Acceptability of HIV self-testing is low among MSM who have not tested: a study with respondent-driven sampling in Brazil

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Abstract

Background: Brazil has a substantial population living with HIV (PLWH) who are still unaware of their serostatus and has recently added HIV self-test (HIVST) into its public health system for key populations such as men who have sex with men (MSM). This study estimates HIVST acceptability among Brazilian MSM and its associated factors among those who had never been tested or had a previous HIV negative result.

Methods: Respondent-driven sampling (RDS) was used for behavioral and biological surveillance to recruit 4,176 MSM in 12 Brazilian cities in 2016. Descriptive, bivariate and multivariate analyses were conducted. Overall proportions were weighted with Gile's estimator in RDS Analyst software and 95% confidence intervals were calculated. The analyses of HIVST acceptability were stratified by prior HIV testing (never or one or more times).

Results: We included 3,605 MSM who did not previously know they were PLWH. The acceptability of HIVST was 49.1%, lower among those who had never tested compared to those who had a previous HIV negative test. In the subgroup of MSM who had never had an HIV test, those who reported discrimination and who had a medical appointment in the last 12 months reported higher HIVST acceptability. Among MSM who had a previous HIV negative test, only those reporting condomless receptive anal sex had greater HIVST acceptability. In addition, we observed that high levels of knowledge of HIV/AIDS, taking part in LGBT nongovernmental organizations, and complete secondary or incomplete higher school were associated with greater acceptability in both groups.

Conclusions: The findings highlight that it is necessary to improve information about HIVST among the most vulnerable MSM in Brazil. Given the acceptability of self-testing and its current promotion in Brazil, we can also point to the need for policies that build on this and enhance timely access to health services and prevention information.

Background

Routine testing to detect HIV infection is an important measure for a combined HIV prevention strategy [1] since it entails three levels of intervention. First, a biomedical level, since technology is used to detect the virus, and is the gateway to antiretroviral treatment, breaking the chain of transmission [2]. Second, a behavioral and cultural level, embedding individual and group decisions to test in a psycho-social matrix of sex, risk and prevention [3]. Finally, successful testing depends not only on the availability of the test, but also on overcoming barriers such as stigma and discrimination when accessing testing services [4, 5].

Unawareness of HIV status impacts on access to antiretroviral treatment (ART) and consequently on higher viral loads, a potential factor for HIV transmission [6]. In many countries, men who have sex with men (MSM) are disproportionately affected as they face much higher rates of HIV and AIDS than the general population [7]. In the United States of America (USA), the number of people living with HIV (PLWH) who do not have suppressed viral loads is higher among MSM compared to male and female heterosexuals [6].

In Latin America, there are 1.9 million PLWH and 80% of these knew their status in 2018 [8]. It has been estimated that in Brazil there are 900,000 PLHIV and that approximately 135,000 PLHIV are unaware of their serostatus. This corresponds to 85% of the 90% target of the initial target of the 90-90-90 UNAIDS goals for PLHIV [9] [10].

A survey using RDS among MSM in 12 state capitals in 2016 indicated that Brazilian MSM knowledge of HIV serostatus is low. Among those who tested for HIV in the study, 44% had not been aware of their positive status [11]. A similar RDS study, conducted in 2009 in 10 cities around the country demonstrated that almost half (48%) of MSM had never previously tested for HIV [12]. In a comparison between the 2009 and 2016 surveys, there was a drop in the proportion of MSM who had never tested, from 49.8% in 2009 to 33.8% in 2016, and an increase in the proportion of those who tested during the previous 12 months, from 21.2% to 43.3% [13]. In Salvador, a capital city in the country’s most impoverished region (Northeast), in the 2009 survey, 62.8% of MSM reported they had never tested for HIV [14]. In Curitiba, a city in a high-income region (South), in another survey
among MSM in 2015, the proportion never tested was much smaller: 24.3% [15], demonstrating important geographical disparities in rates of HIV testing among MSM in Brazil.

In Brazil, free access to HIV test occurs mainly in specialized services (e.g. testing and counseling centers, clinics and hospitals). Recently, HIV test is available in Primary Health Care (PHC) clinics of the Brazilian National Health System (SUS) [16]. However, the benefit of this program is mainly for pregnant women [17], and the coverage among sexual minorities remains low [18, 19]. Stigma and discrimination towards MSM in Brazil are high and one of the barrier to access health care services and HIV test especially at PHC [20–22]. Therefore, it is necessary to expand novel ways of HIV testing among MSM. One way is HIV self-testing (HIVST). It has been introduced in many countries, including Brazil, following a recommendation from the World Health Organization in 2016 [23]. HIVST is simple, easy to use, allows the individual to carry out the test, can use oral fluid or blood sample, and the interpretation of results may be undertaken with or without help from a trained individual [23]. This test procedure should be largely available as complementary to other available options [24].

HIVST guarantee confidentiality and privacy [25, 26]. By enabling testing outside the health services, for example, in the homes, in social venues, and sex work situations, HIVST decentralizes testing and strengthens people's autonomy [23, 27]. Furthermore, it may facilitate an increase in testing frequency among individuals at high risk of HIV infection and in populations groups with less frequency of testing in traditional services [25]. A meta-analysis showed that HIVST doubled uptake of testing among men, frequency of testing among MSM, and the likelihood of an HIV-positive diagnosis [28]. HIVST also could have positive impacts on HIV care as it allows for rapid detection and enables early treatment initiation, which can reduce the number of HIV-related clinical visits [29] and can potentially reduce the spread of HIV infection through test and treat [2, 30, 31], and increased HIV risk perception [32].

There are few studies on the acceptability of HIVST in middle-income countries [26]. In Latin America, an RDS survey in Argentina have showed that 74% of the MSM was likely to buy an HIVST at a pharmacy for use at home [33] In Brazil, a cross-sectional online survey in 2011 among MSM previously tested HIV negative estimated that 47% reported a preference for an HIVST at home [34], and more recently two cross-sectional online surveys carried out on a sample of MSM users of hook up apps from five Brazilian regions, estimated that HIVST awareness ranged from 26.0% in 2016 to 33.0% in 2017, and willingness to use from 50.0% to 42.0%, respectively [35]. Although these studies have accessed HIVST acceptability by MSM, few have explored how previous testing experiences differs in its associated factors with acceptability, especially among those who were never tested as compared to those who had a previous HIV negative result. Both groups could potentially benefit from access to additional testing services [36]. Moreover, there are no studies of HIVST acceptability among a large population sample of Brazilian MSM. Therefore, this article aims to estimate the acceptability of HIVST among MSM from 12 Brazilian cities and to investigate factors associated with acceptability among those who had never been tested or had a previous HIV negative result.

Methods

Study location, design, and population

This is a behavioral and biological surveillance study entitled “A nationwide study of the behaviors, attitudes, practices, and prevalence of HIV, Syphilis and Hepatitis B and C among MSM in Brazil”, conducted in 2016 in 12 state capitals: Manaus and Belém in the Northern region; Fortaleza, Recife and Salvador, in the Northeast; Brasilia and Campo Grande in the Central-West; Belo Horizonte, Rio de Janeiro and São Paulo in the Southeast region; and Curitiba and Porto Alegre in the South.

The study sample was composed of men defined as biologically male, 18 years of age or older, reporting oral or anal sex with another man in the last 12 months; and living, studying or working in one of the study cities.

Data collection
Respondent-driven sampling (RDS) methods were used to recruit participants. Before initiation of the survey a qualitative formative research using both individual interviews and focus group discussions was conducted to ascertain acceptability and feasibility of the study, including testing, the logistics, such as level and kind of incentive, siting, and working hours.

In the survey, to start the recruitment process, six MSM were purposively selected in each city. They had large social networks of MSM and belonged to different sociodemographic characteristics and were known as "seeds". Next, each of these "seeds" invited three other MSM from their social network using three invitation coupons. This procedure was repeated in sequence until the desired sample size was reached, estimated a priori as 350 participants per city. Participants received BRL 25.00 (US$ 7.40) for their participation and for each recruited participant (BRL 25.00 for each one up to a total of three new participants - BRL 100.00) as a means of reimbursing their expenses for transportation and food. Data was collected through structured interviews or self-completed questionnaires using tablets. A total of 4,176 MSM was recruited in 12 Brazilian cities who signed the informed consent and received counseling, educational materials, and condoms. The Research Ethics Committee of the Federal University of Ceará approved the research project. Further details can be found in Kendall et al. [37].

Study variables

A descriptive analysis was performed for the following variables: (1) demographic and education: age (<25 years and ≥25 years), self-declared race (white, black, brown/mixed race, indigenous/native, Asian origin), schooling (primary and incomplete secondary education, complete secondary education and incomplete undergraduate education, complete undergraduate education) and marital status (single, separated or widowed; married or living together); (2) socio-economic status: three economic groups were created (A-B/high; C/middle; D-E/low) based on the Brazilian Economic Classification Criteria [38]; (3) discrimination: self-reported discrimination due to sexual orientation during lifetime (yes, no); (4) health services: medical appointment in the 12 months before the study (yes, no), having taken part in any workshop about sexually transmitted infections (STI) and HIV/AIDS in the 12 months before the study (yes, no); HIV test during lifetime was determined by responses to the following question: “have you ever been tested for HIV/AIDS in your life?” (yes, no); and the time since the last HIV test (<1 year; 1-2 years; > 2 years; and never has taken the test); (5) knowledge about HIV/AIDS (low, middle and high) was analyzed according to item response theory (IRT), measured by 12 questions (items) about transmission and prevention (i.e. there are medicines for HIV-negative people to take to prevent HIV; an HIV-infected person who is taking AIDS medication has a lower risk of transmitting the virus, etc.), as described in Guimarães et al. [39]; (6) perception of risk (low, middle and high), in response to the question: “how do you assess your chance of becoming infected with HIV during your lifetime?”; (7) participation in an LGBT nongovernmental organization (NGO) (yes, no); and (8) condomless receptive anal sex in past six months (always used condoms and irregular use of condoms).

The outcome HIVST acceptability (yes, no) was structured according to the following question: “would you use an HIV/AIDS diagnosis test that you applied to yourself?” The reasons for the decision to use or not use an HIVST were also collected.

Data analysis

We excluded MSM who were aware of their positive HIV serostatus before the study, yielding 3,605 MSM available for this analysis. The dependence between observations resulting from recruitment chains in RDS, i.e., the probability of unequal selection and the different sizes of each participant's contact network [40], was taken into account. Gile's estimator [41] was used to weigh the proportion estimates with a 95% confidence interval using RDS Analyst [42]. We performed all data analyses from the 12 cities aggregated into one database with each city treated as a stratum.

The weighted data were analyzed using the complex sample routines in STATA 15 (StataCorp, College Station, TX, USA). Descriptive, bivariate analyses were conducted using frequency distributions of the variables of interest and the differences between the analyzed proportions using Pearson's $\chi^2$ test. All analyses were stratified according to prior HIV testing. i.e., those
who were never tested or those who were tested at least once in a lifetime and their HIV result was negative. A multivariate logistic regression model was constructed to estimate the Odds Ratio (OR) with 95% confidence interval, as a measure of association between the potential associated factors and HIVST acceptability. Selection of variables for multivariate modeling was based on the bivariate analysis (p-value < 0.15) and the epidemiological relevance concerning potential confounding factors associated for HIVST acceptability. Those variables with a p-value of < 0.05 remained in the final model.

Results

Table 1 shows descriptive results according to no previous HIV test and a previous negative HIV result. The following characteristics did not differ according to the two strata: MSM under 25 years of age (64.3% and 59.5%, respectively), brown/mixed race (48.4% and 39.2%, respectively), single, separated/widowed (90.1% and 86.1%, respectively), and reporting protective sex (66.8% and 61.3%, respectively) (p > 0.05). MSM with no previous HIV test compared to MSM who had a previous negative HIV result, had less schooling (46.1% vs 23.5%, p < 0.001), lower socio-economic status (26.5% vs 9.7%, p < 0.001), reported less experience of discrimination during the lifetime (53.1% vs 71.5%, p < 0.001) and had lower HIV risk perception (24.9% vs 14.6%, p < 0.01). In terms of health services, the majority of MSM did not engage in workshops on STI and HIV/AIDS in the last 12 months (83.0% and 79.0%, respectively, p > 0.05). On the other hand, those with no previous HIV test compared to MSM who had a previous negative HIV result, reported less medical appointment in the last 12 months (68.6% vs 87.1%, p < 0.001), lower knowledge about HIV/AIDS (35.4% vs 24.0%, p < 0.001) and took part less of LGBT NGO (12.1% vs 19.9%, p = 0.03).

Overall HIVST acceptability was 47.3% (95% CI: 43.5, 51.1) and overall reasons for its use were: curiosity (31.3%), as a routine test (27.8%), practicality (17.8%), believe to be at risk for HIV infection (16.6%), and confidentiality (11.3%). And reasons for not using it were: fear (42.7%), did not see why to use it (23.8%), unaware of test availability (2.3%), believe to be at low or no risk for HIV infection (1.8%) and because it has never been offered (1.6%) (Table 2).

HIVST acceptability was higher among those who had a previous negative HIV result (50.1%; 95% CI: 45.3, 54.9), as compare to those with no previous HIV test (42.7%; 95% CI: 36.3, 49.3), but this did not reach statistically significant level (p=0.07). Regarding reasons for its use, only practicality of the test (10.7% vs 21.4%, p = 0.01) and fear (50.0% vs 37.8%, p = 0.03) were statistically significant different comparing the two strata (Table 2).

Table 3 shows the bivariate and multivariate analyses also stratified by testing history. In the multivariate analysis, among MSM with no previous HIV test, experience of discrimination (AOR = 2.00, 95%CI: 1.18, 3.38) and a medical appointment in the last 12 months (AOR = 1.74, 95%CI: 1.01, 2.99) had a higher odds of HIVST acceptability. Among MSM who had a previous HIV negative test, condomless receptive anal sex (AOR = 1.46, 95%CI: 1.00, 2.15) had greater odds of HIVST acceptability. In addition, in both strata, we observed that high levels of HIV/AIDS knowledge (AOR = 2.45, 95%CI: 1.05, 5.70 and AOR = 2.79, 95%CI: 1.58, 4.93), belonging to an LGBT NGO (AOR = 3.26, 95%CI: 1.29, 8.25 and AOR = 2.06, 95%CI: 1.28, 3.32), and complete secondary or incomplete undergraduate school (AOR = 1.74, 95%CI: 1.01, 3.01 and AOR = 2.17, 95%CI: 1.34, 3.51) were associated with greater odds of HIVST acceptability.

Discussion

Our results indicate that almost half of the MSM would accept an HIVST, but it was lower among those with no previous HIV test and who were better off economically and better educated (i.e. those with higher level of schooling and socio-economic status, higher HIV/AIDS knowledge and had medical appointment in the last 12 months). This may indicate that planning and expansion, of HIVST in Brazil should be more focused on vulnerable MSM.

Figueroa et al. [26], in a review of the literature regarding attitudes and HIVST acceptability, demonstrated that, of the 14 studies analyzed, eight indicated high (≥67%), five moderate (between 34-66%), and one low (≤33%) prevalence of HIVST acceptability. Moderate acceptability found in our study may be due to the timing of the survey field work as in 2016, when the HIVST were not yet available in Brazil, neither commercially nor through the services of the Brazilian National Health System (Sistema Único
de Saúde: SUS). The marketing of HIVST in Brazil took place in November 2015, when the National Health Surveillance Agency (Agência Nacional de Vigilância Sanitária: ANVISA) approved the sale of HIVST in pharmacies. And, in 2017, the first HIVST registration was realized. The product has been commercially available since then, in both physical and online drugstores in all Brazilian states, at a cost of BRL 70.00 (21.90 US$) or BRL 80.00 (25.00 US$) per kit (7% to 8% of the minimum wage). It is noteworthy, that even among those willing to use an HIVST, its high cost for Brazilian standards may act as a barrier and compromise the potential role of this strategy, particularly in low-income settings, thereby justifying their free distribution to key and priority populations [43].

Brazil until recently, had a long track record of successfully implementing HIV prevention and treatment interventions through the SUS[44–46]. In 2019, Brazil began offering free access to HIVST in 14 selected cities and is now expanding to other cities. The strategy initially adopted was the distribution of HIVST in familiar venues for key-populations, to PLWH and those highly vulnerable to HIV infection [47]. The implementation of free distribution of HIVST may promote the increase of testing frequency among high-risk MSM [48]. Moreover, it has been considering as a cost-effective prevention technology [49, 50].

HIVST has been advanced as a strategy to enhance testing and contribute to the reduction of HIV transmission [27, 51, 52]. Our results suggest that the acceptability of HIVST is higher precisely among those who have already tested for HIV, thus justifying expanding to MSM with less access to traditional health services.

We also found greater acceptability among those who knew more about HIV/AIDS, belonging to an LGBT NGO and with a recent medical appointment. This highlights the role of both demand creation campaigns directed to MSM and support for MSM-friendly NGOs, which unfortunately have been under- and defunded in the past few years in Brazil [53, 54]. HIVST should be made available with reinforced HIV/AIDS prevention activities that promote HIVST within a combined prevention strategy, including strengthening and extending health services, targeted health education campaigns and support for community-based organizations and NGOs [55].

Of the MSM we interviewed who had no previous HIV test, self-reported discrimination was one of the factors that increased the likelihood of HIVST acceptability. As pointed out in the literature, stigma, and concerns about confidentiality and privacy are among the barriers to testing confronted by MSM [4, 55–57]. Those who have not yet been tested, or were tested a long time ago, may resort to HIVST as a strategy to avoid potential discrimination or confidentiality fears in health services. On the other hand, among MSM who had a previous HIV negative test, those who reported condomless receptive anal sex were more likely to accept an HIVST. A study conducted in Spain showed that MSM reporting high-risk behaviors had greater intentions to test [58].

“Fear” was reported as the main reason for not using the HIVST. However, “fear” is not limited to HIVST technology, given that fear is also a barrier to conventional testing conducted in health services [59]. The fear of testing is well documented in many population groups, perhaps amplified here because of the implications for homosexuality [4, 60, 61]. Furthermore, although our data do not allow in-depth analysis of the meaning of fear as a reason for not using the test, we could argue that such fear is related to more general aspects found in other studies. Specifically, in the case of HIVST, the literature refers to the fear of a positive result without being properly linked to a health service [56, 60, 62]. As Flowers et al. suggest, in a research conducted with MSM in the United Kingdom, in 2014, HIVST has the potential to reduce certain barriers related to traditional testing but may create other complicating factors, such as a reduction in linkage to health services and health professionals to follow up test results and care services, and fewer opportunities for prevention and counseling of risk behaviors [57].

Our analysis is not without limitations, including selection bias in the networks recruited and interpretation of results when using RDS. The survey questionnaire was long and did not allow for more specific questions on HIVST such as awareness. Moreover, as a cross-sectional study, causal inference is not possible.

**Conclusion**

Our data suggest greater acceptability of HIVST precisely within the group of MSM who had a previous HIV negative test and were in a less vulnerable social context. Given the acceptability of HIVST and its current policy in Brazil, we suggest improvements that build on our results and expand this strategy especially in more vulnerable MSM, as well as the
development of a monitoring system capable of incorporating the results of HIVST and link MSM to healthcare services. In future studies, it is worth examining health care providers knowledge and acceptance of HIVST, and the dynamics of recruitment and retention of PLWH into services for follow-up. The growing availability of HIVST in Brazilian pharmacies and services of the national health system may affect an already challenged access-to-treatment system. Future studies should also explore price-sensitivity since currently HIVST available in the commercial sector is too expensive for repeated use (i.e. after each risky sexual episode) for many MSM.

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Tables

Table 1. Descriptive analysis of MSM according to no previous HIV test and a previous negative HIV result Brazil, 2016.
| Variables                                                                 | No previous HIV test | Previous negative HIV result | p-value |
|--------------------------------------------------------------------------|----------------------|-----------------------------|---------|
|                                                                           | % | 95%CI       | % | 95%CI       |               |
| **Age**                                                                  |   |            |   |            |               |
| < 25 years old                                                           | 64.3 | 57.2 | 70.9 | 59.5 | 54.8 | 64.1 | 0.26 |
| ≥ 25 years old                                                           | 35.7 | 29.1 | 42.8 | 40.5 | 35.9 | 45.2 |       |
| **Race**                                                                 |               |                |               |                |               |
| Brown/mixed race                                                         | 48.4 | 41.6 | 55.2 | 39.2 | 34.7 | 43.9 | 0.09 |
| White                                                                    | 29.1 | 22.9 | 36.2 | 34.9 | 30.5 | 39.5 |       |
| Black                                                                    | 22.5 | 17.9 | 27.9 | 25.9 | 21.4 | 31.2 |       |
| **Schooling**                                                            |               |                |               |                |               |
| Primary/Incomplete secondary education                                    | 46.1 | 39.6 | 52.6 | 23.5 | 19.9 | 27.5 | <0.001 |
| Complete secondary/Incomplete undergraduate education                     | 48.8 | 42.4 | 55.2 | 62.6 | 58.1 | 67.0 |       |
| Complete undergraduate education                                          | 5.2 | 2.3 | 11.5 | 13.9 | 11.3 | 17.1 |       |
| **Socio-economic status groups**                                         |               |                |               |                |               |
| D-E (Low)                                                                | 26.5 | 21.0 | 32.8 | 9.7 | 7.5 | 12.4 | <0.001 |
| C (Middle)                                                               | 38.5 | 32.3 | 45.0 | 42.1 | 37.4 | 46.9 |       |
| A-B (High)                                                               | 35.1 | 29.1 | 41.6 | 48.2 | 43.5 | 53.0 |       |
| **Marital status**                                                       |               |                |               |                |               |
| Single/separated/widowed                                                 | 90.1 | 85.9 | 93.2 | 86.1 | 82.9 | 88.8 | 0.10 |
| Married/living together                                                  | 9.9 | 6.8 | 14.1 | 13.9 | 11.2 | 17.1 |       |
| **Self-reported discrimination during the lifetime**                     |               |                |               |                |               |
| No                                                                       | 46.9 | 40.5 | 53.5 | 28.5 | 24.7 | 32.7 | <0.001 |
| Yes                                                                      | 53.1 | 46.5 | 59.5 | 71.5 | 67.3 | 75.3 |       |
| **Medical appointment in the last 12 months**                            |               |                |               |                |               |
| No                                                                       | 30.4 | 25.0 | 36.4 | 12.9 | 10.2 | 16.1 | <0.001 |
| Yes                                                                      | 69.6 | 63.6 | 75.0 | 87.1 | 83.8 | 89.7 |       |
| **Took part of any workshop on STI and HIV/AIDS in the last 12 months**  |               |                |               |                |               |
| No                                                                       | 83.0 | 76.7 | 87.9 | 79.0 | 74.8 | 82.7 | 0.26 |
| Yes                                                                      | 17.0 | 12.1 | 23.3 | 21.0 | 17.3 | 25.2 |       |
| **Knowledge about HIV/AIDS (IRT score)**                                  |               |                |               |                |               |
| Low                                                                      | 35.4 | 29.4 | 41.9 | 24.0 | 19.6 | 29.1 | <0.001 |
| Middle                                                                   | 47.6 | 41.0 | 54.2 | 47.0 | 42.3 | 51.8 |       |
| High                                                                     | 17.1 | 12.7 | 22.6 | 29.0 | 25.0 | 33.3 |       |
| **Perception of risk**                                                   |               |                |               |                |               |
| Low                                                                      | 24.9 | 19.6 | 31.0 | 14.6 | 11.6 | 18.4 | <0.01 |
| Middle                                                                   | 60.8 | 54.1 | 67.8 | 74.8 | 70.2 | 79.0 |       |
| High                                                                     | 14.2 | 9.4 | 20.9 | 10.5 | 7.7 | 14.1 |       |
| **Took part of LGBT NGO**                                                |               |                |               |                |               |
| No                                                                       | 87.9 | 81.7 | 92.2 | 80.1 | 76.2 | 83.6 | 0.03 |
| Yes                                                                      | 12.1 | 7.8 | 18.3 | 19.9 | 16.5 | 23.8 |       |
| **Condomless receptive anal sex (past 6 months)**                        |               |                |               |                |               |
| Always used condoms                                                     | 66.8 | 60.5 | 72.4 | 61.3 | 56.8 | 65.6 | 0.15 |
| Irregular use of condoms                                                | 33.3 | 27.6 | 39.5 | 38.7 | 34.4 | 43.2 |       |

1 Weighted by Gile-SS.

Table 2. Acceptability of HIVST and reasons for use/non-use among MSM according to no previous HIV test and a previous HIV negative result in 12 Brazilian cities, 2016.
| Variables | Overall | No previous HIV test | Negative previous HIV result | p-value* |
|-----------|---------|----------------------|-------------------------------|---------|
|           | % | 95%CI | % | 95%CI | % | 95%CI |         |
| **Acceptability of HIVST** | | | | | | | 0.07 |
| Yes       | 47.3 | 43.5 | 51.1 | 42.7 | 36.3 | 49.3 | 50.1 | 45.3 | 54.9 |
| No        | 52.7 | 48.9 | 56.5 | 57.3 | 50.7 | 63.7 | 49.9 | 45.1 | 54.7 |
| **Reasons to use HIVST** | | | | | | | | | 0.14 | 0.50 | 0.01 | 0.95 | 0.18 |
| Curiosity | 31.3 | 26.7 | 36.4 | 36.8 | 27.1 | 47.7 | 28.6 | 24.0 | 33.7 |
| As a routine test | 27.8 | 24.2 | 31.7 | 25.8 | 19.2 | 33.8 | 28.8 | 24.7 | 33.4 |
| It is more practical | 17.8 | 13.6 | 22.8 | 10.7 | 6.3 | 17.5 | 21.4 | 15.9 | 28.1 |
| Believes to be at risk for HIV infection | 16.6 | 13.5 | 20.4 | 16.8 | 11.0 | 24.8 | 16.6 | 13.1 | 20.8 |
| Confidentiality | 11.3 | 8.5 | 14.9 | 8.9 | 6.1 | 12.8 | 12.6 | 8.8 | 17.6 |
| **Reasons to not use HIVST** | | | | | | | | | | 0.03 | 0.73 | 0.62 | 0.14 | 0.39 |
| Fear | 42.7 | 37.2 | 48.3 | 50.0 | 41.8 | 58.3 | 37.8 | 30.8 | 45.3 |
| Does not see any reason to use it | 23.8 | 20.0 | 27.9 | 24.6 | 19.0 | 31.2 | 23.2 | 18.3 | 28.9 |
| Unaware of test availability | 2.3 | 1.6 | 3.3 | 2.5 | 1.5 | 4.4 | 2.1 | 1.2 | 3.5 |
| Believe to be at low or no risk for HIV infection | 1.8 | 1.0 | 3.0 | 1.1 | 0.5 | 2.3 | 2.2 | 1.1 | 4.4 |
| Because it has never been offered | 1.6 | 1.0 | 2.6 | 1.2 | 0.6 | 2.4 | 1.8 | 1.0 | 3.4 |

† Weighted proportion by Gile-SS;
* P-value refers to the comparison of proportions between: “no previous HIV test” and “negative previous HIV result”.

Table 3. Acceptability of HIVST among an RDS sample of MSM. stratified by the report of prior HIV testing in 12 Brazilian cities. 2016.
| Variables                  | No previous HIV test | Previous negative HIV result |
|---------------------------|----------------------|-----------------------------|
|                           | Bivariate Unadj OR2  | Multivariate AdjOR3 p-value | Bivariate Unadj OR2  | Multivariate AdjOR3 p-value |
|                           | Wt%1 OR2 p-value     |                             | Wt%1 OR2 p-value     |                             |
| **Wt%**                   | **OR**               | **p-value**                 | **OR**               | **p-value**                 |
| **Age**                   |                      |                             |                      |                             |
| >=25 years                | 34.2 1.00 0.07       | -                            | 48.3 1.00 0.53       | -                            |
| < 25 years                | 48.3 1.79 (0.93-3.45)| -                            | 51.4 1.13 (0.76-1.66)| -                            |
| **Race**                  |                      |                             |                      |                             |
| Black                     | 34.6 1.00 0.30       | -                            | 49.9 1.00 0.09       | -                            |
| Brown/mixed race          | 44.5 1.51 (0.83-2.74)| -                            | 44.0 0.78 (0.45-1.36)| -                            |
| White                     | 48.6 1.79 (0.86-3.70)| -                            | 57.4 1.35 (0.76-2.40)| -                            |
| **Schooling**             |                      |                             |                      |                             |
| Primary/Incomplete        | 35.5 1.00 0.008      | 1.00                         | 30.1 1.00 <0.001     | 1.00                         |
| secondary education       |                      |                             |                      |                             |
| Complete                  | 53.1 2.05 1.74 0.04  | 1.74                         | 53.7 2.69 2.17       | 2.17                         |
| secondary/Incomplete      | (1.16-3.64)          | (1.01-3.01)                  | (1.70-4.26)          | (1.34-3.51)                  |
| undergraduate education   |                      |                             |                      |                             |
| Complete undergraduate    | 20.4 0.46 0.86 0.81  | 0.86                         | 67.4 4.80 3.39       | 3.39                         |
| education                 | (0.11-1.93)          | (0.27-2.76)                  | (2.58-8.92)          | (1.75-6.56)                  |
| **Socio-economic status** |                      |                             |                      |                             |
| groups                    |                      |                             |                      |                             |
| D-E                       | 32.5 1.00 0.07       | -                            | 27.0 1.00 <0.001     | -                            |
| C                         | 40.6 1.41 (0.67-2.96)| -                            | 48.5 2.54 (1.47-4.36)| -                            |
| A-B                       | 52.6 2.30 (1.08-4.89)| -                            | 56.1 3.45 (2.02-5.88)| -                            |
| **Marital status**        |                      |                             |                      |                             |
| Married/living together   | 43.7 1.00 0.91       | -                            | 55.2 1.00 0.33       | -                            |
| Single/separated/widowed  | 42.6 0.95 (0.42-2.16)| -                            | 49.2 0.78 (0.47-1.28)| -                            |
| **Self-report of**        |                      |                             |                      |                             |
| discrimination during     |                      |                             |                      |                             |
| the lifetime              | No                    | 29.3 1.00 <0.001             | 1.00                  | 38.8 1.00 0.001              |
|                          | Yes                   | 54.4 2.87 (1.69-4.87)        | 2.00 0.01             | 54.6 1.89 (1.27-2.82)        |
| **Medical appointment in**|                      |                             |                      |                             |
| the last 12 months        | No                    | 33.6 1.00 0.01              | 1.00                  | 48.6 1.00 0.75               |
|                          | Yes                   | 49.9 1.96 (1.12-3.40)        | 1.74 0.04             | 50.7 1.08 (0.64-1.82)        |
| **Took part of any**      |                      |                             |                      |                             |
| workshop on STI and HIV/AIDS in the last 12 months | No | 39.1 1.00 0.03 | 53.1 1.00 0.03 |
| Knowledge about HIV/AIDS (IRT score)² | Low     | Middle | High     |
|-------------------------------------|---------|--------|----------|
|                                     | 38.3    | 39.8   | 59.9     |
|                                     | (1.03-4.57) | (0.57-1.98) | (1.08-5.37) |
|                                     | 2.17    | 1.06   | 2.41     |
|                                     | (0.66-1.96) | (0.57-1.98) | (1.05-5.70) |
|                                     | 0.61    | 1.13   | 2.45     |
|                                     | (0.39-0.96) | (0.66-1.96) | (1.05-5.70) |
|                                     | 41.2    | 52.6   | 61.2     |
|                                     | (1.37-4.14) | (1.85-6.24) | (0.91-5.15) |
|                                     | 58.3    | 65.0   | 64.1     |
|                                     | (1.12-7.17) | (1.29-8.25) | (1.29-8.25) |
| Perception of risk                  |         |        |          |
| Low                                 | 38.0    |        |          |
|                                     | (0.67)  |        |          |
| Middle                              | 45.9    | 42.8   |          |
|                                     | (0.72-2.62) | (0.57-1.76) |         |
|                                     | 1.38    | 1.01   |          |
|                                     | (0.72-2.62) | (0.57-1.76) |         |
|                                     | -       | -      |          |
| High                                | 42.6    | 42.5   |          |
|                                     | (0.40-3.64) | (0.40-3.64) |         |
|                                     | 1.21    | 1.00   |          |
|                                     | (0.91-5.15) | (0.67)  |         |
| Took part of LGBT NGO               |         |        |          |
| No                                  | 39.5    |        |          |
|                                     | (0.92-3.34) |        |          |
| Yes                                 | 65.0    | 42.8   |          |
|                                     | (1.12-7.17) | (0.57-1.76) |         |
|                                     | 2.84    | 1.01   |          |
|                                     | (1.12-7.17) | (0.57-1.76) |         |
|                                      | 1.00    | 3.26   |          |
|                                      | (1.29-8.25) | (1.29-8.25) |         |
| Condomless receptive anal sex (past 6 months) |        |        |          |
| Always used condoms                | 42.5    |        |          |
|                                     | (0.57-1.76) |        |          |
|                                     | 1.00    | 45.1   |          |
|                                     | (0.67)  | (0.67) |          |
| Irregular use of condoms           | 42.8    |        |          |
|                                     | (0.57-1.76) |        |          |
|                                     | 1.01    | 1.58   |          |
|                                     | (0.57-1.76) | (1.09-2.28) |          |
|                                     | 1.00    | 1.46   |          |
|                                     | (1.00-2.15) | (1.00-2.15) |          |

² Gile-SS weighted proportion of acceptability;

Unadjusted weighted odds ratio of acceptability with 95% confidence limits;

³ Adjusted weighted odds ratio of acceptability with 95% confidence limits;

⁴ Score obtained through Item Response Theory Analysis.

Declarations

The following declarations are below:

- Ethics approval and consent to participate
- Consent for publication
- Availability of data and materials
- Competing interests
- Funding
- Authors’ contributions
- Acknowledgements

Ethics approval and consent to participate
The research project was approved by the Research Ethics Committee of the Federal University of Ceará. (nº CAAE-43133915.9.0000.5054 and nº 1.024.053). The written consent was obtained for each participant.

Consent for publication

“Not applicable”

Availability of data and materials

The data that support the findings of this study are available in:

https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/MCMU31

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Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

LM conceptualized, analyzed and interpreted data, and was a major contributor in writing the manuscript the article; AFL supervised the fieldwork, interpreted data and writing the manuscript; DK supervised the fieldwork, interpreted data and writing the manuscript; ID supervised the fieldwork, analyzed and interpreted data and substantively revised it; MDC supervised the fieldwork, analyzed and interpreted data and writing the manuscript; EPS reviewed the manuscript; TJ reviewed substantially the manuscript; GMR supervised the fieldwork and reviewed substantially the manuscript; MAV supervised the fieldwork and reviewed substantially the manuscript; CK supervised the fieldwork and reviewed substantially the manuscript; AMB supervised the fieldwork and reviewed substantially the manuscript; LK coordinated the research and reviewed substantially the manuscript;

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