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Racial differences in the association of undetectable HIV viral load and transportation to an HIV provider among men who have sex with men in Atlanta, Georgia: a health equity perspective

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Abstract

There are well-documented inequities in HIV outcomes among Black gay, bisexual, and other sexual minority men who have sex with men (Black GBMSM) compared to GBMSM overall, including access to transportation to HIV care. It is not known if the relationship between transportation and clinical outcomes extends to undetectable viral load. We assessed the relationship between transportation dependence to an HIV provider and having an undetectable viral load among Black and White GBMSM in Atlanta. We collected demographic, healthcare, transportation, and viral load information from Black and White GBMSM with HIV living in Georgia from 2016 to 2017 (n=345). More Black than White GBMSM had a detectable viral load (25% vs. 15%) and took dependent (e.g. public) transportation (37% vs. 18%). Independent (e.g. car) transportation was associated with undetectable viral load for White (cOR 3.61, 95% CI 1.45, 8.97), but not for Black, GBMSM (cOR 1.18, 95% CI 0.50, 2.24), with the association for White GBMSM attenuated by income (aOR. 2.29, 95% CI 0.78, 6.71). One possible explanation for no statistical association for Black GBMSM is that there are more competing barriers to HIV care for Black GBMSM than White GBMSM. Because of this, one factor changing, such as transportation, may not have an impact on viral load for Black GBMSM, and therefore no significant association was observed. Further investigation is needed to confirm whether 1) transportation is unimportant for Black GBMSM or 2) transportation interacts with additional factors not considered here including other structural barriers.

Keywords

viral load; epidemiology; racial and ethnic inequities; transportation

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Declaration of interest

The authors report no competing interests.

Introduction

There are well-documented inequities in human immunodeficiency virus (HIV) incidence and care outcomes among Black and African American gay, bisexual, and other sexual minority men who have sex with men (GBMSM) compared to GBMSM overall, including viral suppression (Buchacz et al., 2018; Centers for Disease Control and Prevention, 2015, 2020b; Hall et al., 2013; Millett et al., 2007, 2012; Rosenberg et al., 2014; Sullivan et al., 2015, 2021). The National HIV Surveillance System estimates that racial inequities along the HIV treatment cascade culminate in a 30% lower likelihood of viral suppression among Black, compared to White persons living with HIV (Hall et al., 2013). Research on the inequities in HIV incidence and care outcomes among Black GBMSM compared to White GBMSM has historically focused on individual-level risk factors (Millett et al., 2006). However, individual- and meso-level factors associated with HIV and subsequent care are impacted by structural factors, which disproportionately harm communities of color, including Black GBMSM, and may play a greater role in HIV inequities (Bailey et al., 2017; Carter & Flores, 2019; D. T. Duncan et al., 2021; Millett et al., 2007, 2012). For instance, racial and ethnic residential segregation influences the neighborhood environment, such as clinic density and public transportation, which in turn affect HIV treatment services and uptake (Baral et al., 2013; D. T. Duncan et al., 2021). There have been calls to increase efforts to better understand these structural factors, with recent studies collecting more holistic data, exploring intersectional effects of stigma, and incorporating neighborhood context (Carter & Flores, 2019; D. Duncan et al., 2020; D. T. Duncan et al., 2019; Timmins et al., 2021).

Access to transportation to an HIV provider has been identified as a structural barrier to engagement and retention in care among persons living with HIV (Ashman et al., 2002; Dasgupta et al., 2016; Fortenberry et al., 2012; Goswami et al., 2016; Lo et al., 2002; Philbin et al., 2014; Sagrestano et al., 2014; Walcott et al., 2016). While private transportation is associated with improved HIV care engagement, a clinic's ability to provide transportation assistance may be resource dependent (Ashman et al., 2002; Lo et al., 2002; Philbin et al., 2014). Access to public transportation has been identified as a major issue for people living with HIV in both urban and rural settings in the US (Fortenberry et al., 2012; Philbin et al., 2014; Sagrestano et al., 2014; Walcott et al., 2016). One study assessing transportation to HIV care in Atlanta found that the spatial access of HIV providers available decreased if individuals were traveling by public transportation versus a car (Dasgupta et al., 2016). Although these studies assessed the relationship between access to transportation and HIV provider visits or other care-related outcomes, neither explicitly aimed to assess differences in transportation and HIV care outcomes by race and ethnicity in GBMSM populations (Lo et al., 2002; Sagrestano et al., 2014). Lo *et al.* found that, in Boston, receiving transportation services was associated with more primary care visits per year, with a stronger association for non-White versus White people living with HIV (Lo et al., 2002). However, the study sample was majority White GBMSM (75% White, 93% GBMSM). Sagrestano *et al.* found that more Black participants reported using public transportation to travel to their HIV provider and used more modes of transportation overall in a study sample of 76% Black participants living with HIV in the Southeast (Sagrestano et al., 2014). Although these

studies discuss how transportation to an HIV provider differs by race, there is need to translate this relationship to clinical outcomes.

The disproportionate burden of adverse health outcomes associated with race and ethnicity due to structural barriers, including structural racism, is also long-standing in the US (Bailey et al., 2017). Although not limited to Black GBMSM living with HIV, Atlanta and other urban areas have historical and contemporary political and economic processes that can serve as the root of racial health inequities (Sewell, 2016). These processes negatively affect where Black communities live in Atlanta (e.g., historical and contemporary red lining), the availability of transportation frequently used by Black communities (e.g., policies to not adequately fund or expand public transportation), and health outcomes related to both, including HIV care outcomes (Collin et al., 2021; Dasgupta et al., 2015, 2016; Nardone et al., 2020; Peipins et al., 2011, 2013).

Although transportation has been cited as a barrier to care for persons living with HIV and Black GBMSM face persistent inequities in HIV care outcomes, this research has not been extended to assess the association of transportation mode to clinical HIV outcomes, such as undetectable viral load. The purpose of this study is to assess the relationship between mode of transportation and undetectable viral load among Black and White GBMSM living with HIV using survey and clinical data from the EngageMENt Study in Atlanta (Sullivan et al., 2021). We aim to assess this relationship by describing the distribution of clinical and transportation characteristics among Black and White GBMSM and assess the association of mode of transportation to an HIV provider and undetectable viral load.

Materials and methods

Recruitment

This analysis used cross-sectional data from the EngageMENt Study consisting of Black (n=207) and White (n=193) GBMSM diagnosed with HIV (Sullivan et al., 2021). This study was reviewed and approved by the Institutional Review Board March 5, 2016. Informed consent was administered in person at the study clinic, before the first enrollment visit. Participants were recruited via community venues, internet sites, other HIV studies, on public transportation, and incentivized peer recruitment. Baseline data were collected from June 2016 to May 2017. Participants were compensated $60 for the visit.

Inclusion, exclusion criteria

Protocol enrollment has been described in previous studies (Sullivan et al., 2021). Enrollment inclusion criteria consisted of self-reported positive HIV status, male at birth who currently identifies as male, 16 years of age or older, self-identifies as Black, non-Hispanic or White, non-Hispanic, lives in the Atlanta metropolitan area, and was not planning to exclusively receive HIV care outside of metro Atlanta for the duration of the 2-year study.

Analysis-specific exclusion criteria included those who did not list a provider (n=32) or listed one outside of Georgia (n=21). Two additional participants were removed for moving after recruitment (n=1), and listing a clinic name with multiple locations (n=1).

Variable collection

All variables except viral load were self-reported by the participant in a survey.

Demographic variables included age (continuous), recent HIV diagnosis (dichotomous, recent if diagnosis was ≤90 days from the time of survey), highest level of education, employment status, yearly income, housing, and health coverage (all categorical). Health coverage was recategorized after data collection as a 4-level categorical variable to describe insurance and supplemental assistance status.

Participants could list up to 5 HIV care providers and were asked questions about services received and mode of transportation used to travel to each provider. For this analysis, participants were matched with the provider that they reported receiving CD4 and/or HIV viral load tests from; if a participant listed more than one provider the first provider listed was used. Transportation mode to HIV care provider was recategorized as a dichotomous variable ("independent transportation" or "dependent transportation") using mode of transportation information asked during the survey. Mode of transportation was an 8-level categorical variable where participants could select more than one option ("I drive", "A friend or family member drives me", "I ride the MARTA [Metropolitan Atlanta Rapid Transit Authority] train", "I take the bus", "I take a Taxi/Uber/Lyft", "I ride a bicycle", "I walk", or "Other"). Participants were classified as taking independent transportation if they reported driving themselves, regardless of what other modes of transportation they took, or reported only walking or biking to their HIV provider. Participants were classified as taking dependent transportation if they did not report any driving, and reported either a friend or family member driving them, taking the MARTA train, bus, clinic shuttle, or using a rideshare app or taxi. Average one-way commute time, distance, and cost (all categorical) were also collected.

Viral load was ascertained via laboratory testing of plasma specimens collected by the study at the baseline visit; testing was conducted through the Emory University Center for AIDS Research CLIA-certified Kraft Laboratory using Abbott RealTime HIV-1 assay. A participant was considered to have an undetectable viral load if their HIV viral load test reported <40 copies/mL. Receipt of care was defined as having at least one CD4 or viral load test within the past 12 months the survey was administered (Centers for Disease Control and Prevention, 2020a).

Statistical analysis

Frequencies and proportions were calculated to describe demographic, transportation, and clinical characteristics. Multivariable logistic regression models adjusting for age, recent HIV diagnosis, and income were used to assess the association of transportation dependency on undetectable HIV viral load. We hypothesized that using independent transportation was associated with an undetectable viral load for both Black and White participants, and that this effect was stronger for Black GBMSM compared to White GBMSM. Age, recent HIV diagnosis, and income were selected as confounders due to their potential to be both associated with what transportation a participant may use to travel to their provider and their likelihood of undetectable viral load at the time of data collection. Additionally, participants

with a recent HIV diagnosis may not have had sufficient time to achieve an undetectable viral load at the time of survey. All analyses were stratified by race. Variables that were considered downstream factors of income (education, housing, insurance) and transportation dependence (travel distance and travel time) were not considered confounders. All analyses were performed with SAS 9.4 (SAS Institute, Cary, NC).

Results

A total of 345 GBMSM living with HIV were in our analytic sample (Table 1). Of these, 49% (n=170) identified as Black, non-Hispanic GBMSM, and 51% (n=175) identified as White, non-Hispanic GBMSM. The median age of Black study participants was 36 years, and for White participants was 46 years. Inequities in social determinants of health were evident in the descriptive analyses: compared to White participants, fewer Black participants had completed college (Black 35%, White 50%), lived in their own house or apartment (Black 72%, White 87%) and had health insurance (Black 68%, White 85%). Black participants also reported lower income.

There were also differences in access to their healthcare provider: for mode of transportation used to attend appointments at their HIV care provider, a higher proportion of White participants used an independent mode of transportation (81%) compared to Black participants (62%), with Black participants using more modes of transportation compared to White participants (Table 2). For dependent modes of transportation, Black participants reported using transportation via train (44%), bus (23%), and taxi and rideshare services (15%) in higher proportions compared to White participants (17%, 12%, and 8%, respectively). Black participants' average distance and time to provider skewed farther and longer, respectively, compared to White participants.

For HIV care outcomes, 99% (n=341, 99% of Black, 100% of White) participants met the definition of receiving care, defined as receiving either one or more CD4 or viral load tests within the past year at the time the baseline survey was administered (Table 2). For undetectable viral load, 80% (n=276) of participants had an undetectable viral load, including 75% (n=127) of Black participants and 85% (n =149) of White participants (prevalence ratio comparing undetectable viral load among Black participants to White participants 0.88, 95% confidence interval [CI] 0.79, 0.98). Although there was no difference in undetectable viral load by mode transportation used by Black GBMSM, there was a difference for White GBMSM.

There were differences in the association between transportation and undetectable viral load between Black and White participants ($p = 0.007$). Black participants who took an independent mode of transportation were no more or less likely to have an undetectable viral load compared to Black participants who took a dependent mode of transportation to their HIV provider (crude odds ratio [cOR] 1.18, 95% CI 0.58, 2.42). (Table 3). Age, recent HIV diagnosis, and income alone or in combination did not meaningfully change the association (adjusted odds ratio [aOR] 1.12, 95% CI 0.51, 2.46).

Conversely, there was a positive and strong association between using an independent mode of transportation to an HIV provider and undetectable viral load for White participants (Table 4). White participants who took an independent mode of transportation were 3.6 times more likely to have an undetectable viral load compared to White participants who took a dependent mode of transportation (cOR 3.61 95% CI 1.45, 8.97) (Table 4). Although age (aOR 3.43, 95% CI 1.37, 8.59) did not meaningfully change the association, recent HIV diagnosis (aOR 4.09, 95% CI 1.62, 10.36) and income (aOR 1.16, 95% CI 0.95, 1.40) did. After adjusting for all three, White GBMSM who took an independent mode of transportation to their HIV care provider were no more or less likely to have an undetectable viral load compared to those taking a dependent mode of transportation (aOR 2.49, 95% CI 0.85, 7.43).

Discussion

The purpose of this study was to describe the mode of transportation used to travel to an HIV provider and compare the associations between transportation mode and undetectable viral load between Black and White GBMSM living in metro Atlanta as a way to quantify structural drivers of health inequity in this population. We have previously reported that a quarter of Black GBMSM in the cohort had a detectable viral load, which was higher than White GBMSM (15%) (Sullivan et al., 2021). Although there was no difference in undetectable viral load by mode of transportation for Black GBMSM, there was a difference for White GBMSM. This null association between independent transportation and undetectable viral load for Black GBMSM remained unchanged controlling for age, recent HIV diagnosis, and income. The odds of having an undetectable viral load for using independent transportation for White GBMSM was over three times higher than those using dependent transportation. After controlling for recent HIV diagnosis, age, and income, there was no significant difference in undetectable viral load levels by transportation method.

Compared to White GBMSM, fewer Black GBMSM had an undetectable viral load and took independent transportation, but there was no difference in undetectable viral load by transportation mode used among Black GBMSM. These findings are consistent with literature on racial and ethnic differences in viral suppression and transportation mode to HIV care, and provide evidence that racial and ethnic differences in transportation mode to an HIV provider extend to GBMSM populations (Philbin et al., 2014; Rosenberg et al., 2014; Sullivan et al., 2021).

Our study also found that independent transportation was not associated with undetectable viral load for Black GBMSM, and was for White GBMSM, but was attenuated by income. One possible explanation for lack of observed association for Black GBMSM is that the number and magnitude of barriers faced by Black GBMSM to access care may be greater compared to other populations with HIV (Adolescent Medicine Trials Network (A. T. N.) Cares Team et al., 2021; Bailey et al., 2017; Millett et al., 2006; Sullivan et al., 2021). Because of this, one factor changing, including transportation, may not have an impact on viral load for Black GBMSM, and therefore no significant association was observed. In a sensitivity analysis using income as the exposure (not shown), similar null results were seen for Black GBMSM. Additionally, a collinearity assessment (not shown) determined

no collinearity for models with transportation dependence and income. This finding demonstrates that although improved dependent transportation might improve outcomes for GBMSM, a single intervention, such as providing better transportation options, may not be enough to improve viral load levels for Black GBMSM (Ludema et al., 2018). Interventions to achieve undetectable viral load levels for Black GBMSM need to address fundamental causes of racial health inequities and may need to include transportation services and also expanded health coverage, housing stability, and reparations (Buchanan et al., 2009; Sullivan et al., 2021; Williams & Collins, 2004). Our finding that the association of independent transportation and having an undetectable viral load was attenuated by income for White GBMSM is consistent with literature on the association of income and other forms of capital on viral load and HIV care outcomes (Frederick & Gilderbloom, 2018; Holtgrave & Crosby, 2003; Kalichman et al., 2019; Ludema et al., 2018; Syed et al., 2013; Walcott et al., 2016). Lastly, while transportation is associated with HIV medication adherence (Cornelius et al., 2017; Mehta et al., 1997; Sagrestano et al., 2014), it is not fully predictive of it, and may explain our null associations for Black and White GBMSM, and is further complicated by participants who utilized drug assistance programs that restrict pharmacy use (e.g. AIDS Drug Assistance Program).

There were several limitations to this study. First, this analysis was restricted to participants who listed an HIV care provider in Georgia, thus limiting external generalizability. Participants who did not list an HIV provider were not included in the analysis, which might induce selection bias. These participants may not have a provider to list, which is consistent with the higher rates of detectable viral loads among those excluded from the analysis. This limits the generalizability of our study to GBMSM with HIV who see their HIV provider at least once a year for CD4 and/or viral load tests. Additional limitations were selection bias from study recruitment and information bias from the administered survey. Recruitment included those with previous HIV study engagement. Because of this, participants who had more positive HIV outcomes (e.g. retention in care) may have been more easily contacted and more likely to participate in the study compared to those with more adverse HIV outcomes. Lastly, there are a number of ways to describe transportation that are highly correlated with each other. While for this analysis transportation time and distance were considered downstream from transportation dependence in Atlanta, alternate descriptions of transportation can be described to explore downstream interventions from transportation dependence, such as transportation vouchers (Roland et al., 2022).

Our results are generalizable to Black and White GBMSM living with HIV in the Atlanta metropolitan area who have access to an HIV provider. Although we were unable to confirm if our sample participants met the “retained in care” definition, proportions of viral suppression in our sample are similar to Black and White GBMSM who are retained in care and virally suppressed in metro Atlanta (Georgia Department of Public Health, 2016).

We have previously reported differences in undetectable viral load between Black and White GBMSM (Sullivan et al., 2021); in this analysis we identify that transportation as a potentially modifiable structural driver alone does not explain inequitable HIV outcomes for Black GBMSM living in Atlanta. This study contributes to existing literature by demonstrating that for a population with differences in undetectable viral load by race and

ethnicity 1) racial differences in mode of transportation used to an HIV care provider extend to GBMSM populations, and 2) the effect of the mode of transportation used to an HIV care provider on an undetectable viral load differs for GBMSM by race. These differences are likely a result of a multitude of factors related to how societal oppression affects Black GBMSM's experiences that may include transportation to their HIV provider, but also pertain to where Black GBMSM live, travel, and how they navigate care HIV (Arrington-Sanders et al., 2020; D. Duncan et al., 2020; D. T. Duncan et al., 2021; Feelemyer et al., 2021; Levy et al., 2014; Phillips et al., 2021; Teixeira da Silva et al., 2020). According to our results, transportation is one factor that could improve outcomes for low-income White GBMSM, and further investigation is needed to confirm whether 1) transportation is unimportant for Black GBMSM or 2) transportation interacts with additional factors not considered here including other structural barriers. Thus, our findings do not necessarily indicate that transportation is not important for Black GBMSM, but that the barriers are more complex than we have fully captured here.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Demographic characteristics of 345 GBMSM enrolled in EngageMENt who have a provider in Georgia, United States, 2017 [*,†]

	Total Black		Independent Transportation, Black		Dependent Transportation, Black		Total White		Independent Transportation, White		Dependent Transportation, White		p-value (Black vs. white)
	n = 170		n = 106		n = 63		n = 175		n = 143		n = 32		
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
Median Age	36		36		36		46		47		45		0.409
HIV Diagnosis Date													0.971
≤ 90 days	3	(2)	1	(1)	2	(3)	3	(2)	3	(2)	0	(0)	
> 90 days ago	167	(98)	105	(99)	61	(97)	172	(98)	140	(98)	32	(100)	
Highest Level of Education													0.034
College, post graduate, or professional school	60	(35)	42	(40)	18	(29)	88	(50)	80	(56)	8	(25)	
Some college, Associate's degree and/or Technical School	84	(49)	54	(51)	29	(46)	62	(35)	48	(34)	14	(44)	
High school or GED	22	(13)	9	(8)	13	(21)	22	(13)	14	(10)	8	(25)	
Did not finish high school	4	(2)	1	(1)	3	(5)	3	(2)	1	(1)	2	(6)	
Currently enrolled in high school	0						0						
Don't know	0						0						
Employed full-time	84	(49)	59	(56)	25	(40)	103	(59)	97	(68)	6	(10)	0.078
Employed part-time	24	(14)	89	(84)	7	(11)	22	(13)	12	(8)	10	(31)	0.673
A full-time student	9	(5)	5	(5)	4	(6)	6	(3)	3	(2)	3	(9)	0.396
A part-time student	6	(4)	6	(6)			3	(2)	3	(2)			0.290
Active duty in US Armed Forces, Reserves, or National Guard	1	(1)	6		1	(2)	0						0.310
Unable to work for health reasons	20	(12)	6	(8)	11	(18)	19	(11)	12	(8)	7	(22)	0.790
Unemployed	27	(16)	6	(13)	13	(21)	16	(9)	9	(6)	7	(22)	0.058
Other [ǂ]	12	(7)	6	(5)	7	(11)	12	(7)	10	(7)	2	(6)	
Don't know	0						0						
Annual Income													
$0-$4,999	17	(10)	6	(6)	11	(18)	7	(4)	4	(3)	3	(9)	<.0001

	Total Black		Independent Transportation, Black		Dependent Transportation, Black		Total White		Independent Transportation, White		Dependent Transportation, White		p-value (Black vs. white)
	n = 170		n = 106		n = 63		n = 175		n = 143		n = 32		
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
$5,000-$9,999	17	(10)	9	(8)	8	(13)	5	(3)	0	(0)	5	(16)	
$10,000-$14,999	27	(16)	10	(9)	17	(28)	21	(12)	9	(6)	12	(38)	
$15,000-$19,999	14	(8)	9	(8)	4	(7)	14	(8)	9	(6)	5	(16)	
$20,000-$29,999	33	(20)	23	(22)	10	(16)	17	(10)	15	(11)	2	(6)	
$30,000-$39,999	19	(11)	14	(13)	5	(8)	20	(11)	19	(13)	1	(3)	
$40,000-$49,999	13	(8)	12	(11)	1	(2)	14	(8)	13	(9)	1	(3)	
$50,000-$74,999	14	(8)	12	(11)	2	(3)	23	(13)	23	(16)	0	(0)	
$75,000 or more	10	(6)	9	(8)	1	(2)	51	(29)	48	(34)	0	(0)	
Don’t know	4	(2)	2	(2)	2	(3)	2	(1)	2	(2)	3	(9)	
Missing	2				2		1		1				
Housing													0.0011
Own house or apartment	123	(72)	82	(77)	41	(65)	152	(87)	129	(90)	23	(72)	
Temporarily in a home with friends or relatives	34	(20)	20	(20)	13	(21)	18	(10)	13	(9)	5	(16)	
Hotel	2	(1)	0	(0)	2	(3)	0	(0)					
Car	1	(1)	1	(1)	0	(0)	0	(0)					
Shelter	0	(0)					0	(0)					
Group home	0	(0)					3	(2)	1	(1)	2	(6)	
Supportive services housing	10	(6)	3	(3)	7	(11)	1	(1)	0	(0)	1	(3)	
On the street	0	(0)					1	(1)	0	(0)	1	(3)	
With a parent or guardian	0	(0)					0	(0)					
Healthcare Coverage													0.0011
Insurance, no supplemental plans/ assistance programs	58	(35)	39	(38)	19	(32)	56	(33)	47	(33)	9	(30)	
Insurance, with supplemental plans/assistance programs	55	(33)	37	(36)	17	(28)	89	(52)	79	(56)	10	(33)	
No insurance, with supplemental plans/assistance programs	42	(25)	22	(21)	20	(33)	23	(13)	13	(9)	10	(33)	

	Total Black n = 170		Independent Transportation, Black n = 106		Dependent Transportation, Black n = 63		Total White n = 175		Independent Transportation, White n = 143		Dependent Transportation, White n = 32		p-value (Black vs. white)
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
No insurance, no supplemental plans/assistance programs	10	(6)	6	(6)	4	(7)	4	(2)	3	(2)	1	(3)	
Missing	5		2		3		3		1		2		

*GBMSM: gay, bisexual, and other sexual minority men who have sex with men

†Percentages rounded to the nearest whole percent; due to rounding, percentages may not sum to 100%

‡Other responses include “disability” (n = 8) and “self-employed” (n = 9) and “retired” (n=2)

Table 2.

Clinical and travel characteristics of 345 GBMSM enrolled in EngageMENt who have a provider in Georgia, United States, 2017 [*,†]

	Total Black		Independent Transportation, Black		Dependent Transportation, Black		Total White		Independent Transportation, White		Dependent Transportation, Black		p-value (Black vs. white)
	n = 170		n = 106		n = 63		n = 175		n = 143		n = 32		
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
HIV Viral Load[‡]													0.02
Undetectable	127	(75)	80	(76)	46	(73)	149	(85)	127	(89)	22	(69)	
Detectable	42	(25)	25	(24)	17	(27)	26	(15)	16	(11)	10	(31)	
Missing	1		1										
Receipt of HIV Care[§]													0.1477
Yes	166	(99)	104	(98)	62	(100)	175	(100)					
No	2	(1)	2	(2)	0	(0)							
Missing	2				1								
Number of Modes of Transportation													0.0014
1	103	(61)	78	(74)	25	(40)	143	(82)	130	(91)	13	(41)	
2	39	(23)	13	(12)	26	(41)	19	(11)	9	(6)	10	(31)	
3	16	(9)	4	(4)	12	(19)	7	(4)	3	(2)	4	(13)	
4	7	(4)	7	(7)	0	(0)	3	(2)	0	(0)	3	(9)	
5	3	(2)	3	(3)	0	(0)	1	(1)	0	(0)	1	(3)	
6	1	(1)	1	(1)	0	(0)	2	(1)	1	(1)	1	(3)	
Missing	1				1								
Mode of Transportation													
Drive, self	101	(60)	101	(95)	0	(0)	141	(81)	141	(99)	0	(0)	<.0001
Drive, friend of family member	16	(9)	11	(10)	5	(8)	11	(6)	4	(3)	7	(22)	0.273
MARTA train													
//	77	(46)	21	(20)	56	(89)	29	(17)	5	(4)	24	(75)	<.0001
Bus	39	(23)	12	(11)	27	(43)	21	(12)	3	(2)	18	(56)	0.007
Taxi or rideshare app	27	(16)	13	(12)	14	(22)	14	(8)	4	(3)	10	(31)	0.023
Bike	2	(1)	1	(1)	1	(2)	5	(3)	3	(2)	2	(6)	0.272

	Total Black		Independent Transportation, Black		Dependent Transportation, Black		Total White		Independent Transportation, White		Dependent Transportation, Black		p-value (Black vs. white)
	n = 170		n = 106		n = 63		n = 175		n = 143		n = 32		
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
Walk	15	(9)	6	(6)	9	(14)	10	(6)	3	(2)	7	(22)	0.259
Clinic shuttle	1	(1)			1	(2)	0						
Missing	1						0						
Average Time to Provider, One-Way													0.023
Less than 5 minutes	3	(2)	3	(3)	0	(0)	4	(2)	4	(3)	0	(0)	
5 to 15 minutes	28	(17)	21	(20)	7	(11)	55	(32)	52	(37)	3	(10)	
16 to 30 minutes	73	(43)	53	(50)	20	(32)	65	(38)	56	(39)	9	(29)	
31 minutes to 1 hour	47	(28)	24	(23)	23	(37)	37	(21)	22	(15)	15	(48)	
More than 1 hour	17	(10)	4	(4)	13	(21)	12	(7)	8	(6)	4	(13)	
Missing	1		1				2		1		1		
Average Distance to Provider, One-Way													<.0001
5 miles or les	24	(14)	14	(14)	10	(16)	53	(31)	43	(31)	10	(31)	
6 to 10 miles	48	(29)	24	(23)	24	(38)	59	(34)	45	(32)	14	(44)	
11 to 20 miles	56	(34)	38	(37)	18	(29)	34	(20)	30	(21)	4	(13)	
21 to 30 miles	25	(15)	19	(18)	6	(10)	12	(7)	10	(7)	2	(6)	
31 to 40 miles	11	(7)	7	(7)	4	(6)	7	(4)	7	(5)	2	(6)	
More than 40 miles	2	(1)	1	(1)	1	(2)	8	(5)	6	(4)			
Missing	3		3				2		2				
Average Cost to Provider, One-Way													0.104
Less than a dollar	7	(8)	2	(8)	5	(8)	2	(6)	1	(14)	1	(3)	
$1 to $5	60	(71)	14	(54)	46	(78)	21	(58)	1	(14)	20	(69)	
$6 to $10	10	(12)	6	(23)	4	(7)	11	(31)	4	(57)	7	(24)	
$11 to $20	4	(5)	2	(8)	2	(3)	2	(6)	1	(14)	1	(3)	
$21 to $40	4	(5)	2	(8)	2	(3)	0	(0)					
More than $40	0	(0)					0	(0)					
Missing ¶	84		80		4		139		136		3		

	Total Black		Independent Transportation, Black		Dependent Transportation, Black		Total White		Independent Transportation, White		Dependent Transportation, Black		p-value (Black vs. white)
	n = 170		n = 106		n = 63		n = 175		n = 143		n = 32		
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
Reported transportation to provider ever getting in the way of receiving HIV medical care	36	(22)	17	(16)	19	(32)	27	(16)	10	(7)	17	(53)	0.165
Missing	5		1		3		5		5				
Reported receiving transportation services in the past 12 months	24	(14)	5	(5)	19	(30)	11	(6)	4	(3)	7	(22)	0.015
Missing	1												

*GBMSM: gay, bisexual, and other sexual minority men who have sex with men

†Percentages rounded to the nearest whole percent; due to rounding, percentages may not sum to 100%

‡Undetectable viral load was defined as an HIV viral load measurement of <40 copies/mL plasma

§Receipt of care was defined as someone diagnosed HIV who had at least one CD4 or viral load test within the past 12 months (https://www.cdc.gov/hiv/pdf/library/factsheets/cdc-hiv-care-continuum.pdf)

‖Metropolitan Atlanta Rapid Transit Authority train

¶The majority of missing responses come from participants that reported either driving, walking, or biking to their provider

Table 3.

Odds Ratios for Undetectable HIV Viral Load by Mode of Transportation to HIV Provider, 168 Black GBMSM enrolled in EngageMENt Study, 2017 [*, †]

	Undetectable [‡] n = 126		Detectable [‡] n = 42		Odds Ratio or adjusted Odds Ratio	95% CI [§]
	n	(%)	n	(%)		
Independent Transportation [//]	80	(63)	25	(60)	1.18	(0.58, 2.42)
Dependent Transportation [//]	46	(35)	17	(40)	Reference	
Adjusted for age					1.21	(0.58, 2.52)
Adjusted for recent HIV diagnosis [¶]					1.17	(0.57, 2.40)
Adjusted for annual income [**]					1.10	(0.51, 2.34)
Adjusted for age, recent HIV diagnosis, and income					1.12	(0.51, 2.46)

[*] GBMSM: gay, bisexual, and other sexual minority men who have sex with men

[†] Percentages rounded to the nearest whole percent; due to rounding, percentages may not sum to 100%

[‡] Detectable viral load was defined as an HIV viral load measurement of <40 copies/mL plasma

[§] 95% CI: 95% confidence interval

[//] Participants were considered taking independent transportation if they reported driving themselves, regardless of what other modes of transportation they took, or reported only walking or biking to their HIV provider. Dependent mode of transportation was defined as reported either a friend or family member driving them, taking the MARTA (Metropolitan Atlanta Rapid Transit Authority) train, bus, clinic shuttle, or using a rideshare app (Uber or Lyft) or taxi

[¶] Recent HIV diagnosis was defined as being diagnosed ≤90 days from the time of survey

[**] Annual income was collected as an 11-level categorical variable

Table 4.

Odds Ratios for Undetectable HIV Viral Load by Mode of Transportation to HIV Provider, 175 White GBMSM enrolled in EngageMENt Study, 2017 [*, †]

	Undetectable n = 149		Detectable n = 26		Odds Ratio or adjusted Odds Ratio	
	n	(%)	n	(%)		95% CI
Independent Transportation [//]	127	85	16	62	3.61	(1.45, 8.97)
Dependent Transportation [//]	22	15	10	38	Reference	
Adjusted for age					3.43	(1.37, 8.59)
Adjusted for recent HIV diagnosis [¶]					4.09	(1.62, 10.36)
Adjusted for annual income [**]					2.29	(0.78, 6.71)
Adjusted for age, recent HIV diagnosis, and income					2.49	(0.84, 7.43)

[*] GBMSM: gay, bisexual, and other sexual minority men who have sex with men

[†] Percentages rounded to the nearest whole percent; due to rounding, percentages may not sum to 100%

[‡] Undetectable viral load was defined as an HIV viral load measurement of <40 copies/mL plasma

[§] 95% CI: 95% confidence interval

[//] Participants were considered taking independent transportation if they reported driving themselves, regardless of what other modes of transportation they took, or reported only walking or biking to their HIV provider. Dependent mode of transportation was defined as reported either a friend or family member driving them, taking the MARTA (Metropolitan Atlanta Rapid Transit Authority) train, bus, clinic shuttle, or using a rideshare app (Uber or Lyft) or taxi

[¶] Recent HIV diagnosis was defined as being diagnosed ≤90 days from the time of survey

[**] Annual income was collected as an 11-level categorical variable