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Where Does Treatment Optimism Fit in? Examining Factors Associated with Consistent Condom Use Among People Receiving Antiretroviral Treatment in Rio de Janeiro, Brazil

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Abstract In the era of highly active antiretrovirals, people living with HIV (PLWH) have resumed sexual activity in the context of longer and healthier lives, and thus the chances of transmitting the HIV virus, as well as the potential to be re-infected also increase. HIV treatment optimism has been found to be associated with sexual risk behaviors among PLWH in different settings. A cross sectional survey was conducted to examine the relationship between treatment optimism, safer sex burnout and consistent condom use as well as variables associated with treatment optimism in a sample of PLWH on antiretrovirals (ARVs) in Rio de Janeiro, Brazil (n = 604). Seventy-two percent of participants always used a condom in the last 6 months. Homosexual, bisexual, transexual persons were less likely to use condoms consistently than heterosexuals (AOR .58 CI .42–.78). Those who were treatment optimistic (AOR .46 CI .25–.88) were more likely not use a condom consistently in the past 6 months, as were participants who reported safer sex burnout (AOR .58 CI .36–.90). Sexual orientation, safer sex burnout, and lower education levels were significantly associated with higher treatment optimism in multivariate analysis. Study findings highlight the need to address psychosocial factors such as treatment optimism and safer sex burnout associated with lower consistent condom use among PLWH in Rio de Janeiro, Brazil.

Keywords HIV · Condom use · Treatment optimism · Safe sex burnout · Brazil

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Introduction

The advent of effective antiretroviral therapy (ART) changed the course of the HIV epidemic and gave hope to individuals living with HIV/AIDS. Combination therapy increased survival and decreased morbidity, making HIV/AIDS more a chronic disease than a death sentence, and allowed the continuation of sexual activity in the lives of people living with HIV (PLWH) [1–5]. With the normal resumption of sexual activity and longer lifespan, the chances of transmitting the HIV virus also increase, as well as the potential to be re-infected. Sexually transmitted infections (STIs) such as syphilis and HIV have risen among men who have sex with men (MSM) in higher income countries [6–10], highlighting the importance of understanding how to promote and maintain sexual protective behaviors.

While having an undetectable viral load as a result of antiretrovirals (ARVs) substantially decreases the likelihood of HIV transmission, sexual activity is not free of risks [11]. The viral load in the blood does not necessarily correlate with the viral load in the semen [12]. Co-infection with another STI can also increase the likelihood of HIV

transmission due to the increase of viral shedding [13–15]. In addition, mathematical modeling among MSM in the Netherlands [16], Australia [17], and San Francisco [18], as well as among HIV discordant couples in Uganda [19] have shown that HIV treatment benefits at the level of networks and communities may decrease when there is an increase in HIV sexual risk behaviors, such as an increase in sexual partners or unprotected sexual intercourse.

Sexual risk behaviors have been investigated among MSM populations in order to explain the change in STI rates, especially syphilis. While there was a striking decrease in syphilis since the start of the HIV epidemic among MSM, increases in STIs in the late 1990s in developed country settings led researchers to examine psychosocial constructs such as treatment optimism and safer sex burnout to explain the trends [20]. Safer sex burnout relates to the inability or decreased desire or fatigue to maintain protective sexual practices. One study examined safe sex fatigue as a mediator for rectal gonorrhea among MSM and found safe sex fatigue was the only variable associated with infection among HIV positive men [21]. Treatment optimism refers to decreased concern or complacency regarding protective sexual behaviors due to the availability or use of ARVs, creating the perception that HIV is less serious or that transmission is less likely to occur [22]. Studies, mostly of cross sectional design, have shown a significant association between treatment optimism and risk behavior, such as unprotected anal intercourse (UAI) [23–26]. Most of these studies have been conducted in higher income countries and focused on MSM populations.

To date, few studies have addressed the influence of different demographic, psychosocial and structural factors that may influence attitudes related to HIV treatment optimism. Additionally, the vast majority of studies have assessed HIV treatment optimism among MSM living in higher-income countries. Our study benefits from the fact it was carried out in a middle-income country, in a network of public health facilities serving a diverse clientele in terms of age, gender, sexual orientation, race/ethnicity, and socio-economic position. One study with a racially diverse group of MSM across multiple cities in the US did report that those with lower income were more likely to report that HIV is now less transmissible [27]. In the same study, a decrease in the perceived sense of HIV severity was associated with being non-White, having an undetectable viral load, and better mental health. A qualitative study in Brazil found that a minority of participants were treatment optimistic, but findings indicated that men may be more likely to be treatment optimistic than women [28]. A review of recent studies on treatment optimism since the introduction of treatment as prevention found support for the association between treatment optimism and sexual risk behaviors, though most of the findings came from MSM populations [29]. Given the growing emphasis on treatment as prevention to stop the spread of the HIV epidemic and associated large-scale rollout of ARVs across settings, treatment optimism in relation to sexual risk behaviors must be examined comprehensively and across diverse populations.

Brazil has offered universal access to ARVs since 1996 and is an important setting to examine the potential role of treatment optimism. While the HIV prevalence in the general population aged 15–49 has been stable at 0.6 % since 2004, higher prevalence is found among more vulnerable populations such as drug users, female sex workers and MSM [30]. Guimaraes et al. [31] found approximately a quarter of men living with HIV engaged in unprotected anal or vaginal sex in the previous year. In a previous partner study with HIV positive men, Guimaraes et al. [32] found almost 40 % of couples did not consistently use a condom with their partner in the last year, despite serodiscordance. In addition, unsafe sex increased over time in that study following HIV disclosure, indicating the difficulties in maintaining safer sex practices in couples and signifying the potential for safer sex burnout. A recent study in Brazil found that most pregnant women remained sexually active after learning that they were HIV-positive, but did not know their partner's HIV status nor used condoms consistently [33]. While there is a growing literature on the sexual behavior of PLWH in Brazil including to some extent safe sex burnout, the role of treatment optimism has not been explicitly addressed.

In light of the aforementioned gaps in the literature related to treatment optimism, safer sex burnout and condom use, particularly in a diverse population and middle-income country, the purpose of the current study examined the association between psychosocial factors and consistent condom use. We also examine factors associated with treatment optimism among PLWH currently on ARVs recruited from public health units in Rio de Janeiro, Brazil.

Methods

Participants and Procedures

This analysis is part of a larger study focusing on the psychosocial and structural factors associated with the sexual health and wellbeing of PLWH/AIDS receiving treatment from public health clinics in Rio de Janeiro. The study recruited 900 participants, of whom 650 were currently on ARVs. This analysis focuses on complete case participants on ARVs (n = 604) and specifically those who were sexually active in the last 6 months (n = 446) in the case of the consistent condom use analysis.

Eligible participants were at least 18 years of age, had a confirmed HIV-positive status, received HIV treatment and care from a public health clinic, and were willing to provide consent. The participants were recruited from six key

public health facilities of the total 29 health centers managed by the Rio de Janeiro Health Secretariat. The six clinics were selected based on the number of patients in care and location (geographic and administrative), ensuring a heterogeneous sample representing the range of clinics. These six facilities provide care for approximately 60 % of the over 14,000 patients living with HIV/AIDS under care in the public health system in Rio de Janeiro at the time of the study. The study received ethical approval from the Institutional Review Boards (IRB) of the Johns Hopkins School of Public Health, the Oswaldo Cruz Foundation, the Municipal Health Secretariat, and the National IRB of the Brazilian Ministry of Health.

A pilot test was conducted before survey implementation to ensure clarity of the questionnaire. The survey was conducted from August 2008 through July 2009. A trained supervisor recruited participants in the waiting area of the clinics. The purpose of the survey was explained to potential participants and any questions were answered. After they agreed to participate, the participant was taken to a private room where a trained interviewer went through the consent form and obtained written consent. The questionnaire took approximately 50 min to complete. Interview responses were recorded on Teleform® scannable data forms and reviewed by the interviewer for completeness and consistency prior to the participant's departure. The forms were scanned for computer entry by the project coordinator.

Measures

Measures in the survey included sociodemographic variables as well as psychosocial factors including psychological well-being, safer sex burnout and treatment optimism. ARV adherence was also included. The dependent variable, consistent condom use, and measure details are listed below.

Socio-demographic and Background Variables

Analysis variables included: age, gender, race/ethnicity, education, income, sexual orientation, religion, HIV status of partner, number of sexual partners, and length of time on ARVs.

Psychological Well-Being

The Hospital Anxiety and Depression Scale (HAD) is a tested tool to measure psychological well-being over the past week, especially for chronic conditions, and has been used in Brazil [34–36]. This scale is composed of 14 questions divided into an anxiety subscale and a depression subscale to identify possible and probable cases of anxiety and depression among non-psychiatric patients. Physical symptoms are not included in this scale (e.g. headaches, insomnia, fatigue). Responses are rated on a four point scale (hardly at all to most of the time) and include items such as: "I felt tense or wound-up;" "I enjoyed the things I use to;" "I had worrying thoughts go through my mind;" "I felt cheerful;" and "I could sit at ease and relax." This study used 11 as the cutoff for possible depression (Cronbach's alpha = .76) or anxiety (Cronbach's alpha = .81), respectively [37].

Safer Sex Burnout

An eight item aggregate measure based on attitudes towards condom use related to condom use fatigue was developed based on the literature and findings from in-depth interviews with PLWH in Brazil [28]. Responses were rated on a four point scale [1–4] based on degree of agreement with the following phrases: "I feel tired of using condoms;" "I have given up worrying about whether I use condoms or not;" "I feel as though I've been using condoms forever;" "I often wish for a day when I don't have to worry about condoms anymore;" "Using condoms is becoming exhausting;" "I'm tired of worrying about HIV/STIs;" "I often feel like I don't have the energy to worry about condoms anymore." The measure ranged from 8 to 32 (out of a possible range of 8–32) with a median score of 24 (mean 23; SD 4.8). A lower score indicated having safer sex burnout. The aggregate measure had a Cronbach's alpha of .70 and was dichotomized at the median for ease of interpretation.

Treatment Optimism

Treatment optimism was measured through a scale that included 11 of the original items developed by Van de Ven et al. [38] such as: "New HIV treatments take the worry out of sex;" "An HIV positive person on new treatments is unlikely to transmit HIV;" "It's never safe to have sex without a condom, regardless of viral load;" "Until there is a complete cure for HIV/AIDS, prevention is still the best practice." The treatment optimism index ranged from 17 to 44 (out of a possible range of 11–44) with a median score of 38 (mean 37; SD 5.5). A higher score indicated skepticism regarding the statements, therefore not being treatment optimistic. The scale had a Cronbach's alpha of .69 and was dichotomized at the median for ease of interpretation. The dichtomization did not change study results.

ARV Adherence

A modified AIDS Clinical Trial Group's (ACTG) questionnaire was used to measure medication adherence [39]

which has been used in previous studies in Brazil [34]. The questions focus on recent adherence to minimize recall bias. The outcome adherence was measured by the question: In the last 4 days, how many days did you take all of your doses of all of your HIV medications? We dichotomized the indicator as adherent if it was 4 days and all other responses as nonadherent.

Consistent Condom Use

Participants were asked how frequently they used a condom in the last 6 months with responses in a five-point Likert scale ranging from always to never. Answers were dichotomized into always versus anything less.

Analytic Strategy

Data were analyzed using the statistical software Stata_11 [40]. Descriptive analysis was conducted to examine the distribution of the data such as frequencies, medians, and ranges. Aggregate measures were developed using reliability analysis to assess internal consistency.

Bivariate statistical tests such as *t* tests (for continuous variables) and Chi square tests (for categorical variables) were utilized to characterize the direction and significance of the relationship between major study variables, as was bivariate logistic regression. All variables found to be significantly associated with the outcome in the bivariate analysis were included in the multivariate analysis, as well nonsignificant variables hypothesized to be confounders or effect modifiers based on findings from previous research or for conceptual purposes. Multivariate logistic regression analysis was conducted to assess the adjusted association between the primary independent variables and dependent variables, e.g. consistent condom use and treatment optimism. All independent variables were assessed for collinearity by examining their correlation coefficients. Individuals who receive services from the same clinic may have more similarities than individuals from the other clinics, creating a potential clustering effect. The variance–covariance estimate (VCE) command was used to adjust for this within clinic intraclass correlation [41, 42].

Table 1 Sample characteristics among PLWH on ARVs and participants sexually active in the last 6 months attending public clinics in Rio de Janeiro, Brazil (n = 604)

Characteristics	(n = 604)	Percentage
Gender		
Male	409	68
Female	189	31
Transgender	6	1
Age [range = 19–67 years; median = 42]		
19–35	143	24
36–41	136	23
42–47	168	28
48–67	157	26
Race		
White	157	26
Non-White (Black, Brown, Yellow, Indigenous)	447	74
Education		
Primary or less	265	44
Secondary	252	42
Superior or more	87	14
Sexual orientation		
Heterosexual	359	59
Other (homosexual, bi, trans)	245	41
Partner status		
No partner	312	52
With partner	292	48
Sexual partners		
0–1	461	76
2+	143	24
Main partner HIV positive		
No	519	86
Yes	85	14
Religion		
Catholic	232	38
Evangelical	158	26
Other (Espirita, Afro-Brazilian, Other)	137	23
None	77	13
Length of time on ARVs (years)		
0–1	141	23
2–6	190	31
7–23	273	45

Results

Table 1 presents the sociodemographic characteristics for PLWH on ARVs. Participants ranged in age from 19 to 67 years, with a median age of 42 years. Our sample consisted of mostly men (68 %) of whom 46 % were homosexual and 11 % bi-sexual. Education levels were relatively low given only about 14 % had achieved superior level (University level) or more and a median of 11 years. Monthly income ranged from 0 to 4790 USD (mean 530 USD) with the majority in low socio-economic status. Length of time on ARVs ranged from less than 1–23 years, with a median of 6 years.

Approximately 74 % of the participants were sexually active (n = 446) in the previous 6 months. About 24 % (n = 143) of participants, mainly men, had two or more

Table 2 Bivariate and multivariate logistic regression analysis of sociodemographic, psychosocial and treatment variables on consistent condom use (in the last 6 months) among sexually active PLWH in Rio de Janeiro, Brazil (n = 446)

	% Yes	UOR (95 % CI)	AOR (95 % CI)
Sociodemographic variables			
Sex			
Male	74	1.00	1.00
Female	65	.67 (.43–1.06)	.61 (.32–1.15)
Transgender	100	–	–
Age [range = 19-67 years; median = 42]			
19–35	64	1.00	1.00
36–41	70	1.3 (.74–2.29)	1.14 (.85–1.54)
42–47	76	1.75 (.89–2.69)	1.43 (.77–2.67)
48–67	77	1.83 (1.00–3.35)	1.60 (.64–3.46)
Race			
White	73	1.00	1.00
Non-White (Black, Brown, Yellow, Indigenous)	71	.92 (.57–1.48)	1.10 (.65–1.88)
Education			
Primary or less	70	1.00	1.00
Secondary	72	1.09 (.69–1.70)	.98 (.67–1.41)
Superior or more	75	1.24 (.67–2.30)	.90 (.59–1.38)
Religion			
Catholic	41	1.00	1.00
Evangelical	23	.90 (.52–1.55)	.98 (.54–1.79)
Other (Espirita, Afro-Brazilian, Other)	21	.66 (.39–1.12)	.68 (.31–1.46)
None	15	1.10 (.56–2.15)	.82 (.26–2.54)
Sexual orientation			
Heterosexual	73	1.00	1.00
Other (homosexual, bi, trans)	70	.83 (.55–1.26)	.58 (.42–.78)
Sexual partners			
0–1	72	1.00	1.00
2+	71	.97 (.62–1.51)	.93 (.47–1.86)
Main partner HIV positive			
No	74	1.00	1.00
Yes	64	.63 (.38–1.06)	.60 (.26–1.40)
Individual income			
Low (0–374)	66	1.00	1.00
High (375–4,790)	77	1.76 (1.16–2.66)	1.49 (.94–2.36)
Psychosocial variables			
Treatment optimism			
Low	80	1.00	1.00
High	63	.44 (.29–.66)	.46 (.25–.88)
Safer sex burn out			
Low	79	1.00	1.00
High	65	.49 (.32–.75)	.58 (.36–.93)
Depression			
No (<11)	70	1.00	1.00
Depressed (>11)	73	1.15 (.73–1.80)	1.14 (.62–2.10)
Anxiety			
No (<11)	75	1.00	1.00
Anxiety (>11)	65	.62 (.40–.95)	1.15 (.64–2.06)
Treatment variables			
Length of time on ARVs (years)			
0–1	69	1.00	1.00
2–6	71	1.06 (.61–1.84)	1.04 (.68–1.59)
7–23	75	1.32 (.80–2.19)	1.08 (.63–1.84)
Adherence			
No	60	1.00	1.00
Yes	74	1.91 (1.14–3.20)	1.50 (.63–3.57)

UOR unadjusted odds ratio, *CI* confidence interval, *AOR* adjusted odds ratio

sexual partners in the last 6 months. About 27 % (n = 166) of participants were not sexually active in the previous 6 months, and 41 % (n = 77) of women did not have a sexual partner in the last 6 months versus 22 % (n = 89) of men. For those who were sexually active, approximately 60 % (n = 340) had sexual intercourse at least once a week or more. The bivariate and multivariate results will be discussed separately for consistent condom use and treatment optimism.

Consistent Condom Use

Seventy-two percent (n = 320) of sexually active respondents always used a condom in the previous 6 months. The main reasons reported by participants for not using a condom were that it could compromise men's pleasure (n = 67) and that it was not romantic (n = 37). Table 2 presents the bivariate and multivariate regression results

Table 3 Bivariate and multivariate logistic regression analysis of sociodemographic, psychosocial and treatment variables on treatment optimism among PLWH in Rio de Janeiro, Brazil (n = 604)

	% Yes	UOR	(95 % CI)	AOR	(95 % CI)
Sociodemographic variables					
Gender					
Male	45	1.00		1.00	
Female	51	1.30	(.92–1.84)	1.41	(.97–2.06)
Transgender	50	1.23	(.25–6.19)	.93	(.33–2.60)
Age [range = 19–67 years; median = 42]					
19–35	43	1.00		1.00	
36–41	46	1.16	(.72–1.86)	1.34	(.74–2.43)
42–47	49	1.31	(.84–2.06)	1.79	(1.02–3.15)
48–67	48	1.26	(.80–1.99)	1.73	(1.02–2.95)
Race					
White	45	1.00		1.00	
Non-White (Black, Brown, Yellow, Indigenous)	48	1.13	(.79–1.63)	.97	(.65–1.46)
Education					
Primary or less	54	1.00		1.00	
Secondary	45	.70	(.50–.99)	.84	(.58–1.22)
Superior or more	32	.41	(.25–.68)	.50	(.26–.97)
Religion					
Catholic	50	1.00		1.00	
Evangelical	53	1.12	(.74–1.67)	1.22	(.65–2.29)
Other (Espirita, Afro-Brazilian, other)	43	.74	(.49–1.14)	.79	(.49–1.26)
None	30	.42	(24–.73)	.46	(.23–.91)
Sexual orientation					
Heterosexual	48	1.00		1.00	
Other (homosexual, bi, trans)	45	.90	(.65–1.25)	1.65	(1.18–2.29)
Sexual partners					
0–1	46	1.00		1.00	
2+	49	1.12	(.77–1.63)	1.32	(.86–2.02)
Individual income					
Low (0–374)	52	1.00		1.00	
High (375–4,790)	42	.67	(.49–.93)	.85	(.57–1.26)
Psychosocial variables					
Safer sex burn out					
Low	37	1.00		1.00	
High	57	2.22	(1.61–3.08)	2.18	(1.35–3.51)
Depression					
No (<11)	54	1.00		1.00	
Depressed (>11)	44	.66	(.46–.93)	.73	(.54–.98)
Anxiety					
No (<11)	46	1.00		1.00	
Anxiety (>11)	48	1.05	(.75–1.47)	.90	(.63–1.29)
Treatment variables					
Length of time on ARVs (years)					
0–1	53	1.00		1.00	
2–6	53	.99	(.65–1.55)	.98	(.51–1.88)
7–23	39	.57	(.38–.86)	.52	(.28–.99)
Adherence					
No	51	1.00		1.00	
Yes	46	.82	(.54–1.25)	.83	(.60–1.13)

UOR unadjusted odds ratio, *CI* confidence interval, *AOR* adjusted odds ratio

regarding sociodemographic and psychosocial factors associated with consistent condom use. Of the sociodemographic variables in the bivariate analysis, being older (more than 47 years) and having higher income were significantly associated with consistent condom use ($p < .05$). All of the psychosocial variables assessed were significantly associated with consistent condom use in the bivariate analysis (treatment optimism, safer sex burnout and anxiety), except for depression. Being adherent to their ARV medications was significantly associated with consistent condom use in the bivariate analysis.

In the multivariate analysis, homosexual, bisexual, transexual persons were less consistent condom users than heterosexuals (AOR .58 [.42–.78]). Those with higher treatment optimism were significantly negatively associated with consistent condom use in the past 6 months (AOR .46 [.25–.88]). Those who experienced safer sex burnout were also less likely to consistently use condoms in the past 6 months (AOR .58 [.36–.9]). Older age, having anxiety and being adherent to ARV medications were no longer significantly associated in the multivariate model. We also tested the interaction between treatment optimism and safer sex burnout and found that it was not statistically associated with consistent condom use in the multivariate model.

Treatment Optimism

Table 3 presents the bivariate and multivariate regression results regarding factors associated with higher treatment optimism. Of the sociodemographic variables in the bivariate analysis, higher education, having no religious affiliation, higher income, and 7 or more years on ARVs were significantly associated with treatment optimism ($p < .05$). Of the psychosocial measures, safer sex burnout and depression were significantly associated with treatment

optimsim. Treatment optimism and safer sex burnout were significantly correlated (Pearson's r .30 $p < .0001$).

In the multivariate analysis, older age was significantly associated with being treatment optimistic with those 42 years and older being more treatment optimistic than the reference group of 19–35 years old (42–47 years AOR 1.79 [1.02–3.15] and 48 years plus AOR 1.73 [1.02–2.95]). Sexual orientation became significant with those identifying themselves as homosexual, bisexual, and transexual persons more likely to be associated with higher treatment optimism than heterosexuals (AOR 1.65 [1.18–2.2]). Higher education was significantly associated with lower treatment optimism (AOR .50 [.26–.97]). Those who did not have a religious affiliation were less likely to be treatment optimistic than Catholics (AOR .46 [.23–.91]). Those who have been on ARV for more than 7 years were almost half as likely to be treatment optimistic than participants in their first year of therapy (AOR .52 [.28–.99]). Of the psychosocial variables, participants who were experiencing safer sex burnout were more likely to be treatment optimistic (AOR 2.18 [1.35–3.51]). Participants who were depressed were 25 % less likely to be treatment optimistic than those who were not (AOR .73 [.54–.98]). Adherence was not significantly associated with treatment optimism (AOR .83 [.60–1.13]).

Discussion

We found that almost three quarters of the respondents reported practicing consistent condom use in the previous 6 months, similar to findings from another study in Brazil [31]. Significant factors associated with inconsistent condom use in this analysis were treatment optimism, safer sex burnout and sexual orientation. Most of the participants were more treatment realistic than treatment optimistic, as others have noted this has developed over time since the introduction of ARVs [25]. This corroborates the findings of Van de Ven and other's that suggests most PLWH are not treatment optimistic [28, 43, 44]. However, findings from other studies suggest that among those who are treatment optimistic, condom use is significantly lower [23, 45], as found here. A recent systematic review also found that being on ARVs or having a reduced viral load was not associated with unprotected sex, but those who believed that ARVs or a reduced viral load reduced HIV transmission did have more sexual risk practices [46].

Treatment optimism and safer sex burnout were also found to be significantly correlated. This is consistent with other literature suggesting optimism might be a post hoc psychological rationalization for safer sex burnout. For example, a longitudinal study found UAI predicted later treatment optimism, but the reverse was not true [47]. These findings, especially the relationship between safer sex burnout and treatment optimism suggest the need for educational messages tailored to vulnerable groups such as MSM regarding the ongoing important of condom use even in the context of being on treatment. It is also important to note that within this study we developed a reliable aggregate measure for safer sex burnout that could be used in future studies concerning sexual behavior among PLWH in Brazil and globally.

The study also documented that those who were older were more likely to be treatment optimistic in this setting. This finding is not consistent with the argument younger people might be more treatment optimistic because they have not lived through the early days of the AIDS epidemic and did not witness close friends dying from AIDS [48]. This finding merits further exploration within the specific socio-political and cultural context of Brazil and its response to HIV, to better understand the potential social dynamics regarding age and HIV treatment optimism.

Participants who had been on ARVs for longer were less likely to be treatment optimistic. It is likely that those who have been on treatment for some time have experienced the difficulties of adherence and potentially have experienced side effects and other set backs, like drug resistance, and may also be more knowledgeable about how ARVs work. In addition, religious affiliation was significantly associated with treatment optimism, with those who did not identify any religious affiliation were less likely to be treatment optimistic than Catholics. It may be that religious affiliation is a marker for other attitudes or behaviors and in turn this finding warrants further research, especially in Brazil where religious institutions have played a key role in the response to the HIV epidemic [49].

Sexual orientation was also significantly associated with lower consistent condom use and higher treatment optimism while controlling for factors such as number of sexual partners, indicating the importance of further research on these issues. Prior research has examined the possibility that MSM have utilized other safer sex practices as alternative strategies to condom use, which could potentially explain the lower rates of condom use observed here [50]. The term "seroadaptive behaviors" is used as an umbrella term to cover the different types and levels of risk reduction practiced by MSM such as serosorting (having sex with only other HIV positives) or strategic positioning (HIV positive partner being in the receptive rather than insertive position) [51]. A survey in San Francisco with MSM found that seroadaptive behaviors were more common than consistent condom use or on the other end of the spectrum of risk behaviors, such as insertive UAI with an

unknown or HIV negative partner, by HIV positive MSM [51]. The main limitation with describing these categories of risk is that intention was not measured. Therefore while these seroadaptive behaviors are documented, it is not clear how it is conceptualized by MSM, whether they are truly seen as HIV risk reduction or not. Further research is warranted to examine if the lower rates of consistent condom use reported among MSM in this study might be due to these seroadaptive behaviors.

While not statistically significant in the multivariate analysis, it is important to note that participants adherent to ARVs had greater consistent condom use, where 74 % of respondents adherent to their medications were also consistent condom users. Adherence was found to be significantly associated with consistent condom use in the bivariate analysis, but it was not significantly associated with treatment optimism. A longitudinal study also found participants who were treatment optimistic were less likely to be adherent to their HIV medications. This gives credibility to the theory that treatment optimism is rationalization for high risk behavior, since one would assume that those who believed in the efficacy of ARVs would also then be adherent [47]. Other studies have found a significant association with low adherence to ARVs and sexual risk behaviors [52–54]. It is possible that this association is stronger among homogenous populations (e.g. MSM only, adolescents etc.) than our more demographically heterogeneous population in Brazil.

Psychological distress is prevalent among people living with chronic health conditions, especially one such as HIV that greatly impacts intimate relationships [55]. Mental health has been associated with sexual risk behavior, but mostly in developed countries among youth populations [56, 57] or examined within severe mentally ill patients [58]. One prospective cohort study in South Africa found that depressed men were less likely to have used a condom and less likely to report correct condom use at last intercourse [59]. Kerrigan et al. [28] examined the role of treatment optimism on sexual behavior in Rio de Janeiro and found psychosocial factors, such as social validation, to be a key component to participants' sexual behavior, with fear and anxiety surrounding condom use and disclosure in their sexual relationships. This study found participants who were anxious were almost 40 % less likely to have reported using a condom consistently in the last 6 months; though this relationship was no longer significant in the multivariate analysis. We also found depression to be significantly associated with a lower level of treatment optimism. The sheer prevalence of depression (70 %) and anxiety (35 %) among the participants warrants further research, especially in relation to its potential relationship to safer sex burnout and treatment optimism.

Limitations

The main limitation of this study is its cross-sectional design, which only allows us to determine association and not causation. In addition, we have a convenience sample of PLWH and therefore the results might not be generalizable outside of Rio de Janeiro, Brazil. We also collected self-reported data, which may have been subject to underestimation due to social desirability bias, especially when dealing with sensitive questions concerning sexual behaviors.

Conclusion

Study findings highlight the need to address psychosocial factors such as treatment optimism and safer sex burnout, which were associated with lower consistent condom use among PLWH, especially in light of the expansion of treatment as prevention strategies. MSM in this setting reported lower condom use and treatment optimism. Future research should examine barriers to condom use among MSM in this context to more effectively address their increased HIV/STI risk.

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