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Understanding the Racial Disparities in Antiretroviral Therapy Adherence Among Black and White HIV-Positive Men Who Have Sex with Men in Atlanta, Georgia

By

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Master of Public Health

Global Epidemiology

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An abstract of
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Abstract

Understanding the Racial Disparities in Antiretroviral Therapy Adherence Among Black and White HIV-Positive Men Who Have Sex with Men in Atlanta, Georgia

By Erin R. McKeever

Background: There are many documented racial disparities along the human immunodeficiency virus (HIV) care continuum. Studies have indicated HIV-positive minorities are less likely to initiate and adhere to antiretroviral therapy (ART) than HIV-positive whites, and therefore less likely to have HIV viral suppression. Better understanding these disparities in ART adherence, can inform work that needs to be done to address this issue, specifically among the black men who have sex with men (MSM) population, the population with the highest burden of HIV.

Methods: Data were collected from a prospective cohort study of black and white HIV-positive MSM in Atlanta, Georgia from 2017-2019. This analysis used cross-sectional baseline survey data. Self-reported non-adherence was measured by missing a dose of HIV medication on one or more days in the last 30 days. A multivariate logistic regression model was fit to the data to calculate the adjusted odds ratios (aOR) and 95% confidence interval (CI) for factors associated ART adherence among black and white HIV-positive MSM, while controlling for relevant confounders.

Results: The adjusted association between race and ART adherence showed that the black MSM were 68% less likely than white MSM to be adherent to ART (aOR = 0.32, 95% CI: 0.18-0.57, p = 0.0001), when controlling for confounding by education level, poverty, health insurance, inability to pay for medical care, mental health (depression and anxiety), multiple substances use, and self-reported viral.

Conclusions: Our data show that black/white racial disparities exist in ART adherence, one component of HIV care. These data highlight the need for increased education and innovation on adherence and retention efforts in black HIV-positive MSM. These data also indicate that this focus should include the social and structural factors, mental health, substance use, and health care inequalities that are making this disparity even more pronounced. Because HIV treatment is of utmost importance for the health outcomes of people living with HIV and preventing the spread of HIV, focusing control efforts on ART adherence, and the racial disparities within it, is especially important.

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INTRODUCTION

Human Immunodeficiency Virus (HIV) is a substantial public health concern in the United States, especially among men who have sex with men (MSM) [1]. MSM are the highest risk group for HIV incidence in the United States, accounting for 67% of newly diagnosed HIV cases in 2016 [1]. In particular, black MSM are disproportionately impacted by HIV, having significantly higher rates of infection and prevalence than white MSM, which has been the case since the beginning of the epidemic in the United States [1-2]. Black MSM are at higher risk of getting HIV than white MSM, despite both races having similar risk behaviors (i.e., condom use, substance abuse, etc.) [3-5]. Many studies have further documented that black MSM do not have higher or more of these HIV risk behaviors than white MSM, instead many hypotheses for this discrepancy have been within treatment disparities and differing social network structures [2,6-7]. Additionally, major differences that have been shown in studies are that black MSM are less likely than white MSM to know their HIV status, more likely to have a sexual partner with a detectable HIV viral load, and HIV-positive black MSM are less likely to be on antiretroviral therapy (ART) [3-5]. However, in one study conducted in Atlanta, Georgia, social determinants, neighborhood factors, and sexual networks significantly outweighed any individual level risk factors as drivers of HIV disparities [5]. These factors that are contributing to excess HIV risk among black MSM bring to light well documented racial disparities between black and white HIV-positive MSM along many steps of the HIV care and treatment process [3,5,8].

There are many noted disparities along the HIV care continuum, or also referred to as the HIV treatment cascade, so much so that they were set as targets to be improved upon in a comprehensive National HIV/AIDS Strategy (NHAS) in 2010 [9]. These included focusing on linkages to care, testing to increase awareness of HIV status, and increasing viral suppression among HIV-positive MSM, especially for those who are black and Latino [9]. The HIV care

continuum cascades from testing and diagnosis of HIV, starting and engagement in HIV care, initiating ART, and then finally, adhering to ART and achieving viral load suppression [10]. By adhering to ART, an HIV-positive person can significantly reduce the amount of virus in their blood, also referred to as viral load, even to the point of having an undetectable viral load [11]. In 2011, Gardner et al. estimated that that only 19% of people living with HIV in the United States had undetectable viral loads. In order for HIV-infected individuals to fully benefit from ART and achieve viral suppression, as well as prevent the spread of HIV, they must know their HIV status, be engaged in HIV medical care, and initiate and adhere to ART [10]. Racial disparities have been well documented showing that blacks/African-Americans are the least likely to be retained in care or to have viral suppression and young black MSM are the least likely to know their HIV status or be linked to HIV medical care, which shows significant disparities along the HIV care continuum resulting in differing health outcomes [9].

While there are many noted disparities along the HIV care continuum, one disparity of utmost importance in reducing excess HIV risk and achieving viral suppression among black MSM is that of ART initiation and adherence. ART adherence is a critical component of the public health response to HIV and is part of the final step of the HIV care continuum, covering being retained in care, adhering to HIV medication, and ultimately, having an undetectable viral load [10]. ART treats HIV by suppressing HIV viral load levels, but it is also a means of HIV prevention [4,8]. Treatment of HIV serves a means of prevention as those who are HIV positive and take their HIV medicine as prescribed by their doctor maintain an undetectable viral load and thus have effectively no risk of transmitting HIV to a serodiscordant partner [11]. With this being said, adherence to treatment is a must for this treatment as a prevention strategy to be successful [8]. Additionally, ART adherence is critical as there is increased risk of developing drug resistance for HIV-positive persons and these antiretroviral medication resistant strains of

HIV can be sexually transmitted as well [12]. Studies have shown that HIV-positive minorities are less likely to initiate and adhere to ART than HIV-positive whites, therefore they are less likely to have HIV viral suppression [3-4,8,13-15].

There are many documented and hypothesized factors contributing to racial disparities in HIV care and treatment among those who are HIV-positive, potentially contributing to disparities in ART initiation and adherence among white and black HIV-positive MSM. Many structural factors (i.e., education level, poverty, unemployment, housing, transportation, etc.) have been found to be significant contributors to these HIV care disparities [16]. Additionally, things such as distrust in the medical and research community, belief in conspiracy theories about HIV/AIDS, stigma (related to HIV, sexual behaviors, and gender identity), and mental health and other psychosocial influencers have been documented contributors to disparities as well [15,17-18]. Inequities in access to and utilization of health care, insurance coverage, patient-provider relationships, and adherence to scheduled outpatient appointment among patients engaged in medical care are also contributing factors to noted racial disparities in HIV medical care [13,18-19]. While these are specific to the HIV care continuum and MSM as a whole, it is hypothesized that many of these same factors may provide insight to the ART adherence disparities between black and white HIV-positive MSM. Ultimately, better understanding these disparities in HIV care, specifically ART adherence, can inform the work that needs to be done to address this issue, specifically among the black MSM population, which already has the highest burden of HIV [9].

While many studies have documented the racial disparities in HIV care and outcomes, few have focused specifically on racial disparities in ART adherence among black and white HIV-positive MSM in the United States, a key element of HIV care, prevention, and positive health outcomes for people living with HIV. We seek to provide insight into ART adherence

disparities between a cohort of white and black MSM with previously and newly diagnosed HIV infection living in Atlanta, Georgia (n=400) from baseline survey data, as well as assess what additional factors may be contributing to this racial disparity.

METHODS

Study Design

Engage[MEN]t was a prospective longitudinal cohort of 400 black and white HIV-positive MSM with aims of understanding the factors that contribute to gaps and resiliency in HIV care and prevention. Biomedical lab procedures, qualitative in-depth interviews, and survey data was collected on demographics, HIV care engagement, sexually transmitted infections (STI), drug use, disclosure and condom use with anal sex partners, and healthcare utilization and neighborhood characteristics. MSM were enrolled over a one and a half-year time frame and each participant was followed for two years after enrollment, with the last follow-up visits conducted in February 2019.

The baseline enrollment study visit was used for cross-sectional data in this analysis. This enrollment visit consisted of obtaining informed consent; computer assisted self-interview (CASI) behavioral survey; biomedical specimen collection including: HIV testing to confirm positive status, testing for STIs and hepatitis C (HCV), plasma antiretroviral drugs (ARVs), alcohol/drugs of abuse, and CD4 and viral load; prevention counseling; care engagement counseling and referrals. Enrolled participants were compensated $60 for their time.

Setting

This study was conducted from August 2017-February 2019 at various sites throughout Atlanta that were most convenient for the participant. These sites consisted of non-profit agencies, university facilities, or other medical facilities.

Study Population

The study enrolled 400 MSM, with equal numbers of black and white participants, with previously and newly diagnosed HIV infections living in Atlanta, Georgia. Eligible MSM were included in the study if they had self-reported positive HIV status, male at birth, currently identified as male, over the age of 16 years, self-reported single race as black or white, self-reported non-Hispanic ethnicity, able to complete survey instruments in English, lived in the Atlanta Metropolitan area, not planning to exclusively receive HIV care outside of the Atlanta area in the next two years, and had at least one male sex partner in the 12 months before the baseline interview. Those who were not deemed eligible to enroll were determined to not be living with HIV per study testing and if they were also currently enrolled in another HIV prevention or treatment clinical trial.

Recruitment took place in both physical and internet venues, using time-based venue sampling and convenience sampling. Recruitment was done by frequency matching black to white enrollment within each recruitment modality to achieve racial balance and set quotas to minimize selection bias. Additionally, recruitment flyers were distributed to newly diagnosed HIV positive MSM from health departments, community-based organizations and healthcare settings, MSM were also recruited from other HIV studies if they indicated that they wished to be contacted for participation in future studies, and advertisements for recruitment were placed on mass transportation throughout the Atlanta metropolitan area. For MSM deemed eligible and who were willing to participate, were scheduled for a baseline enrollment visit at the study offices, where written informed consent was obtained for all study procedures.

Participants were followed for two years prospectively, however only cross-sectional data from the baseline visit was used in this analysis.

Study size

The study enrolled 400 total participants, 207 were black/African American and 193 were white/Caucasian. 52 were excluded from the analysis because at baseline they were not on antiretroviral therapy, therefore meaning they could not report adherence. The final sample size then was 348 total MSM, with 169 black/African American and 179 white/Caucasian.

Variables

The outcome assessed in this analysis was antiretroviral therapy adherence. Self-reported adherence outcome variable was measured by those who missed a dose of HIV medication on one or more days in the last 30 days were considered non-adherent. This analysis sought to assess differences in ART adherence among black and white MSM. Race was measured as a self-reported single black or white, non-Hispanic, race variable.

Explanatory variables were considered in a few domains: sociodemographic factors, biological factors related to health status, substance use, sexual behaviors, factors related to the HIV care continuum, health literacy, and factors related to ART adherence.

Sociodemographic factors included age, which was assessed as a binary variable at greater than 40 years of age and 40 years or less, per previous literature indicating discrepancies in ART adherence at this age split. Additionally, self-reported measures of sexual orientation, education, employment status, poverty, homelessness, health insurance coverage, and inability to pay for medical care in the past 12 months were assessed. Biological factors were self-reported STI diagnosis in the past 12 months, most recent CD4 count, and most recent viral load. Mental health measures were of medical provider diagnosed chronic depression and anxiety. Substance use was a self-reported measure indicating all substances used in the past six months. Sexual behaviors included number of anal intercourse (AI) partners and unprotected anal intercourse

(UAI) partners in the past six months. Categories for these variables were either none or divided based on the interquartile range for each of these continuous variables. Factors related to the HIV care continuum included missed scheduled appointments in the past 12 months, gone more than one year without seeing a provider, doctor changed HIV medication in the past five years, and reasons that a doctor might have changed HIV medication in the past five years (including insurance coverage changed, side effects, copay for medication changed, different medication options available, new medication that could be taken less often, and doctor recommendation). Health literacy was measured by the response to if the participant experienced a problem with their HIV medication, what would they be likely to do, indicating their level of knowledge of best health practices.

To better understand our outcome variable, other factors related to ART adherence that were assessed were how often they took HIV medication as they were supposed to in the past 30 days, reasons for missing HIV medication, and if HIV medication was intentionally missed in the past 12 months.

Data Sources/Measurement

The baseline survey collected all demographic information as well as information about HIV care engagement and providers, HCV and STIs, drug use, HIV disclosure and condom use with anal sex partners, healthcare access and utilization, mental health and other psychosocial determinants, housing and transportation. The survey was administered using CASI technology and took about 1-1.5 hours to complete. All data used in this analysis were taken from this source as self-reported measures.

Statistical Methods

The explanatory variables, as described previously, were descriptively summarized at baseline comparing black and white MSM using chi-square, fisher's exact and t-tests. Associations were considered significant at alpha level 0.05. After assessing bivariate analysis and assessing the explanatory variables based on review of published literature, we constructed a multivariate logistic regression model to calculate the adjusted odds ratios and 95% confidence intervals for factors associated with ART non-adherence among black and white HIV-positive MSM using SAS 9.4. In order to construct the model each variable was assessed using manual model selection, leaving variables in the model that best controlled for confounding, by assessing the differences in adjusted odds ratios in different versions of the model.

RESULTS

Demographics and Baseline Characteristics

Baseline characteristics of the study population (n=348) of HIV-positive MSM are presented in Table 1. The median age was 41 years old, the median age of black participants was younger (36 years old) than white participants (46 years old). The majority of participants identified as homosexual or gay (92.2%), while 6.3% identified as bisexual and 1.4% identified as other. The majority of the participants had more than a high school degree or GED, with 41.7% having at least some college, associate degree, and/or technical school and 44.3% having college, post graduate, or professional degree at baseline. More than two-thirds were employed (68.1%) and less than one-third were in living in poverty at baseline (28.4%). Four black participants reported being homeless, while no white participant reported baseline homelessness. 85.7% of white participants and 69.3% of black participants had health insurance coverage, resulting in about three-fourths of the participants having health insurance coverage at baseline (77.7%). 38.8% of participants reported not being able to pay for medical care within the past 12 months.

Many of the participants had mental health conditions, with 43.7% having diagnosed depression and 34.8% having diagnosed anxiety. Both of these conditions were statistically significantly higher in white MSM, than black MSM. Almost one-third of the participants had an STI diagnosis within the past 12 months (31.0%). About three-fourths of the participants had a self-reported undetectable most recent viral load (76.0%).

Baseline characteristics related to the HIV care continuum, ART adherence, and health literacy are reported in Table 2. Related to the HIV care continuum, 12.8% of the participants reported having missed a scheduled appointment in the past 12 months, with a significant difference between black and white MSM, with 19.1% of black MSM and 6.9% white MSM

reporting this. Additionally, 20.2% of participants had not seen a provider in the past year. A majority (66.3%) of participants reported having a doctor change their HIV medication in the past five years, with reasons being for insurance coverage changes, side effects, copay for medication changed, different medication options available, new medications that could be taken less often, and just because of doctor recommendations. Related to ART adherence, 45.5% of participants reported always taking their HIV medications as supposed to in the past 30 days, 38% reported adhering almost always, and 1.7% reporting never. A wide variety of reasons for missing HIV medication was reported, however the most reported was that the participant simply forgot (52.8%). Additionally, 11.7% of participants intentionally missed their HIV medication in the past 12 months, with more black MSM (16.5%) reporting this than white MSM (7.3%) (p=0.01). Related to health literacy, almost three-fourths (73.3%) of participants reported that if they experienced a problem with HIV medications, they would be likely to continue taking the medication and contact their provider for assistance.

Bivariate Analysis

Comparisons of the various explanatory variables between black and white MSM, using chi-square, fisher's exact and t-tests, are presented in Table 1 and 2. Many of the variables differed significantly between black and white MSM. At baseline, more black MSM were living in poverty (36.3% vs 21.3%, p=0.002) and homeless (2.4% vs 0.0%, p=0.04) and less black MSM had health insurance compared to white MSM (69.3% vs 85.7%, p=0.0003). White MSM had significantly more diagnosed depression and anxiety than black MSM (p=0.02). White MSM had more partners with UAI in the past six months (p <0.0001). Within the HIV care continuum, black MSM missed more scheduled appointments in the past 12 months than white MSM (19.1% vs 6.9%, p=0.0007). Specifically related to ART adherence, white MSM reported better

adherence in the past month than black MSM, with 36.9% of black MSM and 53.6% of white MSM reporting always taking HIV medication ($p<0.0001$). There were significant differences in reasons for missing HIV medication between black and white MSM. More black MSM than white MSM reported being busy with other things (34.7% vs 20.5%, $p=0.02$), wanted to avoid side effects (9.7% vs 2.3%, $p=0.03$), and ran out of pills (26.6% vs 13.6%, $p=0.02$) as reasons for missing HIV medication.

Crude associations between the exposure of race and the various covariates and the covariates and the outcome of ART adherence are presented in Tables 3-6. Those who were younger (18-40 years) were 1.98 times more likely to be adherent to ART than those who were older (41-71 years) (OR=1.98, 95% CI: 1.27-3.08, $p=0.002$). Regarding healthcare expenses, those who had insurance coverage at baseline were 2.18 times more likely to be adherent to ART than those who did not (OR=2.18, 95% CI: 1.24-3.84, $p=0.007$) and those who reported having an inability to pay for medical care in the previous year were 58% less likely to adhere to ART than those who had the ability to pay (OR=0.42, 95% CI: 0.27-0.68, $p=0.0003$). Additionally, those who did not attend scheduled appoints in the previous year were 83% less likely to adhere to ART than those who did (OR=1.7, 95% CI: 0.07-0.45, $p=0.0003$). In bivariate analysis assessing the crude association between race and ART adherence, black MSM are 65% less adherent to ART than white MSM (OR = 0.35, 95% CI: 0.22-0.55, $p <0.0001$), as presented in Table 3.

Multivariate Analysis

A multivariate logistic regression model was fit to the data to determine if race (black/African-American or white/Caucasian) is associated with self-reported ART adherence (versus not adherent), while controlling for confounders of education level, poverty, health

insurance, inability to pay for medical care, mental health (depression and anxiety), multiple substances use, and self-reported viral load (Table 7). The adjusted association showed that MSM who are black were 67% less likely to be adherent to ART than white MSM (aOR = 0.32, 95% CI: 0.18-0.57, p=0.0001), when controlling for confounding. While this association is statistically significant, none of the other covariates were found to be significant except for the marijuana use, which indicates that those who used marijuana were 46% less likely to be adherent to ART controlling for all other relevant variables (aOR=0.54, 95% CI: 0.31-0.96, p=0.04).

DISCUSSION

Main Findings

In recent years, research has shown racial disparities along the HIV care continuum. In the United States, disease progression, infectiousness, and mortality from HIV occur in greater frequency among HIV-positive black MSM compared to HIV-positive white MSM [6]. This highlights the public health importance of ART initiation and adherence as a part of the HIV care continuum in reducing excess HIV risk and achieving viral suppression, especially among HIV-positive black MSM. Antiretroviral therapy is a treatment and a means of HIV prevention, as reduction in viral load has been shown to diminish the risk of transmission of HIV to a serodiscordant sexual partner [4,8]. Therefore, adherence to HIV medication is a must for this to be successful [8]. However, many studies have documented that HIV-positive minorities are less likely to begin and engage in HIV care, such as initiating and adhering to ART, than HIV-positive whites, therefore they are less likely to have HIV viral suppression [3-4,8,13-14]. Public health professionals and researchers have both documented and hypothesized that social and structural factors (i.e., education level, poverty, unemployment, housing, transportation, etc.), distrust in the medical and research community, stigma related to HIV and gender identities, mental health and other psychosocial influencers contribute to these racial disparities in HIV care and treatment [16-18]. Additionally, inequities in access to and utilization of health care, insurance coverage, patient-provider relationships, and adherence to scheduled outpatient appointment among patients engaged in medical care are contributing factors to noted racial disparities in HIV medical care, which may also be additional factors that provide insight into ART adherence disparities between black and white HIV-positive MSM [13,18-19].

This study explored the association between race, specifically black and white race, and ART adherence among a cohort of newly and previously diagnosed MSM (n=400) in Atlanta,

Georgia using baseline survey data. The aim of this analysis was to provide insight into racial disparities in ART adherence among MSM in the United States, a key element of HIV care, prevention, and positive health outcomes for people living with HIV, while also discussing what other factors may be contributing to this disparity. This analysis found a statistically significant adjusted association between race and ART adherence; black MSM are 67% less likely to be adherent to ART than white MSM (aOR = 0.32, 95% CI: 0.18-0.57, p=0.0001) while controlling for confounders of education level, poverty, health insurance, inability to pay for medical care, mental health (depression and anxiety), multiple substances use, and self-reported viral load. These findings are consistent with much of the published literature on racial disparities in HIV care and treatment.

Limitations

There are a number of acknowledged limitations in our current study. First, this study only occurred in a cohort of HIV-positive MSM in Atlanta, Georgia. While this research may be generalizable to the greater population of black and white HIV-positive MSM in Atlanta, it may not be the case for this same population in other cities, states, and globally. Structural and social factors, health care inequities and insurance coverage, in particular, may differ in different areas of the United States due to legislative policies, structural inequities, and population distributions. Additionally, this study only looked at black and white race and these findings may not be generalizable to other races or ethnic groups of HIV-positive MSM.

Through recruitment methodologies, selection bias was addressed and likely not present in our study findings. Confounding was controlled for in the analysis phase through a multivariate logistic regression model using variables found to be associated with racial disparities in HIV care and treatment in previously published literature (education level, poverty,

health insurance, inability to pay for medical care, mental health (depression and anxiety), multiple substances use, and self-reported viral load) [13,16-19]. However, previous research has also indicated additional factors that may influence this association between race and disparities in HIV care engagement that were not measured in our research such as distrust in the medical and research community, belief in conspiracy theories about HIV/AIDS, and stigma related to HIV, sexual behaviors, and gender identity [17-18]. These unmeasured confounders are a potential source of bias not controlled in this analysis and is a limitation.

An additional limitation of these results is that only self-reported ART adherence was used. Because people tend to over report more socially desirable behaviors, this could be a source of information bias. The study did collect biomedical ART adherence data, however this analysis only accounted for the self-reported ART adherence from baseline survey data. Assessing this potential misclassification to determine whether or not it is differential could help to determine the validity of the results of this study. Additionally, analyses and further exploration could be done to compare these results to actual adherence through the biomedical data or look at the biomedical data alone to confirm these results found in this study.

Public Health Implications

There are important public health implications related to this study and how we can further consider and study racial disparities in epidemiologic research. In this analysis, race was treated as the exposure in order to make an inference on a racial disparity in a health outcome, ART adherence. However, as race cannot really be considered a treatment type variable for counterfactual thinking, making causal inferences about racial disparities in health outcomes becomes more challenging, albeit still important to be acknowledged and studied further through epidemiologic and public health research. Using “race” as a variable, especially in the United

States, inherently encompasses social, economic, and policies which have created these inequalities in health status of populations throughout history [20]. Essentially, we are using black race and white race as a proxy for an encompassing variable that represents the experiences of these populations, this should be acknowledged when discussing the findings of this and other racial disparities in health research [20]. Additionally, in this analysis we sought to select variables in our multivariate regression model which may confound the association between race and ART adherence among HIV-positive MSM, and when comparing the adjusted results to the crude results, we found that the odds of ART adherence was even larger in white HIV-positive MSM than black HIV-positive MSM. This research, along with those previously published, bring to light potential implications of drawing causal inferences about racial disparities in health and should be something that is continually studied in order to draw the most accurate conclusions and provide insight into how we can further reduce these racial disparities in a variety of health outcomes, including HIV care and treatment. Ultimately, understanding the environment (i.e., behaviors, social constructs, stigmatization, marginalization, etc.) in which these disparities are occurring and assessing it through a multilevel framework can help to inform the potential interventions that need to be implemented in order to address these disparities in HIV care, specifically for ART adherence [21]. This is an especially important to be addressed among black MSM, a population that has the highest burden of HIV [9,21].

Conclusion

Our data show that black/white racial disparities exist in ART adherence, one component of HIV care. This is a call to focus on engaging populations in care, promoting knowledge on HIV care and treatment, and innovation on adherence and retention efforts, especially for black HIV-positive MSM. These data also indicate that this focus should consider the social and

structural factors, mental health, substance use and abuse, and health care inequalities that are making this disparity even more pronounced. Because HIV treatment is of utmost importance for the health outcomes of people living with HIV and preventing the spread of HIV as a whole, focusing epidemic control efforts on ART adherence, and the racial disparities within it, is especially important.

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APPENDIX A. TABLES

Table 1

Table 1. Baseline characteristics of Black/African American and White/Caucasian HIV-positive MSM, Atlanta, GA, 2017-2019

	Total (n=348)		Black (n=169)		White (n=179)		
	%	N	%	N	%	N	p-value
Age, years							
Median (IQR)	41 (19.0)	348	36 (16.0)	169	46 (15.0)	179	<0.0001
18-40	45.4	158	60.4	102	31.3	56	<0.0001
41-71	54.6	190	39.6	67	68.7	123	
Sexual Orientation		348		169		179	0.0001
Homosexual or Gay	92.2	321	86.4	146	97.8	175	
Bisexual	6.3	22	10.7	18	2.2	4	
Other	1.4	5	3.0	5	0.0	0	
Education		348		169		179	0.02
College, Post Graduate, or Professional School	44.3	154	36.1	61	52.0	93	
Some College, Associate Degree, and/or Technical School	41.7	145	48.5	82	35.2	63	
High School or GED	12.4	43	13.0	22	11.7	21	
Did not finish High School	1.7	6	2.4	4	1.1	2	
Employed, current	68.1	(237/348)	63.9	(108/169)	72.1	(129/179)	0.10
Poverty, current	28.4	(94/331)	36.3	(57/157)	21.3	(37/174)	0.002
Homeless, current	1.2	(4/342)	2.4	(4/167)	0.0	(0/175)	0.04
Health Insurance coverage, current	77.7	(265/341)	69.3	(115/166)	85.7	(150/175)	0.0003
Inability to pay for medical care, past 12 mo	38.8	(134/345)	43.1	(72/167)	34.8	(62/178)	0.11
STI diagnosis, past 12 mo	31.0	(88/284)	34.53	(48/139)	27.6	(40/145)	0.21
Mental Health		348		169		179	
Depression, diagnosed	43.7	152	37.28	63	49.7	89	0.02
Anxiety, diagnosed	34.8	121	28.4	48	40.8	73	0.02
Substance use, past 6 mo		348		169		179	
Alcohol	77.9	271	79.9	135	76.0	136	0.38
Marijuana	46.3	161	58.6	99	34.6	62	<0.0001
Cocaine/Crack	17.2	60	18.3	31	16.2	29	0.60
Methamphetamine	12.4	43	8.3	14	16.2	29	0.02

Ecstasy	5.8	20	4.7	8	6.7	12	0.43
GHB	8.1	28	4.1	7	11.7	21	0.009
Heroin/Opioids/Pain Killers	9.5	33	6.5	11	12.3	22	0.07
Poppers	32.5	113	22.5	38	41.9	75	0.0001
Other Drugs	3.7	13	1.2	2	6.2	11	0.01
No substance use	9.2	32	10.7	18	7.8	14	0.36
Sexual Behaviors							
No. Partners Anal Intercourse, past 6 mo							
Median (IQR)	2 (4.0)	339	2 (3.0)	167	3 (7.0)	172	0.01
None	5.3	18	5.4	9	5.2	9	0.01
1-2	47.8	162	52.1	87	43.6	75	
3-5	23.0	78	26.4	44	19.8	34	
6-100	23.9	81	16.2	27	31.4	54	
No. Partners Unprotected Anal Intercourse, past 6 mo							
Median (IQR)	2 (3.0)	321	1 (3.0)	158	2 (5.0)	163	0.003
None	18.4	59	27.2	43	9.8	16	<0.0001
1-2	46.1	148	46.8	74	45.4	74	
3-4	13.7	44	11.4	18	16.0	26	
5-100	21.8	70	14.6	23	28.8	47	
CD4, most recent		345		166		179	0.36
Under 200	11.3	39	9.0	15	13.4	24	
200-349	7.0	24	7.2	12	6.7	12	
350-499	16.8	58	16.3	27	17.3	31	
500 or more	53.6	185	53.0	88	54.2	97	
Don't know	11.3	39	14.5	24	8.4	15	
Viral Load, most recent		342		165		117	0.10
Below the level of detection or undetectable	76.0	260	72.1	119	79.7	141	
Detectable but < 5,000 viral copies/mL	11.4	39	10.9	18	11.9	21	
5,000-100,000 viral copies/mL	3.8	13	4.2	7	3.4	6	
>100,000 viral copies/mL	1.2	4	1.2	2	1.1	2	
Don't know	7.6	26	11.5	19	4.0	7	

Table 2

Table 2. Characteristics related to the HIV care continuum and ART adherence for Black/African American and White/Caucasian HIV-positive MSM, Atlanta, 2017-2019

	Total (n=348)		Black (n=169)		White (n=179)		
	%	N	%	N	%	N	p-value
HIV Care Continuum							
Missed scheduled appointments, past 12 mo	12.8	(43/337)	19.1	(31/162)	6.9	(12/175)	0.0007
Gone more than a year without seeing a provider	20.2	(26/129)	22.4	(15/67)	17.7	(11/62)	0.51
Doctor changed HIV medication, past 5 years	66.3	(220/332)	62.5	(100/160)	69.8	(120/172)	0.16
Reasons for HIV medication change, past 5 years		220		100		120	
Insurance coverage changed	5.5	12	7.0	7	4.2	5	0.36
Side effects	32.7	72	32.0	32	18.2	40	0.83
Copay for medication changed	4.1	9	2.0	2	5.8	7	0.15
Different medication option available	55.5	122	46.0	46	63.3	76	0.01
New medication that could be taken less often	33.6	74	32.0	32	35.0	42	0.64
Doctor recommended it	52.7	116	50.0	50	55.0	66	0.46
ART Adherence							
How often take HIV medication as supposed to, past 30 days		347		168		179	<0.0001
Never	1.7	6	3.6	6	0.0	0	
Rarely	2.0	7	3.6	6	0.6	1	
Sometimes	3.5	12	5.4	9	1.7	3	
Usually	9.2	32	13.1	22	5.6	10	
Almost Always	38.0	132	37.5	63	38.6	69	
Always	45.5	158	36.9	62	53.6	96	
Reasons for missing HIV medication		212		124		88	
Away from home	31.1	66	33.9	42	27.3	24	0.31
Busy with other things	28.8	61	34.7	43	20.5	18	0.02
Simply forgot	52.8	112	47.6	59	60.2	53	0.07
Had too many pills to take	2.4	5	4.0	5	0.0	0	0.06
Wanted to avoid side effects	6.6	14	9.7	12	2.3	2	0.03
Did not want others to notice me taking medication	4.3	9	5.7	7	2.3	2	0.23
Had a change in daily routine	28.8	61	31.5	29	25.0	22	0.31

Felt like the drug was harmful/toxic	1.9	4	1.6	2	2.3	2	0.73
Feel asleep/slept through dose time	36.8	78	38.7	48	34.1	30	0.49
Felt sick or ill	9.0	19	6.1	13	2.8	6	0.36
Felt depressed/overwhelmed	11.8	25	9.0	19	2.8	6	0.59
Had problems taking pills at specified times (with meals, on empty stomach, etc.)	18.9	40	21.8	27	14.8	13	0.20
Ran out of pills	21.2	45	26.6	33	13.6	12	0.02
Felt good	2.4	5	3.2	4	1.1	1	0.32
Problem getting a prescription, refill, insurance coverage, or paying for medication	15.1	32	16.1	20	13.6	12	0.62
In the hospital	3.3	7	4.8	6	0.5	1	0.14
Drinking or using drugs	12.7	27	13.7	17	11.4	10	0.61
Did not feel like taking the medication	8.5	18	10.5	13	5.7	5	0.22
Other	3.8	8	4.8	6	2.3	2	0.33
Intentionally missed HIV medication, past 12 mo	11.7	(37/317)	16.5	(25/152)	7.3	(12/165)	0.01
Health Literacy							
If experience a problem with HIV medications, what would be likely to do		348		169		179	0.003
Continue taking the medication and wait for things to improve	6.6	23	7.1	12	6.2	11	
Continue taking the medication and contact my provider for assistance	73.3	255	65.1	110	81.0	145	
Stop taking the medication completely	0.6	2	1.2	2	0.0	0	
Stop taking the medication and contact my provider for assistance	19.3	67	26.0	44	12.9	23	
Stop taking the medication temporarily until I feel better	0.3	1	0.6	1	0.0	0	

Table 3

Table 3. Bivariate analysis self-reported ART adherence (vs not adherent) and associated risk factors, sexual behaviors, and socioeconomic factors

	ART Adherence (OUTCOME)		
(COVARIATES)	**OR**	**95% CI**	**p-value**
Race **(EXPOSURE)**			
Black/African American	0.35	(0.22-0.55)	<0.0001
White/Caucasian	1.00	--	
Age, years			
18-40	1.98	(1.27-3.08)	0.002
41-71	1.00	--	
Sexual Orientation			
Homosexual or Gay	1.00	--	0.48
Bisexual	0.55	(0.21-1.45)	
Other	--	--	
Education			
College, Post Graduate, or Professional School	1.00	--	0.29
Some College, Associate Degree, and/or Technical School	0.71	(0.44-1.13)	
High School or GED	0.68	(0.34-1.37)	
Did not finish High School	0.25	(0.03-2.22)	
Employed, current (vs unemployed)	1.08	(0.68-1.72)	0.75
Poverty, current (vs no)	0.65	(0.39-1.08)	0.10
Homeless, current (vs no)	--	--	--
Health Insurance coverage, current (vs no)	2.18	(1.24-3.84)	0.007
Inability to pay for medical care, past 12 mo (vs ability to pay)	0.42	(0.27-0.68)	0.0003
STI diagnosis, past 12 mo (vs no)	1.00	(0.60-1.67)	1.00
Mental Health			
Depression, diagnosed (vs no)	0.69	(0.45-1.08)	0.10
Anxiety, diagnosed (vs no)	0.64	(0.40-1.01)	0.06
Substance use, past 6 mo (vs no)			
Alcohol	0.76	(0.46-1.27)	0.30
Marijuana	0.43	(0.28-0.67)	0.0002
Cocaine/Crack	0.46	(0.25-0.86)	0.02
Methamphetamine	0.32	(0.14-0.70)	0.005
Ecstasy	0.37	(0.12-1.14)	0.08

GHB	0.24	(0.08-0.70)	0.01
Heroin/Opioids/Pain Killers	1.17	(0.56-2.41)	0.68
Poppers	0.94	(0.59-1.49)	0.79
Other Drugs	2.59	(0.83-8.08)	0.10
No substance use	2.16	(1.04-4.50)	0.04
Sexual Behaviors			
No. Partners Anal Intercourse, past 6 mo			0.39
None	1.00	--	
1-2	2.406	(0.76-7.63)	
3-5	2.435	(0.73-8.08)	
6-100	1.849	(0.56-6.15)	
No. Partners Unprotected Anal Intercourse, past 6 mo			0.10
None	1.00	--	
1-2	0.49	(0.27-0.90)	
3-4	0.69	(0.31-1.51)	
5-100	0.47	(0.23-0.96)	
CD4, most recent			0.95
Under 200	1.04	(0.52-2.11)	
200-349	1.07	(0.45-2.54)	
350-499	0.99	(0.54-1.80)	
500 or more	1.00	--	
Don't know	0.75	(0.36-1.55)	
Viral Load, most recent			0.13
Below the level of detection or undetectable	1.00	--	
Detectable but < 5,000 viral copies/mL	0.40	(0.18-0.88)	
5,000-100,000 viral copies/mL	0.84	(0.27-2.63)	
> 100,000 viral copies/mL	1.34	(0.19-9.68)	
Don't know	0.50	(0.20-1.22)	

Table 4

Table 4. Bivariate analysis self-reported ART adherence (vs not adherent) and associated risk factors related to the HIV care continuum

	ART Adherence (OUTCOME)		
(COVARIATES)	**OR**	**95% CI**	**p-value**
HIV Care Continuum			
Missed scheduled appointments, past 12 mo (vs no)	0.17	(0.07-0.45)	0.0003
Gone more than a year without seeing a provider (vs no)	0.61	(0.23-1.57)	0.30
Doctor changed HIV medication, past 5 years (vs no)	0.92	(0.58-1.47)	0.72
Reasons for HIV medication change, past 5 years			
Insurance coverage changed	0.31	(0.07-1.44)	0.13
Side effects	0.96	(0.54-1.71)	0.88
Copay for medication changed	0.19	(0.02-1.57)	0.12
Different medication option available	1.53	(0.88-2.67)	0.13
New medication that could be taken less often	1.07	(0.60-1.89)	0.83
Doctor recommended it	0.98	(0.57-1.69)	0.94
ART Adherence			
How often take HIV medication as supposed to, past 30 days			<0.0001
Never	--	--	
Rarely	--	--	
Sometimes	0.04	(0.01-0.30)	
Usually	--	--	
Almost Always	0.08	(0.05-0.15)	
Always	1.00	--	
Intentionally missed HIV medication, past 12 mo (vs no)	0.07	(0.02-0.28)	0.0002
Health Literacy			
If experience a problem with HIV medications, what would be likely to do			0.87
Continue taking the medication and wait for things to improve	0.76	(0.31-1.86)	
Continue taking the medication and contact my provider for assistance	1.00	--	
Stop taking the medication completely	--	--	
Stop taking the medication and contact my provider for assistance	0.75	(0.43-1.31)	
Stop taking the medication temporarily until I feel better	--	--	

Table 5

Table 5. Bivariate analysis Black/African American Race (vs White/Caucasian Race) and associated risk factors, sexual behaviors, and socioeconomic factors

	Race (EXPOSURE)		
(COVARIATES)	**OR**	**95% CI**	**p-value**
Age, years			
18-40	0.30	(0.19-0.47)	<0.0001
41-71	1.00	--	
Sexual Orientation			
Homosexual or Gay	1.00	--	0.01
Bisexual	5.39	(1.79-16.29)	
Other	--	--	
Education			
College, Post Graduate, or Professional School	1.00	--	0.02
Some College, Associate Degree, and/or Technical School	1.98	(1.25-3.15)	
High School or GED	1.60	(0.81-3.15)	
Did not finish High School	3.05	(0.54-17.16)	
Employed, current (vs unemployed)	0.69	(0.44-1.08)	0.10
Poverty, current (vs no)	2.11	(1.30-3.44)	0.003
Homeless, current (vs no)	--	--	--
Health Insurance coverage, current (vs no)	0.38	(0.22-0.64)	0.0004
Inability to pay for medical care, past 12 mo (vs ability to pay)	1.42	(0.92-2.19)	0.12
STI diagnosis, past 12 mo (vs no)	1.39	(0.84-2.29)	0.21
Mental Health			
Depression, diagnosed (vs no)	0.60	(0.39-0.92)	0.02
Anxiety, diagnosed (vs no)	0.58	(0.37-0.90)	0.02
Substance use, past 6 mo (vs no)			
Alcohol	1.26	(0.76-2.09)	0.38
Marijuana	2.67	(1.73-4.12)	<0.0001
Cocaine/Crack	1.16	(0.67-2.03)	0.60
Methamphetamine	0.47	(0.24-0.92)	0.03
Ecstasy	0.69	(0.28-1.74)	0.43
GHB	0.33	(0.13-0.79)	0.01
Heroin/Opioids/Pain Killers	0.50	(0.23-1.06)	0.07

Poppers	0.40	(0.25-0.64)	0.0001
Other Drugs	0.18	(0.04-0.84)	0.03
No substance use	1.41	(0.68-2.92)	0.36
Sexual Behaviors			
No. Partners Anal Intercourse, past 6 mo			0.01
None	1.00	--	
1-2	1.16	(0.44-3.07)	
3-5	1.29	(0.46-3.61)	
6-100	0.50	(0.18-1.41)	
No. Partners Unprotected Anal Intercourse, past 6 mo			0.0001
None	1.00	--	
1-2	0.37	(0.19-0.72)	
3-4	0.26	(0.11-0.59)	
5-100	0.18	(0.09-0.39)	
CD4, most recent			0.37
Under 200	0.69	(0.34-1.40)	
200-349	1.10	(0.47-2.58)	
350-499	0.96	(0.53-1.73)	
500 or more	1.00	--	
Don't know	1.76	(0.87-3.58)	
Viral Load, most recent			0.15
Below the level of detection or undetectable	1.00	--	
Detectable but < 5,000 viral copies/mL	1.02	(0.52-2.00)	
5,000-100,000 viral copies/mL	1.38	(0.45-4.23)	
> 100,000 viral copies/mL	1.19	(0.16-8.54)	
Don't know	3.22	(1.31-7.91)	

Table 6

Table 6. Bivariate analysis Black/African American Race (vs White/Caucasian Race) and associated risk factors related to the HIV care continuum

	Race (EXPOSURE)		
(COVARIATES)	**OR**	**95% CI**	**p-value**
HIV Care Continuum			
Missed scheduled appointments, past 12 mo (vs no)	3.21	(1.59-6.51)	0.001
Gone more than a year without seeing a provider (vs no)	1.34	(0.56-3.19)	0.51
Doctor changed HIV medication, past 5 years (vs no)	0.72	(0.46-1.14)	0.16
Reasons for HIV medication change, past 5 years			
Insurance coverage changed	1.73	(0.53-5.64)	0.36
Side effects	0.94	(0.53-1.66)	0.83
Copay for medication changed	0.33	(0.67-1.62)	0.17
Different medication option available	0.49	(0.29-0.85)	0.01
New medication that could be taken less often	0.87	(0.50-1.54)	0.64
Doctor recommended it	0.82	(0.48-1.39)	0.46
ART Adherence			
How often take HIV medication as supposed to, past 30 days			0.007
Never	--	--	
Rarely	9.29	(1.09-79.04)	
Sometimes	4.65	(1.21-17.83)	
Usually	3.41	(1.51-7.68)	
Almost Always	1.41	(0.89-2.26)	
Always	1.00	--	
Reasons for missing HIV medication			
Away from home	1.37	(0.75-2.49)	0.31
Busy with other things	2.06	(1.09-3.90)	0.26
Simply forgot	0.60	(0.35-1.04)	0.07
Had too many pills to take	--	--	--
Wanted to avoid side effects	4.61	(1.00-21.19)	0.05
Did not want others to notice me taking medication	2.57	(0.52-12.69)	0.25
Had a change in daily routine	1.38	(0.75-2.54)	0.31
Felt like the drug was harmful/toxic	0.71	(0.10-5.10)	0.73
Feel asleep/slept through dose time	1.22	(0.69-2.16)	0.49
Felt sick or ill	1.60	(0.58-4.39)	0.36
Felt depressed/overwhelmed	2.47	(0.95-6.47)	0.07

Had problems taking pills at specified times (with meals, on empty stomach, etc.)	1.61	(0.78-3.32)	0.20
Ran out of pills	2.30	(1.11-4.75)	0.03
Felt good	2.90	(0.32-26.40)	0.34
Problem getting a prescription, refill, insurance coverage, or paying for medication	1.22	(0.56-2.64)	0.62
In the hospital	4.42	(0.52-37.39)	0.17
Drinking or using drugs	1.24	(0.54-2.85)	0.61
Did not feel like taking the medication	1.94	(0.67-5.66)	0.22
Other	2.19	(0.43-11.10)	0.35
Intentionally missed HIV medication, past 12 mo (vs no)	2.51	(1.21-5.19)	0.01
Health Literacy			
If experience a problem with HIV medications, what would be likely to do			0.03
Continue taking the medication and wait for things to improve	1.44	(0.61-3.38)	
Continue taking the medication and contact my provider for assistance	1.00	--	
Stop taking the medication completely	--	--	
Stop taking the medication and contact my provider for assistance	2.52	(1.44-4.42)	
Stop taking the medication temporarily until I feel better	--	--	

Table 7

Table 7. Multivariate analysis self-reported ART adherence (vs not adherent) and associated risk factors

	ART Adherence		
	AOR	**95% CI**	**p-value**
Race			
Black/African American	0.32	(0.18-0.57)	0.0001
White/Caucasian	1.00	--	
Education			0.57
College, Post Graduate, or Professional School	1.00	--	
Some College, Associate Degree, and/or Technical School	1.16	(0.66-2.04)	
High School or GED	0.59	(0.22-1.52)	
Did not finish High School	--	--	
Poverty, current (vs no)	1.06	(0.56-2.01)	0.86
Health Insurance coverage, current (vs no)	1.24	(0.62-2.50)	0.54
Inability to pay for medical care, past 12 mo (vs ability to pay)	0.62	(0.35-1.07)	0.08
Mental Health			
Depression, diagnosed (vs no)	0.69	(0.37-1.28)	0.23
Anxiety, diagnosed (vs no)	0.74	(0.46-1.42)	0.36
Substance use, past 6 mo (vs no)			
Alcohol	1.01	(0.46-2.21)	0.98
Marijuana	0.54	(0.31-0.96)	0.04
Cocaine/Crack	0.82	(0.36-1.83)	0.62
Methamphetamine	0.63	(0.20-2.03)	0.44
Ecstasy	0.75	(0.19-2.90)	0.67
GHB	0.42	(0.09-1.90)	0.26
Heroin/Opioids/Pain Killers	1.54	(0.64-3.68)	0.33
Poppers	1.28	(0.71-2.33)	0.42
Other Drugs	2.70	(0.70-10.42)	0.15
No substance use	2.73	(0.85-8.71)	0.09
Viral Load, most recent			0.28
Below the level of detection or undetectable	1.00	--	
Detectable but < 5,000 viral copies/mL	0.48	(0.20-1.15)	
5,000-100,000 viral copies/mL	1.03	(0.28-3.79)	
> 100,000 viral copies/mL	3.78	(0.38-37.49)	
Don't know	0.53	(0.16-1.73)	