The rising tide of HIV among young men who have sex with men in Brazil: insights from the Conectad@s study

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Summary

Background Young gay, bisexual, and other men who have sex with men (YMSM) in Latin America experience disproportionately high rates of HIV. While new case numbers have stabilised in other demographics, the incidence of HIV in this particular group continues to rise. We estimated the prevalence of HIV and sexually transmitted infections (STI) and identified correlates of new HIV diagnoses among YMSM in Brazil.

Methods Conectad@s was a respondent-driven sampling-based study to recruit and engage YMSM in HIV prevention and treatment services in Rio de Janeiro, Brazil (November 2021–October 2022). Eligibility criteria were age 18–24 years and self-identification as MSM (cis/trans) or non-binary person who have sex with men. Participants underwent HIV/STI testing and completed a socio-behavioural questionnaire. We described baseline characteristics by HIV status and used logistic regression models to identify correlates of new HIV diagnoses. Trial ID: DERR1-10.2196/34885.

Findings Among 409 participants, 370 (90.5%) self-identified as cisgender men, nine (2.2%) transgender men, and 30 (7.3%) non-binary. Median age was 21 years (IQR: 20–23), with 80 (19.6%) aged 18–19 years. Most self-identified as Black or *Pardo* (70.6%); 109 (26.7%) never tested for HIV. HIV prevalence was 9.8%; 50% (n = 20/40) were newly diagnosed with HIV. Only nine participants ever used PrEP and three were currently using it. Overall, 133 (32.5%) reported sexual violence in their lifetime and 102 (24.9%) reported a suicide attempt. Prevalence of active syphilis, chlamydia, and gonorrhoea were 14.4%, 15.9%, and 14.7%, respectively. New HIV diagnoses were positively associated with engaging in high-risk behaviour (aOR 4.88 [95% CI: 1.88–13.40]) and anxiety (aOR 2.67 [95% CI: 1.01–7.70]), and negatively associated with ever disclosing sexual orientation (aOR 0.19 [95% CI: 0.04–0.92]) and HIV knowledge (aOR 0.77 [95% CI: 0.59–1.01]).

Interpretation High prevalence of HIV coupled with a high proportion of new HIV diagnoses underscore a potentially growing HIV epidemic among YMSM in Brazil.

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Keywords: Sexual and gender minorities; Young MSM; HIV prevention; Pre-exposure prophylaxis (PrEP); Brazil; Latin America

Introduction

Young gay, bisexual and other men who have sex with men (YMSM) face disproportionately high rates of HIV in Latin America, with escalating HIV case rates persisting despite a plateau of new cases in other populations.[1,2] Most people living with HIV in Latin America reside in Brazil (60%).[3] Annualised HIV incidence among MSM in Brazil was recently estimated at 2.62% (95% CI 1.78–3.43) being higher among YMSM aged 18–24 years [3.48% (95% CI 1.99–4.94)].[4] Furthermore, 25% of men diagnosed with HIV in the country (2007–2023) were aged 15–24 years.[5]

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Research in context

Evidence before this study

The HIV epidemic in Latin America disproportionally affects specific populations, particularly gay, bisexual, and other men who have sex with men (MSM). While the HIV prevalence in the adult general population is 0.4% in Latin America, the estimated HIV prevalence among MSM is 12.6%. HIV case rates continue to climb among young MSM (YMSM) aged 18–24 years, despite a plateau in new cases in other populations. A systematic review published in 2021 analysed studies from January 2010 to May 2020 estimating HIV prevalence among YMSM in Latin America. Nineteen studies (15 using probability-based sampling methods and 4 non-probability-based sampling) reported HIV prevalence estimates among YMSM, with more than half exceeding 5.0%.

On January 11, 2024, we conducted a search on PubMed using the same terms employed in the systematic review related to "MSM", "HIV", "prevalence" and "Latin America", with a restriction to manuscripts published after May 2020. We found 29 manuscripts; only one reported HIV prevalence among MSM aged 15–19 years (5.9%) screened for the PrEP 15-19 project in Salvador, Brazil (February 2019 to February 2021). Additionally, the ImPrEP seroincidence study estimated annualized HIV incidence among YMSM in Brazil at 3.48% (95% CI: 1.99–4.94) and in Peru at 9.77% (95% CI: 5.77–13.69). However, none of these studies were designed to comprehensively reach and estimate HIV prevalence among YMSM in Latin America using probability-based sampling methods.

Added value of this study

The Conectad@s study enhances existing research by focusing specifically on YMSM in Brazil, a region with one of the highest HIV rates in Latin America. Unlike previous studies, which often amalgamated data across diverse age groups and sexual orientations, our research delves into the unique challenges and needs of YMSM, providing detailed insights, for which the literature is incomplete. One of the key contributions of this manuscript is that we present data collected from YMSM in Brazil post-PrEP implementation in the universal public health care and private care systems. Employing innovative digital recruitment methods, tailored to the communication habits of younger populations, facilitated substantial participant engagements. Additionally, the study's mixed-method approach, integrating quantitative and qualitative data, offers a more nuanced understanding of the interplay between socio-behavioural factors and HIV risk among YMSM.

Implications of all the available evidence

The findings derived from the Conectad@s study, when combined with existing evidence, underscore the imperative necessity for targeted HIV prevention and treatment strategies for YMSM in Latin America. YMSM in the region face unique challenges, characterized by elevated rates of stigma, discrimination, and socio-economic barriers, amplifying susceptibility to HIV. Our research highlights the significance of culturally sensitive and accessible health services capable of addressing these barriers. Additionally, the study's results advocate for the integration of digital tools in public health strategies to effectively reach and engage younger populations. The insights gained from this study should inform future policies and interventions aimed at reducing HIV incidence among YMSM in Brazil and similar contexts worldwide.

Oral HIV pre-exposure prophylaxis (PrEP) has been available at no direct cost to users within the Brazilian Public Health System (SUS) since 2017, with recent approval for adolescents aged 15–17 years. Despite its availability, the implementation of PrEP as a public policy has been insufficient to curb the HIV epidemic in Brazil, especially among youth. Data from ImPrEP, the largest PrEP implementation study in Latin America, indicate that MSM and transgender women aged 18–24 years had higher HIV incidence, increased odds of early loss to follow-up and lower odds of PrEP adherence compared to their older counterparts.[6] Factors like stigma, discrimination, and violence, more prevalent among the youth, are important barriers to health and may both affect vulnerability for HIV and contribute to low PrEP uptake.[7]

Data on socio-behaviour and prevention uptake among YMSM in Latin America are scarce.[1] Conectad@s was a mixed-methods study that included recruitment through a respondent-driven sampling (RDS)-based approach to specifically reach and engage YMSM in HIV prevention and treatment services in Rio de Janeiro, Brazil.[8] We hereby describe socio-behavioural characteristics of Conectad@s participants, estimate the prevalence of HIV and other sexually transmitted infections (STI) at baseline, and identify correlates of new HIV diagnosis.

Methods

Study design and participants

Conectad@s, a mixed-method study developed by the Instituto Nacional de Infectologia Evandro Chagas (INI), at the Fundação Oswaldo Cruz (Fiocruz), in Rio de Janeiro, Brazil, and the San Francisco Department of Public Health, United States, employed long chains of peer referrals (i.e., RDS-based methods) to recruit a diverse sample of YMSM between November 2021 and October 2022. The detailed study design and procedures are described elsewhere.[8] Briefly, following a formative

phase, we purposively selected initial participants ('seeds') based on their connections to other YMSM, their enthusiasm about the research, and diversity of demographic characteristics. Seeds and their referrals were invited to recruit their peers to the study, creating successive waves of enrolment to reach diverse social networks.[9] Participants received a primary incentive upon study enrolment ($20 and a gift) and a secondary incentive ($10 and a gift) for each peer enrolled, with gifts including a mug, card holder, rainbow pin badge, and eco-friendly bag.

Digital coupons were employed for recruitment, a strategy previously utilized in San Francisco for recruiting young transgender women.[10] The paper coupons were transformed into a digital format suitable for sharing via mobile phone, tailored to the ways in which young people interact with their mobile phones. Each digital coupon had a QR Code and an identification number to track the participant who was referring the potential participant. Our team established a system, utilizing the QR Code, to manage the distribution of secondary incentives. Every participant, including the seeds, received instructions on how to recruit peers and the digital coupon through *WhatsApp*. Digital coupons were particularly advantageous amid the constraints imposed by the COVID-19 pandemic, offering added benefits over physical coupons by preventing loss.

Eligible participants were aged 18–24 years, self-identified as man (cisgender or transgender) or non-binary/queer persons assigned male sex at birth, sexually attracted to men, lived in the Rio de Janeiro metropolitan area, and had a digital referral coupon.

This study was approved by the INI-Fiocruz Institutional Review Board (CAAE: 26086719.0.0000.5262). All study participants provided either oral or written informed consent to participate. This study is registered at the International Registered Report Identifier (IRRID): DERR1-10.2196/34885.

Procedures

Potential participants who received a digital coupon could schedule a study appointment or visit the site as drop-in. After written informed consent, a trained interviewer administered a structured socio-behavioural questionnaire. We collected information on socio-demographics (age, gender, region, sexual orientation, race, education, and income), health (private health insurance, previous HIV/STI testing/diagnosis, PrEP knowledge/use), sexual behaviour, sexual orientation disclosure, mental health, and sexual violence.

We used validated measures to assess engagement in HIV risk behaviour (HIV risk scale; 0–2 points: low-risk; 3–8 points: middle-risk; ≥9 points: high-risk),[11] HIV knowledge (HIV/AIDS Knowledge Assessment tool [HIV-KA]; 12-items with scores ranging from 0 to 12, high scores mean high HIV knowledge),[12] internalised homonegativity (Reactions to Homosexuality Scale [RHS]; 7-items with scores ranging 0–42; high scores indicate greater internalized homonegativity),[13] discrimination (Explicit Discrimination Scale [EDS]; 18-items with scores ranging 0–54; higher scores indicate more experiences of discrimination),[14,15] anxiety and depression (Patient Health Questionnaire-4 [PHQ-4]; 0–3 points for each item; considered positive if scores ≥3), posttraumatic stress disorder (PTSD) (Abbreviated PTDS checklist [PCL]; 2-items, each ranging from 1 to 5; positive if score ≥4).[16] Substance use (any illicit substance), binge drinking and alcohol use before/during sex were also evaluated. Chemsex was assessed using the question: "In the last three months, have you used any illicit drug before/during sex?".[17]

Participants underwent HIV, syphilis, hepatitis B and C rapid testing. Participants testing positive for HIV (Alere, Abbott Alere, US) provided a second sample for a confirmatory HIV rapid test (Abon HIV, Biopharma, Brazil). For those who tested positive during the syphilis rapid test (Bioclin), a non-treponemal test (venereal disease research laboratory [VDRL]) was performed. Positive samples for hepatitis B and C rapid tests (Bioclin and Abon, respectively) underwent serologies as appropriate (i.e., anti-HBs and HBsAg for hepatitis B and anti-HCV for hepatitis C). Participants were referred for confirmatory testing as applicable. Provider-collected anal swabs were conducted for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoea* (NG) screening (PCR, Abbott Molecular, Des Plains, IL, USA). We also screened for CT/NG on urine (self-collected) and oropharyngeal (provider-collected) samples.

We offered same-day oral PrEP with tenofovir disoproxil fumarate (300 mg) co-formulated with emtricitabine (200 mg) (TDF/TFC) to all participants who were interested in starting PrEP and who tested negative for HIV. Individuals reporting condomless sex within the past 72 h were offered immediate post-exposure prophylaxis initiation (PEP). We collected samples for HIV viral load (VL) testing to assess for acute HIV infections among all individuals reporting condomless anal sex in the prior 30 days. We collected VL and CD4 cell count for all participants who tested positive for HIV.

Statistical analysis

The sample size for this study was 400 participants, enabling us to detect an estimated HIV prevalence of 5%, with 95% CI, 80% power, 5% precision, and a design effect of 2. We categorised participants into three mutually exclusive groups according to HIV status: HIV-negative, known HIV diagnosis, and new HIV diagnosis (participants who reported having a HIV-negative or unknown status with a positive HIV rapid test or a detectable VL). To verify accuracy of new infections, we compared the HIV status of participants who newly tested positive with data from the medical records of our institution, as well as from the Brazilian Information Registry Databases.

Descriptive statistics included median (and interquartile range [IQR]) and absolute and relative frequencies overall and according to HIV status. At first, we compared participants with new HIV diagnosis to those with HIV-negative status. Then, we compared participants with new HIV diagnosis to those who had a known HIV diagnosis. For this comparison we used Pearson's chi-square and Fisher's test for categorical variables, and Wilcoxon test for continuous variables. In the tables we bold the proportions with statistical differences ($p < 0.05$).

We used logistic regression models to measure the correlates of HIV infection among YMSM, comparing participants with new HIV diagnosis (reference group) to those with HIV-negative status. We tested the effect of demographic factors (age, race, education, and monthly per capita income), engagement in risk behaviour using the HIV risk scale,[11] substance use, alcohol use before/during sex, chemsex, knowledge about HIV prevention and treatment using HIV-KA,[12] stigma and discrimination using RHS[13] and EDS,[14] and mental health factors using PHQ-4 and PTSD.[16] All variables with $p < 0.20$ were included in the initial multivariable model. We used backward selection to obtain a final adjusted model, maintaining only variables statistically significant ($p < 0.05$). We checked multicollinearity in the final model using Variance Inflation Factor (VIF). We did not include gender in the model as all new HIV diagnoses occurred among cisgender man. All analysis were performed in R version 3.6.2 (www.r-project.com).

Role of the funding source

The funding body (NIH, CNPq, Ministry of Health of Brazil) had no role in study design, data collection, data analysis, or data interpretation. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

We recruited 12 seeds; 10 (83.3%) were assigned male sex at birth, nine (75.0%) self-identified as cisgender men, two as transgender men, and one as a non-binary person (Table 1). A majority were Black (7, 58.3%) and all but one was HIV-negative (11, 91.7%). Three seeds (all cisgender men, aged 18–20 years) did not recruit any participant and one seed (transgender man) recruited only one participant. Recruitment was completed after 48 weeks with a mean of 6.2 waves (standard deviation [SD] 3.1) among active seeds. Study recruitment referred 605 individuals to be screened for participation. Of these, 143 (23.6%) were not interested in participating, 65 (10.7%) did not meet inclusion criteria (aged >24 years [n = 45] and feminine identity [n = 20]); 397 (65.6%) consented to participation. Each active seed originated a chain with a mean number of 19.5 (IQR 2.3–47.8) participants included in the study. Each participant recruited a mean number of 2.0 (IQR 1.0–3.0) enrolled recruits.

Among the 409 YMSM enrolled (12 seeds and 397 recruited participants), 369 (90.2%) tested HIV negative and 40 (9.8%) tested HIV positive, with 20 (4.9%) newly diagnosed and 20 (4.9%) previously known to be living with HIV (Table 2). Median age was 21 years (IQR 20–23) with 80 (19.6%) aged 18–19 years. Participants with known HIV diagnosis were significantly older than those newly diagnosed. Overall, 370 (90.5%) self-identified as cisgender men, nine (2.2%) transgender men, and 30 (7.3%) as non-binary or queer persons. All transgender men tested negative for HIV; HIV prevalence among non-binary persons was 6.7% (n = 2/30), both with known diagnosis. Compared to participants newly diagnosed with HIV, those previously diagnosed and with HIV-negative status more frequently lived in Rio de Janeiro and Niterói (larger cities with higher income) than other metropolitan cities. Overall, most participants self-identified as gay (278, 68.0%) or bisexual (89, 21.8%). Majority self-identified as Black or *Pardo* (288, 70.6%), had secondary education or less (247, 60.4%), and monthly income per capita at minimum wage or less (290, 70.9%), with higher wages reported by participants with HIV-negative status compared to those newly diagnosed with HIV.

Table 3 shows health and behaviour characteristics of participants by HIV status. More than one quarter (26.7%, n = 109) of YMSM reported no prior HIV testing. Participants with HIV-negative status less frequently reported a STI diagnosis in the previous 12 months compared to those newly diagnosed with HIV (29.3% vs 55.0%). Prevalence of chlamydia and gonorrhoea in any of the three sites assessed were 15.9% and 14.7%, respectively. Both STIs were more frequent in the anorectal region (12.8% and 9.9%, respectively) which were less likely to occur among participants with HIV-negative status compared to those newly diagnosed with HIV. Prevalence of ever and current syphilis were 28.4% and 14.4%, respectively, with both being less likely among HIV-negative participants compared to those newly diagnosed with HIV. Median age of sexual debut was 15 years (IQR 14–17). Median number of sex partners in the prior 12 months was 11 (IQR 9–11), being lower among participants with HIV-negative status compared to those newly diagnosed with HIV (5 [IQR 3–10] vs. 9 [IQR 5.8–20]). HIV knowledge scores were higher among participants with HIV-negative status (11 [IQR 9–11]) and known to be living with HIV (11 [IQR 10.8–12]) than those newly diagnosed for HIV (9.5 [IQR 8–11]). Most participants had a moderate (n = 225, 57.8%) or high (n = 104, 25.2%) HIV risk score, with scores being significantly lower among participants with HIV-negative status compared to those newly diagnosed for HIV. Over three-fourths (314, 76.8%) reported condomless anal sex in the prior 6 months. Substance use was common, with

Seed ID	Age (years)	Known HIV status	Started PrEP	Sex assigned at birth	Gender identity	Race	Schooling	Waves (N)	Recruits (N)	Recruit % (n = 397)
1	22	Negative	Yes	Male	Cisgender man	Black	> Secondary	4	18	4.5
2	20	Negative	No interest	Male	Cisgender man	White	> Secondary	9	51	13.2
3	23	Negative	Yes	Male	Non-binary	Black	> Secondary	7	27	6.7
4	20	Positive	NA	Male	Cisgender man	White	> Secondary	0	0	0
5	22	Negative	Yes	Male	Cisgender man	Black	> Secondary	10	169	42.5
6	23	Negative	Already using	Male	Cisgender man	White	≤ Secondary	2	5	1.3
7	24	Negative	Yes	Male	Cisgender man	White	≤ Secondary	5	21	5.2
8	24	Negative	Yes	Male	Cisgender man	Black	≤ Secondary	8	45	11.4
9	19	Negative	Yes	Male	Cisgender man	White	≤ Secondary	0	0	0
10	20	Negative	Yes	Female	Transgender man	Black	≤ Secondary	9	58	14.4
11	18	Negative	Yes	Male	Cisgender man	Black	≤ Secondary	0	0	0
12	24	Negative	Yes	Female	Transgender man	Black	≤ Secondary	2	3	0.8

NA: not applicable.

Table 1: **"Seeds" characteristics and recruitment, the Conectad@s study among young men who have sex with men, Rio de Janeiro, Brazil, 2021–2022.**

	Total	New HIV diagnosis	HIV negative	Known HIV diagnosis
	N = 409 (100%)	N = 20 (4.9%)	N = 369 (90.2%)	N = 20 (4.9%)
Median age, years (IQR)[b]	21 (20–23)	21 (20–22)	21 (20–23)	**22.5 (20.8–23)**[a]
Age category, years[d]				
18–19	80 (19.6)	2 (10.0)	77 (20.9)	**1 (5.0)**[a]
20–22	207 (50.6)	15 (75.0)	183 (49.6)	**9 (45.0)**[a]
23–24	122 (29.8)	3 (15.0)	109 (29.5)	**10 (50.0)**[a]
Gender[d]				
Cisgender man	370 (90.5)	20 (100)	332 (90.0)	18 (90.0)
Transgender man	9 (2.2)	0 (0.0)	9 (2.4)	0 (0.0)
Non-binary or queer	30 (7.3)	0 (0.0)	28 (7.6)	2 (10.0)
Region[c,d]				
Rio de Janeiro and Niteroi	262 (64.1)	8 (40.0)	**238 (64.5)**[a]	**16 (80.0)**[a]
Other metropolitan cities	147 (35.9)	12 (60.0)	**131 (35.5)**[a]	**4 (20.0)**[a]
Sexual orientation[d]				
Gay	278 (68.0)	17 (85.0)	246 (66.7)	15 (75.0)
Bisexual	89 (21.8)	3 (15.0)	82 (22.2)	4 (20.0)
Other	42 (10.3)	0 (0.0)	41 (11.1)	1 (5.0)
Race[d]				
Black	170 (41.7)	10 (50.0)	153 (41.6)	7 (35.0)
Pardo	118 (28.9)	8 (40.0)	100 (27.2)	10 (50.0)
White	116 (28.4)	2 (10.0)	111 (30.2)	3 (15.0)
Indigenous	3 (0.7)	0 (0.0)	3 (0.8)	0 (0.0)
Asian	1 (0.2)	0 (0.0)	1 (0.3)	0 (0.0)
Education (completed)[d]				
Primary	38 (9.3)	4 (20.0)	31 (8.4)	3 (15.0)
Secondary	209 (51.1)	12 (60.0)	188 (50.9)	9 (45.0)
Post-secondary	162 (39.6)	4 (20.0)	150 (40.7)	8 (40.0)
Monthly income per capita[d,e]				
0.5 minimum wage	125 (30.6)	11 (55.0)	**105 (28.5)**[a]	9 (45.0)
> 0.5–1 minimum wage	165 (40.4)	6 (30.0)	**153 (41.6)**	6 (30.0)
> 1 minimum wage	118 (28.9)	3 (15.0)	**110 (29.9)**	5 (25.0)

YMSM: young men who have sex with men, IQR: inter-quartile range. Comparisons: new HIV diagnosis vs. those with HIV-negative status and new HIV diagnosis vs. known HIV diagnosis. **Bold** means that comparisons were statistically significant ($p < 0.05$). Missing: race = 1; monthly income per capita = 1. [a]$p<0.05$. [b]Wilcoxon test. [c]Pearson's chi-square. [d]Fisher's. [e]Minimum wage per month in Brazil in 2022 was R$1212 (USD 230).

Table 2: **Sociodemographic characteristics according to HIV status of YMSM (aged 18–24 years) in the Conectad@s study, Rio de Janeiro, Brazil, 2021–2022.**

	Total	New HIV diagnosis	HIV negative	Known HIV diagnosis
	N = 409 (100%)	N = 20 (4.9%)	N = 369 (90.2%)	N = 20 (4.9%)
Has private health insurance[i]	101 (24.9)	0 (0.0)	**99 (27.0)**[a]	**2 (10.0)**[a]
Ever tested for HIV[h]	300 (73.3)	13 (65.0)	267 (72.4)	20 (100)
Had STI diagnosis[d,h]	132 (32.3)	11 (55.0)	**108 (29.3)**[a]	13 (65.0)
Chlamydia[i]				
Anorectal	48 (12.8)	6 (35.3)	**39 (11.4)**[a]	3 (17.6)
Oropharynx	10 (2.5)	1 (5.0)	8 (2.2)	1 (5.0)
Urine	19 (4.6)	3 (15.0)	15 (4.1)	1 (5.0)
Any site	65 (15.9)	6 (30.0)	55 (14.9)	4 (20.0)
Gonorrhoea[i]				
Anorectal	37 (9.9)	7 (41.2)	**28 (8.2)**[b]	2 (11.8)
Oropharynx	39 (9.6)	3 (15.0)	35 (9.5)	1 (5.0)
Urine	6 (1.5)	2 (10.0)	**4 (1.1)**[a]	0 (0.0)
Any site	60 (14.7)	9 (45.0)	**49 (13.3)**[b]	**2 (10.0)**[a]
Syphilis[h,i]				
Ever	116 (28.4)	11 (55.0)	**94 (25.5)**[a]	11 (55.0)
Current	59 (14.4)	10 (50.0)	**45 (12.2)**[b]	**4 (20.0)**[a]
Hepatitis B	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Hepatitis C	1 (0.2)	0 (0.0)	1 (0.3)	0 (0.0)
Median age of sexual debut (IQR)[j]	15 (14–17)	14.5 (12.8–16)	15 (14–17)	15 (13–16.2)
Median number of sex partners (IQR)[d,j]	5 (3–11)	9 (5.8–20)	**5 (3–10)**[c]	6.5 (2.8–15.2)
Number of sex partners[i]				
0–1	65 (15.9)	0 (0.0)	62 (16.8)	3 (15.0)
2–4	109 (26.7)	4 (20.0)	99 (26.8)	6 (30.0)
5–10	132 (32.3)	8 (40.0)	121 (32.8)	3 (15.0)
>10	103 (25.2)	8 (40.0)	87 (23.6)	8 (40.0)
HIV knowledge scale, median (IQR)[j]	11 (9–11)	9.5 (8–11)	**11 (9–11)**[b]	**11 (10.8–12)**[a]
HIV risk scale[e,i]				
Low (0–2 points)	60 (15.4)	0 (0.0)	**60 (16.3)**[b]	NA
Moderate (3–8 points)	225 (57.8)	8 (40.0)	**217 (58.8)**[b]	NA
High (≥9 points)	104 (26.7)	12 (60.0)	**92 (24.9)**[b]	NA
Had condomless anal sex[f,h]	314 (76.8)	17 (85.0)	281 (76.2)	16 (80.0)
Had condomless receptive anal sex[f,h]	262 (64.1)	16 (80.0)	234 (63.4)	12 (60.0)
Transactional sex[d,i]	26 (6.5)	2 (10.0)	21 (5.8)	3 (15.0)
Substance use[f,i,k]	283 (69.2)	14 (70.0)	252 (68.3)	17 (85.0)
Binge drinking[g,i]	361 (88.3)	20 (100)	321 (87.0)	20 (100)
Alcohol before/during sex[g,i]	250 (61.1)	15 (75.0)	218 (59.1)	17 (85.0)
Chemsex[g,i]	152 (37.2)	7 (35.0)	135 (36.6)	10 (50.0)

STI: sexually transmitted infections, YMSM: young men who have sex with men, NA: not applicable. Comparisons: new HIV diagnosis vs. those with HIV-negative status, and new HIV diagnosis vs. known HIV diagnosis. **Bold** means that comparisons were statistically significant ($p < 0.05$). Missing: has private health insurance = 3; chlamydia/gonorrhoea anorectal = 37; chlamydia/gonorrhoea oral = 1; transactional sex = 7. [a]$p < 0.01$. [b]$p < 0.001$. [c]$p < 0.05$. [d]In prior 12 months. [e]Among HIV-negative participants and those with new HIV diagnosis (i.e.unaware of their HIV-positive status). [f]In prior six months. [g]In prior three months. [h]Pearson's chi-square. [i]Fisher's test. [j]Wilcoxon test. [k]Substance use was defined as use of any illicit substance as marijuana, cocaine (powder, crack, or paste), ecstasy, LSD, MDMA, methamphetamine, ketamine, poppers or other inhalants.

Table 3: **Health and behaviour characteristics among YMSM (aged 18–24 years) according to HIV status in the Conectad@s study, Rio de Janeiro, Brazil, 2021–2022.**

283 participants (69.2%) reporting any substance use in the prior six months, 88.3% binge drinking (n = 361), and 37.2% chemsex (n = 152).

Table 4 presents measure of disclosure, support, stigma, discrimination, and mental health by HIV status. Overall, 393 (96.1%) ever disclosed their sexual orientation to someone, although 309 (75.6%) did to their parents and 239 (58.4%) reported having parental support. Participants with HIV negative status more frequently disclosed sexual orientation than those newly diagnosed with HIV (96.7% vs. 80.0%). Most participants (397; 97.1%) reported discrimination due to their sexual orientation. Verbal and physical violence due to sexual orientation were commonly reported (366 [89.5%] and 113 [27.6%], respectively), as well as healthcare avoidance due to fear of discrimination related to their

	Total	New HIV diagnosis	HIV negative	Known HIV diagnosis
	N = 409 (100%)	N = 20 (4.9%)	N = 369 (90.2%)	N = 20 (4.9%)
Ever disclosed sexual orientation[c]	393 (96.1)	16 (80.0)	**357 (96.7)**[a]	20 (100)
Disclosured sexual orientation to parents[c]	309 (75.6)	10 (50.0)	**282 (76.4)**[a]	**17 (85.0)**[b]
Parental support for sexual orientation[c]	239 (58.4)	218 (59.1)	**7 (35.0)**[b]	**14 (70.0)**[b]
Experienced any discrimination due to sexual orientation[c]	397 (97.1)	359 (97.3)	19 (95.0)	19 (95.0)
Ever experienced physical violence due to sexual orientation[c]	113 (27.6)	98 (26.6)	6 (30.0)	9 (45.0)
Ever experienced verbal violence due to sexual orientation[c]	366 (89.5)	332 (90.0)	16 (80.0)	18 (90.0)
Avoided heath care assistance because of fear of being discriminated against[c]	143 (35.0)	127 (34.4)	8 (40.0)	8 (40.0)
Treated badly/unfairly by healthcare professionals due to sexual orientation[d,c]	64 (15.7)	55 (14.9)	3 (15.0)	6 (30.0)
Health professionals refused to assist due to sexual orientation[d]	18 (4.4)	15 (4.1)	1 (5.0)	2 (10.0)
Internalized homonegativity scale score (median, IQR)[e]	6 (3–10)	9 (3.8–12.2)	6 (4–10)	6.5 (2.8–9.2)
Explicit discrimination scale score (median, IQR)[e]	9 (5–14)	7 (4–12.2)	9 (5–14)	9.5 (7–14.2)
Positive PTSD screening[c]	278 (68.0)	13 (65.0)	250 (67.8)	15 (75.0)
Positive depression screening[c]	210 (51.3)	9 (45.0)	187 (50.7)	14 (70.0)
Positive anxiety screening[c]	185 (45.2)	12 (60.0)	161 (43.6)	12 (60.0)
Ever experienced sexual violence[c]	133 (32.5)	7 (35.0)	119 (32.2)	7 (35.0)
Ever experienced sexual violence from partner[c,d]	88 (21.5)	80 (21.7)	5 (25.0)	3 (15.0)
Ever worried about safety from partner[c]	145 (35.5)	127 (34.4)	8 (40.0)	10 (50.0)
Ever attempted suicide[c]	102 (24.9)	6 (30.0)	90 (24.4)	6 (30.0)

PTSD: post-traumatic stress disorder, YMSM: young men who have sex with men. Comparisons: new HIV diagnosis vs. those with HIV-negative status, and new HIV diagnosis vs. known HIV diagnosis. **Bold** means that comparisons were statistically significant ($p < 0.05$). Missing: Treated badly/unfairly by healthcare professionals due to sexual orientation = 1. [a]$p < 0.01$. [b]$p < 0.05$. [c]Pearson's chi-square. [d]Fisher's test. [e]Wilcoxon test.

Table 4: **Disclosure, support, stigma, discrimination, and mental health characteristics according to HIV status among YMSM (aged 18–24 years) in the Conectad@s study, Rio de Janeiro, Brazil, 2021–2022.**

sexual orientation: 35.0% (n = 143) of participants delayed or avoided healthcare services for fear of discrimination, 15.7% (n = 64) had already been treated badly/unfairly by healthcare professionals due to sexual orientation, and 4.4% (n = 18) reported prior healthcare refusal. Median internalized homonegativity and discrimination scores were six (IQR 3–10) and nine (IQR 5–14), respectively. Mental health issues were common as 278 (68.0%), 210 (51.3%), and 185 (45.2%) individuals screened positive for PTSD, depression, and anxiety, respectively, and 102 (24.9%) ever attempted suicide.

Table 5 presents factors associated with new HIV diagnoses among YMSM. The final adjusted models showed that YMSM newly diagnosed with HIV were more likely to have a high-risk score (aOR 4.88 [95% CI 1.88–13.40]) compared to YMSM with HIV-negative status. YMSM who have ever disclosed their sexual orientation had lower odds of a new HIV diagnosis (aOR 0.19 [95% CI 0.04–0.92]). YMSM with increased HIV knowledge scale scores had lower odds of a new HIV diagnosis (aOR per scale point 0.77 [95% CI 0.59–1.01]), although the association was of borderline significance. YMSM with a positive anxiety screening had increased odds of a new HIV diagnosis (aOR 2.67 [95% CI 1.01–7.70]).

Among 369 HIV-negative participants, only nine (2.4%) participants ever used PrEP and three (0.8%) were currently using it, while 25 (6.8%) reported sexual exposure in the last 72 h and were prescribed PEP (data not shown in tables). The median CD4+ count was 478 (IQR 356–728) cells/mm^3, with 570 (IQR 438–761) cells/mm^3 among participants with prior HIV diagnosis, and 422 (IQR 309–577) cells/mm^3 among those with new HIV diagnosis. Among participants with a prior HIV diagnosis (n = 20), 17 (85.0%) were on antiretroviral therapy (ART) and 16 (80.0%) had an undetectable VL.

Discussion

This study revealed that YMSM living in Rio de Janeiro, Brazil, presented elevated rates of HIV and other STIs and high unawareness of HIV status. A significant proportion of YMSM (over one in four) had no prior HIV testing, although once enrolled in the study, the uptake of HIV testing was 100%. By the age of 24, one in ten YMSM were living with HIV, with only half of them aware of their HIV infection. New HIV diagnoses were identified among YMSM with greater socioeconomic vulnerability, who engaged in HIV-related high-risk behaviour, with lower HIV knowledge, and who screened positive for anxiety. To our knowledge, this study represents the first attempt to estimate HIV/STI prevalence specifically tailored for YMSM in Latin America after PrEP implementation as a public health strategy in Brazil.

HIV prevalence among YMSM in this study was 9.8%. A systematic review aggregating HIV estimates among MSM in Latin America and the Caribbean identified 19 studies reporting HIV prevalence among

	Unadjusted		Adjusted	
	OR (95% CI)	p-value	aOR (95% CI)	p-value
Age (per year)	0.91 (0.71–1.17)	0.45	NA	NA
Black/*Pardo*/Indigenous race (ref. White/Asian)	3.94 (1.11–25.04)	0.069	NA	NA
Education ≤ secondary	2.74 (0.98–9.71)	0.076	NA	NA
Monthly per capita income ≤1	2.42 (0.79–10.50)	0.17	NA	NA
High HIV risk scale (ref. Low/middle)	4.52 (1.81–11.85)	0.001	4.88 (1.88–13.40)	0.001
Substance use (yes vs. no)	1.08 (0.42–3.12)	0.87	NA	NA
Alcohol before/during sex	2.08 (0.79–6.50)	0.16	NA	NA
Chemsex (yes vs. no)	0.93 (0.34–2.34)	0.89	NA	NA
Ever disclosure sexual orientation (ref. No)	0.13 (0.04–0.52)	0.001	0.19 (0.04–0.92)	0.029
HIV knowledge scale (per point)	0.72 (0.56–0.92)	0.008	0.77 (0.59–1.01)	0.054
Internalized homonegativity (per point)	1.03 (0.95–1.11)	0.49	NA	NA
Explicit Discrimination Score (per point)	0.98 (0.90–1.04)	0.50	NA	NA
Positive depression screening (ref. No)	0.80 (0.31–1.97)	0.62	NA	NA
Positive anxiety screening (ref. No)	1.94 (0.78–5.05)	0.16	2.67 (1.01–7.70)	0.055
Positive PTSD screening (ref. No)	0.88 (0.35–2.41)	0.80	NA	NA

YMSM: young men who have sex with men, OR: odds ratio, aOR: adjusted OR, 95% CI: 95% confidence interval, PTSD: post-traumatic stress disorder, NA: not applicable. Results from the logistic regression models, using backward selection to obtain a final adjusted model (variables with p < 0.05 maintained).

Table 5: **Factors associated with new HIV diagnosis compared to HIV negative status among YMSM (aged 18–24 years) in the Conectad@s study, Rio de Janeiro, Brazil, 2021–2022.**

YMSM, with more than half of these studies surpassing 5%.[1] In a 2016 national survey among Brazilian MSM of all ages, HIV prevalence was 18.4%, which surpassed the HIV prevalence (14.2%) from 2009 similar study.[18] In a 2018 large online survey assessing 4231 Brazilian YMSM (18–24 years), 7.7% self-reported as HIV positive.[19] YMSM (18–24 years) also had higher HIV incidence compared to older (>30 years) counterparts in the ImPrEP study (1.94/100 person-years [95% CI 1.49–2.53] vs. 0.45/100 person-years [95% CI 0.30–0.66]) and in the ImPrEP seroincidence study (3.48% [95% CI 1.99–4.94] vs. 1.11% [95% CI 0.34–1.86]).[4,6] In a PrEP demonstration study conducted in Salvador, Brazil, among 288 YMSM aged 15–19 years (2019–2021), HIV prevalence at baseline was 5.9%.[20] This data underscores the extreme HIV vulnerability faced by this population.

In our study, other STIs were notably prevalent, especially among YMSM newly diagnosed with HIV. STI incidence has been steadily rising in Latin America, with 12,955.71 cases per 100,000 person-years in 2019.[21] In the ImPrEP study, YMSM exhibited a higher baseline prevalence of syphilis, rectal chlamydia and gonorrhoea and higher odds of having an incident STI during follow-up compared to those aged >30 years.[6,22] Besides engaging in high-risk behaviour, the combination of low awareness and barriers to accessing health services contributes significantly to the heightened vulnerability to HIV and other STIs among youth.[23] Post-exposure prophylaxis with doxycycline (doxy-PEP) to prevent bacterial STIs should be considered for YMSM in Brazil.[24,25]

A significant proportion of YMSM in our study had no prior HIV testing, were unaware of their HIV status, and only a few had utilized PrEP. Our sample is composed mostly of Black/*Pardo* YMSM with low income. Most newly diagnosed HIV infections occurred among YMSM residing in economically vulnerable settings characterized by low income and education levels. Brazilian National Surveillance data show that Black/Pardo individuals have a high burden of HIV in the country, accounting for most cases of HIV infection, AIDS cases, and AIDS-related deaths.[5] Brazil, marked by extensive inequality and a history marked by racism and slavery, experiences notable disparities despite the availability of HIV prevention and treatment in the Public Health System, including PrEP. For instance, most MSM accessing PrEP in Brazil have high levels of schooling (71%) and self-identify as White (55%),[26] although most of the Brazilian population self-identify as Black/*Pardo*.[27] In a large online survey among Brazilian YMSM, lower socioeconomic status and schooling were associated with higher odds of self-reported HIV-positive status.[19] Black/*Pardo* individuals also face worse HIV outcomes, including low retention in HIV services and ART adherence, HIV care initiation at advanced disease stages, and low viral suppression.[28] Our results reinforce the importance of increasing access to HIV prevention to YMSM under social-economic vulnerability.

In our study, being newly diagnosed with HIV was associated with engaging in HIV-related high-risk behaviour, low HIV knowledge and anxiety, and was negatively associated with sexual orientation disclosure. Prior studies in Brazil found that YMSM aged 18–24 years had lower HIV knowledge compared to older counterparts.[12,29] A study evaluating 16,667 MSM in

Brazil showed a discordance between perception and behaviour among YMSM, who had lower perceived HIV risk despite higher odds of binge drinking and engagement in high-risk sexual behaviour.[30] The authors of this study hypothesized that such inconsistency among YMSM could be related to HIV knowledge. Moreover, PrEP use among MSM in Brazil was associated with low internalized homonegativity and high HIV knowledge.[31] Increasing knowledge on HIV prevention, transmission and treatment is urgently needed in Brazil. Open discussions about sexuality, sexual behaviour and HIV prevention should be encouraged in schools, mass media, social media, and events where YMSM gather. Despite being a highly burdened population, there are few or no specific recommendations for HIV prevention and care among youth in low- and middle-income countries, including in Brazil.[32] Although Brazil has a national health policy for LGBTQIA + people, there is no specific recommendation for youth.[33]

Experiences of discrimination, violence, and lack of support were prevalent in our sample, especially in healthcare services. In addition, a substantial proportion of YMSM reported substance use and mental health issues, indicating high level of syndemics (i.e., two or more concomitant health conditions within a population, interacting and reinforcing one another and increasing the occurrence of other health problems).[34] A concerning finding was that one in four participants reported a prior suicide attempt by the age of 24, highlighting a worrisome percentage at such young age, consistent with the global trend of increasing youth suicide rates.[35] Given their youth, limited experience and autonomy, YMSM may be more vulnerable to the negative effects of discrimination, posing a major barrier to accessing health services for sexual and gender minorities.[36] The disproportionate burden of mental health challenges among YMSM points to an underlying epidemic, with direct and indirect impacts on this group's HIV vulnerability.

Our study has several strengths. First, it stands as the inaugural survey specifically designed to engage YMSM in Latin America. Second, peers successfully recruited over 400 YMSM in a large Brazilian city, presenting a unique opportunity to comprehend the HIV epidemics in one of the groups most affected by HIV in Brazil and other Latin-American countries.[1] Third, the use of digital coupons distributed by peers underscores the use of a technologically appropriate approach for recruiting and engaging YMSM in HIV prevention. Fourth, although their number was limited in our study, we demonstrated the ability to include trans men and non-binary persons who have sex with men. Fifth, we achieved a 100% acceptance rate for HIV testing, potentially related to building trust with the institution where the study took place and our diverse, trained, and highly dedicated team. These factors may also have in turn contributed to the motivation for recruitment of peers. However, certain limitations were identified. As with any cross-sectional study, we cannot infer causality from current associations. The high variability in recruitment percentages among seeds may influence the obtained sample. Despite peer-led referrals, some potential participants may have been particularly interested in joining the study as our institute is a well-known referral service for HIV care and prevention in the city. Less than 20% of YMSM in our study were aged 18–19 years, and only 9.3% of the sample completed primary schooling. In addition, our sample comprised only 40 YMSM living with HIV, 20 of them newly diagnoses. Thus, inferences regarding this group may be limited due to small sample size. Consequently, some groups of YMSM might be underrepresented in the sample, and our results may not be generalizable to them.

In conclusion, our findings highlight a substantial HIV burden among YMSM, which is especially worrisome considering their young age, relatively recent sexual debut, and in the context of declining HIV among older MSM and other populations. The HIV epidemic among YMSM is not solely influenced by individual aspects and behaviours, but also embedded in a broader social and structural context that contributes to its persistence. Therefore, addressing the HIV epidemic among YMSM requires a comprehensive approach, including biomedical strategies, advances in public health and fostering an inclusive society to ensure no one is left behind.

Contributors

EMJ, VGV, ECW, WM, TST and BG conceived and designed the Conectad@s study. CMJ, EMJ, TST, and BG conceived and supervised the current analysis and manuscript preparation. CMJ reviewed the literature, interpreted the findings, and drafted the manuscript. CMJ and RS were responsible for study coordination and data acquisition. CMJ and TST had access to raw data and verified the data. TST did the statistical analyses. CC, MSTS, SWC and BH were involved in revising the manuscript for important intellectual content. All authors read and approved the final manuscript. TST and BG had final responsibility for the decision to submit for publication.

Data sharing statement

A complete de-identified dataset sufficient to reproduce the primary study findings will be made available upon request to the corresponding author, following approval of a concept sheet summarizing the analyses to be done.

Declaration of interests

All authors declare no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lana.2024.100798.

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