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Hiwote Solomon Date

Housing Instability, Depression and HIV Viral Load among Young Black Men Who Have Sex with Men in Atlanta, GA

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By

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Bachelor of Arts
Boston College
2013

Thesis Committee Chair:
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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Health
2017

# Abstract

Housing Instability, Depression, and HIV Viral Load among Young Black Men Who Have Sex with Men in Atlanta, GA

By Hiwote Solomon

**Background:** Housing instability is common among sexual minority youth. Prior research suggests psychological distress may mediate the association between housing instability and poor HIV-related outcomes, but this hypothesis remains underexplored.

**Objectives:** 1) Assess the cross-sectional relationship between housing instability and achieving an undetectable HIV-1 viral load (VL) in a sample of young black men who have sex with men (YBMSM) in Atlanta, GA. 2) Assess whether depression mediated this relationship.

**Methods:** We surveyed 81 HIV-infected YBMSM [mean age=22 years (SD=1.5)] recruited from a single HIV clinic in Atlanta, GA. Housing instability was defined as a dichotomous variable (no moves in the past months vs. at least one residential move in the past 6 months). Depression was defined as a score of ≥16 on the Center for Epidemiologic Studies-Depression Revised version (CESD-R) scale. Undetectable VL was defined as ≤ 40 copies/mL.

**Results:** Among the sample, 65% of YBMSM achieved undetectable VL; 55.6% reported housing instability; and 46.9% reported depression. Housing instability was significantly associated with both depression (Adjusted Odds Ratio (AOR)=2.74, 95% CI: 1.1-6.806) and HIV VL detectability (AOR=2.8, 95% CI: 1.05-6.47). When depression was included in the model as a mediator, the association between housing instability and HIV VL detectability was no longer significant (AOR=2.149, 95% CI 0.76-6.01).

**Conclusion:** This pilot study suggests that psychological distress may partially mediate the inverse association between housing instability and undetectable VL among HIV-infected YBMSM. In addition to structural interventions that ensure housing stability, increasing utilization of mental health services among HIV-infected-unstably housed people may improve HIV outcomes in this high-risk population.

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I would also like to thank my personal support network: my parents, Azeb Tefera and Solomon Woldemariam, my sister Gete Solomon, and my friends near and far for their continued patience and encouragement during this process. Special thanks to Ruth Tesfaye and Aasli Abdi Nur for your constant emotional support, and, to my aunt and uncle, Genet Tefera and Mulat Semu, who graciously opened their home to me whenever I needed an escape these past two years.

Lastly, a deep heartfelt thank you to the Grady IDP Clinic and the men who participated in this research study and allowed us a glimpse into their world.

***

**"Decent, affordable housing should be a basic right for everybody in this country. The reason is simple: without a stable shelter, everything else falls apart."**
-Matthew Desmond, *Eviction: Poverty and Profit in the American City*

## TABLE OF CONTENTS

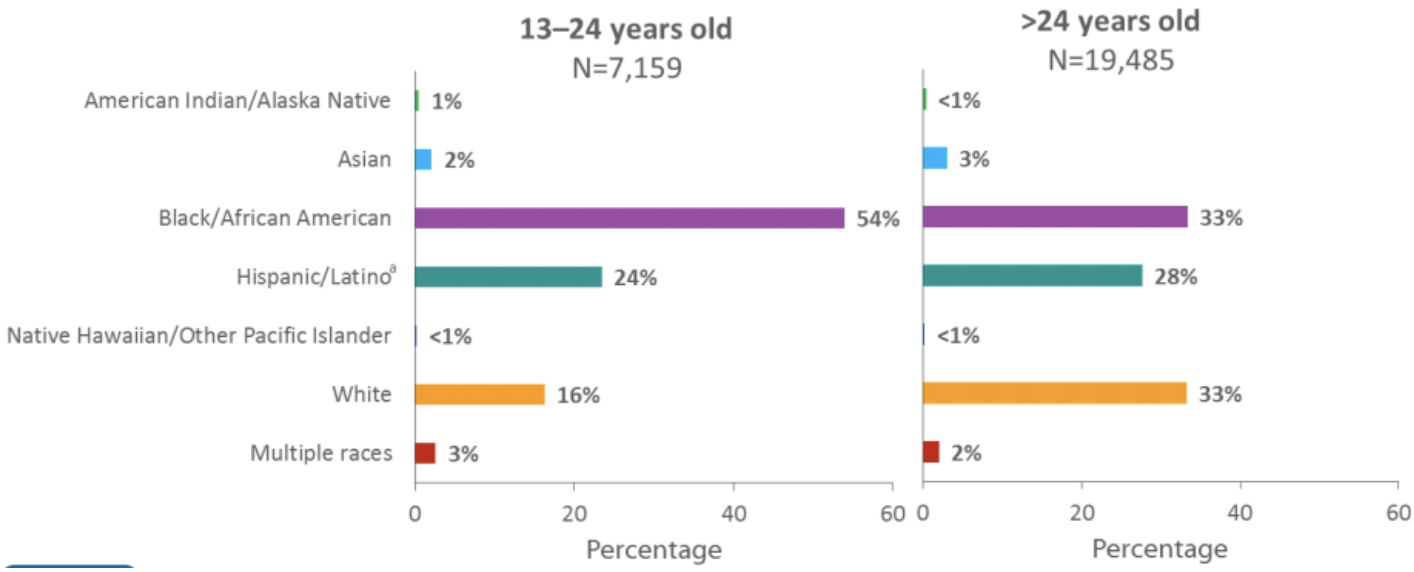
# CHAPTER I: Introduction

Men who have sex with men (MSM) bear a higher burden of human immunodeficiency virus (HIV) than any other group in the United States (U.S.).[1] In 2013, MSM represented approximately 2% of the population but accounted for 55% of people living with HIV (PLWH).[1] When stratifying by race and age, young Black men who have sex with men (YBMSM) make up a disproportionate number of new cases of HIV in the U.S.[2-5] In 2015, 38% of Black gay and bisexual men who received an HIV diagnosis were between 13 and 24 years of age.[6] From 2005 to 2014, HIV diagnoses among YBMSM in this age range increased 87%, even though the number of HIV diagnoses declined for Black Americans as a whole during this same time period.[6] Figure 1 illustrates the impact of HIV on young MSM, especially among Blacks in the United States and 6 dependent areas (American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, the Republic of Palau, and the U.S. Virgin Islands).[6, 7] While there are no definitive answers to explain why HIV infections are increasing in this population, socioeconomic and structural barriers faced by MSM, specifically Black MSM, have been explored by researchers as potential contributors to the increased risk of HIV infection in this population.[1-3, 8-14]

Black MSM have a higher chance of being exposed to HIV compared with MSM of other races.[15] This disparity is exacerbated by the large number of Black MSM, who are unaware of their HIV infection, making them less likely to seek medical care and more likely to unknowingly transmit the virus.[1, 5] In 2008, of 8,153 MSM tested for HIV during a Centers for Disease Control and Prevention (CDC) study aimed at estimating and monitoring risk behaviors among MSM, 1,562 (19%) tested positive for HIV; among this group 680 (44%) were unaware of their status with 70% of this group being comprised of YBMSM[5]. Prior research indicates that stigma, homophobia, and

discrimination play a large role in impeding willingness to seek care (including HIV testing) and increasing risk for multiple physical and mental health problems.[1,16,17]

*Figure 1.Diagnoses of HIV Infection among Men Who Have Sex with Men, by Age Group and Race/Ethnicity, 2015—United States and 6 Dependent Areas.*[6]



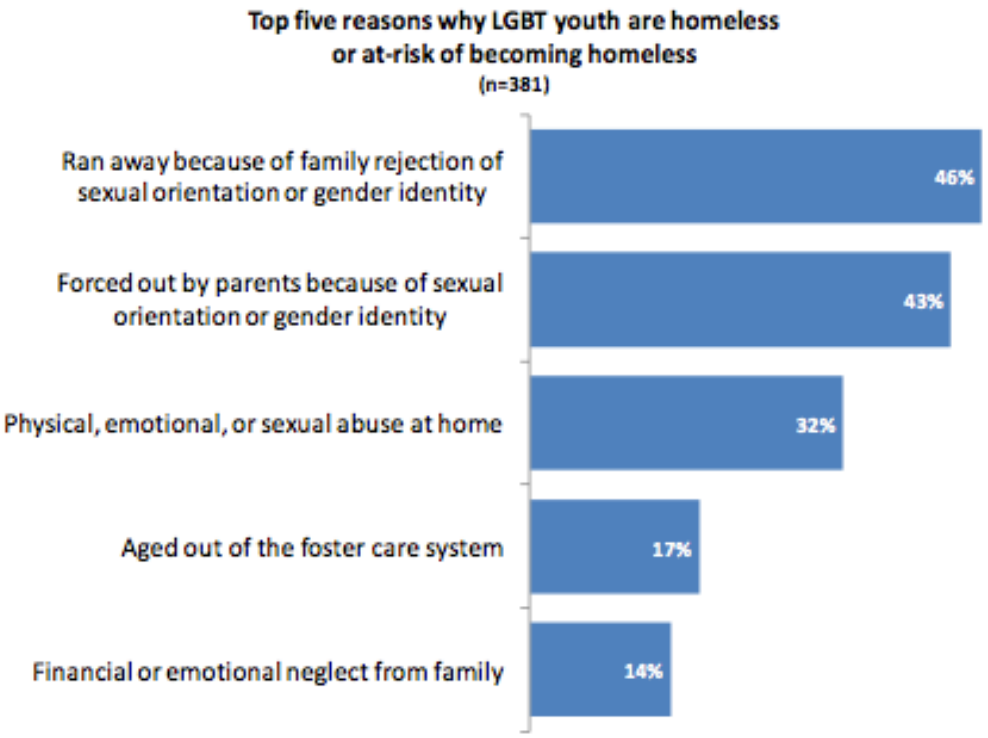

**Source: Centers for Disease Control and Prevention, 2015**

The need to improve HIV prevention and treatment services among YBMSM has been well documented, however, barriers to care engagement continue to influence HIV-related service delivery.[4, 9-12, 14, 18-25] Engagement in HIV care has been conceptualized as a *continuum of care,* with the following stages: (1) being tested for, and diagnosed with HIV; (2) being linked to HIV care; (3) being regularly retained in HIV care; (4) adhering to an antiretroviral therapy (ART) regimen, and (5) achieving HIV viral load (VL) suppression.[26] Each of the first four steps are critical to achieving HIV VL suppression, which is the desired outcome in HIV care.[26, 27] Achieving VL suppression (meaning that the HIV viral level in the blood is below the limit of detection for the laboratory) improves life expectancy to near-normal levels, and essentially

eliminates one's chance of transmitting HIV.[26-28] However, rates of engagement in care are notoriously poor among adolescents and young adults living with HIV, including YBMSM.[29]

Given these disparities and suboptimal clinical outcomes, it is critically important to identify barriers to care engagement among YBMSM. Stigma, homophobia, and discrimination make it difficult for many YBMSM to disclose their sexual orientation to their social networks, including their families, which can lead to negative health outcomes due to increased stress, internalized homophobia, and limited social support.[1, 14, 22] This in turn can lead to unstable housing, which is one of the major sociostructural barriers commonly faced by sexual minority youth, including YBMSM. According to the Williams Institute, 40% of the homeless youth served by agencies across the U.S. identified as lesbian, gay, bisexual or transgender (LGBT).[30] These agencies reported that the top two reasons for homelessness (or risk for homelessness) among their LGBT youth clients were: (1) family rejection on the basis of sexual orientation and/or gender identity; and, (2) being kicked out of their family homes as a result of disclosing their sexual orientation and/or gender identity (Figure 2).[30]

*Figure 2. Top five reasons why LGBT youth are homeless or at-risk of becoming homeless*[30]




**Williams Institute, 2012**

Housing instability has emerged as a consistent and detrimental influence to HIV care in other populations; a significant body of research has shown poorer rates of engagement in care across the continuum among PLWH who are not stably housed.[4, 19, 20, 23-25, 31-33] In the literature addressing housing and health outcomes, two main frameworks have been elicited about the mechanism of housing's impact on health. These are known as the *neo-materialist theory* and the *psychosocial theory*. Neo-materialist theory suggests inequities in the distribution of economic and other resources among populations, effects health and well-being through multiple mechanisms.[34] Specifically, the neo-materialist framework posits housing as a material resource that can provide physical (a place to eat, sleep, wash, etc.), economical (access to employment, quality food, education, etc.), and social (a sense of belonging, social network, etc.) resources.[35] In contrast, the

biopsychosocial framework highlights the influence of "non-material" biological, psychological, and social conditions on disease outcome,[36] which can ultimately interact with macro-level socioeconomic factors (e.g., poverty) among racial/ethnic minorities in particular.[14, 35, 37] The biopsychosocial framework sees housing as more than a material resource and one that has the ability to impact neurologic and metabolic stress.[35 36, 38] For example, those who are living in unstable or sub-standard housing are more likely to be depressed, feel unsafe, experience social rejection, and be disengaged in health care.[24, 25, 31, 35, 37] Additionally, unstably-housed persons living with HIV/AIDS are also more likely to suffer from psychosocial health problems, abuse drugs, be uninsured, and face barriers accessing ART.[19, 21, 33, 35, 39-41]

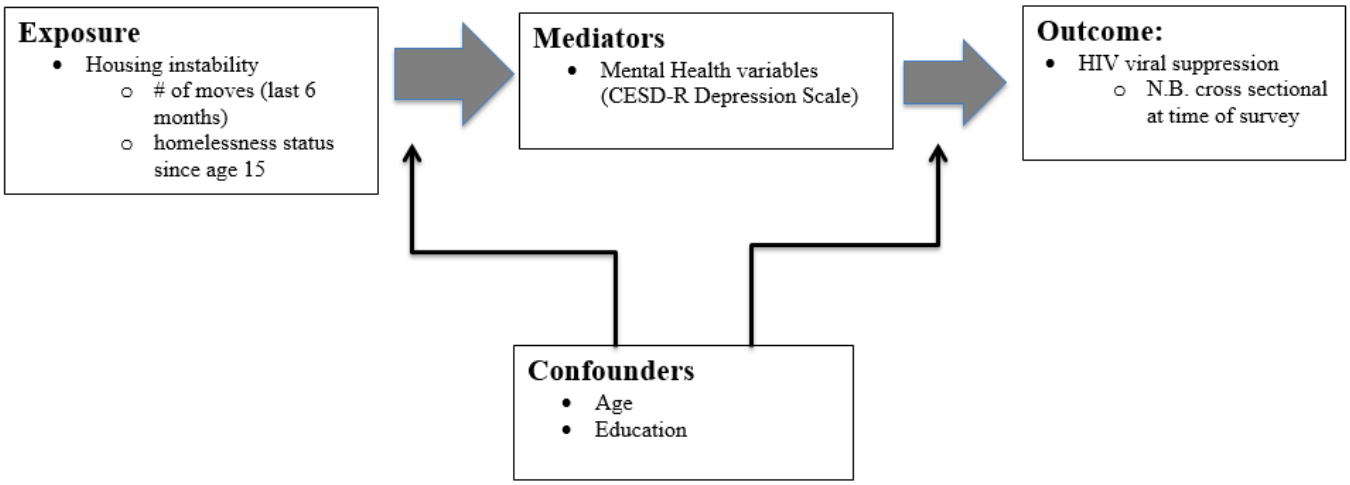
Despite the well-established linkage between housing and achievement of HIV outcomes among PLWH in general, there is a gap in the literature investigating the causal pathways linking housing instability to HIV outcomes specifically among YBMSM. Specificity in the study population is important, as reasons for (and responses to) housing instability may be different in YBMSM compared to other populations (e.g., drug users). Additionally, the role of psychological distress as a potential mediator of the association between housing instability and poor HIV-related outcomes, remains underexplored.

The objectives of this study are to:

1. Assess the cross-sectional relationship between housing instability and achieving an undetectable VL in a sample of YBMSM in Atlanta, GA;
2. Assess whether depression mediates this relationship.

We measure two forms of housing instability: moves within the past 6 months and homelessness status since age 15, to capture the effect of two different yet important aspects of housing instability. Frequently moving, or residential instability, can have negative outcomes, especially among children and adolescents.[42] Similarly, adverse childhood experiences (e.g. residential instability or homelessness) has been linked with adult homelessness.[43, 44] This study aims to test the hypothesis that psychosocial processes mediate the impact of housing instability on HIV VL detectability (Figure 3). Guided by the biopsychosocial model, we focus on housing as more than a material resource, and conceptualize it as something that can modify health behaviors and lifestyles and biological processes, by influencing mental health.

*Figure 3. Conceptual Framework*



# CHAPTER II: Literature Review

## Housing and HIV

The impact of unstable housing on HIV-related outcomes has been extensively studied. In a systematic review of the literature concerning housing and HIV, Aidala & Sumartojo explore how recent literature has moved from focusing on the influence of community housing conditions on population health to viewing homeless persons as a special risk group, and analyses of individual risk factors associated with homelessness and poor health outcomes.[35] However, Aidala & Sumartojo posit, "people are homeless or unstable housed not simply because of their individual traits or characteristics, but because of a confluence of interacting environmental influences. The same "fundamental causes" put persons at risk for both homelessness and HIV infection: economic and political contexts, inequality of opportunities and conditions, social processes of discrimination and exclusion."[35] Thus, unstable housing is influenced by broader economic and political factors, beyond any individual's control.

A study of homeless and marginally-housed people, found that homeless/marginally-housed PLWH were more likely to have inadequate access to ART and sub-optimal treatment outcomes, with seroprevalence of HIV in this population typically 5 to 10 times higher than among housed populations.[21, 45] Using a representative sample of 1,661 persons living in New York City, Aidala et al. found strong evidence for the inverse relationship between housing need and access to appropriate HIV medical care/adherence to medication.[46] The study found persons who were homeless, unstably housed, or experiencing other housing needs were significantly less likely to have had any engagement in HIV medical care in the 6 months prior to interview (adjusted odds ratio (AOR)= 0.74; 95% Confidence Interval (CI): 0.64-0.86).[46] In this same sample, 33% were

marginally housed or homeless with 18% living in unstable, temporary or transitional housing, and 15% homeless, which was defined as sleeping the streets, in a shelter, jail, or halfway house.[46] Similarly, a multi-site study in the U.S. by Kidder et al. found that homeless PLWH were more likely to have CD4+ cell counts below 200 cells/mL (43% vs. 32%, $p<0.001$) and detectable HIV-1 VL (65% vs. 51%, $p<0.001$) compared to non-homeless participants.[31] Similar findings were published by Buchanan et al. where homelessness was a strong predictor of poor health outcomes among HIV- positive homeless inpatients at a public hospital in Chicago (n=105) who were randomized into usual care or permanent housing with intensive case management.[20]

Additionally, the Housing and Health Study, a randomized trial initiated by the CDC and the Department of Housing and Urban Development (HUD) in 2003 to examine the effects of Housing Opportunities for People with AIDS (HOPWA) rental assistance on the health and risk behaviors of homeless and unstably housed PLWH provides more data on the differences in health outcomes among unstably housed persons. [32, 37] Participants (n=630) were recruited across three sites with HOPWA programs (Baltimore, MD; Los Angeles, CA; and Chicago, IL) and randomized to receive either immediate HOPWA rental housing assistance or assistance finding housing through "local standard practice". [32, 37] Participants were then followed for 18 months after baseline, with follow up visits occurring at 6, 12, and 18 months after baseline.[32, 37] Participants were considered to be unstably housed if in the prior 90 days, they were staying temporarily with others or lived in transitional housing, but had not been homeless.[32, 37] Homelessness was defined as sleeping in shelters or places not suitable for human habitation at least once in the 90-day recall period.[32] Homelessness was significantly associated with detectable VL compared to those who did not experience homelessness (79% vs. 61%, $p<0.0001$).[32] The study found that housing status and

some health outcomes improved in both groups, but greater improvement was noted in the immediate assistance group.[32] While limitations of the study (including limited statistical power, greater than expected movement into stable housing in the comparison group, and some delayed housing entry in the treatment group) resulted in inconsistent findings across groups and sites, the study provided additional evidence for the importance of stable housing for health outcomes and the need for interventions for homeless/unstably housed PLWH.[32]

A recent study by Thakarar et al. assessed risk factors associated with incomplete VL suppression in HIV-seropositive patients (n=138) enrolled in a health care program for homeless individuals in Boston, Massachusetts.[23] The primary independent variable was housing status of participants, while the primary outcome variable was HIV viral suppression (defined as VL less than 75 copies/mL).[3,23] Participants were classified as "homeless" if they were living in transitional housing, a shelter, living on the street, or identified their housing status as "other" or "unknown" at the initial visit.[23] Housed participants were those patients who reported living in assisted housing, rest home, nursing home, or housed with or without supportive services.[23] In the multivariable analysis, homeless participants were more likely to have incomplete HIV VL suppression than housed participants (AOR=3.84, 95% CI 1.36-10.86).[23] Of the 89% of housed- and 86% homeless-participants who had been prescribed ART, homeless individuals were more likely to have had incomplete viral suppression (47% vs. 20%, p=0.008).[31] This study further illustrates the importance of stable housing in linkage to care and achieving HIV VL suppression.

## Factors affecting HIV VL

Medication adherence to ART every day and exactly as prescribed has made achieving HIV VL suppression possible for PLWH across the world. Achieving HIV VL suppression is the desired outcome for HIV care with implications for both individual and public health.[26, 27, 47] HIV VL suppression significantly reduces the risk of transmitting the HIV virus to others and improves overall individual health.[26, 47, 48] While the benefits of medication adherence and achieving VL suppression are known, certain social, economic, political, and psychosocial barriers—particularly racial and ethnic disparities-- make this difficult. A recently published study by Feller and Agins, used a "data mining" approach to try and understand underlying factors of racial and ethnic disparities among PLWH.[33] The study looked at 11,419 adult PLWH receiving HIV treatment from 186 New York State HIV clinics in 2013. Among this group, 8885 (77.8%) were virally suppressed.[33] Those with unsuppressed HIV VLs were more like to be under 45 years of age, African-American, lack stable housing, use illicit drugs/acquired infection through intravenous drug use, have a mental disorder, have Medicaid or be uninsured.[33] In contrast, the suppressed individuals were more likely to be older, MSM, self-identify as white or as an Asian or Pacific Islander, be stably housed, and not use illicit drugs during the study period.[33] Unstably housed participants, regardless of history of drug were least likely to be suppressed.[33] This study closely aligns with the results mentioned above by Thakarar et al. where homelessness predicted incomplete HIV VL suppression in the study.[23]

Adherence to medication inherently facilitates VL suppression, but access to HIV care and other confounding factors make it an intricately complex process. Aside from racial and ethnic disparities, structural barriers such as housing and mental health further complicate achieving VL

suppression. A 2009 study by DiIorio et al. used data from a randomized controlled trial which evaluated an intervention to facilitate medication adherence to test a psychosocial model of medication adherence among people on ART. The study, which was primarily made up of Black men, found that self-efficacy and depression were directly associated with adherence.[38] This data again calls for the need to understand and address the various psychosocial factors influencing adherence, and in turn, achieving VL suppression.

Housing instability has emerged as a consistent and detrimental influence to HIV care in other populations; a significant body of research has shown poorer rates of engagement in care across the continuum among PLWH who are not stably housed.[4, 19, 20, 23-25, 31-33] In the literature addressing housing and health outcomes, two main frameworks have been elicited about the mechanism of housing's impact on health. These are known as the *neo-materialist theory* and the *psychosocial theory*. Neo-materialist theory suggests inequities in the distribution of economic and other resources among populations, effects health and well-being through multiple mechanisms.[34] Specifically, the neo-materialist framework posits housing as a material resource that can provide physical (a place to eat, sleep, wash, etc.), economical (access to employment, quality food, education, etc.), and social (a sense of belonging, social network, etc.) resources.[35] In contrast, the biopsychosocial framework highlights the influence of "non-material" biological, psychological, and social conditions on disease outcome, [36] which can ultimately interact with macro-level socioeconomic factors (e.g., poverty) among racial/ethnic minorities in particular.[14, 35, 37] The biopsychosocial framework sees housing as more than a material resource and one that has the ability to impact neurologic and metabolic stress.[35 36, 38] For example, those who are living in unstable or sub-standard housing are more likely to be depressed, feel unsafe, experience social

rejection, and be disengaged in health care.[24, 25, 31, 35, 37] Additionally, unstably-housed persons living with HIV/AIDS are also more likely to suffer from psychosocial health problems, abuse drugs, be uninsured, and face barriers accessing ART.[19, 21, 33, 35, 39-41] Thus, mental health may act as a potential mediator between housing instability among PLWH and HIV VL detectability.

## Mental Health among PLWH

The role of mental health among PLWH has been explored in the literature especially among MSM.[4, 18, 22, 49-51] More generally, depression has been identified as one of the most common co-morbidities of HIV infection, with the prevalence of major depressive disorder among PLWH three times greater than in the general population.[39] Mental health plays a major role in the engagement of care among PLWH. A study by Hussen et al. assessed the influence of psychosocial health problems on engagement in HIV care among HIV-seropositive YBMSM (n=132) recruited at 14 adolescent medicine clinical sites. The study examined background factors which included demographic factors, ethnic identity, sexual orientation identity, identity as a young man living HIV, and psychological distress; self-change processes which included social support and motivational appraisals; and health promoting behaviors and health outcomes which included linkage to care, retention in care, initiation of ART, and adherence to ART.[51] The authors found that negative self-image was inversely associated with adherence to medical appointments (OR=0.95; 95% CI 0.91-0.99), while employment (OR=0.30; 95% CI 0.12-0.75) and ethnic identity affirmation (0.28; 95% CI 0.12-0.68) were both positively associated with adherence to medical appointments.[51] The study highlighted the importance of psychosocial factors for the engagement in HIV care among YBMSM.

The need to address the mental health and psychosocial needs of MSM has been emphasized in the literature as a call to action to future researchers. A 2007 study by Mustanski et al. called for more research to further identify the HIV risk and resilience factors among young MSM, specifically in urban areas, and to develop interventions targeting this group. Using a community-recruited sample of ethnically-diverse, self-identified young MSM from Chicago (n=310) Mustanski et al. assessed the prevalence of a myriad of health problems including substance abuse, psychological distress, partner violence, sexual assault, and sexual risk taking. The study used a "syndemic" variable which assessed the number of psychosocial health problems by taking the sum scores for regular binge drinking, street drug use, regular marijuana use, psychological distress, intimate partner violence, and sexual assault.[52] Mustanski et al. found that rates of sexual risk behaviors and prevalence of psychosocial health problems were high among this population.[52] Fourteen percent of participants reported being HIV-seropositive while 34% of participants reported experiencing partner violence. After controlling for demographic factors, the number of psychosocial health problems significantly increased the odds of having multiple anal sex partners (OR=1.24), unprotected anal sex (OR=1.42), and an HIV positive status (OR=1.42).[52] These results are similar as to those seen in a 2003 cross-sectional household probability telephone sample of MSM in Chicago, Los Angeles, New York, and San Francisco by Stall et al. That study looked at the association of co-occurring psychosocial problems and increased vulnerability to HIV/AIDS among urban MSM and found their sample to have higher prevalence for sexual risk taking and a myriad of other health problems.[53] A comparison of MSM stigma, HIV stigma and depression in HIV-seropositive Latino and Black MSM in Los Angeles County, California which found both HIV stigma ($p<0.0001$) and MSM stigma ($p<0.0001$) were associated with depression.[4] The study found statistically significant differences between experienced HIV stigma and MSM

stigma among Latino versus Black MSM, emphasizing the need for further research among HIV risk subgroups to drive stigma reduction programs and behavioral counseling.[4]

In the aforementioned study conducted by Aidala et al. HIV-seropositive persons with "low-functioning" mental health (assessed using the Mental Component Summary Score (MCS) of the MOS-SF36) were statistically less likely to have been engaged in appropriate HIV medical care (AOR=0.80; 95% CI: 0.69-0.93).[46] Similarly, the Housing and Health Study conducted by CDC and HUD in 2003 found that mental health was more consistently influenced by housing status than any of the measures assessed in the study.[32] Royal et al. (2009) used baseline data from the Housing and Health Study to examine associations between self-reported two- and seven- day adherence to ART and access to health care, mental health, substance use, and attitudes toward HIV medical therapy. Controlling for gender, race, age, and education, the study found of 644 participants, 55% were currently on ART, of this 78% reported missing no prescribed doses for 2-day adherence, while 81% reported >= 90% adherence for 7-day adherence.[54] Mental health, including scoring lower on SF=36 mental component summary scale, higher risk for depression (CES-D), and stress (Perceived Stress Scale) were associated with poorer adherence for both two- and seven- day outcomes.[54] This highlights the need to provide comprehensive HIV medical care which focuses on more than HIV-related treatment by addressing psychological/mental health disorders.

## Gaps in the Literature

The review of the literature shows it is not merely being without a home (e.g., homelessness) that is detrimental to health, but housing instability in all its forms. However, while housing has

increasingly been proven to be a determinant of poor HIV treatment outcomes, the potential role of depression as a mediator has not been explored. There is a need for increased understanding of the complex psychosocial factors affecting YBMSM is needed to develop effective prevention and response strategies. Additionally, in the review of the literature, there are no studies that explore the impact of housing instability *specifically* among HIV-seropositive YBMSM. This is concerning as YBMSM are a highly stigmatized and vulnerable risk subgroup bearing a disproportionate amount of the current HIV burden. While the link between housing instability, specifically homelessness, and HIV has been explored in the literature, limited research is available on forms of housing instability that are not homelessness. Similarly, the role of depression in medication adherence, housing stability, and HIV VL suppression has been cited in the literature, however limited evidence exists exploring the relationships between these constructs, specifically among YBMSM. The present study aims to bridge this gap by assessing the relationship between two forms of housing instability—moves in the past 6 months and homelessness status since age 15—and HIV VL, and determining whether depression mediates this relationship. By increasing knowledge about the relationship of housing to HIV VL, this study will generate findings that inform future research and public health action aimed at mobilizing further interventions and response efforts to this epidemic, including but not limited to, increase in mental health services in HIV/AIDS clinics, housing assistance and case management, and methods to improve the continuum of care for YBMSM who are unstably housed.

# CHAPTER III: Manuscript

# Housing Instability, Depression, and HIV Viral Load among Young Black Men Who Have Sex with Men in Atlanta, GA

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**Contribution of the Student**

The work herein is the product of a secondary data analysis performed by the student. The student did not have a role in creating the survey or the collection of data through survey implementation. However, the student did perform all work after data collection independently, including the analysis of the data, the construction of regression models, summation of results in tables, and all writing. Advisement throughout this process was provided by the student's thesis committee.

## Abstract

**Title:** Housing Instability, Depression, and HIV Viral Load among Young Black Men Who Have Sex with Men in Atlanta, GA

**Authors:** Hiwote Solomon, MPH; Sabriya L. Linton PhD, MPH, Carlos del Rio MD, Sophia A. Hussen MD, MPH

**Background:** Housing instability is common among sexual minority youth. Prior research suggests psychological distress may mediate the association between housing instability and poor HIV-related outcomes, but this hypothesis remains underexplored.

**Objectives:** 1) Assess the cross-sectional relationship between housing instability and achieving an undetectable HIV-1 viral load (VL) in a sample of young black men who have sex with men (YBMSM) in Atlanta, GA. 2) Assess whether depression mediated this relationship.

**Methods:** We surveyed 81 HIV-infected YBMSM [mean age=22 years (SD=1.5)] recruited from a single HIV clinic in Atlanta, GA. Housing instability was defined as a dichotomous variable (no moves in the past months vs. at least one residential move in the past 6 months). Depression was defined as a score of ≥16 on the Center for Epidemiologic Studies-Depression Revised version (CESD-R) scale. Undetectable VL was defined as ≤ 40 copies/mL.

**Results:** Among the sample, 65% of YBMSM achieved undetectable VL; 55.6% reported housing instability; and 46.9% reported depression. Housing instability was significantly associated with both depression (Adjusted Odds Ratio (AOR)=2.74, 95% CI: 1.1-6.806) and HIV VL detectability (AOR=2.8, 95% CI: 1.05-6.47). When depression was included in the model as a mediator, the association between housing instability and HIV VL detectability was no longer significant (AOR=2.149, 95% CI 0.76-6.01).

**Conclusion:** This pilot study suggests that psychological distress may partially mediate the inverse association between housing instability and undetectable VL among HIV-infected YBMSM. In addition to structural interventions that ensure housing stability, increasing utilization of mental health services among HIV-infected-unstably housed people may improve HIV outcomes in this high-risk population.

## Introduction

Men who have sex with men (MSM) bear a higher burden of human immunodeficiency virus (HIV) than any other group in the United States (U.S.).[1] In 2013, MSM represented approximately 2% of the population but accounted for 55% of people living with HIV (PLWH).[1] When stratifying by race and age, young Black men who have sex with men (YBMSM) make up a disproportionate number of new cases of HIV in the U.S.[2-5] In 2015, 38% of Black gay and bisexual men who received an HIV diagnosis were between 13 and 24 years of age.[6] From 2005 to 2014, HIV diagnoses among YBMSM in this age range increased 87%, even though the number of HIV diagnoses declined for Black Americans as a whole during this same time period.[6] While there are no definitive answers to explain why HIV infections are increasing in this population, socioeconomic and structural barriers faced by MSM, specifically Black MSM, have been explored by researchers as potential contributors to the increased risk of HIV infection in this population.[1-3, 8-14]

Black MSM have a higher chance of being exposed to HIV compared with MSM of other races.[15] This disparity is exacerbated by the large number of Black MSM, who are unaware of their HIV infection, making them less likely to seek medical care and more likely to unknowingly transmit the virus.[1, 5] In 2008, of 8,153 MSM tested for HIV during a Centers for Disease Control and Prevention (CDC) study aimed at estimating and monitoring risk behaviors among MSM, 1,562 (19%) tested positive for HIV; among this group 680 (44%) were unaware of their status with 70% of this group being comprised of YBMSM[5]. Prior research indicates that stigma, homophobia, and discrimination play a large role in impeding willingness to seek care (including HIV testing) and increasing risk for multiple physical and mental health problems.[1,16,17]

The need to improve HIV prevention and treatment services among YBMSM has been well documented, however, barriers to care engagement continue to influence HIV-related service delivery.[4, 9-12, 14, 18-25] Engagement in HIV care has been conceptualized as a *continuum of care,* with the following stages: (1) being tested for, and diagnosed with HIV; (2) being linked to HIV care; (3) being regularly retained in HIV care; (4) adhering to an antiretroviral therapy (ART) regimen, and (5) achieving HIV viral load (VL) suppression.[26] Each of the first four steps are critical to achieving HIV VL suppression, which is the desired outcome in HIV care.[26, 27] Achieving VL suppression (meaning that the HIV viral level in the blood is below the limit of detection for the laboratory) improves life expectancy to near-normal levels, and essentially eliminates one's chance of transmitting HIV.[26-28] However, rates of engagement in care are notoriously poor among adolescents and young adults living with HIV, including YBMSM.[29]

Given these disparities and suboptimal clinical outcomes, it is critically important to identify barriers to care engagement among YBMSM. Stigma, homophobia, and discrimination make it difficult for many YBMSM to disclose their sexual orientation to their social networks, including their families, which can lead to negative health outcomes due to increased stress, internalized homophobia, and limited social support.[1, 14, 22] This is turn can lead to unstable housing, which is one of the major sociostructural barriers commonly faced by sexual minority youth, including YBMSM. According to the Williams Institute, 40% of the homeless youth served by agencies across the U.S. identified as lesbian, gay, bisexual or transgender (LGBT).[30] These agencies reported that the top two reasons for homelessness (or risk for homelessness) among their LGBT youth clients were: (1) family rejection on the basis of sexual orientation and/or gender identity;

and, (2) being kicked out of their family homes as a result of disclosing their sexual orientation and/or gender identity.[30]

Housing instability has emerged as a consistent and detrimental influence to HIV care in other populations; a significant body of research has shown poorer rates of engagement in care across the continuum among PLWH who are not stably housed.[4, 19, 20, 23-25, 31-33] In the literature addressing housing and health outcomes, two main frameworks have been elicited about the mechanism of housing's impact on health. These are known as the *neo-materialist theory* and the *psychosocial theory*. Neo-materialist theory suggests inequities in the distribution of economic and other resources among populations, effects health and well-being through multiple mechanisms.[34] Specifically, the neo-materialist framework posits housing as a material resource that can provide physical (a place to eat, sleep, wash, etc.), economical (access to employment, quality food, education, etc.), and social (a sense of belonging, social network, etc.) resources.[35] In contrast, the biopsychosocial framework highlights the influence of "non-material" biological, psychological, and social conditions on disease outcome, [36] which can ultimately interact with macro-level socioeconomic factors (e.g., poverty) among racial/ethnic minorities in particular.[14, 35, 37] The biopsychosocial framework sees housing as more than a material resource and one that has the ability to impact neurologic and metabolic stress.[35 36, 38] For example, those who are living in unstable or sub-standard housing are more likely to be depressed, feel unsafe, experience social rejection, and be disengaged in health care.[24, 25, 31, 35, 37] Additionally, unstably-housed persons living with HIV/AIDS are also more likely to suffer from psychosocial health problems, abuse drugs, be uninsured, and face barriers accessing ART.[19, 21, 33, 35, 39-41]

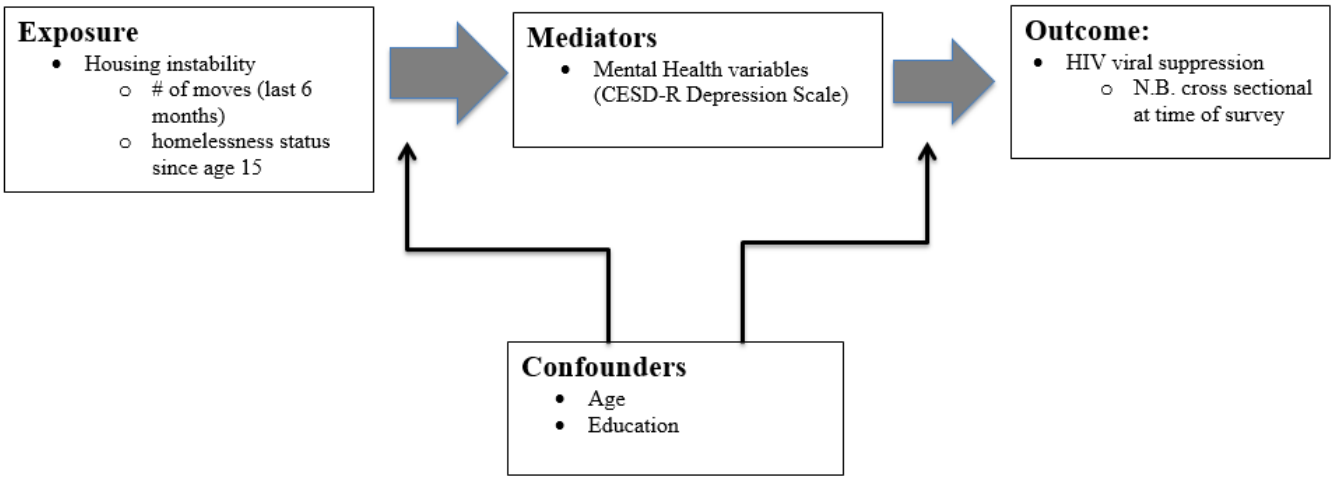
Despite the well-established linkage between housing and achievement of HIV outcomes among PLWH in general, there is a gap in the literature investigating the causal pathways linking housing instability to HIV outcomes specifically among YBMSM. Specificity in the study population is important, as reasons for (and responses to) housing instability may be different in YBMSM compared to other populations (e.g., drug users). Additionally, the role of psychological distress as a potential mediator of the association between housing instability and poor HIV-related outcomes, remains underexplored.

The objectives of this study are to:

1. Assess the cross-sectional relationship between housing instability and achieving an undetectable VL in a sample of YBMSM in Atlanta, GA;
2. Assess whether depression mediates this relationship.

This study aims to test the hypothesis that psychosocial processes mediate the impact of housing instability on HIV VL detectability (Figure 1). We measure two forms of housing instability: moves within the past 6 months and homelessness status since age 15, to capture the effect of two different yet important aspects of housing instability. Guided by the biopsychosocial model, we focus on housing as more than a material resource, and conceptualize it as something that can modify health behaviors and lifestyles and biological processes, by influencing mental health.

*Figure 1. Conceptual Framework*




**Methods**

This analysis utilized data from a cross-sectional survey to assess the relationships between housing instability and HIV VL detectability (VL), and determine the potential for depression to mediate this relationship. This survey was designed to capture information on psychosocial factors (including depression, social capital, and identity measures) and engagement in care among YBMSM from November 2015 to May 2016. A convenience sample of 81 young men was recruited from the pediatric/adolescent clinic of the Grady Infectious Disease Program (IDP) in Atlanta, Georgia. The IDP is a comprehensive care center that serves approximately 6,000 men, women and children living with HIV, the majority of whom are Black and uninsured. Potential participants were approached during their visits to the clinic and screened for eligibility. Inclusion criteria were: (1) age 18-24 years old; (2) male sex assigned at birth; (3) horizontally infected with HIV through sex with a male partner; (4) Black race (inclusive of multiracial identities); and (5) being an enrolled patient at the IDP clinic.

Trained graduate research assistants conducted a brief screening interview to confirm eligibility. Upon verification of eligibility, signed informed consent was obtained for interested participants.

Once enrolled, participants completed a one-time Audio Computer Assisted Survey Instrument (ACASI) on a laptop computer, which included measures of depression and housing instability, demographics, behavior, life events and other psychosocial variables of interest in the parent study. Surveys took approximately 30 minutes to complete. Participants were provided with $50 gift cards as tokens of appreciation for their time and effort. A graduate research assistant then abstracted data from the patient's medical record to document engagement in HIV care (e.g., missed appointments) and clinical measures (e.g. HIV VL) for the one-year period leading up to the date of survey completion. Ethical review and approvals were granted by the Emory University Institutional Review Board and the Grady Memorial Hospital Research Oversight Committee.

## Measures

*1. Outcome*

*Viral Suppression.* Viral suppression was defined here as HIV RNA below the limit of detection for the assay used in the clinical encounter. In this clinical setting, this typically corresponds to less than 40 copies/mL. We utilized the participant's most recent VL, which was in most cases collected on the date of the survey.

*2. Exposure*

*Housing Variables*. Moves in the past 6 months and homelessness status since age 15 were the primary exposures in this study. Responses for moves in the last 6 months were categorized into "No moves in the last 6 months" (reference) and "Moved one or more times in the last 6 months". Homelessness since age 15 was a binary variable with participants answering "yes" or "no" to whether they had ever considered themselves homeless since 15 years of age.

*3. Mediator*

*Depression.* We utilized the Centers for Epidemiologic Studies-Depression Revised version (CESD-R) scale to measure depression. The CESD-R is a 20-item scale that requires participants to characterize their frequency of depressive symptoms using a 5-point Likert scale ranging from 0 (*not at all or less than 1 day last week)* to 4 (*nearly every day for two weeks*). The sum of all the item scores is used as the total scale score. In the clinical setting, a total score less than 16 indicates no depressive symptoms. The CESD-R has demonstrated validity and reliability in numerous other studies of people living with HIV.[39] Reliability was excellent in our sample ($\alpha$ =0.91). For the purposes of descriptive statistics, we evaluated depression as a continuous and categorical variable. For logistic regression modeling, depression was transformed into a categorical variable, with scale scores below 16 categorized as "no depressive symptoms" and scale scores above 16 categorized as "depressive symptoms."[55]

*4. Descriptive Statistics*

*Demographics.* Demographic data captured age, race, ethnicity, educational level, employment and student status. Educational attainment was classified as below 9$^{th}$ grade, some high school (HS) or general education diploma (GED) program, completed HS/GED, some college, technical/vocational school, college graduate, some post-graduate school, post-graduate. Employment was classified as either currently employed or unemployed. Student status was classified as either currently a student or non-student. Participants were asked to identify their sexual orientation as "homosexual/gay," "bisexual," "heterosexual/straight," "questioning/unsure," or "other." Because only participants who endorsed a history of sex with

men were invited to participate, all men, regardless of orientation identified on the ACASI, were included in analysis.

*Data analysis*

Descriptive statistics were obtained for demographic and housing variables stratified by HIV VL detectability. Chi-square independence tests were conducted for categorical variables and Student's t-test were conducted for continuous variable to compare statistical significance by HIV VL detectability. Logistic regression modeling was used for both bivariate and multivariate analyses. Bivariate models were used to assess the associations of each housing variable (i.e., having moved in the past 6 months and homelessness status since age 15) with detectable VL. If the association between a given housing variable and detectable VL was significant, potential mediation by depression was explored via three subsequent processes. First, a bivariate model was used to assess the association between depression and detectable VL. Second, a bivariate model was used to assess the association between the housing variable and depression. Finally, a multivariable model was used to re-assess the association between the respective housing variable and HIV VL detectability, controlling for depression, to determine the extent to which the magnitude and significance of the relationship between the respective housing variable and HIV VL detectability changed when depression was added to the model.[56] We also controlled for age and education level in this final multivariable model. The data were analyzed using SAS software, Version 9 (Cary, NC, USA).

## Results

*Description of sample.* A total of 81 HIV-seropositive YBMSM were surveyed. The ages of participants included in our sample ranged from 18-24 years (Mean=22, SD=1.5). Demographic,

housing, and clinical characteristics of the sample are summarized in Table 1. Sixty-five percent of YBMSM achieved undetectable VL at the most recent measurement. Fifty-six percent of participants indicated that they had moved at least once in the past 6 months, compared to 44% who did not move in the last 6 months. Thirty-seven percent of participants had ever considered themselves homeless since age 15. Furthermore, participants moved, on average, once in the past 6 months (Mean=1.02, SD=1.21).

The mean number of moves significantly differed among participants who had detectable HIV VL and those who did not (p=0.0286), with the detectable HIV VL group having a higher mean number of moves (Mean=1.43, SD=1.32) as compared to those who had an undetectable HIV VL (Mean=0.81, SD=1.11). When number of moves was analyzed as a categorical variable, 71% of participants with detectable VL indicated they moved one or more times in the past 6 months compared to 47% of participants who had an undetectable VL (p=0.0367). There was no statistically significant difference in the proportion of any occurrence of homelessness since age 15 among participants who had a detectable VL as compared to those with an undetectable VL (p=0.2033).

The mean CESD-R scale score for the sample was 18.86 (SD=13.13), suggesting that on average, participants had symptoms consistent with clinical depression. When stratified by HIV VL detectability, participants with detectable HIV VL were significantly more depressed than those with an undetectable HIV VL (71.43% vs. 33.96%, p=0.0013).

*Bivariate analysis*. Bivariate models were used to assess the relationship of housing variables of interest with detectable VL (Table 2). On average, the odds of having a detectable VL were 2.8 times higher (95% CI: 1.049-7.471) for participants who indicated they moved at least once in the past 6 months compared to those who did not move. There was no significant association between homelessness since age 15 and HIV VL detectability (Odds Ratio (OR)=0.545, 95% CI: 0.213-1.395).

*Exploration of mediation and multivariable analysis*. The odds of having a detectable VL differed across the two categories of depression, the proposed mediator (Table 3). Specifically, HIV detectable VL was significantly higher among participants with depression than participants without depression (OR=4.861, 95% CI: 1.792-13.184). Housing instability was also significantly higher among participants with depression as compared to participants without depression (OR=2.74; 95% CI: 1.1-6.81). When housing instability and depression and covariates/confounders were included in a multiple logistic regression model to predict the odds of HIV VL detectability, the magnitude of the relationship between housing instability and HIV VL detectability decreased and lost statistical significance (Adjusted Odds Ratio (AOR)= 2.15; 95% CI=0.76-6.09).

## Discussion

In this sample of HIV-seropositive YBMSM recruited from a clinic in Atlanta, Georgia, moving at least once in the past 6 months was a significant predictor of detectable HIV VL. Findings from this study also suggest that this relationship was partly explained by depression. This is similar to other studies that have identified psychosocial factors affecting the health of young MSM[4, 23, 52, 53]

and documented the effect of housing instability on poor health outcomes, including detectable VL, among PLWH.[20, 21, 23, 25, 32]

Our study's focus on this particular subgroup of MSM who may be experiencing other forms of housing instability offers a unique perspective lacking in the current literature. Our definition of housing instability as number of moves in the previous 6 months and/or being homeless since age 15 differs from the widespread of literature available on the effect of homelessness on HIV outcomes. Frequently moving, or residential instability, can have negative outcomes, especially among children and adolescents.[42] Similarly, adverse childhood experiences (e.g. residential instability or homelessness) has been linked with adult homelessness.[43, 44] Thus we believe our study builds upon studies like Thakarar et al.'s study (2016) exploring the effect of homelessness on HIV VL suppression by honing on this specific vulnerable subgroup of MSM and focusing on history of homelessness and/or number of moves in the previous 6 months to define housing instability among our sample.[23] While our sample is not a representative sample, this distinction between homelessness and other forms of housing is important in shaping the continuum of care for this population, including the engagement of mental health services.

Our findings further highlight the role depression in the relationship between housing instability and HIV care outcomes. The potential for depression to mediate the relationship between moving in the past 6 months and VL detectability is supported by previous studies that have found depression to be a strong predictor of poor HIV health outcomes,[4, 10, 19, 38, 39, 52, 53] including disengagement in HIV care and lack of adherence to ART, and, housing instability, specifically homelessness.[19, 23, 24, 31, 32, 35, 45, 54] Furthermore, the findings have strong policy and clinical

implications specifically regarding the comprehensive care needed to treat YBMSM. With the disproportionate burden of HIV affecting this group, policy makers must focus on housing as more than just a logistical or economical barrier, but one that has the potential to facilitate further transmission by worsening mental well-being. A study by the Centers for AIDS Research Social and Behavioral Science Network points out the assessment, methodical, and cultural challenges in addressing depression within HIV research.[39] Authors of the study provide guidance to future researchers on main diagnostic, screening, and symptom rating measures of depression, procedures, and cultural considerations in the assessment of depression among PLWH.[39] Future studies should utilize these suggestions and incorporate the theoretical frameworks aforementioned in the study to further explore the effect of depression on HIV treatment, care, and viral load suppression.

**Limitations:**

There are several limitations of our study. First, our small sample size, while adequate to detect a significant association between moving in the past 6 months and detectable VL, may not have been powered to detect associations of other housing variables with detectable VL (as evidenced by the wide confidence intervals). However, despite its small sample size, the findings from this study generate hypotheses for future research investigating the impact of housing on HIV outcomes and the mediators that are on the causal pathway.

Given that data are cross-sectional, causality cannot be ascertained, thus we can neither conclude that housing instability causes incomplete VL suppression nor that depression mediates this relationship. All housing data and data used to inform the CESD-R scale were self-reported, which

may have influenced under- or over- reporting on certain questions, however the use of ACASI may have minimized this bias.[49] Additionally, given that this study used a clinic-recruited sample, participants might be better off in some ways than those who are not showing up to the clinic.

**Conclusions:**

We found that housing instability had a significant association with HIV VL detectability among YBMSM, and that depression may serve as a mediator of this relationship. The role of depression in this relationship lends support to the psychosocial theory, which suggests the need to address the various psychological and social factors that influence the health of an individual, and highlights the need for comprehensive mental health services in this population, particularly among those who are unstably housed. Additionally, the findings highlight the importance of additional macro-level structural interventions that prevent homelessness (e.g., affordable and adequate housing, and less racial/ethnic discrimination in housing policies that prevent racial/ethnic minorities from accessing housing assistance in "opportunity areas." Future longitudinal studies should investigate these possibilities further to advance knowledge about the pathways linking housing conditions to HIV outcomes. In the absence of structural interventions that ensure housing stability, increasing utilization of mental health services among HIV-infected-unstably housed people may improve HIV outcomes in this high-risk population.

# Tables

Table 1. Sociodemographic, housing, and clinical indicators by HIV Viral Load (VL) Detectability

| Characteristics | Overall | Detectable VL | Undetectable VL | p-value* |
|---|---|---|---|---|
| ***Sociodemographic*** | | | | |
| Age in years, mean (SD) | 22.41 (1.56) | 22.21 (1.55) | 22.51 (1.56) | **0.4202** |
| Gender, n (%) | | | | 0.2972 |
| Male | 79 (97.53) | 27 (96.43) | 52 (98.11) | |
| Other | 2 (2.46) | 1 (3.57) | 1 (1.89) | |
| Sexual Orientation, n (%) | | | | 0.1461 |
| Homosexual/gay | 68 (83.95) | 22 (78.57) | 46 (86.79) | |
| Bisexual | 9 (11.11) | 5 (17.86) | 4 (7.55) | |
| Heterosexual/straight | 1 (1.23) | 1 (3.57) | 0 (0) | |
| Questioning/unsure | 3 (3.7) | 0 (0) | 3 (5.66) | |
| Education level, n (%) | | | | 0.2723 |
| No higher education | 31 (38.27) | 13 (46.43) | 18 (33.96) | |
| Higher Education | 50 (61.73) | 15 (53.57) | 35 (66.04) | |
| Currently a student | | | | 0.8356 |
| Yes | 22 (27.16) | 8 (28.57) | 14 (26.42) | |
| No | 59 (72.84) | 20 (71.43) | 39 (73.58) | |
| Currently employed | | | | 0.692 |
| Yes | 54 (66.67) | 15 (53.57) | 39 (73.58) | |
| No | 27 (33.33) | 13 (46.43) | 14 (26.42) | |
| ***Clinical*** | | | | |
| CD4+ Count at time of survey, mean (SD) | 502.42 (242.51) | 369.07 (212.34) | 572.87 (228.98) | **0.0002** |
| Absolute VL, mean (SD) | 40.80 (182.55) | 118.04 (298.81) | 0.00 (0.00) | **0.0049** |
| CESD-R Depression Scale Score, mean (SD) | 18.86 (13.13) | 26.14 (14.31) | 15.02 (10.73) | **0.0008** |
| Depressive symptoms | | | | **0.0013** |
| Yes (CESD-R Score >16) | 38 (46.91) | 20 (71.43) | 18 (33.96) | |
| No (CESD-R Score <16) | 43 (53.09) | 8 (28.57) | 35 (65.04) | |
| ***Housing*** | | | | |
| Moves in the past 6 month, mean (SD) | 1.02 (1.21) | 1.43 (1.32) | 0.81 (1.11) | **0.0286** |
| Moves in the last 6 months | | | | |
| No moves | 36 (44.44) | 8 (28.57) | 28 (52.83) | **0.0367** |
| Moved ≥ 1 time | 45 (55.56) | 20 (71.43) | 25 (47.17) | |
| Since age 15, have you ever considered yourself homeless? | | | | |
| Yes | 30 (37.04) | 13 (46.43) | 17 (32.08) | 0.2033 |
| No | 51 (62.96) | 15 (53.57) | 36 (67.92) | |

**Gender**: *Self-identified.* **VL suppression***: defined as undetectable VL (here, an absolute VL of zero).* ***Education level****: Those with only high school education (including GED) were categorized as having "no higher education" while those with some college or technical education were categorized as having "higher education."*

**Chi-square test for categorical variables, t-test for continuous variables*

***Bold*** *represent statistically significant at an alpha level of 0.05*

Table 2. Bivariate analysis

| **Variable (n=81)** | **Odds Ratio (95% CI)** |
|---|---|
| Moves in the past 6 months | |
| No moves | reference |
| Moved ≥ 1 times | **2.800 (1.049-7.471)** |
| Since age 15, have you ever considered yourself homeless? | |
| Yes | 0.545 (0.213-1.395) |
| No | reference |
| CESD-R score | |
| <16 (not depressed) | reference |
| >16 (depressed) | **4.861 (1.782-13.184)** |

95% CI: 95% Confidence Interval
***Bold*** *represent statistically significant at an alpha level of 0.05*

Table 3. Multivariable analysis

| **Relationship being tested** | **Odds Ratio (95% CI)** |
|---|---|
| X associated with M | **2.737 (1.1-6.806)** |
| M associated with Y (controlling for X) | **4.228 (1.526-11.716)** |
| Mediation Model: X associated with Y (controlling for M) | 2.149 (0.758-6.087) |
| X associated with Y (controlling for age and education) | **2.712 (1.005 -7.256)** |
| Mediation Model (controlling for age and education) | 2.088 (0.732-5.955) |

**X= Moves in past 6 months; Y= HIV VL; M= Depression**
95% CI: 95% Confidence Interval
***Bold*** *represent statistically significant at an alpha level of 0.05*

# CHAPTER IV: Public Health Implications

The primary findings of this study illustrate the interwoven relationship between housing instability, depression, and HIV VL. While additional research is needed to better understand the role of depression as a mediator between the relationship of housing instability and HIV VL detectability, the importance of addressing housing instability and depression among YBMSM is underscored.

The most effective way to prevent housing instability is by making sure proper services are in place to serve vulnerable populations. We have seen in past literature how housing assistance programs have had a positive impact on the health outcomes of HIV positive persons compared to those who were not receiving any assistance[20, 32, 37] Additionally, our study's focus on this particular subgroup of MSM who may be experiencing other forms of housing instability offers a unique perspective lacking in the current literature. Our definition of housing instability as number of moves in the previous 6 months and/or being homeless since age 15 differs from the widespread of literature available on the effect of homelessness on HIV outcomes. Thus, we believe our study builds upon studies like Thakarar et al.'s study (2016) exploring the effect of homelessness on HIV VL suppression by honing on this specific vulnerable subgroup of MSM and focusing on history of homelessness and/or number of moves in the previous 6 months to define housing instability among our sample.[23] While our sample is not a representative sample, this distinction between homelessness and other forms of housing is important in shaping the continuum of care for this population, including the engagement of mental health services. Our findings further highlight the role depression in the relationship between housing instability and HIV care outcomes. The mediator relationship depression plays in this relationship is supported by previous

studies that have found depression to be a strong predictor in stigma and negative self-identity,[51] poor HIV health outcomes,[4, 10, 19, 38, 39, 52, 53] including disengagement in HIV care and lack of adherence to ART, and, housing instability, specifically homelessness.[19, 23, 24, 31, 32, 35, 45, 54] The role of depression in this relationship lends support to the psychosocial theory, which suggests the need to address the various psychological and social factors that influence the health of an individual, and highlights the need for comprehensive mental health services in this population, particularly among those who are unstably housed. Additionally, the findings highlight the importance of additional macro-level structural interventions that prevent homelessness (e.g., affordable and adequate housing, and less racial/ethnic discrimination in housing policies that prevent racial/ethnic minorities from accessing housing assistance in "opportunity areas." Future longitudinal studies should investigate these possibilities further. In the absence of structural interventions that ensure housing stability, increasing utilization of mental health services among HIV-infected-unstably housed people may improve HIV outcomes in this high-risk population.

The findings have strong policy and clinical implications specifically regarding the comprehensive care needed to treat YBMSM. With the disproportionate burden of HIV affecting this group, policy makers must focus on housing as more than just a logistical or economical barrier, but one that has the potential to facilitate further transmission and greatly influences mental well-being. Data from the Williams Institute, highlights the stigma, discrimination, and scrutiny faced by young LGBT persons that facilitates the housing instability faced by this population.[30] Thus, agencies and health care facilities serving this population must have the adequate resources available to provide comprehensive care, including test and treat strategies, mental health services, housing referrals, and case managers.

In his award-winning book *Evicted: Poverty and profit in the American city* Matthew Desmond writes, "The home is the center of life. It is a refuge from the grind of work, the pressure of school, and the menace of the streets. We say that at home, we can "be ourselves." Everywhere else, we are someone else. At home, we remove our masks." These words emphasize not only the importance of safe, stable housing on the physical and mental well-being of individuals but the sense of belonging and empowerment one ties to the home.

## References


**1.** Centers for Disease Control and Prevention. HIV Among Gay and Bisexual Men September 30, 2016. Available at: https://www.cdc.gov/hiv/group/msm/index.html. Accessed March 24, 2017.

**2.** Maulsby C, Millett G, Lindsey K*, et al.* HIV among Black men who have sex with men (MSM) in the United States: a review of the literature. *AIDS Behav.* Jan 2014;18(1):10-25.

**3.** Wejnert C, Le B, Rose CE*, et al.* HIV infection and awareness among men who have sex with men-20 cities, United States, 2008 and 2011. *PLoS One.* 2013;8(10):e76878.

**4.** Wohl AR, Galvan FH, Carlos JA*, et al.* A comparison of MSM stigma, HIV stigma and depression in HIV-positive Latino and African American men who have sex with men (MSM). *AIDS Behav.* May 2013;17(4):1454-1464.

**5.** Centers for Disease C, Prevention. Prevalence and awareness of HIV infection among men who have sex with men --- 21 cities, United States, 2008. *MMWR Morb Mortal Wkly Rep.* Sep 24 2010;59(37):1201-1207.

**6.** Control CfD, Prevention. Diagnoses of HIV infection in the United States and dependent areas, 2015. *HIV surveillance report.* 2015;27:1-114.

**7.** Control CfD, Prevention. HIV surveillance in men who have sex with men (MSM). *Atlanta, GA: US Government Printing Office.* 2015.

**8.** Millett GA, Peterson JL, Flores SA*, et al.* Comparisons of disparities and risks of HIV infection in black and other men who have sex with men in Canada, UK, and USA: a meta-analysis. *Lancet.* Jul 28 2012;380(9839):341-348.

**9.** Auerbach J. Transforming social structures and environments to help in HIV prevention. *Health Aff (Millwood).* Nov-Dec 2009;28(6):1655-1665.

**10.** Burch LS, Smith CJ, Phillips AN, Johnson MA, Lampe FC. Socioeconomic status and response to antiretroviral therapy in high-income countries: a literature review. *AIDS.* May 15 2016;30(8):1147-1162.

**11.** Colasanti J, Stahl N, Farber EW, Del Rio C, Armstrong WS. An Exploratory Study to Assess Individual and Structural Level Barriers Associated With Poor Retention and Re-

engagement in Care Among Persons Living With HIV/AIDS. *J Acquir Immune Defic Syndr.* Feb 01 2017;74 Suppl 2:S113-S120.

**12.** Holtgrave DR, Kim JJ, Adkins C*, et al.* Unmet HIV service needs among Black men who have sex with men in the United States. *AIDS Behav.* Jan 2014;18(1):36-40.

**13.** Levy ME, Wilton L, Phillips G, 2nd*, et al.* Understanding structural barriers to accessing HIV testing and prevention services among black men who have sex with men (BMSM) in the United States. *AIDS Behav.* May 2014;18(5):972-996.

**14.** Mayer KH, Wang L, Koblin B*, et al.* Concomitant socioeconomic, behavioral, and biological factors associated with the disproportionate HIV infection burden among Black men who have sex with men in 6 U.S. cities. *PLoS One.* 2014;9(1):e87298.

**15.** Raymond HF, McFarland W. Racial mixing and HIV risk among men who have sex with men. *AIDS Behav.* Aug 2009;13(4):630-637.

**16.** Ayala G, Bingham T, Kim J, Wheeler DP, Millett GA. Modeling the impact of social discrimination and financial hardship on the sexual risk of HIV among Latino and Black men who have sex with men. *Am J Public Health.* May 2012;102 Suppl 2:S242-249.

**17.** Arnold EA, Rebchook GM, Kegeles SM. 'Triply cursed': racism, homophobia and HIV-related stigma are barriers to regular HIV testing, treatment adherence and disclosure among young Black gay men. *Cult Health Sex.* Jun 2014;16(6):710-722.

**18.** Bravo P, Edwards A, Rollnick S, Elwyn G. Tough decisions faced by people living with HIV: a literature review of psychosocial problems. *AIDS Rev.* Apr-Jun 2010;12(2):76-88.

**19.** Aidala AA, Wilson MG, Shubert V*, et al.* Housing Status, Medical Care, and Health Outcomes Among People Living With HIV/AIDS: A Systematic Review. *Am J Public Health.* Jan 2016;106(1):e1-e23.

**20.** Buchanan D, Kee R, Sadowski LS, Garcia D. The health impact of supportive housing for HIV-positive homeless patients: a randomized controlled trial. *Am J Public Health.* Nov 2009;99 Suppl 3:S675-680.

**21.** Milloy MJ, Marshall BD, Montaner J, Wood E. Housing status and the health of people living with HIV/AIDS. *Curr HIV/AIDS Rep.* Dec 2012;9(4):364-374.

**22.** Parker CM, Garcia J, Philbin MM, Wilson PA, Parker RG, Hirsch JS. Social risk, stigma and space: key concepts for understanding HIV vulnerability among black men who have sex men in New York City. *Cult Health Sex.* Aug 23 2016:1-15.

**23.** Thakarar K, Morgan JR, Gaeta JM, Hohl C, Drainoni ML. Homelessness, HIV, and Incomplete Viral Suppression. *J Health Care Poor Underserved.* Feb 2016;27(1):145-156.

**24.** Wolitski RJ, Kidder DP, Fenton KA. HIV, homelessness, and public health: critical issues and a call for increased action. *AIDS Behav.* Nov 2007;11(6 Suppl):167-171.

**25.** Xiao H, Mains W. Relationship between Housing Status and Retention Rates among HIV-Positive African Americans Enrolled in a Comprehensive Care Program. *J Psychoactive Drugs.* Apr-Jun 2016;48(2):109-114.

**26.** Gardner EM, McLees MP, Steiner JF, Del Rio C, Burman WJ. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clin Infect Dis.* Mar 15 2011;52(6):793-800.

**27.** Safren SA, Mayer KH, Ou SS*, et al.* Adherence to Early Antiretroviral Therapy: Results From HPTN 052, a Phase III, Multinational Randomized Trial of ART to Prevent HIV-1 Sexual Transmission in Serodiscordant Couples. *J Acquir Immune Defic Syndr.* Jun 01 2015;69(2):234-240.

**28.** Centers for Disease Control and Prevention. Living with HIV. Available at: https://www.cdc.gov/hiv/basics/livingwithhiv/index.html. Accessed March 24, 2017.

**29.** Zanoni BC, Mayer KH. The adolescent and young adult HIV cascade of care in the United States: exaggerated health disparities. *AIDS Patient Care STDS.* Mar 2014;28(3):128-135.

**30.** Durso LE, Gates GJ. Serving our youth: Findings from a national survey of services providers working with lesbian, gay, bisexual and transgender youth who are homeless or at risk of becoming homeless. 2012.

**31.** Kidder DP, Wolitski RJ, Campsmith ML, Nakamura GV. Health status, health care use, medication use, and medication adherence among homeless and housed people living with HIV/AIDS. *Am J Public Health.* Dec 2007;97(12):2238-2245.

**32.** Wolitski RJ, Kidder DP, Pals SL*, et al.* Randomized trial of the effects of housing assistance on the health and risk behaviors of homeless and unstably housed people living with HIV. *AIDS Behav.* Jun 2010;14(3):493-503.

**33.** Feller DJ, Agins BD. Understanding Determinants of Racial and Ethnic Disparities in Viral Load Suppression: A Data Mining Approach. *J Int Assoc Provid AIDS Care.* Sep 14 2016.

**34.** Lynch JW, Smith GD, Kaplan GA, House JS. Income inequality and mortality: importance to health of individual income, psychosocial environment, or material conditions. *BMJ.* Apr 29 2000;320(7243):1200-1204.

**35.** Aidala AA, Sumartojo E. Why housing? *AIDS Behav.* Nov 2007;11(6 Suppl):1-6.

**36.** Engel GL. The clinical application of the biopsychosocial model. *Am J Psychiatry.* May 1980;137(5):535-544.

**37.** Kidder DP, Wolitski RJ, Royal S*, et al.* Access to housing as a structural intervention for homeless and unstably housed people living with HIV: rationale, methods, and implementation of the housing and health study. *AIDS Behav.* Nov 2007;11(6 Suppl):149-161.

**38.** Diiorio C, McCarty F, Depadilla L*, et al.* Adherence to antiretroviral medication regimens: a test of a psychosocial model. *AIDS Behav.* Feb 2009;13(1):10-22.

**39.** Simoni JM, Safren SA, Manhart LE*, et al.* Challenges in addressing depression in HIV research: assessment, cultural context, and methods. *AIDS Behav.* Feb 2011;15(2):376-388.

**40.** Arnold EM, Desmond KA, Rotheram-Borus MJ*, et al.* Drug use and emotional distress differentiate unstably- versus stably-housed adults living with HIV who engage in unprotected sex. *J Health Psychol.* Sep 09 2015.

**41.** Cordts L. Housing should be seen as critical part of health care. *HIV Clin.* Spring 2015;27(2):1, 4-7.

**42.** Jones A. Residential mobility and trajectories of adiposity among adolescents in urban and non-urban neighborhoods. *J Urban Health.* Apr 2015;92(2):265-278.

**43.** Herman DB, Susser ES, Struening EL, Link BL. Adverse childhood experiences: are they risk factors for adult homelessness? *Am J Public Health.* Feb 1997;87(2):249-255.

**44.** Koegel P, Melamid E, Burnam m A. Childhood risk factors for homelessness among homeless adults. *Am J Public Health.* Dec 1995;85(12):1642-1649.

**45.** Robertson MJ, Clark RA, Charlebois ED*, et al.* HIV seroprevalence among homeless and marginally housed adults in San Francisco. *Am J Public Health.* Jul 2004;94(7):1207-1217.

**46.** Aidala AA, Lee G, Abramson DM, Messeri P, Siegler A. Housing need, housing assistance, and connection to HIV medical care. *AIDS Behav.* Nov 2007;11(6 Suppl):101-115.

**47.** Mugavero MJ, Amico KR, Horn T, Thompson MA. The state of engagement in HIV care in the United States: from cascade to continuum to control. *Clin Infect Dis.* Oct 2013;57(8):1164-1171.

**48.** Centers for Disease C, Prevention. Vital signs: HIV prevention through care and treatment--United States. *MMWR Morb Mortal Wkly Rep.* Dec 02 2011;60(47):1618-1623.

**49.** Bogart LM, Wagner GJ, Galvan FH, Landrine H, Klein DJ, Sticklor LA. Perceived discrimination and mental health symptoms among Black men with HIV. *Cultur Divers Ethnic Minor Psychol.* Jul 2011;17(3):295-302.

**50.** Evans GW, Wells NM, Chan HY, Saltzman H. Housing quality and mental health. *J Consult Clin Psychol.* Jun 2000;68(3):526-530.

**51.** Hussen SA, Harper GW, Bauermeister JA, Hightow-Weidman LB, Adolescent Medicine Trials Network for HIVAI. Psychosocial influences on engagement in care among HIV-positive young black gay/bisexual and other men who have sex with men. *AIDS Patient Care STDS.* Feb 2015;29(2):77-85.

**52.** Mustanski B, Garofalo R, Herrick A, Donenberg G. Psychosocial health problems increase risk for HIV among urban young men who have sex with men: preliminary evidence of a syndemic in need of attention. *Ann Behav Med.* Aug 2007;34(1):37-45.

**53.** Stall R, Mills TC, Williamson J*, et al.* Association of co-occurring psychosocial health problems and increased vulnerability to HIV/AIDS among urban men who have sex with men. *Am J Public Health.* Jun 2003;93(6):939-942.

**54.** Royal SW, Kidder DP, Patrabansh S*, et al.* Factors associated with adherence to highly active antiretroviral therapy in homeless or unstably housed adults living with HIV. *AIDS Care.* Apr 2009;21(4):448-455.

**55.** Van Dam NT, Earleywine M. Validation of the Center for Epidemiologic Studies Depression Scale--Revised (CESD-R): pragmatic depression assessment in the general population. *Psychiatry Res.* Mar 30 2011;186(1):128-132.

**56.** Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol.* Dec 1986;51(6):1173-1182.