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## Trends in racial and ethnic disparities in antiretroviral therapy prescription and viral suppression in the United States, 2009–2013

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### Abstract

**Objectives**—To examine trends in racial/ethnic disparities in antiretroviral therapy (ART) prescription and viral suppression among HIV-infected persons in care, overall and among MSM, from 2009 to 2013.

**Design**—The Medical Monitoring Project (MMP) is a complex sample survey of HIV-infected adults receiving medical care in the United States.

**Methods**—We used weighted interview and medical record data collected 06/2009–05/2014 to estimate the prevalence of ART prescription and viral suppression among racial/ethnic groups overall and among men who have sex with men (MSM).

**Results**—We found significant increases in ART prescription and viral suppression among all racial/ethnic groups from 2009 to 2013, both overall and among MSM. By 2013, overall and among MSM, the Hispanic-white disparity in ART prescription was non-existent, and the black-white disparity was not significant after accounting for differences between blacks and whites in age and length of HIV diagnosis. Despite reductions in racial/ethnic disparities in viral suppression over the time period, significant disparities remained among the total population, even after adjusting for differences in racial/ethnic group characteristics. Encouragingly, however, there was no significant Hispanic-white disparity in viral suppression among MSM by 2013.

**Conclusions**—Despite significant improvements in ART prescription and viral suppression in recent years, racial and ethnic disparities persist, particularly for black persons. If the United States is to achieve the National HIV/AIDS Strategy goal of reducing HIV-related health disparities, continued efforts to accelerate the rate of improvement in ART prescription and viral suppression among Hispanic and black persons may need to be prioritized.

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## Keywords

HIV; Antiretroviral therapy; Viral load; Health Status Disparities; Social Determinants of Health

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## Introduction

Reducing racial and ethnic disparities in HIV care and treatment is a primary goal of the National HIV/AIDS Strategy [1]. A national assessment of these disparities and whether they have changed as treatment for HIV has evolved is key to achieving this goal. Recent studies have found increases in antiretroviral therapy (ART) use and viral suppression among blacks, Hispanics, and whites over recent years [2–8], but it is unclear whether these improvements have reduced racial/ethnic disparities.

Further, assessing trends in racial and ethnic disparities among men who have sex with men (MSM) is of paramount concern, as MSM constitute the majority of new infections in the United States [9] and, in contrast to declining incidence among other groups, new infections among young black MSM have increased [10]. Improving ART prescription and viral suppression among MSM is essential for reducing morbidity, mortality, and onward HIV transmission [11, 12]. Few studies have examined trends in racial/ethnic disparities in ART prescription and viral suppression among MSM.

To address these gaps, we used population-based estimates of HIV-infected adults receiving medical care in the United States and Puerto Rico to examine trends in racial and ethnic disparities in ART prescription and viral suppression from 2009 to 2013 among two populations: 1) all black, Hispanic, and white persons and 2) black, Hispanic, and white MSM. We conducted regression-based difference-in-differences analyses to determine whether there were significant changes in disparities among the racial/ethnic groups and to assess confounders and mediators of observed disparities in clinical outcomes.

## Methods

### Medical Monitoring Project (MMP)

We analyzed data from the 2009–2013 cycles of the Medical Monitoring Project (MMP), an HIV surveillance system designed to produce annual nationally representative cross-sectional estimates of behavioral and clinical characteristics of HIV-infected adults receiving medical care in the United States and Puerto Rico. MMP methods, including sampling, weighting procedures, and response rates, have been described in detail elsewhere [13]. During these years, MMP used a three-stage, probability-proportional-to-size sampling method. First, U.S. states and one territory were sampled, then facilities providing outpatient HIV care in those areas, and finally, eligible HIV-infected patients. All sampled states and territories participated in every cycle. The facility response rate ranged from 76–85% and the patient response rate ranged from 49–55%. Eligible persons were HIV-infected, age 18 years or older, and those who had received medical care in participating facilities between January and April in the cycle year for which they were sampled. Interview and medical record abstraction data were collected June 2009 through May 2014. Data were weighted on

the basis of known probabilities of selection at state or territory, facility, and patient levels [14]. In addition, predictors of nonresponse were determined from analysis of data from sampled facilities and patients, and data were then weighted to adjust for non-response, following established methods [15, 16]. Predictors of nonresponse varied by cycle year and project area, but in general we found facility size, private practice, male gender, younger age, race/ethnicity, and shorter time since HIV diagnosis were associated with nonresponse and informed the weighting classes for the data.

In accordance with the federal human subjects protection regulations [17] and guidelines for defining public health research [18], MMP was determined to be a non-research, public health surveillance activity used for disease control program or policy purposes.

Participating states or territories and facilities obtained local institutional review board approval to conduct MMP if required locally. Informed consent was obtained from all interviewed participants.

### Analytic methods

In this analysis we included 22,081 HIV-infected adults receiving medical care who self-identified as non-Hispanic black or African American (black), Hispanic, or non-Hispanic white (white), and participated in MMP between 2009 and 2013. The sample sizes and proportions by year were as follows: 2009, 1,740 (44%) black, 881 (20%) Hispanic, 1,395 (36%) white; 2010, 1,822 (44%) black, 960 (20%) Hispanic, 1,489 (36%) white; 2011, 1,842 (43%) black, 989 (21%) Hispanic, 1,450 (35%) white; 2012, 2,072 (44%) black, 1,060 (20%) Hispanic, 1,560 (37%) white; 2013, 2,143 (45%) black, 1,131 (22%) Hispanic, 1,547 (33%) white. We were unable to examine other racial/ethnic groups due to small sample size. We examined trends over this time period in racial/ethnic disparities overall and among MSM in two outcomes: ART prescription in the past year and viral suppression at most recent visit in the 12 months prior to interview. Both outcome variables were based on medical record documentation and viral suppression was defined as a viral load that was undetectable or <200 copies/mL. MSM status was defined by male gender and self-reported sex with a man over the past 12 months or reported gay or homosexual sexual orientation.

To examine trends in racial/ethnic disparities in our outcomes of interest we used a regression-based difference-in-difference approach following Weinick et al [19]. This allowed us to examine changes in disparities among the racial/ethnic groups, and to control for confounders and mediators of the observed disparities. This approach involves estimating linear regression models for each outcome using pooled data from 5 annual cross-sectional MMP cycles (2009–2013), including indicators for race/ethnicity, year, and interaction terms between race/ethnicity and year. In our models, whites and cycle year 2009 are the reference groups. We used the regression coefficients and standard errors from these models to estimate the disparity between whites and blacks in 2009 and 2013, and the change in disparity between 2009 and 2013. We take this same approach to examine the disparity between whites and Hispanics. We separately estimated models for the overall population and for MSM.

As covariates for our adjusted models we selected characteristics that 1) significantly changed between 2009 and 2013 in at least one of the racial/ethnic groups and 2) were

significantly associated with race/ethnicity and a given outcome, based on the regression approach described above. Variables assessed for confounding were not hypothesized to be on the causal pathway between 1) the interaction between race/ethnicity and year and 2) the outcome), whereas variables assessed for mediation were hypothesized to be on the causal pathway. As potential confounders of the trend in ART prescription and viral suppression disparities we examined age (18–29, 30–39, 40–49, 50+), gender, and years since HIV diagnosis (<5, 5–9, 10+). As potential mediators of the trends in ART prescription and viral suppression disparities we examined household poverty, education, homelessness, incarceration, insurance type (any private insurance, public insurance only, uninsured or Ryan White HIV/AIDS Program funding only), binge drinking (5 or more drinks per sitting for men and 4 or more drinks per sitting for women in the past 30 days), drug use, depression (major or other depression in the past 2 weeks as measured by the Patient Health Questionnaire 8 [20], and, for viral suppression, a three-level variable indicating self-reported current ART use and 100% adherence to all ART doses in the past 3 days (no ART use, ART use and nonadherent, ART use and adherent). All variables were measured in the 12 months prior to interview unless otherwise noted.

All analyses accounted for the complex sampling design and unequal selection probabilities by using the survey procedures in SAS 9.3 (SAS Institute Inc., Cary, NC, USA) and SUDAAN 10.0.1 (RTI International, Research Triangle Park, NC, USA) and all percentages reported are weighted.

## Results

### Trends in ART prescription, viral suppression, and selected covariates

Between 2009 and 2013, the prevalence of ART prescription increased among blacks from 86% (95% confidence interval [CI] 84–88) to 93% (CI 92–94), among Hispanics from 89% (CI 87–92) to 95% (CI 94–97), and among whites from 92% (CI 91–93) to 95% (CI 94–96) ( $P_{\text{TREND}} < .01$  for all groups, Figure 1a). During this time, viral suppression also increased significantly for all groups. The prevalence of viral suppression increased among blacks from 64% (CI 61–68) to 76% (CI 72–79), among Hispanics from 75% (CI 71–78) to 81% (CI 78–84), and among whites from 79% (CI 77–82) to 86% (CI 84–88) ( $P_{\text{TREND}} < .01$  for all groups, Figure 1b). Among MSM, the prevalence of ART prescription and viral suppression were similar and increased significantly over the time period for all racial/ethnic groups ( $P_{\text{TREND}} < .01$  for all groups) (Figures 2a and 2b).

From 2009 to 2013, the percentage of blacks and whites ages 50 and over increased significantly, the percentage of blacks who had been diagnosed with HIV for 10 or more years increased significantly, the percentage of black and whites with depression decreased significantly, and the proportion of all three racial/ethnic groups reporting 100% ART adherence increased significantly (Table S1, Supplemental Digital Content, <http://links.lww.com/QAI/A860>). There was no significant change among any of the racial/ethnic groups in gender, insurance type, household poverty, education, homelessness, recent incarceration, binge drinking, or drug use (data not shown). Patterns were similar among MSM (data not shown).

## Trends in racial/ethnic disparities in ART prescription and viral suppression

**Overall disparities**—Table 1 shows the black-white and Hispanic-white disparities in both outcomes in 2009 and 2013, along with the change in disparity from 2009 to 2013 (the full unadjusted and adjusted linear probability model regression results are presented in Table S2, Supplemental Digital Content, <http://links.lww.com/QAI/A860>). From 2009 to 2013, the 6.2 percentage point black-white disparity in ART prescription decreased to 2.4, a 62% reduction, although the disparity remained significant. After adjusting for the confounding factors of age and time since HIV diagnosis, the black-white disparity in ART prescription was no longer significant in 2013. The 3 percentage point disparity observed in ART prescription between whites and Hispanics declined by 100% over the time period, and by 2013 there was no disparity between Hispanics and whites.

For viral suppression, the 15.4 percentage point black-white disparity in viral suppression observed in 2009 decreased to 10.4 in 2013, a 32% reduction. However, this change was not significant and disparities remained at the end of the period. The Hispanic-white disparity in viral suppression remained virtually unchanged over the time period (from 4.9 to 4.8 percentage points), and a significant disparity persisted in 2013. After adjusting for the confounding factors of age and time since HIV diagnosis, the magnitude of the observed disparities were somewhat reduced, but significant racial/ethnic disparities remained for both blacks and Hispanics compared to whites.

Further adjustment for mediation via ART use, adherence, and depression reduced the magnitude of the racial/ethnic disparity, but significant black-white and Hispanic-white differences remained. This suggests that racial/ethnic disparities in viral suppression would persist in 2013 even after attainment of equal levels of depression, ART use and adherence and consideration of the effects of group differences in age and time since diagnosis.

**Disparities among MSM**—As in the overall population, the black-white disparity in ART prescription among MSM significantly declined from 9.5 to 4.1 percentage points over the time period and, after adjusting for differences in age and time since HIV diagnosis, there was no significant black-white disparity in ART prescription by 2013. Among MSM, there was no significant Hispanic-white disparity in ART prescription during 2009–2013. Although the black-white disparity in viral suppression declined from 16.5% to 13.2%, this change was not significant and the disparity remained in 2013, even after adjustment for confounding and mediating factors. By 2013 there was no significant Hispanic-white disparity in viral suppression among MSM.

## Discussion

We found significant increases in ART prescription and viral suppression among persons in HIV medical care in all racial/ethnic groups from 2009 to 2013, both overall and among MSM. By 2013, the Hispanic-white disparity in ART prescription was non-existent, and the black-white disparity was explained by differences between blacks and whites in age and time since HIV diagnosis. Despite reductions in the magnitude of racial/ethnic disparities in viral suppression over the time period, significant disparities remained, even after adjusting

for differences in racial/ethnic group characteristics. Encouragingly, however, there was no significant Hispanic-white disparity in viral suppression among MSM by 2013.

Our findings of declining but persisting national racial/ethnic disparities is generally supported by the available literature. While many studies have found significant black-white disparities in ART use [2, 4, 6, 21–23], some have found no racial disparities when examining specific populations, such as clinic attendees or those newly eligible for ART [3, 5, 24]. Regarding Hispanic-white disparities, many [2, 3, 6, 21, 22, 25], though not all [4, 23, 24], found no significant Hispanic-white difference in ART use. Across varying populations, most studies find black-white disparities in viral suppression [4–7, 21, 25–28]. Only one recent analysis found no black-white differences in time to viral suppression among a large cohort of persons newly eligible for ART [3]. Among recent studies, all but one [4] found no differences between Hispanics and whites in viral suppression [3, 6, 7, 21, 25, 26]. Adjudicating between these disparate findings can be challenging due to different study populations, measurement of outcomes, and adjustment factors. The MMP data presented here provides annual information on national trends in racial/ethnic disparities among HIV-positive persons in care in the United States and, due to the richness of behavioral and clinical data collected, can help identify areas for intervention that may decrease these disparities.

This analysis adds to the limited body of knowledge about trends in racial/ethnic disparities in ART prescription and viral suppression among MSM. Hoots and colleagues documented increased ART use between 2008 and 2011 among black, Hispanic, and white MSM living in 20 U.S. cities with high AIDS burden, and found significant black-white disparities in ART use for both time periods[29]. We found encouraging reductions in Hispanic-white disparities in this highly affected population, although black-white disparities persisted. It is important to note that Hispanic-white disparities in viral load were smaller than black-white disparities at the start of the time period examined; therefore, a smaller decline was needed to render the disparity non-significant. With a longer observation period we may see further reductions in the black-white disparity in viral suppression among MSM. However, black MSM face the same barriers to optimal health as those faced by all black persons, as well as higher prevalence of HIV stigma and homonegativity that may add to these challenges [30–32], so enhanced efforts to reduce disparities for this population may be warranted.

The observed improvements in ART prescription may be due in part to changing clinical guidelines for ART initiation, which steadily moved towards universal prescription over the time period [33]. In addition, the development of simpler, more tolerable regimens may have lessened providers' concerns about prescribing ART for persons for whom they have adherence concerns. Interventions addressing the contributors to the persisting black-white disparity in ART prescription—differences between the groups in age and time since diagnosis—could contribute to further reductions in black-white disparities in ART prescription. Expanding provider adoption of universal ART immediately upon diagnosis could increase ART prescription among black persons, a higher proportion of whom are more recently diagnosed. Understanding and addressing provider barriers to prescribing ART to younger adults, who are disproportionately black, may also inform efforts to further reduce black-white disparities.



The significant increases in viral suppression observed among all racial/ethnic groups is cause for optimism, as higher levels of viral suppression can be expected to reduce HIV transmission and improve life expectancy [11, 12]. By 2013, levels of viral suppression for Hispanics and whites were over 80%, but the persistence of significant black-white disparities in suppression is troubling and not fully understood. More time may be needed to see reductions in black-white disparities in viral suppression, as they were the largest disparities observed in 2009. MMP as an ongoing surveillance system can be used to monitor such future trends.

In addition to increasing ART prescription among blacks, efforts to reduce the prevalence of factors associated with lack of viral suppression that are more common among blacks may have the potential to reduce black-white disparities in viral suppression. Evidence-based programs that address social determinants of health such as poverty, education, incarceration, and homelessness have been recommended [1, 34, 35]. Although addressing social determinants of health is notoriously difficult, these efforts are crucial to achieve the goals of the NHAS. Patient-provider factors such as lack of trust and poor communication may also contribute to ongoing black-white disparities in viral suppression, due to lack of engagement in care or because patients might not fully understand their treatment regimens and providers may be operating with incomplete understanding of the patient's behaviors and environment [36, 37]. Saha and colleagues found racial disparities in receipt of ART and viral suppression among patients of providers with low cultural competency, but no racial disparities were observed among patients of providers with moderate to high cultural competency [38]. Finally, factors related to the influence of care setting on racial disparities in viral suppression could be explored. Weiser and colleagues found that poor HIV patients were more likely to achieve viral suppression if they received care at facilities funded by the Ryan White HIV/AIDS program, which have greater availability of ancillary services to address lack of resources [39].

This analysis is subject to several limitations. First, unmeasured confounders and mediators, and thus some residual bias, may exist. Second, racial/ethnic disparities in our outcomes in the overall sample may differ according to gender [23, 26]. However, our sample sizes for Hispanic and white women in each data collection year do not allow for adequate gender-stratified assessment of trends in our outcomes. As the MMP surveillance system is ongoing, in the future we may be able to examine these trends by gender and race/ethnicity by grouping data from multiple years. Additionally, our patient response rate was lower than optimal, though our use of population-based sampling methods and weighting adjustments for nonresponse should reduce bias [40] and the MMP population has been found to be demographically similar to all HIV-diagnosed persons in the United States [41].

Despite significant improvements in ART prescription and viral suppression in recent years, racial and ethnic disparities persist, particularly for black persons. If the United States is to achieve the NHAS goal of reducing HIV-related health disparities, continued efforts to accelerate the rate of improvement in ART prescription and viral suppression among Hispanic and black persons may need to be prioritized.

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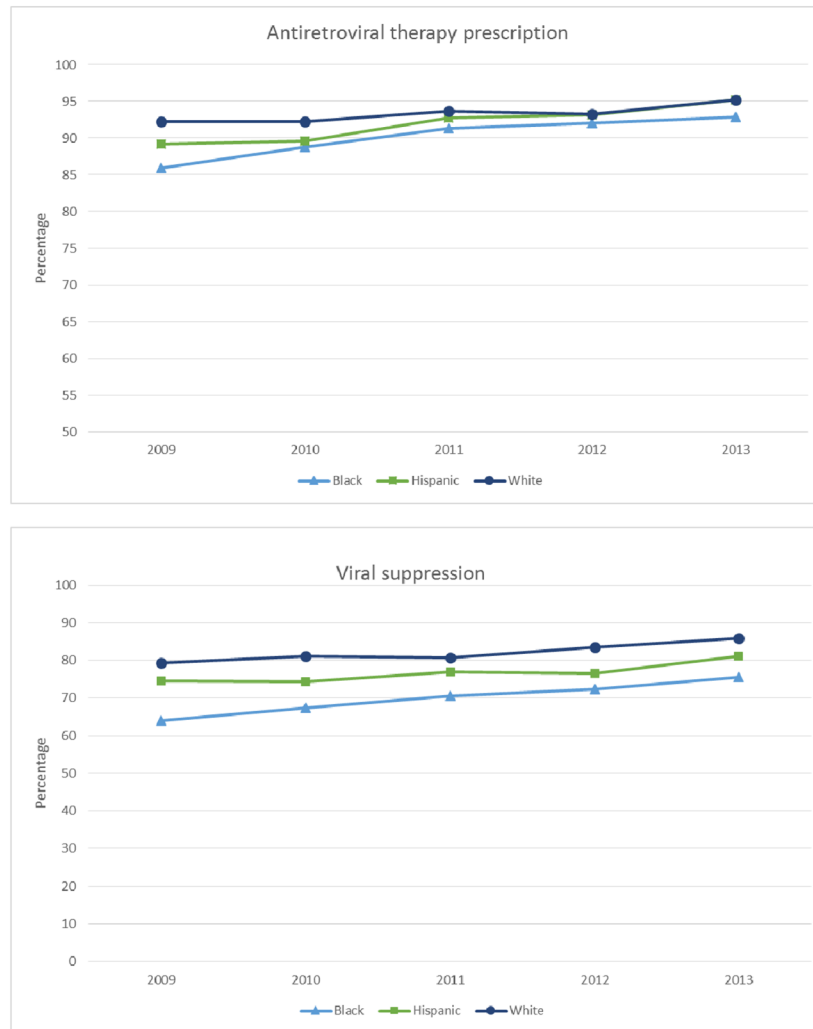
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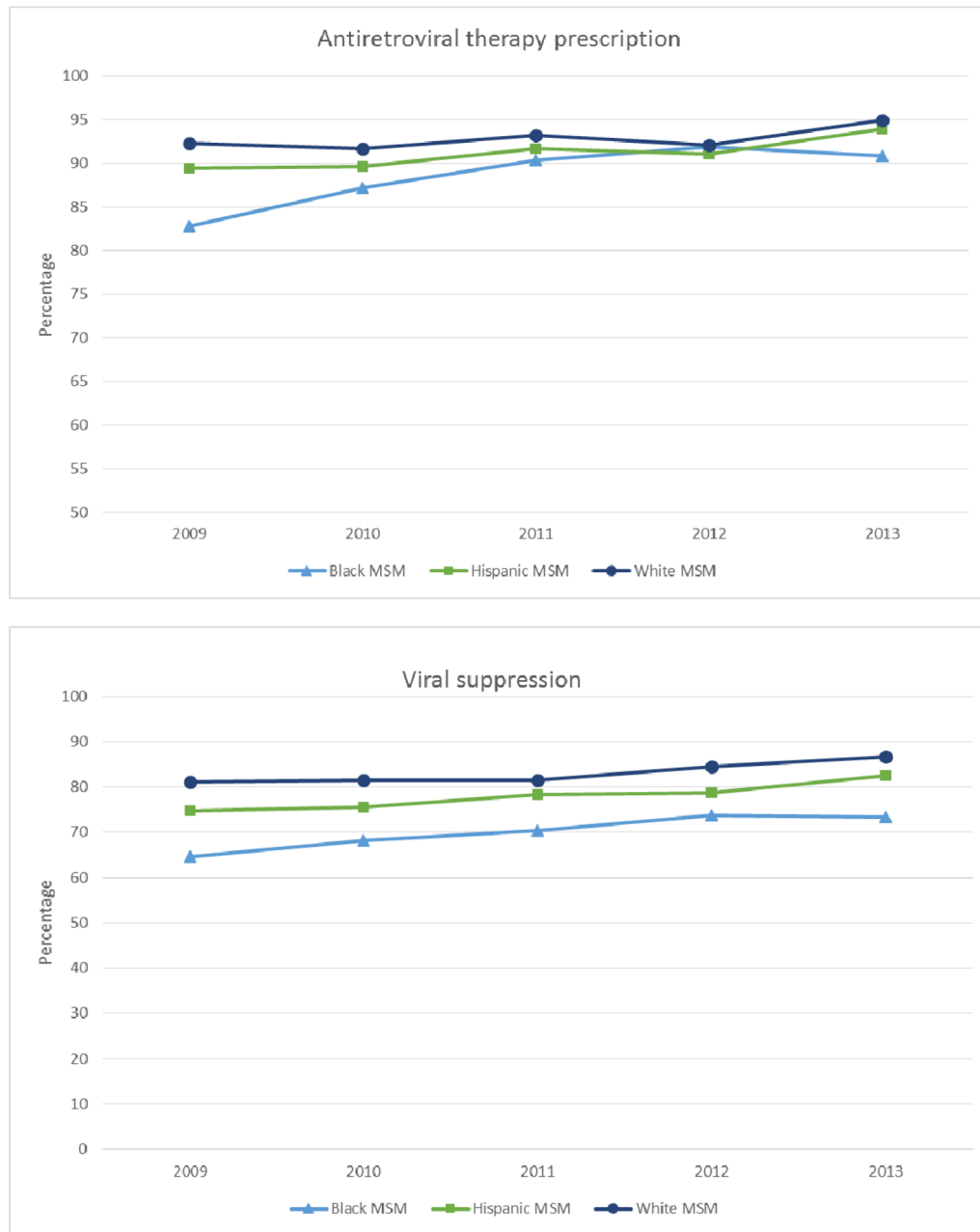


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**Figure 1.** Figures 1a and 1b. Trends in antiretroviral therapy prescription and viral suppression (<200 copies/mL or undetectable at last measurement) by race/ethnicity among HIV-infected patients, 2009–2013—Medical Monitoring Project, United States  
All trends significant at  $p < 0.01$ ; black and white persons are non-Hispanic; Hispanic persons can be of any race.



**Figure 2.** Figures 2a and 2b. Trends in antiretroviral therapy prescription and viral suppression (<200 copies/mL or undetectable at last measurement) by race/ethnicity among HIV-infected men who have sex with men 2009–2013—Medical Monitoring Project, United States. All trends significant at  $p < 0.01$ ; black and white persons are non-Hispanic; Hispanic persons can be of any race.

Unadjusted and adjusted racial/ethnic differences in antiretroviral therapy prescription and viral suppression at last measurement, United States 2009–2013

**Table 1**

	Unadjusted		Adjusted for age and time since diagnosis		Adjusted for age, time since diagnosis, ART use, adherence, and depression	
	Disparity in 2009	Percentage point change in disparity from 2009–2013	Disparity in 2009	Percentage point change in disparity from 2009–2013	Disparity in 2009	Percentage point change in disparity from 2009–2013
Percentage prescribed ART (n=22,081)						
Black-white	-6.2**	3.9**	-5.5**	4.1**	-1.4	
Hispanic-white	-3.0*	3.0				
Percentage virally suppressed at last visit in past 12 months						
Black-white	-15.4**	4.9	-14.7**	5.6	-9.1**	2.1
Hispanic-white	-4.9**	0.1	-3.8*	0.4	-3.3*	0.4
Percentage MSM prescribed ART (n=10,264)						
Black-white	-9.5**	5.5*	-7.3**	6.0**	-1.3	
Hispanic-white	-2.8	1.8				
Percentage MSM virally suppressed at last visit in past 12 months						
Black-white	-16.5**	3.3	-13.7**	4.5	-9.2**	-1.0
Hispanic-white	-6.3*	2.1				

Viral suppression, <200 copies/mL or undetectable at last measurement; ART, antiretroviral therapy; MSM, men who have sex with men; black and white persons are non-Hispanic; Hispanic persons can be of any race;

\*\* p < 0.01;

\* p < 0.05