

Awareness and Willingness to Use Pre-exposure Prophylaxis (PrEP) Among Men Who Have Sex with Men and Transgender Women in Brazil

Brenda Hoagland¹ · Raquel B. De Boni¹ · Ronaldo I. Moreira¹ · José Valdez Madruga² · Esper G. Kallas³ · Silvia Pereira Goulart² · Natalia Cerqueira³ · Thiago S. Torres¹ · Paula M. Luz¹ · Nilo Martinez Fernandes¹ · Albert Y. Liu⁴ · Beatriz Grinsztejn¹ · Valdilea G. Veloso¹ · For the PrEP Brasil Study Team

Published online: 17 August 2016
© Springer Science+Business Media New York 2016

Abstract Antiretroviral pre-exposure prophylaxis (PrEP) is recommended to prevent HIV infection among high-risk men who have sex with men (MSM) though not available in Brazil where the HIV epidemic persists unabated in this group. This cross-sectional study describes PrEP awareness and willingness and associated factors among MSM and transvestite/transgender women (trans women) prescreened for the PrEP Brasil study. Awareness was reported by 61.3 % of the participants and was associated with age, education, site, study period and prior HIV testing. Most participants (82.1 %) were willing to use PrEP, which was associated with site, study period, number of male condomless anal sexual partners and anal sex with HIV positive/unknown partners. PrEP information is need among young and less educated individuals. Willingness to use PrEP was high and future studies should be conducted to confirm PrEP acceptability and the characteristics of the population who chose to adopt this intervention.

Keywords Pre-exposure prophylaxis · HIV prevention · MSM · Transvestite · Transgender women · Awareness · Willingness

Introduction

Antiretroviral pre-exposure prophylaxis (PrEP), with either daily oral tenofovir disoproxil fumarate (TDF) or daily TDF in combination with emtricitabine (FTC), has been shown to be efficacious for HIV prevention for high-risk men who have sex with men (MSM), heterosexual men and women, discordant heterosexual couples and people who inject drugs [1–6]. The growing support for PrEP as a prevention tool has prompted a number of studies evaluating the willingness to use PrEP. Willingness to use PrEP, its uptake and patterns of adherence may vary across different geographic locations, with studies so far showing that 44–92 % of MSM were receptive to taking PrEP in both high and low/middle income countries [7–11].

Brazil has the largest population of individuals living with HIV/AIDS in Latin America [12], and a concentrated epidemic with an estimated HIV prevalence of 0.6 % in the general population (0.4 % among women and 0.8 % among men) and a 14.2 % prevalence among MSM [13]. Young MSM account for nearly 40 % of AIDS cases, with an increase of 41.3 % (aged 15–19 years) and 25.1 % (aged 20–24 years) observed in this group from 2004 to 2013 [14].

Although transgender women (trans women) represent a smaller population than MSM, they have extremely elevated HIV infection rates and very high risk for HIV infection [15]. Scarce data is available in Brazil on the HIV burden in the trans women population but reported HIV prevalence rates are high and driven by the interplay of several levels of HIV risks which contribute to a dynamic process of increased vulnerability to HIV/AIDS in this group [16, 17]. Thus, the HIV epidemic in Brazil persists unabated in MSM and trans women, with a high proportion of individuals remaining unaware of their HIV status [13].

✉ Brenda Hoagland
brenda.hoagland@ini.fiocruz.br

¹ Instituto Nacional de Infectologia Evandro Chagas, Fundação Oswaldo Cruz (INI/FIOCRUZ), Avenida Brasil 4365, Manguinhos, Rio de Janeiro 21040-360, Brazil

² Centro de Referência e Treinamento em DST/AIDS, São Paulo, Brazil

³ Universidade de São Paulo, São Paulo, Brazil

⁴ Bridge HIV, San Francisco Department of Public Health, San Francisco, CA, USA

In this context, the PrEP Brasil Study (NCT01989611), a multicenter, open-label, PrEP demonstration project, was designed to assess uptake, safety and feasibility of PrEP provided at no cost for high risk MSM and trans women through the Brazilian public health system (*Sistema Único de Saúde*—SUS). During the PrEP Brasil pre-screening phase, awareness and willingness to use PrEP and other prevention strategies for HIV were assessed. The aims of the present analysis are to describe: (1) PrEP awareness and its associated factors, as well as (2) PrEP willingness and its associated factors among MSM and trans women pre-screened for the PrEP Brasil study.

Methods

This study refers to the cross-sectional analysis of PrEP Brasil data collected at the pre-screening visit. PrEP Brasil was conducted in 3 sites: Fundação Oswaldo Cruz (Fiocruz) in Rio de Janeiro city (RJ), Centro de Referência e Treinamento em DST/AIDS (CRT-SP) and Universidade de São Paulo (USP), both in São Paulo city (SP). Information about the project was made widely available in newspapers, magazines, social media web site and a project homepage. Participants were either self-referred to the study or approached when seeking HIV testing, post exposure prophylaxis (PEP) or other health services. In Rio de Janeiro city, potentially eligible participants were also approached when seeking HIV testing at a Lesbian, Gay, Bisexual, Transgender Non-Governmental Organization (LGBT NGO) and at a mobile testing unit located in a LGBT friendly venue.

Study Population

A convenience sample of 1270 individuals, were accessed from April 01, 2014 to July 28, 2015. Inclusion criteria for the present study were male sex at birth, 18 years of age or more, any sexual intercourse with other men/trans women in the last 12 months, self-report of HIV negative status, and residency in RJ or SP. Individuals were ineligible for the following reasons: 2 were younger than 18 years of age, 5 did not live in the participating states, 3 were HIV positive, and 24 did not have sex with a male partner. Additionally, 49 individuals were excluded from this analysis because they were interviewed more than once ($n = 26$) or had missing data on the inclusion criteria ($n = 23$).

Measures

A self-administered questionnaire answered on tablets measured PrEP awareness and willingness and a face-to-

face structured interview evaluated demographics and sexual risk-behavior. After that, an HIV rapid test was offered to all participants, although it was not mandatory at the pre-screening visit. For those who accepted HIV-1/2 Bio-Manguinhos[®] (Bio-Manguinhos/Fiocruz), HIV Rapid Check[®] (FAHUCAM) and HIV-1/2Bioeasy[®] (Standard Diagnostic Inc.) were performed, in accordance to the Brazilian official guidelines for HIV testing [18]. Individuals who were not tested at this visit ($n = 51$) and those with discordant samples ($n = 1$) were classified as not tested, for the purpose of the present analysis.

Main Outcomes

This study had two main outcomes: (1) PrEP awareness measured as a positive answer to the question “Have you ever heard about PrEP for HIV prevention?”, and (2) Willingness to use PrEP defined as the “High interest” option on a four-point Likert scale to the question “What would be your level of interest in using PrEP if it was available through the Brazilian public health system (*Sistema Único de Saúde*—SUS)?”. These questions were asked after a brief information about PrEP “PrEP is pre-exposure prophylaxis where medication is used daily to prevent HIV.”

Variables

Demographics variables included were age (categorized in three groups: 18–24 years, 25–35 years and more than 36 years); self-reported skin color/race (white, black, mixed-black, native and Asian options were dichotomized to white/non-white following previous categorization used in Brazilian HIV studies [19, 20]), schooling (dichotomized to less than 12 years and 12 years or more), steady partner (yes/no) and site (Fiocruz, CRT-SP and USP). Gender was self-reported and dichotomized to ‘Male’ and ‘Trans women’.

Risk perception for HIV was measured by the question “What is your chance of getting HIV in the next year?” with the possible options being None (0 %), Low, Some (50 %), High, Certainly (100 %), these options were dichotomized into Low (None and Low options) and High (Some, High and Certainly options). Prior HIV testing was evaluated in the past year (yes/no). Risk behavior for HIV was evaluated by the following questions: Number of condomless anal sex partners in the last 12 months (less than 2 and 2 or more), anal sex with HIV-positive partners in the last 12 months (yes/no/I don’t know) and history of STD diagnosis in the last 12 months (yes/no).

Interview dates were categorized into two successive eight-month periods (April 2014–November 2014, December 2014–July 2015). In addition, awareness

(through the question “Have you ever heard of... to prevent HIV infection?”) and willingness (through the question “In case it was available in Brazilian public health system (SUS), would you have great interest in using...for preventing HIV?”) for other HIV prevention measures (in addition to PrEP as detailed above) including condoms, microbicide, circumcision, post-exposure prophylaxis (PEP) and HIV-self-testing were assessed. A brief explanation on the preventive measures was provided before these questions were asked. Finally, we assessed individuals’ willingness to use PrEP even if they had to pay for it (measured using a five-point Likert scale). Compensatory behavior (“I would not use condoms if I used PrEP”) was also investigated among individuals reporting willingness to use PrEP using a five-point agreement/disagreement Likert scale.

Statistical Analysis

Awareness and willingness to use PrEP as well as other HIV prevention measures are given as percentages. Logistic regression models were used to explore and quantify the association of factors with PrEP awareness and willingness. Variables with $p < 0.1$ in bivariate analysis were included in the initial adjusted models. The final adjusted models included variables that remained significant (at 5 % significance threshold) as well as variables that were considered confounders (i.e., those that changed the odds ratio estimate of any of the remaining variables by more than 10 %). The prevalence of HIV was calculated excluding missing cases (HIV rapid test ‘not performed’, $n = 52$).

Ethical Aspects

INI Evandro Chagas-FIOCRUZ institutional review board has approved this study (#CAAE08405912.9.1001.5262 at “Plataforma Brasil”) and all study participants have signed an informed consent form. Institutional Review Boards at CRT-AIDS and USP also approved the study after first approval has been granted at Fiocruz.

Results

The final study sample was comprised of 1187 individuals, 95.3 % were male and 4.7 % were trans women. Median age was 29 years (IQR 24–36), 56.2 % were non-white and 63.4 % had 12 years of education or more. Compared to males, trans women had lower schooling (less than 12 years of education: trans women 78.6 % vs. Male 34.5 %, $p < 0.001$) and were less likely to have a steady partner (trans women 32.1 % vs. Male 49.0 %, $p = 0.013$).

Trans women were mostly recruited at Fiocruz ($n = 48$, 85 %) compared to CRT-SP ($n = 6$, 10 %) and USP ($n = 2$, 1.3 %), (trans women 85.7 %, $p = 0.01$ vs. Male 68.1 %, $p = 0.008$). Males and trans women were not significantly different with respect to age, skin color/race or HIV rapid test result. Overall, HIV prevalence was 9.8 % ($n = 111/1135$).

Figure 1 shows awareness and willingness to use the different HIV prevention methods. The most commonly known method was condom (99.4 %) while the least known was microbicide (19.4 %); 728 participants (61.3 %) reported being aware of PrEP (Fig. 1, top panel) and 975 (82.1 %) reported they would be willing to use PrEP (Fig. 1, bottom panel).

Awareness of PrEP was reported more frequently among older individuals, as well as among those self-identifying as white or who had 12 years or more of education. Additionally, participants who were recruited at the USP site reported greater awareness of PrEP (all $p < 0.05$ in bivariate analyses). Individuals with a higher perceived risk of getting HIV in the next year, as well as those who reported having a prior HIV test, anal sex with an HIV-positive partner and a STD diagnosis in the last 12 months more frequently reported PrEP awareness (all $p < 0.05$). Only 47 % of the individuals who had a positive HIV test had heard of PrEP compared to 63 % of those with a negative test ($p < 0.001$).

In the adjusted model, factors independently associated with PrEP awareness were age, education, site, prior HIV test, and study period. Individuals aged 25–35 years (adjusted odds ratio—AOR 1.43; 95 % CI 1.07–1.93) and those with more than 36 years (AOR 1.93; 95 % CI 1.35–2.75) had a higher odds of PrEP awareness when compared to those younger than 24 years as well as those with higher education (AOR 1.78; 95 % CI 1.36–2.32). Additionally, participants from CRT-SP (AOR 1.52; 95 % CI 1.06–2.19) and USP (AOR 2.41; 95 % CI 1.53–3.81), and those enrolled in the second half of the study (AOR 1.52; 95 % CI 1.18–1.96) were more likely to report PrEP awareness (Table 1).

After receiving brief information about PrEP, most individuals ($n = 975/1187$, 82.1 %) reported they would have great interest in using PrEP if available through the Brazilian public health system; 150 (12.6 %) reported they would have some interest; 45 (3.8 %) reported little interest and 17 (1.4 %) reported no interest. Moreover, most individuals ($n = 900$; 75.8 %) would use PrEP even if they had to pay for it (Totally Agree: $n = 460$, 38.8 %, and Agree: $n = 440$, 37.1 %); 152 (12.8 %) neither agree or disagree; $n = 66$ (5.6 %) partially disagree and 69 individuals (5.8 %) totally disagree. Among those individuals who were willing to use PrEP ($n = 975$), most ($n = 526$, 53.9 %) reported total disagreement with the sentence “I

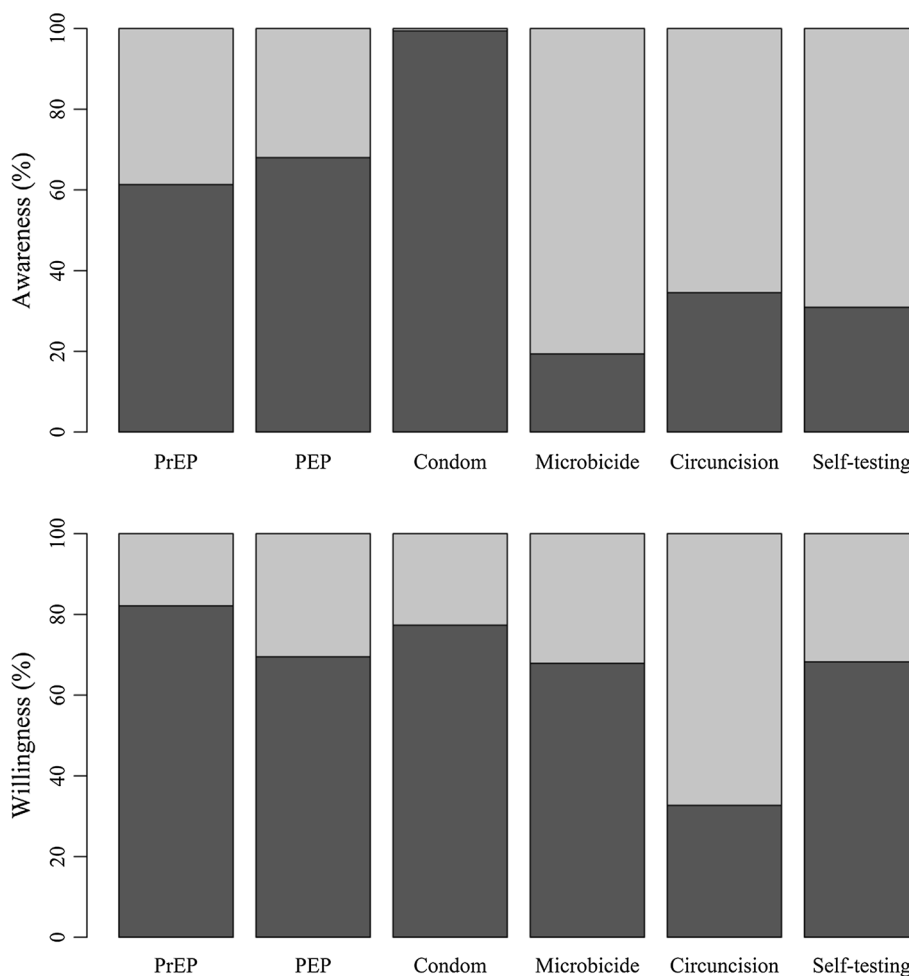


Fig. 1 Percentage of participants reporting awareness of (*top panel*) and willingness (*bottom panel*) to use PrEP as well as other HIV prevention methods

would not use condoms if I used PrEP”, while only 38 (3.9 %) reported total agreement (171/17.5, 134/13.7 and 106/10.9 % reported partial disagreement, neither agree or disagree and partial agreement, respectively).

In the bivariate analysis (Table 2), most variables were associated with PrEP willingness, except for age, gender, steady partner and HIV test result. In the adjusted model, variables that remained independently associated with PrEP willingness were CRT-SP and USP sites (AOR 4.03; 95 % CI 2.12–7.77 and AOR 2.60; 95 % CI 1.35–4.99, respectively) compared to Fiocruz, high perceived likelihood of getting HIV over the next 12 months (AOR 1.42; 95 % CI 1.00–2.02), PrEP awareness (AOR 1.42; 95 % CI 1.03–1.94), two or more male condomless anal sexual partners (AOR 2.07; 95 % CI 1.47–2.91), anal sex with an HIV positive partner in the prior 12 months (AOR 2.46; 95 % CI 1.60–3.78) and not knowing partner’s HIV serostatus (AOR 1.46; 95 % CI 1.01–2.10) compared to not having an HIV positive partner.

Discussion

In this large contemporary study to investigate PrEP awareness and willingness in Brazil, PrEP awareness was reported by 61.3 % of participants. We found that PrEP awareness was associated with older age and higher education, with enrollment in São Paulo and in the second half of the study, as well as with having tested for HIV in the prior 12 months. Our study also showed substantial willingness to use PrEP (82.1 %), and found that willingness to use PrEP was associated with higher risk behavior, higher risk perception and previous PrEP awareness.

The present study shows that the observed level of PrEP awareness is similar to previous reported studies with MSM/trans women from different regions of the world notwithstanding the fact those studies were conducted 1 or 2 years earlier than ours [11, 21, 22]. We have also described awareness of other preventive measures such as condoms, PEP, microbicides, circumcision and HIV self-

Table 1 Sample characteristics by PrEP awareness

	Have you heard about PrEP for HIV prevention before?		Unadjusted				Adjusted			
	Yes	No	95 % CI				95 % CI			
	N = 728	N = 459	OR	Lower	Upper	p value	AOR	Lower	Upper	p value
<i>Age</i>										
18–24	168 (50.9)	162 (49.1)	Ref.				Ref.			
25–35	372 (64.1)	208 (35.9)	1.72	1.31	2.27	<0.001	1.43	1.07	1.93	0.02
≥36	188 (67.9)	89 (32.1)	2.04	1.46	2.84	<0.001	1.93	1.35	2.75	<0.001
<i>Color</i>										
White	357 (68.7)	163 (31.3)	1.75	1.37	2.22	<0.001	–			
Non-white	371 (55.6)	296 (44.4)	Ref.				–			
<i>Schooling</i>										
<12 years	206 (47.5)	228 (52.5)	Ref.				Ref.			
≥12 years	522 (69.3)	231 (30.7)	2.50	1.96	3.19	<0.001	1.78	1.36	2.32	<0.001
<i>Gender</i>										
Male	696 (61.5)	435 (38.5)	1.20	0.70	2.06	0.51	–			
Trans	32 (57.1)	24 (42.9)	Ref.				–			
<i>Steady partner</i>										
Yes	360 (62.9)	212 (37.1)	1.14	0.90	1.44	0.27	–			
No	368 (59.8)	247 (40.2)	Ref.				–			
<i>Site</i>										
Fiocruz	442 (54.0)	376 (46.0)	Ref.				Ref.			
CRT-SP	163 (74.8)	55 (25.2)	2.52	1.80	3.53	<0.001	1.52	1.06	2.19	0.02
USP	123 (81.5)	28 (18.5)	3.74	2.42	5.76	<0.001	2.41	1.53	3.81	<0.001
<i>Perceived likelihood of getting HIV in next year</i>										
Low	420 (59.1)	291 (40.9)	Ref.				–			
High	308 (64.7)	168 (35.3)	1.27	1.00	1.62	0.05	–			
<i>Prior HIV test in last 12 months</i>										
Yes	552 (70.5)	231 (29.5)	3.10	2.41	3.97	<0.001	2.44	1.86	3.20	<0.001
No	176 (43.6)	228 (56.4)	Ref.				Ref.			
<i>#Male condomless anal sexual partners in 12 months</i>										
2 or more	349 (61.7)	217 (38.3)	1.03	0.81	1.30	0.82	–			
Less than 2	379 (61.0)	242 (39.0)	Ref.				–			
<i>Anal sex with HIV positive partner in last 12 months</i>										
No	143 (53.8)	123 (46.2)	Ref.				–			
Yes	261 (66.1)	134 (33.9)	1.68	1.22	2.30	0.001	–			
I don't know	324 (61.6)	202 (38.4)	1.38	1.02	1.86	0.03	–			
<i>STD diagnosis last 12 months</i>										
Yes	108 (68.8)	49 (31.2)	1.46	1.02	2.09	0.04	–			
No	620 (60.2)	410 (39.8)	Ref.				–			
<i>HIV test result^a</i>										
Negative	642 (62.7)	382 (37.3)	Ref.				–			
Positive	52 (46.8)	59 (53.2)	0.52	0.35	0.78	0.001	–			
Not performed	34 (65.4)	18 (34.6)	1.12	0.63	2.02	0.70	–			
<i>Interview date</i>										
Apr'14–Nov'14	339 (56.9)	257 (43.1)	Ref.				Ref.			
Dec'14–Jul'15	389 (65.8)	202 (34.2)	1.46	1.15	1.85	0.002	1.52	1.18	1.96	0.001

Unadjusted and adjusted odds ratio (and 95 % confidence interval) for factors associated with PrEP awareness among individuals pre-screened in PrEP Brasil, 2014–2015

^a Individuals who did not perform a rapid HIV testing in this visit (n = 51) and n = 1 individual with discordant samples were grouped as “not performed”

Table 2 Sample characteristics by willingness to use PrEP for HIV prevention

	Willing to use PrEP		Unadjusted 95 % CI				Adjusted 95 % CI			
	Yes N = 975	No N = 212	OR	Lower	Upper	p value	AOR	Lower	Upper	p value
<i>Age</i>										
18–24	268 (81.02)	62 (18.8)	Ref.				–			
25–35	474 (81.7)	106 (18.3)	1.03	0.73	1.46	0.85				
≥36	233 (84.1)	44 (15.9)	1.23	0.80	1.87	0.35				
<i>Color</i>										
White	446 (85.8)	74 (14.2)	1.57	1.15	2.14	0.004	–			
Non-white	529 (79.3)	138 (20.7)	Ref.							
<i>Schooling</i>										
<12 years	339 (78.1)	95 (21.9)	Ref.				–			
≥12 years	636 (84.5)	117 (15.5)	1.52	1.13	2.06	0.006				
<i>Gender</i>										
Male	925 (81.8)	206 (18.2)	0.54	0.23	1.27	0.16	–			
Trans	50 (89.3)	6 (10.7)	Ref.							
<i>Steady partner</i>										
Yes	467 (81.6)	105 (18.4)	0.94	0.70	1.26	0.67	–			
No	508 (82.6)	107 (17.4)	Ref.							
Fiocruz	628 (76.8)	190 (23.2)	Ref.				Ref.			
CRT-SP	207 (95.0)	11 (5.0)	5.69	3.04	10.67	<0.001	3.85	2.01	7.34	<0.001
USP-SP	140 (92.7)	11 (7.3)	3.85	2.04	7.26	<0.001	2.56	1.33	4.92	0.005
<i>Perceived likelihood of getting HIV on the next 12 months</i>										
Low	556 (78.2)	155 (21.8)	Ref.				Ref.			
High	419 (88.0)	57 (12.0)	2.05	1.47	2.85	<0.001	1.42	1.00	2.02	0.05
<i>Prior HIV test on the last 12 months</i>										
Yes	673 (86.0)	110 (14.0)	2.07	1.53	2.79	<0.001	–			
No	302 (74.8)	102 (25.2)	Ref.							
<i>#Male condomless anal sexual partners in 12 months</i>										
2 or more	500 (88.3)	66 (11.7)	2.33	1.70	3.20	<0.001	2.07	1.47	2.91	<0.001
Less than 2	475 (76.5)	146 (23.5)	Ref.				–			
<i>Anal sex with HIV positive partner in last 12 months</i>										
No	190 (71.4)	76 (28.6)	Ref.				–			
Yes	351 (88.9)	44 (11.1)	3.19	2.12	4.81	<0.001	2.37	1.54	3.65	<0.001
I don't know	434 (82.5)	92 (17.5)	1.89	1.33	2.67	<0.001	1.46	1.01	2.10	0.04
<i>STD diagnosis last 12 months</i>										
Yes	140 (89.2)	17 (10.8)	1.92	1.14	3.26	0.02	–			
No	835 (81.1)	195 (18.9)	Ref.							
<i>HIV test result^a</i>										
Negative	839 (81.9)	185 (18.1)	Ref.				–			
Positive	91 (82)	20 (18)	1.00	0.60	1.67	0.99				
Not performed	45 (86.5)	7 (13.5)	1.42	0.63	3.19	0.40				
<i>Interview date</i>										
Apr'14–Nov'14	476 (79.9)	120 (20.1)	Ref.				–			
Dec'14–Jul'15	499 (84.4)	92 (15.6)	1.37	1.01	1.84	0.04				
<i>PrEP awareness</i>										
Yes	622 (85.4)	106 (14.6)	1.76	1.31	2.38	<0.001	1.42	1.03	1.94	0.03
No	353 (76.9)	106 (23.1)	Ref.				Ref.			

Crude and adjusted odds ratio for factors associated with willingness to use PrEP among individuals pre-screened in PrEP Brasil Study, 2014–2015

^a Individuals who did not perform a rapid HIV testing in this visit (n = 51) and n = 1 individual with discordant samples were grouped as “not performed”

testing that might be related to the characteristics of the HIV epidemic in Brazil as well as to the availability of preventive interventions through the public health system. Interestingly, we found that if all technologies were available through SUS, over half the surveyed individuals would be very interested in using all of them, except for circumcision. This is a promising result in the context of combination approach to HIV prevention. Moreover, most participants (75.9 %) reported they would use PrEP even if they had to pay for it. Although Brazil has a well-known ARV universal access program for HIV treatment, the same does not happen for many other diseases. Thus, the population is used to paying out of pocket for medications in general. Nonetheless, taken together these results indicate that once available as a public health program PrEP will likely be used by MSM/trans women populations.

Our findings showing the association of PrEP awareness with older age and higher education highlight the need to increase access to PrEP information among young MSM/trans women, especially among the less educated. In Brazil, the HIV/AIDS epidemic is growing fast among youth [23], especially MSM [14] and lower education, may function as an additional barrier to access information on new preventive technologies. The association of prior HIV testing and PrEP awareness may be related to a higher risk perception among those who test more frequently, as well as to a higher exposure to prevention messages during testing-related counseling. Similarly, enrollment during the second half of the study as opposed to the first half was associated with higher odds of PrEP awareness, likely due to exposure to PrEP information through PrEP Brasil social media interventions as well as through articles in newspapers and magazines addressing the project. This point highlights the importance of building a strong component of community education within PrEP implementation programs in Brazil. It also highlights that strategies tailored to higher risk populations with low educational level and low health literacy who face additional barriers to access health services will be critical.

Similar to other studies conducted in high and low/middle income countries [9, 10, 24, 25] we found that most individuals would be willing to use PrEP. High risk behavior increased willingness to use PrEP, as described by others [25–29], as well as high risk perception of getting HIV. In particular, higher number of condomless anal sex partners was associated with willingness to use PrEP. Considering that the estimated HIV prevalence rates among MSM in Brazil ranges from 5.2 to 23.7 % [13, 30], with half of those HIV-infected being unaware of their serostatus [13], motivation could indeed be greater for taking PrEP in such context. As suggested by Golub [31], the subjective experience of risk-taking may vary by relational context. A sense of risk could be greater in

serodiscordant relationships, especially in our context where, differently from other contexts, the knowledge of the HIV-positive partner's viral load is not usually used to guide sexual practices [32]. PrEP empowers users by allowing greater control over their HIV risk, rather than relying on partners to use condoms, take antiretroviral therapy, or accurately disclose their serostatus [33]. Results from qualitative research among heterosexual serodiscordant couples showed that PrEP was perceived as a solution to the threat of HIV transmission providing further stabilization for couples in serodiscordant relationships [34].

Interestingly, although the unadjusted analysis suggested that a prior STD diagnosis was associated with PrEP awareness (unadjusted odds ratio 1.46, 95 % CI 1.02–2.09) as well as with willingness to use PrEP (unadjusted odds ratio 1.92, 95 % CI 1.14–3.26) this association did not persist in the adjusted analyses. We hypothesize this is due to the fact that STDs are under diagnosed given that STD screening is not available through the Brazilian public health system. That is, despite WHO recommendations, the syndromic approach remains the standard of care thus not capturing asymptomatic infections, especially rectal chlamydia. The end result is many fewer opportunities for a patient-provider encounter where the patient could perceive his risk (not before acknowledged given his asymptomatic infection) and the role of STDs in HIV risk could be discussed.

Three important points are worthy of mentioning regarding the present study. First, our analysis highlighted differences in both PrEP awareness and willingness among sites in Rio de Janeiro and São Paulo. We hypothesize these differences are explained by participants' motivation when seeking the site. Considering $n = 867$ available answers, while at the Fiocruz site, in Rio de Janeiro, most individuals ($n = 340$, 61.7 %) were seeking HIV testing when assessed for the PrEP study, both at CRT-SP and USP, in São Paulo, most individuals were directly seeking participation in the PrEP Brasil study thus explaining their higher awareness and willingness ($n = 149$, 89.5 % and $n = 129$, 98.5 %, respectively). Second, PrEP Brasil assessed a trans women population ($n = 56$, 4.7 %) that is small but significantly higher than the proportion pre-screened in other demonstration studies, such as the US PrEP demonstration project [21] and PrEP efficacy trials [35]. In a post hoc analysis of iPrEx trial, trans women participants had lower adherence despite presenting higher risk behaviors [36]. Demonstration studies designed for the trans women population and addressing their needs are urgently required in order to investigate PrEP engagement and its predictors in this population. Finally, increased condomless sex and participation in riskier sexual roles have been documented among PrEP users in PrEP demonstration projects and in hospital-based clinical

settings [37]. An increase in condomless sex with non-primary partners was also noted in the open label extension of the Partners PrEP Study [38]. In our study, among the 975 individuals who reported willingness to use PrEP, 144 (14.8 %) partially/totally agree with the sentence “I would not use condoms if I used PrEP”, a fraction that resembles that from other PrEP acceptability studies [11, 39]. Predicted increases in sexual risk behavior among PrEP users may function as a barrier to access for reasons such as reduced motivation to seek PrEP or to sustain PrEP use for fear of stigmatization [40], stigma-related misperceptions of self-eligibility or need for PrEP and reduced willingness to prescribe PrEP among providers [41]. Also, fostering shame of sexual practices under the rubric of ‘risk compensation’ can jeopardize PrEP implementation and adherence [33]. Ideally, PrEP should be targeted to individuals who are at high risk of acquiring HIV, and this includes those who intentionally or not end up not using condoms consistently. The high degree of protection provided by PrEP when properly used likely outweighs the increased risk of HIV acquisition resulting from increased risk taking [42]. As such, hindering access to PrEP could prevent a net reduction in HIV risk even for individuals who increase their sexual risk behavior [43].

A recent study evidencing un-prescribed use of Truvada in some settings [45] warrants attention given the high willingness to use PrEP found in our sample. In Brazil, despite non-availability of Truvada for HIV treatment, tenofovir and lamivudine are available through the Brazilian Public Health System for treatment and post-exposure prophylaxis. Impeding access to PrEP may lead potential PrEP candidates to obtain these drugs, which were not evaluated in clinical trials for PrEP, in at least two ways: from an HIV-infected individual or by claiming recent exposure to HIV [45]. In either scenario, drug use would happen without any counseling or medical supervision.

The study has limitations. First, the sample is not probabilistic and data may not be generalized to all Brazilian MSM and trans women. However, it is important to note that some results, like HIV prevalence are similar to other Brazilian studies, meaning that the sample may have similarities with the population of MSM from Rio de Janeiro and São Paulo. Second, given the cross-sectional nature of the data, causality and the direction of association may not be inferred. Third, as in all self-reported behavioral studies, social desirability bias may not be ruled out, although self-answering study questionnaire on a tablet may have partially mitigated this effect. Fourth, the small number of trans women in our study population prevented us from stratifying the analysis to the trans women population. Fifth, we can’t exclude that some individuals had PrEP awareness due to previous participation on the iPrEx/iPrEx OLE studies [1, 44] conducted in sites from RJ and

SP. Finally, we have measured intention to use PrEP as a proxy of willingness. There are different methods for accessing PrEP awareness and willingness, as reviewed by Young and McDaid [46] and as such our results should be interpreted with care.

In summary, this study showed that willingness to use PrEP was high among MSM/trans women, and its association with riskier behavior is reassuring as it indicates that those individuals who are at higher risk of HIV infection are interested in this new prevention strategy. Efforts to increase access of young and less educated MSM/trans women to PrEP information must be implemented in Brazil. Finally yet importantly, PrEP studies tailored to trans women population are urgently needed.

Acknowledgments We are grateful to the study participants and the following individuals: Tania Krstic, Vinícius Pacheco, Mônica Derico, Flávia Esper, Desirée Vieira, Marcus Vinícius M. da Costa, Gelson Perim. PrEP Brasil Study Team includes Lucilene A. de Freitas, Iuri Leite, Tiago Porto, Luana Marins, Sandro Nazer, Cristiane Castro, Daniel Waite, José Roberto Granjeiro, Albert Y. Liu, Larissa Villela, Toni Araújo, Josias Freitas, Laylla Monteiro (FIOCRUZ); Ricardo Vasconcelos, Daniel Bertevello (USP); Roberta Schiavon Nogueira, Priscilla de Lima e Menezes, Valvina Madeira Adão, Gustavo Mizuno (CRT-SP).

Funding This study was funded by CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico—Grant PROEP 402004/2012-4; Grant Universal 45931/2014-0), FAPERJ (Fundação Carlos Chagas de Amparo à Pesquisa do Estado do Rio de Janeiro—Grant E-26/110.261/2017; Grant 2012/51743), SVS-MS (Secretaria de Vigilância em Saúde do Ministério da Saúde—Grant 281/2013) and Departamento de HIV/AIDS e Hepatites Virais—Ministério da Saúde (Grant 01/2013 projeto BRA/K27). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Compliance with Ethical Standards INI Evandro Chagas-FIOCRUZ institutional review board has approved this study (#CAAE08405912.9.1001.5262 at “Plataforma Brasil”) and all study participants have signed an informed consent form. Institutional Review Boards at CRT-AIDS and USP also approved the study after first approval has been granted at Fiocruz.

Conflict of interest Albert Liu has participated in trials in which study drug and support for drug level testing were provided by Gilead Sciences.

References

1. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J Med*. 2010;363(27):2587–99.
2. Baeten JM, Donnell D, Ndase P, Mugo NR, Campbell JD, Wangisi J, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *N Engl J Med*. 2012;367(5):399–410.
3. Thigpen MC, Kebaabetswe PM, Paxton LA, Smith DK, Rose CE, Segolodi TM, et al. Antiretroviral preexposure prophylaxis for heterosexual HIV transmission in Botswana. *N Engl J Med*. 2012;367(5):423–34.

4. Choopanya K, Martin M, Suntharasamai P, Sangkum U, Mock PA, Leethochawalit M, et al. Antiretroviral prophylaxis for HIV infection in injecting drug users in Bangkok, Thailand (the Bangkok Tenofovir study): a randomised, double-blind, placebo-controlled phase 3 trial. *Lancet*. 2013;381:2083–90.
5. McCormack S, Dunn DT, Desai M, Dolling DI, Gafos M, Gilson R, et al. Articles pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *Lancet*. 2016;387:53–60.
6. Molina J-M, Capitant C, Spire B, Pialoux G, Cotte L, Charreau I, et al. On-demand preexposure prophylaxis in men at high risk for HIV-1 infection. *N Engl J Med*. 2015;373(23):2237–46.
7. Mimiaga MJ, Case P, Johnson CV, Safren SA, Mayer KH. Pre-exposure antiretroviral prophylaxis attitudes in high-risk Boston area men who report having sex with men: limited knowledge and experience but potential for increased utilization after education. *JAIDS*. 2009;50:77–83.
8. Barash EA, Golden M. Awareness and use of HIV pre-exposure prophylaxis among attendees of a Seattle gay pride event and sexually transmitted disease clinic. *AIDS Patient Care STDS*. 2010;24:689–91.
9. Eisingerich AB, Wheelock A, Gomez GB, Garnett GP, Dybul MR, Piot PK. Attitudes and acceptance of oral and parenteral HIV preexposure prophylaxis among potential user groups: a multinational study. *PLoS One*. 2012;7(1):e28238.
10. Wheelock A, Eisingerich AB, Ananworanich J, Gomez GB, Hallett TB, Dybul MR, et al. Are Thai MSM willing to take PrEP for HIV prevention? An analysis of attitudes, preferences and acceptance. *PLoS One*. 2013;8:e54288.
11. Bil JP, Davidovich U, van der Veldt WM, Prins M, de Vries HJC, Sonder GJB, et al. What do Dutch MSM think of preexposure prophylaxis to prevent HIV-infection? A cross-sectional study. *AIDS*. 2015;29:955–64.
12. De Boni RB, Veloso V, Grinsztejn B. The epidemiology of HIV in Latin America and the Caribbean. *Curr Opin HIV AIDS*. 2014;9(2):192–8.
13. Kerr LRF, Mota RS, Kendall C, Pinho ADA, Mello MB, Guimarães MDC, et al. HIV among MSM in a large middle-income country. *AIDS*. 2013;27:427–35.
14. Departamento de DST Aids e Hepatites Virais. Boletim Epidemiológico—Aids e DST. Brasília: Ministério da Saúde; 2015.
15. Baral SD, Poteat T, Strömdahl S, Wirtz AL, Guadamuz TE, Beyrer C. Worldwide burden of HIV in transgender women: a systematic review and meta-analysis. *Lancet Infect Dis*. 2013;13:214–22.
16. Martins TA, Kerr LRF, Macena RHM, Rosa S, Carneiro KL, Gondim RC, et al. Travestis, an unexplored population at risk of HIV in a large metropolis of northeast Brazil: a respondent-driven sampling survey. *AIDS Care*. 2013;25:606–12.
17. Brandelli A, Anna C, Vaites M, Michelle F, Jacinto M, Filho R, et al. Population-based HIV prevalence and associated factors in male-to-female transsexuals from southern Brazil. *Arch Sex Behav*. 2015;44:521–4.
18. Saúde M, De Vigilância S, Girade R, Costa AR. Protocolo Clínico e Diretrizes; 2013.
19. Silva DS, De BoniRB, Lake JE, Cardoso SW, Ribeiro S, Moreira RI, et al. Retention in early care at an HIV outpatient clinic in Rio de. *AIDS Behav*. 2015. doi:10.1007/s10461-015-1235-3.
20. Grinsztejn B, Luz PM, Pacheco AG, Santos DVG, Velasque L, Moreira RI, et al. Changing mortality profile among HIV-infected patients in Rio de Janeiro, Brazil: shifting from AIDS to non-AIDS related conditions in the HAART era. *PLoS One*. 2013;8:e59768.
21. Cohen SE, Vittinghoff E, Bacon O, Doblecki-Lewis S, Postle BS, Feaster DJ, et al. High interest in pre-exposure prophylaxis among men who have sex with men at risk for HIV-infection: baseline data from the US PrEP demonstration project. *JAIDS*. 2015;68(4):439–48.
22. Yang D, Chariyalertsak C, Wongthanae A, Kawichai S, Yotruean K, Saokhieo P, et al. Acceptability of pre-exposure prophylaxis among men who have sex with men and transgender women in northern Thailand. *PLoS One*. 2013;8(10):e76650.
23. Bassichetto KC, Bergamaschi DP, Oliveira SM, Deienno MCV, Bortolato R, de Rezende HV, et al. Elevated risk for HIV-1 infection in adolescents and young adults in São Paulo, Brazil. *PLoS One*. 2008;3(1):e1423.
24. Zhou F, Gao L, Li S, Li D, Zhang L, Fan W, et al. Willingness to accept HIV pre-exposure prophylaxis among Chinese men who have sex with men. *PLoS One*. 2012;7:e32329.
25. Krakower DS, Mimiaga MJ, Rosenberger JG, Novak DS, Mitty JA, White JM, et al. Limited awareness and low immediate uptake of pre-exposure prophylaxis among men who have sex with men using an internet social networking site. *PLoS One*. 2012;7(3):e33119.
26. Sineath RC, Finneran C, Sullivan P, Sanchez T, Smith DK, Van Griensven F, et al. Knowledge of and interest in using preexposure prophylaxis for HIV prevention among men who have sex with men in Thailand. *J Int Assoc Provid AIDS Care*. 2013;12(4):227–31.
27. Holt M, Murphy DA, Callander D, Ellard J, Rosengarten M, Kippax SC, et al. Willingness to use HIV pre-exposure prophylaxis and the likelihood of decreased condom use are both associated with unprotected anal intercourse and the perceived likelihood of becoming HIV positive among Australian gay and bisexual men. *Sex Transm Infect*. 2012;88:258–63.
28. Aghaizu A, Mercey D, Copas A, Johnson AM, Hart G, Nardone A. Who would use PrEP? Factors associated with intention to use among MSM in London: a community survey. *Sex Transm Infect*. 2013;89:207–11.
29. Lebouché B, Engler K, Machouf N, Lessard D, Thomas R. Predictors of interest in taking pre-exposure prophylaxis among men who have sex with men who used a rapid HIV-testing site in Montreal (Actuel sur Rue). *HIV Med*. 2016;17:152–8.
30. Mascena MADS, Gabriela V, Calazans J. High HIV prevalence among men who have sex with men São Paulo, Brazil in a time-location sampling survey. *AIDS Behav*. 2015;19:1589–98.
31. Golub SA. Tensions between the epidemiology and psychology of HIV risk: implications for pre-exposure prophylaxis. *AIDS Behav*. 2014;18:1686–93.
32. Bavinton BR, Jin F, Prestage G, Zablotska I, Grinsztejn B, Phanuphak N, et al. Viral load awareness and risk behaviour in male serodiscordant couples in Australia, Brazil and Thailand. *IAS*. Vancouver; 2015. p. 141.
33. Grant RM, Koester KA. What people want from sex and preexposure prophylaxis. *Curr Opin HIV AIDS*. 2016;11:3–9.
34. Ware NC, Wyatt MA, Haberer JE, Baeten JM, Kintu A, Psaros C, et al. What's love got to do with it? Explaining adherence to oral antiretroviral pre-exposure prophylaxis for HIV-serodiscordant couples. *JAIDS*. 2012;59:463–8.
35. Escudero DJ, Kerr T, Operario D, Socías ME, Sued O, Marshall BDL. Inclusion of trans women in pre-exposure prophylaxis trials: a review. *AIDS Care*. 2015;27:637–41.
36. Deutsch MB, Glidden DV, Sevelius J, Keatley J, McMahan V, Guanira J, et al. HIV pre-exposure prophylaxis in transgender women: a subgroup analysis of the iPrEx trial. *Lancet HIV*. 2015;2:e512–9.
37. Carlo Hojilla J, Koester KA, Cohen SE, Buchbinder S, Ladzekpo D, Matheson T, et al. Sexual behavior, risk compensation, and HIV prevention strategies among participants in the San Francisco PrEP demonstration project: a qualitative analysis of counseling notes. *AIDS Behav*. 2015;20:1461–9.

38. Mugwanya KK, Donnell D, Celum C, Thomas KK, Ndase P, Mugo N, et al. Sexual behaviour of heterosexual men and women receiving antiretroviral pre-exposure prophylaxis for HIV prevention: a longitudinal analysis. *Lancet Infect Dis*. 2013;13:1021–8.
39. Brooks RA, Landovitz RJ, Kaplan RL, Lieber E, Lee S-J, Barkley TW. Sexual risk behaviors and acceptability of HIV pre-exposure prophylaxis among HIV-negative gay and bisexual men in serodiscordant relationships: a mixed methods study. *AIDS Patient Care STDS*. 2012;26:87–94.
40. Liu A, Cohen S, Follansbee S, Cohan D, Weber S, Sachdev D, et al. Early experiences implementing pre-exposure prophylaxis (PrEP) for HIV prevention in San Francisco. *PLoS Med*. 2014;11(3):1–6.
41. Blumenthal J, Jain S, Krakower D, Sun X, Young J, Mayer K. Knowledge is power! Increased provider knowledge scores regarding pre-exposure prophylaxis (PrEP) are associated with higher rates of PrEP prescription and future intent to prescribe PrEP. *AIDS Behav*. 2015;19:802–10.
42. Smith DK, Herbst JH, Rose CE. Estimating HIV protective effects of method adherence with combinations of preexposure prophylaxis and condom use among African American men who have sex with men. *Sex Transm Dis*. 2015;42:88–92.
43. Calabrese SK, Underhill K. How stigma surrounding the use of HIV preexposure prophylaxis undermines prevention and pleasure: a call to destigmatize “truvada whores”. *Am J Public Health*. 2015;105:1960–4.
44. Grant RM, Anderson PL, McMahan V, Liu A, Amico KR, Mehrotra M, et al. Uptake of pre-exposure prophylaxis, sexual practices, and HIV incidence in men and transgender women who have sex with men: a cohort study. *Lancet Infect Dis*. 2014;14:820–9.
45. Kurtz SP, Buttram ME. Misunderstanding of pre exposure prophylaxis use among MSM: public health and policy implications. *LGBT Health*. 2016. doi:10.1089/lgbt.2015.0069.
46. Young I, Mcdaid L. How acceptable are antiretrovirals for the prevention of sexually transmitted HIV? A review of research on the acceptability of oral pre-exposure prophylaxis and treatment as prevention. 2014;195–216.