Factors Associated with Antiretroviral Therapy Adherence Among a Community-Based Sample of Sexual Minority Older Adults with HIV

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Abstract

Older sexual minorities (e.g., gay, bisexual) living with HIV are at risk for poor HIV outcomes due to their frequent experience with both psychosocial challenges and structural barriers to care. This study utilized a stochastic search variable selection (SVSS) approach to explore potential psychosocial and structural factors associated with HIV-related health outcomes among a community-based sample of older sexual minorities (N = 150) in South Florida, an U.S. HIV-epidemic epicenter. After SVSS, a forward entry regression approach suggested unstable housing, illicit substance use, current nicotine use, and depression were all associated with poorer ART adherence among older sexual minority adults living with HIV. No associations between potential correlates and biological measures of HIV disease severity were observed. Findings highlight a need to focus on multiple levels of intervention that target a combination of psychosocial and structural factors to improve HIV-care outcomes among older sexual minorities and achieve *Ending the HIV Epidemic* goals.

Abstract

Minorías sexuales mayores (p.ej., gay, bisexual) que viven con VIH están en riesgo de resultados negativos de VIH debido a sus experiencias con desafíos psicosociales y barreras estructurales. Este estudio uso selección de variables de búsqueda estocástica (SVSS) para explorar factores

psicosociales y estructurales asociadas con resultados de salud relacionado a VIH entre una muestra comunitaria de minorías sexuales mayores (N = 150) el la Sur de la Florida, un epicentro de la epidemia de VIH en EE. UU. Después de SVSS, una regresión de entrada directa sugirió que vivienda inestable, uso de sustancias ilícitas, consumo actual de nicotina, y depresión eran asociados con menos adherencia de terapias antirretroviral entre adultos mayores de minorías sexuales que viven con el VIH. No se encontraron asociaciones entre correlatos potenciales y medidas biológicas de VIH. Recomendaciones destacan una necesidad de concentrarse en múltiples niveles de intervención que apuntan una combinación de factores psicosociales y estructurales para mejorar resultados de VIH entre las minorías sexuales mayores y lograr las metas de *Finalizando la Epidemia del VIH.*

Keywords

Introduction

People living with HIV (PLWH) are living longer and healthier lives than ever before; yet, HIV remains a significant public health challenge from both a medical and economic perspective [1, 2]. Despite the availability of effective HIV prevention and treatment tools (e.g., highly effective antiretroviral therapy), over 30,000 people in the United States (U.S.) acquired HIV in 2020 adding to the already more than 1 million PLWH in the U.S. [3]. This increasing prevalence incurs a high cost burden of HIV treatment, with the average lifetime cost of treatment for one person living with HIV at over $420,000 [4]. Therefore, to achieve national *Ending the HIV Epidemic* (EHE) goals [5], it is vital to continue researching, developing, and disseminating effective interventions to reduce HIV transmission and improve HIV treatment outcomes—one of the four pillars of the EHE priorities—specifically among groups disproportionately affected by the epidemic.

Although overall rates of HIV have decreased nationally, subpopulations like sexual, racial, and ethnic minorities continue to experience significant HIV-related health disparities. Since the start of the epidemic in the early 1980s, sexual minority men (SMM; particularly gay, bisexual, and other men who have sex with men) bear the greatest burden of HIV morbidity and mortality compared to any other demographic groups within the U.S. [2]. In 2019, SMM made up nearly 70% of all new HIV diagnoses in the U.S adding to the already more than 800,000 SMM already living with HIV [2]. Although a greater number of SMM may engage with HIV prevention services compared to their heterosexual counterparts, the proportion of SMM receiving services as it relates to their disproportionate risk is much lower than their heterosexual peers due to stigma, discrimination, and other structural and social factors [1, 6, 7]. Furthermore, these HIV disparities are even more apparent among SMM who identify as a racial or ethnic minority demonstrating the intersectional nature of HIV inequities among multiple marginalized populations. For example, of all new HIV diagnoses in the U.S. in 2019, 50% were among Hispanic/Latinx or Black/African American SMM, even though racial and ethnic minority groups make up a much smaller proportion of the overall population [8].

Similarly, older adults face unique HIV-related health disparities that are generally understudied [1, 9]. Overall, the average age of PLWH has continued to rise as HIV has shifted towards a manageable chronic illness [10, 11]. In 2019, more than 50% of all PLWH in the United States (U.S.) were over the age of 50 [12] with this proportion expected to grow to just over 73% in 2030 [13]. Furthermore, engagement in the HIV care cascade remains a challenge among older adults with only 57% of older adults living with HIV over the age of 55 in the U.S. reporting receiving consistent HIV-related health services in 2018 [12]. Similar trends have been observed within other high- and middle-income nations demonstrating a growing need to focus research attention and resources to the "greying of the epidemic" [14].

Compared to their younger heterosexual peers, sexual minority older adults may experience more HIV-related health disparities due to the intersecting systems of prejudice they face as a result of their multiple marginalized identities. *Minority Stress Theory* suggests that sexual minorities face a greater likelihood of physical health problems and psychological distress because they frequently experience identity-based stressors such as stigma and discrimination [15, 16]. This theory has since been adapted in the past few decades to help explain how age-related discrimination and stigma faced by older sexual minorities may further contribute to poorer physical and mental health outcomes [17, 18]. For example, age-related psychosocial factors such as internalized ageism and age-related discrimination may lead to chronic stress, poorer psychological functioning, and more negative physical health outcomes [19] particularly among older sexual minorities who are already facing sexual orientation-based stressors such as discrimination or victimization across the life course [9, 20, 21]. Furthermore, *Intersectionality Theory* [22] posits that people with multiple marginalized identities (e.g., HIV-status, sexual orientation, age) experience worse psychosocial health outcomes due to overlapping systemic oppression they experience because of their minoritized identities. Therefore, older sexual minorities living with HIV bear the significant burden of facing stigmatizing experiences due to their multiple marginalized identities that perpetuate HIV-related health disparities.

Older sexual minority adults living with HIV experience additional structural and psychosocial barriers that make managing their HIV-care more challenging and exacerbate the negative impacts of identity-based stigma and discrimination. Life destabilizing structural barriers such as unstable housing, poverty, and a history of incarceration are associated with poorer antiretroviral therapy (ART) adherence and HIV-care appointment adherence among older adults [23–25] and among sexual minorities of all ages [26–28]. These factors of life instability negatively affect HIV-care outcomes for PLWH of all ages; however, older adults have the potential to experience socioeconomic marginalization (e.g., reduced access to employment opportunities) more intensely than younger peers which may lead to even poorer HIV-related care and mental health care outcomes among this group [21]. Moreover, in addition to structural barriers to care, older adults living with HIV tend to experience more frequent mental health comorbidities [29, 30], including anxiety, depression, loneliness, and substance use [25, 31, 32], that affect their ability to adequately engage in the HIV-care cascade [25, 29, 33]. It is possible that psychosocial factors related to identity-based stigma and discrimination, a general weathering away of social support, and stressors related to managing chronic illness(es) may create poorer

psychological functioning that negatively impacts and individual's ability to proactively manage their HIV-care.

To date, few studies have identified how life destabilizing structural and psychosocial factors affect HIV-care behaviors among older sexual minority older adults. To further explore this gap in the literature, this cross-sectional study utilized a data driven approach to examine which structural and psychosocial factors identified in the larger HIV adherence literature are associated with ART adherence among a low-resourced, community-based, racial/ethnic majority sample of sexual minority older adults living with HIV in South Florida, an epicenter in the U.S. HIV epidemic.

Methods

Participants

One hundred and fifty older sexual minorities living with HIV enrolled in a public, non-profit tertiary care hospital in Miami completed an interviewer-administered psychosocial assessment between April 2017 through January 2022. Participants eligible for this secondary analysis were those who were 50 years or older, identified as a sexual minority (e.g., gay, bisexual, lesbian), were currently engaged in HIV-care at the University of Miami and Jackson HIV clinics, and able to speak and understand English, Spanish, or Creole. Excluded participants were those who were unable to provide informed consent due to cognitive or emotional issues or those who were currently incarcerated. All study procedures were IRB approved by the University of Miami and informed consent was obtained from all participants prior to the start of the interviewer-administered psychosocial assessment.

Measures

Sociodemographic Information—Age, race/ethnicity, gender, education level (continuous variable from less than a high school degree up and through post graduate professional/doctoral degree), and sexual orientation were collected. Housing instability was also collected via a one-item question in which participant's reported if they experienced homelessness or temporary/transitional housing in the past 12 months.

HIV Disease Severity Outcomes—Continuous HIV RNA viral load data were extracted from electronic medical records. Viral load suppression was considered those who presented with a viral load lower than 200 copies/mL [34]. The log of the continuous HIV RNA viral load was calculated and analyzed and utilized for analyses purposes.

ART Adherence—Self-reported ART adherence was collected using Wilson and colleagues' 3-item adherence measure [35]. A participant's overall percentage of ART adherence for the past month was calculated based on participant responses on three questions: number of missed dose days, frequency of optimal adherence (from 0 = never to 5 = always), and overall self-reported adherence (from 0 = very poor to 5 = excellent) in the past 30 days. Based on these items, past month adherence was calculated on a scale from 0 (missed all doses) to 100 (perfect adherence). For this study, ART adherence was analyzed as a continuous variable based on the overall adherence composite score (0–100%).

Depression Symptoms—Depressive symptoms reflecting major depression diagnostic criteria in the Diagnostic and Statistical Manual of Mental Disorders 5 were assessed via the 9-item Patient Health Questionnaire-9 [36, 37]. Participants reported frequencies of depressive symptoms on a 4-point scale from 0 (*not at all*) to 3 (*nearly every day*) with greater scores indicating greater symptoms.

Anxiety Symptoms—Adapted from the National Comprehensive Cancer Network Distress Thermometer, participants' anxiety was assessed using the anxiety thermometer, a single item self-report measure that assesses distress using a visual analog scale from 0 (*no distress*) to 10 (*extreme distress*; [38]).

Illicit Substance Use—To examine overall substance use, participants reported their frequency over the past 30 days. Participants were asked to report if they used crack, cocaine, heroin, other opioids, amphetamines, hallucinogens, ecstasy/MDMA, sedatives/tranquilizers, and or any other drugs in the past 30 days. Score options ranged from 0 (no use) to 4 (about every day). Marijuana use was not included in our substance use analyses. Analytically, this variable was treated as a dichotomous variable with participants reporting a 2, 3, or 4 as being positive for illicit substance use.

Current Nicotine Use—To evaluate nicotine use, participants were asked to report if they (a) have ever been a tobacco smoker, (b) are currently tobacco smoker, and (c) if they currently use smokeless tobacco products. Nicotine use was treated as a dichotomous variable analytically with participants labeled as either a current smoker or former/never smoker.

History of Sexual Abuse—To assess for childhood sexual abuse, participants responded to the yes/no question "as a child, were you ever sexually attacked, raped, or abused". This variable was treated analytically as a dichotomous variable.

Post-traumatic Stress Symptoms—Post-traumatic stress symptomatology was assessed using the Primary Care PTSD questionnaire [39, 40]. Participants reported whether or not they had ever "experienced an event that was so upsetting, frightening, or horrible", that they (a) "had nightmares or thought about it when they did not want to", (b) "tried hard not to think about it or went out of your way to avoid situations that reminded you of it", (c) "were constantly on guard, watchful, or easily startled", and (d) "felt numb or detached from others, activities, or your surrounding". Analytically, this variable was treated as a dichotomous variable with participants who met criteria for post-traumatic stress disorder being considered positive for this condition.

Data Analytic Plan

The analytic plan consisted of four steps. First, we examined descriptive statistics which explored demographics and variable distributions. Second, to select the most important indicators related to adherence, we performed stochastic search variable selection (SSVS; [41]) which estimates the probability that each predictor is related to the outcome (i.e., adherence). SSVS is an effective way to identify potential predictors that may be related

to an outcome of interest (e.g., adherence) when eventually assessed via regression models in a way that is less biased than just testing each potential predictor individually through regression. Overall, SSVS can account for model uncertainty, by increasing power and decreasing false-positive results, compared with traditional approaches [42]. This was done using the SSVSforPsych shiny app, specifying a 0.5 prior inclusion probability, 1000 burn-in iterations, 10,000 total iterations [41].

After completing the SSVS procedure, we ran two separate hierarchal multiple linear regression models which tested the association between the variables selected in SSVS and (1) adherence and (2) log transformed viral load. Finally, we ran a hierarchal multivariate logistic regression model to test the association between the SSVS identified variables and detectable viral load in SPSS version 28 [43]. We used the F-value and the Omnibus Tests of Model Coefficients to test the global model fit for the linear and logistic regression models, respectively. Based on those indices, we proceeded with the models which showed a statistically significant relationship with the dependent variable.

Results

Descriptive Statistics

Participants were between the ages of 50 and 70 ($M = 56$ years old; SD = 5.18 years) with almost 27% of participants being 60 years or older. More than 86% identified as a cisgender man with an overwhelming number of participants identifying as Gay or Lesbian (60%). A slight majority of participants were U.S. born (59.2%) and 48% identified racially as White and ethnically Hispanic/Latino. Just over 11% of participants had a detectable viral load (i.e., 200 copies/mL) and average ART adherence among participants was quite high at 90.99% (SD = 19.21). A more comprehensive review of participant demographics can be found in Table 1.

Correlates of ART Adherence

SSVS identified eight factors with inclusion probabilities above 0.50 which were entered into a multiple linear regression model for adherence, see Table 2 for all SSVS model variables. Based on the SSVS approach, the indicators with the highest inclusion probabilities included unstable housing, illicit substance use, current nicotine use, depression, education, childhood sexual abuse, anxiety, and post-traumatic stress symptoms. A forward entry regression approach suggested that the model with ART adherence regressed on the first four factors (unstable housing, illicit substance use, current nicotine use, and depression) yielded significant model fit ($F_{4,141} = 18.95$, p 0.01). In this model, unstable housing ($B = -0.31$, p 0.01), illicit substance use ($B = -0.27$, p 0.01), current nicotine use ($B = -0.15$, $p < 0.05$), and depression ($B = -0.15$, $p < 0.05$) were all associated with less ART adherence among older sexual minority adults living with HIV.

Correlates of Viral Load

There were no models that identified significant factors associated with either continuous log transformed RNA viral load in the linear regression or viral suppression in the logistic regression models. None of the variables previously selected for inclusion in the SSVS

model were significantly associated with continuous log transformed RNA viral load or detectable viral load among older sexual minority adults living with HIV.

Discussion

This study is one of the first to examine potential factors related to HIV-care outcomes (e.g., ART adherence, viral suppression, continuous log transformed RNA viral load) within a sample of older sexual minorities receiving HIV care within two public, community-based HIV-care clinics in Miami, an U.S. HIV epicenter. Four structural and psychosocial factors were significantly related to lower ART adherence among our sample of older sexual minority adults with HIV ($N = 150$) including unstable housing, illicit substance use, current nicotine use, and depression. Of those four indicators, housing instability appeared to be the most influential correlate, followed by substance use and then depression and current nicotine as the least influential.

Within our sample, depression, nicotine use, and illicit substance use were some of the strongest correlates of suboptimal ART adherence demonstrating the pivotal role that psychological functioning may play in HIV-care outcomes among older sexual minority adults. These findings corroborate findings from prior studies that indicate that depression and substance use are inversely associated with HIV-care outcomes (e.g., ART adherence, continuous log RNA viral load) among PLWH more broadly [44] and among older adults aged 50 years and older more specifically [25]. Adhering to a daily ART regimen may be particularly challenging for people living with depression and who use substances due to the life instability generated by secondary issues related to motivation, memory, and concentration that stem from these psychosocial conditions. These challenges may be exacerbated further among older sexual minority adults living with HIV due to cognitive issues related to accelerated aging [45] as well as compounded identity-based stressors (e.g., sexual orientation-based discrimination, HIV-related stigma) experienced by older sexual minority adults who live their lives at the intersection of multiple systems of [46]. Future studies should continue examining how psychosocial factors unique to the experiences of older sexual minority adults may be associated with improving HIV-care outcomes so that researchers and clinicians can better identify older sexual minorities most at risk for poorer health outcomes due to their unique constellation of risk factors [21].

Additionally, our findings support prior literature highlighting the pivotal role housing stability, a structural barrier, has in suboptimal ART adherence among marginalized groups disproportionately affected by HIV. Data indicates that older adults with HIV who experience more life instability (e.g., housing instability) often have greater challenges in engaging with HIV-related care behaviors like attending their medical appointments or adhering to their ART medication [24, 25]. These challenges may be exacerbated for older sexual minorities who are unstably housed in multiple ways. First, maintaining daily medication adherence requires a sense of structure and routine that can be easily disrupted if constantly moving from one home to another. Therefore, housing instability may cause challenges to adherence by increasing the likelihood that medications may be kept in suboptimal conditions (e.g., out in the sun) or forgotten from one location to the next. Additionally, housing instability may foster privacy and confidentiality concerns generated

by not having one's own person space that can perpetuate poor daily ART adherence. Furthermore, compared to both younger SMM and their heterosexual peers, older sexual minorities with HIV may be at risk of experiencing more housing instability due to identity-based stressors they face because of their marginalized identities (e.g., financial hardship due to HIV-related disability, social isolation related to decades of marriage inequality). Therefore, more research is needed to determine not only which structural barriers impact HIV-care outcomes, but also the mechanisms by which these barriers affect HIV-care outcomes among older sexual minority adults with HIV.

Surprisingly, we observed no significant associations of viral suppression rates (viral load < 200 copies/mL), or continuous log transformed RNA viral load among the older sexual minority adults with HIV enrolled in this study. Although this finding deviates from some of the prior literature [25, 27, 44] it is likely that because our study sample was predominately virally suppressed (88.7%), we were unable to discern any significant relationship between our potential correlates and viral suppression rates or continuous log transformed RNA viral load. This may be due to either the minimal variability in our outcomes and or the potential power issues that stem from the multicollinearity between outcomes of interest and significant structural and psychosocial indicators. Furthermore, since viral load is so closely affected by levels of ART in a person's body and has the potential to fluctuate both across days and within a given day, it may be a more challenging outcome to observe significant associations with the structural and psychosocial factors we investigated within this study. Therefore, this absence of significant findings related to biomedical HIV-related outcomes may indicate that behavioral HIV-related outcomes (e.g., ART adherence) may be more sensitive to structural and psychosocial factors than biomedical HIV-related outcomes. This further demonstrates the added utility of exploring ART adherence behaviors which are strong proxies to objective biomedical measures of HIV disease severity [47–49].

There were some limitations to this study. First, this study was cross-sectional; therefore, authors were unable to conduct any mediation models or establish causality between variables and the HIV-care outcomes of interest due to issues related to temporal sequence and potential bidirectionality. The inability to explore mediation prohibited authors from assessing if certain structural or psychosocial factors identified by SSVS as being related to the HIV-care outcomes of interest may have mediated the relationship between potentially relevant demographic factors. Second, because this study was a secondary data analysis from a larger longitudinal study assessing the general physical and mental health of people living with HIV, authors were unable to assess for additional unique structural (e.g., food insecurity) [50] or psychosocial factors (e.g., social support) [51] that specifically affect HIV-care outcomes among older sexual minorities with HIV, a multiple marginalized group. Third, bias associated with self-report data (e.g., social desirability, recall) may have led to data misclassification and affected our ability to observe true associations between potential correlates and our outcomes of interest. Finally, study inclusion was restricted to older sexual minority adults, aged 50 years or over, receiving HIV care from a public community clinic thereby limiting generalizability of our findings to individuals with similar profiles. However, because Miami, Florida is a city with one of the highest incidence and prevalence of HIV in the U.S. [34], our findings may be applied to describe the life experiences of other sexual minority older adults with HIV in other HIV epicenters across the U.S.

Conclusion

Overall, our findings highlight how a combination of psychosocial and structural factors contributes to suboptimal ART adherence among older sexual minority adults, suggesting an urgent need to focus on multiple levels of intervention to improve HIV-care outcomes. Although implementing interventions at the individual level to reduce depression symptoms or decrease substance use may facilitate improvements in ART adherence and general HIV-care outcomes, addressing larger systems of inequity (e.g., differential access to healthcare services, discriminatory housing policies, a widening income gap) may facilitate more substantial changes. As a way to improve the physical (e.g., HIV-care outcomes) and mental health (e.g., depression, substance use) of older sexual minority adults, the field should develop and adopt multilevel (e.g., system and individual level) interventions that offer direct support by addressing psychosocial issues that may affect adherence challenges in combination with more generalized support by reducing factors related to structural life instability at the societal and community levels. Therefore, to best achieve *Ending the HIV Epidemic* goals [5], policy makers should partner with researchers and older sexual minority adult advocates to better identify the how the specific systems, structures, and social contexts of their given communities may affect an individual's ability to engagement with HIV-care behaviors more consistently.

Funding

Data Availability

The data that support the findings of this study are available within the article and/or its supplementary materials. All other data are available from the corresponding author, ERW, upon reasonable request.

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Table 1

Participant characteristics (N = 150)

Variable	M (SD) or n (%)
Participant demographics	
Age	56.47 (5.18)
Sex at birth	
Male	130 (86.7%)
Female	19 (12.7%)
Sexual orientation	
Gay/Lesbian	90 (60.0%)
Bisexual	53 (35.3%)
Other identity	6 (4.0%)
Education level	
Less than high school education	31 (20.7%)
More than high school education	119 (79.3%)
Race and ethnicity	
Black, Hispanic	5 (3.3%)
Black, non-Hispanic	50 (33.3%)
Asian, non-Hispanic	2 (1.3%)
White, Hispanic	72 (48.0%)
White, non-Hispanic	13 (8.7%)
Other/multiracial, Hispanic	8 (5.3%)
Country of origin	
U.S. born	89 (59.3%)
Foreign born	61 (40.7%)
Potential correlates	
Unstably housed (yes/no)	22 (14.7%)
Illicit substance use (more than once per month/less than once per month)	16 (10.7%)
Current nicotine use (yes/no)	43 (28.7%)
Depression symptoms	4.72 (5.50)
Anxiety symptoms	3.80 (3.31)
History of child abuse (yes/no)	68 (45.3%)
PTSD (yes/no)	31 (20.7%)
Study outcomes	
Antiretroviral therapy adherence	90.99 (19.21)
Detectable viral load (yes/no)	17 (11.3%)
Continuous log RNA viral load	1.57 (0.92)

Table 2

SSVS marginal inclusion probabilities and multiple linear regression models for ART adherence ($N = 150$)

Predictors	SSVS marginal inclusion probability	Multiple linear regression model (B, SE)
Unstably housed	1.00	−0.31 (3.98) ***
Illicit substance use	0.98	−0.27 (4.47) ***
Current nicotine use	0.66	−0.15 (3.06) *
Depression symptoms	0.62	−0.15 (0.25) *
Education level	0.57	–
History of child abuse	0.54	–
Anxiety symptoms	0.53	–
PTSD diagnosis criterion met	0.51	–
HIV stigma	0.46	–
Nativity	0.43	–
History of incarceration	0.41	–
Total PTSD symptoms	0.40	–
Employment status	0.37	–
Total intimate partner violence symptoms	0.37	–
Positive for intimate partner abuse	0.36	–
Positive for abuse as an adult	0.36	–
Identifying as a racial or ethnic minority	0.34	–
Age	0.33	–
Relationship status	0.30	–
Having health insurance	0.30	–
Gender	0.30	–
Meeting criteria for binge drinking	0.29	–

*
$p < 0.05$,

**
$p < 0.01$,

***
$p < 0.001$