veterans, or those with previous incarcerations, rather than the homeless by designation. Also, in the National Survey of American Families, researchers defined homelessness as adults living 200% or more beneath the federal poverty level (Kessell, Bhatia, Bamberger, & Kushel, 2006; Kushel, Gupta, Gee, & Haas, 2006); moreover, Royal and colleagues (2007) characterized the homeless as those with "severe risk of homelessness", such as those facing imminent eviction or those who expect to be removed from their current living situation in the near future. Similar to Koegel's work (1995), these results may include homeless persons, but comprehensively may represent the working poor who may have no current or prior history of homelessness.

Housing Instability Definitions within This Dissertation

The terms “homeless”, “unstably housed”, “doubled up”, and “housing instability” are often used to describe the range of individual and family living situations.

1. Homeless: For the purposes of this dissertation, “homeless” is defined as the definition provided by HUD which includes ‘doubled up’ individuals and families. “Definitions for homelessness varies from study to study, but homelessness is typically defined as sleeping or living on the streets, in a car, in a homeless shelter, in an abandoned building, or other places not intended for sleeping” (Weir, Bard, O'Brien, Casciato, & Stark, 2007). Within most research, if a person is currently or has ever considered him or herself as homeless according to the above-mentioned definition, he or she may be included descriptively as a homeless person.

2. Unstably Housed: Housing stability is determined by a person’s ability to live freely and afford his or her space without the assistance of another person. “Stable housing is typically defined as residing in one’s own house or apartment. Unstable housing is typically defined as living in transitional housing, a drug treatment facility, jail or prison, or doubled up with family, friends, or strangers” (Weir et al., 2007).

3. Living Doubled Up: Living doubled up has a similar definition as being “unstably housed” and, in some research, may be used interchangeably. While it is difficult to definitively describe doubled up for economic reasons, this research will describe households with three considerations:

    1. Doubled Up – Family: Under this definition, which we constructed based on household composition, persons living in doubled up households include those living in the housing unit of an extended

family member. Doubled up family is defined by relationship to head of household and includes, for example, households with a head of household's sibling, grandparent, grandchildren, aunt or uncle, nephew or niece, or cousin, among others. Partners, roommates, people living in group quarters, and other non-relatives are not included in this definition.

2. Living with Partner: It includes unmarried and married sexual partners.
3. Doubled Up – Other Non-relatives and Group Shelter Accommodation: Under this definition, which we constructed based on household composition, persons living in doubled up households include those with extended family, friends, and other non-relatives living in the unit. Other non-relatives are included— including roommates, lodgers, or people living in group quarters.

Housing Affordability

In the United States, a commonly accepted guideline for housing affordability is a housing cost that does not exceed 30% of a household's gross income. When the monthly carrying costs of a home exceed 30–35% of household income, then the housing is considered unaffordable for that household. Generally, income is the primary factor— not price and availability, that determines housing affordability. In a market economy the distribution of income is the key determinant of the quantity and quality of housing obtained. Therefore, in order to understand challenges of making housing affordable, it is essential to understand trends and disparities in income and wealth. Housing is often the single biggest expenditure of low and middle-income families and

may be the greatest source of wealth or disparity for a family. Affordable housing is defined as housing which is "reasonably adequate in standard and location for lower or middle income households and does not cost so much that a household is unlikely to be able to meet other basic needs on a sustainable basis" (Ainsworth, 1998).

Quantifying Homelessness

The homeless are often displaced and move frequently; therefore, quantifying homelessness has been approached many ways. Three important methods are discussed in this review. First, most major cities utilize a method called "point-in-time" counting that counts the number of persons in shelters or unsheltered (by volunteers counting street people) on a given day or within a given week. This method overestimates the unsheltered and underestimates those who are marginally housed or living in places that go unnoticed by workers or volunteers, such as caves, boxes, or automobiles (National Coalition for the Homeless, 2008a). A second approach is to use self-reports from population-level surveys. Link et al (1994) reported lifetime and five-year prevalence estimates of homelessness based on self-report of persons randomly dialed in 48 states. The study concluded that "lifetime and five-year prevalence of all types of homelessness combined were 14.0% of the total population (26 million people) and 4.6% (8.5 million people), respectively" (Link, Susser, Stueve, Phelan, Moore, & Struening, 1994). Lifetime unsheltered homelessness (i.e. sleeping in shelters, abandoned buildings, bus and train stations, etc.) was 7.4% (13.5 million people), and five-year prevalence (1985 through 1990) of self-reported homelessness among those who had ever been unsheltered was 3.1% (5.7 million people) (Link, Susser, Stueve, Phelan, Moore, & Struening, 1994). Lastly, a "period prevalence" count calculates the

homeless used by service providers across the country at two different points in time and interprets the figures as a percentage of the US population. In a study cited by the Centers for Disease Control and Prevention (CDC), Koegel, Burnam, and Morton (1996) determined that at least 1% of the US population experienced homelessness, generating a figure of nearly 3.5 million persons with more than 1.35 million being children. In the parent study that will be evaluated for this dissertation, point in time estimates reveal that three of four cities sampled (California, Georgia, and New York) contribute to nearly 50% of homeless population in the US (AFAR Report, 2011).

In addition to varying tallying practices, many studies utilize different sampling techniques and research methodologies to generalize results to the homeless community. Most studies on the homeless report local data from one city with a convenient sampling method and cross-sectional study design (Bassuk & Rosenberg, 1988; Bassuk et al, 1997; Shinn et al, 1998; Schwarcz, Hsu, Vittinghoff, Vu, Bamberger & Katz, 2009). Larger, national studies collect data from three or more cities (as many as 20 cities) and may employ quasi-experimental design (Fertig & Reingold, 2008; Royal et al, 2007). National samples are generally longitudinal and include broader definitions of homelessness based on income and other demographic information to identify the sample for study inclusion. Utilizing yet another sampling method similar to meta-analyses, in order to determine the reliability of point prevalence data to accurately characterize the homeless population, Phelan and Link (1999) compared in-person qualitative interviews of 722 sheltered and unsheltered homeless in Chicago, surveys of 1704 homeless in 20 cities, random-digit dialed surveys of 1507 homeless in 20 US cities, and completed a comprehensive literature review of other US homeless studies.

Within Phelan and Links' review, Shlay and Rossi (1992) showed that there was so much variability within persistence of homelessness, that there were no identified central tendencies in distribution; from their own work, Phelan and Link (1999) concluded that point prevalence studies may "wrongly depict homelessness as a chronic, deviant condition for a few, rather than an ordinary, brief condition of many."

Because there is concern about homelessness affecting not only individuals but families with children, there has been considerable effort aimed at counting homeless families. The homeless family can be defined as at least one adult and one child living in a homeless or unstably housed situation. Studies have found that families with children constitute one-third of the homeless population (Burt et al., 2001) and that this group is the largest rising subset of the homeless population (Haber & Toro, 2004); Rosenheck, 1994). As mentioned, probable cause for the rise in this group may be due to the influx of individuals and families who can be characterized as "doubled up" or unstably housed. This is defined as persons who experience homelessness or housing instability, who are more likely to live with relatives in overcrowded or substandard housing" (National Coalition for the Homeless, 2007b). Unlike other forms of homelessness, it is especially difficult to quantify this group on a national level other than self-report data collected during resource use or access to care services.

Housing Status: Health Outcomes

Amongst PLHA, housing status is singly the most significant determinant contributing to increased risk of HIV transmission, infectivity, and mortality (Solorio, Rosenthal et al. 2008). Up to 70% of all PLHA report a lifetime experience of homelessness or housing instability due to poverty, discrimination, and threat of housing

loss; at any given point in time, 10 – 16% of all PLWH are homeless or sleeping in places not intended for human habitation. Research has shown that among PLHA, controlling for age, gender, and ethnicity, persons who are homeless or unstably housed are the most affected group, and that increased housing stability decreases HIV transmission and infectivity. Equally, among seronegative persons, housing instability is the leading cause of increased HIV risk after controlling for other factors. Any homeless or unstably housed person is disproportionately-affected by HIV and HIV-related factors, such as STIs, drug and alcohol use. A nationally-based CDC study showed that, compared to stably housed counterparts, PLHA who lack stable housing are: 2.9 times as likely to engage in sex exchange; 2 times more likely to have unprotected sex; 2.3 times more likely to recently use drugs; and 2.75 times as likely to inject drugs; have worse mental, physical, and overall health; more likely to delay entry into HIV medical care; more likely to be uninsured and use emergency medical care; have lower CD4 counts; and self-report lower ART adherence (Kidder, Wolitski, Pals, & Campsmith, 2008). Unstably housed PLHA are also less likely to receive appropriate health care and experience higher rates of opportunistic infections, HCV, TB, and STIs. The death rate for unstably housed PLHA is five times the all-cause death rate for stably housed PLHA.

Equally, housing status, gender and age interact to produce different HIV and sexual risk outcomes. Homeless adolescent females and women are more privy to partner violence, having 2-4 sex partners concurrently, trading sex for money, food, or shelter, and are less likely to engage in condom-protected sex acts (Solorio, Rosenthal et al. 2008). Unstably housed women are at greater risk of HIV transmission, infection, and sexual risk behaviors than comparative groups (i.e. homeless men who have sex

with women or stably housed women). After controlling for poverty, homeless women were two to four times more likely to have multiple sex partners and engage in transactional sex than housed poor women. They are also more likely to experience intimate partner violence and physical violence. Harm reduction and other behavioral risk reduction interventions are less effective for women who lack stable housing. Similarly, homeless young adults show significantly lower levels of condom use and greater numbers of sexual partners among unstably housed youth as compared to those who are stably housed. Interventions for unstably housed populations are key in addressing HIV prevention and health inequities. US government intervention strategists acknowledge the intersection of violence against women and girls, gender-related health disparities, and HIV and have placed heightened attention on prevention efforts.

Risk Factors Associated with Housing Instability

Demographic data provides statistics that describe different homeless population subsets and risk factors that are associated with housing instability and disease. Reviews and meta-analyses generally describe the homeless individual as: male, single, and unemployed; completed less than a high school education; with weak social ties and poor family networks, including upbringing in a foster home. At least 25 – 33% of this population may have severe mental health and substance abuse problems, one-quarter are likely to be disabled, and almost 40% have previous incarcerations (Shlay & Rossi, 1992; Phelan & Link, 1999; Koegel, Melamid, & Burnam, 1995).

Demographically, homeless families are generally headed by female head of household (Bassuk & Rosenberg, 1988; Bassuk, Rubin, & Lauriat, 1986)—although some studies exclude homeless families headed by fathers from their dataset (Fertig &

Reingold, 2008), receive financial assistance through AFDC/TANF funds, have long histories of residential instability, and have unemployment rates of more than 60% (Bassuk, Rubin, & Lauriat, 1986). Longitudinal data collected by Phinney and colleagues (2007) showed that nearly 20% of women who received previous welfare subsidies had been evicted and 12% of them experienced homelessness after public assistance was no longer received. Mothers with less education, psychological or mental health disorders, and minimal amount of work experience and low vocational skills were more likely to be homeless with their children. Equally, housing instability among mothers is associated with histories of criminal conviction, drug use, and domestic abuse (Phinney, Danzinger, Pollack & Seefeldt, 2007). Fertig and Reingold (2008) provided characteristics of homeless and doubled up families in more than 20 US cities and demonstrated that homeless families are more likely to be female-headed households, African-Americans (as opposed to white or Latina), with mothers who have had a drug problem, fair or poor health, endured physical abuse, and receive little to no financial and social support from friends or relatives. Conversely, doubled up families (as opposed to homeless) included mothers who were more likely to be headed by Latinas or white women (as opposed to African-Americans) and more likely to have fewer children (Fertig & Reingold, 2008).

Contrary to individual homeless, homeless families generally do include parents who have completed high school—even some mothers who may have attended college (Bassuk & Rosenberg, 1988); yet, their children underperform academically—historically presenting with learning disabilities, developmental lags, anxiety and depression (Bassuk, Rubin, & Lauriat, 1986). Among homeless families with children, the majority

of its youth is pre-school aged (Bassuk et al., 1996; Burt el al., 2001; Rog & Buckner, 2007) leaving nearly 900,000 young children at risk for educational and developmental delays and further economic and health risks in their futures (Bassuk et al., 1996). Children in homeless families have limited health care access and use, and one study demonstrated fifth-grade homeless children self-reported poorer health-related quality of life, depression, and increased exposure to violence (Coker et al, 2009). Inequities include educational and cognitive deficiencies. Shinn et al (2008) determined that although both homeless and poor housed children scored below average on cognitive and achievement norms, there were small group differences favoring poor, housed children on cognition and mental health outcomes than their homeless counterparts.

Interestingly, there may also be cultural and socioeconomic differences at play that differentiate homeless from conflicting backgrounds. Based upon neighborhood data, Hickler and colleagues (2009) showed African-American homeless youth come from structurally disenfranchised communities with little or no economic and social support; conversely, white homeless youth come from established communities with socioeconomic support, but tend to be runaways from physically and sexually abusive relationships. Accordingly, white youth tend to identify as or be labeled as “homeless” and accessed all resources available to the homeless (i.e. healthcare), while Black youth did not consider themselves “homeless,” but instead, described themselves as “hustlers” and did not access care or resources that they may have been afforded (Hickler et. al, 2009). This type of idiosyncratic behavior may lead to poorer health outcomes for particular ethnicities and subgroups within the homeless community, and interventions to target homeless populations’ health outcomes may need to be sensitive

to cultural and socioecological differences.

To summarize, factors associated with increased risk for homelessness and housing instability include: individual and parental history of substance abuse (Bassuk & Rosenberg, 1988; Bassuk et al, 1997), past domestic violence and familial physical and sexual abuse (Fertig & Reingold, 2008; Bassuk & Rosenberg, 1988), higher likelihood of depression and compromised mental health (Fertig & Reingold, 2008; Bassuk & Rosenberg, 1988; Bassuk et al, 1997), less education, poor social support (Fertig & Reingold, 2008; Bassuk & Rosenberg, 1988; Bassuk et al, 1997), foster care placement (Bassuk et al, 1997), and city-level factors such as scarcity of affordable housing units (Fertig & Reingold, 2008). As adults, race and ethnicity, drug use, serial displacement (multiple residences), poor or low social networks and mental health are contributors to repeated homelessness (Bassuk & Rosenberg, 1988; Bassuk et al, 1997). Conversely, protective factors include having your own residence (lease in your name and financial resources to secure affordable housing), social funding programs (Bassuk & Rosenberg, 1988; Bassuk et al, 1997), and positive social relationships (Bassuk et al, 1997). Social welfare programs that provide adequate housing may increase residential stability long-term (Shinn et al, 1998), although the positive health outcomes from such programs may not be realized immediately (Fertig & Reingold, 2007).

Concerns Regarding Definition, Quantifying, and Describing Risk Factors of the Homeless

Homelessness is an extreme situation based on the convergence of many macroeconomic factors that have multiplicative, detrimental effects (Shlay & Rossi, 1992), and consequently, make it difficult to delimit. Research, federal, and service

organizations have varying definitions of homelessness, and therefore, make it difficult to compare study results and make population-level generalizations. With different definitions and sampling techniques, it is difficult to describe the characteristics of the homeless population and the magnitude of the problem in the US for future research and policy implications (Phelan & Link, 1995). In order to link descriptive data or evaluate outcomes across a broad range of studies, randomized controlled trials must be conducted to determine causal relationships between levels of housing instability and health outcomes. Currently, this review has identified three trials. In one trial, Sadowski and colleagues randomized 405 chronically ill homeless adults—of which 36% were HIV positive— to a housing intervention and found that housing created better healthcare outcomes (particularly access to care) for the homeless (Sadowski, Kee, VanderWeele, & Buchanan, 2009).

The Role of Relationship Dynamics and Social Support in HIV and Housing Choice

Relationship dynamics play a huge role in sexual decision making. Sex occurs within the context of a relationship and is based on or involves individual gender or sexual norms, beliefs, and practices. Research shows that amongst couples, individual gender, age, ethnicity, understanding of gender roles and normative beliefs regarding sexual decision making, individual drug use, domestic violence, the length of relationship, and relationship significance (i.e. casual or steady) impact risky sexual practices (Crosby, DiClemente et al. 2000; Soler, Quadagno et al. 2000). Among heterosexual couples, the number of times that a person has unprotected penetrative vaginal and/or anal sex—a leading cause of heterosexual STI and HIV transmission—is controlled by gender and power dynamics (Crosby, DiClemente et al. 2000). In order to

increase condom negotiation skills and partner communication about HIV and STIs, interventionists recommend involving both partners in prevention education (Worth 1989).

Interestingly, relationship dynamics equally play an integral role in housing choice—in its selection, affordability, stability, safety, and continuity. For anyone who lives with another person (excluding parent/child relationships), there is a price that is paid for continued living arrangements. For those involved in sexually intimate relationships, housing selection, stability, and continuity may be contingent on the success or failure of the relationship (i.e. long-term live ins or married relationships). Persons who are living with family members or friends may be enticed or forced into risky sexual practices such as drug use, molestation, or providing sexual favors in return for housing continuity. Consequently, individuals may make choices that impair or are outside of their normal decision making in order to maintain housing stability.

Rice and colleagues show that recently homeless adolescents are more likely to rebuild or continue relationships with family members or friends who were part of their lives prior to homelessness and that dynamic helped them to be reintegrated and establish housing again. In housing with family members or friends, youth were able to refrain from risky sexual practices. Continued research needs to control for if the positive social support or the stable/safe/secure housing played the key role in lessening risky sexual practices. It is unclear what elements of housing (social support, stability, neighborhood) play key roles in lessening risky sex.

The Importance of Couples-Based Research

Eighty six percent of HIV transmission is due to sexual contact in the US (El-Bassel, 2010; CDC, 2008). Social theory shows that in heterosexual relationships, partners play a critical role in decision-making, being the key driver between risky or safe sex practices. Literature shows that having both members of the couple identify the mutual responsibility they have for each other to stay healthy and safe and the power of both working together to induce and sustain behavior change are positive ingredients for successful HIV prevention. As such, couples-based interventions (with both partners involved in an intimate relationship) are needful to address prevention because they allow the couple as a unit to establish effective communication and negotiation skills (condoms, gender power and equity), explore condom use technical skills, and problem-solving techniques. A systematic review of couples-based HIV prevention research concluded that couples-based interventions are more efficacious in support of knowing a person's status, ARV medication adherence, and increased adherence to treatment regimens for reduction in mother-to-child transmission (El-Bassel, 2010; Remien, 2005; El-Bassel, 2003; Wu, 2010; Harvey, 2002; Koniak-Griffin, 2008). Couple-oriented HIV/STI interventions—that focus on the couple as the unit of intervention—provide relationship-based approaches that address the context of gender and power and facilitate the development of couple communication skills that enable long-term intimate partners to negotiate condom use (Wingood, et al. 2000; El-Bassel, Witte et al. 2003; El-Bassel, Witte et al. 2005). Intervention messages have been proven efficacious when delivered individually and jointly and show sustained risk reduction effects over time.

Outcome Variables: Health Outcomes and Risk Factors for the Homeless and Unstably Housed

Although poor health outcomes pervade low-income communities, the homeless are a population with increased morbidity and mortality rates due to a number of socioeconomic, structural, and individual risk factors—including discrimination, poverty, and stress as causally related bases for disease (Crane, et al., 2005; Nyamathi, Bennett, Leake, Lewis, & Flaskerud, 1993). Specifically, illnesses that commonly affect the homeless include: addictive disorders, including alcohol, injection drug use, and crack cocaine (Dickson-Gomez, Hilario, Convey, Corbett, Weeks, & Martinez, 2009; North, Eyrich-Grag, Pollio, & Thirthalli, 2009); chronic disease, including diabetes (Raoult, Foucault, & Brouqui, 2001); nutritional disorders, including malnutrition and obesity (Fertig & Reingold, 2007); mental health and neurological functioning, including psychosis and severe mental illness and cognition deficits (Burra, 2009); and infectious diseases, including hepatitis, tuberculosis, HIV, and STIs (Marshall, 2009; Raoult, Foucault, & Brouqui, 2001; Royal et al, 2007; Schwarcz et al, 2009). Regardless of disease, exposure, or means of acquisition, the homeless experience higher morbidity and mortality (Cheung & Hwang, 2004). According to Cheung and Hwang (2004), Toronto homeless women were ten times more likely to die than women in the general population, and across seven major cities, the risk of death among homeless women under the age of 45 was 4.6 to 31.2 times greater than that among women in the general population.

Higher morbidity and mortality rates for the homeless may be due to lack of access to care, including primary, specialist, dental, and emergent care; lack of follow

through with prescribed care due to an inability to maintain health in a clean, safe environment; and poor follow-up with primary care and specialist physicians. Of all access to care services available, research reflects that the homeless meet their health needs by utilizing emergency rooms for critical and non-emergent visits (Reid, Vittinghoff, & Kushel, 2008). Contrary to optimal care practices, being seen in emergency rooms ensures that long-term or follow-up care is rarely utilized by the homeless (Song, et al., 2007). In a national survey of more than 16,000 low income adults in the US, Kushel, Gupta, and Gee (2006) found that more than 25% had both housing and food insecurity which lead to self-reported measures of not having a usual source of care, postponing needed medical care and medications, and increased hospitalizations. Equally, Reid et al (2008) posited that as economic deprivation and housing instability increased, there would be increased deficiency in access to and use of healthcare services. In this research, there were four 'access to care' variables: 1) having no usual source of care, 2) having no health insurance, 3) postponing needed medical care, and 4) postponing medications. Once plotted against economic and housing stability indicators, three measures (all excluding having a usual source of care) showed a trend toward poorer access to care with progression toward worsening economic and housing gauges (Reid, Vittinghoff & Kushel, 2008). Lastly, in a landmark randomized controlled trial, Sadowski and colleagues (2009) tested the effects of a housing intervention on health outcomes—particularly number of hospitalizations, emergency department visits, and total hospital days for chronically ill homeless patients. The trial found that for the housed, there were fewer hospitalizations and fewer emergency department visits, but similar to other studies that preceded this research,

there was not clear evidence showing improvement to health (Sadowski, Kee, VanderWeele, & Buchanan, 2009; Fertig & Reingold, 2007).

Rotheram-Borus et al (2009) described homeless persons living with HIV were more likely to have criminal convictions, be members of minority ethnic groups (African-American), have less education, less likely to have health insurance, less likely to be employed, have lower CD4 count, and be less likely to use antiretroviral therapy (ART) as an effective treatment option than HIV+ stably housed persons. This data lends credence to the effects of housing on HIV health outcomes, both for the long and short-term.

Outcome Variables Manuscript 1: HIV and Sexual Risk

As it relates to HIV and STIs, inequities facing the homeless and unstably housed are even more evident. Sexual health outcomes heighten the disparity within the unstably housed community, favoring those who are sheltered more than those who are not. Research reflects that unsheltered homeless are at a significantly increased risk of HIV and other STIs due to individual and contextual factors associated with HIV transmission and acquisition than their housed counterparts. Kidder's research team demonstrated that after controlling for potential confounding factors between homeless and housed persons living with HIV/AIDS (i.e. race, gender), housing status acted as a significant predictor of increased number of sex partners; increased sex events of unprotected sex with unknown serostatus partners, including sex exchange (Kidder et al, 2007).

In three groups—homeless heterosexual men, homeless women, and homeless youth—Tucker and colleagues explored condom-use decision-making. In previous

research, condom use amongst the general, stably housed population was associated with individual attitudes towards condom use, condom self-efficacy, and whether the couple discussed condom use prior to sexual activity (Tucker, 2012; her 23, 24), However amongst the homeless, additional predictors of condom use include partner type (casual vs. main), whether alcohol or illicit substances were used prior to having sex, and the setting of the event (apartment or house, motel/hotel room, or a public place). For all three populations, drug use and setting were significantly associated with each other; in sex acts where hard drugs (generally crack) were used, the setting was much more likely to be in a public place versus home or motel. Also, if the person is considered a primary partner—generally determined by emotional ties and length of relationship for women or how the relationship was described by men—the couple is less likely to use a condom (Tucker, 2012).

Outcome Variables Manuscript 2: Substance Abuse

At least one-third of all HIV transmission and acquisition is due to injection drug use, via needle-sharing or sexual contact with an IDU (Salazar, 2007). While drug rehabilitation and syringe exchange programs have been directive prevention methods in use for this population, Kidder and colleagues found housing status to be a significant predictor of any substance use, including illicit drugs and alcohol (Kidder et al, 2007). Among IDUs in particular, several longitudinal studies found associations between unstable housing and HIV-associated risk factors (Salazar, 2007; Andia et al, 2001; Corneil et al, 2006, Metraux, 2004). After adjusting for age and income, Salazar found that injecting homeless men compared to housed IDUs were more than twice as likely to report sharing needles used by someone else (AOR = 2.61; 95% CI 1.43 – 4.75; P <

.01); more than twice as likely to have sex with a male partner (AOR = 2.38; 95% CI = 1.01 – 5.60, P < .05); nearly twice as likely to have unprotected sex with a casual partner (AOR = 1.96; 95% CI = 1.17 – 3.30, P < .01); and 2.5 times as likely to have oral, anal or vaginal sex with more than 3 partners (AOR = 2.49; 95% CI = 1.49 – 5.00, P < .001). Interestingly, amongst Salazar's research participants, those who were aware they were seropositive engaged in less HIV high-risk activities, such as needle sharing and unprotected sex. This may be due to the desire of the HIV positive persons to protect their community or due to being ostracized from high-risk activities by HIV-negative persons who know their status; either way, this merely slows transmission, not acquisition in this population.

Outcome Variables Manuscript 3: Mental Health

Rotheram-Borus' work (2009) revealed unstably housed participants had less social support and were more likely to be depressed than persons living with HIV who were stably housed. Additional authors conclude that significant portions of the homeless suffer mental health problems, such as depression, victimization, and lack of social support.

Outcome Variables: Summary

Major factors that lead to this increased HIV risk for the homeless are: 1) poverty, 2) drug and alcohol abuse, 3) physical and sexual abuse, and 4) lack of a stable environment (James & et al., 1991). These risk factors are critical because they pinpoint macroeconomic and societal factors (poverty, violence, and lack of stable environment) that can play a large part in individual risk behaviors (addictive behaviors, substance abuse, and victimization). Equally, systematic evaluation of the current

literature support review of socioeconomic status (poverty and lack of stable environment) and drug treatment programs (addictive behaviors) as key elements in informing program and policy developments (Leaver, Bargh, Dunn, & Hwang, 2007; (Eyrich-Garg, Cacciola, Carise, Lynch, & McLellan, 2008).

Socioecological Theory

Socioecological theory provides a broader framework within which to assess individual behavioural change. Bronfenbrenner's (1977) theory postulates that individuals develop and interact within a larger physical and social environment made up of nested systems (Figure 2.1). Microsystems, mesosystems, exosystems, and macrosystems make up this framework, and all persons are influenced by or make decisions within these systems. A microsystem is a person's immediate environment in which he or she embodies a distinct role in a particular place for a designated period of time. For instance, a person may be a daughter while at home for the duration of her parents' lives. A mesosystem is defined as the interrelationship of microsystem settings and roles; specifically, the mesosystem of a married, female adult with children may encompass interactions between immediate and extended family, relationships and roles in her workplace, and responsibilities at church and with friends. An exosystem is a setting in which a person is found, but the individual generally has little or no influence on the decisions made within that system. For instance, exosystems include community neighborhoods, mass media, government, and informal social networks. A macrosystem differs from the other three systems in that it does not deal with personal or individual roles. Instead, it is the cultural, moral, economic, legal, political and educational systems that humans live and interact in daily. As such, macrosystems

contain micro-, meso- and exosystems and are the structural information systems that shape how people individually make decisions, interact, and behave.

Additional models have been developed or adapted to describe the social or ecological determinants of health—the ways in which elements of the social, economic, and physical environments interact with individual biological factors and behaviors and shape health status. Structural interventions work differently than behavioral interventions by targeting factors or changing variables that influence a person's or community's behavior. Structural factors include housing, education, economic empowerment or employment. For instance, change in housing options does not inherently change a person's risky sexual practices; however, it likely influences personal decision making regarding who a person chooses to be sexually involved with, where they choose to have sex, how often they have sex, and if protection is used. Research that supports housing as an HIV prevention strategy is grounded in at least two socioecological models: 1) Wingood's adaptation of the theory of gender and power and 2) Aidala's "Risky Contexts" model.

Theory of Gender and Power

Due to societal factors such as violence and poverty, women are disproportionately at risk for HIV infection and homelessness. A structural adaptation of Connell's theory of gender and power asserts that gender differences arise from the global dominance of men over women. According to Connell's theoretical approach, there are three major social structures that characterize the gendered relationships between men and women: the sexual division of labor, the sexual division of power, and the structure of cathexis. This approach can be utilized to examine the exposures,

social/behavioral risk factors, and biological properties that increase women's vulnerability for acquiring HIV.

Macrosocial factors are conceptualized as a domain of exposures that arise from the sexual division of labor, power, and cathexis which are widely posited to be potent determinants of racial/ethnic disparities in sexually-transmitted HIV (Aral, Adimora and Fenton, 2008; Adimora, Schoenback and Doherty, 2006; Thomas, 1999). As such, women's risk is a function of the three interlinked structures (structural examples of each are in parentheses): 1) the sexual division of labor, which examines economic inequities that favor men (i.e. local rates of poverty, income inequality); division of power, which investigates abuses of authority and control in relationships that favor men (i.e. local male-to-female sex ratios, rates of violence against women); and the structure of cathexis, which looks at community social and gender norms (i.e. social acceptability of woman protecting herself from HIV, local marriage rates). To date, however, empirical investigations lag behind investigation of these propositions. Plans to elaborate exposures within the theory of gender and power could include intensifying efforts to explore the role of select macrosocial processes, arising from the sexual division of labor, the division of power, and the structure of cathexis in shaping African American girls and women's risk of HIV. "Employing the theory of gender and power among women marshals new kinds of data, asks new and broader questions with regard to women and their risk of HIV, and, most important, creates new options for prevention" (Wingood, 2000).

The Risky Contexts Model

The “Risky Contexts Model” takes two vantage points to answer the important question: Does housing status influence individual risk behaviors and healthcare outcomes, or are the findings evidence of self-selection of risky persons‘ into conditions of housing instability? The “Risky Person Model” (Figure 2.2) asserts an individual‘s personality leads him or her to HIV sexual risk behavior with negative consequences on health and housing. Conversely, the “Risky Contexts Model” (Figure 2.3) views housing as an intermediary by which the stress and disease inequality that exists in broader economic and political structures is carried to a susceptible host. As such, broader processes of inequality and exclusion lead to the deterioration of housing situations and neighborhood environments for vulnerable members. Lack of housing makes it hard to move out of risky situations or to use risk-reducing tools and institutions.

Determining the major structural factors that drive or influence individual risk behaviors are ones that can play as major contributors to lessening the epidemic. Research concludes that housing is a structural factor that impacts a person’s economic well-being, social networks, and likelihood of physical violence. If housing interventions are written to play a major role in HIV prevention and care, local, national and international communities may see a marked change or improvement in HIV statistics.

People who are homeless or those who may be exposed to homelessness lack a stable environment to grow and heal in. In our society, a person’s home is related with the concept of physical and psychological security—our homes provide us with a sense of order, peace, continuity, status, and control (Padgett, 2007). Homes and the environments they are in also “lead to a sense of personal and social identity and

agency that helps build resistance to risky behaviors" (Aidala & Sumartojo, 2007). Consequently, those who live in "bad" or substandard neighborhoods may feel not only a reduced sense of safety, but lower self-esteem and personal value (Blacksher, 2002). Again, the homeless are the most vulnerable amongst the "precariously housed" because they are exposed to negative social networks, illicit and illegal behaviors, addictive behaviors, and substandard living conditions in community shelters or on the streets. In "Why Housing?" Aidala and Sumartojo (Aidala & Sumartojo, 2007) state:

> "Particularly important for understanding relationships between housing and HIV is the extent to which access to housing structures intimate relations. The lack of housing, transient living conditions, and the communal sleeping arrangements in most homeless shelters pose a formidable barrier to forming stable intimate relationships. Lack of a stable 'home' and community ties has long been associated with multiple sexual partners, casual liaisons, sex exchanges, and low rates of marriage or stable partner relationships."

In these poor living environments, the homeless are limited in their ability to create or access positive psychosocial relationships, and are instead exposed to networks that may encourage drug use, illegal activities, and risky sexual behavior such as sex exchange. Equally, there are hypothesized pathways between residential transience and HIV risk behaviors that are mostly centered around how the continual change in environment leads to disrupted, poor social networks (German, Davey, & Latkin, 2007).

Stabilizing housing has been shown to be effective, but less research has clarified what environmental or psychosocial aspects of housing are vital in HIV risk

reduction. Aidala, in her Risky Person/Risky Context model, states that studies show researchers have not broken down components of housing, but have merely addressed if persons are housed or not in structural HIV interventions. Components of housing—stability, affordability, safety, security, and cohabitants—are key components to any person's social, physical, and economic well-being. Whether individuals have shelter with basic amenities and a place where they can exhibit some control over their space seem to be important housing characteristics that are correlated with HIV risk (Weir, 2007). For example, individuals with low or no basic amenities and an inability to afford housing may exchange sex for shelter (Weir, 2007). Equally, if they have less control over their space or environment, persons may be unable to keep condoms or safe injection equipment accessible (Weir, 2007; Rhodes et al, 2005 in Weir) and are more likely to be exposed to intimate partner violence (Weir, 2007; Weir, 2008; Baker, Cook, 2003). For a simulated composite of this dissertation's theoretical modeling, please refer to Figure 2.4.

Figure 2.1. Socioecological Theory

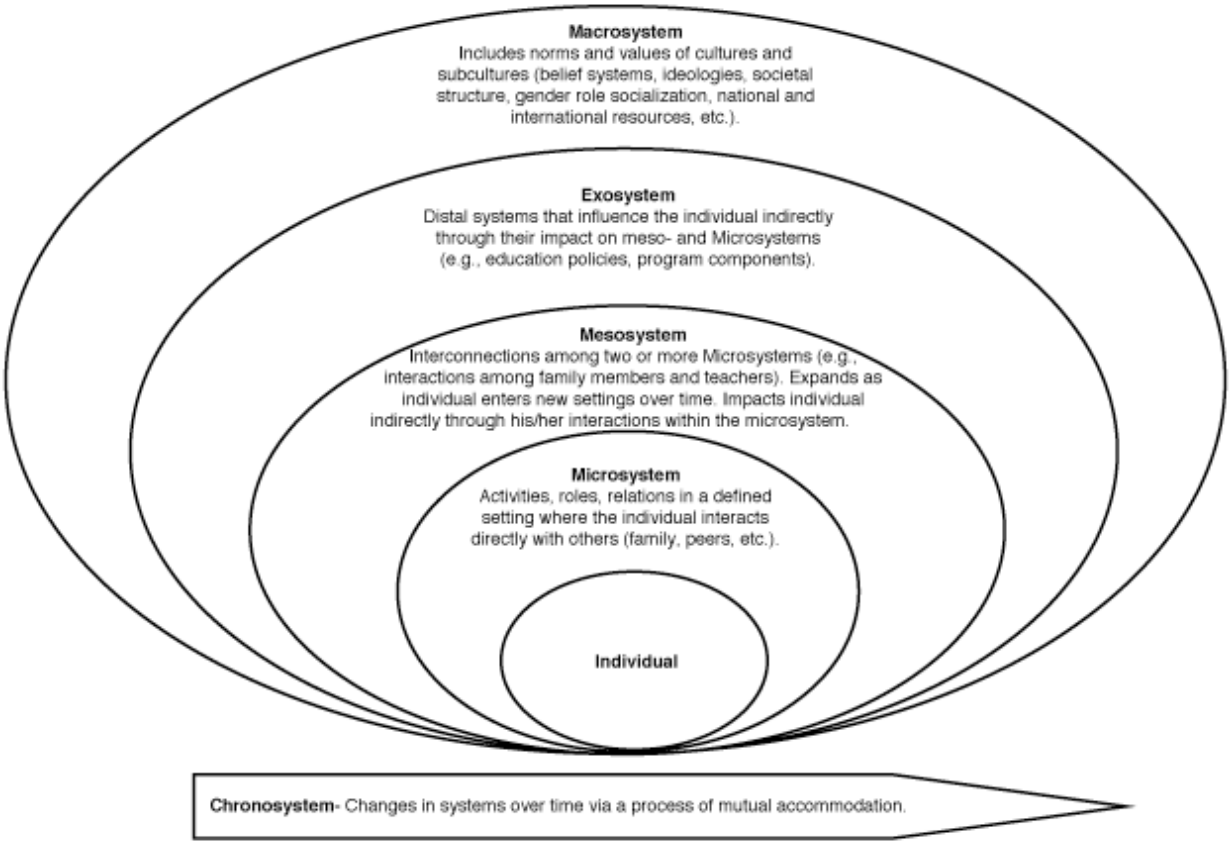


Figure 2.2. Risky Contexts Model

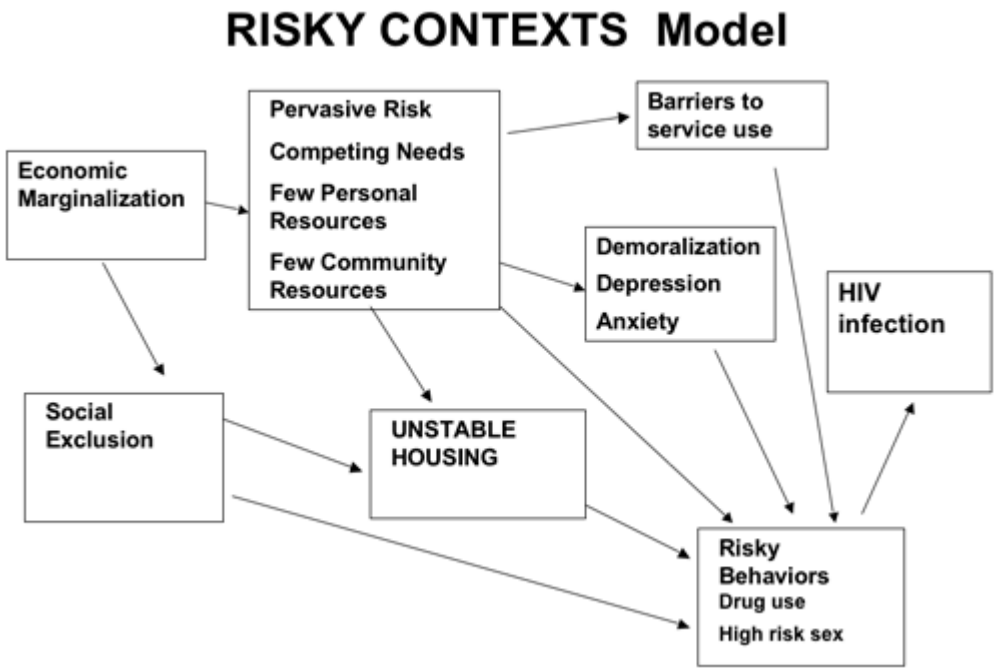


Figure 2.3. Risky Person Model

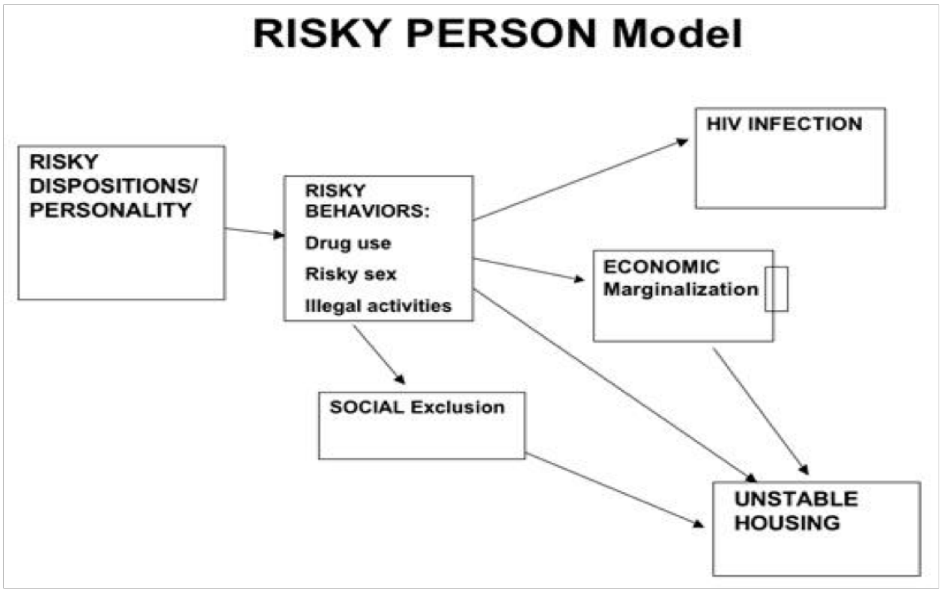
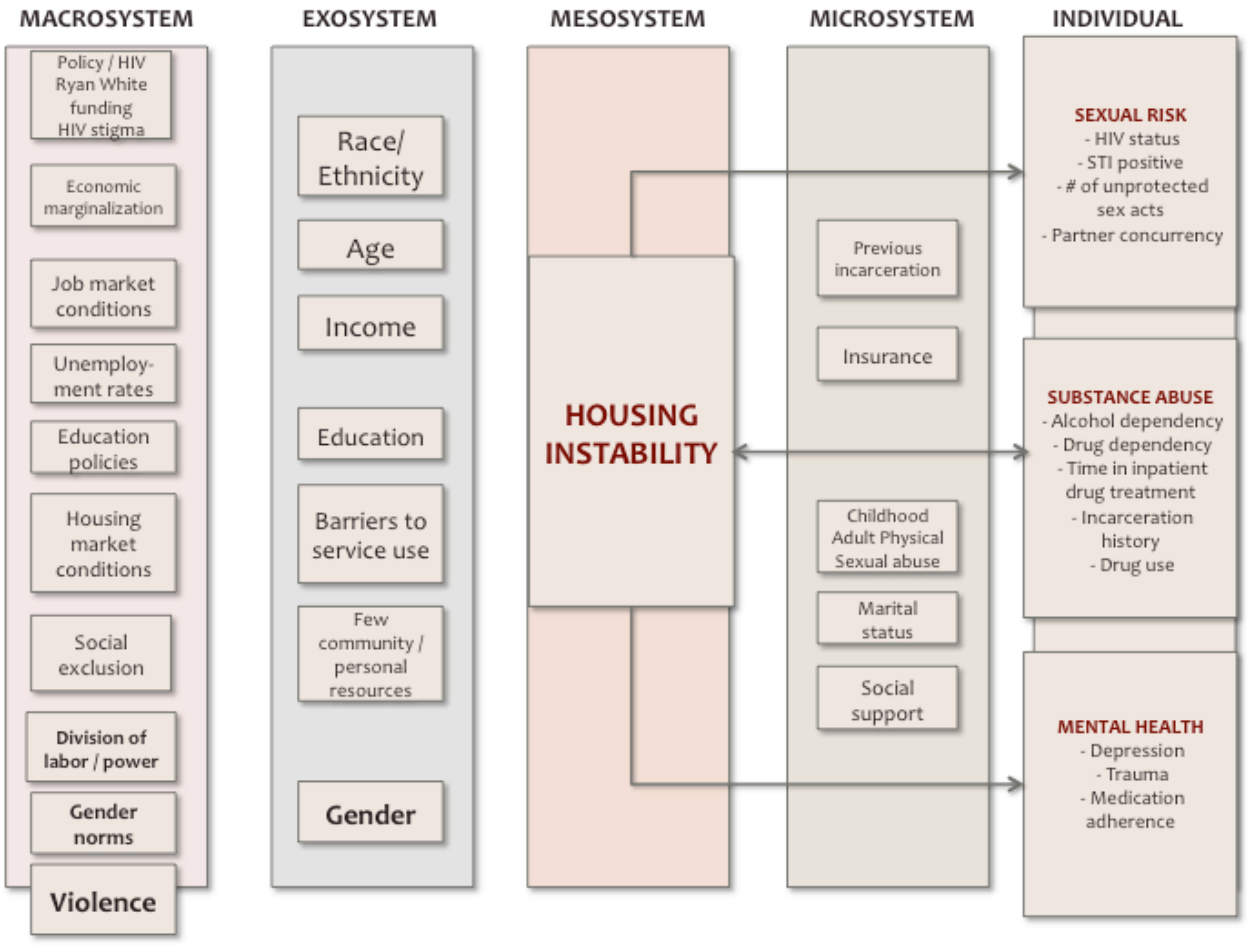


Figure 2.4. Dissertation Theoretical Modeling



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CHAPTER 3

HOUSING INSTABILITY, HIV AND SEXUAL RISK[1]

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Abstract

Housing instability ranges from homelessness to an array of sheltered living arrangements. Marginally/unstably-housed persons are known to demonstrate high-risk HIV behaviors at exponential rates than their housed peers. This manuscript reviews housing instability among serodiscordant couples to confirm the relationship between housing instability, HIV, and sexual-risk behaviors and seeks to establish a continuum whereby increased housing instability leads to greater risk. African-Americans (n=1,063) were grouped according to whether they owned their home, lived with family, sexual partner, or other group living arrangement, such as a homeless shelter. Housing status was evaluated against HIV/STI infection, unprotected sex acts, and partner concurrency. Multivariate analysis revealed partner-living (OR=0.192, p<0.001) and other-group living (OR=0.373, p<0.001) were less likely to be HIV+ than stably-housed; however, partner-living (OR=3.89, p=0.013) and other-group living (OR=4.88, p=0.006) were more likely to be STI+ than stably-housed persons. Women in other-living were more than twice as likely to be HIV+ than males (OR=2.23, p=0.036). Partner-living (OR=0.562, p=0.052) was protective against concurrent relationships, yet women in other-living were twice as likely to be in concurrent sexual relationships than males (OR=2.18, p=0.088). Persons in partner-living (IRR=0.937, p=0.023) or other-group living situations (IRR=0.812, p<0.001) were less likely to have unprotected sex than persons in stably-housed environments, and women in other-living were less likely to have risk for unprotected sex than males (OR=0.888, p=0.017). A housing continuum incorporating individual, psychosocial, and structural factors may benefit HIV risk-reduction efforts through further identification of most-at-risk persons/populations and

generate appropriate measures to lessen risk.

Introduction

Out of the world's estimated 100 million homeless persons, 650,000 to 740,000 live in the United States (Beijer, Wolf, & Fazel, 2012; Fazel, Khosla, Doll, & Geddes, 2008; Sermons & Witte, 2011). A 2011 report documented that 40% of America's homeless live unsheltered and that the remaining 60% live in transitional housing, single room units, or emergency shelters (Sermons & Witte, 2011). Another emerging group is those who live "doubled up" with family, friends, or sex partners, which has increased homeless estimations to more than 10 million U.S. persons per year (Cunningham & Henry, 2007; US Census Bureau, 2011).

Housing conditions—including where, how, and with whom persons live— are seen as descriptive points along a housing instability continuum and have long been acknowledged as primary indicators of physical, psychological, and social aspects of an individual's health (Bonnefoy, 2007). Sheltered, secure accommodation is the most advantageous; living "doubled up", exchanging sex for shelter, or residing in single room units or transitional housing leads to higher health risks; and unsheltered living (emergency shelters or street living) renders persons the most vulnerable. It is difficult to monitor HIV, sexual risk factors, and infectious disease outcomes of the two latter, highly-transient populations.

Unstably housed persons are known to demonstrate high-risk HIV behaviors—such as injection drug use and unprotected vaginal and anal sex—at a rate of four to six times higher than that of their housed peers (Kidder, Wolitski, Pals, & Campsmith, 2008; Kidder et al., 2007; Kipke, Weiss, & Wong, 2007; Marshall et al., 2009; Wolitski, Pals,

Kidder, Courtenay-Quirk, & Holtgrave, 2009). In addition, HIV rates are 3 to 16 times higher for homeless persons than those who are stably housed (Culhane, Gollub, Kuhn, & Shpaner, 2001; Culhane & Gollub, 2001). Among persons living with HIV/AIDS (PLHAs), the homeless have higher viral loads, worse overall physical and mental health, and a mortality rate five times higher than housed PLHAs (Cheung & Hwang, 2004; Fullilove et al., 1999; Geddes & Fazel, 2011; Hwang, Orav, O'Connell, Lebow, & Brennan, 1997). Homeless PLHAs live below the poverty level, which results in inadequate support and access to care. Consequently, they also have elevated rates of STIs, HBV, HCV, and other blood-borne infections (Aidala, Lee, Garbers, & Chiasson, 2006; Marshall et al., 2009; Roy et al., 2003).

Gender differences regarding high-risk sexual practices and factors that contribute to such risk are clearly demonstrated in the literature. Unstably housed men report having earlier onset of sexual debut, greater partner concurrency, and engaging in more survival sex relative to women. Conversely, females report less condom use and more STIs associated with substance abuse and low social support (MacKellar et al., 2000; Tevendale, Lightfoot, & Slocum, 2009). With whom persons live is also an important aspect to consider when describing optimal housing conditions. Research shows that social support, both at personal and institutional levels, may have influence on homelessness among unstably-housed persons (Fertig & Reingold, 2008). Such support may come from family members, sexual and non-sexual partners, and local government.

It is important to identify how various levels of housing instability influence HIV and sexual risk factors in order to develop effective future prevention efforts. Previous

research has shown that HIV/STI incidence and infectious disease morbidity and mortality go hand in hand with housing instability, but it has not thoroughly acknowledged or addressed the connection between the housing instability continuum and HIV and sexual risk factors (Burt, 2001; Wolitski et al., 2010). Equally, research utilizes varying definitions of homelessness and study inclusion, and the current sample may provide a method to standardize results among study populations, including families with children (Park, Fertig, & Allison, 2011).

Consequently, this research hypothesizes: 1) housing instability has an effect on sexual risk after controlling for HIV risk covariates; 2) along a continuum, those with increased housing instability exhibit the most sexual risk; and 3) gender differences and additional housing members affect HIV risk. To meet these aims, this research will utilize data from an HIV prevention randomized controlled trial for African-American heterosexual serodiscordant couples conducted in four major cities in the United States (El-Bassel et al., 2010).

Methods

Sample

Data for this analysis are from Project Eban: HIV Risk-Reduction Prevention for African-American Serodiscordant Couples. Subsequent methods are previously described by El-Bassel and her colleagues (2011). Briefly, African-American HIV serodiscordant couples were enrolled at four sites (Atlanta, GA; New York, NY; Los Angeles, CA; Philadelphia, PA) from November 2003 to June 2007. Institutional review board approval was received, and all subjects were recruited with a common recruitment protocol. To ensure adequate sample size and a representative sample, participant

recruitment occurred at HIV clinics, AIDS service and community-based organizations and through word of mouth, referrals, targeted street outreaches, and a media campaign—including radio appearances, commercials, and newspaper advertisements. A total of 535 couples (*N* = 1,070) were enrolled.

The original aim of the trial was to test the efficacy of a contextually appropriate behavioral intervention on HIV and sexual risk behaviors among couples. Inclusion and exclusion criteria couples were required to meet for participation are summarized in Figure 3.1.

Data Collection

To confirm HIV serostatus at enrollment, both partners provided oral specimens tested with OraSure HIV procedural kits (OraSure Technologies, Bethlehem, PA). Reactive specimens were confirmed with Western blot assays. Urine (male) and vaginal swab (female) specimens were collected to test for three common STIs (chlamydia, gonorrhea, and trichomoniasis) via amplified DNA and PCR assay techniques.

Participants received instruction on how to enter personal information via audio computer-assisted self-interviewing (ACASI) by trained data monitors. Participants confidentially recorded sociodemographic information, including age, education, income, housing status, employment, incarceration history, length and quality of the current sexual relationship, and cohabitation with the study partner. All participants also provided sexual history information, including incidence of concurrent partners and number of unprotected vaginal and anal intercourse acts. Seropositive participants recorded length of HIV diagnosis, CD4 count, and viral load information. Data were recorded regarding substance use or abuse (current and past), childhood and adult

physical and sexual abuse, and HIV knowledge and attitudes via the ACASI. Data collection, including ACASI and biological specimen collection, occurred at four time points—baseline, immediately postintervention (approximately 8–10 weeks postenrollment), and 6 and 12 months postintervention. Each individual participant was compensated for time and travel for each visit. Full review of these data and primary outcomes are published elsewhere (El-Bassel et al., 2010).

Measures

Exposure Variable. In order to determine if varying levels of housing instability are correlated with HIV and sexual risk factors, we utilized the trial's baseline ACASI data to categorize participants into one of four housing groups: 1) stably housed (own or rent your own home), 2) living with family members, 3) living with sexual partner(s), or 4) living transitionally in sheltered (group arrangements) or unsheltered situations with other persons who are not related (other). The ACASI questions that separated these groups are provided in Figure 3.2. Participants were categorized as stably housed if they answered affirmatively to "living in my own home or my own apartment" within the ACASI interview. For all other categories, housing status was categorized by information collected from three ACASI questions: "Where do you live now?", "Does anyone else live with you?", and if so, "Who lives there with you?"

Outcome and Confounding Variables. Outcome and confounding variables included in this analysis were categorized as follows— *outcome variables*: HIV status (negative/positive), STI status (negative/positive), unprotected sex acts (none/ ≥1 in bivariate analysis; continuous in multivariate analysis), partner concurrency (no/yes); *demographic covariates:* gender (male/female), age (continuous), education (through

HS diploma/some college), income (> $850 per month/ < $851 per month), employment (yes/no), insurance (yes/no), married to study partner (yes/no), dependents (no/yes); *HIV and sexual risk covariates:* previous or recent incarcerations (no/yes), recent inpatient drug treatment (no/yes), alcohol dependence (no/yes), illegal drug dependence (no/yes), time involved with study partner (continuous), and for HIV seropositive persons, years known HIV+ (continuous).

Statistical Analysis

The data analysis overview and statistical analysis plan are summarized in Figures 3.3 and 3.4, respectively. Descriptive statistics were used to characterize the sample, and housing status was run as a dichotomous exposure variable in bivariate analysis using chi-squared test for trend. In multivariate analysis, multiple logistic regression modeling described the effects of housing status on HIV status, STI status and partner concurrency. In order to appropriately fit distributions to count data collected for the unprotected sex outcome (25% of all values were zeros), likelihood ratio and Vuong tests (Vuong, 1989) confirmed negative binomial regression modeling best fit the data as opposed to Poisson and zero-inflated models. Incidence rate ratios were calculated by exponentiating regression coefficients. All p values were based on 2-tailed tests; values less than .05 were considered statistically significant. Statistical analyses were completed using Stata version 12.1 (StataCorp, College Station, Texas).

Logistic and negative binomial regression analyses for sexual behavior variables were run with housing status, gender, age, education, income, employment, if insured, married to study partner, whom a person lived with, recent incarcerations, recent inpatient drug treatment, and problem drinking or drug use added as covariates. Based

upon theoretical value, covariates were forced into the model regardless of significance. If data were missing on one or more variables, the respondent's data were excluded from the regression analyses. The purpose of these analyses was to examine the effects of housing instability on risky sexual behavior, controlling for additional HIV risk factors across housing status groups (Kidder et al., 2008).

Results

Housing Group Differences

Of 1063 participants, 605 (57%) were stably housed and 458 (43%) were unstably housed. Of 458 unstably housed participants, 104 (23%) lived with a family member, 189 (41%) lived with his/her sexual partner, and 165 (36%) lived in a rooming house, single room, group living arrangement, welfare-type living, or were unsheltered ("other living arrangement"). Baseline characteristics between participants in varying housing groups were dissimilar and, subsequently, statistically significant in χ^2 analyses (Table 3.1). For instance, more women (57%) were stably housed than men (43%), ($\chi^2(3)=49.15$, $p=0.000$); the greatest within-group disparity among women's and men's housing groups were those who were stably housed (women: 65%, men 49%) and those living with a sexual partner (women: 10%, men: 26%).

Additional Factors

Gender Differences. Theoretically, it is understood that gender differences exist. Consequently, we completed χ^2 tests to investigate the relationship of gender on income, unemployment, and education for this sample. There was a significant difference amongst gender and employment, with women being more likely to be unemployed than men (χ^2 $(1)=16.5059$, $p=0.000$). Conversely, there was no significant

difference between gender and income ($\chi^2(1)=0.7749$, $p=0.379$) or education ($\chi^2(1)=1.4578$, $p=0.227$).

Site. Secondly, this trial was completed in four major US cities (Atlanta, Los Angeles, New York, and Philadelphia). In order to preliminarily describe the relationship between the city and housing instability, we performed χ^2 tests on site and housing status, unemployment, and education. Chi-squared tests revealed that there were significant differences amongst locations and housing instability. New York had the highest number of persons who were living with sexual partners (Group 3) and homeless (Group 4), while persons living in Atlanta were more likely to be living with family members (Group 2) ($\chi^2(9)=37.0976$, $p=0.000$). New York, Los Angeles, and Philadelphia had significantly higher rates of unemployed persons ($\chi^2(3)=66.3240$, $p=0.000$), lower-income persons ($\chi^2(3)=30.1546$, $p=0.000$) and lower education ($\chi^2(3)=27.3639$, $p=0.000$). Although Philadelphia had the lowest enrollment, they had the second highest low education attainment among our sample.

Dependents. For those with dependents, we performed a t-test to characterize the relationship between dependents and housing status. Stably housed participants' mean number of dependents were 1.18 (SD=1.52; 95% CI: 1.05 – 1.29), while unstably housed participants averaged .97 dependents (SD=1.41; 95% CI: .84-1.10) ($t(1047)=2.23$, $p=0.025$). We further analyzed differences between groups, using stably housed as the referent group. T-tests showed that there is no statistically significant difference between stably housed and unstably housed participants living with family members or partner and each subsequent group's number of dependents; however,

those living in other housing situations had significantly fewer dependents (mean: .77) than stably housed participants (mean: 1.18) (t(758)=3.09, p=0.002).

Age, amount of time with study partner and known HIV seropositive status. On average, unstably housed participants were more than 1 year younger (t(1058)=2.51, p=0.012) and had shorter relationship length by nearly 1.5 years than stably housed participants (t(1057)=3.40, p=0.000). For those who were HIV seropositive, the unstably housed knew their status 1 year less than stably housed participants (t(518)=2.09, p=0.036). Corresponding means are provided in Table 3.2.

Primary Outcomes

As shown in Tables 3.3 and 3.4, bivariate analysis showed there were statistically significant differences in sexual risk behaviors based upon housing status. Specifically, dichotomized and grouped housing variables show there is significant difference between the expected and observed result for HIV and STI status; however, there is not a statistically significant difference between groups regarding partner concurrency (χ^2 tests) and unprotected sex (t-tests for dichotomized variable; 2-way ANOVA for multiple housing groups). Results for the dichotomized housing variable (stably versus unstably housed) showed that 31% of HIV-positive individuals were unstably housed ($\chi^2(1)=58.5778$, $p<0.0001$) and 51% were positive for at least one sexually transmitted infection ($\chi^2(1)=4.9553$, p=0.026). Forty-seven percent of participants with concurrent partners were unstably housed ($\chi^2(1)=1.1561$, p=0.282), and the average between groups for number of unprotected sex encounters was nearly the same, with 14.73 unprotected sex acts for stably housed and 14.66 unprotected sex acts for unstably housed persons in a 30-day period (t(1041)=0.0453, p=0.964). Across

four housing groups, the results were similar: chi-squared tests showed a majority of HIV+ persons were stably housed (69%); the largest majority of unstably housed HIV+ persons (15%) were those who are living in group or unsheltered arrangements (χ^2 (3)=88.9812, p<0.0001). Also, 49% of stably housed participants were STI-positive; of the unstably housed, 21% reported living with partner and 21% reported living in group or unsheltered living arrangements (χ^2(3)=7.3592, p=0.061). There were no statistically significant differences observed among multiple housing groups for partner concurrency (χ^2(3)=2.6143, p=0.455) and unprotected sex (F(3, 1039)=0.89, p= 0.4463).

Unadjusted odds ratios of primary outcomes (HIV status, STI status, partner concurrency, and unprotected sex) reveal unstably housed persons: have a 62.1% decrease in likelihood of being HIV positive than stably housed persons (OR=.379, p=0.000) and a 48% increase in likelihood to have an STI than stably housed persons (OR=1.48, p=0.027). Conversely, unadjusted analysis revealed insignificant results for partner concurrency (OR=1.18, p=.283) and unprotected sex (analyzed as a dichotomous variable) (OR=1.11, p=.483).

HIV status. After controlling for covariates, adjusted odds ratios for primary outcomes revealed persons living with family members had a 48% decrease in likelihood of being HIV+ when compared to stably housed participants, yet they were 2.4 times more likely to be HIV+ than those who were living with a partner. Individuals living with a partner had a 78% decrease in likelihood of HIV+ status compared to stably housed participants. Persons living in group or unsheltered accommodations had a 44% decrease in likelihood of being HIV+ when compared to stably housed, yet they

were 2.6 times more likely to be HIV+ than those who were living with a partner and 1.08 times more likely to be HIV+ than those who were living with family members.

STI status. Persons living with family members had a .15% decrease in likelihood of being STI+ when compared to stably housed participants, though this result did not reach statistical significance. Individuals living with a partner were nearly 3 times more likely to be STI+ compared to stably housed participants (AOR=2.687, p=0.007). Also, participants living with partners were 1.28 times more likely to be STI+ compared to persons in group or unsheltered living arrangements and 2.7 times more likely to have an STI compared to those living with family members. Persons living in group or unsheltered accommodations were 2 times more likely to be positive for an STI compared to stably housed participants and were 2 times more likely to have an STI compared to persons living with family members.

Partner concurrency. Adjusted odds ratios revealed persons living with family members were 1.18 times more likely to have a concurrent sexual partner than stably housed participants; equally, they were 1.5 times more likely than persons living with a partner and 2 times more likely than persons living in group or unsheltered arrangements to have a concurrent relationship. Persons living with a partner had a 22% decrease in likelihood of having a concurrent relationship when compared to stably housed participants, yet they were 1.3 times more likely to have concurrent relationships than those who were living in group or unsheltered arrangements. Persons living in group or unsheltered accommodations had a 40% decrease in likelihood of having a concurrent partner when compared to stably housed. No adjusted results related to partner concurrency reached statistical significance; in bivariate analysis of

partner concurrency and housing group evaluated separately based upon gender, partner concurrency among men was statistically insignificant ($\chi^2(3)=1.37$, $p=0.712$) while concurrency for women was statistically significant ($\chi^2(3)=10.39$, $p=0.016$). This will be discussed in further detail later in the manuscript.

Unprotected sex. After controlling for covariates and the interaction of housing and gender, adjusted incidence rate ratios for unprotected sex revealed persons living with family members were 2.5 times more likely to engage in unprotected sex compared to stably housed participants. Compared to other 'unstably housed' groups, persons living with family members were 9.3 times more likely to engage in unprotected sex than persons living with a partner and were 1.07 times more likely to have unprotected sex than persons living in other or group living arrangements. Individuals living with a partner had a 73% decrease in likelihood of unprotected sex acts compared to stably housed participants. Persons living in group or unsheltered accommodations were 2.3 times more likely to engage in unprotected sex compared to stably housed participants, and 8.7 times more likely than participants living with family members. It is important to note that when the housing and gender interaction term was added to other models, the interaction term was insignificant and excluded. All adjusted odds and incidence rate ratios are summarized in Table 3.5.

Gender interaction. For three of the four outcomes described above, the covariate 'gender' was sustained as a statistically significant variable in the model. Specifically, women were twice as likely as men to be HIV seropositive (AOR=1.95, p=0.000), women were eight times as likely to be STI positive (AOR=8.29, p=0.000), and women were nearly twice as likely to have unprotected sex (IRR=1.72, p=0.024).

Though the model adjusted odds ratio was insignificant for gender differences related to partner concurrency (AOR=.958, p=0.878), chi-squared and unadjusted odds revealed significant differences between men and women. When evaluated as separate groups, bivariate analysis showed men with concurrent partners were stably housed or living with his partner ($\chi^2(3)=1.37$, p=0.712). Conversely, women with concurrent partners were either stably housed or living in group or unsheltered living arrangements ($\chi^2(3)=10.389$, p=0.016). The unadjusted odds ratio revealed women living in group or unsheltered living arrangements were 2.4 times more likely to be in concurrent relationships than women who were stably housed (OR=2.41, p=0.013).

Housing continuum. A primary aim of this research was to determine a housing continuum for HIV sexual risk based upon where and with whom a person lives. Figure 3.5 summarizes risk for each outcome based upon adjusted odds and incidence rate ratios. Among the four outcome variables, persons living with family members exhibited the most risk for two out of four variables (partner concurrency and unprotected sex); living in group or unsheltered arrangements was the second highest group for risk in three out of four outcomes (HIV status, STI status, and unprotected sex); in two of four groups, being 'stably housed' was third among risk groups; and persons living with a partner exhibited the least risk among two of four outcomes (HIV status and unprotected sex).

Whom a person cohabitates with. A secondary goal of this study was to evaluate the effect of whom a person lives with on each of the outcomes. In each of the models designed above, we included whom a person lived with as an independent variable along with other model factors. For this portion of the analysis description, we

will report values with a p<0.1. The results showed that after controlling for all other covariates, persons who are living with roommates were less likely to be HIV positive (OR=.501, p=0.067); persons who are living with a spouse (OR=.599, p=0.082) or specified 'others' (OR=.111, p=0.047) are less likely to be STI positive; persons who are living with roommates are 3.4 times more likely (OR=3.41, p=0.004) and persons living with specified 'others' are 3.5 times more likely to have at least 1 concurrent partner; and persons living in a supervised living arrangement were less likely to have unprotected sex (IRR=.381, p=0.085).

Discussion

In the US, it is anticipated that approximately 3% of the US population is unstably housed and that percentages for more vulnerable subpopulations may be markedly higher. Review of at-risk, African-Americans recruited across four major cities showed more than 40% were unstably housed. A cursory appraisal of this work shows that homelessness approximations for 'doubled up' and unsheltered groups may be grossly underestimated for African-Americans and persons living with HIV across the US.

Housing instability has an impact on sexual risk. The results among this sample population reveal that housing instability has a statistically significant association with HIV status and sexual risk. For each sexual risk outcome, housing instability (solely or when combined with an interaction term) was statistically significant as an exposure attributing to additional risk behaviors.

In both bivariate and multivariate analysis, housing instability led to a significant decrease in HIV+ serostatus. This result is contrary to previous literature which documents housing instability should have a positive association with HIV status and,

thus, risk for HIV-positive serostatus should increase as housing instability increases. A plausible explanation for this finding is that 68% of HIV-seropositives owned or rented their own homes. Equally, HIV-positive persons within this trial were more likely to be older, have been in a relationship with his or her partner for a longer time, and were more likely to have known their status for nearly 1.5 years longer than unstably housed persons. Thus, stably housed HIV-positive respondents may represent a more mature, well-settled population that has experience accessing healthcare and funding assistance for seropositives.

Conversely, unstably housed groups were more at risk for positive STI status, partner concurrency, and number of unprotected sex acts. This merely confirms, along with previous literature, that after controlling for HIV risk covariates, housing instability hails as a statistically significant exposure variable for HIV and sexual risk behaviors.

Housing instability has a continuum that increases or decreases sexual risk. This research hypothesized that housing instability and subsequent risk outcomes occur along a continuum. As persons live in situations that seem more vulnerable, their level of risk would increase. This work purported housing stability and risk along this continuum (from least risk to most risk): 1) stably housed, 2) living with family members, 3) living with partner, and 4) living in group or unsheltered accommodations. Notwithstanding HIV status, all outcomes had an unstably housed group as the one who was most at risk. Consequently, our findings support that a continuum exists; however it fails to establish groups that place participants at most or least risk consistently across outcomes. A potential limitation is that different behavioral, social, and structural factors impact behaviors—for instance, factors that place a person at risk for partner

concurrency may be different than those that lead to unprotected sex. It is important to note that living in group or unsheltered living arrangements was second for most risk across three outcomes (positive HIV and STI status and unprotected sex). This finding supports previous literature and reveals that this group continues as one that needs additional support.

Gender differences and with whom a person lives. Within this sample, 60% of women were HIV seropositive and 65% of women were stably housed. Hence, stably housed appears to be the group 'most at risk' for HIV+ status. Interestingly, women were most at risk for HIV in this sample; however, characteristically, factors regarding age (women were older), knowledge of status (knew status longer), and relationship length (in relationship for longer time period than those who were unstably housed) lend credence to the proposal that the stably housed in our population (mostly women) knew their status and sought appropriate care. Since women were more often unemployed than men yet no differences were observed in monthly income, stably housed women may have their housing funded through government subsidies or receive additional support from alternate sources. While literature shows that women are more vulnerable to negative outcomes related to housing instability (such as positive HIV or STI status, greater unprotected sex events, or concurrent relationships), women were more likely to be HIV-positive and stably housed in this cohort. These findings may be generalizable to those who seek care and maintain treatment.

Our findings also revealed women were more likely to be unemployed than men, but income levels between the two were homogeneous. These results may mean that although men were significantly more often employed, their money may be used for

other factors than housing or personal living expenses. Also, men amongst this group may be minimally employed or underemployed. An alternate explanation may also be that women within this sample receive other means of income (i.e. government subsidies, child support) to arrive at the same income as men. No significant differences were seen between gender and educational attainment. Participants within this sample were in sexual partnerships, and thus, may have similar age and educational attainment to engage in relationships.

HIV risk-reduction measures may prove more efficacious if prevention experts and clinicians viewed data on where and with whom a person lives as seriously as they may knowledge of HIV serostatus, current or previous substance use, sexual partner information, or other infectious disease history. Housing instability, as defined by this study, points to the fact that utilizing simple demographic questions regarding where and with whom a person lives with may point to an ability to create a housing scale that may identify heightened risk or protective measures for HIV.

Limitations

Limitations of this study include generalizability—it is unclear based upon the intense inclusion and exclusion criteria of this study if it can be generalized across African-Americans generally, and if these results are specific to serodiscordant couples and the scope of such relationships. One goal of this work is to provide covariation of cause and effect through use of randomly selected and assigned groups to provide plausible reasoning for causal relationship between housing instability and infectious disease. Due to the cross-sectional study design, it is impossible to estimate causality. Equally, covariation of cause and effect cannot be well established because we cannot

match timing of housing instability with infectious disease or HIV onset for seropositive individuals. Future research would do well to triangulate the self-report and biological outcomes data with qualitative research that can better estimate major themes such as previous housing instability, social support, and where and with whom a person was living when he or she contracted HIV. Lastly, participants in this trial were recruited from HIV clinics, AIDS service organizations, and word of mouth. Consequently, our findings may apply to individuals who regularly seek HIV care.

Conclusion

Housing interventions are a laudable response to better health inequities for PLHA and seronegative, at-risk persons. This research is innovative in that it utilizes two simple characteristics: 1) owning or renting your own home and 2) cohabitational relationships—in order to rank the exposure based upon the severity of its relationship with the outcome variables. While many of our findings were statistically significant, no one housing or cohabitational group emerged as leaders for risk; regardless, these results should provide a baseline for future investigations.

Figure 3.1. Inclusion/Exclusion Criteria

- Both partners were over 18 years of age
- Their relationship had existed for at least 6 months prior to enrollment, and they intended to stay with each other at least 1 year postenrollment
- At least one partner reported having had unprotected intercourse with his or her partner in the previous 90 days
- Each partner had no relocation plans for 1 year postenrollment
- At least one partner self-identified as African American
- At least one partner was not planning a pregnancy within 18 months
- In the dyad, one partner was male and the other female
- Each partner was aware of the other's HIV serostatus
- Only one partner was HIV seropositive and was aware of his or her status at least 3 months prior to enrollment.

Couples were excluded based on the following restrictions:

- If either partner did not have a mailing address
- If either partner showed evidence of psychological or neurological impairment
- If either partner reported severe physical or sexual abuse (with the proposed study partner)
- If either partner was not fluent in English

Figure 3.2. ACASI Housing and Outcome Questions

Where do you live now?

- ❑$_1$ In my own home or my own apartment
- ❑$_2$ In my family's home or apartment
- ❑$_3$ In my partner's home or apartment
- ❑$_4$ In someone else's home or apartment (not family)
- ❑$_5$ In a rooming house or single room hotel
- ❑$_6$ In a welfare-type place
- ❑$_7$ In a group home or institution
- ❑$_8$ No regular place to live (i.e., park, street, steam vent)

Does anyone else live there with you?

- ❑$_1$ Yes
- ❑$_0$ No

Who lives there with you? **(Click all that apply)**

- ❑ Spouse

- ❑ Your own children or other's children
- ❑ One or both parents
- ❑ One or more brothers and/or sisters
- ❑ Other relatives(s)
- ❑ Foster parent/family
- ❑ Roommate (s) (nonrelated, nonsex partners)
- ❑ Nonspouse sex partner
- ❑ Supervised living arrangement
- ❑ Other (i.e., other residents of an institution) _____

Figure 3.3. Data Analysis Plan

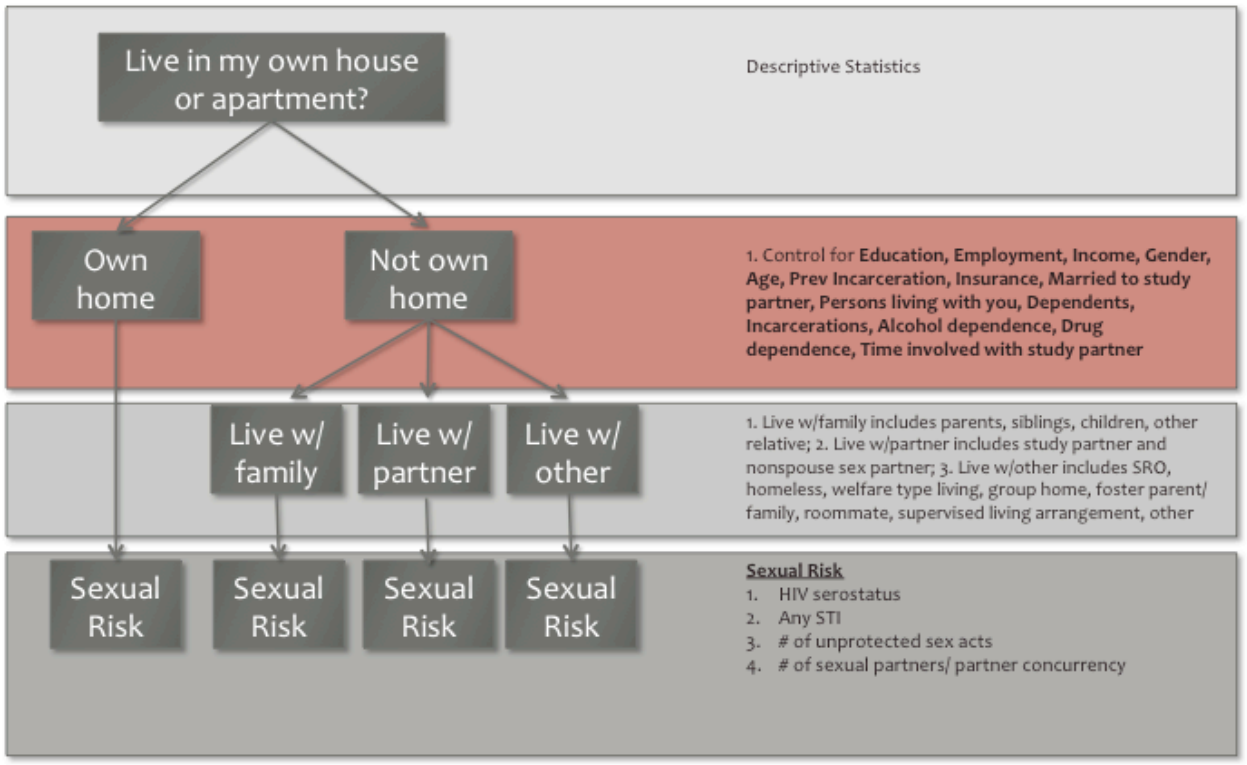


Figure 3.4. Statistical Analysis Overview

Variable name	Description	Reason for inclusion	Distribution	Coding	Statistical analysis used	
					Bivariate	Multivariate
Housing	Housing status	**Exposure**	Ordinal	1: Stably housed 2: Living with family 3: Living with partner 4: Living with other	-	-
Xhivstatus	HIV +	**Outcome**	Dichotomous	0: HIV – 1: HIV +	X^2	Multiple logistic regression
xanystd	STI +	**Outcome**	Dichotomous	0: STI – 1: STI +	X^2	Multiple logistic regression
xUnp_VAsex90 _mf	Unprotected sex acts	**Outcome**	Interval	Continuous	-	Negative binomial regression
xConcurrent2_ couple_C	Partner concurrency	**Outcome**	Dichotomous	0: No concurrent partners 1: Has concurrent partners	X^2	Multiple logistic regression
Gender	Gender	**Moderator**	Dichotomous	1: Male 2: Female	X^2	-
xAge	Age	**Confounder**	Interval	Continuous	ANOVA	-
Eduhousing	Education	**Confounder**	Ordinal	1: > HS, GED 2: HS diploma 3: Some college	X^2	-
Inchousing	Income	**Confounder**	Categorical	1: > 400 2: 400 – 850 3: 851 – 1650 4: < 1650	X^2	-
A4	Employment	**Confounder**	Dichotomous	0: No 1: Yes	X^2	-
A7	Insurance	**Confounder**	Dichotomous	0: No 1: Yes	X^2	-
xMarried	Married to study partner	**Moderator**	Dichotomous	0: No 1: Yes	X^2	-

Table 3.1. Characteristics by Housing Group

Descriptive Statistics by Housing Group						
	Full Sample	Stably Housed	Unstably Housed			*P* Value
			Living with Family	Living with Partner	Living with Other	
Group totals (n)	1063 (100)	605 (57)	104 (10)	189 (18)	165 (15)	-
Gender, No. (%)						
Female	532/1063 (50)	346 (65)	53 (10)	53 (10)	80 (15)	0.000
Marital status, No. (%)						
Married to study partner	345/1062 (32.5)	235 (68)	30 (9)	40 (12)	40 (12)	0.000
Educational status, No. (%)						
No formal schooling – HS Diploma (or GED)	763/1063 (72)	410 (54)	84 (11)	147 (19)	122 (16)	0.005
Employment						
Unemployed	759/1061 (71.5)	417 (55)	80 (10)	122 (16)	140 (19)	0.000
Monthly income						
$0 – 850/month	753 (71)	385 (51)	87 (12)	149 (20)	132 (17)	0.000
Insured						
No	261/1061 (24.6)	103 (39)	36 (14)	68 (26)	54 (21)	0.000
Persons living with you						
Alone	341/1063 (32)	212 (62)	4 (1)	77 (23)	48 (14)	0.000
Spouse	337/720 (47)	220 (65)	26 (8)	55 (16)	36 (11)	0.000
Your own children or other's children	348/720 (48)	227 (65)	38 (11)	66 (19)	17 (5)	0.000
One or both parents	66/720 (9)	13 (20)	43 (65)	8 (12)	2 (3)	0.000
One or more brothers/sisters	39/720 (5)	12 (31)	21 (54)	5 (13)	1 (2)	0.000
Other relative(s)	63/720 (9)	20 (32)	27 (43)	7 (11)	9 (14)	0.000
Foster parent/family (OMITTED)	1/720 (.14)	1 (100)	0	0	0	0.839
Roommate(s) (non-related, non-sex partners)	60/720 (8)	14 (23)	2 (3)	3 (5)	41 (68)	0.000
Non-spouse sex partner	75/720 (10)	48 (64)	4 (5)	15 (20)	8 (11)	0.036
Supervised living arrangement	22/720 (3)	2 (9)	1 (5)	1 (5)	18 (82)	0.000
Other (i.e. residents of institution)	21/720 (3)	3 (14)	1 (5)	2 (10)	15 (71)	0.000
Have dependents	521/1049 (50)	321 (62)	49 (9)	93 (18)	58 (11)	0.000
Incarceration(s) in previous 3 months	661/1057 (63)	346 (52)	64 (10)	135 (20)	116 (18)	0.000
Inpatient drug treatment program in previous 3 months	554/1062 (52)	311 (56)	49 (9)	88 (16)	106 (19)	0.005
Medical care/health diagnoses						
HIV +	531/1063 (50)	364 (68.5)	47 (8.9)	40 (21.2)	80 (15.1)	0.000
STI +	148/1057 (14)	72 (49)	13 (8.8)	32 (21.6)	31 (21)	0.061
Receipt of HIV medical care in previous 6 months	475/531 (89)	335 (71)	41 (9)	32 (7)	67 (14)	0.005
Knowledge of CD4 count	365/531 (69)	254 (70)	32 (9)	25 (7)	54 (15)	0.587
Knowledge of viral load	292/529 (55)	212 (73)	24 (8)	18 (6)	38 (13)	0.096

Table 3.2. Additional Factors included in Model

Interval covariates included in model, Mean** years **(SD)				
	N	Stably housed	Unstably housed	P value
Age	1060	43.95 (7.87)	42.70 (8.29)	0.012
Years with study partner	1059	7.51 (6.93)	6.13 (5.95)	0.000
Years known HIV + *	520	9.48 (5.33)	8.40 (5.72)	0.036

*Strictly for participants with known positive HIV serostatus

Table 3.3. Descriptive Statistics of Additional Factors Included in the Model

Characteristic	Mean	SD	P
Age, Years			
Stably housed	43.95	7.87	-
Living with family	41.19	8.91	0.013
Living with partner	42.73	8.04	0.064
Living with other	43.62	8.09	0.634
Years with study partner			
Stably housed	7.51	6.93	-
Living with family	5.98	5.26	0.033
Living with partner	6.53	6.36	0.087
Living with other	5.76	5.89	0.003
Years known HIV seropositive*			
Stably housed	9.48	5.33	-
Living with family	8.17	6.04	0.122
Living with partner	7.06	5.46	0.006
Living with other	9.24	5.58	0.725

Table 3.4. Bivariate Analysis: Dichotomized Housing Variable

Bivariate Analysis / Sexual Risk – Dichotomized Housing Variable				
	Full sample	Stably Housed	Unstably Housed	P Value
HIV status – Positive, No. (%)	1063	364 (69)	167 (31)	0.000
STI status – Positive, No. (%)	1063	72 (49)	76 (51)	0.026
Concurrent partners, No. (%)	1055	104 (53)	91 (47)	0.282
Unprotected sex, Mean (SD)*	1043	14.73 (26.63)	14.66 (24.52)	0.964

*T-tests

Table 3.5. Bivariate Analysis: Multi-Group Housing Variable

Bivariate Analysis / Sexual Risk						
	Full Sample	Stably Housed	Unstably Housed			*P* Value
			Living with Family	Living with Partner	Living with Other	
HIV status	531/1063 (50)	364 (68)	47 (9)	40 (8)	80 (15)	0.000
STI status	148/1057 (14)	72 (49)	13 (9)	32 (21)	31 (21)	0.061
Concurrent partners	195/1055 (18)	104 (53)	24 (12)	33 (17)	34 (17)	0.455
Unprotected sex	1043	F = 0.89				0.446

Table 3.6. Adjusted Ratios for Outcome Variables

Risk	**AOR[a]**	**95% CI[b]**
HIV Seropositive		
Living with family	.5163*	.2782, .9583
Living with partner	.2159**	.1247, .3738
Living with other	.5604*	.3170, .9905
STI Positive		
Living with family	.9985	.4205, 2.370
Living with partner	2.687**	1.317, 5.482
Living with other	2.088*	1.001, 4.358
Partner Concurrency		
Living with family	1.118	.5053, 2.477
Living with partner	.7762	.3921, 1.536
Living with other	.5949	.2754, 1,285
Unprotected Sex[c]		
Living with family	2.506 [d]	.9826, 6.393
Living with partner	.2865**[d]	.1107, .7413
Living with other	2.336* [d]	1.006, 5.422

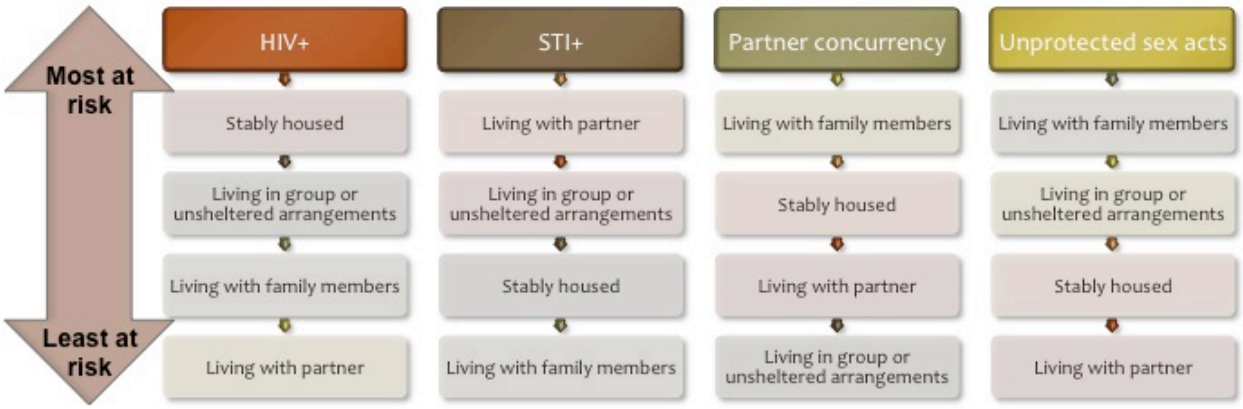
[a]Adjusted odds ratio; [b]Confidence Interval; [c]During the last 90 days; [d]Incidence Rate Ratio; *p<0.05; **p<0.01

Table 3.7. Complete Model Including 'Cohabitant' Variables

	HIV status			STI status			Partner concurrency			Unprotected sex		
Model Factors	AOR	95% CI		AOR	95% CI		AOR	95% CI		IRR	95% CI	
Housing*Gender												
Live family	-	-	-	-	-	-	-	-	-	.547	.172	1.73
Live partner	-	-	-	-	-	-	-	-	-	*3.61	.879	14.86
Live other	-	-	-	-	-	-	-	-	-	**.362	.131	.996
Living with…												
Spouse	1.25	.817	1.91	*.599	.337	1.06	.858	.488	1.51	1.35	.903	2.02
Your own (or other's) children	1.07	.673	1.72	1.03	.533	1.97	1.10	.601	2.03	1.29	.790	2.12
Parents	.788	.402	1.54	.809	.298	2.19	1.14	.500	2.62	.676	.308	1.48
Sibling(s)	1.13	.514	2.49	.621	.169	2.27	1.57	.635	3.92	1.74	.794	3.85
Other relatives	.888	.473	1.67	.998	.432	2.30	.947	.398	2.24	.935	.445	1.96
Roommate	*.502	.239	1.05	1.01	.393	2.60	***3.41	1.46	7.92	1.00	.432	2.35
Nonspouse sex partner	.902	.482	1.69	1.48	.679	3.24	1.05	.483	2.28	1.63	.853	3.11
Supervised living arrangement	1.99	.722	5.49	1.60	.492	5.22	1.34	.388	4.63	.381	.127	1.14
Other(s)	1.88	.660	5.37	**.111	.012	.967	**3.51	.988	12.48	1.07	.377	3.06
Sociodemographic												
Gender	***1.96	1.34	2.86	***8.29	4.23	15.88	.958	.559	1.64	-	-	-
Age	*.980	.957	1.00	1.00	.971	1.03	***.955	.926	.985	**.971	.947	.996
Education	.957	.648	1.41	1.14	.667	1.97	1.32	.755	2.38	.877	.589	1.31
Income	1.03	.666	1.61	1.32	.729	2.40	1.31	.713	2.39	1.08	.689	1.70
Employment	***2.74	1.78	4.23	1.20	.659	2.18	**.551	.315	.963	**.572	.344	.951
Insurance	***.547	.363	.825	1.41	.801	2.48	1.34	.798	2.28	.996	.594	1.67
Married to study partner	1.01	.669	1.53	1.42	7.82	2.58	***4.38	2.28	8.58	1.26	.859	1.84
Individual												
Dependents	1.07	.683	1.67	1.45	.775	2.69	.978	.556	1.72	.842	.513	1.38
Alcohol dependent	1.35	.810	2.26	.921	.455	1.86	1.31	.722	2.39	.857	.544	1.34
Drug dependent	**1.73	1.05	2.85	1.31	.676	2.52	***2.09	1.18	3.71	***1.87	1.18	2.95
Incarceration history	***1.79	1.20	2.65	.896	.541	1.48	.909	.542	1.53	***1.77	1.19	2.63
Inpatient drug treatment history	***1.60	1.09	2.33	1.26	.751	2.12	1.41	.841	2.36	1.13	.789	1.63
Years with study partner	-	-	-	-	-	-	***1.06	1.02	1.11	.999	.972	1.02
HIV+	-	-	-	-	-	-	.801	.489	1.31	***.054	.005	.567
STI+	-	-	-	-	-	-	*1.62	.896	2.93	.966	.601	1.55

* p<.10
** p<.05
*** p<.01

Figure 3.5. Ordered risk for housing groups



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CHAPTER 4

HOUSING INSTABILITY AND SUBSTANCE ABUSE[2]

[2] Daniel, TM, Hou, S, Fertig, A, Shen, Y, Bellamy, S, Wingood, G. To be submitted to *AIDS Behavior.*

Abstract

Housing instability may be cause or effect of substance abuse; both lead to increased HIV transmission and mortality. This manuscript seeks to confirm the relationship between housing instability and addictive behaviors and to establish a continuum whereby increased housing instability leads to greater substance use and HIV risk. African-Americans (n=1,070) were grouped according to whether they owned their home, lived with family, sexual partner, or other group living arrangement, such as a homeless shelter. Housing status was evaluated against alcohol and drug dependence, substance use, and drug treatment and incarceration history.

Compared to stably housed, persons in partner-living had 2.22 increased odds of alcohol dependence (p=0.023), and family-living had 1.77 increased odds of drug dependence (p=0.025). Other-living had increased likelihood of recent inpatient drug treatment (OR=1.70, p=0.004). Persons in partner-living (OR=1.92, p=0.000) or other-living (OR=1.75, p=0.003) were more likely to be recently incarcerated. Zero-inflated poisson regression models revealed recent odds of drug use: 1) heroin—family-living led to a 42% increase (p=0.023), while other-living had 30% decrease (p=0.036); 2) marijuana—partner-living (p=0.000) and other-living (p=0.000) had 25% and 33% decrease, respectively; 3) other illegal drugs—family- and partner-living had 41% and 17% decrease in use, while other-living had 25% increase in odds of use; and 4) injecting drugs—other-living were 1.49 times more likely to inject (p=0.001). Diverse living arrangements may lead to varying substance use and HIV risk behaviors. Risk-reduction and treatment programs must identify with whom and how people interact in their living environments to better abstinence outcomes.

Introduction

In the United States, housing instability, substance abuse, and HIV-associated health risks are intricately related (Metraux, Metzger, & Culhane, 2004; Milby, Schumacher, Wallace, Freedman, & Vuchinich, 2005; Tsai, Rosenheck, Kasprow, & McGuire, 2012). Housing instability may be either a cause or an effect of addictive behaviors (Kertesz & Weiner, 2009), and substance abuse affects HIV transmission and infectivity, medication adherence and uptake, and morbidity and mortality.

It has been estimated that 30% to 50% of America's 750,000 homeless persons living unsheltered are affected by alcohol abuse and that 10% to 38% are illicit drug users (Heath, Lanoye, & Maisto, 2011; Lehman & Cordray, 1993; Tsai, O'Connell, Kasprow, & Rosenheck, 2011; Tsai et al., 2012; Wenzel et al., 2004). Health outcomes and mortality rates among homeless substance abusers have been likened to those in developing countries; the average life expectancy in this population is 42 to 52 years of age, with 30% to 70% of deaths being related to alcohol (Larimer et al., 2009; O'Connell, 2005; Turnbull, Muckle, & Masters, 2007). Due to the high levels of homelessness and housing instability among substance abusers, a number of addiction recovery programs provide transitional housing as a form of structural support to their drug treatment interventions.

Injecting drug use (IDU) is a major contributor to HIV transmission and infectivity, accounting for 36% of current AIDS cases (Centers for Disease Control and Prevention, 2011, 2012; Salazar et al., 2007). In addition, substance abuse is a primary predictor of unprotected sex and the subsequent high HIV transmission and susceptibility rates (Robertson et al., 2004). The impact of substance abuse on high-risk sexual behavior

may be due to lowered behavioral inhibitions and perceptions of risk; for example, drugs may be used as an excuse for refusal to use condoms, to reduce condom awareness, or as an arousal- or sex-enhancing mechanism (Kennedy et al., 2010; MacDonald, MacDonald, Zanna, & Fong, 2000; Milloy, Marshall, Montaner, & Wood, 2012). It has also been documented that highly active antiretroviral treatment (HAART) use and uptake among HIV-positive substance abusers is much lower than HAART use among seropositive persons infected via sexual transmission; consequently, inferior treatment uptake and adherence may lead to faster disease progression and morbidity and mortality rates that are five times higher for IDUs than other HIV-infected populations (Milloy, Marshall, Kerr, et al., 2012; Royal et al., 2009).

Therefore, it is vital that the confluence of housing instability and substance abuse on HIV is better understood. Prevention efforts for substance abusers typically focus on drug-use behaviors and, to a lesser degree, sexual risk behaviors, but these have had limited effectiveness (Salazar et al., 2007). To improve HIV health outcomes, recent research has identified contextual factors, such as housing stability, that directly and indirectly affect risk behaviors among substance users.

In order to examine the influence of housing instability on substance use and HIV-related risk outcomes, we grouped African-American HIV serodiscordant couples recruited across four U.S. cities into four housing categories and identified substance users within those housing groups. Our aim is to test the hypothesis that unstably housed participants are more likely than stably housed participants to:

- be alcohol or substance dependent;

- be illicit drug users— including heroin, marijuana, injecting drugs, and/or shared use of injecting supplies;
- have spent time in inpatient drug treatment programs; and
- have previous incarceration experience.

With these data, we also hypothesize that there is a housing and health continuum and that decreased housing stability is associated with increased substance abuse (e.g., hard drug use and/or prolonged history of use). Outcomes from this research will further substantiate previous research on substance abuse and HIV and provide information regarding how contextual influences (such as with whom and where people live) converge to create marginalized populations.

Methods

Design Setting and Sample

Data for this analysis are from Project Eban: HIV Risk-Reduction Prevention for African-American Serodiscordant Couples. Subsequent methods are previously described in El-Bassel (2011). Briefly, African-American HIV serodiscordant couples were enrolled at four sites (Atlanta, GA; New York, NY; Los Angeles, CA; Philadelphia, PA) from November 2003 to June 2007. Institutional review board approval was received, and all subjects were recruited with a common recruitment protocol. To ensure adequate sample size and a representative sample, participant recruitment occurred at HIV clinics, AIDS service and community-based organizations and through word of mouth, referrals, targeted street outreaches, and a media campaign—including radio appearances, commercials, and newspaper advertisements. A total of 535 couples (*N* = 1,070) were enrolled. The original aim of the trial was to test the efficacy of a

contextually appropriate behavioral intervention on HIV and sexual risk behaviors among couples. Inclusion and exclusion criteria couples were required to meet for participation are summarized in Figure 2.1.

Data Collection

To confirm HIV serostatus at enrollment, both partners provided oral specimens tested with OraSure HIV procedural kits (OraSure Technologies, Bethlehem, PA). Reactive specimens were confirmed with Western blot assays. Urine (male) and vaginal swab (female) specimens were collected to test for three common STIs (chlamydia, gonorrhea, and trichomoniasis) via amplified DNA and PCR assay techniques.

Participants received instruction on how to enter personal information via audio computer-assisted self-interviewing (ACASI) by trained data monitors. Participants confidentially recorded sociodemographic information, including age, education, income, housing status, employment, incarceration history, length and quality of the current sexual relationship, and cohabitation with the study partner. All participants also provided sexual history information, including incidence of concurrent partners and number of unprotected vaginal and anal intercourse acts. Seropositive participants recorded length of HIV diagnosis, CD4 count, and viral load information. Data were also recorded regarding substance use or abuse (current and past), childhood and adult physical and sexual abuse, and HIV knowledge and attitudes via the ACASI. Data collection, including ACASI and biological specimen collection, occurred at four time points—baseline, immediately postintervention (approximately 8–10 weeks postenrollment), and 6 and 12 months postintervention. Each individual participant was compensated for time and travel for each visit. Full review of these data and primary

outcomes are published elsewhere (El-Bassel et al., 2010).

Measures

Exposure variable. In order to determine if varying levels of housing instability are correlated with substance abuse, we utilized the trial's baseline ACASI data to categorize participants into one of four housing groups: 1) stably housed (own your own home), 2) living with family members, 3) living with sexual partner(s), or 4) living transitionally in sheltered (group arrangements) or unsheltered situations with other persons who are not related (other). The ACASI questions utilized to separate these groups are cited previously and included in Figure 2.2 (Daniel, Hou, Fertig, & Wingood, 2013).

Outcome and confounding variables. Outcome and confounding variables included in this analysis were categorized as follows—*outcome variables:* alcohol dependence (no/yes), drug dependence (no/yes), drug use—heroin, marijuana, other illegal drugs, injecting drug use, and shared needles, cottons, and cookers (count data: none/ ≥1), inpatient drug treatment (no/yes), days in inpatient treatment (continuous), recent incarcerations (no/yes), number of days incarcerated (count data: none/ ≥1), HIV status (yes/no); *demographic covariates:* gender (male/female), age (continuous), education (through HS diploma/some college and above), income (> $850 per month/ < $851 per month), employment (yes/no), insurance (yes/no), and married to study partner (yes/no), dependents (no/yes); and *substance use covariates:* HIV serostatus (no/yes), time involved with study partner (continuous), and for HIV seropositive persons, years known HIV+ (continuous).

Alcohol Dependence. The alcohol use measure utilized with this sample was

CAGE (Ewing, 1984), a 4-item scale that provides information on lifetime alcohol dependence. It has been used with a variety of populations, including women living with HIV (Chronbach's alpha=0.77) (Wingood & DiClemente, 2000). There are four Yes/No questions that are weighted equally, and a score of two or greater is considered clinically significant for alcohol dependence.

Drug Use. The Texas Christian University Drug Screen (TCUDS II) is a 15-item scale that identifies individuals with a history of heavy drug use or dependence (Peters et al., 2000). The scores range from 0 to 9 and a score of three or higher is indicative of drug dependence based on DSM-IV and NIMH Diagnostic Interview Schedule criteria.

Incarceration and Drug Use. Incarceration and inpatient drug treatment assessments were measured via one ACASI question each that asked if an individual 1) spent time in jail or prison or 2) spent time in an inpatient drug treatment program within the past 3 months. The questions are included in Figure 2.2. If either question had an affirmative answer, participants were asked how many days within the past 3 months they spent in the correctional or inpatient setting.

Data Plan and Statistical Analysis

The data analysis overview and statistical analysis plan are summarized in Figures 2.3 and 2.4, respectively. Bivariate analyses comparing housing stability (exposure) with incarceration, drug treatment, and alcohol and drug dependency (outcome variables) were conducted using χ^2 tests for categorical variables. Descriptive statistics were used to characterize the sample, and housing status was run as a dichotomous variable in bivariate analysis using chi-squared test for trend (otherwise, it was evaluated as an ordinal variable).

In multivariate analysis, multiple logistic regression modeling described the effects of housing status on substance use outcomes. In multivariate analysis, multiple logistic regression modeling described the effects of housing status on alcohol dependence, drug dependence, recent incarceration, and drug treatment history. Due to alternate explanations for a large subset of zero count data (no drug use in the prescribed time frame versus persons who do not use illicit drugs), zero-inflated negative binomial regression models were used to better model the underlying distribution of the count data and increase statistical efficiency (Larimer et al., 2009). Likelihood ratio tests and the Vuong test (Vuong, 1989) suggested that zero-inflated negative binomial regression models better fit the data than zero-inflated Poisson models or regular negative binomial models, owing to the data dispersion and the preponderance of zeros. The models adjusted for all baseline covariates; the zero-inflation factor was modeled with an intercept and indicators for drug dependence and inpatient drug treatment history. Incidence rate ratios were produced by exponentiating the study group regression coefficients (Larimer et al., 2009; Tevendale, Lightfoot, & Slocum, 2009).

Logistic and zero-inflated negative binomial regression analyses for substance abuse variables were run with housing status, gender, gender and housing interaction, age, education, income, employment, if insured, married to study partner, city location, whom a person lived with, HIV status, depression and trauma, recent incarcerations, recent inpatient drug treatment, and problem drinking or drug use added as covariates. Based upon theoretical value, exposure variables and covariates were forced into the model regardless of significance. If data were missing on one or more variables, the

respondent's data were excluded from the regression analyses. The purpose of these analyses was to examine the effects of housing instability on risky sexual behavior, controlling for additional HIV risk factors across housing status groups (Kidder, Wolitski, Pals, & Campsmith, 2008).

Results

Housing Group Differences

Of 1063 participants, 605 (57%) were stably housed and 458 (43%) were unstably housed. Of 458 unstably housed participants, 104 (23%) lived with a family member, 189 (41%) lived with his/her sexual partner, and 165 (36%) lived in a rooming house, single room, welfare-type living, or were unsheltered ("other living arrangement"). Many baseline characteristics between participants in varying housing groups were dissimilar and, subsequently, statistically significant (Table 1). For instance, more women (57%) were stably housed than men (43%), ($\chi^2(3)=49.15$, $p=0.000$); the greatest within-groups disparity among women's and men's housing groups were those who were stably housed (women: 65%, men 49%) and those living with his/her sexual partner (women: 10%, men: 26%).

Additional Factors

Gender Differences. Theoretically, it is understood that gender differences exist. Consequently, we completed χ^2 tests to investigate the relationship of gender on income, unemployment, and education for this sample. There was a significant difference amongst gender and employment, with women being more likely to be unemployed than men ($\chi^2(1)=16.5059$, $p=0.000$). Conversely, there was no significant

difference between gender and income ($\chi^2(1)=0.7749$, $p=0.379$) or education ($\chi^2(1)=1.4578$, $p=0.227$).

Site. Secondly, this trial was completed in four major US cities (Atlanta, Los Angeles, New York, and Philadelphia). In order to preliminarily describe the relationship between the city and housing instability, we performed χ^2 tests on site and housing status, unemployment, and education. Chi-squared tests revealed that there were significant differences amongst locations and housing instability. New York had the highest number of persons who were living with sexual partners (Group 3) and homeless (Group 4), while persons living in Atlanta were more likely to be living with family members (Group 2) ($\chi^2(9)=37.0976$, $p=0.000$). New York, Los Angeles, and Philadelphia had significantly higher rates of unemployed persons ($\chi^2(3)=66.3240$, $p=0.000$), lower-income persons ($\chi^2(3)=30.1546$, $p=0.000$) and lower education ($\chi^2(3)=27.3639$, $p=0.000$). Although Philadelphia had the lowest enrollment, they had the second highest low education attainment among our sample.

Dependents. For those with dependents, we performed a t-test to characterize the relationship between dependents and housing status. Stably housed participants' mean number of dependents were 1.18 (SD=1.52; 95% CI: 1.05 – 1.29), while unstably housed participants averaged .97 dependents (SD=1.41; 95% CI: .84-1.10) ($t(1047)=2.23$, $p=0.025$). We further analyzed differences between groups, using stably housed as the referent group. T-tests showed that there is no statistically significant difference between stably housed and unstably housed participants living with family members or partner and each subsequent group's number of dependents; however,

those living in other housing situations had significantly fewer dependents (mean: .77) than stably housed participants (mean: 1.18) (t(758)=3.09, p=0.002).

Age, amount of time with study partner and known HIV seropositive status. On average, unstably housed participants were more than 1 year younger (t(1058)=2.51, p=0.012) and had shorter relationship length by nearly 1.5 years than stably housed participants (t(1057)=3.40, p=0.000). For those who were HIV seropositive, the unstably housed knew their status 1 year less than stably housed participants (t(518)=2.09, p=0.036). Corresponding means are provided in Table 4.2.

Primary Outcomes

As shown in Tables 4.3 and 4.4, bivariate analysis showed there were statistically significant differences in substance use behaviors based upon housing status. Specifically, dichotomized housing results show there is significant difference between the expected and observed result for alcohol and drug dependence, recent incarceration history, and use of other illegal drugs; however, there is not a statistically significant difference between groups regarding recent inpatient drug treatment and use of heroin, marijuana, injecting drugs, or shared needles, cottons, or cookers.

Unstably housed persons were 1.49 times more likely to be alcohol dependent (OR=1.49, p=0.017) and 1.39 times as likely to be drug dependent (OR=1.39, p=0.042) compared to stably housed participants. Compared to stably housed, unstably housed participants living with family (OR=1.59, p=0.088), living with a partner (OR=1.63, p=0.023), or living in other housing situations (OR=1.28, p=0.297) were more likely to be alcohol dependent. Similarly, unstably housed participants living with family (OR=1.77, p=0.025), living with a partner (OR=1.14, p=0.554), or living in other housing

situations (OR=1.47, p=0.087) were more likely to be drug dependent than stably housed persons.

Unadjusted odds ratios of primary outcomes (recent drug treatment and incarceration histories) reveal unstably housed persons living with family (OR=1.21, p=.376), living with partner (OR=1.92, p=0.000), and living in group or unsheltered accommodation (OR=1.75, p=0.003) were more likely to have been in jail or prison in the past three months; also, unstably housed persons living with family (OR=.857, p=.472) or living with partner (OR=.823, p=0.245) were less likely to have recently been in inpatient drug treatment, and those living in group or unsheltered accommodation (OR=1.69, p=0.004) were more likely to have a recent history of inpatient drug treatment.

Alcohol dependence. After controlling for substance use covariates, adjusted odds ratios for alcohol dependence revealed persons living with family members were 1.13 times more likely than stably housed participants to be alcohol dependent. Individuals living with a partner were 1.86 times more likely to be alcohol dependent compared to stably housed participants. Persons living in group or unsheltered accommodations were 1.22 times more likely than stably housed participants to be alcohol dependent. Though the relationship between housing status as an exposure variable on alcohol dependence was not statistically significant within the confines of the model, those with less education (no formal schooling – HS graduate) were 1.81 times more likely to be alcohol dependent (AOR=1.81, p=0.046), persons who were drug dependent were 4.39 times more likely to also be alcohol dependent (AOR=4.39, p=0.000), and persons who were depressed were 2.39 times more likely to be alcohol

dependent. Those with dependents and an incarceration in the past 90 days were more likely to be alcohol dependent (AOR=1.65, p<.10; AOR=1.58, p<.10, respectively).

Drug dependence. Persons living with family members were 77% more likely to be drug dependent (AOR=1.77, p=0.162), persons living with partners were 8% less likely (AOR=0.92, p=0.834), and persons living in other group accommodation were 14% less likely to be drug dependent when compared to stably housed participants (AOR=0.86, p=0.695). Within the model, being alcohol dependent (OR=4.35, p=0.000), HIV seropositive (OR=1.78, p=0.026), or recently being in a drug treatment program (OR=3.02, p=0.000) were statistically significant predictors of drug dependence. Those who were unemployed, uninsured, and had experienced trauma were more likely to be drug dependent (OR=1.80, p<.10; OR=1.66, p<.10; OR=2.04, p<.10, respectively).

Recent incarceration. After controlling for covariates, adjusted odds ratios for incarcerations within the past 3 months revealed persons living with family members were 8% less likely to have recently been incarcerated compared to stably housed participants (AOR=0.91, p=0.779). Persons living in group or unsheltered living arrangements had a similar outcome, being 8% less likely to have recent incarcerations compared to stably housed participants (AOR=0.92, p=0.801). Conversely, persons who lived with partners were 1.43 times more likely to have been recently incarcerated (AOR=1.43, p=0.208). Compared to other 'unstably housed' groups, persons living with partners were 1.5 times more likely to have recent incarcerations than persons living with family members or those housed in group or unsheltered arrangements. Though results related to housing stability were not statistically significant within the model, women were 76% less likely to have recently been incarcerated (AOR=0.24, p=0.000),

HIV seropositive persons were nearly 2 times more likely to have recently been incarcerated (AOR=1.85, p=0.002), and persons who recently were in inpatient drug treatment programs were 3 times more likely to have recently been incarcerated (AOR=3.14, p=0.000) than stably housed persons.

Recent inpatient drug treatment history. After controlling for covariates, adjusted odds ratios for recent inpatient drug treatment showed persons living with family members were 27% more likely (AOR=1.27, p=0.455), persons living with partners were 1% more likely (AOR=1.01, p=0.970) and persons living in group or unsheltered arrangements were 10% more likely (AOR=1.10, p=0.757) to have received recent drug treatment therapy compared to stably housed participants. Though results related to housing stability were not statistically significant within the model, many covariates reached critical significance. For each year's increase in a person's age, persons were 6% more likely to have a recent history of inpatient drug treatment (AOR=1.06, p=0.000); less educated persons (high school diploma or less) were 1.5 times more likely to recently participate in inpatient drug treatment (AOR=1.50, p=0.040); and persons with income less that $850 per month were 1.63 times more likely to recently receive inpatient drug treatment (AOR=1.63, p=0.031). Also, HIV seropositive persons were more likely (AOR=1.57, p=0.017); persons who live with roommates are 3.56 times more likely (AOR=3.56, p=0.004); persons who are drug dependent were nearly 3 times more likely (AOR=2.87, p=0.000); and persons who recently were incarcerated were 3 times more likely (AOR=3.19, p=0.000) to have a recent inpatient drug treatment history than stably housed persons.

Heroin use. When we assessed drug use outcomes using zero-inflated negative binomial models adjusted for all baseline variables, persons living with family members (IRR=1.80, p=0.184) and living with partners (IRR=1.09, p=0.792) had increased rates of heroin use; conversely, persons living in group or unsheltered housing arrangements had 43% less likelihood of heroin use (IRR=0.57, p=0.157). Statistically significant covariates included: women were 47% decreased rates of heroin use (IRR=0.53, p=0.047); those with an income of less than $850/month were 54% less likely to use heroin (IRR=.46, p=0.010); persons who were alcohol dependent were 46% less likely to use heroin (IRR=0.54, p=0.024), and depressed persons were 1.06 times more likely to use heroin (IRR=1.06, p=0.002).

Marijuana use. After adjusting for covariates, persons living with family members were more likely to have increased rates of marijuana use (IRR=1.36, p=0.371)**;** conversely, persons living with partners (IRR=0.78, p=0.397) or in group living arrangements (IRR=0.52, p=0.047) had decreased rates of marijuana use. There were no other significant covariates produced from the model.

Other illegal drugs. After adjusting for covariates, persons living with family members (IRR=0.66, p=0.177) and partners (IRR=0.91, p=0.730) had decreased rates of other illegal drug use**;** conversely, persons living in group or unsheltered living arrangements had increased rates of other illegal drug use (IRR=1.88, p=0.019). This result reflects those in group or unsheltered housing were 2.85 times more likely than those living with family members and 2.1 times more likely than those living with partners to use other illegal drugs. Being drug dependent according to the TCUDS II was the only significant covariate produced from the model (IRR=3.71, p=0.000).

Injecting drug use. After adjusting for covariates, persons living with partners (IRR=0.89, p=0.706) had decreased rates of injecting drug use**;** conversely, persons living with family members (IRR=1.17, p=0.638) or in group or unsheltered living arrangements (IRR=2.04, p=0.025) had increased rates of injecting drug use. This result reflects those in group or unsheltered housing were 1.75 times more likely than those living with family members and 2.3 times more likely than those living with partners to use injecting drugs. Positive HIV status (IRR=0.43, p=0.000), being drug dependent (IRR=12.51, p=0.000), and depression (IRR=1.73, p=0.041) were clinically significant covariates to injecting drug use.

Gender interaction. For recent incarcerations, 'gender' was sustained as a statistically significant covariate within the model. Gender was near significance as a covariate in the recent inpatient drug treatment model. The interaction term of gender and housing was not significant in any model and was subsequently removed.

Housing continuum. Living in unsheltered or group accommodations was the only housing group that reached significance for marijuana use (protective), other illegal drug use (harmful), and injecting drugs (harmful).

Housing instability has a continuum that increases or decreases substance use. Persons living with family members were most at risk for many drug dependent behaviors—specifically, drug dependence, inpatient drug treatment history, heroin use, and marijuana use. Persons living in group or unsheltered accommodations were most at risk for other illegal drugs (i.e. crack cocaine, methamphetamines) and injecting drugs. Lastly, persons living with partners were most at risk for alcohol dependence and recent incarceration history.

Discussion

Similar to previous literature, our findings suggest that unstably housed persons are more likely to use specific drugs, be alcohol dependent, drug dependent, and have previous incarceration or drug treatment histories. In multivariate logistic regression modeling, no housing groups or cohabitants were statistically significant in models for alcohol dependence, drug dependence, or recent incarcerations; however, for recent inpatient drug treatment history, persons living with parents were less likely to be in inpatient treatment while living with a roommate increased the likelihood to 3.56 times that of stably housed participants. Significant covariates in the substance use models included all demographic factors (gender, education, income, insurance, married to study partner) and HIV positive serostatus was associated with nearly twice the likelihood of drug dependence, recent incarceration, and inpatient drug treatment within the past 3 months.

This research aims to establish a housing continuum across four housing groups that may estimate risk. For the group hypothesized to be the most at risk, persons living in 'other' arrangements (group or unsheltered accommodations) were nearly 2 times more likely to use other illegal drugs, were 42% less likely to use heroin, and were 2 times more likely to use injecting drugs than stably housed participants. Within this trial, persons living in group or unsheltered accommodations were more likely to use drugs like cocaine, methamphetamines, crack cocaine, and injecting drugs than stably housed persons. Compared to their unstably housed counterparts, persons in group or unsheltered accommodations were also 2.85 times more likely than persons living with family to use other illegal drugs and 2 times more likely than persons living with a

partner to use other illegal drugs. Equally, persons living in group or unsheltered accommodations were 1.75 times more likely to use injecting drugs than persons living with family members and 2.29 times more likely than persons who lived with a partner for injecting drug use.

Limitations of our research include that a majority of participants were recruited through AIDS service organizations and clinic-based care. Consequently, many are actively engaged in HIV/AIDS treatment, and while receiving those services, clinicians may directly refer substance abusers to inpatient drug treatment and/or may notice signs or symptoms of drug or alcohol dependence within their continuum of care. As such, our results may not be generalizable to persons who do not receive treatment or may need to depend on other internal or external support to aid in receipt of HIV and substance use care.

Conclusion

Many drug treatment programs offer transitional housing to its participants if sobriety is exercised; these findings may contribute to the growing body of literature that states provision of housing is most important to better health outcomes. Therefore, it may prove more important for beneficial physical and psychological health to provide transitional housing to persons who have temporary relapses in sobriety.

Figure 4.1. Inclusion/Exclusion Criteria

- Both partners were over 18 years of age
- Their relationship had existed for at least 6 months prior to enrollment, and they intended to stay with each other at least 1 year postenrollment
- At least one partner reported having had unprotected intercourse with his or her partner in the previous 90 days
- Each partner had no relocation plans for 1 year postenrollment
- At least one partner self-identified as African American
- At least one partner was not planning a pregnancy within 18 months
- In the dyad, one partner was male and the other female
- Each partner was aware of the other's HIV serostatus
- Only one partner was HIV seropositive and was aware of his or her status at least 3 months prior to enrollment.

Couples were excluded based on the following restrictions:

- If either partner did not have a mailing address
- If either partner showed evidence of psychological or neurological impairment
- If either partner reported severe physical or sexual abuse (with the proposed study partner)
- If either partner was not fluent in English

Figure 4.2. ACASI Housing and Outcome Questions

Where do you live now?

- ❑$_1$ In my own home or my own apartment
- ❑$_2$ In my family's home or apartment
- ❑$_3$ In my partner's home or apartment
- ❑$_4$ In someone else's home or apartment (not family)
- ❑$_5$ In a rooming house or single room hotel
- ❑$_6$ In a welfare-type place
- ❑$_7$ In a group home or institution
- ❑$_8$ No regular place to live (i.e., park, street, steam vent)

Does anyone else live there with you?

- ❑$_1$ Yes
- ❑$_0$ No

Who lives there with you? **(Click all that apply)**

- ❑ Spouse
- ❑ Your own children or other's children

- ❑ One or both parents
- ❑ One or more brothers and/or sisters
- ❑ Other relatives(s)
- ❑ Foster parent/family
- ❑ Roommate (s) (nonrelated, nonsex partners)
- ❑ Nonspouse sex partner
- ❑ Supervised living arrangement
- ❑ Other (i.e., other residents of an institution) _____

In the past 3 months, have you spent time in jail or prison?

- ❑$_1$ Yes
- ❑$_0$ No

In the past 3 months, have you spent time in an inpatient drug treatment program?

- ❑$_1$ Yes
- ❑$_0$ No

Figure 4.3. Data Analysis Plan

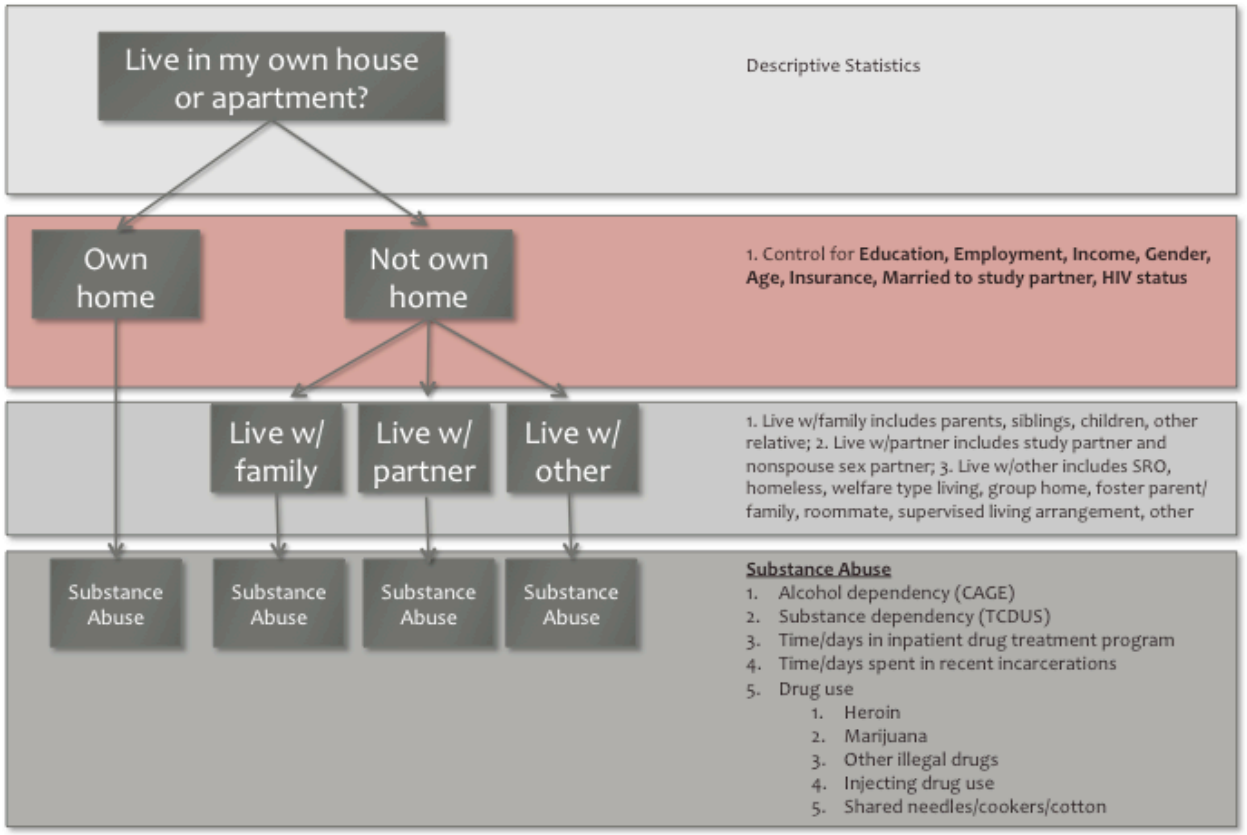


Figure 4.4. Statistical Analysis Overview

Variable name	Description	Reason for inclusion	Distribution	Coding	Statistical analysis used	
					Bivariate	Multivariate
Housing	Housing status	Exposure	Ordinal	1: Stably housed 2: Living with family 3: Living with partner 4: Living with other	-	-
xCage_sum2	Alcohol dependence	Outcome	Dichotomous	0: Not dependent 1: Alcohol dependent	X^2	Multiple logistic regression
XTCUDS2B	Drug dependence	Outcome	Dichotomous	0: Not dependent 1: Drug dependent	X^2	Multiple logistic regression
D8	Heroin use	Outcome	Count/Interval	Continuous	-	Zero-inflated negative binomial regression
D9	Marijuana use	Outcome	Count/Interval	Continuous	-	Zero-inflated negative binomial regression
D10	Other illegal drug use	Outcome	Count/Interval	Continuous	-	Zero-inflated negative binomial regression
D11	Injecting use	Outcome	Count/Interval	Continuous	-	Zero-inflated negative binomial regression
D12	Shared needles, cookers, cotton	Outcome	Count/Interval	Continuous	-	Zero-inflated negative binomial regression
A19A	Inpatient drug treatment	Outcome	Dichotomous	0: No treatment (past 3 mo.) 1: Treatment (past 3 mo.)	X^2	Multiple logistic regression
A19B	Days in treatment	Outcome	Interval	Continuous	-	Poisson regression
A18A	Incarceration	Outcome	Dichotomous	0: No jail (past 3 mo.) 1: Jail (past 3 mo.)	X^2	Multiple logistic regression
A18B	Days in jail	Outcome	Interval	Continuous	-	Poisson regression
Gender	Gender	Moderator	Dichotomous	1: Male 2: Female	X^2	-
xAge	Age	Confounder	Interval	Continuous	X^2	-
Eduhousing	Education	Confounder	Ordinal	1: > HS, GED 2: HS diploma 3: Some college	X^2	-
Inchousing	Income	Confounder	Categorical	1: > 400 2: 400 – 850 3: 851 – 1650 4: < 1650	X^2	-
A4	Employment	Confounder	Dichotomous	0: No 1: Yes	X^2	-
A7	Insurance	Confounder	Dichotomous	0: No 1: Yes	X^2	-
xMarried	Married to study partner	Moderator	Dichotomous	0: No 1: Yes	X^2	-

Table 4.1. Characteristics by Housing Group

Descriptive Statistics by Housing Group						
	Full Sample	Stably Housed	Unstably Housed			*P* Value
			Living with Family	Living with Partner	Living with Other	
Group totals (n)	1063 (100)	605 (57)	104 (10)	189 (18)	165 (15)	-
Gender, No. (%)						
Female	532/1063 (50)	346 (65)	53 (10)	53 (10)	80 (15)	0.000
Marital status, No. (%)						
Married to study partner	345/1062 (32.5)	235 (68)	30 (9)	40 (12)	40 (12)	0.000
Educational status, No. (%)						
No formal schooling – HS Diploma (or GED)	763/1063 (72)	410 (54)	84 (11)	147 (19)	122 (16)	0.005
Employment						
Unemployed	759/1061 (71.5)	417 (55)	80 (10)	122 (16)	140 (19)	0.000
Monthly income						
$0 – 850/month	753 (71)	385 (51)	87 (12)	149 (20)	132 (17)	0.000
Insured						
No	261/1061 (24.6)	103 (39)	36 (14)	68 (26)	54 (21)	0.000
Persons living with you						
Alone	341/1063 (32)	212 (62)	4 (1)	77 (23)	48 (14)	0.000
Spouse	337/720 (47)	220 (65)	26 (8)	55 (16)	36 (11)	0.000
Your own children or other's children	348/720 (48)	227 (65)	38 (11)	66 (19)	17 (5)	0.000
One or both parents	66/720 (9)	13 (20)	43 (65)	8 (12)	2 (3)	0.000
One or more brothers/sisters	39/720 (5)	12 (31)	21 (54)	5 (13)	1 (2)	0.000
Other relative(s)	63/720 (9)	20 (32)	27 (43)	7 (11)	9 (14)	0.000
Foster parent/family (OMITTED)	1/720 (.14)	1 (100)	0	0	0	0.839
Roommate(s) (non-related, non-sex partners)	60/720 (8)	14 (23)	2 (3)	3 (5)	41 (68)	0.000
Non-spouse sex partner	75/720 (10)	48 (64)	4 (5)	15 (20)	8 (11)	0.036
Supervised living arrangement	22/720 (3)	2 (9)	1 (5)	1 (5)	18 (82)	0.000
Other (i.e. residents of institution)	21/720 (3)	3 (14)	1 (5)	2 (10)	15 (71)	0.000
Have dependents	521/1049 (50)	321 (62)	49 (9)	93 (18)	58 (11)	0.000
Incarceration(s) in previous 3 months	661/1057 (63)	346 (52)	64 (10)	135 (20)	116 (18)	0.000
Inpatient drug treatment program in previous 3 months	554/1062 (52)	311 (56)	49 (9)	88 (16)	106 (19)	0.005
Medical care/health diagnoses						
HIV +	531/1063 (50)	364 (68.5)	47 (8.9)	40 (21.2)	80 (15.1)	0.000
STI +	148/1057 (14)	72 (49)	13 (8.8)	32 (21.6)	31 (21)	0.061
Receipt of HIV medical care in previous 6 months	475/531 (89)	335 (71)	41 (9)	32 (7)	67 (14)	0.005
Knowledge of CD4 count	365/531 (69)	254 (70)	32 (9)	25 (7)	54 (15)	0.587
Knowledge of viral load	292/529 (55)	212 (73)	24 (8)	18 (6)	38 (13)	0.096

Table 4.2. Additional Factors Included in Model

Interval covariates included in model, Mean** years **(SD)				
	N	Stably housed	Unstably housed	P value
Age	1060	43.95 (7.87)	42.70 (8.29)	0.012
Years with study partner	1059	7.51 (6.93)	6.13 (5.95)	0.000
Years known HIV + *	520	9.48 (5.33)	8.40 (5.72)	0.036

*Strictly for participants with known positive HIV serostatus

Table 4.3. Descriptive Statistics of Additional Factors Included in the Model

Characteristic	Mean	SD	P
Age, Years			
Stably housed	43.95	7.87	-
Living with family	41.19	8.91	0.013
Living with partner	42.73	8.04	0.064
Living with other	43.62	8.09	0.634
Years with study partner			
Stably housed	7.51	6.93	-
Living with family	5.98	5.26	0.033
Living with partner	6.53	6.36	0.087
Living with other	5.76	5.89	0.003
Years known HIV seropositive*			
Stably housed	9.48	5.33	-
Living with family	8.17	6.04	0.122
Living with partner	7.06	5.46	0.006
Living with other	9.24	5.58	0.725

Table 4.4. Bivariate Analysis: Dichotomized Housing Variable

Bivariate Analysis / Substance Abuse – Dichotomized Housing Variable				
	Full sample	Stably Housed	Unstably Housed	P Value
Alcohol dependence	1062	83 (49)	88 (51)	0.016
Drug dependence	1058	91 (50)	91 (50)	0.042
Ever on drug treatment	1062	311 (56)	243 (44)	0.568
Days in drug treatment	1056	305 (56)	236 (44)	0.671
Ever incarcerated	1057	346 (52)	315 (48)	0.000
Days incarcerated	1042	336 (52)	304 (48)	0.000
Specific drug use				
- Heroin	1049	27 (50)	27 (50)	0.313
- Marijuana	1051	134 (52)	123 (48)	0.083
- Other illegal drug use	1048	103 (44)	130 (56)	0.000
- Injecting use	1051	21 (48)	23 (52)	0.209
- Shared use of needles, cookers, cotton	1052	5 (56)	4 (44)	0.942

Table 4.5. Bivariate Analysis: Multi-Group Housing Variable

Bivariate Analysis / Substance Abuse						
	Full Sample	Stably Housed	Unstably Housed			*P* Value
			Living with Family	Living with Partner	Living with Other	
Alcohol dependence	1062	83 (49)	21 (12)	39 (23)	28 (16)	0.080
Drug dependence	1058	91 (50)	25 (14)	32 (17)	34 (19)	0.084
Ever on drug treatment	1062	311 (56)	49 (9)	88 (16)	106 (19)	0.005
Ever incarcerated	1057	346 (52)	64 (9)	135 (20)	116 (18)	0.000
Specific drug use						
- Heroin	1049	27 (50)	5 (9)	14 (26)	8 (15)	0.472
- Marijuana	1051	134 (52)	37 (14)	50 (19)	36 (14)	0.026
- Other illegal drug use	1048	103 (44)	31 (13)	46 (20)	53 (23)	0.000
- Injecting drugs	1051	21 (48)	7 (16)	9 (20)	7 (16)	0.453
- Shared needles, cookers, cotton	1052	5 (56)	1 (11)	2 (22)	1 (11)	0.972

Table 4.6. Adjusted Ratios for Outcome Variables

	Alcohol Dependence		**Drug Dependence**		**Incarcerated**		**Inpatient Drug Treatment**	
Model Factors	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Housing Group								
Live family	1.13	.48, 2.66	1.77	.79, 3.96	.91	.48, 1.73	1.27	.67, 2.41
Live partner	1.86	.95, 3.62	.92	.45, 1.91	1.43	.81, 2.52	1.01	.59, 1.72
Live other	1.22	.55, 2.73	.86	.41, 1.79	.92	.49, 1.71	1.10	.59, 2.02
Living with…								
Spouse	.79	.45, 1.42	1.32	.73, 2.39	.77	.49, 1.20	1.07	.69, 1.64
Your own (or other's) children	.79	.42, 1.48	.68	.37, 1.26	.92	.56, 1.48	.71	.45, 1.13
Parents	1.06	.45, 2.51	.69	.27, 1.76	1.42	.71, 2.85	*.54	.27, 1.08
Sibling(s)	1.59	.62, 4.05	.93	.35, 2.52	.83	.37, 1.85	.68	.30, 1.56
Other relatives	.35	.12, 1.03	1.42	.62, 3.27	.89	.46, 1.72	.64	.34, 1.21
Roommate	.49	.16, 1.53	1.06	.42, 2.71	1.34	.58, 3.11	***3.56	1.49, 8.54
Nonspouse sex partner	.57	.22, 1.47	.82	.33, 2.03	.92	.48, 1.75	.61	.33, 1.14
Supervised living arrangement	1.06	.26, 4.32	.85	.22, 3.24	1.71	.47, 6.25	1.75	.49, 6.20
Other(s)	.86	.16, 4.61	.19	.02, 1.78	.69	.19, 2.40	2.48	.67, 9.18
Sociodemographic								
Gender	.78	.45, 1.36	.69	.40, 1.17	***.24	.16, .36	1.19	.79, 1.79
Age	1.01	.97, 1.04	.98	.95, 1.01	1.00	.98, 1.02	***1.06	1.03, 1.08
Education	**1.81	1.01, 3.26	1.02	.59, 1.77	1.31	.88, 1.95	**1.50	1.01, 2.22
Income	1.38	.73, 2.61	1.06	.56, 2.02	.90	.57, 1.41	**1.63	1.04, 2.52
Employment	1.14	.61, 2.12	*1.80	.95, 3.42	1.15	.73, 1.82	.77	.49, 1.19
Insurance	1.12	.65, 1.95	*1.66	.96, 2.87	1.04	.67, 1.61	*.71	.47, 1.07
Married to study partner	.87	.51, 1.50	1.17	.68, 2.05	1.20	.78, 1.84	.91	.60, 1.37
Individual								
Dependents	*1.65	.91, 2.98	.69	.39, 1.22	*.64	.39, 1.02	*1.50	.96, 2.36
HIV +	1.32	.79, 2.23	**1.78	1.07, 2.95	***1.84	1.24, 2.74	**1.58	1.08, 2.30
STI +	.86	.42, 1.73	1.52	.79, 2.91	.85	.51, 1.41	1.33	.79, 2.20
Alcohol dependent	-	-	***4.35	2.56, 7.39	*1.57	.91, 2.69	.77	.46, 1.28
Drug dependent	***4.39	2.59, 7.43	-	-	1.18	.69, 2.00	***2.89	1.71, 4.81
Incarceration history	*1.58	.91, 2.74	1.20	.70, 2.08	-	-	***3.19	2.18, 4.66
Inpatient drug treatment history	.81	.49, 1.35	***3.02	1.77, 5.14	***3.14	2.15, 4.58	-	-
Depression	***2.39	1.31, 4.39	1.44	.78, 2.69	*.60	.35, 1.04	1.10	.65, 1.88
Trauma	.67	.29, 1.55	*2.04	.94, 4.43	1.38	.66, 2.85	1.34	.67, 2.70

* p<.10
** p<.05
*** p<.01

Table 4.7. Adjusted Ratios for Outcome Variables—Specific Drugs

	Heroin use		Marijuana use		Other illegal drugs		Injecting drug use	
Model Factors	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Housing Group								
Live family	.59	-.28, 1.46	.31	-.36, .97	-.42	-1.03, .19	.16	-.49, .81
Live partner	.09	-.58, .76	-.25	-.82, .32	-.09	-.63, .44	-.11	-.66, .45
Live other	*-.55	-1.32, .21	**-.64	-1.28, -.01	**.63	.10, 1.15	**.72	.08, 1.34
Sociodemographic								
Gender	**-.64	-1.27, -.01	-.26	-.69, .17	-.22	-.61, .18	-.26	-.79, .27
Income	***-.77	-1.36, -.18	-.16	-.69, .38	-.10	-.61, .40	*.58	-.07, 1.22
Individual								
HIV +	.32	-.29, .93	.32	-.13, .78	-.23	-.62, .15	***-.84	-1.29, -.39
Alcohol dependent	**-.62	-1.15, -.08	.06	-.47, .61	-.09	-.52, .32	-.14	-.61, .32
Drug dependent	*.44	-.15, 1.03	-.24	-.78, .29	***1.31	.89, 1.72	***2.52	1.89, 3.15
Incarceration history	*.60	-.08, 1.29	.10	-.35, .55	.09	-.38, .57	.18	-.53, .89
Inpatient drug treatment history	-.27	-.89, .34	.15	-.33, .64	.28	-.15, .72	-.38	-.95, .18
Depression	***1.07	.37, 1.76	-.03	-.59, .53	.04	-.39, .48	**.55	.02, 1.07

* p<.10
** p<.05
***p<.01

Figure 4.5. Ordered Risk for Housing Groups

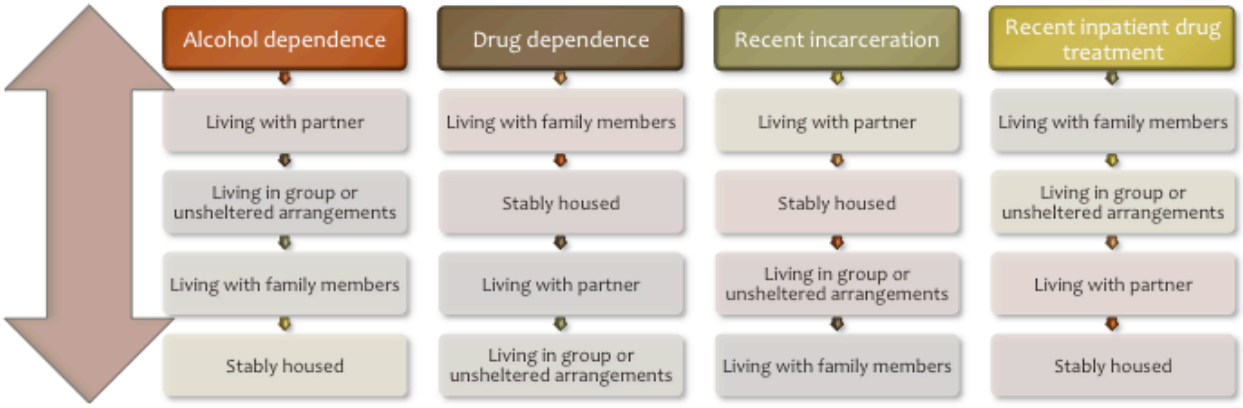
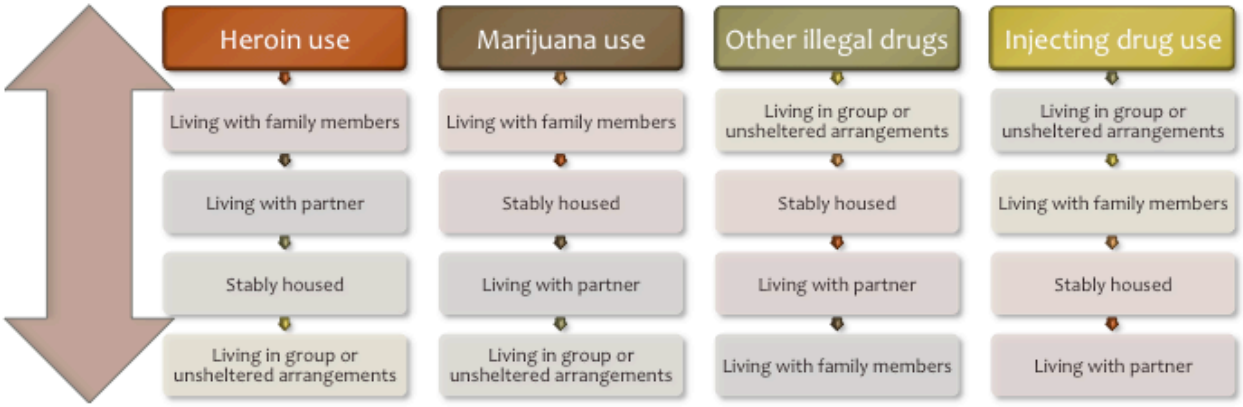


Figure 4.6. Ordered Risk for Housing Groups—Specific Drugs



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CHAPTER 5

HOUSING INSTABILITY AND MENTAL HEALTH[3]

[3] Daniel, TM, Hou, S, Fertig, A, Shen, Y, Bellamy, S, Wingood, G. To be submitted to *AIDS Behavior.*

Abstract

Social and behavioral factors (i.e. lack of social support, substance dependence) cause unstably housed persons to shoulder exponentially higher rates of depression and HIV risk. Among PLHA, one-third is diagnosed with major depressive disorder, which has been linked to reduced ART adherence. This manuscript seeks to confirm the relationship between housing instability, depression, stress, and medication adherence and to establish a continuum whereby increased housing instability leads to greater risk.

African-Americans (n=1,070) were grouped according to whether they owned their home [referred to as “stably-housed”], lived with family [“family-living”], sexual partner [“partner-living”], or other group living arrangement, such as a homeless shelter [“other-living”], which was evaluated against depression, trauma, quality of life, and ART adherence for PLHA.

Model analysis revealed persons in family-living were 1.68 times more likely to be depressed (p=0.038); conversely, living with a spouse was protective against depression (OR=0.580, p=0.044). Substance-dependent persons were twice as likely to be depressed (AlcoholOR=2.08, p=0.046; DrugOR=2.28, p=0.021). Compared to stably-housed persons, those in other-living (OR=-4.23, p=0.05) or living with a spouse (OR=-3.41, p=0.028) were less likely to experience trauma; conversely, persons who were alcohol (OR=5.58, p=0.001) or drug dependent (OR=6.20, p=0.000) were more likely to experience trauma. Drug dependent persons were 1.5 times more likely to rate worse quality of life (p=0.001). Seropositive drug-dependent persons were 2.34 times more likely to not be ART-medically adherent (p=0.017). Treatment agencies must assess living environment, family and friendship relationship quality, and substance

dependence to better mental health and HIV outcomes.

Introduction

It is not sufficient to simply address the consequences of HIV transmission; rather, HIV prevention efforts must focus on transmission within the macrosocial, environmental contexts in which risk behaviors occur (German & Latkin, 2011). Housing, mental health, and social stability are all contextual factors that greatly influence an individual's HIV risk (Evans, Wells, Chan, & Saltzman, 2000; Suglia, Duarte, & Sandel, 2011).

Conservative estimates document that 1% of the U.S. population is homeless and that 10% to 20% are unstably housed (US Census Bureau, 2011). Homeless persons battle many chronic and infectious diseases (Jacobs, Wilson, Dixon, Smith, & Evens, 2009), and their age-standardized morbidity and mortality rates are three for five times higher than those of their housed peers (S Fazel, V. Khosla, H. Doll, & J. Geddes, 2008). In addition to worsened general health outcomes, a recent meta-analysis (S. Fazel, V. Khosla, H. Doll, & J. Geddes, 2008) found a more than 10-fold variation in the prevalence of serious mental health disorders among homeless persons. Diagnoses of psychosis ranged from 2% to 31%, depression ranged from 4% to 41%, and personality disorders ranged from 3% to 71%. Meta-analytic review revealed a random effects pooled prevalence of psychotic illness at 12.7%, major depression at 11.4%, and personality disorders at 23.1%. Additional evidence shows that depression among the unstably housed and persons living with HIV (PLWH) are commonplace, and living with both exponentially increases health risk (Tsai, O'Connell, Kasprow, & Rosenheck, 2011). For PLWH, the 12-month prevalence of major depressive disorder is 36%,

compared to only 5% to 7% in the general population. For PLWH, depression is also associated with reduced ART uptake and adherence, including CD4 decline and a rapid progression to AIDS (Tsai, Rosenheck, Kasprow, & McGuire, 2012).

At an individual level, chronic stress, lack of social support, and victimization increase mental health risks for unstably housed persons. At a structural level, the closure of large psychiatric institutions, the shortage of low-cost housing, and a lack of community-based supports and services over the past few decades are thought to have contributed to increasing homelessness among persons with mental illness, with resulting increased levels of psychiatric morbidity among homeless persons (S. Fazel et al., 2008). With the continued reduction in the numbers of inpatient psychiatric beds and available community support services, the number and proportion of homeless persons with mental disorders are expected to rise (Montgomery et al., 2008).

Apart from contributing to increased rates of mortality—including suicide and drug abuse, the presence of serious mental disorders in the homeless is likely to contribute to increased rates of violent victimization, criminality, and longer periods of homelessness (Hwang et al., 2009). A better understanding of the interrelationship among housing, depression, social support, and mental health would reduce psychiatric morbidity, garner better mental health and HIV-related outcomes, and inform public policy and the development of psychiatric services, particularly in urban centers (Montgomery et al., 2008). Equally, such research may identify protective factors, such as individual hope for the future and an positive outlook on one's quality of life, thereby affording the unstably housed better coping skills (Tevendale, Lightfoot, & Slocum, 2009).

This research will test the hypothesis that housing instability is associated with

increased severity of depression, increased stress and trauma, a worsened outlook on an individual's perception of the future, and decreased medication adherence for HIV positive persons. With these data, we also hypothesize that there is a housing and health continuum and that decreased housing stability is associated with increased depression, stress and trauma, quality of life and medication adherence. Outcomes from this research will further substantiate previous research on mental health outcomes and HIV and provide information regarding how contextual influences (such as with whom and where people live) converge to create marginalized populations.

Methods

Design Setting and Sample

Data for this analysis are from Project Eban: HIV Risk-Reduction Prevention for African-American Serodiscordant Couples. Subsequent methods are previously described in El-Bassel (2011). Briefly, African-American HIV serodiscordant couples were enrolled at four sites (Atlanta, GA; New York, NY; Los Angeles, CA; Philadelphia, PA) from November 2003 to June 2007. Institutional review board approval was received, and all subjects were recruited with a common recruitment protocol. To ensure adequate sample size and a representative sample, participant recruitment occurred at HIV clinics, AIDS service and community-based organizations and through word of mouth, referrals, targeted street outreaches, and a media campaign—including radio appearances, commercials, and newspaper advertisements. A total of 535 couples (*N* = 1,070) were enrolled. The original aim of the trial was to test the efficacy of a contextually appropriate behavioral intervention on HIV and sexual risk behaviors among couples. Inclusion and exclusion criteria couples were required to meet for

participation are summarized in Figure 5.1.

Data Collection

To confirm HIV serostatus at enrollment, both partners provided oral specimens tested with OraSure HIV procedural kits (OraSure Technologies, Bethlehem, PA). Reactive specimens were confirmed with Western blot assays. Urine (male) and vaginal swab (female) specimens were collected to test for three common STIs (chlamydia, gonorrhea, and trichomoniasis) via amplified DNA and PCR assay techniques.

Participants received instruction on how to enter personal information via audio computer-assisted self-interviewing (ACASI) by trained data monitors. Participants confidentially recorded sociodemographic information, including age, education, income, housing status, employment, incarceration history, length and quality of the current sexual relationship, and cohabitation with the study partner. All participants also provided sexual history information, including incidence of concurrent partners and number of unprotected vaginal and anal intercourse acts. Seropositive participants recorded length of HIV diagnosis, CD4 count, and viral load information. Data were also recorded regarding substance use or abuse (current and past), childhood and adult physical and sexual abuse, and HIV knowledge and attitudes via the ACASI. Data collection, including ACASI and biological specimen collection, occurred at four time points—baseline, immediately postintervention (approximately 8–10 weeks postenrollment), and 6 and 12 months postintervention. Each individual participant was compensated for time and travel for each visit. Full review of these data and primary outcomes are published elsewhere (El-Bassel et al., 2010).

Measures

Exposure variable. In order to determine if varying levels of housing instability are correlated with mental health, we utilized the trial's baseline ACASI data to categorize participants into one of four housing groups: 1) stably housed (own your own home), 2) living with family members, 3) living with sexual partner(s), or 4) living transitionally in sheltered (group arrangements) or unsheltered situations with other persons who are not related (other). The ACASI questions utilized to separate these groups are cited previously and included in Figure 5.2 (Daniel, Hou, Fertig, & Wingood, 2013).

Outcome and confounding variables. Outcome and confounding variables included in this analysis were categorized as follows—*outcome variables:* depression (no/yes), trauma (no/yes), quality of life (5-point Likert ordinal scale from excellent quality=0 to worse=5), a 10-point 'ladder of life' to assess individual outlook on current and future quality of life, and medical adherence (ordinal scale ranging from never missed medications [0] to missed medications in the past week [4]; *demographic covariates:* gender (male/female), age (continuous), education (through HS diploma/some college and above), income (> $850 per month/ < $851 per month), employment (yes/no), insurance (yes/no), and married to study partner (yes/no), dependents (no/yes); and *depression covariates:* inpatient drug treatment (no/yes), recent incarcerations (no/yes), HIV serostatus (no/yes), time involved with study partner (continuous), and for HIV seropositive persons, years known HIV+ (continuous).

Depression. Within the trial, depression is assessed via the Center for Epidemiologic Studies – Depression Scale (Brief Version). The 4-item scale is a brief

self-report measure of depressive symptoms within the past week. The scale is used predominantly with African-American women, and the brief version is significantly correlated with scores from the longer, 20-item scale (Melchior, Huba, Brown, & Reback, 1993).

Stress and Trauma. The PCL-C yields a total score as well as subscale scores for Intrusion, Avoidance-Numbing, and Arousal. Respondents are considered likely to meet DSM-IV criteria for PTSD if (a) they endorse (i.e. rate as "moderately" or greater) one or more intrusion symptoms, three or more avoidance-numbing symptoms, and two or more arousal symptoms in accordance with DSM-IV criteria or (b) they obtain a total score of 50 or greater (Weathers & Litz, 1994).

Quality of Life and Medication Adherence. Three ACASI questions related to quality of life assessed: 1) how an individual feels now about his or her life on a general level and 2) how he or she may feels about life right now and in the future (a 10-point 'ladder of life'). One question assessed personal compliance for HIV medication for participants who were HIV seropositive. All questions related to quality of life and medication adherence are provided in Figure 5.2.

Statistical Analysis

The data analysis overview and statistical analysis plan are summarized in Figures 5.3 and 5.4, respectively. Descriptive statistics were used to characterize the sample, and housing status was run as a dichotomous exposure variable in bivariate analysis using chi-squared test for trend. In multivariate analysis, multiple logistic regression modeling described the effects of housing status on depression and stress and trauma. For the measures with ordered responses, ordinal logistic regression

modeling described the effects of housing instability on medication adherence and quality of life. All p values were based on 2-tailed tests; values less than .05 were considered statistically significant. Statistical analyses were completed using Stata version 12.1 (StataCorp, College Station, Texas).

Logistic and ordinal logistic regression analyses for mental health variables were run with housing status, gender, age, education, income, employment, if insured, married to study partner, whom a person lived with, recent incarcerations, recent inpatient drug treatment, and problem drinking or drug use added as covariates. Based upon theoretical value, covariates were forced into the model regardless of significance. If data were missing on one or more variables, the respondent's data were excluded from the regression analyses. The purpose of these analyses was to examine the effects of housing instability on mental health outcomes, controlling for additional HIV risk factors across housing status groups (Kidder, Wolitski, Pals, & Campsmith, 2008).

Results

Housing Group Differences

Of 1063 participants, 605 (57%) were stably housed and 458 (43%) were unstably housed. Of 458 unstably housed participants, 104 (23%) lived with a family member, 189 (41%) lived with his/her sexual partner, and 165 (36%) lived in a rooming house, single room, group living arrangement, welfare-type living, or were unsheltered ("other living arrangement"). Baseline characteristics between participants in varying housing groups were dissimilar and, subsequently, statistically significant in χ^2 analyses (Table 5.1). For instance, more women (57%) were stably housed than men (43%), ($\chi^2(3)=49.15$, $p=0.000$); the greatest within-group disparity among women's and men's

housing groups were those who were stably housed (women: 65%, men 49%) and those living with a sexual partner (women: 10%, men: 26%).

Additional Factors

Gender Differences. Theoretically, it is understood that gender differences exist. Consequently, we completed χ^2 tests to investigate the relationship of gender on income, unemployment, and education for this sample. There was a significant difference amongst gender and employment, with women being more likely to be unemployed than men (χ^2 (1)=16.5059, p=0.000). Conversely, there was no significant difference between gender and income (χ^2(1)=0.7749, p=0.379) or education (χ^2 (1)=1.4578, p=0.227).

Dependents. For those with dependents, we performed a t-test to characterize the relationship between dependents and housing status. Stably housed participants' mean number of dependents were 1.18 (SD=1.52; 95% CI: 1.05 – 1.29), while unstably housed participants averaged .97 dependents (SD=1.41; 95% CI: .84-1.10) (t(1047)=2.23, p=0.025). We further analyzed differences between groups, using stably housed as the referent group. T-tests showed that there is no statistically significant difference between stably housed and unstably housed participants living with family members or partner and each subsequent group's number of dependents; however, those living in other housing situations had significantly fewer dependents (mean: .77) than stably housed participants (mean: 1.18) (t(758)=3.09, p=0.002).

Age, amount of time with study partner and known HIV seropositive status. On average, unstably housed participants were more than 1 year younger (t(1058)=2.51, p=0.012) and had shorter relationship length by nearly 1.5 years than

stably housed participants (t(1057)=3.40, p=0.000). For those who were HIV seropositive, the unstably housed knew their status 1 year less than stably housed participants (t(518)=2.09, p=0.036). Corresponding means are provided in Table 5.2.

Primary Outcomes

As shown in Tables 5.3 and 5.4, bivariate analysis showed there were statistically significant differences in mental health behavior and medication adherence based upon housing status. For this analysis, the quality of life outcomes were dichotomized by taking persons who felt their lives were fair or poor and comparing them with persons who felt their lives were excellent, very good, or good. Also, for persons who ranked their current and future quality of life on a 10-point scale, ratings of 1 – 4 were evaluated as poor and compared with persons who rated their expectations as 5 – 10 (excellent/good). Analysis of the dichotomized housing variable show there was a significant difference between the expected and observed result for quality of life (dichotomized quality of life variable), expectations for the current quality of life (dichotomized current and future quality of life variable), and if a person ever missed taking HIV medications as prescribed. However, there was not a statistically significant difference between groups regarding depression, trauma, future quality of life, and the last time (how recent) HIV medications were missed. Specifically, 48% of depressed persons were unstably housed (p=0.135), 45% of persons who experienced trauma were unstably housed (p=0.613), 58% of persons who rated their future life quality as poor or substandard were unstably housed (p=0.088), and 37% of HIV-positive persons who never missed taking their medications were unstably housed (p=0.205).

Across four housing groups, chi-squared tests showed 19% of depressed persons live in group or unsheltered accommodations (p=0.060), 19% of persons who have experienced trauma live with a partner (p=0.920), 20% of persons who rate their quality of life as fair or poor live with a partner (p=0.076), 29% who rate their future as fair or poor are living in group or unsheltered accommodations (p=0.144), and 13% of persons who missed taking medications within the past week live in group or unsheltered accommodation (p=0.366). The only outcome that reached critical significance in bivariate analysis of multiple housing groups is individual rating of the current quality of life. Twenty-three percent of those who consider their lives to be of poor or fair current quality are living in group or unsheltered housing (p=0.002).

Depression. After controlling for mental health covariates, adjusted odds ratios for depression revealed persons living with family members were 1.38 times more likely than stably housed participants to be depressed (AOR=1.38, p=0.444). Individuals living with a partner were 1.01 times more likely to be depressed compared to stably housed participants (AOR=1.01, p=0.968). Persons living in group or unsheltered accommodations were 1.27 times more likely than stably housed participants to be depressed (AOR=1.27, p=0.552). Though the relationship between housing status as an exposure variable on depression was not statistically significant within the confines of the model, those with less income (less than $850 per month) (AOR=2.36, p=0.019), alcohol dependent (AOR=2.55, p=0.003), and who had experienced trauma (AOR=21.76, p=0.000) were more likely to be depressed. Model-adjusted ratios for all outcome variables are reported in Table 5.5.

Trauma. After controlling for covariates, persons living with family members were 39% less likely (AOR=0.61, p=0.453) and persons living in other housing were 27% less likely (AOR=0.73, p=0.594) to have experienced trauma than stably housed persons. Persons living with a sexual partner were 18% more likely to experience trauma than stably housed counterparts (AOR=1.18, p=0.741). Significant covariates within the model included drug dependent persons were 2.22 times more likely to have experienced trauma (AOR=2.22, p=0.05) and depressed persons were 22 times more likely to have experienced trauma (AOR=21.92, p=0.000).

Quality of life. Ordered logistic regression modeling revealed persons living with family members were 1.43 times more likely to have poor quality of life (AOR=1.43, p=0.178), persons living with partners were 1.42 times more likely to have poor quality of life (AOR=1.42, p=0.114), and persons living in other group accommodation were 1.38 times more likely to have a poor quality of life compared to stably housed participants (AOR=1.38, p=0.190). Within the model, being unemployed (AOR=1.48, p=0.031), unmarried to the study partner (AOR=1.47, p=0.029), drug dependent (AOR=1.85, p=0.004), depressed (AOR=2.07, p=0.001), or living with a spouse (AOR=1.51, p=0.022) were significant predictors of a poorer quality of life.

Medication adherence. After controlling for covariates, adjusted odds ratios for HIV+ persons being medically adherent revealed persons living with family members were 24% less likely to be medically adherent compared to stably housed participants (AOR=0.76, p=0.545). Persons living in group or unsheltered living arrangements were 11% less likely to be medically adherent compared to stably housed participants (AOR=0.89, p=0.768), and persons living with a partner had a similar outcome, and

were 10% less likely to be medically adherent compared to stably housed persons (AOR=0.90, p=0.822). Persons who recently were in inpatient drug treatment programs were 1.65 times more likely to be medically non-adherent than stably housed persons (AOR=1.65, p=0.042).

Discussion

Previous research confirms that mental health diagnoses—including depression, trauma, poor outlook on the quality of one's life, and lack of social support—lead to increased morbidity and mortality for unstably housed persons. Depression also gravely affects HAART medication adherence, as persons who are depressed are clinically and physically unable to direct their attentions to adequate medication compliance. These results suggest that housing instability has an impact on depression, current and future quality of life, and medication adherence for HIV+ persons. Bivariate analysis concludes that housing instability is significantly associated with poor quality of life and chances of a person ever missing his or her medications. Amongst multiple housing groups, bivariate analysis is also nearly significant with depression. Multivariate analysis show that housing groups, as defined within this research, are not statistically significant predictors of depression, trauma, quality of life, and medication adherence. Within these models though, living with a spouse increases odds of personal ranking of a poorer quality of life and living with a non-spouse sex partner is associated with being medically non-adherent.

A primary aim of this study is to determine if there is a housing instability continuum that leads to increased mental health and medication adherence risk. Across four outcomes, each of the four housing groups hailed as most risky; the group

with the third highest level of risk in three of four outcomes is one with group or unsheltered living accommodations (Figure 5.6). Otherwise, there is no congruent order as to levels of risk between the housing groups and outcomes.

Conclusion

Notwithstanding medical adherence, being unstably housed is riskier for worse mental health outcomes. From a treatment perspective, mental health clinicians should include housing status and cohabitants in care review assessments. Also, policymakers must lobby for additional funds to provide transitional housing units to depressed persons living with HIV.

Figure 5.1. Inclusion/Exclusion Criteria

- Both partners were over 18 years of age
- Their relationship had existed for at least 6 months prior to enrollment, and they intended to stay with each other at least 1 year postenrollment
- At least one partner reported having had unprotected intercourse with his or her partner in the previous 90 days
- Each partner had no relocation plans for 1 year postenrollment
- At least one partner self-identified as African American
- At least one partner was not planning a pregnancy within 18 months
- In the dyad, one partner was male and the other female
- Each partner was aware of the other's HIV serostatus
- Only one partner was HIV seropositive and was aware of his or her status at least 3 months prior to enrollment.

Couples were excluded based on the following restrictions:

- If either partner did not have a mailing address
- If either partner showed evidence of psychological or neurological impairment
- If either partner reported severe physical or sexual abuse (with the proposed study partner)
- If either partner was not fluent in English

Figure 5.2. ACASI Housing and Outcome Questions

Where do you live now?

- ❑$_1$ In my own home or my own apartment
- ❑$_2$ In my family's home or apartment
- ❑$_3$ In my partner's home or apartment
- ❑$_4$ In someone else's home or apartment (not family)
- ❑$_5$ In a rooming house or single room hotel
- ❑$_6$ In a welfare-type place
- ❑$_7$ In a group home or institution
- ❑$_8$ No regular place to live (i.e., park, street, steam vent)

Does anyone else live there with you?

- ❑$_1$ Yes
- ❑$_0$ No

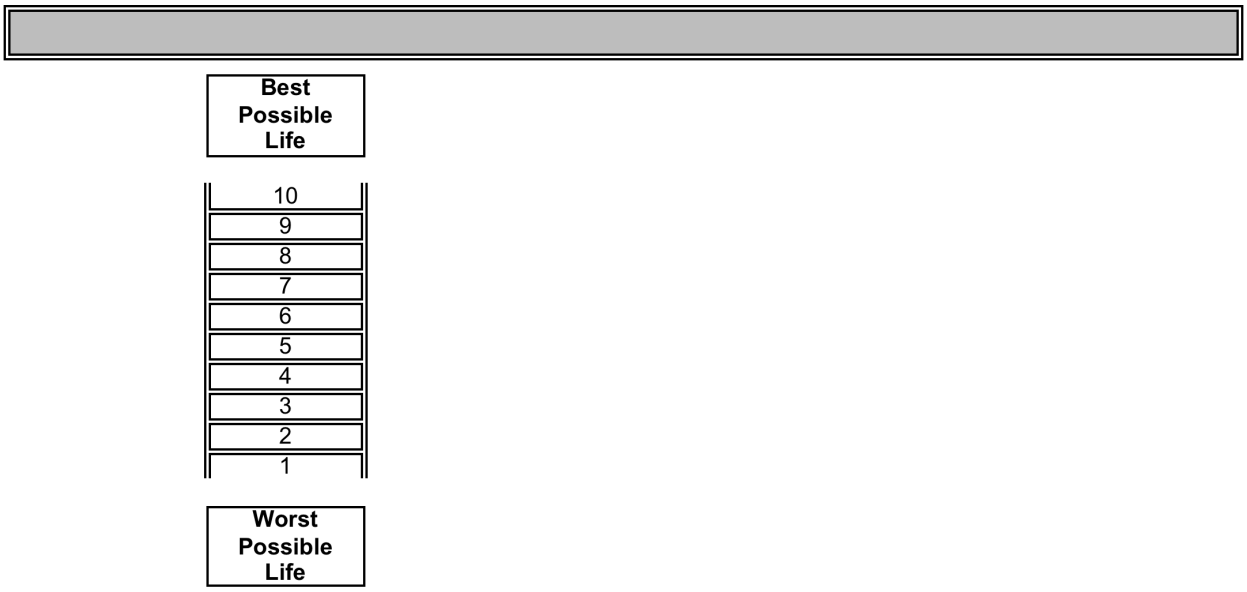
Who lives there with you? **(Click all that apply)**

- ❑ Spouse

- ❑ Your own children or other's children
- ❑ One or both parents
- ❑ One or more brothers and/or sisters
- ❑ Other relatives(s)
- ❑ Foster parent/family
- ❑ Roommate (s) (nonrelated, nonsex partners)
- ❑ Nonspouse sex partner
- ❑ Supervised living arrangement
- ❑ Other (i.e., other residents of an institution) _____

In general, how would you rate your overall quality of life?

- ❑$_1$ Excellent
- ❑$_2$ Very good
- ❑$_3$ Good
- ❑$_4$ Fair
- ❑$_5$ Poor



On which step of the ladder do you feel you personally stand at the present time?

Thinking about your future, on which step do you think you will stand about one year from now?

When was the last time you missed any of your HIV medications?

- ❑$_1$ Within the past week
- ❑$_2$ 1-2 weeks ago
- ❑$_3$ 3-4 weeks ago
- ❑$_4$ Between 1 and 3 months ago
- ❑$_5$ More than 3 months ago
- ❑$_6$ Never missed medications

Figure 5.3. Data Analysis Plan

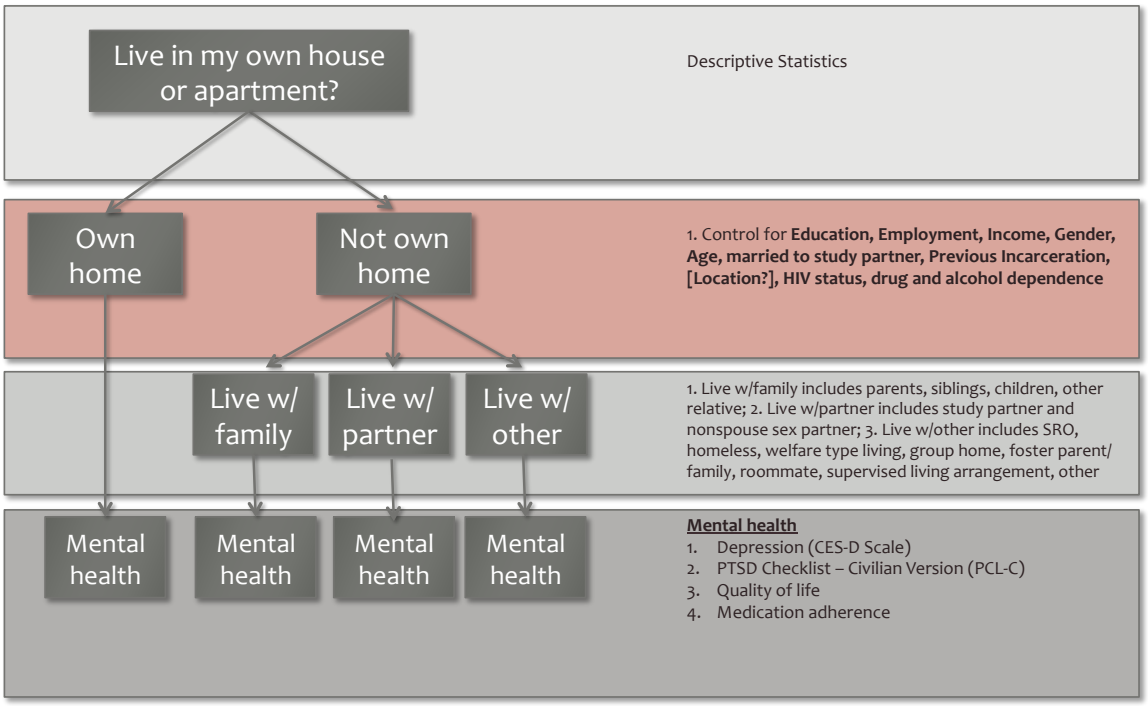


Figure 5.4. Statistical Analysis Plan

Variable name	Description	Reason for inclusion	Distribution	Coding	Statistical analysis used	
					Bivariate	Multivariate
Housing	Housing status	**Exposure**	Ordinal	1: Stably housed 2: Living with family 3: Living with partner 4: Living with other	-	-
H1-H6	CES-D (Depression)	**Outcome**	Scale/Sum of scores	Score <7: 0 Score>=7: 1	X^2	Multiple logistic regression
I1-I17	PCL-C (Trauma)	**Outcome**	Scale/Sum of scores	-	ANOVA	Multiple linear regression
B1	Quality of life	**Outcome**	Ordinal	1: Excellent 2: Very good 3: Good 4: Fair 5: Poor	-	Ordinal logistic regression
C7	Medication adherence	**Outcome**	Ordinal	Missed medications: 1: Within the past week 2: 1 – 2 weeks ago 3: 3 – 4 weeks ago 4: Between 1 and 3 months ago 5: More than 3 months ago 6: Never missed medications	-	Ordinal logistic regression
A6	# of dependents	**Moderator**	Interval	Continuous	ANOVA	-
Gender	Gender	**Moderator**	Dichotomous	1: Male 2: Female	X^2	-
xAge	Age	**Confounder**	Interval	Continuous	ANOVA	-
Eduhousing	Education	**Confounder**	Ordinal	1: > HS, GED 2: HS diploma 3: Some college	X^2	-
Inchousing	Income	**Confounder**	Categorical	1: > 400 2: 400 – 850 3: 851 – 1650 4: < 1650	X^2	-
A4	Employment	**Confounder**	Dichotomous	0: No 1: Yes	X^2	-
A7	Insurance	**Confounder**	Dichotomous	0: No 1: Yes	X^2	-
xMarried	Married to study partner	**Moderator**	Dichotomous	0: No 1: Yes	X^2	-

Table 5.1. Characteristics by Housing Group

Descriptive Statistics by Housing Group						
	Full Sample	Stably Housed	Unstably Housed			*P* Value
			Living with Family	Living with Partner	Living with Other	
Group totals (n)	1063 (100)	605 (57)	104 (10)	189 (18)	165 (15)	-
Gender, No. (%)						
Female	532/1063 (50)	346 (65)	53 (10)	53 (10)	80 (15)	0.000
Marital status, No. (%)						
Married to study partner	345/1062 (32.5)	235 (68)	30 (9)	40 (12)	40 (12)	0.000
Educational status, No. (%)						
No formal schooling – HS Diploma (or GED)	763/1063 (72)	410 (54)	84 (11)	147 (19)	122 (16)	0.005
Employment						
Unemployed	759/1061 (71.5)	417 (55)	80 (10)	122 (16)	140 (19)	0.000
Monthly income						
$0 – 850/month	753 (71)	385 (51)	87 (12)	149 (20)	132 (17)	0.000
Insured						
No	261/1061 (24.6)	103 (39)	36 (14)	68 (26)	54 (21)	0.000
Persons living with you						
Alone	341/1063 (32)	212 (62)	4 (1)	77 (23)	48 (14)	0.000
Spouse	337/720 (47)	220 (65)	26 (8)	55 (16)	36 (11)	0.000
Your own children or other's children	348/720 (48)	227 (65)	38 (11)	66 (19)	17 (5)	0.000
One or both parents	66/720 (9)	13 (20)	43 (65)	8 (12)	2 (3)	0.000
One or more brothers/sisters	39/720 (5)	12 (31)	21 (54)	5 (13)	1 (2)	0.000
Other relative(s)	63/720 (9)	20 (32)	27 (43)	7 (11)	9 (14)	0.000
Foster parent/family (OMITTED)	1/720 (.14)	1 (100)	0	0	0	0.839
Roommate(s) (non-related, non-sex partners)	60/720 (8)	14 (23)	2 (3)	3 (5)	41 (68)	0.000
Non-spouse sex partner	75/720 (10)	48 (64)	4 (5)	15 (20)	8 (11)	0.036
Supervised living arrangement	22/720 (3)	2 (9)	1 (5)	1 (5)	18 (82)	0.000
Other (i.e. residents of institution)	21/720 (3)	3 (14)	1 (5)	2 (10)	15 (71)	0.000
Have dependents	521/1049 (50)	321 (62)	49 (9)	93 (18)	58 (11)	0.000
Incarceration(s) in previous 3 months	661/1057 (63)	346 (52)	64 (10)	135 (20)	116 (18)	0.000
Inpatient drug treatment program in previous 3 months	554/1062 (52)	311 (56)	49 (9)	88 (16)	106 (19)	0.005
Medical care/health diagnoses						
HIV +	531/1063 (50)	364 (68.5)	47 (8.9)	40 (21.2)	80 (15.1)	0.000
STI +	148/1057 (14)	72 (49)	13 (8.8)	32 (21.6)	31 (21)	0.061
Receipt of HIV medical care in previous 6 months	475/531 (89)	335 (71)	41 (9)	32 (7)	67 (14)	0.005
Knowledge of CD4 count	365/531 (69)	254 (70)	32 (9)	25 (7)	54 (15)	0.587
Knowledge of viral load	292/529 (55)	212 (73)	24 (8)	18 (6)	38 (13)	0.096

Table 5.2. Additional Factors Included in Model

Interval covariates included in model, Mean** years **(SD)				
	N	Stably housed	Unstably housed	P value
Age	1060	43.95 (7.87)	42.70 (8.29)	0.012
Years with study partner	1059	7.51 (6.93)	6.13 (5.95)	0.000
Years known HIV + *	520	9.48 (5.33)	8.40 (5.72)	0.036

*Strictly for participants with known positive HIV serostatus

Table 5.3. Descriptive Statistics of Additional Factors Included in the Model

Characteristic	Mean	SD	P
Age, Years			
Stably housed	43.95	7.87	-
Living with family	41.19	8.91	0.013
Living with partner	42.73	8.04	0.064
Living with other	43.62	8.09	0.634
Years with study partner			
Stably housed	7.51	6.93	-
Living with family	5.98	5.26	0.033
Living with partner	6.53	6.36	0.087
Living with other	5.76	5.89	0.003
Years known HIV seropositive*			
Stably housed	9.48	5.33	-
Living with family	8.17	6.04	0.122
Living with partner	7.06	5.46	0.006
Living with other	9.24	5.58	0.725

Table 5.4. Bivariate Analysis—Dichotomized Housing Variable

Bivariate Analysis / Mental Health – Dichotomized Housing Variable				
	Full sample	Stably Housed	Unstably Housed	P Value
Depression	192/1063 (18)	100 (52)	92 (48)	0.135
Trauma	99/1059 (9)	54 (55)	45 (45)	0.613
Quality of life (*Fair,Poor)*	188/1063 (18)	92 (49)	96 (51)	0.015
Rating of current quality of life (1-4)	115/1059 (11)	50 (43)	65 (57)	0.002
Plans (rating) of future quality of life (1-4)	31/1060 (3)	13 (42)	18 (58)	0.088
Missed medications	275/421 (65)	201 (73)	74 (27)	0.032
Last time missed medications				
- Never missed medications	146 (35)	92 (63)	54 (37)	0.205
- More than 3 months ago	44 (10)	30 (68)	14 (32)	
- Between 1 – 3 months ago	42 (10)	34 (81)	8 (19)	
- 3 – 4 weeks ago	38 (9)	29 (76)	9 (24)	
- 1 – 2 weeks ago	49 (12)	37 (76)	12 (24)	
- Within the past week	102 (24)	71 (70)	31 (31)	

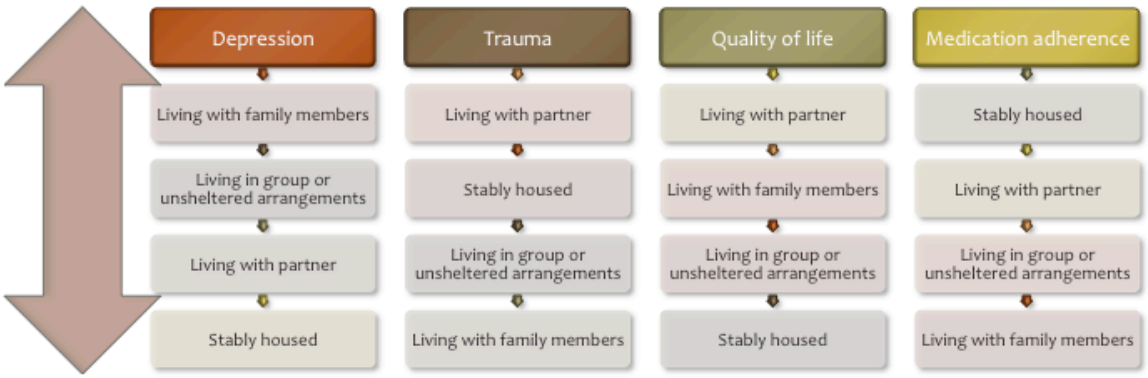
Table 5.5. Bivariate Analysis—Multiple Housing Groups

Bivariate Analysis / Mental Health						
	Full Sample	Stably Housed	Unstably Housed			*P* Value
			Living with Family	Living with Partner	Living with Other	
Depression	192	100 (52)	26 (14)	29 (15)	37 (19)	0.060
Trauma	99	54 (55)	9 (9)	19 (19)	17 (17)	0.920
Quality of life *(Fair, poor)*	188	92 (49)	25 (13)	37 (20)	34 (18)	0.076
Rating of current quality of life (1-4)	115	50 (43)	18 (16)	20 (17)	27 (23)	0.002
Plans (rating) of future quality of life (1-4)	31	13 (42)	4 (13)	5 (16)	9 (29)	0.144
Missed medications	275	201 (73)	20 (7)	21 (8)	33 (12)	0.124
Last time missed medications						
- Never missed medications	146	92 (63)	17 (11)	11 (8)	26 (18)	0.366
- More than 3 months ago	44	30 (68)	1 (2)	6 (14)	7 (16)	
- Between 1 – 3 months ago	34	34 (81)	3 (7)	2 (5)	3 (7)	
- 3 – 4 weeks ago	38	29 (76)	1 (3)	4 (11)	4 (11)	
- 1 – 2 weeks ago	49	37 (76)	5 (10)	1 (2)	6 (12)	
- Within the past week	102	71 (70)	10 (10)	8 (8)	13 (13)	

Table 5.6. Adjusted Ratios for Outcome Variables

	Depression		Trauma		Quality of life[a]		Medication adherence[a]	
Model Factors	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Housing Group								
Live family	1.38	.60, 3.18	.61	.17, 2.19	1.42	.85, 2.39	.76	.32, 1.81
Live partner	1.01	.46, 2.26	1.18	.45, 3.08	1.43	.91, 2.21	.90	.37, 2.20
Live other	1.27	.57, 2.83	.73	.23, 2.29	1.38	.85, 2.24	.89	.40, 1.95
Living with…								
Spouse	.62	.34, 1.12	.60	.26, 1.36	**1.51	1.06, 2.15	1.14	.66, 1.98
Your own (or other's) children	.77	.39, 1.49	1.03	.40, 2.66	1.32	.90, 1.92	1.22	.65, 2.26
Parents	1.15	.46, 2.85	.68	.15, 3.10	1.32	.76, 2.29	1.53	.59, 3.92
Sibling(s)	1.29	.50, 3.35	.30	.03, 2.71	.79	.41, 1.51	1.91	.67, 5.43
Other relatives	.79	.32, 1.94	1.22	.38, 3.90	1.38	.80, 2.36	.85	.35, 2.07
Roommate	.93	.32, 2.67	.99	.24, 4.16	.99	.54, 1.84	1.07	.35, 3.20
Nonspouse sex partner	.75	.29, 1.91	1.75	.58, 5.31	1.44	.86, 2.39	*2.03	.89, 4.62
Supervised living arrangement	.96	.22, 4.30	1.03	.14, 7.24	1.28	.52, 3.14	.62	.12, 3.11
Other(s)	.26	.04, 1.59	*5.10	.91, 28.30	1.25	.47, 3.31	.43	.09, 1.86
Sociodemographic								
Gender	1.47	.84, 2.57	1.61	.72, 3.61	.87	.63, 1.21	1.36	.80, 2.32
Age	.99	.96, 1.02	1.00	.95, 1.04	1.00	.98, 1.02	.99	.96, 1.02
Education	.77	.44, 1.34	1.20	.56, 2.61	1.03	.75, 1.41	.74	.44, 1.22
Income	***2.36	1.15, 4.84	1.40	.53, 3.74	1.15	.80, 1.66	*1.62	.93, 2.83
Employment	1.71	.87, 3.37	1.35	.54, 3.41	**1.48	1.04, 2.12	*.56	.30, 1.03
Insurance	.88	.48, 1.61	1.33	.59, 2.97	*1.33	.94, 1.87	.64	.32, 1.25
Married to study partner	.73	.41, 1.28	.79	.37, 1.70	**1.47	1.04, 2.08	.76	.44, 1.27
Individual								
Dependents	1.38	.73, 2.64	1.56	.65, 3.77	.99	.69, 1.41	1.06	.56, 2.00
HIV +	1.13	.67, 1.91	.90	.44, 1.83	1.07	.78, 1.46	1.37	.10, 18.60
STI +	1.21	.63, 2.32	.53	.21, 1.37	1.32	.86, 2.00	*.54	.27, 1.07
Alcohol dependent	***2.55	1.38, 4.69	.64	.27, 1.35	.94	.61, 1.47	1.03	.55, 1.90
Drug dependent	1.41	.76, 2.63	**2.22	1.00, 4.92	***1.85	1.21, 2.81	*1.82	.96, 3.44
Incarceration history	.63	.37, 1.08	1.44	.68, 3.07	*1.34	.95, 1.82	1.19	.71, 1.98
Inpatient drug treatment history	1.08	.63, 1.85	1.34	.66, 2.72	.85	.62, 1.15	**1.65	1.01, 2.68
Depression	-	-	***21.92	10.88, 44.14	***2.06	1.33, 3.21	*.55	.27, 1.07
Trauma	***21.76	10.82, 43.74	-	-	**1.99	1.11, 3.59	1.71	.69, 4.24

Figure 5.5. Ordered Risk for Housing Groups



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CHAPTER 6

CONCLUSION

In each of the manuscripts, housing instability as an exposure factor was evaluated for its effect on sexual risk, substance abuse, and mental health outcomes. In each evaluation, assessments were made regarding 1) if housing instability was associated with risk; 2) a potential housing continuum, where a level of individual housing instability may lead to greater risk; and 3) who persons lived with and if, in turn, there was less or greater risk exhibited by each participant.

Housing Instability as a Continuum

Regarding the continuum, it was hypothesized that persons who were stably housed would exhibit the least amount of risk for all outcomes. Stably housed persons were those who lived in their own home or apartment, and regardless of if others lived there as well, this individual considered the housing space to be his or hers. In this study, persons who owned or lived in a space with a spouse may consider the home to be his or hers, but for persons who did not consider the space to be theirs for any reason—such as financial or relationship dynamics—a choice was available for persons to ascribe to living with his or her partner in *their* space (i.e. third level of risk).

Secondly, those who lived with family members (parents, siblings, children) were expected to exhibit less risk due to the stability of their housing situation. While it may not be ideal for a person to live with a parent, sibling or other family member at the

mean age for these participants (43 years), it may still provide comfort and stability to know that your family members will not suddenly or immediately ask you to vacate the premises outside of dire circumstances (such as their own eviction, crime, or drug use).

Third, those who lived with a partner (spouse or non-spouse sexual partner) were hypothesized to exhibit the third level of risk because they may do what is asked or required by the partner, regardless of the known risk. For instance, a person may have unprotected sex because his or her partner wants to, although they personally know that doing such may place them in risk of HIV or STIs. An individual may feel compelled to do what is asked or required by the partner in order to maintain secure housing, and subsequently place themselves at greater risk.

Lastly, according to this hypothesis, the riskiest group would be those living in group or unsheltered accommodation. This group is comprised of persons who live in someone else's home or apartment (who are not related), in a rooming house or single room hotel, in welfare-type living arrangements, in a group home or institution, or who are homeless with no regular place to live. This group is most at risk for all behaviors because they experience the greatest level of uncertainty regarding their living situation. As such, they may be housed transitionally, for 1 – 7 days if in a shelter, or live unsheltered.

Living with Particular Cohabitants

This study also evaluated outcomes against who persons lived with and the protective or potentially harmful effects of such. Nine groups were evaluated: spouse, non-spouse sex partner, siblings (one or more brothers and/or sisters), one or both parents, children (your own children or other person's children), other relatives (i.e.

aunts, uncles, grandparents), roommates (non-related, non-sex partners), other persons (non-relatives, but generally in group environments), or in supervised living arrangements. The questionnaire also asked if a person lived with a foster parent or family; however, there was only 1 participant who answered affirmatively and the data was omitted from analysis. The study's hypothesis claimed that living with particular persons for each outcome may influence risk, and that there would be observed differences between groups.

Sexual Risk: Summarized Findings

Differences observed and study conclusions are shown in Table 6.1. Compared to housed respondents, unstably housed participants had greater odds of: having unprotected sex with a known-status partner, being STI positive, and having concurrent partners. Contrary to previous literature, persons who were stably housed were more likely to be HIV seropositive, but this result was more likely due to the fact that an over propensity of women were HIV positive. In our sample, 60% of those who were HIV positive were women, and 65% of women were stably housed. When the HIV-model included a 'gender and housing status' interaction, women in 'group or unsheltered accommodation' status were twice as likely to be HIV positive than those who were stably housed.

In multivariate analysis, the relationship between housing status and partner concurrency was also steered by gender. Though model-adjusted statistics were not significant, when males and females were evaluated separately, women were more likely to have concurrent partners, especially when stably housed or living in group or unsheltered living arrangements. The unadjusted odds ratio revealed women living in

group or unsheltered living arrangements were 2.4 times more likely to be in concurrent relationships than women who were stably housed.

Women were also at greater risk for unprotected sex. After controlling for HIV-risk covariates, women were twice as likely when living with a partner or in an unsheltered condition to have unprotected sex than unstably housed men. Consequently, in line with previous literature, women are more at risk for HIV sexual risk behaviors—especially when unstably housed.

Substance Abuse: Summarized Findings

Differences observed and study conclusions are shown in Table 6.2. Similar to previous literature, our findings suggest that unstably housed persons are more likely to use specific drugs, be alcohol dependent, drug dependent, and have previous incarceration or drug treatment histories. In multivariate logistic regression modeling, no housing groups or cohabitants were statistically significant in models for alcohol dependence, drug dependence, or recent incarcerations; however, for recent inpatient drug treatment history, persons living with parents were less likely to be in inpatient treatment while living with a roommate increased the likelihood to 3.56 times that of stably housed participants. Significant covariates in the substance use models included all demographic factors (gender, education, income, insurance, married to study partner) and HIV positive serostatus was associated with nearly twice the likelihood of drug dependence, recent incarceration, and inpatient drug treatment within the past 3 months.

This research aims to establish a housing continuum across four housing groups that may estimate risk. For the group hypothesized to be the most at risk, persons living

in ‘other’ arrangements (group or unsheltered accommodations) were nearly 2 times more likely to use other illegal drugs, were 42% less likely to use heroin, and were 2 times more likely to use injecting drugs than stably housed participants. Within this trial, persons living in group or unsheltered accommodations were more likely to use drugs like cocaine, methamphetamines, crack cocaine, and injecting drugs than stably housed persons. Compared to their unstably housed counterparts, persons in group or unsheltered accommodations were also 2.85 times more likely than persons living with family to use other illegal drugs and 2 times more likely than persons living with a partner to use other illegal drugs. Equally, persons living in group or unsheltered accommodations were 1.75 times more likely to use injecting drugs than persons living with family members and 2.29 times more likely than persons who lived with a partner for injecting drug use.

Limitations of our research include that a majority of participants were recruited through AIDS service organizations and clinic-based care. Consequently, many are actively engaged in HIV/AIDS treatment, and while receiving those services, clinicians may directly refer substance abusers to inpatient drug treatment and/or may notice signs or symptoms of drug or alcohol dependence within their continuum of care. As such, our results may not be generalizable to persons who do not receive treatment or may need to depend on other internal or external support to aid in receipt of HIV and substance use care.

Secondly, many drug treatment programs offer transitional housing to its participants if sobriety is exercised; these findings may contribute to the growing body of literature that states provision of housing is most important to better health outcomes.

Therefore, it may prove more important for beneficial physical and psychological health to provide transitional housing to persons who have temporary relapses in sobriety.

Mental Health: Summarized Findings

Differences observed and study conclusions are shown in Table 6.3. Stably housed persons are least likely to be depressed; persons living with sex partners (spouse/non-spouse) and children were less likely to be depressed; persons living with parents, siblings are more likely to be depressed; persons who are traumatized, alcohol dependent, and with a lower income are more likely to be depressed. Persons living with family are the least likely to experience trauma; similarly, those living with siblings, spouse, and parents are less likely to experience trauma. Among housing groups, 18% of persons living with a partner are more likely to experience trauma, though this result is statistically insignificant. As expected, trauma is highly linked with depression, with persons who are depressed being 22 times more likely to have been traumatized. Quality of life followed similarly with trauma. Persons living with sex partners (especially a spouse) were more likely to have lower quality of life, although this result may be affected by other persons who contribute to individual household composition as well (i.e. also live with children, other relatives, parents in the same household). Persons who were unemployed and not married to their study partner were 1.5 times more likely to experience lower quality of life. Also, persons who were drug dependent, traumatized, and depressed were nearly twice as likely to experience lower quality of life. Those who lived in supervised or group living arrangements were less likely to be medically non-adherent, while persons living with close family members and sex partners were nearly twice as likely to be medically non-adherent. Interestingly, 65% of

persons with a recent inpatient drug treatment history were more likely to be medically non-adherent. This may be due to inpatient drug treatment programs having stringent processes to keep persons on their ART regimen and upon release, persons may find it difficult to immediately maintain in addition to illegal drug abstinence; or conversely, while in drug treatment, a course may be to not take any substances at all (prescribed or unprescribed medications).

Living with persons that you have sex with or children may be protective against depression; however, living in situations where you are housed in a parent's or sibling's home may cause greater likelihood of depression. In clinical assessments, practitioners should assess trauma and depression together since they are so closely tied. Persons can live with more than one person—the questionnaire asked persons to select all that apply. Therefore, persons may live with a spouse, children, parents and while it is beneficial to take each of these groups and view them collectively, it may be necessary to group a complete household and view the data from that perspective.

Previous research shows that persons need close social support to maintain medication adherence, and generally, close family members (spouse, parents, children) are engaged to help the seropositive person prescribe to treatment. This data shows that more research should be initiated because the lines of support may be murky or not appropriately delineated, since persons who are medically non-adherent are those living with close family members.

Limitations

Limitations within this research include that this is a cross-sectional view of housing instability; thus, we cannot measure temporal precedence and have limited

understanding of covariation of cause and effect. Due to the fact that we have no longitudinal data that points to housing stability or instability prior to the observed outcomes (i.e. HIV onset), we are unable to speak definitively regarding causality. Also, our data evaluated one housing timepoint. Without additional timepoints, we are unable to measure the effects of transience and movement—whether it is the participant in and out of stability or cohabitants who may greatly affect the housing environment and social support for the index participant. Additional timepoints and qualitative measures may provide key data for forced relocations (as done in most major cities for HOPWA and Housing Choice). Lastly, we utilized self-report data for exposure and outcome variables. Participants may have reported information as they anticipated researchers or data collection personnel to expect or provided answers to questions based upon what was considered socially acceptable.

Future Research

While current research may provide understanding to housing interventionists and service providers for barriers to care for PLHA and the unstably housed community, further research should include longitudinal or qualitative data to give better insight on housing situations—including with whom a person lives and the quality of each of those relationships—to assess against each outcome variable. Such evidence may exponentially increase the knowledge base in the literature, and shed insight on best practices for future housing interventions.

Table 6.1. Housing Instability and Sexual Risk: Summarized Findings

Observations	HIV Status	STI Status	Partner Concurrency	Unprotected Sex
Housing group	Null rejected, there are statistically significant differences observed among housing groups	Null rejected, there are statistically significant differences observed among housing groups	Null accepted, there are no statistically significant differences observed among housing groups	Null rejected, there are statistically significant differences observed among housing groups
Housing group continuum	Order: • Stably housed, • Live with other, • Live with family, • Live with partner Did not follow hypothesized order	Order: • Live with partner, • Live with other, • Stably housed, • Live with family Did not follow hypothesized order	Order: • Live with family, • Stably housed, • Live with partner, • Live with other Did not follow hypothesized order	Order: • Live with family, • Live with other, • Stably housed, • Live with partner Did not follow hypothesized order
Cohabitants	Order: • supervised living arrangement, • other, • spouse, • siblings, • children, • non-spouse sex partner, • other relatives, • parents, • roommate	Order: • supervised living arrangement, • non-spouse sex partner, • children, • roommates, • other relatives, • parents, • siblings, • spouse, • other	Order: • other, • roommates, • siblings, • supervised living arrangement, • parents, • children, • non-spouse sex partner, • other relatives, • spouse	Order: • siblings, • non-spouse sex partner, • spouse, • children, • other, • roommates, • other relatives, • parents, • supervised living arrangement
Significant covariates	Employment, gender, insurance, drug dependence, incarceration history, inpatient drug treatment history	Gender	Age, employment, married to study partner, drug dependence, years with study partner	Age, employment, drug dependence, incarceration history, HIV+
Explanation? Reasons seen in dataset?	Amongst housing groups, stably housed persons were most at risk for HIV. This may be due to the fact that women comprised 60% of seropositives and 65% of stably housed. Though theory may suggest women to be the most at risk, women in our sample may have known their status longer and utilized resources available to HIV+ persons more readily than others (i.e. accessed housing, disability income, healthcare opportunities).	Persons living with family are the least likely to be STI-positive—however, living with a partner generates increased risk. Conversely, amongst cohabitants, living with a spouse is lower among risk, yet living with a non-spouse sex partner may generate more concern. Gender is the only statistically significant covariate that leads to 8 times increased STI risk for women.	Persons who lived with family were more likely to have concurrent relationships, although no housing groups were statistically significant when both genders were evaluated together. When separated, women were twice as likely to have concurrent relationships than men.	Those who lived in supervised or group living arrangements were more likely to have unprotected sex—second only to those living with close family members. Among cohabitants, living with siblings was the group most at risk; potentially, those who live with family members (siblings) have to locate unconventional or unsafe places to have sex, or may have it in a rushed manner. Also, when a housing and gender interaction variable was added to the model, women who lived with her partner were 3.6 times more

				likely to have unprotected sex. Covariates include HIV status, drug dependence, and incarceration history.
Implications and future research?	Women may still be at greater risk for HIV seroposivity and should receive additional preventive services.	Women may still be at greater risk for STI-positive status and should receive additional preventive services.	Women may still be at greater risk for partner concurrency and should receive additional preventive services.	As with other sexual risk outcomes, women may still be at greater risk for unprotected sex and should receive additional preventive services.

Table 6.2. Housing Instability and Substance Abuse: Summarized Findings

Observations	Alcohol Dependence	Drug Dependence	Incarcerated	Inpatient Drug Treatment
Housing group	Null accepted, there are no statistically significant differences observed among housing groups	Null accepted, there are no statistically significant differences observed among housing groups	Null accepted, there are no statistically significant differences observed among housing groups	Null accepted, there are no statistically significant differences observed among housing groups
Housing group continuum	Order: • Live with partner, • Live with other, • Live with family, • Stably housed Did not follow hypothesized order, although stably housed were least at risk; none significant	Order: • Live with family, • Stably housed, • Live with partner, • Live with other Did not follow hypothesized order; none significant	Order: • Live with partner, • Stably housed, • Live with other, • Live with family Did not follow hypothesized order; none significant	Order: • Live with family, • Live with other, • Live with partner, • Stably housed Did not follow hypothesized order; none significant
Cohabitants	Order: • siblings, • parents, • supervised living arrangement, • other, • spouse, • children, • non-spouse sex partner, • roommate, • other relatives	Order: • other relatives, • spouse, • roommate, • siblings, • supervised living arrangement, • non-spouse sex partner, • parents, • children, • other	Order: • supervised living arrangement, • parents, • roommate, • children, • non-spouse sex partner, • other relatives, • siblings, • spouse, • other	Order: • roommate, • other, • supervised living arrangement, • spouse, • children, • siblings, • other relatives, • non-spouse sex partner, • parents
Significant covariates	Drug dependence, depression, education	Alcohol dependence, inpatient drug treatment history, HIV+	Depression, trauma, drug dependence, employment, married to study partner	Incarceration history, drug dependence, income, HIV+, education, age
Explanation? Reasons seen in dataset?	Amongst housing groups, stably housed persons are least likely to be alcohol dependent. Living with siblings, parents persons living with sex partners (spouse/non-spouse) and children were less likely to be depressed; persons living with parents, siblings are more likely to be depressed; persons who are traumatized, alcohol dependent, and with a lower income are more likely to be depressed	Persons living with family are the least likely to experience trauma; similarly, those living with siblings, spouse, and parents are less likely to experience trauma. Among housing groups, 18% of persons living with a partner are more likely to experience trauma, though this result is statistically insignificant. As expected, trauma is highly linked with depression, with persons who are depressed being 22 times more likely to have been traumatized.	Quality of life followed similarly with trauma. Persons living with sex partners (especially a spouse) were more likely to have lower quality of life, although this result may be affected by other persons who contribute to individual household composition as well (i.e. also live with children, other relatives, parents in the same household). Persons who were unemployed and not married to their study partner were 1.5 times more likely to experience lower quality of life. Also,	Those who lived in supervised or group living arrangements were less likely to be medically non-adherent, while persons living with close family members and sex partners were nearly twice as likely to be medically non-adherent. Interestingly, 65% of persons with a recent inpatient drug treatment history were more likely to be medically non-adherent. This may be due to inpatient drug treatment programs having stringent processes to keep persons on their ART regimen

			persons who were drug dependent, traumatized, and depressed were nearly twice as likely to experience lower quality of life.	and upon release, persons may find it difficult to immediately maintain in addition to illegal drug abstinence; or conversely, while in drug treatment, a course may be to not take any substances at all (prescribed or unprescribed medications).
Implications and future research?	Living with persons that you have sex with or children may be protective against depression; however, living in situations where you are housed in a parent's or sibling's home may cause greater likelihood of depression.	In clinical assessments, practitioners should assess trauma and depression together since they are so closely tied.	Persons can live with more than one person—the questionnaire asked persons to select all that apply. Therefore, persons may live with a spouse, children, parents and while it is beneficial to take each of these groups and view them collectively, it may be necessary to group a complete household and view the data from that perspective.	Previous research shows that persons need close social support to maintain medication adherence, and generally, close family members (spouse, parents, children) are engaged to help the seropositive person prescribe to treatment. This data shows that more research should be initiated because the lines of support may be murky or not appropriately delineated, since persons who are medically non-adherent are those living with close family members.

Table 6.3. Housing Instability and Mental Health: Summarized Findings

Observations	Depression	Trauma	Quality of life	Medication adherence
Housing group	Null accepted, there are no statistically significant differences observed among housing groups	Null accepted, there are no statistically significant differences observed among housing groups	Null accepted, there are no statistically significant differences observed among housing groups	Null accepted, there are no statistically significant differences observed among housing groups
Housing group continuum	Order: • Live with family, • Live with other, • Live with partner, • Stably housed Did not follow hypothesized order; none significant	Order: • Live with partner, • Stably housed, • Live with other, • Live with family Did not follow hypothesized order; none significant	Order: • Live with partner, • Live with family, • Live with other, • Stably housed Did not follow hypothesized order; none significant	Order: • Stably housed, • Live with partner, • Live with other, • Live with family Did not follow hypothesized order; none significant
Cohabitants	Order: • siblings, • parents, • supervised living arrangement, • roommate, • other relatives, • children, • nonspouse sex partner, • spouse, • other	Order: • other, • nonspouse sex partner, • other relatives, • supervised living arrangement, • children, • roommate, • parents, • spouse, • siblings	Order: • spouse, • nonspouse sex partner, • other relatives, • children, • parents, • supervised living arrangement • other, • roommate, • siblings	Order: • nonspouse sex partner, • siblings, • parents, • children, • spouse, • roommate, • other relatives, • supervised living arrangement, • other
Significant covariates	Trauma, alcohol dependence, income	Depression, drug dependence	Depression, trauma, drug dependence, employment, married to study partner	Inpatient drug treatment history
Explanation? Reasons seen in dataset?	Stably housed persons are least likely to be depressed; persons living with sex parners (spouse/nonspouse) and children were less likely to be depressed; persons living with parents, siblings are more likely to be depressed; persons who are traumatized, alcohol dependent, and with a lower income are more likely to be depressed	Persons living with family are the least likely to experience trauma; similarly, those living with siblings, spouse, and parents are less likely to experience trauma. Among housing groups, 18% of persons living with a partner are more likely to experience trauma, though this result is statistically insignificant. As expected, trauma is highly linked with depression, with persons who are depressed being 22 times more likely to have been	Quality of life followed similarly with trauma. Persons living with sex partners (especially a spouse) were more likely to have lower quality of life, although this result may be affected by other persons who contribute to individual household composition as well (i.e. also live with children, other relatives, parents in the same household). Persons who were unemployed and not married to their	Those who lived in supervised or group living arrangements were less likely to be medically non-adherent, while persons living with close family members and sex partners were nearly twice as likely to be medically non-adherent. Interestingly, 65% of persons with a recent inpatient drug treatment history were more likely to be medically non-adherent. This may be due to inpatient drug treatment programs having stringent processes to

		traumatized.	study partner were 1.5 times more likely to experience lower quality of life. Also, persons who were drug dependent, traumatized, and depressed were nearly twice as likely to experience lower quality of life.	keep persons on their ART regimen and upon release, persons may find it difficult to immediately maintain in addition to illegal drug abstinence; or conversely, while in drug treatment, a course may be to not take any substances at all (prescribed or unprescribed medications).
Implications and future research?	Living with persons that you have sex with or children may be protective against depression; however, living in situations where you are housed in a parent's or sibling's home may cause greater likelihood of depression.	In clinical assessments, practitioners should assess trauma and depression together since they are so closely tied.	Persons can live with more than one person—the questionnaire asked persons to select all that apply. Therefore, persons may live with a spouse, children, parents and while it is beneficial to take each of these groups and view them collectively, it may be necessary to group a complete household and view the data from that perspective.	Previous research shows that persons need close social support to maintain medication adherence, and generally, close family members (spouse, parents, children) are engaged to help the seropositive person prescribe to treatment. This data shows that more research should be initiated because the lines of support may be murky or not appropriately delineated, since persons who are medically non-adherent are those living with close family members.