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Disparities in HIV transmission risk among HIV-infected black and white men who have sex with men, United States, 2009

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Abstract

Objective—To better understand why HIV incidence is substantially higher among black than white men who have sex with men (MSM), we present the first nationally representative estimates of factors that contribute to transmission – sexual behavior, antiretroviral therapy (ART) use, and viral suppression – among HIV-infected black and white MSM in the United States.

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 during June 2009 to May 2010 to estimate the prevalence of sexual behaviors, ART use, and viral suppression among sexually active HIV-infected black and white MSM. We used χ^2 tests to assess significant differences between races and logistic regression models to identify factors that mediated the racial differences.

Results—Sexual risk behaviors among black and white MSM were similar. Black MSM were significantly less likely than white MSM to take ART (80 vs. 91%) and be durably virally suppressed (48 vs. 69%). Accounting for mediators (e.g. age, insurance, poverty, education, time since diagnosis, and disease stage) reduced, but did not eliminate, disparities in ART use and rendered differences in viral suppression among those on ART insignificant.

Conclusion—Lower levels of ART use and viral suppression among HIV-infected black MSM may increase the likelihood of HIV transmission. Addressing the patient-level factors and structural inequalities that contribute to lower levels of ART use and viral suppression among this group will improve clinical outcomes and might reduce racial disparities in HIV incidence.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Conflicts of interest

The authors declare no conflicts of interest.

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Keywords

antiretroviral therapy; health status disparities; men who have sex with men; surveillance; viral load

Introduction

In the United States, black men who have sex with men (MSM) are disproportionately affected by HIV. The rate of new HIV diagnoses among black MSM is six times that among white MSM, and black MSM are almost four times as likely to be living with HIV [1]. The factors among HIV-infected MSM that may contribute to higher HIV incidence among HIV-uninfected black MSM are not completely understood. Because black MSM have a high probability of choosing other black MSM as partners [2–5], factors that increase the probability of transmission from HIV-infected black MSM to their partners also increase HIV incidence among HIV-uninfected black MSM. Previous studies have not found substantial differences in sexual transmission risk behaviors among black vs. white MSM [6–11]. However, the higher HIV prevalence among black MSM means that despite having similar or lower numbers of sex partners, HIV-uninfected black MSM are more likely to have an HIV-infected same-race partner and are, thus, at increased risk of exposure to HIV [12,13].

In addition, lower use of antiretroviral therapy (ART) and, thus, lower levels of viral suppression among HIV-infected black MSM might also contribute to increased HIV transmission [9,14]. The landmark results of the HIV Prevention Trials Network 052 study confirmed that among serodiscordant couples (most of whom were heterosexual), ART use resulting in viral suppression sharply reduces the probability of HIV transmission to uninfected partners [15]. Most [8,10,16–18], though not all [13,19], studies have documented significantly lower ART use among black HIV-infected MSM. However, the samples in all of these studies were small or nonrepresentative. Further, only Kelley *et al*. [13] examined viral suppression, which is the direct link between ART use and risk of HIV transmission. They found lower levels of viral suppression among black vs. white HIV-infected MSM in Atlanta, but the difference was not statistically significant. A recent meta-analysis by Millett *et al*. [9] used unpublished data from three studies (one of which is the source of the data presented in our analysis) to document decreased odds of viral suppression among black compared with white MSM. Improving our understanding of the differences in viral suppression among US black and white MSM is a first step toward assessing ‘treatment as prevention’ [20] as a tool for reducing racial disparities in incidence among MSM.

We present the first examination of nationally representative data on the characteristics of HIV-infected black and white MSM that may contribute to racial disparities in HIV transmission and, thus, help explain some of the racial disparities in HIV incidence. Specifically, we present estimates of sexual risk behavior, ART use, and viral suppression among sexually active HIV-infected black and white MSM receiving medical care in the United States.

Methods

Medical Monitoring Project design and data collection

The Medical Monitoring Project (MMP) is a supplemental HIV surveillance system designed to produce nationally representative estimates of behavioral and clinical characteristics of HIV-infected adults receiving medical care in the United States [21–23]. MMP is a complex-sample, cross-sectional survey. For the 2009 data collection cycle, US states and territories were sampled first, followed by facilities providing HIV care, and then by HIV-infected adults (persons aged 18 years and older) who had at least one medical care visit during January to April 2009 at participating facilities. Data were collected through face-to-face interviews and medical record abstractions from June 2009 through May 2010. All sampled states and territories participated in MMP: California (including the separately funded jurisdictions of Los Angeles County and San Francisco), Delaware, Florida, Georgia, Illinois (including Chicago), Indiana, Michigan, Mississippi, New Jersey, New York (including New York City), North Carolina, Oregon, Pennsylvania (including Philadelphia), Puerto Rico, Texas (including Houston), Virginia, and Washington. Of 603 sampled facilities, 461 participated in MMP (facility response rate, 76%). Most of the HIV care facilities sampled were private practices [60%, 95% confidence interval (CI) 51–69], followed by hospital-based facilities (30%, CI 26–34) and community health centers (19%, CI 13–25). The remainder were clinical research facilities (10%, CI 8–13), state or local health department clinics (5%, CI 3–7), community-based service organizations (4%, CI 2–6), and Veterans Administration facilities (4%, CI 2–5). A facility could belong to multiple categories. Of 9338 sampled persons, 4217 completed the interview and had their medical records abstracted (patient-level response rate, 51%), for an overall response rate of 39%. Data were weighted on the basis of known probabilities of selection at state or territory, facility, and patient levels. In addition, data were weighted to adjust for nonresponse by using predictors of patient-level response, including facility size, race/ethnicity, time since HIV diagnosis, and age group. After weighting for probability of selection and nonresponse, the 4217 participants in the 2009 MMP data collection cycle were estimated to represent a population of 421 186 HIV-infected adults receiving medical care in the United States during January to April 2009.

Ethics statement

The institutional review board of the Centers for Disease Control and Prevention (CDC) determined that MMP is a public health surveillance activity, not research. Participating states or territories and facilities obtained local institutional review board approval to conduct MMP if required locally.

Analysis of racial differences in transmission risk factors

All analyses were performed by using SAS, version 9.3 (SAS Institute, Cary, North Carolina, USA), and SUDAAN, version 10.0.1 (Research Triangle Institute, Research Triangle Park, North Carolina, USA), and accounted for clustering, unequal selection probabilities, and facility and patient nonresponse. Weighted estimates and percentages are presented. To determine the proportion of sexually active black and white MSM, we identified black or white MSM on the basis of self-report of black (not Hispanic) or white

(not Hispanic) race and self-report of oral or anal sex with a man during the past 12 months or, for those reporting no sexual activity, self-report of gay or bisexual sexual orientation. We restricted our primary analysis to sexually active MSM. Our principal goal was to test for differences in factors associated with HIV transmission, specifically the prevalence of unprotected anal sex with a male partner of negative or unknown HIV status, number of male oral or anal sex partners in the past 12 months, self-reported current ART use, and viral suppression. Using data abstracted from the participant's medical records, we assessed two measures of viral suppression: current viral suppression (most recent viral load documented as undetectable or ≤200 copies/ml) and durable viral suppression (all viral loads in past 12 months documented as undetectable or <400 copies/ml). The former captured HIV treatment success per US Department of Health and Human Services clinical guidelines [24]; the latter was used to assess the potential for HIV transmission during the period in which behaviors were assessed. We used modified Rao–Scott χ^2 tests to assess differences in the transmission risk factors of black and white MSM.

Analysis of mediators of racial differences in transmission risk factors

After calculating the transmission risk factors (sexual behavior, ARTuse, and viral suppression), we performed multivariable analysis to determine which transmission risk factors significantly differed for black and white MSM and might explain increased risk of HIV transmission among black MSM (e.g. more sexual risk behavior, lower ART use, or lower viral suppression). To assess factors that mediated the relationship between race and each outcome, in our models we included variables that met the following criteria: associated with the outcome at P <0.10 according to modified Rao–Scott χ^2 tests, and inclusion in the model changed the association between race and the outcome by more than 10%. We used logistic regression models with predicted marginals to calculate the adjusted predicted prevalence of each outcome after adjusting for the other variables in the model. We then compared the unadjusted and the adjusted predicted prevalence of each outcome to assess how the racial difference changed with the inclusion of the other variables in the model.

Candidate variables for inclusion in the models were self-reported age, educational attainment, time since HIV diagnosis, homelessness (per the Stewart B. McKinney Homeless Assistance Act, 42 U.S.C. §11301, et seq; 1987), lapse in health coverage, household poverty [per US Health and Human Services poverty guidelines (http://aspe.hhs.gov/poverty/figures-fed-reg.shtml)], depression in the past 2 weeks (assessed by using the Patient Health Questionnaire 8-item scale [25]), and HIV disease stage (AIDS diagnosis or lowest $CD4^+$ T-cell count of < 200, no AIDS diagnosis and lowest $CD4^+$ T-cell count of 200–499, no AIDS diagnosis and lowest $CD4^+$ T-cell count of ≥500).

Results

Of the 4217 MMP participants with matched interview and medical record data, 445 were black MSM (10%; CI 8–13 or an estimated 44 142 persons, CI 35 122–53 163) and 1004 were white MSM (25%; CI 20–30 or an estimated 105 346 persons, CI 78 542–132 149). Of the 445 black MSM, 314 were sexually active (69%; CI 63–75 or an estimated 30 477

persons, CI 24 397–36 558). Of the 1004 white MSM, 696 were sexually active (68%; CI 65–71 or an estimated 71 823 persons, CI 52 560–91 086). Compared with sexually active white MSM, sexually active black MSM were significantly younger, less educated, poorer, more likely to have had a lapse in health coverage, and to have a more recent HIV diagnosis (Table 1).

Factors related to transmission risk

Sexually active black MSM were no more likely than white MSM to engage in unprotected sex with a male partner of negative or unknown HIV status (P =0.71) or to do so while not durably virally suppressed (P =0.60; Table 1). Moreover, black MSM were less likely to have four or more male sex partners (P =0.01). Black MSM had significantly lower levels of ART use (P <0.01), current viral suppression (P <0.01), and durable viral suppression (P <0.01; Fig. 1). During the past 12 months, 69% of white MSM vs. 48% of black MSM had experienced durable viral suppression.

Mediators of racial differences in transmission risk factors

Table 2 presents the unadjusted and adjusted logistic regression models for ART use and durable viral suppression among those taking ART. Variables that met our criteria for mediating the racial disparity in ART use were age, lapse in health coverage, poverty, time since HIV diagnosis, and HIV disease stage. Adjusting for these covariates reduced, but did not eliminate, the disparity between black and white MSM in ART use. Variables that met our criteria for mediating the racial disparity in durable viral suppression were age, lapse in health coverage, poverty, education, and time since HIV diagnosis. After adjusting for these covariates, fewer black MSM on ART were virally suppressed compared with white MSM, but this difference was no longer statistically significant.

Figures 2 and 3 present, by race, the unadjusted and adjusted predicted prevalence of ART use and durable viral suppression among those taking ART. In the final multivariable model for ART use, adjusting for other factors did not change the predicted prevalence of ART use for white MSM (91%) but increased the predicted prevalence of ART use for black MSM from 80 to 84%, decreasing the risk difference by 36% (from 11 to 7 percentage points; Fig. 2). In the final model for durable viral suppression, adjusting for other factors changed the predicted prevalence of durable viral suppression for white MSM from 74 to 72% and increased the predicted prevalence of durable viral suppression for black MSM from 58 to 65%, reducing the racial risk difference by 56% (from 16 to 7 percentage points; Fig. 3).

Discussion

We present the first national estimates of the prevalence of sexual transmission risk behaviors, ART use, and viral suppression among black and white HIV-infected MSM who are receiving medical care in the United States. We, like other researchers [6–11], found no evidence of racial differences in prevalence of sexual behaviors that increase the risk of HIV transmission; thus, racial differences in sexual risk behaviors among HIV-infected MSM who are in care do not appear to contribute to disparities in HIV incidence among MSM. However, black MSM were significantly less likely to take ART, and those who took ART

were less likely to be virally suppressed – differences that contribute to relatively poorer health outcomes among HIV-infected black MSM and may partially explain higher HIV incidence among HIV-uninfected black MSM.

Among persons receiving HIV care, the continuum of care involves two additional steps: the prescription of ART and viral suppression. At each step, we found evidence of disparities between sexually active black and white MSM. Our multivariable models suggest that both disease-related and sociodemographic factors contribute to these differences. HIV-infected black MSM were more recently diagnosed than white MSM, which may contribute to racial differences in ART use and viral suppression because recent diagnosis is associated with decreased engagement in care [26], which can result in suboptimal treatment and health outcomes [27–30]. Therefore, implementing robust early linkage and retention to care programs specifically for black MSM with a recent diagnosis may help to reduce disparities in HIV incidence. Additionally, HIV-infected black MSM as a group are younger than white MSM, and younger persons have been shown to be less likely to engage in care, adhere to ART, and achieve viral suppression [31,32]. This difference in age distribution partially contributes to the racial disparity in ARTuse and viral suppression and highlights the need for the delivery of youth-centered care for MSM, especially black MSM.

We used a social determinant of health framework [33] to illustrate our findings about the mechanisms through which differences in access to health resources contribute to racial disparities. We found that the lower levels of continuous health coverage, higher poverty, and lower education of black MSM partially explained the racial difference in ART use and subsequent viral suppression. The Affordable Care Act offers an opportunity to address inequities in healthcare access that may improve health outcomes and potentially decrease disparities in HIV incidence among black and white MSM through the provision of continual health coverage and access to high-quality care [34]. Through their positive effect on health and health promoting behaviors, improvements in income and education through job training and community development programs [35–37] may also help to decrease racial disparities in HIV infection and health outcomes among MSM. The disproportionate burden of poverty and low education among HIV-infected black MSM highlights the need to design care models that accommodate the subsistence needs of black MSM and address poor health literacy and numeracy in this population.

However, even after we adjusted for these other factors, black MSM were still less likely than white MSM to take ART. Another possible contributor to racial differences in ART use is variation in provider prescribing practices, which may be influenced by providers' perceptions of a patient's likelihood of adherence [38,39] or by limited resources for medications at the patient, facility, or community levels [39–41]. Other possible reasons for differences in ART use may be related to racial disparities in acceptance of ART, which are influenced by negative healthcare beliefs [42–44], stigma [45], and the differential impact of homophobia in black vs. white communities [46]. Understanding these factors is crucial for developing interventions that increase ART use among black MSM.

In addition, our multivariable model showed that black MSM taking ART were less likely than white MSM taking ART to achieve durable viral suppression. This finding might be

partially explained by lower ART adherence by black MSM [9,47]. Racial differences in health literacy and medication management have been found to mediate the relationship between black race and poor ART adherence [48,49], but the effect of health literacy and medication management on adherence among black MSM needs further exploration. Black MSM who do not adhere to ART or have treatment interruptions might also be at increased risk of antiretroviral resistance, which may limit treatment options.

Our analysis is subject to several limitations. First, the study population was limited to those in medical care. Racial disparities in the entire HIV-infected MSM population are likely greater than those presented in this analysis, because blacks are less likely than whites to be aware of their infection, linked to care, and retained in care [9,50,51]. Second, self-reported information may have led to measurement bias, although we have no reason to believe that this bias would differ by race. Third, although we found no differences in our measures of sexual behaviors that could explain higher HIV incidence among black MSM, we did not assess other factors that might increase the risk of sexual transmission of HIV, such as sexual network characteristics, sexually transmitted disease prevalence, or frequency of sex acts. Also, MMP does not collect information on the race of the participant's sex partners. However, black MSM are likely to have black males as sex partners [2–5], although this may vary by geographic area and the demographics of the local population. Fourth, our analysis only addresses factors that affect HIV transmissions from black and white MSM who are aware of their HIV diagnosis and receiving medical care, a subset of the HIV-infected population. In addition, we were unable to assess other factors that may affect the likelihood of HIV transmission, such as partner or HIV viral characteristics. Because persons who are unaware of their infection are estimated to account for a large proportion of HIV transmissions [52] and those not receiving medical care are less likely to be virally suppressed, our recommendations should be viewed as components of the more comprehensive efforts that are needed to decrease HIV transmission and reduce racial disparities in HIV acquisition. However, engagement in medical care is dynamic [53]; thus, there is a need to direct prevention efforts to those in and out of care. Finally, our combined response rate was lower than optimal, but even with low response there is tremendous value in unbiased sampling from rigorously constructed frames [54]. Moreover, we have assessed and adjusted for nonresponse using widely accepted statistical techniques, although we acknowledge the possibility of residual nonresponse bias.

In conclusion, we found that most HIV-infected MSM in medical care in the United States were taking ART and were virally suppressed, but black MSM, compared with white MSM, were significantly less likely to use ART and achieve viral suppression. Some estimates suggest that as many as one-half of black MSM will be HIV infected at age 35 [12], and our analysis suggests that if current trends continue, many of these men will not achieve durable viral suppression. Although we cannot change the current HIV prevalence in the black MSM community, we can make efforts to ensure that all HIV-infected black MSM achieve viral suppression, which would improve their health and could lower the likelihood of HIV transmission to their partners. In addition to increasing the numbers of HIV-infected black MSM who are diagnosed and engaged in medical care, our analysis suggests that, to accomplish this we need to make efforts to increase ART use among black MSM and address the structural inequalities between black and white MSM. Although further studies

are needed to fully explain disparities in ART use and subsequent viral suppression among MSM, our results suggest several areas of focus that may help reduce HIV incidence among black MSM: aggressive early linkage and retention programs, youth-focused delivery of care, and programs that increase access to resources – such as healthcare, income, and education – that promote health.

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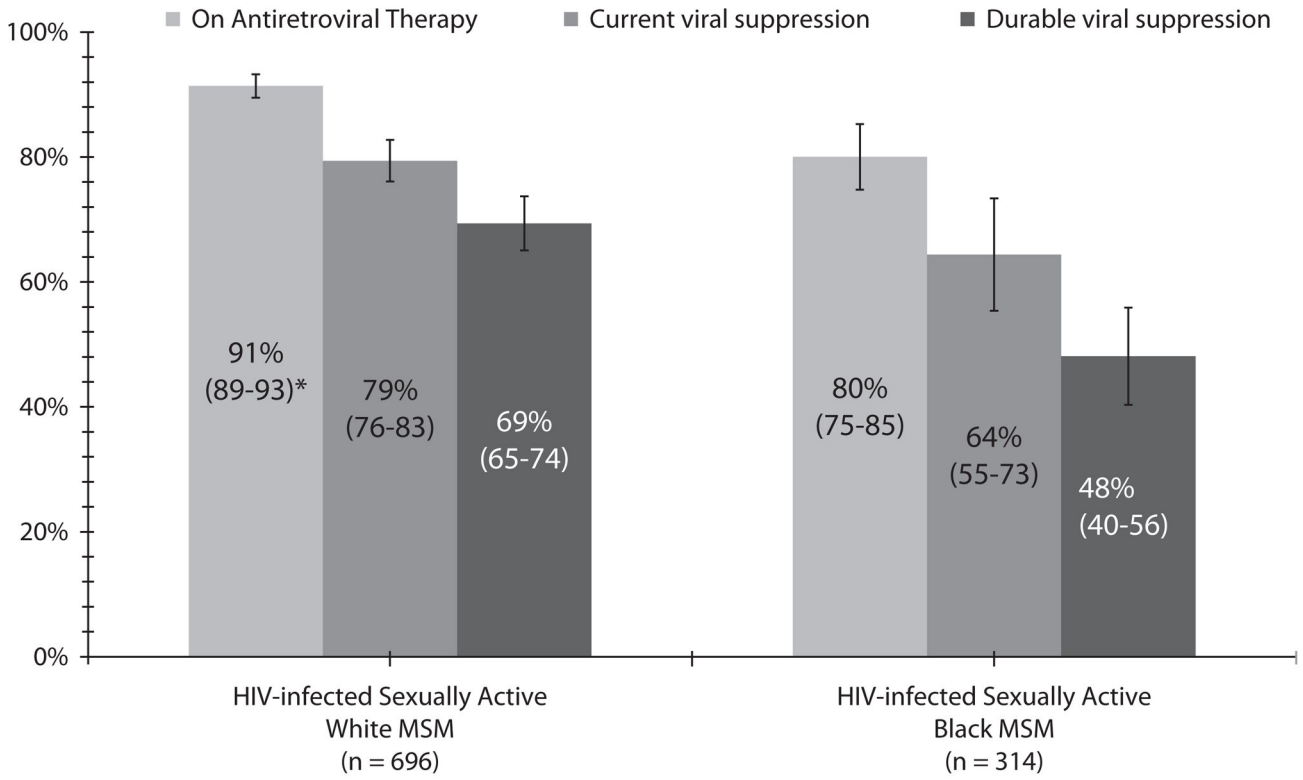

Fig. 1. Antiretroviral therapy use and recent and durable viral suppression among black and white HIV-infected sexually active MSM receiving medical care – Medical Monitoring Project, United States, 2009

Recent viral suppression: most recent viral load documented ≤200 or undetectable; durable viral suppression: all viral loads past year documented less than 400 or undetectable; all black/white differences significant at $P < 0.01$. *95% confidence limits.

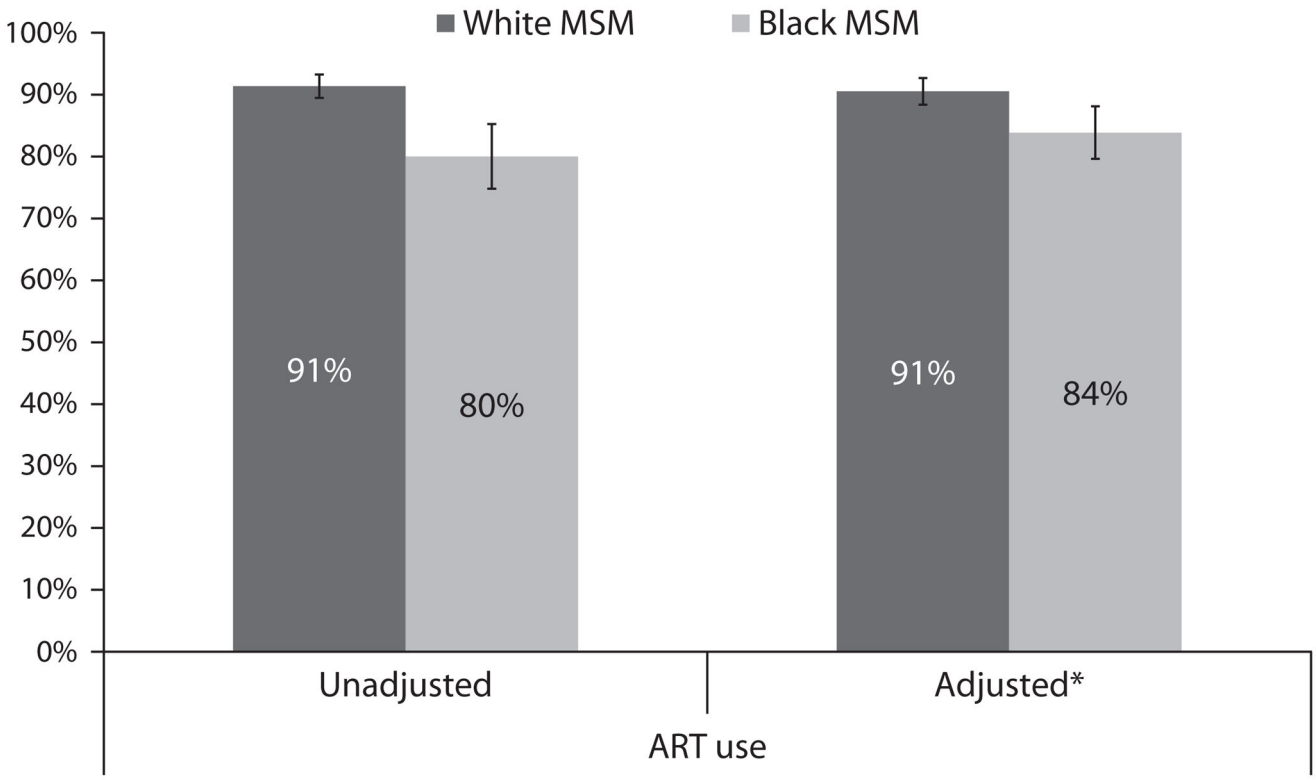

Fig. 2. Antiretroviral therapy use among black and white HIV-infected sexually active MSM receiving medical care – Medical Monitoring Project, United States, 2009

*Adjusted for age, lapse in health coverage, poverty, time since diagnosis, and disease stage.

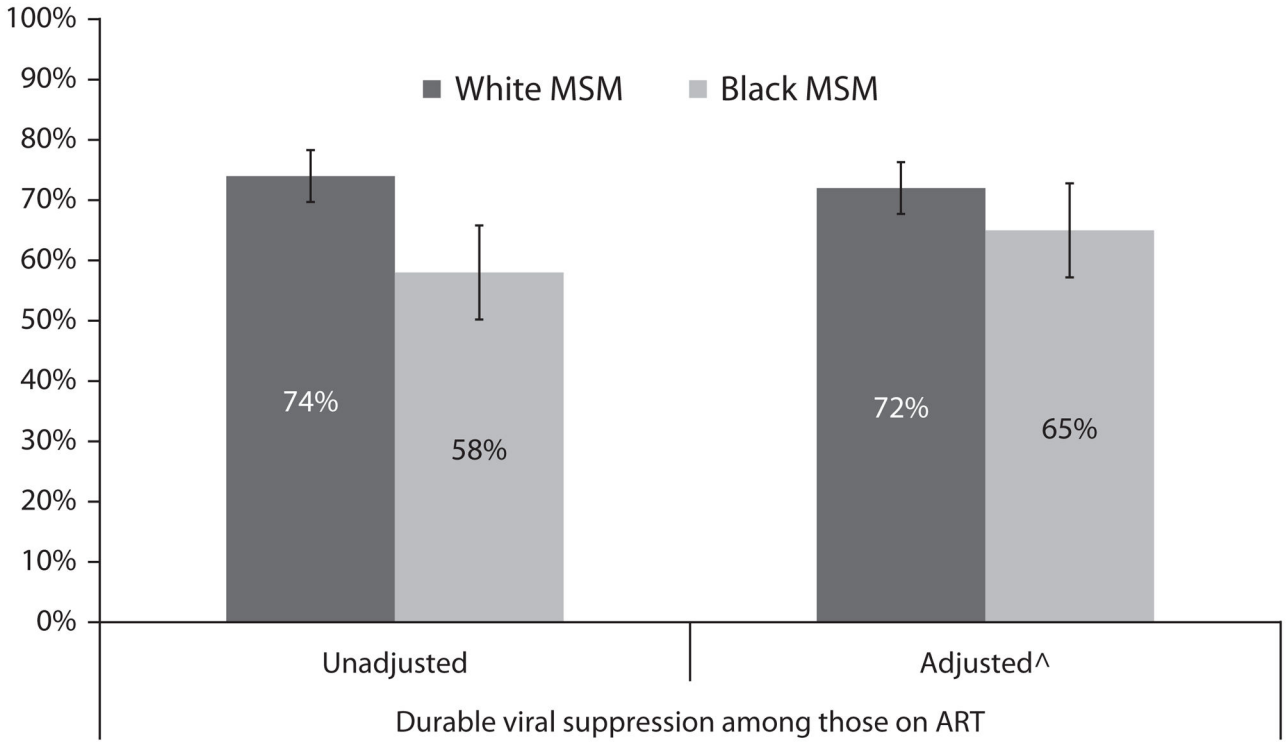

Fig. 3. Durable viral suppression among black and white HIV-infected sexually active MSM receiving medical care – Medical Monitoring Project, United States, 2009

^Adjusted for age, lapse in health coverage, poverty, time since diagnosis, and education.

Table 1

Selected characteristics of black and white HIV-infected sexually active MSM – Medical Monitoring Project, United States, 2009.

	Total (*n* =1010)		White MSM (*n* =696)		Black MSM (*n* =314)		
	n*/*N	**wt.% (95% CI)**	***n*/*N***	**wt.% (95% CI)**	***n*/*N***	**wt.% (95% CI)**	**Rao–Scott χ^2 *P* value**
Age at interview (years)							
18–29	95/1010	9 (7–12)	34/696	5 (3–7)	61/314	21 (15–26)	<0.01
30–39	182/1010	19 (16–21)	112/696	16 (14–19)	70/314	24 (18–30)	
40–49	411/1010	41 (37–45)	290/696	43 (39–46)	121/314	36 (28–45)	
50+	322/1010	31 (28–34)	260/696	36 (32–40)	62/314	19 (14–24)	
Educational attainment							
<High school	66/1010	6 (4–8)	25/696	3 (2–5)	41/314	11 (6–16)	<0.01
High school diploma or equivalent	211/1010	20 (17–24)	125/696	18 (14–22)	86/314	25 (20–30)	
>High school	733/1010	74 (69–79)	546/696	78 (74–83)	187/314	64 (57–71)	
Household income at or below poverty guideline	221/993	21 (18–24)	109/687	15 (12–18)	112/306	35 (28–42)	<0.01
Homeless, past 12 months	61/1010	6 (4–7)	33/696	4 (2–6)	28/314	9 (5–13)	0.10
Any lapse in health coverage, past 12 months	251/1008	25 (19–30)	131/695	18 (14–22)	120/313	39 (30–48)	<0.01
Depression, past 2 weeks	209/1003	22 (19–25)	137/692	21 (18–25)	72/311	24 (18–29)	0.42
Time since HIV diagnosis (years)							
<5	250/1010	26 (22–30)	152/696	23 (18–27)	98/314	34 (28–40)	<0.01
5–9	199/1010	19 (17–22)	130/696	18 (15–22)	69/314	21 (17–25)	
10+	561/1010	55 (51–59)	414/696	59 (54–64)	147/314	45 (38–51)	
HIV disease stage							
AIDS or nadir $CD4^+$ <200	632/1008	61 (58–64)	438/696	62 (59–66)	194/312	59 (51–67)	0.17
No AIDS and nadir $CD4^+$ 200–499	276/1008	29 (25–32)	182/696	27 (23–31)	94/312	33 (26–40)	
No AIDS and nadir $CD4^+$ ≥500	100/1008	10 (8–12)	76/696	11 (8–14)	24/312	8 (5–11)	
Unprotected anal sex with a male partner of negative/unknown HIV status, past 12 months	189/952	20 (17–23)	138/658	20 (16–24)	51/294	19 (13–24)	0.71
Unprotected anal sex with a male partner of negative/unknown HIV status while not durably virally suppressed, past 12 months	78/345	23 (18–28)	42/198	21 (15–28)	36/147	25 (14–36)	0.60
Number of oral or anal sex partners, past 12 months							
1	456/1000	46 (41–50)	304/688	45 (40–50)	152/312	48 (41–55)	0.01
2–3	268/1000	27 (24–30)	171/688	25 (22–29)	97/312	31 (26–36)	

	Total (*n* =1010)		White MSM (*n* =696)		Black MSM (*n* =314)		
	n*/*N	**wt.% (95% CI)**	***n*/*N***	**wt.% (95% CI)**	***n*/*N***	**wt.% (95% CI)**	**Rao–Scott χ^2 *P* value**
4+	276/1000	27 (24–31)	213/688	30 (26–34)	63/312	21 (16–26)	

CI, confidence interval; wt., weight.

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Table 2

Mediators of the disparity between sexually active black and white MSM in antiretroviral therapy use and durable viral suppression among those taking antiretroviral therapy – Medical Monitoring Project, United States, 2009.

	ART use						Durable viral suppression among those taking ART					
	%	(95% CI)	PR	(95% CI)	aPR	(95% CI)	%	(95% CI)	PR	(95% CI)	aPR	(95% CI)
Race												
White	91	(89–93)	Ref.		Ref.		74	(70–79)	Ref.		Ref.	
Black	80	(75–85)	0.88	(0.82–0.94)	0.93	(0.87–0.98)	58	(50–66)	0.78	(0.68–0.90)	0.90	(0.79–1.02)
Age (years)												
18–29	74	(64–84)	Ref.		Ref.		45	(34–56)	Ref.		Ref.	
30–39	82	(75–88)	1.10	(0.95–1.29)	0.98	(0.90–1.07)	59	(48–69)	1.31	(0.96–1.79)	1.16	(0.85–1.57)
40–49	89	(86–93)	1.21	(1.06–1.37)	1.00	(0.92–1.09)	71	(65–76)	1.58	(1.20–2.07)	1.30	(0.99–1.69)
50+	95	(92–97)	1.28	(1.12–1.46)	1.03	(0.95–1.12)	81	(77–85)	1.81	(1.39–2.35)	1.45	(1.11–1.90)
Any lapse in health coverage, past 12 months												
No	91	(89–92)	1.13	(1.04–1.23)	1.04	(0.98–1.10)	73	(69–77)	1.23	(1.10–1.38)	1.04	(0.95–1.14)
Yes	80	(73–87)	Ref.		Ref.		59	(52–67)	Ref.		Ref.	
Household income at or below poverty guideline												
No	89	(87–92)	1.06	(1.00–1.13)	1.03	(0.97–1.09)	73	(69–77)	1.26	(1.09–1.45)	1.12	(0.99–1.26)
Yes	84	(79–88)	Ref.		Ref.		58	(49–68)	Ref.		Ref.	
Educational attainment												
<High school							52	(38–67)	Ref.		Ref.	
High school diploma or equivalent							68	(62–74)	1.30	(0.99–1.72)	1.14	(0.91–1.44)
>High school							72	(67–77)	1.37	(1.06–1.77)	1.15	(0.95–1.40)
Time since HIV diagnosis (years)												
<5	78	(71–85)	Ref.				58	(50–66)	Ref.		Ref.	
5–9	88	(83–94)	1.13	(1.00–1.29)	1.06	(0.95–1.17)	70	(59–82)	1.21	(1.01–1.45)	1.09	(0.95–1.25)
10+	93	(90–95)	1.19	(1.08–1.31)	1.06	(0.99–1.13)	75	(70–79)	1.29	(1.10–1.51)	1.08	(0.92–1.25)
HIV disease stage												
AIDS or nadir $CD4^+$ <200	95	(94–97)	1.27	(1.13–1.43)	1.24	(1.12–1.38)						
No AIDS and nadir $CD4^+$ 200–499	78	(71–84)	1.04	(0.89–1.21)	1.06	(0.94–1.20)						
No AIDS and nadir $CD4^+$ ≥500	75	(66–84)	Ref.		Ref.							

aPR, adjusted prevalence ratio; ART, antiretroviral therapy; CI, confidence interval; MMP, Medical Monitoring Project; PR, prevalence ratio.