

The Impact of Race, Education, Economic Vulnerability, and Stigma on Viral Load Detectability Among People Living with HIV in Brazil

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Background: Understanding barriers to viral undetectability is crucial for developing targeted interventions for populations struggling with treatment adherence. The aim of this study was to investigate the impact of race, education, economic vulnerability and HIV-related stigma on viral load detectability among people living with HIV (PLWHA) in Brazil.

Methods: This was a cross-sectional, community-based study. The sample consisted of 1767 participants. We used the Brazilian version of the HIV Stigma Index 2.0 questionnaire, the Internalized AIDS-Related Stigma Scale, and a sociodemographic questionnaire. Viral load was self-reported. Data were collected by 30 PLHV themselves in 2019, after receiving training on the Brazilian Stigma Index. Data was analyzed with both descriptive and inferential statistics using SPSS.

Results: Our generalized linear model showed that participants who were non-white, with low education and of lower economic status had a lower likelihood of reporting undetectable viral load (UVL) compared compared to their respective counterparts (white participants, those with higher education, and those of higher economic status). Key population group membership was not significantly associated with UVL. Higher internalized stigma was negatively associated with lower UVL.

Conclusion: Our findings highlight the impact of racial, educational and economic disparities and internalized stigma on HIV outcomes and underscore the need for tailored interventions that address the specific challenges faced by different racial/ethnic and more vulnerable groups. These findings challenge the dominant treatment-as-prevention framework that focuses primarily on key populations, suggesting the need to broaden our focus to include other vulnerable populations, such as non-whites and those experiencing economic hardship. Such approach is critical to avoid overlooking situations where community viral load remains high.

Keywords: HIV-related stigma, HIV/AIDS, key populations, HIV/AIDS prevention, HIV/AIDS treatment, viral load

Introduction

There are almost a million people living with HIV and AIDS (PLWHA) in Brazil and an estimated 74% are on treatment.¹ There is now strong evidence that highly effective antiretroviral medications can control the viral load of PLWHA within a few months and maintain it at undetectable levels in blood plasma and body fluids.² Maintaining an undetectable viral load (UVL) significantly reduces the morbidity and mortality associated with HIV infection.^{3,4} The development of more effective antiretroviral therapies (ART) and reduced toxicity has also increased the life expectancy and quality of life of PLWHA.^{2,5} In addition, sustained HIV suppression is an important strategy for preventing HIV and controlling the epidemic.¹ The authors of a large longitudinal study that assessed the incidence of HIV transmission

among serodiscordant couples not using prevention methods found no cases of viral transmission, provided the person living with HIV was regularly taking ART and had a sustained undetectable viral load.⁶ Based on this study, the phrase “undetectable=untransmittable” was developed and popularized, and HIV case detection, early treatment and UVL became one of the most urgent measures to reduce new infections.¹

Achieving HIV epidemic control requires an understanding of the main barriers and facilitators to UVL, a crucial marker of individual and community-level HIV treatment success. Efforts have been focused on key populations, including sex workers, men who have sex with men, transgender individuals, and people who use drugs. These groups are disproportionately affected by HIV^{7–9} and still face unique challenges related to stigma, discrimination, healthcare access, and present high prevalence of psychological distress.^{10,11} Detectable viral loads also disproportionately affect key populations, especially in low- and middle-income countries, where social inequalities, HIV-related stigma and prejudice are higher.^{10,12,13} The socioeconomic profile of individuals belonging to key populations can be highly heterogeneous, highlighting the need for studies to understand the context of these individuals and their characteristics, such as age, race, income, and educational attainment, that influence their understanding of HIV literacy, their attribution of importance to treatment, and their behaviors related to antiretroviral adherence and behavioral prescriptions, such as those related to healthier lifestyles. In a recent Brazilian study, authors found that black individuals exhibited higher rates of AIDS-related mortality in multiple Brazilian states, compared to white individuals.¹⁴ The results also indicate that the states in the north and northeast – regions with the largest proportions of people who self-identify as black and the most affected by poverty – experienced significant increases in mortality trends.^{14,15}

When analyzing socioeconomic indicators and HIV prevalence in Brazil, Lua et al¹⁶ found that illiterate people had a 176% higher risk of an AIDS-related death, and individuals who had only completed elementary school had a 104% higher fatality rate compared to those who had completed higher education. According to the study, income is a relevant factor relating to HIV/AIDS outcomes, as individuals with lower income levels were 55% more likely to develop AIDS and 99% more likely to have an HIV/AIDS-related death.¹⁶ Indeed, the outcomes of HIV treatments are increasingly affected by socioeconomic status.¹⁷ Pellowski et al¹⁸ reviewed the burden of low socioeconomic status in HIV infection and treatment, indicating that individuals with low income and living in poor communities were more susceptible to HIV infections and to poor adherence to ART and viral suppression. Indeed, they examined individuals with low education level (middle school diploma) and their higher probability of contracting HIV. Furthermore, the review also analyzes how the HIV epidemic grew within racial disparities and sexual orientation.¹⁸

Although there is a growing body of evidence on the psychosocial determinants of adherence of PLWHA to ART, as well as on associations between sociodemographic variables and viral load status, most of the research comes from developed countries. In low- and middle-income countries, marked by poverty, low education and prejudice, research remains scarce. Hence, this study sought to investigate the impact of race, education, economic vulnerability and HIV-related stigma on viral load detectability among PLWHA in Brazil. To the best of our knowledge, this is the first Brazilian community-based study to examine this association in a diverse sample of PLWHA. HIV viral load suppression is the primary treatment goal to interrupt transmission. Understanding barriers to viral undetectability is crucial for developing targeted interventions for populations struggling with treatment adherence. We hypothesize that detectable load of HIV will be more common among black people, in situations of socio-economic vulnerability, with low levels of education and with higher indicators of internalized HIV-related stigma.

Methods

Study Design

This is a cross-sectional, community-based study, in which we examined the association between race, economic vulnerability, internalized and externalized HIV stigma, and UVL among a diverse sample of people living with HIV in Brazil.

Participants

Settings

People living with HIV living in seven Brazilian cities were evaluated: Manaus, Brasília, Porto Alegre, Salvador, Recife,

São Paulo and Rio de Janeiro. These cities were chosen because they represent the highest prevalence and incidence of HIV in Brazil, and are politically and geographically relevant cities, being capital cities representing each of Brazil's regions. These cities are located across various regions of Brazil: Manaus is in the North, Brasília in the Central-West, Porto Alegre in the South, Salvador and Recife in the Northeast, and São Paulo and Rio de Janeiro in the Southeast. In 2018, the reported number of new HIV cases in these regions were: North (5084), Northeast (10,808), Southeast (16,586), Central-West (3625), and South (7838). The overall HIV detection rate in Brazil was 17.8 cases per 100,000 inhabitants in 2018.¹⁹

Participants and Sampling Approach

Data were collected by 30 PLWHA themselves after receiving training on the Stigma Index Brazil, in 2019.²⁰ They recruited a diverse group of PLHIV by two non-probabilistic, purposive sampling methods – venue-based and snowball, based on contacts of interviewers recruited in the seven focus cities.

To be identified as a key population, participants should be in at least one of the following groups. A) sexual orientation was assessed by asking whether participants currently or had previously identified as MSM, lesbian/homosexual, or bisexual and/or ever had sex with women. B) Sex work was assessed by asking whether participants had ever had sex in exchange for money or goods. C) For PWUD, participants were asked if they self-identified as individuals who use or have used drugs. D) Participants indicated if they were currently or had ever been incarcerated or in prison, e) Finally, TGNP were those with a different gender from the one assigned at birth.

The sample size was calculated based on the prevalence of the main outcome of the study, as described in the Stigma Index 2.0 scientific literature, and the number of people living with HIV/AIDS in each city studied, as described in the Ministry of Health Epidemiological Bulletin.¹⁹ A confidence level of 99% and a confidence limit of 5% were considered. The sample size was estimated at 1470 participants. The overall sample consisted of 1767 PLWHA from all regions of Brazil.

Data Collection and Security

Data were meticulously collected via face-to-face interviews using a paper-and-pen questionnaire. Following collection, all data were securely transferred to the Pontifical Catholic University of Rio Grande do Sul (PUCRS) for comprehensive analysis, where they will be stored for five years in strict accordance with data retention legislation. To ensure maximum data integrity and participant privacy, all research team members signed confidentiality agreements. Rigorous quality control measures were implemented, including verification of informed consent forms, assessment of questionnaire completeness, and random telephone calls to a contact list voluntarily provided by participants. It's crucial to note that identification data, such as phone numbers, were kept strictly separate and not linked to individual responses to preserve participant anonymity.

Measures

Dependent Variable

Viral Load Status: Participants were asked whether they had been informed of having an undetectable or suppressed or suppressed viral load (“optimal levels of viral load”) in the past 12 months. The possible responses were: “Undetectable”, “Detectable or undetectable without confirmation or knowledge”, or “No; I have not had a viral load test in the last 12 months” or “No; I have had a viral load test and am awaiting the results” or “No; the virus was detectable OR I do not have a suppressed viral load” or “I do not know what viral load or viral suppression is”. For the Chi-square analysis, these categories were grouped into two: “Undetectable”, “Detectable” and “Don't Know”. For the generalized linear model (GLM) analysis, these categories were grouped into two: “Undetectable” and “Detectable or Don't Know”.

Independent Variables

Sociodemographic: Information was collected on gender, socio-economic vulnerability and race. Gender identity was assessed using the two-step question method: sex assigned at birth and gender identity. For this study, in the may

analysis, only sex assigned at birth was used for the analysis. For the variable Race/Ethnicity, the criteria established by the Brazilian Institute of Geography and Statistics (IBGE) were used. The IBGE classification includes five categories: White, Black, Brown, Yellow, and Indigenous. For this analysis, participants were grouped into two categories: White and Non-White. All individuals who identified as Black, Brown, Yellow, or Indigenous were categorized as Non-White. For education, participants were grouped into two categories: up to primary education (low educational level) and secondary education or above (high educational level).

Economic Vulnerability: It was assessed with the following question “In the last 12 months, how often have you been unable to meet basic needs (eg, food, shelter, clothing)?” Participants that answered “Never” were classified in the non-socioeconomic vulnerability group (Never). Those who answered, “Some of the time” and “Most of the time” were grouped in the socioeconomic vulnerability group (Yes).

HIV-Related stigma: It was evaluated using the Brazilian Version²⁰ of the Stigma Index 2.0 questionnaire.²⁰ It consists of 11 items covering experiences of stigma and discrimination in relation to HIV over the participants’ lifespan and in the previous 12 months.²¹ An example question is “Have you ever been aware of family members making discriminatory remarks or gossiping about you because of your HIV status?” Possible answers are “no”, “yes, within the last twelve months” and “yes, but not in the last 12 months”.²⁰ Cronbach’s alpha for this instrument was considered adequate ($\alpha = 0.81$).

Internalized stigma: It was assessed using the Brazilian version of the Internalized AIDS-Related Stigma Scale (IA-RSS), developed by Kalichman et al²² it is a validated measure of internalized stigma among PLHV. It is composed of 6 items that assess whether individuals reported negative self-perceptions for being HIV positive in the previous year. “Being HIV positive makes me feel dirty” is one of the questions of the IA-RSS, and possible responses are “yes” or “no”.²¹ In this study, Cronbach’s alpha was deemed satisfactory ($\alpha = 0.73$).

Data Analyses

Central tendency statistics and chi square analysis, with Cramer’s V for effect size, were performed to compare UVL frequency by race and SES. Furthermore, a generalized linear model (GLM) was used to analyze the relationship between the dependent variable UVL and several independent variables: race/ethnicity, SES, sex assigned at birth, and being part of a key population. The purpose of the GLM was to examine the main effects of the independent variables on UVL, while controlling for the covariates. The covariates Internalized and Externalized HIV-Related stigma were also included in the model. The analysis was conducted using SPSS.

Ethical Aspects

The project was approved by the Research Ethics Committee of the Pontifical Catholic University of Rio Grande do Sul (99716918.5.0000.5336) and all research participants consented to participate according to Brazilian legislation. Moreover, all participants were informed about the purpose of the study, in accordance with the Declaration of Helsinki.

Results

The participants’ mean age was 40.12 (SD 12.95) years, ranging between 18 and 76 years, and 31.41% were assigned female at birth. Approximately 38% of the participants were brown and 27,5% were black, and 46.41% of the participants comprised the group with socioeconomic vulnerability. Participants reported living with HIV, on average, for 10.59 years (SD 8.70). Of the total sample, 1220 (69.04%) were identified as key populations. [Table 1](#) shows the sociodemographic variables which were the independent variables in our study.

Most participants (83.63%) reported an UVL, while 16.38% reported a detectable or unknown viral load. Notably, 2.39% of participants reported not knowing what UVL meant. [Table 2](#) shows the frequencies and proportions of participants based on viral load status.

Non-white participants were more likely to report not knowing what Undetectable Viral Load (UVL) meant. A lower proportion of non-white participants reported undetectable viral load compared to white participants (as evidenced in [Table 3](#)). Socioeconomic vulnerability also negatively influenced responses, with higher vulnerability associated with lower UVL. Similarly, lower education levels were associated with a lower proportion of UVL. While being part of a

Table 1 Sample Distribution by Key Population, Race/Ethnicity and Socioeconomic Status (n=1767)

		n	%
Key Population	TGNP	1220	69.04
	MSM	107	6.06
	IP	908	51.39
	PWUD	31	1.75
	Sex workers	230	13.07
		358	20.26
Race/Ethnicity	Black	489	27.67
	Brown	660	37.35
	White	536	30.33
	Yellow	34	1.92
	Indigenous	42	2.38
	Do not want to disclose	6	0.34
Socioeconomic Vulnerability	Never	947	53.59
	Sometimes	588	33.28
	Most of the time	232	13.13
Education Level	No formal education	77	4.37
	Elementary school or equivalent	398	22.56
	High school or equivalent	608	34.47
	Technical or vocational training	159	9.01
	Third degree or university	522	29.59

Abbreviations: TGNP (Transgender and Gender Non-binary People), MSM (Men who have Sex with Men), IP (Incarcerated Persons), PWUD (People Who Use Drugs).

Table 2 Frequency of UVL and Other Viral Load Responses (n=1767)

Viral Load Status	n	%
Undetectable	1471	83.63%
Detectable or undetectable without confirmation	246	13.99%
No; I have not had a viral load test in the last 12 months	60	3.41
No; I have had a viral load test and am awaiting the results	68	3.87
No; the virus was detectable OR I do not have a suppressed viral load	118	6.71
I do not know what viral load or viral suppression is	42	2.39

Table 3 Association Between UVL and Demographic and Economic Variables (n=1767)

		Undetectable		Detectable or UVL Without Confirmation		Do Not Know What UVL is		χ^2	p	Cramer's V
		n	%	n	%	n	%			
Socioeconomic Vulnerability	Never	831	88.03	98	10.38	15	1.58	29.09	<0.001	0.13
	Yes	640	78.53	148	18.16	27	3.31			
Race/Ethnicity	White	477	88.99	55	10.26	4	0.75	19	<0.001	0.10
	Non-white	994	81.28	191	15.62	38	3.11			
Key population	No	441	80.77	84	15.38	21	3.85	8.93	0.01	0.07
	Yes	1030	84.91	162	13.36	21	1.73			
Education	High	1115	86.91	155	12.08	13	1.01	56.71	<0.001	0.18
	Low	353	74.63	91	19.24	29	6.13			

Table 4 Generalized Linear Model Results for UVL (df=1748)

	Estimate	B	SE	t	p-value	Partial eta Square
Intercept	0.91	–	0.05	17.23	<0.001	0.17
Race/Ethnicity=White	0.05	0.13	0.02	2.60	0.010	0.004
Socioeconomic Vulnerability=Never	0.06	0.15	0.02	3.02	0.003	0.005
Sex=Assigned Female at Birth	0.02	0.06	0.03	0.84	0.40	<0.001
Internalized Stigma	0.03	0.15	0.01	6.49	<0.001	0.02
Externalized Stigma	<0.001	<0.001	<0.001	0.01	0.99	<0.001
Key Population=Yes	0.02	0.06	0.02	0.89	0.37	<0.001
Education level=Low	0.08	0.02	0.02	4.09	<0.001	0.01

Key Population (KP) showed varying influences on responses across different viral load statuses. In [Table 3](#), we present all the associations between UVL and sociodemographic variables..

The GLM revealed that being part of a key population and being assigned female at birth were not significantly associated with UVL ([Table 4](#)). Participants who were non-white, with low education and of lower economic status had a lower likelihood of reporting undetectable viral load (UVL) compared compared to their respective counterparts (white participants, those with higher education, and those of higher economic status). Participants reporting higher internalized stigma had lower UVL. Externalized stigma was not associated with the outcome.

Discussion

The main objective of this study was to investigate the incremental utility of utilizing social determinants, such as education, race/ethnicity, and socio-economic vulnerability—which often define priority populations in the context of HIV epidemics—on the impact of viral load awareness in comparison to participants who are solely part of the so-called “key population”. This analysis was conducted while considering the influence of internalized and externalized stigma and viral load-related variables, including information on viral load and factors that affect achieving and maintaining UVL. Our results highlight the fact that traditionally socially disadvantaged PLWHA in Brazil, such as non-white, poorer, less educated and members of a KP report more not knowing what an UVL is as well as having a detectable viral load or an UVL without confirmation. This finding is consistent with one of the few Brazilian studies to investigate the association between food insecurity and adherence to antiretroviral therapy among people living with HIV, or without HIV, taking PrEP.¹⁷ The authors found that higher food insecurity was associated with lower adherence to antiretroviral medication, suggesting that economic support for this population is an important intervention to increase adherence rates.

These results reinforce how intersecting social factors and traditional forms of oppression can create disparities in HIV viral suppression among marginalized populations, when compared to historically privileged groups. This is consistent with previous research that shows how these disparities are based on intersectional identities,²³ enhancing the adverse effect of HIV-related stigma, and increasing detectable VL risk through suboptimal ART adherence.²⁴ Hence, discrimination and social marginalization may undermine optimal HIV treatment outcomes, and combined with HIV-related stigma, aggravate non-adherence to ART, misinformation, and lack of confirmation of UVL.²⁵ On the other hand, participants reporting higher internalized stigma had lower levels of UVL. These results reaffirm that HIV-related internalized stigma may be a relevant hurdle to ART adherence, potentially harming long-term health.^{26,27} In fact, previous research consistently showed strong correlations between the internalized stigma domains and suppressed viral load,²⁸ usually mediated by variables such as fear and depressive symptoms.²⁹ Unlike enacted stigma, internalized stigma can result in a devaluation of self-esteem and self-concept, leading to feelings of shame, lower self-worth or guilt which, in turn, may be linked with poorer mental health outcomes, more HIV-related symptoms and poor treatment-seeking behaviors.^{30–32}

The results revealed several others crucial insights. Firstly, while key population status is undeniably important, it was not significantly associated with UVL in our generalized linear model. This suggests that other factors might exert a more

substantial influence on viral suppression. Secondly, race/ethnicity emerged as a significant factor, with White participants exhibiting a higher likelihood of reporting UVL compared to non-White participants, which highlights the need for tailored interventions that address the specific challenges faced by different racial/ethnic groups. Thirdly, socioeconomic vulnerability also played a vital role, as participants with higher SES were more likely to report UVL, reinforcing the importance of addressing economic vulnerabilities in HIV prevention and treatment programs. Lastly, internalized stigma was negatively associated with UVL, emphasizing the detrimental effect of self-stigma on HIV outcomes and the necessity of interventions that target internalized stigma.

The results indicated that the individuals receiving the benefits had a lower prevalence of HIV infection and better adherence to ART, which is explained through the increased household income and the health-related conditionalities required to receive the benefits.³³ Thus, it is evident that social policies that aim to diminish the issues of poverty and social inequality also have a positive impact in reducing the prevalence of HIV infection and AIDS related health complications and mortality.

Furthermore, even though Brazil can be considered a global reference in HIV/AIDS prevention and treatment, knowledge is scarce regarding the effectiveness of these prevention and treatment efforts for the Afro-Brazilian population.³⁴ In Brazil, the introduction of the variable “race” into national databases that systematically collect information related to HIV/AIDS is relatively recent, making long-term trend analysis difficult.³⁵ Therefore, the need to broaden the focus of studying key populations related to the HIV epidemic is once again highlighted. Caldwell³⁴ emphasizes the need for activists, scholars, and the Brazilian government to rethink health disparities by recognizing the interconnectedness of racial, gender, and socio-economic inequalities. Another key factor explored within this study that is also correlated with recent international findings is the influence of discrimination against transgenders and gender diverse individuals (TGD) with HIV. Within PLWHA, TGD individuals suffer from internalized stigma, especially when they come from diverse backgrounds (eg Black/African American). This factor compromises access to healthcare, which may later influence UVL in the long run. Hence, many studies (including the present) highlight the need of acknowledging individuality and impartial judgement from healthcare providers to provide ART in a healthy and immediate manner during UVL. Further studies also discussed MSM and HIV epidemic. With these findings and the present study, sexual orientation and TGD individuals are more at risk of contracting HIV and having less access to ART, increasing mortality rates.^{8,18,36} SES becomes a determinant for the increase of HIV within poorer communities and individuals with lower education.¹⁸ The findings within this study and international literature urge the healthcare community to inform and emancipate individuals and communities to create an inclusive environment, thus reducing stigma and discrimination.^{37–39} Additionally, data from Sub-Saharan Africa indicate that low education levels are associated with discriminatory attitudes towards HIV, which can hinder prevention and care efforts.³⁷ While much of the existing literature has focused on the United States, it is crucial to recognize that these dynamics are not limited to a single nation.⁴⁰

This study, while providing valuable insights into the impact of social determinants and stigma on viral load detectability among PLWHA in Brazil, is not without limitations. Firstly, viral load status was self-reported, which may introduce potential biases due to recall inaccuracies or social desirability. Secondly, the cross-sectional design of the study limits the ability to establish causal relationships between the independent variables and viral load outcomes. Finally, the non-probabilistic sampling methods employed may limit the generalizability of the findings to the broader population of PLWHA in Brazil.

Conclusions and Recommendations

In conclusion, while efforts rightly prioritize key populations and some address stigma, the role of race and SES must be considered since we identified that UVL, a crucial aspect to control both HIV infection progression and transmission, demonstrated significant differences when contextual factors were considered. Our results help to complex the usual notion in the context of treatment as prevention that focus on key-population as a main target to reducing community viral load to reach the end of the HIV/AIDS epidemic. Our findings underscore the necessity of broadening this focus in Brazil, as well as other middle-income nations in the global South, to include additional vulnerable demographics such as non-white individuals and those facing economic hardships. A singular emphasis on key populations risks obscuring

scenarios where community viral load remains elevated. Consequently, this calls for a critical reassessment of health policy interventions. It is also imperative that HIV prevention and treatment strategies evolve to be informed by empirical research, incorporating comprehensive and targeted measures. These should encompass enhanced health communication and patient counseling that address the clinical and behavioral dimensions impacting PLWHA, with particular attention to racial and socioeconomic disparities.

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Disclosure

The authors report no conflicts of interest in this work.

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