



BMJ Open Factors associated with attitudes towards HIV cure research among transgender women and travestis: a cross-sectional survey in São Paulo, Brazil

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ABSTRACT

Objective Characterising the perceptions of groups most affected by HIV is fundamental in establishing guidelines for biomedical advancement. Although Brazil has successfully fought HIV/AIDS through several measures, transgender women still have a likelihood of HIV infection 55 times higher than the general population. This study aimed to better understand the perception and awareness of HIV cure research among the trans-identifying population in São Paulo, Brazil, and to determine factors that motivate or discourage participation in HIV cure studies.

Setting This cross-sectional study analysed data collected from a questionnaire administered to 118 transgender women and travestis at 5 sites within the city of São Paulo. It uses quantitative methodology to describe the perspectives of transgender and travesti people in relation to HIV cure research and the context in which such perspectives are produced.

Results Of 118 participants, most participants (73%) had some knowledge of HIV cure research and were most willing to participate in online surveys (52%), interviews (52%), focus groups (52%) and studies involving blood draws (57%). Those with a higher education or employment status were more likely to agree that someone had been cured of HIV, people living with HIV are discriminated against, and more information about HIV cure research is needed before the community embraces it. Only 55% of participants completely trusted their physician. The biggest motivational factors included gaining additional knowledge about HIV infection (77%) and the potential for a longer, healthier life for all (73%).

Conclusions As a primary analysis of HIV cure attitudes among the transgender and travesti population as well as the social context in which they are formed, this study identifies opportunities to strengthen the dialogue and develop more educational collaborations between scientific investigators, community educators and the trans-identifying population to ensure that HIV cure research is inclusive of diverse perspectives.

Strengths and limitations of this study

- This is the first study to report on attitudes to HIV cure research in a group of more than 100 transgender women and travestis in São Paulo, Brazil—South America's largest city.
- This study provides novel insight on this community's general HIV cure research knowledge, the types of studies they are willing and motivated to participate in, as well as the social and demographic factors that influence these preferences.
- To obtain the desired sample size of the study population, convenience sampling had to be used by approaching transgender or travesti-identifying individuals seeking health services, social services or communal living spaces at the designated study sites, which may have contributed to sampling bias.
- Education and reading level were not screened prior to administration of the questionnaire, which may have contributed to the amount of missing data and uncertainty in responses.

INTRODUCTION

Although Brazil has been able to successfully fight HIV/AIDS through a number of governmental and societal measures, transgender women and travestis in this country still have an HIV prevalence of about 25%–30%, 55 times higher than that of the general population.^{1,2} Despite the development of a universal and free public health system, discussions with pharmaceutical companies to reduce antiretroviral (ARV) drug prices, investments towards the development of generic drugs, and compulsory licensing of ARVs,³ these measures have not effectively engaged



Brazil's transgender community with HIV prevention and care.⁴ From a global perspective, the overall estimate of new HIV infections in 2019 was 1.7 million, and the large number of people living with HIV (PLWH) without access to antiretroviral treatment (ART) suggests the incidence may increase to 40 million in the coming years.^{5,6} Latin American transgender women face the highest burden of HIV of any group, with a 35% infection rate.⁷ To prevent new infections and ultimately reach the UNAIDS goal of ending the epidemic, HIV cure research initiatives are targeting immunotherapeutic vaccine research, viral transcript editing, immune effector therapies, gene editing and other investigative approaches.⁸ With more than one person now cured of HIV infection,^{9–11} attention has turned to developing scalable approaches if a widespread cure were to become available, especially in vulnerable communities like the transgender population.¹²

The heightened HIV vulnerability faced by the transgender community remains rooted in a variety of structural, social and individual factors. This study specifically focuses on these factors related to transgender women and travestis, who are more greatly impacted in comparison to transgender men, non-binary individuals and other LGBTQ+-identifying counterparts.¹³ The overlapping gender identities of transgender women and travestis have been long debated, as both often identify as female, undergo a male-to-female transition period, and use female pronouns (she/her/they).¹⁴ Travestis are often assumed to have no desire for genital gender affirming surgeries; however, specifying a clear-cut definition between the two identities has been considered a form of identity invalidation, placing the focus on the degree of body dysphoria or modification rather than self-identification or experience.¹⁵ These identities are analysed in the context of intersectionality, a framework for understanding how the interconnected nature of an individual's social and political identities, such as race, class, sex, gender and/or sexual orientation, generate cultural experiences and power differentials that make transgender individuals more vulnerable to negative health outcomes.¹⁶

At the structural level, the transgender community continues to face enormous barriers to obtaining higher education, entering the formal labour market, and securing employment.¹⁷ Previous studies report that only 16.7% of transgender individuals in São Paulo, Brazil, worked within the formal labour market, with almost 40% involved in sex work.¹⁸ This can be attributed to the country's lack of equal opportunities, discriminatory public policies, limited protections for transgender individuals and the use of sex work as a means of economic survival.¹⁷ From a social and interpersonal perspective, the transgender population is also disproportionately at risk for experiencing physical and systemic violence due to deep-rooted stigma and transphobia, often in connection to their HIV status.¹⁹ This is further complicated by other intersecting factors, including race and gender identity, with Black and travesti-identifying individuals at

a greater risk for both physical violence and HIV infection in comparison to their non-Black and transgender-identifying counterparts.²⁰ Although there are little data on exact HIV prevalence rates among non-white transgender individuals in Brazil, several studies have demonstrated that Black and mixed race is associated with increased HIV-related morbidity and mortality in the transgender population.^{21–23}

These intersectional factors have manifested in enormous barriers to healthcare access and education as well as HIV prevention and care.^{20,24} First, there exists a scarcity of services and medical professionals who understand and advocate for the complexities of transgender health. Further, prejudice and discrimination have remained rooted in the culture of health professionals, leading transgender patients to avoid engaging with the healthcare system due to the fear of disrespect and identity delegitimisation.²⁵

Despite the existence of evidence-based HIV prevention strategies, including PrEP and long-acting injectables, within the Brazilian healthcare system, the transgender population has historically benefited less from these initiatives in comparison to other high-risk groups, such as men who have sex with men.^{26,27} As a 'hidden population', the transgender community is often stigmatised, criminalised, difficult to reach and consequently left out of research initiatives and HIV-related programming.²⁸ Although previous studies have investigated the numerous structural and social factors that are associated with this community's increased risk of HIV infection, no study has yet assessed the specific features of HIV cure research that would meet the needs and preferences of the Brazilian transgender population as well as their overall attitudes to these investigations.

Communicating with populations most affected by the epidemic about advancements in HIV cure research is fundamental in establishing guidelines for biomedical advancement.²⁹ It is essential to consider a number of questions regarding HIV cure research programmes to ensure that these new approaches are inclusive and applicable to the realities of those impacted by the disease, specifically transgender individuals; for example, how does language and communication affect the meaning of 'cure' to PLWH and broader communities; how would a cure affect the identity and social position of PLWH; what counselling and support interventions are needed to address the psychosocial needs and concerns of study participants related to analytical treatment interruptions; how are motivation, acceptability and decision-making processes of potential study participants related to different cure strategies; and how can potential social harms or adverse social events associated with cure research participation be mitigated?

Thus, it is essential to further understand the healthcare disparities faced by the transgender community in these settings as well as evaluate their attitudes towards current treatment options and a potential future cure. We undertook a cross-sectional survey of transgender women

in São Paulo, Brazil to address these questions. The aim of this study was to better understand the perception and awareness of HIV cure research among the transgender and travesti population of São Paulo, Brazil, and to determine willingness to participate in HIV cure studies.

METHODS

This study analyses data collected from a questionnaire administered at five sites within the city of São Paulo, Brazil. It is a cross-regional study that uses quantitative methodology to describe the perspectives of transgender and travesti people in relation to HIV cure research and the context in which such perspectives are produced.

Study population

A convenience sample of 118 individuals was obtained from 5 July 2019 to 15 August 2019. To obtain the desired sample size, convenience sampling was used by approaching transgender or travesti-identifying individuals seeking health services, social services, or communal living spaces at the designated study sites. Inclusion criteria for the study consisted of being 18 years of age or more, being a resident of the state of São Paulo, self-identification as a transgender woman or travesti, and attendance at a study site. To limit potential sampling bias and obtain a more regionally representative sample, the study was conducted in five sites where transgender women and travestis assembled for social and supportive activities: Centro de Cidadania LGBT Sul (LGBT Citizenship Center, South Zone), Instituto NICE (NICE Institute, North Zone), Casa Florescer (Transgender Housing, Downtown Zone), Casa de Profissionais de Sexo (Sex Worker House, East Zone), and Centro de Pesquisa USP (USP Clinical Research Center, West Zone). A self-administered questionnaire was used to gather quantitative data (see online supplemental file).

Consent forms were distributed before the activities to all possible participants. For those who consented, the consent form was signed by both the participant and a member of the research team; copies were kept by both the participant and the team. After consenting, the questionnaires were completed and collected, with the responses recorded on a secure online database (REDCap).

Patient and public involvement

Before data collection, the questionnaire was translated from English to Portuguese and discussed with the community advisory board of the clinical research centre, which advised on changes suggested to improve comprehension by the local population. The questionnaire was revised by transgender health experts and transgender women to ensure it was appropriate for the study population. This version was back translated to English to ensure the main principles of the original questionnaire were maintained. A transgender woman working as a field coordinator helped identify potential participants and crafted appropriate invitations. Participants were self-referred to

the study or approached when seeking health services, social services or communal living spaces. Through the help of various socioeconomic resource centres, clinical research centres and LGBTQ+ organisations around the city of São Paulo, the research was announced, inviting all transgender people involved in these sites to participate in the study. To encourage attendance at the sites, the research team also worked with the various organisations to provide an educational session on beauty and health, consisting of a makeup application class followed by a presentation on current HIV prevention and treatment options, the current status of HIV research and the purpose of this study. The data will be disseminated to all study sites to share the findings with participants and the wider transgender and travesti communities. The research team plans for continued collaboration with these organisations in future studies and health education services.

Measurements and main outcomes

The self-administered paper questionnaire measured demographic factors, HIV awareness, attitudes to HIV cure research, past participation in HIV research studies and willingness to participate in HIV cure studies. This study had four main outcomes: (1) willingness to participate in various forms of HIV cure research (2) factors which could motivate participation in HIV cure research (3) factors which could discourage participation in HIV cure research, and (4) general attitudes towards HIV and HIV cure research. A modified Likert Scale was used to determine participants' level of agreement with specific statements or aspects of research studies.³⁰ The variables were chosen based on previous research, namely a study completed by members of the collaboration team that analysed data from an online questionnaire about perceptions towards HIV cure in the USA. (Magnus M. Perceptions about HIV prevention in relation to the concept of HIV cure.)

Variables

As the questionnaire indicates (see online supplemental file), demographic variables included self-reported age, skin colour/race, site location, sexual orientation, gender identity, level of education, employment status, health status and HIV status.

Knowledge and perceptions about HIV cure were measured by asking participants if they had heard of HIV/AIDS cure research and what an HIV cure mean to them, with the possible options being: 'No more HIV treatment needed temporarily'; 'No more HIV treatment needed ever'; 'No risk of transmitting HIV to others'; 'Negative HIV test'; 'HIV completely eliminated from the body'; 'There is no risk of HIV/AIDS-related complications or other effects of HIV'; or 'Other'. To determine whether general knowledge of news surrounding HIV cure had been assimilated by the associated population, we asked participants if they thought someone had been cured of

HIV as well as how many years it would take to make an HIV cure that is available to the public.

To evaluate previous involvement in general health studies, participants were asked to report any participation in research involving online questionnaires, HIV prevention surveys, interviews, focus group discussions and long-term studies. They were also asked about involvement in studies that included blood draws, HIV prevention medications, behavioural treatments, new treatments or approaches, and drug safety.

To assess participant preferences regarding their potential involvement in HIV cure research, they were asked if they would be willing to participate in studies involving online questionnaires, in-person or phone interviews, focus group discussions, blood draws, tissue biopsies, leukapheresis or apheresis, latency reversing agents, gene editing, autologous or allogenic transplants, therapeutic vaccines, treatment interruption, broadly neutralising antibodies, unique proteins or T cells, new treatments untested on people, early safety studies and efficacy studies.

The subsequent portion of the questionnaire evaluated factors that would motivate participants to engage in HIV cure research. Participants were asked to indicate the level of importance for each of the following factors: gaining additional knowledge about HIV, having access to medical doctors, researchers or nurses, contributing to HIV cure research, hope for health improvement, payment for participation, care for the community, information about new treatment options, free laboratory work, free meals at the study site, money for transportation, care for future generations, contributions to scientific knowledge, the potential for a longer and healthier life for themselves, and the potential for a longer and healthier life for others.

To understand potential study risks that would discourage participation in HIV cure research, participants were asked whether various factors would dissuade them from engaging in research studies. These included toxicities or adverse side effects, the potential of drug resistance development, the potential of an increased viral load to do ART interruption, the activation of cancer-causing genes, graft-versus-host disease, invasive study procedures, long study visits, long-term follow-up, neurological side effects, gastrointestinal side effects, psychological side effects, HIV-related side effects, dermatological side effects, musculoskeletal side effects, allergic reactions, reproductive side effects, potential HIV transmission, unknown side effects, pain or discomfort, overnight hospital stays and taking time away from family or work.

Finally, general attitudes towards HIV cure research were assessed by asking participants their level of agreement with various statements regarding the impact of cost on a potential HIV cure, the potential dangers of a new cure, whether a cure is actually needed, the use of sexually transmitted infection (STI) prevention methods if an HIV cure were available, the need for more HIV cure research education, and whether they believed there

would ever be a cure for HIV. Participants were also asked about discrimination against PLWH and their level of trust for their healthcare provider.

All technical terms used in the questionnaire were accompanied by brief definitions and/or examples in layman's terms to improve participant comprehension.

Data collection

For data entry and database construction, REDCap (V.6.5.0) was used.³¹

Statistical analyses

A univariate analysis was performed to determine the association between demographic variables, perceptions and willingness to undergo different types of cure research studies using χ^2 tests or Fisher exact tests for categorical variables as well as Wilcoxon Rank-Sum tests for numeric variables. A univariate analysis was also performed on the association between demographic variables and 'Missing/Do Not Understand' responses in order to explore the characteristics of participants who failed to provide valid answers. For all comparisons, two-tailed p values <0.05 were considered statistically significant. All analyses were performed in Stata V.15.1 (StataCorp).

RESULTS

Demographics

The questionnaire was answered by 132 participants, and 14 responses were excluded because they did not meet the inclusion criteria (5 self-identified as transgender men, 5 self-identified as men, and 4 were under 18 years of age). The final sample size was 118 (table 1). The questionnaire application sites were diverse, representing each region of São Paulo (North, South, East, West and Downtown Zones), with the highest concentrations of eligible participants in the South and West Zones.

Participants mainly identified as mixed race (52%), white (29%) or Black (19%), with a median age of 33 years (minimum 18 years, maximum 62 years) in a skewed distribution towards younger than 36 (table 1). Forty-three per cent self-identified as transgender women, 40% as travestis and 17% as women. Regarding sexual orientation, 42% of participants identified as heterosexual. The study population had a limited level of education and employment, with 44% only having completed elementary or middle school and only 14% engaged in full-time work. Considering health status, 49% defined themselves as healthy and 40% had been diagnosed with HIV.

General attitudes towards HIV cure research

With respect to general attitudes towards HIV cure research, 73% of participants had previously heard about HIV cure research (table 2). Just over half of participants believed there was no HIV cure at the present time (58%) and that no one had been cured of HIV (54%); further, knowledge that someone had been cured of HIV was correlated with a higher education level (PR 1.24,

Table 1 Demographic characteristics of participants

	All participants N=118 (%)
Age (%)	
Median (min–max)	33 (18–62)
18–24 years old	17 (14)
25–35 years old	32 (27)
>36 years old	33 (28)
Missing	36 (31)
Race (%)	
White	29 (25)
Black	22 (19)
Mixed race	61 (52)
Native	4 (3)
Asian	–
Missing	2 (2)
Location (%)	
Clinical research centre (West)	38 (32)
LGBT centre (South)	39 (33)
Transgender housing (Downtown)	16 (14)
Sex worker house (East)	14 (12)
NICE Institute (North)	11 (9)
Sexual orientation (%)	
Bisexual	14 (12)
Homosexual	13 (11)
Questioning	7 (6)
Straight	49 (42)
Asexual	5 (4)
No identification	20 (17)
Other	7 (6)
Missing	3 (3)
Gender (%)	
Female	20 (17)
Transgender woman	51 (43)
Travesti	47 (40)
Other	–
Missing	–
Education (%)	
Incomplete elementary and middle school	37 (33)
Elementary and middle school	12 (11)
Incomplete high school	30 (26)
High school	23 (20)
Skilled training	5 (4)
Some college	5 (4)
Undergrad. degree	2 (2)
Some Grad. school	–

Continued

Table 1 Continued

	All participants N=118 (%)
Graduate degree	–
Employment status (%)	
Full-time work	17 (14)
Looking for work	37 (31)
No paid work by choice	10 (9)
Part-time work	6 (5)
Retired	–
Seasonal work	7 (6)
Student	21 (18)
Informal work	13 (11)
Other	11 (9)
Health status (%)	
Very health	24 (20)
Healthy	58 (49)
Somewhat healthy	19 (16)
Not very healthy	10 (9)
Not health at all	1 (1)
Missing	6 (5)
HIV status (%)	
Living with HIV	47 (40)
Fam/friends w/ HIV	39 (33)
Partner w/ HIV	3 (3)
At risk of HIV	13 (11)
Work in HIV field	11 (9)
None apply	23 (20)
Participation in health studies (%)	
Online questionnaire research	12 (10)
Interviews	26 (22)
Focus group discussions	41 (35)
Study with blood draws	28 (24)
Long-term study	4 (3)
None	30 (25)
Other	8 (7)

Max, maximum; Min, minimum.

95% CI 1.01 to 1.53, $p \leq 0.05$; [table 3](#)). Participants with a higher education level were also more likely to agree that PLWH are discriminated against in comparison to those with a lower education level (PR 1.21, 95% CI 0.98 to 1.49, $p \leq 0.05$; [table 4](#)); however, the majority of all study participants did agree that PLWH are discriminated against (64%). Most participants also agreed that more information about HIV cure research is needed before the community embraces it (66%), with employed participants being more likely to hold this belief in comparison to their unemployed counterparts (PR 0.83, 95% CI

Table 2 General attitudes towards HIV cure research

	Strongly agree N (%)	Agree N (%)	DNK N (%)	Disagree N (%)	Strongly disagree N (%)	Missing N (%)
High costs of HIV cure would prevent people from taking it	40 (34)	18 (15)	21 (18)	10 (9)	14 (12)	15 (13)
People living with HIV are discriminated against	52 (44)	24 (20)	7 (6)	5 (4)	9 (8)	21 (18)
The dangers of a new cure may be too high	16 (14)	25 (21)	26 (22)	5 (4)	11 (9)	35 (29)
We do not need a cure	11 (9)	7 (6)	17 (14)	38 (32)	21 (18)	24 (20)
A cure would prevent people from using HIV prevention methods	29 (25)	25 (21)	12 (10)	17 (14)	14 (12)	21 (18)
More education about cure research is needed before a cure is accepted by community	47 (40)	30 (26)	8 (7)	2 (2)	8 (7)	23 (20)
There will never be a cure for HIV	13 (11)	15 (13)	13 (11)	33 (28)	23 (20)	21 (18)
A cure that would stop the need for all treatment would be desirable	26 (22)	28 (24)	16 (14)	17 (14)	13 (11)	18 (15)
I can trust my healthcare provider's decisions on medical treatments	35 (30)	31 (26)	15 (13)	8 (7)	9 (8)	20 (17)
I completely trust my healthcare provider	36 (31)	28 (24)	17 (14)	8 (7)	10 (9)	19 (16)

DNK, do not know.

0.66 to 1.03, $p \leq 0.05$; [table 4](#)). A minority of participants thought that there is no need for an HIV cure (15%) or that there would never be a cure for HIV (24%), and almost half (47%) of respondents thought there would be a cure in the future. About half (56%) of participants were trusting of their physicians' medical decisions (56%) or completely trusted their physician (55%); there were no significant differences between the different demographic categories with respect to these beliefs.

Willingness to participate in HIV cure research

With respect to willingness to participate in HIV cure research, participants were more willing to engage in studies with hypothetical blood draws (57%), online surveys (52%), phone/in-person interviews (52%) or focus groups discussion (52%), whereas they were much less willing to interrupt ART (9%) or use broadly neutralising antibodies (8%) ([table 5](#)). In response to questions about gene editing, latency reversing agents, bone marrow transplants, or T cell therapy, there was a high

percentage of 'Missing/Not Sure/I Do Not Understand' responses (40%–69%) ([table 5](#)).

A limited education level was associated with less willingness to participate in a focus group (PR=0.86, 95% CI 0.75 to 0.99, $p=0.02$) ([table 6](#)). Further, those who were employed were less likely to participate in new drug research than those who were unemployed (PR=0.75, 95% CI 0.55 to 1.03, $p=0.01$). In comparison to self-identified transvestis, self-identified women and transgender women were less likely to participate in tissue biopsy research (PR=0.82, 95% CI 0.70 to 0.96, $p \leq 0.05$) and more likely to participate in safety studies (PR 1.24, 95% CI 1.00 to 1.52, $p=0.01$; [table 6](#)) Those who had already participated in health studies were less willing to participate in a safety study (PR=0.93; 95% CI 0.85 to 1.01, $p=0.27$) or efficacy study (PR=0.89; 95% CI 0.79 to 0.99, $p=0.17$).

Motivation for participation in HIV cure research

The greatest motivators for participation in HIV cure research were to gain additional knowledge about HIV

Table 3 Attitudes towards HIV cure research (higher vs lower education)

	Complete middle school or lower N=49			Incomplete high school or higher N=65			P value
	Answered N	Yes N (%)	Missing data N (%)	Answered N	Yes N (%)	Missing data N (%)	
Have you already heard about HIV cure research?	47	35 (71)	2 (4)	65	50 (77)	0	0.76
Do you believe someone has been cured from HIV?*	47	33 (67)	2 (4)	62	54 (83)	3 (5)	0.03
Do you believe that is an HIV cure available now?	47	19 (39)	2 (4)	62	24 (37)	3 (5)	0.86

Bolded values represent statistically significant findings ($p < 0.05$).

*PR 1.24, 95% CI (1.01 to 1.53), $\chi^2=0.03$.

PR, prevalence ratio.

Table 4 Prevalence ratio (PR) of general attitudes towards HIV cure research between groups based on gender, employment status, education and the belief that an HIV cure is available

	Gender (TGW/ W vs travestis)			Employment status (employed vs unemployed)			Education (at least high school vs until incomplete high school)			Believe that HIV cure is available (Yes vs No)		
	PR	95% CI	P value	PR	95% CI	P value	PR	95% CI	P value	PR	95% CI	P value
More education about cure research is needed before a cure is accepted by community	1.01	0.86 to 1.18	0.88	0.83	0.66 to 1.03	0.03	1.15	0.97 to 1.37	0.07	1.08	0.93 to 1.26	0.35
People living with HIV are discriminated against	1.03	0.87 to 1.24	0.74	0.97	0.79 to 1.19	0.78	1.21	0.98 to 1.49	0.04	1.15	0.99 to 1.35	0.11
A cure would prevent people from using HIV prevention methods	0.79	0.58 to 1.08	0.16	0.69	0.45 to 1.04	0.05	0.88	0.64 to 1.22	0.45	0.76	0.51 to 1.15	0.16
High costs of HIV cure would prevent people from taking it	0.97	0.73 to 1.29	0.86	0.80	0.58 to 1.12	0.17	1.31	0.97 to 1.76	0.07	1.04	0.78 to 1.37	0.81
I can trust my healthcare provider's decisions on medical treatments	1.03	0.82 to 1.29	0.80	0.79	0.60 to 1.05	0.07	1.11	0.89 to 1.39	0.35	0.91	0.71 to 1.17	0.44
A cure that would stop the need for all treatment would be desirable	1.08	0.77 to 1.51	0.66	0.72	0.48 to 1.08	0.08	0.89	0.64 to 1.23	0.48	1.05	0.75 to 1.46	0.78
I completely trust my healthcare provider	0.95	0.75 to 1.19	0.66	0.82	0.62 to 1.08	0.12	1.04	0.82 to 1.31	0.77	0.90	0.69 to 1.16	0.41
The dangers of a new cure may be too high	1.22	0.86 to 1.73	0.24	1.11	0.80 to 1.54	0.54	1.16	0.81 to 1.66	0.39	0.96	0.67 to 1.37	0.81
There will never be a cure for HIV	0.68	0.37 to 1.24	0.21	1.00	0.52 to 1.92	1.00	0.76	0.41 to 1.42	0.39	0.56	0.25 to 1.23	0.12
We do not need a cure	0.64	0.29 to 1.42	0.27	0.78	0.31 to 1.96	0.59	0.94	0.42 to 2.11	0.88	0.79	0.32 to 1.95	0.59

Bolded values represent statistically significant findings (p < 0.05).

Table 5 Willingness to participate in HIV cure research procedures

	Very willing N (%)	Willing N (%)	Not sure N (%)	Unwilling N (%)	Very unwilling N (%)	DNA N (%)	DNU N (%)	Missing N (%)
Online surveys	29 (25)	32 (27)	14 (12)	2 (2)	4 (3)	9 (8)	9 (8)	19 (16)
Phone/in-person interview	34 (29)	27 (23)	11 (9)	4 (3)	5 (4)	11 (9)	4 (3)	22 (19)
Focus group discussions	32 (27)	29 (25)	10 (9)	2 (2)	2 (2)	7 (6)	8 (7)	28 (24)
Blood draws	30 (25)	37 (31)	5 (4)	2 (2)	–	9 (8)	6 (5)	29 (25)
Tissue biopsies	22 (19)	25 (21)	16 (14)	3 (3)	3 (3)	10 (9)	14 (12)	25 (21)
Leukapheresis/apheresis	22 (19)	28 (24)	14 (12)	6 (5)	1 (1)	13 (11)	15 (13)	19 (16)
Latency reversing agents	12 (10)	16 (14)	23 (20)	4 (3)	5 (4)	15 (13)	23 (29)	20 (17)
Gene editing	15 (13)	16 (14)	25 (21)	5 (4)	4 (3)	12 (10)	21 (18)	20 (17)
Autologous transplants	18 (15)	19 (16)	27 (23)	2 (2)	–	12 (10)	20 (17)	20 (17)
Allogenic transplants	18 (15)	14 (12)	22 (19)	7 (6)	–	12 (10)	19 (16)	26 (22)
Therapeutic vaccines	30 (25)	28 (23)	13 (11)	4 (3)	2 (2)	11 (9)	13 (11)	17 (14)
Treatment interruption	19 (16)	15 (13)	20 (17)	7 (6)	4 (3)	17 (14)	19 (16)	17 (14)
Broadly neutralising antibodies	20 (17)	20 (17)	18 (15)	8 (7)	2 (2)	13 (11)	18 (15)	19 (16)
Unique proteins or T cells	19 (16)	13 (11)	22 (19)	5 (4)	–	13 (11)	25 (21)	21 (18)
New, untested treatments	22 (19)	27 (23)	18 (15)	3 (3)	2 (2)	13 (11)	13 (11)	20 (17)
Early safety studies	26 (26)	28 (24)	19 (16)	3 (3)	1 (1)	5 (4)	12 (10)	24 (20)
Efficacy studies	24 (20)	22 (19)	19 (16)	3 (3)	1 (1)	12 (10)	18 (16)	19 (16)

DNA, does not apply; DNU, do not understand.

infection (77%), the potential for a longer and healthier life for oneself (73%), and the potential for a longer and healthier life for others (73%). The least important motivators were free meals at a study site (12%) and access to study nurses (6%) (table 7). In comparison to self-identified travestis, self-identified transgender women and self-identified women were more likely to refer to access to physicians as a motivator to participate in research (PR=1.09; 95% CI 0.99 to 1.22, $p \leq 0.05$) and to assign contribution to scientific knowledge as a motivator to participate in HIV cure research (PR=1.13; 95% CI 1.00 to 1.26, $p \leq 0.05$; table 8). Those that believed an HIV cure is currently available were less likely to have health improvement as a motivator to participate in cure research (PR=0.89; 95% CI 0.79 to 1.01, $p \leq 0.05$) (table 8).

Identifiable risks that were most likely to discourage participation in research were dermatological side effects (43%), musculoskeletal side effects (41%), HIV-related side effects (40%), toxicities/adverse side effects (40%) and psychological side effects (39%) (table 9). Participants were also more likely to be discouraged to participate in research which required long study visits (19%), taking time away from work (19%) or having to stay in a hospital overnight (19%) (table 9).

People living with HIV (PLWH)

Within the study group, 47 participants (40%) were PLWH (table 1). Of those PLWH, the majority self-identified as women or transgender women (66%), were non-white (77%) and were unemployed (64%). Almost all of these

participants had heard of HIV cure research (85%), believed that PLWH are discriminated against (85%), and agreed that more education about HIV cure research was needed before being accepted by the community (91%) (table 10). Around half of these participants believed that someone had been cured from HIV (52%) and that an HIV cure was currently available (44%). Still, 41% believed there will never be a cure for HIV, and 29% believed that a cure is not needed. PLWH were very willing and motivated to be involved in HIV cure research, as a higher percentage of these participants were willing to participate in almost every type of study in comparison to participants that were not living with HIV, even if the study required treatment interruption (tables 11 and 12). Factors that were most likely to discourage PLWH from participating in HIV cure research included musculoskeletal side effects, toxicities and potential drug resistance development (table 13).

Missing data

The missing data due to non-responsiveness varied between different questions and sections, but it is an important aspect to consider when analysing the data. For questions on attitudes towards HIV cure research and motivations to participate in HIV cure research, there was a range of 22%–35% of missing data (tables 2 and 7). With respect to willingness and risks associated with participation in HIV cure research, the amount of missing data was even higher at 45%–65% (tables 5 and 9). Notably, PLWH answered more questions in comparison to participants

Table 6 Prevalence ratio (PR) of willingness to participate in HIV cure research procedures based on gender, employment status, education and the belief that an HIV cure is available

	Gender (TGW/ W vs travestis)			Employment status (employed vs unemployed)			Education (at least high school vs until incomplete high school)			Believe that HIV cure is available (Yes vs No)		
	PR	95% CI	P value	PR	95% CI	P value	PR	95% CI	P value	PR	95% CI	P value
New, untested treatments	1.17	0.91 to 1.49	0.12	0.75	0.55 to 1.03	0.01	1.05	0.88 to 1.26	0.57	1.07	0.91 to 1.27	0.45
Early safety studies	1.24	1.00 to 1.52	0.01	0.94	0.78 to 1.12	0.39	1.03	0.89 to 1.19	0.72	1.04	0.89 to 1.19	0.66
Focus group discussions	1.03	0.90 to 1.18	0.62	1.12	1.00 to 1.25	0.09	1.16	1.00 to 1.34	0.02	0.89	0.74 to 1.05	0.09
Tissue biopsies	0.82	0.70 to 0.96	0.05	0.97	0.77 to 1.22	0.79	1.03	0.84 to 1.26	0.76	0.89	0.71 to 1.12	0.25
Therapeutic vaccines	0.99	0.84 to 1.16	0.89	0.86	0.72 to 1.03	0.06	0.99	0.86 to 1.15	0.93	1.01	0.85 to 1.20	0.93
Autologous transplants	0.92	0.83 to 1.03	0.30	0.98	0.84 to 1.14	0.79	0.92	0.82 to 1.03	0.28	0.98	0.83 to 1.16	0.80
Efficacy studies	1.08	0.88 to 1.32	0.42	0.91	0.72 to 1.14	0.32	1.03	0.87 to 1.23	0.69	0.88	0.72 to 1.07	0.16
Blood draws	0.95	0.89 to 1.02	0.26	0.98	0.88 to 1.08	0.59	0.95	0.89 to 1.02	0.27	0.97	0.88 to 1.08	0.63
Online surveys	1.04	0.88 to 1.22	0.61	1.00	0.85 to 1.18	0.98	1.12	0.94 to 1.34	0.15	0.98	0.84 to 1.15	0.80
Leukapheresis/apheresis	1.00	0.81 to 1.25	0.97	1.04	0.86 to 1.26	0.69	1.08	0.88 to 1.32	0.45	0.87	0.70 to 1.08	0.18
Unique proteins or T cells	1.05	0.79 to 1.41	0.69	0.92	0.68 to 1.26	0.59	0.88	0.69 to 1.11	0.31	0.99	0.76 to 1.30	0.96
Broadly neutralising antibodies	1.14	0.83 to 1.55	0.38	0.86	0.63 to 1.18	0.29	0.92	0.71 to 1.21	0.57	1.00	0.74 to 1.36	0.98
Treatment interruption	0.85	0.62 to 1.17	0.37	0.72	0.44 to 1.20	0.13	1.02	0.71 to 1.45	0.92	0.78	0.52 to 1.15	0.17
Phone/in-person interview	1.05	0.86 to 1.27	0.63	1.09	0.92 to 1.30	0.35	1.14	0.94 to 1.39	0.15	0.86	0.68 to 1.09	0.16
Gene editing	0.85	0.62 to 1.17	0.36	0.79	0.53 to 1.18	0.20	0.87	0.63 to 1.21	0.42	0.92	0.65 to 1.29	0.61
Allogenic transplants	0.83	0.64 to 1.08	0.24	0.94	0.68 to 1.31	0.71	0.94	0.69 to 1.27	0.68	0.88	0.63 to 1.22	0.41
Latency reversing agents	1.20	0.77 to 1.87	0.38	1.00	0.67 to 1.49	1.00	1.25	0.85 to 1.84	0.25	0.97	0.63 to 1.49	0.89

Bolded values represent statistically significant findings ($p < 0.05$).

Table 7 Motivations to participate in HIV cure research

	Very important N (%)	Somewhat important N (%)	DNK N (%)	Barely important N (%)	Not important N (%)	DNA N (%)	Missing N (%)
Additional knowledge about HIV infection	61 (52)	29 (25)	7 (6)	1 (1)	1 (1)	9 (8)	10 (9)
Access to medical doctors/researchers	50 (42)	30 (25)	8 (7)	2 (2)	1 (1)	8 (7)	19 (16)
Access to study nurses	40 (34)	26 (22)	8 (7)	3 (3)	4 (3)	8 (7)	29 (25)
Feel good about contributing to HIV cure research	45 (38)	36 (31)	9 (8)	1 (1)	1 (1)	8 (7)	18 (15)
Hoping for health improvements	51 (43)	28 (24)	4 (3)	1 (1)	2 (2)	12 (10)	20 (17)
Care for community	50 (42)	30 (25)	7 (6)	1 (1)	1 (1)	7 (6)	22 (19)
Knowledge about new treatment options	51 (43)	29 (25)	8 (7)	1 (1)	–	6 (5)	23 (20)
Laboratory work without costs	50 (42)	29 (25)	5 (4)	1 (1)	3 (3)	8 (7)	22 (19)
Free meals at study sites	39 (33)	29 (25)	4 (3)	7 (6)	7 (6)	7 (6)	25 (21)
Payment for gas, parking, or transportation	46 (39)	30 (25)	6 (5)	2 (2)	2 (2)	9 (8)	23 (20)
Care for future generations	45 (38)	27 (23)	7 (6)	2 (2)	3 (3)	7 (6)	27 (23)
Contributions to scientific knowledge	51 (43)	29 (25)	8 (8)	2 (2)	2 (2)	9 (8)	17 (14)
Potential for longer, healthier life for self	58 (49)	28 (24)	7 (6)	–	1 (1)	8 (7)	16 (14)
Potential for longer, healthier life for others	60 (51)	26 (22)	5 (4)	1 (1)	3 (3)	9 (8)	14 (12)

DNA, does not apply; DNK, do not know.

not living with HIV, specifically regarding questions about awareness and willingness to participate in HIV cure research (tables 10 and 11). Further, participants who self-identified as travestis answered fewer total questions from this questionnaire compared with those identifying as women and transgender women.

DISCUSSION

This study is the first to report on attitudes to HIV cure research in a group of more than 100 transgender women and travestis in São Paulo, Brazil, South America's largest city. The study provides novel insight on the types of studies that transgender and travesti participants are most willing to participate in, such as online surveys, person-to-person interviews, focus group discussions and blood draws, as well as those they are least willing to participate in, such as complex studies involving gene editing or T cell therapy. This indicates that some complex studies, especially those which may expose participants to dermatological, musculoskeletal and psychological side effects, may need to find further means to encourage participation and inclusion of the transgender and travesti communities.

The study also reveals how intersecting demographic and social factors impact the overall perspective of transgender and travesti individuals, their general attitudes towards HIV cure research, and their willingness to participate in HIV cure studies. The study population had a limited level of education, and only 14% were engaged in full-time work. This may be explained, among other factors, by the hostile environment of schools and workplaces, with transgender people noting experiences of harassment, physical aggression and sexual violence in these spaces.³² Notably, those with a higher education or

employment status were significantly more likely to have knowledge that someone had been cured of HIV, agree that PLWH are discriminated against, and agree that more information about HIV cure research is needed before the community embraces it. This indicates that education and employment opportunities within the transgender community may lead to a greater understanding of HIV cure research and a larger engagement in HIV prevention and control strategies, as suggested in previous research.^{33 34} Studies in other low-income to middle-income Latin American countries indicate that early intervention programmes targeted towards those with lower levels of education and socioeconomic status can provide additional support and risk reduction opportunities.^{35 36} This demonstrates the vital importance of making these opportunities available to the transgender population, which are too often lacking in São Paulo.³⁷

In parallel with previous literature regarding medical mistrust within the transgender and broader LGBTQ+ communities,^{32 38} only about half of participants trusted their physician's decisions on medical treatments or completely trusted their physician. Because training in transgender health is limited in medical education due to social and institutional stigma,³⁹ many providers approach transgender patients with uncertainty and ambivalence.⁴⁰ This often manifests in a reinforced power dynamic between the patient and provider, resulting in loss of follow-up and lack of care engagement among the transgender population; ultimately, this functions to maintain the systems of inequality that contribute to health disparities.⁴¹ This highlights the ongoing need for physician education with respect to transgender healthcare and the establishment of spaces that make transgender patients

Table 8 Prevalence ratio (PR) of motivations to participate in HIV cure research based on gender, employment status, education and the belief that an HIV cure is available

	Gender (TGW/W vstravestis)			Employment status (employed vs unemployed)			Education (at least high school vs until incomplete high school)			Believe that HIV cure is available (Yes vs No)		
	PR	95%CI	P value	PR	95%CI	P value	PR	95%CI	P value	PR	95%CI	P value
Hoping for health improvements	1.04	0.95 to 1.14	0.39	1.01	0.92 to 1.09	0.98	1.04	0.95 to 1.14	0.39	0.89	0.79 to 1.01	0.02
Contributions to scientific knowledge	1.13	1.00 to 1.26	0.02	1.02	0.92 to 1.12	0.77	0.92	0.84 to 0.99	0.08	0.95	0.85 to 1.06	0.25
Access to medical doctors/researchers	1.09	0.99 to 1.22	0.03	1.04	0.99 to 1.09	0.29	0.99	0.91 to 1.07	0.77	1.00	0.92 to 1.10	0.92
Additional knowledge about HIV infection	1.06	0.98 to 1.15	0.06	1.04	0.99 to 1.09	0.31	0.96	0.91 to 1.01	0.23	0.99	0.93 to 1.06	0.78
Care for community	0.96	0.91 to 1.01	0.29	0.98	0.91 to 1.07	0.64	1.07	0.97 to 1.17	0.06	0.98	0.90 to 1.07	0.64
Feel good about contributing to HIV cure research	0.96	0.91 to 1.02	0.24	0.98	0.91 to 1.07	0.64	1.07	0.98 to 1.17	0.08	0.98	0.90 to 1.07	0.64
Knowledge about new treatment options	0.98	0.94 to 1.02	0.42	0.96	0.89 to 1.04	0.17	1.03	0.97 to 1.09	0.24	1.02	0.98 to 1.06	0.44
Potential for longer, healthier life for self	0.98	0.94 to 1.02	0.39	1.02	0.98 to 1.05	0.47	1.03	0.97 to 1.08	0.24	1.02	0.98 to 1.06	0.47
Laboratory work without costs	1.02	0.92 to 1.14	0.63	1.08	1.00 to 1.16	0.16	1.07	0.96 to 1.19	0.17	1.02	0.92 to 1.13	0.68
Potential for longer, healthier life for others	1.02	0.93 to 1.13	0.64	1.00	0.92 to 1.09	0.94	1.03	0.95 to 1.12	0.45	1.01	0.93 to 1.09	0.88
Payment for gas, parking or transportation	0.97	0.88 to 1.07	0.53	1.02	0.92 to 1.13	0.68	0.96	0.87 to 1.06	0.45	1.09	1.00 to 1.18	0.15
Care for future generations	1.05	0.93 to 1.19	0.42	1.02	0.92 to 1.24	0.72	1.05	0.93 to 1.20	0.40	1.09	1.00 to 1.20	0.12
Access to study nurses	1.08	0.92 to 1.28	0.32	0.93	0.79 to 1.11	0.38	0.99	0.85 to 1.16	0.92	0.96	0.81 to 1.15	0.66
Free meals at study sites	0.92	0.76 to 1.12	0.43	1.07	0.89 to 1.29	0.47	0.98	0.81 to 1.19	0.82	0.98	0.79 to 1.21	0.86

Bolded values represent statistically significant findings ($p < 0.05$).
TGW/W, transgender women and women.

**Table 9** Risks associated with discouraging participation in HIV cure research

	Very likely to discourage N (%)	Somewhat likely to discourage N (%)	Not likely to discourage N (%)	Not discouraging N (%)	DNK N (%)	DNA N (%)	Missing N (%)
Toxicities/adverse side effects	35 (30)	12 (10)	14 (12)	3 (3)	17 (14)	10 (9)	27 (23)
Potential for drug resistance development	31 (26)	11 (9)	13 (11)	5 (4)	19 (16)	15 (13)	24 (20)
Potential for virus returning if ART is stopped	31 (26)	9 (8)	7 (6)	5 (4)	25 (21)	14 (12)	27 (23)
Activation of cancer-causing genes	27 (23)	5 (4)	13 (11)	3 (3)	28 (24)	14 (12)	28 (24)
GVHD	29 (25)	8 (7)	9 (8)	3 (3)	28 (24)	12 (10)	29 (25)
Invasive study procedures	25 (21)	10 (9)	7 (6)	9 (8)	20 (17)	12 (10)	35 (30)
Long-term follow-up for safety and outcomes	28 (24)	12 (10)	10 (9)	8 (7)	24 (20)	10 (9)	26 (22)
Neurological side effects	23 (20)	18 (15)	10 (9)	5 (4)	17 (14)	16 (14)	29 (25)
Gastrointestinal side effects	26 (22)	17 (14)	10 (9)	7 (6)	18 (16)	15 (13)	25 (21)
Psychological side effects	29 (25)	17 (14)	9 (8)	7 (6)	17 (14)	13 (11)	26 (22)
HIV-related side effects	33 (28)	14 (12)	8 (7)	7 (6)	20 (17)	15 (13)	21 (18)
Dermatological side effects	37 (31)	14 (12)	5 (4)	6 (5)	21 (18)	13 (11)	22 (19)
Musculoskeletal side effects	33 (28)	15 (13)	9 (8)	6 (5)	15 (13)	14 (12)	26 (22)
Allergic reactions	29 (25)	13 (11)	11 (9)	3 (3)	15 (13)	17 (14)	30 (25)
Risk of giving HIV to sexual partners	32 (27)	10 (9)	11 (9)	2 (2)	18 (15)	13 (11)	32 (27)
Unknown side effects	26 (22)	11 (9)	6 (5)	3 (3)	22 (13)	19 (16)	31 (26)
Pain or discomfort	28 (24)	13 (11)	4 (3)	3 (3)	21 (18)	19 (16)	30 (25)
Having to stay in hospital overnight	18 (16)	12 (10)	10 (9)	12 (10)	19 (16)	19 (16)	28 (24)
Taking time away from family	19 (16)	13 (11)	12 (10)	9 (8)	14 (12)	23 (20)	28 (24)
Taking time away from work	20 (17)	11 (9)	11 (9)	12 (10)	16 (14)	20 (17)	28 (24)
Long study visits (4+ hours)	22 (19)	11 (9)	12 (10)	11 (9)	17 (14)	19 (16)	26 (22)

DNA, does not apply; DNK, do not know.

feel supported and welcome, which have been shown to improve health outcomes and overall engagement with care.^{42 43} It also supports a potential explanation for why this community is often unengaged with their health status or HIV cure research initiatives, as the physician–transgender patient relationship is seen to lack trust or true understanding.⁴⁴

It was also important to consider how an HIV diagnosis could potentially impact participant attitudes towards HIV cure research. In this study, 40% of participants were living with HIV, the majority of which were non-white and unemployed. This supports the findings of previous studies that have indicated the increased HIV vulnerability for non-white (specifically Black) transgender individuals as well as those who are not engaged with the formal labour market.^{18 20 32 38} In almost every type of study considered in the questionnaire, PLWH were more willing and motivated to participate in HIV-cure research compared with participants not living with HIV. As supported by previous studies, this suggests that PLWH are some of the most willing to participate in HIV cure research and are often motivated by altruistic factors and the ability to contribute to scientific advancement.^{45 46} Still, the general study

population expressed being highly motivated to participate in HIV cure research, specifically to gain additional knowledge about HIV infection and the potential for a longer, healthier life for all. Again, this demonstrates that participation in HIV cure research is often rooted in altruistic motivations and the pursuit for more information rather than material or financial benefits^{45 47}; therefore, by providing HIV-related education and clear explanations on how HIV cure research is benefitting populations most affected by the epidemic, researchers can potentially engage more participants in studies and/or HIV prevention/care.⁴⁸

With respect to study limitations, an important feature was the participant ambivalence to several of the questions, demonstrated through the amount of missing data and uncertainty in responses. Other quantitative studies approaching HIV cure with self-completed questionnaires have demonstrated similar results in missing data, with an answer rate around 60%.⁴⁹ One potential explanation for the missing data could be the questionnaire language, which may have been too technical for some participants, with only 44% having completed elementary or middle school. In future HIV cure research studies involving this population, we recommend including less technical word

Table 10 General attitudes towards HIV cure research (HIV+ vs HIV- participants)

	HIV+ N=47			HIV- N=71			PR
	Answered N	Yes %	Missing data N (%)	Answered N	Yes %	Missing data N (%)	P value
Have you already heard about HIV cure research?	46	85	1 (2)	69	70	2 (3)	0.06
Do you believe someone has been cured from HIV?	46	52	1 (2)	70	40	1 (1)	0.19
Do you believe that there is an HIV cure available now?	43	44	4 (8)	70	36	1 (1)	0.37
More education about cure research is needed before a cure is accepted by community	35	91	12 (25)	52	87	19 (27)	0.48
I can trust my healthcare provider's decisions on medical treatments	38	87	9 (19)	45	73	26 (37)	0.13
I completely trust my healthcare provider	37	87	10 (21)	45	71	26 (37)	0.09
The dangers of a new cure may be too high	24	83	23 (49)	33	63	38 (54)	0.10
People living with HIV are discriminated against	39	85	8 (17)	51	84	20 (28)	0.97
High costs of HIV cure would prevent people from taking it	38	71	9 (19)	44	71	27 (38)	0.95
A cure that would stop the need for all treatment would be desirable	37	70	10 (21)	47	60	24 (34)	0.31
A cure would prevent people from using HIV prevention methods	34	65	13 (28)	51	63	20 (28)	0.85
There will never be a cure for HIV	32	41	15 (32)	52	29	19 (27)	0.27
We do not need a cure	34	29	13 (28)	43	19	28 (39)	0.27

PR, prevalence ratio.

choices and ensuring that those at a low reading level can fully understand the questionnaire.

It is also important to consider the potential sampling bias in the study, as convenience sampling was used in

order to obtain the desired sample size. Perspectives were limited to transgender women and travestis already seeking assistance or resources at the study sites, which may have influenced their level of knowledge regarding

Table 11 Willingness to participate in HIV cure research procedures (HIV+ vs HIV- participants)

	HIV+ N=47			HIV- N=71			PR
	Answered N	Yes %	Missing data N (%)	Answered N	Yes %	Missing data N (%)	P value
Autologous transplants	22	100	25 (53)	17	88	54 (76)	0.09
Efficacy studies	20	100	27 (57)	30	87	30 (42)	0.09
Blood draws	29	100	18 (38)	40	95	31 (44)	0.22
Early safety studies	30	97	17 (36)	28	89	43 (61)	0.27
Therapeutic vaccines	32	94	15 (32)	32	88	39 (55)	0.39
Tissue biopsies	28	93	19 (40)	25	84	46 (65)	0.31
New, untested treatments	26	92	21 (45)	28	89	43 (61)	0.70
Online surveys	26	92	21 (45)	41	90	30 (42)	0.77
Leukapheresis/apheresis	23	91	24 (51)	34	85	37 (52)	0.49
Unique proteins or T cells	20	90	27 (57)	17	82	54 (76)	0.49
Focus group discussions	29	90	18 (38)	36	97	35 (49)	0.20
Broadly neutralising antibodies	26	89	21 (45)	24	71	47 (66)	0.12
Treatment interruption	24	88	23 (49)	21	62	50 (70)	0.04
Phone/in-person interview	30	87	17 (36)	40	88	31 (44)	0.91
Gene editing	21	86	26 (55)	19	68	52 (73)	0.19
Allogenic transplants	20	85	27 (57)	19	79	52 (73)	0.62
Latency reversing agents	18	78	29 (62)	19	74	52 (73)	0.77

PR, prevalence ratio.

**Table 12** Motivations to participate in HIV cure research (HIV+ vs HIV- participants)

	HIV+ N=47			HIV- N=71			PR
	Answered N	Yes %	Missing data N (%)	Answered N	Yes %	Missing data N (%)	P value
Hoping for health improvements	35	100	12 (25)	47	94	24 (34)	0.13
Additional knowledge about HIV infection	41	98	6 (13)	51	98	20 (28)	0.88
Access to medical doctors/researchers	37	97	10 (21)	46	96	25 (35)	0.69
Feel good about contributing to HIV cure research	36	97	11 (23)	47	98	24 (34)	0.85
Knowledge about new treatment options	36	97	11 (23)	45	100	26 (37)	0.26
Potential for longer, healthier life for self	38	97	9 (19)	49	100	22 (31)	0.25
Care for community	37	95	10 (21)	45	100	26 (37)	0.11
Laboratory work without costs	35	94	12 (25)	48	96	23 (32)	0.75
Contributions to scientific knowledge	35	94	12 (25)	49	96	22 (31)	0.73
Potential for longer, healthier life for others	40	93	7 (15)	50	98	21 (29)	0.21
Payment for gas, parking or transportation	35	91	12 (25)	45	98	26 (37)	0.19
Care for future generations	37	89	10 (21)	40	98	31 (44)	0.14
Access to study nurses	33	85	14 (30)	40	95	31 (44)	0.14
Free meals at study sites	36	83	11 (23)	46	83	25 (35)	0.93

PR, prevalence ratio.

Table 13 Risks associated with discouraging participation in HIV cure research (HIV+ vs HIV- participants)

	HIV+ N=47			HIV- N=71			PR
	Answered N	Yes %	Missing data N (%)	Answered N	Yes %	Missing data N (%)	P value
Musculoskeletal side effects	33	76	14 (30)	36	64	35 (49)	0.28
Dermatological side effects	37	73	10 (21)	41	60	30 (42)	0.18
Psychological side effects	30	73	17 (36)	40	60	31 (44)	0.24
Toxicities/adverse side effects	29	72	18 (38)	38	68	33 (47)	0.72
Potential for drug resistance development	28	71	19 (40)	38	56	33 (47)	0.26
HIV-related side effects	34	71	13 (28)	40	58	31 (44)	0.24
Pain or discomfort	31	71	16 (34)	34	56	37 (52)	0.21
Gastrointestinal side effects	33	70	14 (30)	35	57	36 (50)	0.28
Neurological side effects	26	69	21 (44)	37	62	34 (48)	0.56
Unknown side effects	29	69	18 (38)	33	52	38 (54)	0.16
Potential for virus rebound if ART is stopped	29	66	18 (38)	41	51	30 (42)	0.23
Taking time away from family	27	59	20 (42)	28	57	43 (61)	0.87
Long-term follow-up for safety and outcomes	31	58	16 (34)	41	54	30 (42)	0.71
Long study visits (4+ hours)	30	57	17 (36)	31	52	40 (56)	0.69
Activation of cancer-causing genes	28	54	19 (40)	35	49	36 (51)	0.69
GVHD	28	54	19 (40)	40	55	31 (44)	0.90
Taking time away from work	27	52	20 (42)	32	53	39 (55)	0.92
Invasive study procedures	27	48	20 (42)	37	60	34 (48)	0.37
Having to stay in hospital overnight	29	48	18 (38)	32	50	39 (55)	0.89
Allergic reactions	28	23	19 (40)	32	60	39 (55)	0.05

GVHD, graft versus host disease; PR, prevalence ratio.

HIV prevention, treatment and cure research. This potential bias was mitigated by choosing study sites that encompassed all regions of the city and recruited participants from a range of backgrounds and experiences. Still, it is essential to recognise the vast diversity that exists within the transgender and travesti population. Some transgender women and travestis, such as those with a higher socioeconomic status or those who have experienced a social transition, may be under-represented due to their lack of involvement with the sites involved in this study. Additionally, these data only refer to São Paulo and its metropolitan area. Therefore, the results cannot be generalised beyond the scope of the study.

Finally, although the study attempted to assess the impact of intersecting social factors, such as stigma, racism, employment and education opportunities, due to the sample size, some of the comparative variables could not be analysed to find statistically significant results. Thus, the impact of social and demographic variables likely plays a larger role in attitudes towards HIV cure research than indicated in the results of this study. Future studies should attempt to obtain a greater sample size with a larger number of participants belonging to each demographic category. Further, the study did not address how other medical conditions or the use of hormone therapy could potentially have an impact on participant perspectives. Therefore, future HIV cure research investigations should evaluate whether concurrent medical conditions or the use of hormonal therapies within the participant population has an impact on their overall attitudes.

In conclusion, this study provides novel insight on attitudes to HIV cure research in the transgender women and travesti populations of São Paulo as well as the improvements that are needed to strengthen the dialogue between scientists and the populations that are most affected by HIV. It serves as a primary analysis of these attitudes and the social context in which they are formed, providing important information for future HIV cure research. Considering this study's initial research questions, the meaning of 'HIV cure' varies greatly, even within a specific community that shares many experiences and is impacted by similar social factors. It is evident that various forms of marginalisation and stigma towards the transgender and travesti population are ingrained in several aspects of Brazilian society, specifically education,^{35 36 39} the labour market^{18 19 34} and healthcare.^{7 38 41} Because of these barriers, it is unclear whether an HIV cure would affect the social position of PLWH and the broader transgender community, as it would only address one aspect of a complex web of intersecting issues.⁵⁰ Still, this population appears to be motivated and willing to be a part of scientific and clinical initiatives that push us closer to a cure.^{45–47} This exemplifies the importance of HIV cure research and education that appreciate the social perspectives of this population, consider the broader social context, and find ways to meet the needs and preferences of the community. Through this approach, inclusive HIV cure research provides an opportunity to inform

participants, engage them with care, and move closer to the goal of ending the epidemic.⁵¹

As we move forward towards this goal, it is essential to develop more educational collaborations between scientific investigators, community educators, transgender-identifying people and travestis in order to ensure that future HIV cure research is inclusive and supportive of the perspectives of the trans-identifying community. We must also advocate for public policies that support inclusive actions to reduce stigma, discrimination, violence and transphobia in educational, employment and health-care institutions. Especially in the context of transgender health, scientific advancement and social mobilisation must function simultaneously in order to protect, support and uplift this vulnerable population.

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REFERENCES

- Costa AB, Fontanari AMV, Jacinto MM, *et al*. Population-based HIV prevalence and associated factors in male-to-female transsexuals from Southern Brazil. *Arch Sex Behav* 2015;44:521–4.
- Saúde BMda, Vigilância Dde. *Prevenção E Controle das IST, do HIV/AIDS E das Hepatites Virais. Relatório de Monitoramento Clínico do HIV*. Brasília: Ministério da Saúde, 2018. <http://www.aids.gov.br/pt-br/pub/2018/relatorio-de-monitoramento-clinico-do-hiv-2018>. (Accessed 27 Feb 2019).
- Benzaken AS, Pereira GFM, Costa L, *et al*. Antiretroviral treatment, government policy and economy of HIV/AIDS in Brazil: is it time for HIV cure in the country? *AIDS Res Ther* 2019;16:19.
- Jalil EM, Grinsztejn B, Velasque L, *et al*. Awareness, willingness, and PrEP eligibility among transgender women in Rio de Janeiro, Brazil. *J Acquir Immune Defic Syndr* 2018;79:445–52.
- Baral S, Rao A, Sullivan P, *et al*. The disconnect between individual-level and population-level HIV prevention benefits of antiretroviral treatment. *Lancet HIV* 2019;6:e632–8.
- UNAIDS. 90-90-90 an ambitious treatment target to help end the AIDS epidemic, 2014. Available: https://www.unaids.org/sites/default/files/media_asset/90-90-90_en.pdf [Accessed 27 Feb 2019].
- Sevelius J, Murray LR, Martinez Fernandes N, *et al*. Optimising HIV programming for transgender women in Brazil. *Cult Health Sex* 2019;21:543–58.
- Clutton GT, Jones RB. Diverse impacts of HIV latency-reversing agents on CD8+ T-cell function: implications for HIV cure. *Front Immunol*;2018:1452.
- Gupta RK, Abdul-Jawad S, McCoy LE, *et al*. HIV-1 remission following CCR5Δ32/Δ32 haematopoietic stem-cell transplantation. *Nature* 2019;568:244–8.
- The Lancet HIV. Like London buses, two putative cure cases arrive at once. *Lancet HIV* 2019;6:e205.
- Hütter G, Nowak D, Mossner M, *et al*. Long-term control of HIV by CCR5 Delta32/Delta32 stem-cell transplantation. *N Engl J Med* 2009;360:692–8.
- Keller M. Ending AIDS: reach vulnerable populations or risk erasing gains made against HIV. *Vax* 2016;14.
- Benotsch EG, Zimmerman RS, Cathers L, *et al*. Non-medical use of prescription drugs and HIV risk behaviour in transgender women in the Mid-Atlantic region of the United States. *Int J STD Aids* 2016;27:776–82.
- Cutuli, María Soledad. *Antropología y travestismo : revisando las etnografías latinoamericanas recientes*. Sudamérica: Revista de Ciencias Sociales, 2012: 1.1. 161–81.
- Campuzano G. Reclaiming *Travesti* Histories. *IDS Bull* 2006;37:34–9.
- Wilson Y, White A, Jefferson A, *et al*. Intersectionality in clinical medicine: the need for a conceptual framework. *Am J Bioeth* 2019;19:8–19.
- Bastos FI, Bastos LS, Coutinho C, *et al*. HIV, HCV, HBV, and syphilis among transgender women from Brazil: assessing different methods to adjust infection rates of a hard-to-reach, sparse population. *Medicine* 2018;97:S16–24.
- Silva MAD, Luppi CG, Veras M. Work and health issues of the transgender population: factors associated with entering the labor market in the state of São Paulo, Brazil. *Trabalho E saúde Na população transexual: fatores associados inserção no mercado de trabalho no estado de São Paulo, Brasil. Cien Saude Colet* 2020;25:1723–34.
- Hatzenbuehler ML, Phelan JC, Link BG. Stigma as a fundamental cause of population health inequalities. *Am J Public Health* 2013;103:813–21.
- Grinsztejn B, Jalil EM, Monteiro L, *et al*. Unveiling of HIV dynamics among transgender women: a respondent-driven sampling study in Rio de Janeiro, Brazil. *Lancet HIV* 2017;4:e169–76.
- Fonseca MGP, Lucena FdeFA, Sousa Ade, *et al*. AIDS mortality, ‘race or color’, and social inequality in a context of universal access to highly active antiretroviral therapy (HAART) in Brazil, 1999–2004. *Cad Saude Publica* 2007;23:S445–55.
- Masculinidade BLE. *raça/cor E saúde. Ciênc Saúde Coletiva* 2005;10:71–80.
- Lopes F. Mulheres negras E não negras vivendo CoM HIV/AIDS no Estado de São Paulo: um estudo sobre suas vulnerabilidades. *Revista de Saúde Pública* 2007;41:39–46.
- Martins TA, Kerr LRFS, Macena RHM, *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.
- Krüger A, Sperandei S, Bermudez XPCD, *et al*. Characteristics of hormone use by travestis and transgender women of the Brazilian federal district. *Rev Bras Epidemiol* 2019;22:e190004.
- Deutsch MB, Glidden DV, Sevelius J, *et al*. HIV pre-exposure prophylaxis in transgender women: a subgroup analysis of the iPrEx trial. *Lancet HIV* 2015;2:e512–9.
- Grant RM, Anderson PL, McMahan V, *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.
- Magnani R, Sabin K, Saidel T, *et al*. Review of sampling hard-to-reach and hidden populations for HIV surveillance. *AIDS* 2005;19:S67–72.
- Dubé K, Auerbach JD, Stirratt MJ, *et al*. Applying the behavioural and social sciences research (BSSR) functional framework to HIV cure research. *J Int AIDS Soc* 2019;22:e25404.
- Tullis T, Albert B, Metrics S-R. Measuring the user experience collecting, analyzing, and presenting usability metrics. *Amsterdam, Netherlands: Elsevier* 2013;6:121–61.
- Harris PA, Taylor R, Thielke R, *et al*. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377–81.
- Grant JM, Mottet LA, Tanis J, *et al*. *Injustice at every turn: a report of the National transgender discrimination survey, executive summary*. Washington: National Center for Transgender Equality and National Gay and Lesbian Task Force, 2011.
- Baral SD, Poteat T, Strömdahl S, *et al*. Worldwide burden of HIV in transgender women: a systematic review and meta-analysis. *Lancet Infect Dis* 2013;13:214–22.
- Poteat T, Wirtz AL, Radix A, *et al*. HIV risk and preventive interventions in transgender women sex workers. *Lancet* 2015;385:274–86.
- Andrade FCD, Mehta JD. Increasing educational inequalities in self-rated health in Brazil, 1998–2013. *PLoS One* 2018;13:e0196494.
- Deuba K, Sapkota D, Shrestha U, *et al*. Effectiveness of interventions for changing HIV related risk behaviours among key populations in low-income setting: a meta-analysis, 2001–2016. *Sci Rep* 2020;10:2197.
- Magno L, Silva L, Veras MA, *et al*. Stigma and discrimination related to gender identity and vulnerability to HIV/AIDS among transgender women: a systematic review. *Estigma E discriminação relacionados identidade de gênero E vulnerabilidade AO HIV/AIDS entre mulheres transgênero: revisão sistemática. Cad Saude Publica* 2019;35:e00112718.
- Costa AB, da Rosa Filho HT, Pase PF, *et al*. Healthcare needs of and access barriers for Brazilian transgender and gender diverse people. *J Immigr Minor Health* 2018;20:115–23.
- Obedin-Maliver J, Goldsmith ES, Stewart L, *et al*. Lesbian, gay, bisexual, and transgender-related content in undergraduate medical education. *JAMA* 2011;306:971–7.
- Norton AT, Herek GM. Heterosexuals’ attitudes toward transgender people: findings from a National Probability sample of U.S. adults. *Sex Roles* 2013;68:738–53.
- Poteat T, German D, Kerrigan D. Managing uncertainty: a grounded theory of stigma in transgender health care encounters. *Soc Sci Med* 2013;84:22–9.
- Collier R. Addressing transgender discrimination in health. *CMAJ* 2015;187:E493.
- White Hughto JM, Reisner SL, Pachankis JE. Transgender stigma and health: a critical review of stigma determinants, mechanisms, and interventions. *Soc Sci Med* 2015;147:222–31.
- Ferreira ACG, Coelho LE, Jalil EM, *et al*. Transcendendo: a cohort study of HIV-infected and uninfected transgender women in Rio de Janeiro, Brazil. *Transgend Health* 2019;4:107–17.
- Chin LJ, Berenson JA, Klitzman RL. Typologies of Altruistic and financial motivations for research participation. *J Empir Res Hum Res Ethics* 2016;11:299–310.
- Tarimo EAM, Bakari M, Kakoko DCV, *et al*. Motivations to participate in a phase I/II HIV vaccine trial: a descriptive study from Dar ES Salaam, Tanzania. *BMC Public Health* 2016;16:182.

- 47 Arnold MP, Evans D, Vergel N. Recruitment and ethical considerations in HIV cure trials requiring treatment interruption. *J Virus Erad* 2015;1:43–8.
- 48 Power J, Westle A, Dowsett GW, *et al.* Perceptions of HIV cure research among people living with HIV in Australia. *PLoS One* 2018;13:e0202647.
- 49 Sylla L, Evans D, Taylor J, *et al.* If we build it, will they come? perceptions of HIV cure-related research by people living with HIV in four U. S. cities: a qualitative focus group study. *AIDS Res Hum Retroviruses* 2018;34:56–66.
- 50 Jackson-Best F, Edwards N. Stigma and intersectionality: a systematic review of systematic reviews across HIV/AIDS, mental illness, and physical disability. *BMC Public Health* 2018;18:919.
- 51 Giroir BP. The time is now to end the HIV epidemic. *Am J Public Health* 2020;110:22–4.