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ORIGINAL PAPER

Disparities in Viral Suppression and Medication Adherence among Women in the USA, 2011–2016

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Abstract

We assessed disparities in viral suppression (VS) and antiretroviral therapy (ART) adherence among women of the HIV Outpatient Study to inform HIV treatment strategies. We used adjusted prevalence ratios (aPR) with 95% confidence intervals (CI) to assess VS by race/ethnicity and generalized estimating equations to investigate factors associated with not achieving VS and ART non-adherence. Among 426 women (median age = 46 years), at baseline, VS was less prevalent among black women (63%) compared with Hispanic women/Latinas (73%) and white women (78%). In the multivariable analysis, factors significantly associated with not achieving VS included the following social and behavioral determinants of care: using public insurance (aPR = 1.69, CI 1.01–2.82, p = 0.044) compared to using private insurance, seeking care in a public clinic (aPR = 1.60, CI 1.03–2.50, p = 0.037) compared to seeking care in a private clinic, and ART non-adherence (aPR = 2.79, CI 1.81–4.29), p < 0.001). Although race was not a significant factor in not achieving VS, race was associated with ART non-adherence; black women were more likely to miss a dose of ART medication (aPR = 2.07, CI 1.19–3.60, p = 0.010) when compared to white women and Hispanic women/Latinas. Interventions and resources disseminated to address social barriers to care and improve VS and ART adherence among HIV-positive women, particularly black women, are warranted.

Keywords Viral suppression · Medication adherence · HIV/AIDS · African American · Women · Disparities

Introduction

Although new HIV diagnoses among women in the United States (U.S.) have declined in recent years, 7312 women were diagnosed in 2017 [1, 2]. African American/black (hereafter referred to as black) women were disproportionately affected: 60% of women diagnosed with HIV were black, 20% were white, and 15% were Hispanic/Latina [1]. In 2016, women also accounted for 24% of persons living with HIV in the U.S.; of an estimated 1,006,691 persons living with HIV infection, 240,306 were women: 58% black, 16% white, and 20% Hispanic/Latina [3]. Among women diagnosed with HIV, an estimated 64% received care, 50% were retained in care and 48% achieved viral suppression (VS) [1–3]. These estimates fell short of the national indicators of progress for 90% of diagnosed persons to be retained in care and for 80% of diagnosed persons to be virally suppressed [4].

Despite the disproportionate representation of black women and Hispanic women/Latinas among U.S. women diagnosed with and living with HIV, these populations are less likely to have access to or utilize HIV treatment and care services, most often due to social and structural barriers such as HIV-related stigma by healthcare professionals, inadequate social support, and unmet needs beyond HIV treatment and care services (e.g., limited economic stability and lack of childcare, housing, and transportation) [5]. These barriers to HIV services contribute to increased HIV-related morbidity and mortality primarily by decreasing the opportunities available for some women to receive antiretroviral therapy (ART) and be retained in HIV care for optimal ART adherence and VS [4]. These barriers also contribute to decreased quality of life and increased potential for unintended HIV transmission [6–8].

Limited published studies have examined disparities of VS and medication adherence, particularly for HIV-positive women of color [9, 10]. Moreover, recent updates to

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national prevention goals include a focus on disproportionately affected women, to strengthen access to and use of HIV care services, increase VS, and decrease HIV-related disparities [4]. To address this gap in the literature and examine indicators of progress along the HIV care continuum for women, we reviewed correlates of racial/ethnic disparities in ART adherence and HIV viral load (VL) suppression, among black women, white women, and Hispanic women/Latinas using 2011 through 2016 longitudinal data from the HIV Outpatient Study (HOPS) cohort.

Methods

The HIV Outpatient Study

The HOPS is a longstanding (since 1993), prospective, observational cohort study of HIV-infected adults receiving care at nine HIV clinics (university-based, public and private). Currently, the study is conducted in six U.S. cities (Chicago, IL; Denver, CO; Long Island, NY; Philadelphia, PA; Tampa, FL; and Washington, DC) [10]. The HOPS patients consent to participate in the study post HIV infection diagnosis and have the option to leave the study at any time [10, 11]. Since 2007, HOPS has implemented a supplemental survey to examine patient sociodemographic and risk behavior characteristics. This survey was implemented through the use of telephone or web-based audio-computer assisted self-interview (ACASI). The data include sexual risk, adherence to ART, and other behavioral information. Patient data, including socio-demographic characteristics, symptoms, diagnoses, treatments, and laboratory values are abstracted from medical records and entered into an electronic database (Discovere; Cerner Corporation, Kansas City, MO) by trained staff. These data are reviewed for quality and analyzed centrally.

The HOPS protocol is reviewed and approved annually by the Centers for Disease Control and Prevention (Atlanta, GA), Cerner Corporation (Kansas City, MO), and each local site's institutional review board. The study protocol conforms to the guidelines of the U.S. Department of Health and Human Services for the protection of human subjects in research. All HOPS participants have provided written informed consent. This analysis is based on the HOPS data current through June 30, 2017.

Study Population

We analyzed data from 426 female HOPS participants whose last HOPS contact was between 2011 and 2016. This cohort of women had at least two HOPS visits by the end of 2016, self-identified as either white, black, or Hispanic/Latina race/ethnicity, were prescribed ART anytime during 2011–2016, had at least one VL test done during this same time-period, and completed at least one ACASI (Fig. 1). Study participants were seen at nine sites located in Denver, Philadelphia, Chicago, Washington DC, Tampa, and Stony Brook, New York. Within these cities, there are three public clinics located in Philadelphia, Chicago, and Stony Brook, NY.

Measurements and Definitions

The main outcomes of interest were not achieving VS, defined as having VL $\leq$ 50 copies/mL [10–12] and ART non-adherence, defined as missing at least one ART dose during the prior 3 days before completing each ACASI (these data are self-reported). For the longitudinal analyses, only the most recent ACASI in a given calendar year was included for each participant. Baseline was defined as the date of the first VL test result for the participant during 2011 to 2016.

The baseline predictor variables included race/ethnicity (black, Hispanic/Latina, or white), education level (high school or less, any college, or unknown; available only at HOPS entry), employment status (full/part-time, or not employed or unknown, available only at HOPS entry), and clinic type (public or private). Predictor variables from the medical records were time-updated such that those closest to the date of each ACASI were used for the analysis: age in years, CD4+ cell count, presence of an AIDS diagnosis by clinical or immunologic criteria, and insurance payer (private, public or none). Predictor variables from the ACASI, obtained at most recent measurement in each calendar year, included: whether a woman missed an ART dose during the 3 days prior to completing each ACASI (for the model with outcome being lack of VS), whether she had sexual activity in the six months before ACASI, how many of her sexual partners know about her HIV-positive status and did she engage safe communication with her sexual partner. Missing education, employment, or insurance payer information were treated as separate categories, except that unknown employment was combined with the not employed category. No other analysis variables had missing values for any analysis participants.

Statistical Analyses

Descriptive summaries of the data, and univariate and multivariable regression model analyses, were done using SAS version 9.4 (SAS Institute, Cary, NC). Likelihood ratio Chi square or Fisher exact test were used to compare patient characteristics (binary or class variables) and Kruskal–Wallis or Wilcoxon rank-sum test were used to compare continuous variables by race/ethnicity. To examine longitudinal patterns in data, allowing for multiple measurements of VL and ART non-adherence per woman, we performed univariate

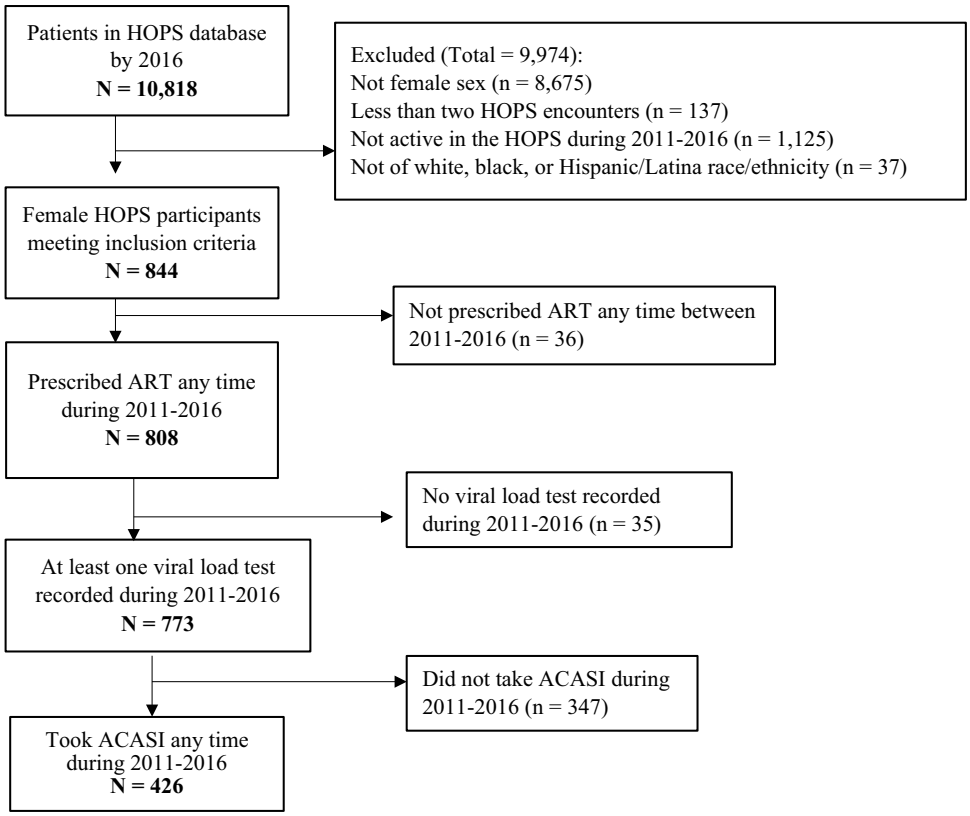

Fig. 1 Selection steps flowchart of HIV Outpatient Study participants in the analysis. *ART* antiretroviral therapy, *HOPS* HIV Outpatient Study, *ACASI* audio computer assisted self-interview

and multivariable analyses using generalized estimated equation (GEE) modeling assuming a binomial distribution. The test statistic used was the z-score. Factors entered into parsimonious multivariable models had p values < 0.15 in full multivariable models [13]. Results with $p < 0.05$ were considered statistically significant.

Results

Among 426 women included in this analysis, 62% were black, 24% were white, and 15% were Hispanic/Latina; the median baseline age was 46 years; 18% had private insurance. At baseline, the median duration of ART use was 7.1 years and median CD4+ cell count was 512 cells/mm^3; 63% had a documented AIDS diagnosis that occurred at or before baseline (64% among blacks, 66% among Hispanics/Latinas, and 59% among whites). Another 4.7% received an AIDS diagnosis during observation: 5.3% among blacks, 6.5% among Hispanics/Latinas, and 2.0% among whites.

In univariate analyses of baseline data, compared with white women, black women and Hispanic women/Latinas were significantly less ART-experienced (years of prescribed ART medications) (6.0 years among blacks, 6.7 years among Hispanics/Latinas, and 11.8 years among whites, $p < 0.001$). Viral suppression was less prevalent among black women (63%) and Hispanic women/Latinas (73%) compared to white women (78%) ($p = 0.013$). Black women and Hispanic women/Latinas were more likely to have missed a dose of their HIV medicine (27% among blacks, 18% among Hispanics/Latinas, and 15% among whites, $p = 0.024$); have public insurance (80% among blacks, 81% among Hispanics/Latinas, and 55% among whites, $p < 0.001$); and be in care at a public HOPS clinic (73% among blacks, 74% among Hispanics/Latinas, and 43% among whites, $p < 0.001$). Moreover, compared with white women, black women and Hispanic women/Latinas had lower baseline CD4+ cell counts (483 [282–767] among blacks, 496 [312–842] among Hispanics/Latinas and 562 [397–878] among whites, $p = 0.03$), but similar nadir CD4+ cell counts (206 [63–316] among blacks, 206 [57–338] among Hispanics/Latinas, and 203 [57–378] among whites, $p = 0.97$). No significant differences were identified regarding recent sexual activity (47% among blacks, 45% among Hispanics/Latinas, 51% among whites); partner knowledge of HIV-positive status (15% among blacks, 11% among Hispanics/Latinas, 24% among whites, $p = 0.07$); and safe sex communication with sexual partners (27% among blacks, 21% among Hispanics/Latinas, 28% among whites, $p = 0.55$) (Table 1).

The 426 women in our study population contributed a total of 5060 VL measurements during 2011–2016, with a median of 12 VL measurements per woman over a median of 5.9 years of observation time in this analysis. From 2011 to 2016, the percentage of VL test results 50 copies/mL

Table 1 Characteristics of women in our study population by race/ethnicity, the HIV Outpatient Study, 2011–2016 (N = 426)

Baseline characteristics[a]	White women (N = 101)	Black women (N = 263)	Hispanic/Latina women (N = 62)	p value[b]
Age, years: n (%)				0.49
≤ 29	4 (4.0)	22 (8.4)	5 (8.1)	
30–39	15 (14.9)	40 (15.2)	11 (17.7)	
40–49	48 (47.5)	98 (37.3)	26 (41.9)	
≥ 50	34 (33.7)	103 (39.2)	20 (32.3)	
Education level: n (%)				**< 0.001**
High school or less	37 (36.6)	151 (57.4)	34 (54.8)	
Any college	51 (50.5)	73 (27.8)	15 (24.2)	
Unknown	13 (12.9)	39 (14.8)	13 (21.0)	
Employment status: n (%)				**< 0.001**
Full or part-time	48 (47.5)	71 (27.0)	15 (24.2)	
Not employed or unknown	53 (52.5)	192 (73.0)	47 (75.8)	
Insurance payer: n (%)				**< 0.001**
Private	34 (33.7)	35 (13.3)	9 (14.5)	
Public	56 (55.4)	209 (79.5)	50 (80.7)	
None/other/unknown payer	11 (10.9)	19 (7.2)	3 (4.8)	
Clinic type: n (%)				**< 0.001**
Public	43 (42.6)	191 (72.6)	46 (74.2)	
Private	58 (57.4)	72 (27.4)	16 (25.8)	
Years living with HIV: median (IQR)	17.2 (10.8–19.9)	10.6 (5.2–15.8)	10.9 (2.2–15.6)	**< 0.001**
AIDS diagnosis: n (%)	60 (59.4)	168 (63.9)	41 (66.1)	0.64
CD4+ cell count/mm^3: median (IQR)	562 (397–878)	483 (282–767)	496 (312–842)	**0.029**
Nadir CD4+ cell count/mm^3: median (IQR)	203 (57–378)	206 (63–316)	206 (57–338)	0.97
Viral load < 50 copies/mL: n (%)	79 (78.2)	166 (63.1)	45 (72.6)	**0.013**
Any ART prescription: n (%)	100 (99.0)	242 (92.0)	59 (95.2)	**0.014**
ART use, years: median (IQR)	11.8 (5.3–14.7)	6.0 (2.5–10.2)	6.7 (1.1–12.9)	**< 0.001**
Missed HIV medicine in the past 3 days[c]				**0.024**
Yes	15 (14.9)	71 (27.0)	11 (17.7)	
No	86 (85.1)	192 (73.0)	51 (82.3)	
Had sexual activity in prior 6 months[c]				0.78
Yes	51 (50.5)	124 (47.1)	28 (45.2)	
No	50 (49.5)	139 (52.9)	34 (54.8)	
Partners with knowledge of your HIV+ status[c,d]				
All	24 (23.8)	39 (14.8)	7 (11.3)	0.07
Some	23 (22.8)	56 (21.3)	16 (25.8)	0.74
None	3 (3.0)	26 (9.9)	4 (6.5)	0.054
Safe sex communication with sexual partners[c]				0.55
Yes	28 (27.7)	72 (27.4)	13 (21.0)	
No	73 (72.3)	191 (72.6)	49 (79.0)	

Bold indicates p value < 0.05

ART Antiretroviral therapy, *IQR* interquartile range

[a]Baseline date is the date of first viral load test result during observation

[b]Yates-corrected Chi square test, or Fisher exact test for categorical variables; Kruskal–Wallis test of medians for continuous variables

[c]At date of first analyzed ACASI during observation

[d]This question was answered by 198 of the 426 participants

increased from 63% to 79% for black women (p < 0.001), from 73% to 76% for Hispanic women/Latinas (p = 0.84) and 78% to 89% for white women (p = 0.06).

In the univariate GEE analysis, factors associated with not achieving VS included: being aged 29 and under (PR = 3.38, CI 1.50–7.64, p = 0.003), aged 30–39 (PR = 2.28, CI 1.24–4.17, p = 0.008), and aged 40–49 (PR = 1.74, CI 1.13–2.68, p = 0.012); black race/ethnicity (PR = 2.06, CI 1.19–3.58, p = 0.010); having an education level of high school or less (PR = 1.65, CI 1.07–2.54, p = 0.023); having public insurance (PR = 1.90, CI 1.15–3.16, p = 0.013); receiving care in a public clinic (PR = 1.85, CI 1.22–2.80, p = 0.004); having baseline CD4+ cell count < 350 cells/mm^3 (PR = 5.07, CI 3.31–7.77, p < 0.001); reporting having missed a dose of HIV medicine in the prior 3 days before completing an ACASI (PR = 3.22, CI 2.15–4.81, p < 0.001); recent sexual activity (PR = 1.49, CI 1.01–2.18, p = 0.042); partners knowledge of their HIV-positive status (some partners) (PR = 1.44, CI 1.00–2.08, p = 0.048) (Table 2). Factors not associated with not achieving VS included: Hispanic race/ethnicity, unknown education level, unknown employment status, unknown insurance payer, partners knowledge of your HIV+ status (no partners), and safe sex communication. (Table 2).

In the parsimonious multivariable analysis, factors significantly associated with not achieving VS included: being aged 29 and under (aPR = 2.33, CI 1.01–5.38, p = 0.048) and aged 30–39 (aPR = 2.12, CI 1.17–3.83, p = 0.013); having public insurance (aPR = 1.69, CI 1.01–2.82, p = 0.044), seeking care in a public clinic (aPR = 1.60, CI 1.03–2.50, p = 0.037), having a CD4+ cell count < 350 cells/mm^3 (aPR = 4.58, CI 2.97–7.07, p < 0.001), and having missed a dose of HIV medicine in the past 3 days (aPR = 2.79, CI 1.81–4.29), p < 0.001). Factors not associated with not achieving VS included: ages 40–49 and having no insurance or an unknown insurance payer (Table 2).

In the univariate GEE analysis, factors associated with self-report of missing an ART dose in the previous 3 days included: younger age, including aged 29 and under (PR = 2.40, CI 1.13–5.10, p = 0.023) and aged 40–49 (PR = 1.97, CI 1.33–2.92, p < 0.001); black race/ethnicity (PR = 2.09, CI 1.21–3.62, p = 0.008), and having a CD4+ cell count less than 350 cells/mm^3 (PR = 1.81, CI 1.21–2.71, p = 0.004). Factors not associated with missing ART dose included: being aged 30–39, Hispanic/Latina race ethnicity, education, employment, insurance payer and receiving care in a public clinic, recent sexual behavior, partners knowledge of your HIV+ status (some partners and no partners), and safe sex communication (Table 3).

In the parsimonious multivariable analysis, factors associated with missing an ART dose in the previous 3 days included: being aged 40–49 (aPR = 1.99, CI 1.33–2.97, p < 0.001) black race/ethnicity (aPR = 2.07, CI 1.19–3.60, p = 0.010), and having a CD4+ cell count < 350 cells/mm^3 (aPR = 1.68, CI 1.11–2.55, p = 0.014). Factors not associated with missing ART dose included: being aged 29 and under and aged 30–39, and Hispanic/Latina race ethnicity (Table 3).

Discussion

Overall, compared with white women and Hispanic women/Latinas, black women had significantly fewer years of ART use, lower levels of ART adherence and lower levels of VS, although the latter findings were not statistically significant after controlling for several sociodemographic characteristics. These racial/ethnic disparities among women are consistent with previous reports [5, 10, 15–19]. We also found that not being virally suppressed, after controlling for missed doses of ART medications, was associated with younger age, seeking care in a public clinic, having public insurance, and having a CD4+ cell count < 350 cells/mm^3. Although analyses of time from HIV diagnosis to start of ART are beyond the scope of the present study, prior research in the HOPS and other cohorts suggests that persons of color and persons experiencing psychosocial barriers may experience longer times from HIV diagnosis to ART initiation [20, 21]. These findings align with prior HOPS cohort analyses identifying poorer VS outcomes among female patients attending publicly funded versus privately funded clinics [10, 14].

Lower CD4+ cell counts (more advanced HIV disease) were also observed among these patients, suggesting VS may be related to, in part, socioeconomic contexts of patients who attend public clinics compared to those who attend private clinics [15]. For many women living with HIV, challenging healthcare systems, as well as competing priorities (e.g. family and work) and schedules with limited flexibility, create ongoing barriers to seeking HIV treatment and care services [16]. In addition, clinic factors such as limited staff, high patient volume, and extended wait times may discourage patients from seeking medical care, which may impact ART adherence and VS [17]. Some published studies suggest that flexible clinical time schedules, non-judgmental and sensitive staff persons, comprehensive access at a single location, and community-based access all provide options that facilitate HIV care for women living with HIV infection, especially women of color [17, 18]. Notably, recent national analyses have found that HIV-positive patients served in clinics receiving Ryan White-supported care can experience improvements in health outcomes that parallel or exceed those seen for patients served in other settings [19].

We found that ART non-adherence, having missed at least one dose of ART medication in the past 3 days, was associated with younger age, black race/ethnicity, and having a baseline CD4+ cell count < 350 cell/mm^3. Recent

Table 2 Generalized estimating equation analyses of factors associated with not having viral suppression (i.e., VL ≤ 50 copies/mL) among women who completed a behavioral survey, the HIV Outpatient Study, 2011–2016 (N = 426)

Patient characteristics	Univariate model		Multivariable full model		Multivariable parsimonious model[a]	
	PR (95% CI)	p value	APR (95% CI)	p value	APR (95% CI)	p value
Age, years[b]						
≤ 29	3.38 (1.50–7.64)	**0.003**	2.22 (0.95–5.19)	0.07	2.33 (1.01–5.38)	**0.048**
30–39	2.28 (1.24–4.17)	**0.008**	2.11 (1.16–3.84)	**0.015**	2.12 (1.17–3.83)	**0.013**
40–49	1.74 (1.13–2.68)	**0.012**	1.49 (0.93–2.39)	0.09	1.49 (0.94–2.38)	0.09
≥ 50	Referent		Referent		Referent	
Race/ethnicity						
White	Referent		Referent			
Black	2.06 (1.19–3.58)	**0.010**	1.31 (0.72–2.36)	0.37		
Hispanic/Latina	0.90 (0.52–1.56)	0.72	1.13 (0.55–2.31)	0.74		
Education level						
High school or less	1.65 (1.07–2.54)	**0.023**	1.12 (0.69–1.81)	0.65		
Any college	Referent		Referent			
Unknown	1.10 (0.55–2.21)	0.79	0.91 (0.41–2.00)	0.81		
Employment status						
Full or part time	Referent		Referent			
Not employed or unknown	1.27 (0.84–1.93)	0.25	0.93 (0.56–1.56)	0.80		
Insurance payer[b]						
Private	Referent		Referent		Referent	
Public	1.90 (1.15–3.16)	**0.013**	1.70 (0.92–3.13)	0.09	1.69 (1.01–2.82)	**0.044**
None/other/unknown payer	0.85 (0.32–2.24)	0.74	0.96 (0.35–2.59)	0.93	0.94 (0.37–2.39)	0.90
Clinic type						
Private	Referent		Referent		Referent	
Public	1.85 (1.22–2.80)	**0.004**	1.50 (0.93–2.42)	0.09	1.60 (1.03–2.50)	**0.037**
CD4+ cell count < 350 cells/mm^{3}[b]						
Yes	5.07 (3.31–7.77)	**< 0.001**	4.57 (2.96–7.08)	**< 0.001**	4.58 (2.97–7.07)	**< 0.001**
No	Referent		Referent		Referent	
Missed a dose of HIV medicine in the past 3 days[b]						
Yes	3.22 (2.15–4.81)	**< 0.001**	2.72 (1.76–4.21)	**< 0.001**	2.79 (1.81–4.29)	**< 0.001**
No	Referent		Referent		Referent	
Had sexual activity in prior 6 months[b]						
Yes	1.49 (1.01–2.18)	**0.042**	1.24 (0.74–2.09)	0.41		
No	Referent		Referent			
Partners with knowledge of your HIV+ status[b]						
All	Referent		Referent			
Some	1.44 (1.00–2.08)	**0.048**	1.07 (0.67–1.69)	0.78		
None	1.06 (0.55–2.04)	0.87	0.92 (0.46–1.85)	0.81		
Safe sex communication with your sexual partners[b]						
Yes	1.35 (0.90–2.01)	0.14	0.95 (0.55–1.63)	0.84		
No	Referent		Referent			

Bold indicates p value < 0.05

p values were based on z-score

aPR Adjusted prevalence ratio, *PR* prevalence ratio

[a]Factors entered into the parsimonious multivariable model had p values < 0.15 in the full multivariable model

[b]Time-updated variables

Table 3 Generalized estimating equation analyses of factors associated with missing an ART dose in the previous 3 days among women who completed a behavioral survey, the HIV Outpatient Study, 2011–2016 (N = 426)

Patient characteristics	Univariate model		Multivariable full model		Multivariable parsimonious model[a]	
	PR (95% CI)	p value	APR (95% CI)	p value	APR (95% CI)	p value
Age, years[b]						
≤ 29	2.40 (1.13–5.10)	**0.023**	1.95 (0.91–4.18)	0.09	2.05 (0.98–4.28)	0.06
30–39	1.62 (0.95–2.75)	0.08	1.57 (0.91–2.73)	0.11	1.55 (0.90–2.69)	0.12
40–49	1.97 (1.33–2.92)	**< 0.001**	1.97 (1.31–2.96)	**0.001**	1.99 (1.33–2.97)	**< 0.001**
≥ 50	Referent		Referent		Referent	
Race/ethnicity						
White	Referent		Referent		Referent	
Black	2.09 (1.21–3.62)	**0.008**	1.92 (1.07–3.42)	**0.028**	2.07 (1.19–3.60)	**0.010**
Hispanic/Latina	1.38 (0.66–2.87)	0.39	1.24 (0.57–2.70)	0.58	1.36 (0.64–2.86)	0.42
Education level						
High school or less	1.32 (0.85–2.05)	0.22	1.17 (0.74–1.86)	0.50		
Any college	Referent		Referent			
Unknown	0.84 (0.42–1.65)	0.61	0.81 (0.41–1.63)	0.56		
Employment status						
Full or part time	Referent		Referent			
Not employed or unknown	1.03 (0.68–1.56)	0.88	0.89 (0.54–1.47)	0.65		
Insurance payer[b]						
Private	Referent		Referent			
Public	1.28 (0.80–2.05)	0.30	1.21 (0.68–2.18)	0.52		
None/other/unknown payer	0.77 (0.31–1.88)	0.56	0.81 (0.33–2.01)	0.65		
Clinic type						
Private	Referent		Referent			
Public	1.31 (0.85–2.00)	0.22	1.06 (0.67–1.69)	0.79		
CD4+ cell count < 350 cells/mm^3[b]						
Yes	1.81 (1.21–2.71)	**0.004**	1.68 (1.11–2.54)	**0.014**	1.68 (1.11–2.55)	**0.014**
No	Referent		Referent		Referent	
Had sexual activity in prior 6 months[c]						
Yes	1.10 (0.75–1.62)	0.63	1.06 (0.66–1.69)	0.82		
No	referent		referent			
Partners with knowledge of your HIV+ status[c]						
All	Referent		Referent			
Some	1.14 (0.75–1.75)	0.53	1.05 (0.64–1.72)	0.83		
None	0.77 (0.38–1.57)	0.47	0.67 (0.32–1.40)	0.28		
Safe sex communication with your sexual partners[c]						
Yes	0.93 (0.61–1.42)	0.74	0.74 (0.44–1.24)	0.25		
No	Referent		Referent			

Bold indicates p value < 0.05

p values were based on z-score

aPR Adjusted prevalence ratio, *PR* prevalence ratio

[a]Factors entered into the parsimonious multivariable model had p values < 0.15 in the full multivariable model

[b]Time-updated variables

[c]At date of first analyzed ACASI during observation

reports suggest factors such as limited access and use of HIV care services, HIV-related stigma, relationship turbulence, limited prioritization of self-care, inadequate support, and unmet needs that extend beyond HIV care (e.g., housing, childcare, and reliable transportation) are barriers to ART adherence among black women [5].

Moreover, we found that social and behavioral factors, including recent sexual activity, partner knowledge of HIV-positive status, and safe sex communication, were not significantly associated with medication adherence. These factors are the foundation of HIV interventions in other populations [22]. These findings suggest a need to better understand the complex and intersectional barriers and facilitators of medication adherence in this population. Furthermore, these findings suggest the need for culturally-tailored interventions to improve medication adherence among black women. These factors should be considered by health professionals to enhance the quality of HIV treatment for black women, and by policymakers to improve access to HIV care services utilized by black women. During routine clinical visits, providers should consider asking about adherence, underscoring the importance of adherence, and offering counseling if patients describe barriers to daily adherence.

Our study had some limitations [10]. First, data were obtained by review of medical records from routine HIV clinical visits and an optional brief behavioral survey. These data had limited social and structural determinants of health, information that could have been used to enhance our explanation of racial/ethnic disparities of VS and medication adherence. Second, there is a possibility of misclassification of ART experience (prescription in the medical records may not be indicative of actual use), and misclassification of self-reported adherence on ACASI. Third, we had data on relatively few Hispanic women/Latinas, limiting our ability to examine VS and medication adherence differences within this heterogeneous population. Future studies of trends in VS in large cohorts [22] with diverse samples of women of color are indicated. Fifth, data were not available regarding stress and trauma for the women in our sample. As stress and trauma may affect medication adherence and VS, adding these variables to future surveys may provide vital information. Sixth, due to a small sample size of women with available ACASI data, our study may have lacked statistical power to detect some true underlying associations between the outcomes and various predictor variables. Finally, our analyses were based on data from nine HIV-specialty public and private HIV clinics. Therefore, the findings may not be generalizable to women in other clinical settings, [23] and likely do not reflect VS levels for women outside of HIV care. However, although we relied on a convenience sample of clinics and patients, the nine U.S. clinical sites participating in the HOPS are demographically diverse, with patient characteristics similar to those seen in HIV clinical settings throughout the U.S. [24].

Conclusions

HIV VS and ART adherence disparities exist among women of color living with HIV infection. Black women and Hispanic women/Latinas are less likely to be virally suppressed and more likely to experience barriers to ART adherence [5, 10]. Future in-depth assessments of facilitators and barriers to HIV VS and medication adherence, and evidence-informed interventions designed to address the contextual barriers to HIV treatment and care within this population, are warranted. These interventions are essential to increasing medication adherence and subsequent VS for women of color. If we are able to close these HIV care gaps, we can get closer to our goal of eliminating HIV-related disparities among women living with HIV infection.

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Compliance with Ethical Standards

Conflicts of interest The authors have no conflicts of interest to disclose.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study formal consent is not required.

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