

Research article

Full title- acceptability and feasibility of HIV self-testing (HIVST) among MSM and transgender women (*hijra*) in Bangladesh: A mixed-method study

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ARTICLE INFO

Keywords:

HIV
AIDS
HIV self-testing
Bangladesh

ABSTRACT

Background: HIV testing coverage among males having sex with males (MSM) and transgender women (locally known as *hijra*) is low in Bangladesh. Oral fluid-based HIV self-testing (HIVST) may improve coverage due to its convenience and privacy but is yet to be tested in Bangladesh. Therefore, the acceptability and feasibility of supervised HIVST was examined.

Methods: A cross-sectional study was conducted among 379 MSM and *hijra* selected from five geographical regions from February–October 2020. Semi-structured questionnaire was used to examine socio-demographics, risk behaviors, and perception to acceptability and feasibility (correct completion) of HIVST. Both bivariate and multivariable logistic regression analyses were performed. Qualitative data collection encompassed in-depth interviews (N = 19), key informant interviews (N = 10), and two focus group discussions (N = 12). Line-by-line content, contextual and thematic analysis were done and triangulated to explore facilitators and challenges of HIVST among MSM and *hijra*.

Results: Among 379 participants, the acceptability of HIVST was 99.5 % (n = 377). Reasons for acceptability included interest in independent testing (84.3 %), peer influence (57.3 %), quicker-easier procedure (54.9 %), and painless procedure (52.5 %). Qualitative findings revealed participant's risk perceptions, empowering feelings, social stigma, complementing working hours, and convenience during COVID-19 lockdowns. Around 92 % of the participants correctly completed HIVST. In multivariable analysis, the likelihood of correct test conduction was found higher among metropolitan, younger, married, educated, and participants who felt confident during HIVST process. Qualitative findings underscored the importance of supervising the use of HIVST for first-time users. Participants, particularly the less educated groups, highlighted the video demonstration as a useful tool in the context of difficulties in reading the textual instructions. However, most participants pointed out the result interpretation as the trickiest part of HIVST. All participants demonstrated willingness for future HIVST, were interested in social

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<https://doi.org/10.1016/j.heliyon.2024.e31477>

Received 18 February 2023; Received in revised form 15 May 2024; Accepted 16 May 2024

Available online 17 May 2024

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media-based approaches (84 %), were willing to purchase subsidized kits, and preferred conducting future tests alone at home (83.2 %).

Conclusion: Oral fluid-based HIVST was an acceptable and feasible approach for MSM and *hijra* in Bangladesh who were willing to do future tests independently after the supervised approach. Willingness to purchase kits and interest for social media-based approaches indicate scalability and sustainability potential of HIVST.

1. Introduction

According to a report by the United Nations Programme on HIV/AIDS (UNAIDS), 84 % of people living with HIV (PLHIV) knew their status as of 2020 [1]. The same degree of progress was not proportionately reflected in the Asia-Pacific region, as only 76 % of PLHIV knew their status, thus implicating a significant diagnosis gap [1]. Bangladesh, a country in the South-East Asian region, has been experiencing a concentrated HIV epidemic driven by Key Populations (KPs) at risk of HIV [2]. Overall HIV incidence rose by 56 % and HIV-related mortality by 110 % since 2010 [3]. As of October 2020, only 57 % of the estimated HIV cases had been detected in Bangladesh which is considerably behind the UNAIDS Fast-Track targets of 90 % of PLHIV who know their status [4].

There are an estimated total of 131,037 males who have sex with males (MSM) including male sex workers (MSW), and 10,199 transgender women (TGW) locally known as *hijra* in Bangladesh [5]. Recent government reports showed that an annual number of reported HIV cases had consistently been increasing among these KPs [6]. However, HIV testing services (HTS) and treatment uptake were found insufficient among the KPs in low-income settings like Bangladesh compared to high-income countries due to the inadequate programmatic coverage of the population, as well as individual and structural barriers such as low-risk perception, discriminatory and judgmental attitudes of service providers, fear of stigma and potential criminal prosecution [7–9]. In Bangladesh, HIV prevention services towards MSM and *hijra* had mostly been operated under the Global Fund (GF) supported intervention, covering only 23 % of the estimated population in 2020 [10]. Despite the increase of the HTS target within the GF supported intervention over the years, the coverage has remained low, i.e., 68 % and 65 % for MSM and *hijra* respectively in 2020. In the context of a significant fall in external funding and a lack of increase in domestic investment in Bangladesh, the facility-based HTS-approach may incur challenging scenarios in increasing HTS coverage among this group.

HIV self-testing (HIVST), that has been labeled as a complementary approach to conventional testing by WHO. It is a well-accepted, potentially cost-effective, and demand generating approach, especially for KPs [11]. However, participants from several HIVST studies raised concerns about the availability of pre and post-test counselling, test accuracy, and price of HIVST kits [12]. Feasibility of undertaking HIVST, i.e., the correct completion and interpretation of test result by the participant showed variability ranging from 50 % to 94 % [12]. Participants' literacy, level of HIV-related knowledge, supervision from health workers, and ability to understand the instruction manual were highlighted as important factors for correctly conducting HIVST [12–14]. Bringing HIVST positive cases into confirmatory testing and linkage to HIV treatment was cited as a major challenge in various settings [14,15].

MSM and *hijra* are highly stigmatized population groups based on the pretext that their anal sex behavior is a punishable criminal offense in a Muslim predominant country like Bangladesh which could even lead to life imprisonment [16]. This criminalized status of MSM in Bangladesh is a stark contrast to the male-to-male sexual activity in other Asian countries like Thailand and Vietnam where same sex relationships are legalized and have gained prominence in their commercial sex industry [17,18]. Yet, the cultural perspective of male-to-male sexual relationship in Bangladesh bears greater resemblance to neighbouring countries in the Indian sub-continent like India, Pakistan, and Nepal. There is a dearth of evidence regarding HIVST among MSM and *hijra* in this Indian sub-continent region and this had never been tested in Bangladesh. Therefore, evidence is needed on ways for introducing this approach to these population groups. The acceptability and feasibility of HIVST also need to be explored. Moreover, the possible facilitators and implementation challenges of this approach need to be identified in order to facilitate the scale-up of this method. This study aimed to assess the acceptability and feasibility of HIVST and the associated factors among MSM and *hijra* in Bangladesh.

2. Materials and methods

2.1. Study design, settings and participants

A cross-sectional study with mixed-method design was conducted in five HIV prevention service centers (referred to as Drop-In-Center (DIC)) situated in five different geographical regions of Bangladesh, namely Dhaka and Chattogram as metropolitan cities with high HIV cases and Sirajganj, Belkuchi, and Tangail as peri-urban and rural areas respectively. Various geographical regions were selected to check the feasibility of the HIVST approach in diverse settings. Data were collected between February and October 2020. To calculate the sample size, we first reviewed published studies on the acceptability of HIVST across different regions such as New York, US; Madrid, Spain; Baltimore, US; Malawi; and Canada with acceptability rates of 74 %, 78 %, 85 %, 92 %, and 95 %, respectively [14]. Standard formula for estimating sample size in cross-sectional studies was used and included 5 % loss to follow-up, thus amounting the final sample sizes to 311, 277, 206, 119, and 77 respectively [19]. The maximum sample size of 311 was selected, therefore for the two divisional study areas the sample size was $311 \times 2 = 622$. This sample size included MSM, MSW, and *hijra* and their male sexual partners whom we had reached through the secondary distribution of HIVST kits. As the study was interrupted due to COVID-19 during 2020–21, it was only possible to enrol a total of 571 participants. For this manuscript, we deducted 192 male sexual partners and

considered 571–192 = 379 participants for this analysis whom we directly approached and enrolled in the DICs. The findings from male sexual partners HIVST will be published in a separate manuscript. Finally, the enrolled total of 379 MSM included MSM-*panthi* (plays insertive role), MSM-*kothi* (plays receptive role) who typically works as male sex workers (MSW), and *hijra* (i.e., MSM-317 and *hijra* –62). The geographical area-wise distribution of study participants include: Dhaka (25.8 %, n = 97), Sirajganj (24.8 %, n = 94), Chittagong (23.4 %, n = 88), Belkuchi (16.6 %, n = 63) and Tangail (9.4 %, n = 35). The sampling was proportional to the total number of MSM and *hijra* enlisted in these service centers on a first-come-first-serve basis. Therefore, consecutive patients were enrolled in each of these groups until a pre-specified sample size was reached for each subset.

Participants were approached by Peer Educators (PE) who referred them to study counselors for enrollment in this study. Participants willing to undertake HTS were offered an HIVST kit by the study counsellor. The inclusion criteria for the study included: i) age 18 years or above; and ii) self-identified as MSM and TGW who belong to the traditional *hijra* subculture. Participants were excluded if they had self-reported their HIV-positive status.

2.2. Materials

This study used the OraQuick HIV-1/2 Rapid Antibody Test kit (OraSure Technologies, Bethlehem, Pennsylvania, US) which was approved by the United States FDA in 2012. This is a WHO pre-qualified self-test kit with test sensitivity and specificity of 99.3 % and 99.8 % in a laboratory setting, and 93.0 % and 99.98 % in self-testing studies, respectively [13,20,21]. The participants were provided with the illustrated instruction manual to interpret the test window as HIV-positive, negative and invalid. Quality Control (QC) of all HIV positive and 5 % of HIV negative cases was ensured by rechecking their results against standard HIV laboratory testing by following the national HIV testing algorithm [22].

2.3. Procedure

Considering the population and country context such as the low literacy, low levels of HIV risk perception among others [9], the supervised HIVST approach was employed for MSM and *hijra* in this study. Participants who were willing to partake in HTS were briefed about the HIVST procedure and offered the testing kit. Those who accepted HIVST had provided their written informed consent.

Each consenting participant was given pre-test information on HIVST by following the WHO-guideline [11]. Thereafter, the process of conducting HTS was explained to them using an illustrated instruction manual and a recorded video describing the whole testing procedure which was translated into the local language. Participants were instructed to follow the sequential steps of: i) checking the instruction manual before starting the test; ii) collecting oral fluid from both upper and lower gums; iii) placing the strip inside the buffer solution tube; iv) Properly merging the tip of the strip inside solution; v) waiting for 20 min before interpretation of results; and vi) correct interpretation of test result.

The study counsellor informed the participant that the counselors would not interfere or assist rather quietly observe the correctness of the procedure and document this in a feasibility checklist. This is in order to facilitate the independent conduction of the test. The observation period started when the participants were ready to conduct the test and ended with the interpretation of the test result by the participants. The test result was interpreted first by the participants and then by the counsellor independently in a private setting at service center. Both HIV positive and negative participants received post-test counselling. The confirmatory test was performed by the DIC Medical Assistant using the whole blood Rapid Diagnostic Test for reactive results in HIVST, in line with the national HIV testing algorithm [22]. All the confirmed cases were linked to the antiretroviral treatment (ART) centers at government hospitals through accompanied referral by the counsellor. The existing Global Fund project's Peer Navigators (PN) assisted in the smooth coordination of the participants with the ART center and maintained follow-up for treatment adherence subsequently. According to Institutional Review Board (IRB) recommendations, reimbursement of their travel expenses and light refreshment were provided for their participation (USD 2 per participant).

2.4. Measures

The primary outcome of the study was to measure the acceptability and feasibility of the oral fluid-based HIVST among MSM and *hijra* in Bangladesh. The following operational definitions of acceptability and feasibility were adopted for the study:

1. **Acceptability:** Acceptability refers to the number of participants who have chosen HIVST (numerator) among those who were offered and consented to the HIV test (denominator) [14].
2. **Feasibility:** Feasibility refers to the number of correctly completed HIVST (numerator) among those who had accepted and performed HIVST (denominator) [14].

Each participant was interviewed with a semi-structured questionnaire consisting of three sections. The first section asked about socio-demographic characteristics, marriage and sexual partnership, drug use-related risk behaviors, HIV related sexual risk behaviors with partners, knowledge and treatment history of sexually transmitted infections (STIs), knowledge about HIV, knowledge and uptake of confidential HIV testing, HIV risk perceptions and exposure to HIV prevention services.

The second section focused on the acceptability of HIVST where participants were asked about their reasons for accepting/rejecting the HIVST procedure (e.g. "What made you accept/reject the HIVST procedure?"). The third section consists of a feasibility checklist

which was filled by the counsellor while observing the participant during the procedure and some related questions about the ease of use, confidence in conducting and interpreting the result, the necessity of counselling in HIVST procedure, willingness to pay for HIVST kit, preferred place for future HIVST uptake, use of mobile phone and social media, and willingness to receive HIVST information and procedure through mobile phone or social media-based channels.

2.5. Data analysis

Quantitative data were analyzed using STATA (Version 13, College Station, Texas). Descriptive statistics such as frequency, percentage and mean were used to present the sociodemographic characteristics, sexual behaviors, HIV knowledge and HIVST-related perceptions of the study participants. Bivariate analysis was conducted on all explanatory variables and variables that were significant at least 10 % in the bivariate analysis, were included in the multivariable logistic regression. Multivariable analysis was done to identify factors associated with the correct completion of all HIVST steps. Results in the multivariable analysis were expressed in terms of adjusted odds ratio (AOR) along with 95 % confidence intervals (CI) and p-values. Multicollinearity was assessed with pairwise correlation coefficients from a correlation matrix in order to get the final selected model.

2.6. Qualitative component

2.6.1. Study population

MSM and *hijra* that had participated in the study, HIV prevention service providers and monitoring experts, and peer educators that belongs to the MSM and *hijra* community and provides voluntary services at field level.

2.6.2. Participant selection

The maximum variation sampling technique that was one of the purposive sampling methods was used to conduct In-depth interviews (IDIs) with MSM and *hijra* participants and data was collected until reaching the point of saturation (N = 19) [23]. Purposeful intensity sampling was used for conducting key informant interviews (KIIs) (N = 10) with experienced service providers such as DIC staffs (i.e., DIC managers, medical assistants, outreach supervisors, and peer educators), program coordinators, and monitoring and evaluation (M&E) officers of MSM and *hijra* focused HIV prevention programs. Two focus group discussions (FGDs) were conducted by following a homogeneous sampling technique with field service providers (e.g., peer educators) (N = 12), who had regular close contact with the study participants.

2.6.3. Data collection methods and procedures

Semi-structured guidelines were developed separately for IDI, KII, and FGDs considering the different group of participants. The interview guidelines were field tested by the researchers that comprised of Medical Anthropologists, Social Scientists, and public health experts. All face-to-face interviews were conducted by anthropologists supported by public health experts. Interviews were audio recorded after obtaining informed consent from the participants. The researchers had listened to the audio-recording of the interview and transcribed it verbatim in a computer on the same day of the interview. All transcripts were stored in a password-protected computer that could only be accessed by authorized personnel.

2.6.4. Data analysis

All qualitative data were analyzed manually. Thematic analysis strategies were followed by coding and re-coding data into themes and sub-themes.

2.6.5. Validity and reliability of qualitative data

To ensure validity and reliability of qualitative data peer debriefing meetings and member checking techniques were used during data collection, analysis, triangulation, and report writing period.

2.6.6. Merging of qualitative and quantitative data

The parallel convergent mixed-method design was followed where both quantitative and qualitative data was collected concurrently but separately which means one set of data collection did not depend on the other [24]. Then each group of data was analyzed separately and independently following respective analytical procedures. In the next step, both sets of results regarding acceptability and feasibility of HIVST were compared in a table and interpreted to find out to what extent both sets of results converged or diverged to each other. In case of convergence of findings, both sets of results were combined for a better understanding. For divergence of findings, additional steps such as re-examining the results, more data collection would have been taken to explain the differences.

2.7. Ethics statement

The study protocol was reviewed and approved by the Research Review Committee (RRC) and Ethical Review Committee (ERC) of icddr,b which are part of the Institutional Review Board (IRB, protocol no: PR-19112). All participants provided written informed consent to participate in the study. Participation was voluntary, and the participant reserved the right to withdraw from the study at any point.

3. Results

3.1. Profile of study participants

A total of 379 participants were approached. Among them, 377 had accepted HIVST from whom data were collected. Of these, more than four-fifths (83.5 %, n = 315) were MSM and the rest (16.5 %, n = 62) were *hijra* (Fig. 1). The mean age of participants was 27.7 years with the majority of the participants (62.1 %) being aged over 24 years. Nearly two-third of the participants were unmarried (65.2 %, n = 246) and one-third were married (31.8 %, n = 120).

Very few participants had no education (11.7 %, n = 44). The majority had received at least one year of schooling and a sizeable percentage (18.3 %, n = 69) had university education (>12 years). Only around one-fifth (21.2 %, n = 80) participants lived alone, others lived with family, friends, or other relatives. Likewise, the number of participants living in mess/hostel was also low (17.2 %, n = 65) while four-fifths lived in residential areas (80.6 %, n = 304) (Table 1).

Occupational status indicates that the majority (59.2 %, n = 223) were engaged in the service sector. The number of participants who partook in selling sex (19.1 %, n = 72), business (18.6 %, n = 70), and traditional *hijra* Earning or *Challa/Badhai* (16.4 %, n = 62) was relatively low. Several participants reported that they were being supported by their families (13.5 %, n = 51). The mean monthly income of the participants was 155 US dollars (USD) and the median income was 120 USD. Further details are provided in Table 1.

3.2. Sexual behaviors and risks

Among the participants, non-transactional/transactional sex in the last month with male, female and *hijra* were 66.8 % (n = 252), 32.9 % (n = 124) and 2.9 % (n = 11) respectively, with some overlap (sex with more than one gender) (Table 2). Participants demonstrated higher condom use rates during anal sex (58.1 %, n = 150) and vaginal sex (53.7 %, n = 66) in the last month compared to oral sex (29.3 %, n = 56), in the last month among those who reported practicing each type of sex. Around one-fifth (17.5 %, n = 66) of the respondents reported at least one STI symptom from urethral discharge or anal discharge or genital ulcer/sore in the last year. However, at the time of testing, nearly two-thirds (65.7 %, n = 247) of the participants were in the window period of HIV infection based on their last exposure of unsafe sexual behavior.

3.3. Acceptability of HIVST

Out of 379 participants approached with HIVST at service centers, only two participants (0.5 %) declined self-testing citing that they have inadequate time to be involved in the study and 377 participants accepted HIVST. Thus, the acceptability of HIVST in this study was $(377/379 \times 100 \%) = 99.5 \%$. The majority (98.4 %, n = 359) of the participants tested for HIV in the last year with an average of nearly twice in the year in the ongoing HIV prevention services. When asked if they “Ever heard of the HIVST procedure”,

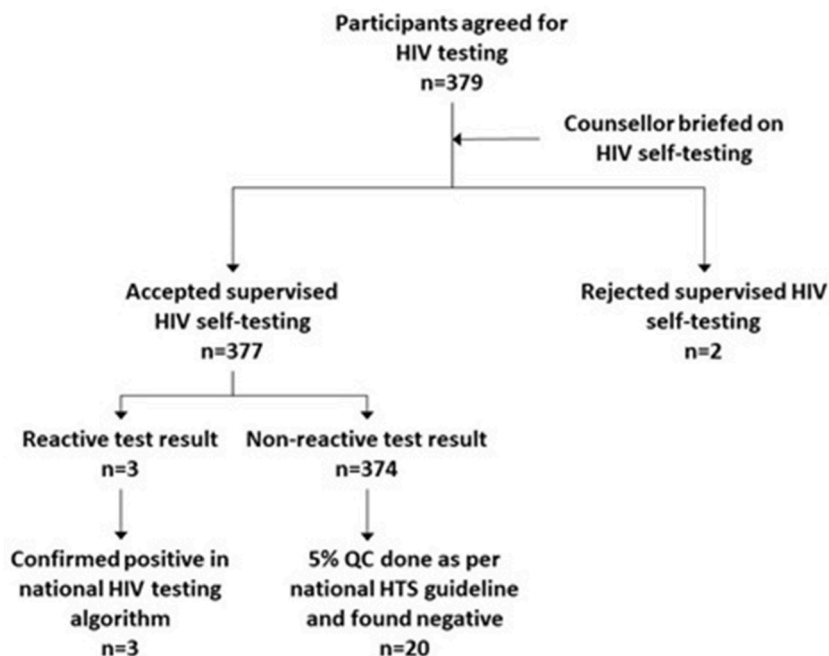


Fig. 1. Flow chart showing briefly the process of supervised HIV self-testing from recruitment till final confirmation of HIV reactive results with national HIV testing algorithm.

Table 1
Socio-demographic and other information of study participants who accepted self-testing.

Characteristic	N = 377 Column n (%)
Study sites	
Dhaka	97 (25.8)
Chattogram	88 (23.4)
Sirajganj	94 (24.8)
Belkuchi	63 (16.6)
Tangail	9.4 (35)
Participant Category	
MSM (including MSW)	315 (83.5)
TGW (<i>hijra</i>)	62 (16.5)
Having history of using any other self-test (Blood glucose check, pregnancy check etc.)	16 (4.2)
Age (years)	
18-24	143 (37.9)
25-34	179 (47.5)
≥35	55 (14.6)
Mean (SD)	27.7 (±7.5)
Years of schooling	
No education	44 (11.7)
Primary (1–5 years)	86 (22.8)
Secondary (6–10 years)	124 (32.9)
Higher secondary (11–12 years)	54 (14.3)
University (>12 years)	69 (18.3)
Current marital status	
Married	120 (31.8)
Unmarried	246 (65.2)
Widowed/Divorced/Separated	11 (2.9)
Current place of Residence	
Residential Area	304 (80.6)
Mess/Hostel/Dera (<i>residence of hijra leader</i>)	65 (17.2)
Slum Area	6 (1.6)
Workplace (Office)	2 (0.5)
Currently living with	
Alone	80 (21.2)
Family	248 (65.8)
Relative/Friend/Sexual partner	49 (13.0)
Income in last month (USD)	
Mean income (SD)	155 (±197)
≤120 ^a	205 (54.1)
>120	174 (45.9)
Source of income (Multiple responses)	
Service	223 (59.2)
Sell sex	72 (19.1)
Business	70 (18.6)
<i>Cholla/Badhai</i> (Traditional <i>hijra</i> earning)	62 (16.4)
Family	51 (13.5)
Others	7 (1.9)

^a 1 USD = 84.862 BDT as of October 30, 2020 and 120 USD calculated as median value for the population.

the majority replied negatively with only a few (2.4 %, n = 9) saying they have heard about the HIVST procedure from various sources. To understand the reasons for accepting HIV self-testing, several questions were asked to the participants. The majority (84.3 %, n = 318) of the participants responded “yes” to the reason “Interested in independent testing”. The other common reasons that participants mentioned were “Peers suggested about the new method of self-testing” (57.3 %, n = 216), “Quick and very easy” (54.9 %, n = 207), and “Painless” (52.5 %, n = 198). One-fifth of the participants (21.0 %, n = 79) also responded affirmatively to “As it was free of cost”. All of the reasons are provided in [Table 3](#).

3.4. Feasibility of HIVST: monitoring participants HIV self-test procedure

All of the participants were observed by trained counsellors who recorded each step of the HIVST procedure. Only six (1.6 %) participants made some major mistakes, for which, they had to discard the first kit and repeat the test with a second kit. Overall, 92 % of the participants performed all steps correctly. The percentage of errors ranged from reading the instruction manual (0.5 %, n = 2), the collection technique of saliva (1.6 %, n = 6), not waiting for the required time before interpreting the result (2.7 %, n = 10) up to incorrectly interpreting the result at the end (3.7 %, n = 14). Nevertheless, less than 4 % participants made a mistake in each step. However, combinedly completing all steps was comparatively a little lower (92 %, n = 347), which indicates that a group of participants (8 %, n = 30) each missed one or more steps, thus combinedly making up the errors of each step. When asked about their feeling towards the test, 99.7 % (n = 376) felt the test was easy ([Table 3](#)). When asked “How confident were you to do the test yourself”, 92.8 % (n = 350) reported being very confident. However, a lesser number (80.6 %, n = 304) reported being very confident when the

Table 2

HIV testing, sexual behaviors and mental health status of the study participants who accepted self-testing.

Characteristic	N = 377 Column n (%)
Ever tested for HIV	365 (96.8)
Tested for HIV in the last year	359 (95.2)
Had sex with a male in the last month	252 (66.8)
Had sex with a female (wife/sex worker/others) in the last month	124 (32.9)
Had sex with a <i>hijra</i> in the last month	11 (2.9)
Ever had sex with wife	130 (34.5)
Had sex with wife in the last month	101 (26.8)
Used condom during last sex act with wife in the last month (Among those who had sex with wife in the last month)	N = 100 38 (37.6)
Ever bought sex from female sex worker	64 (17.0)
Bought sex from female sex worker in the last month	12 (1.2)
Used condom during last sex act with female sex worker in the last month (Among those who bought sex from female sex worker in the last month)	N = 12 7 (58.3)
Ever had sex with another woman (other than wife or sex worker)	105 (27.9)
Had sex with another woman (other than wife or sex worker) in the last month	19 (5.0)
Used condom during last sex with a woman (other than wife or sex worker) in the last month (Among those who had sex with other women in the last month)	N = 19 10 (52.6)
Used condom during last vaginal sex with wife/sex worker/other women in the last month (Among those who had sex with wife/sex worker/other women in the last month)	N = 123 66 (53.7 %)
Ever had anal sex with male/ <i>hijra</i>	364 (96.6)
Had anal sex with male/ <i>hijra</i> in the last month	258 (68.4)
Used condom during last anal sex act with a male/ <i>hijra</i> in the last month (Among those who had sex with male/ <i>hijra</i> in the last month)	N = 258,150 (58.1)
Ever had oral sex with a male or <i>hijra</i>	254 (67.4)
Had oral sex with a male or <i>hijra</i> in the last month	191 (50.67)
Used condom during last oral sex act with a male/ <i>hijra</i> in the last month (Among those who had oral sex in the last month)	N = 191 56 (29.3)
Total number of sex partner (male/ <i>hijra</i>) in last month	
No partner	58 (15.4)
1 partner	171 (45.4)
≥2 partners	148 (39.2)
Reported at least one STI symptom (urethral discharge or anal discharge or genital ulcer/sore in the last year)	66 (17.5)
Participant currently in window period due to any sexual risk (anal/oral/vaginal)	247 (65.7)
Took illicit drugs in the last year	126 (33.4)
Self-risk perception of HIV	
High risk	24 (6.4)
Medium risk	61 (16.2)
Low risk	165 (43.7)
No risk	120 (31.8)
Not able to assess own risk	7 (1.9)
History of depression	41 (10.9)
History of anxiety	9 (2.4)
History of other mental disease	5 (1.3)
History of self-harm	33 (8.8)
Comprehensive knowledge of HIV [‡]	128 (34.0)

[‡]This indicator was computed by correct answers to five questions.

¹Can people reduce their risk of HIV by using a condom correctly and consistently in any type of sex.

²Can people reduce their risk of HIV by avoiding sex with multiple partners.

³Can a person get HIV through mosquito bites.

⁴Can a person get HIV by sharing a meal with someone who is HIV infected, and.

⁵Can you tell by looking at someone whether s/he is infected with HIV

question was, "How confident were you to interpret the result by yourself". Out of the 377 participants who did the supervised HIVST, three participants received reactive test results (0.79 %) and were referred to confirmatory testing at the DIC where all three participants were confirmed as HIV positive.

3.5. Future testing

All of the accepting participants replied 'Yes' when asked about their willingness to take the test (HIVST with OraQuick) again in the future. Around 94.7 % (n = 356) of them were willing to pay for the test, with a mean price of 2.9 USD among those who were willing to pay. The majority of the participants (83.2 %, n = 312) wanted to do the test at home by themselves while the rest either wanted to do it either at the DIC (15.5 %, n = 58) or any other place. Cell phone and social media usage was found to be 98.7 % (n = 371) and 67.6 % (n = 254) respectively, among the respondents. When asked "Would you be willing to receive HIVST related message on social media?", 84.0 % (n = 316) of respondents expressed their interest to receive HIVST related information through mobile or social media.

Table 3
Acceptability and Feasibility of supervised self-testing.

Characteristic	N = 377 Column n (%)
Acceptability	
Ever heard of HIVST procedure	9 (2.4)
Tested for HIV by any testing method in last 12 months	359 (98.4)
Reported reason of accepting HIVST (multiple responses)	
Interested in independent testing	318 (84.3)
Peers suggested about the new method of self-testing	216 (57.3)
Quick and very easy to perform	207 (54.9)
Painless	198 (52.5)
Free of cost	79 (21.0)
Curiosity around new test	36 (9.6)
Test results can be obtained fast	23 (6.1)
Test center safe and comfortable	16 (4.2)
Favorable time	15 (4.0)
No need to go anywhere for test	13 (3.4)
Partner told about test	7 (1.9)
Result will be accurate and reliable	6 (1.6)
Confidential test	3 (0.8)
Feasibility	
Number of kits used in conducting HIVST	
One	371 (98.4)
Two	6 (1.6)
Observed to have properly completed all steps	347 (92.0)
Mentioned test as easy	376 (99.7)
Confidence on how to do test	
Very Confident	350 (92.8)
Not very confident	27 (7.2)
Confidence on how to interpret results	
Very Confident	304 (80.6)
Not very confident	73 (19.4)
Mentioned they will encourage partner to do HIVST	289 (76.7)
Prefer in-person counselling in addition to video and brochure	335 (88.9)
Mentioned that they will buy if test kit is available in the local market	356 (94.7)
Mentioned that they would like to do HIVST alone at home	312 (83.2)
Mentioned that they would like to do HIVST at DIC	60 (16.0)
Amount willing to pay (USD) ^a (Among those who mentioned that they will pay if kit is available in the local market)	
Mean (SD)	3.0 (±2.73)
Median (IQR)	1.8 (1.18–3.54)
Currently has cell phone	371 (98.7)
Currently uses social media	254 (67.6)
Mentioned that they would like to get information on self-testing through social media	316 (84.0)

^a 1 USD = 84.862 BDT as of October 30, 2020.

3.6. Finding the predictors of the feasibility of HIVST among the respondents

Both bivariate (Table 4) and multivariable logistic regression (Table 5) were performed to explore the factors associated with the feasibility of HIVST among the respondents. The bivariate analysis indicated that the study area, age, education, marital status and confidence of both doing the test and interpreting results were important predictors of correctly completing all steps related to HIVST. In the final adjusted model, coming from metropolitan cities had higher odds of completing all steps correctly compared to respondents from peri-urban/rural areas (AOR: 3.4; 95 % CI: 1.2–9.6; p-value: 0.018). In the crude model, odds of successful completion also increased with each level of increase beyond primary education. However, in the adjusted model, only secondary education had significantly higher odds (AOR: 3.4; 95%CI: 1.1–10.1; p-value: 0.032) of successfully completing all steps compared to primary education. In the adjusted model, participants aged between 25 and 34 years were associated with better test performance compared to those who were more than 35 years (AOR: 4.0; 95%CI: 1.1–14.8; p-value: 0.038) and being married was associated with higher odds of successfully completing all steps, compared to those who were divorced or separated (AOR: 5.1; 95%CI: 1.0–25.8; p-value: 0.046). Feasibility (successful completion of all steps) was also higher among those who reported being very confident in both the test process and analyzing the result correctly compared to those who were not very confident (AOR: 4.3; 95%CI: 1.8–10.7; p-value: 0.001).

3.7. Qualitative findings

Qualitative findings on acceptability (Table 6), feasibility (Tables 7 and 8), and future prospects of HIVST (Table 9) was thematically analyzed and triangulated with the quantitative findings and presented in the below corresponding sections. During this analysis, we had found the following findings as a collective opinion both from MSM and *hijra* participants.

Table 4

Factors associated with doing all steps correctly (Feasibility): Results from bivariate analysis.

Factors	Bivariate Analysis			UOR (95 % CI)	p value
	Yes	No	Total		
	n (Row %)	n (Row %)	N (Row %)		
Area^β					
Metropolitan area	176 (95.1)	9 (4.9)	185 (100.0)	2.4 (1.1–5.4)	0.035
Peri-urban area (RC)	171 (89.1)	21 (10.9)	192 (100.0)	1.0	–
Client Category					
MSM (<i>panthi</i> and <i>kothi</i>) (RC)	288 (91.4)	27 (8.6)	315 (100.0)	1.0	–
TGW (<i>hijra</i>)	59 (95.2)	3 (4.8)	62 (100.0)	1.8 (0.5–6.3)	0.329
History of using any other self-test					
Yes (RC)	13 (81.3)	3 (18.7)	16 (100.0)	1.0	–
No	334 (92.5)	27 (7.5)	361 (100.0)	2.85 (0.8–10.7)	0.094
Socio-economic Characteristics					
Age (in years)					
18–24	130 (90.9)	13 (9.1)	143 (100.0)	2.2 (0.9–5.4)	0.080
25–34	172 (96.1)	7 (3.9)	179 (100.0)	5.5 (1.9–15.2)	0.001
≥35 (RC)	45 (83.7)	10 (16.3)	55 (100.0)	1.0	–
Years of schooling					
No education	37 (84.1)	7 (15.9)	44 (100.0)	1.0 (0.4–2.8)	0.957
Primary (1–5) (RC)	72 (83.7)	14 (16.3)	86 (100.0)	1.0	–
Secondary (6–10)	119 (96.0)	5 (4.0)	124 (100.0)	4.6 (1.5–13.5)	0.005
Higher secondary (11–12)	52 (96.3)	2 (3.7)	54 (100.0)	5.0 (1.1–23.3)	0.038
University (>12)	67 (97.1)	2 (2.9)	69 (100.0)	6.5 (1.4–29.9)	0.016
Current Marital Status					
Married	113 (94.2)	7 (5.8)	120 (100.0)	6.1 (1.3–28.2)	0.022
Unmarried	226 (91.9)	20 (8.1)	246 (100.0)	4.2 (1.0–17.4)	0.045
Widowed/divorced (RC)	8 (72.7)	3 (27.3)	11 (100.0)	1.0	–
Current place of Residence					
Residential area (RC)	279 (91.8)	25 (8.2)	304 (100.0)	1.0	–
Slum/Mess/Hostel/Office/Dera*	68 (93.2)	5 (6.8)	73 (100.0)	1.2 (0.4–3.3)	0.887
Currently living with					
Alone	75 (93.8)	5 (6.2)	80 (100.0)	1.5 (0.6–4.2)	0.631
Family (RC)	225 (90.7)	23 (9.3)	248 (100.0)	1.0	–
Relative/Friend/Parikh/Guru	47 (95.9)	2 (4.1)	49 (100.0)	2.4 (0.5–10.6)	0.306
Income in last month					
≤10,000	190 (92.7)	15 (7.3)	205 (100.0)	1.2 (0.6–2.5)	0.223
>10,000 (RC)	158 (91.3)	16 (8.7)	174 (100.0)	1.0	–
Risk Behavior					
Ever Tested for HIV					
Yes	336 (92.1)	29 (7.9)	365 (100.0)	1.1 (0.1–8.4)	0.961
No (RC)	11 (91.7)	1 (8.3)	12 (100.0)	1.0	–
Tested for HIV in the last year					
1	142 (94.7)	8 (5.3)	150 (100.0)	2.0 (0.8–4.9)	0.802
2 (RC)	156 (89.7)	18 (10.3)	174 (100.0)	1.0	–
>2	32 (91.4)	3 (8.6)	35 (100.0)	1.2 (0.3–4.4)	0.534
Had sex with male in the last month					
Yes (RC)	228 (90.5)	24 (9.5)	252 (100.0)	1.0	–
No	119 (95.2)	6 (4.8)	125 (100.0)	2.1 (0.8–5.2)	0.257
Had sex with female in the last month					
Yes	115 (92.7)	9 (7.3)	124 (100.0)	1.2 (0.5–2.6)	0.227
No (RC)	232 (91.7)	21 (8.3)	253 (100.0)	1.0	–
Had sex with <i>hijra</i> in the last month					
Yes	11 (100.0)	0 (0.0)	11 (100.0)	1.0	–
No (RC)	336 (91.8)	30 (8.2)	366 (100.0)	1.0	–
Has wife and ever had sex with wife					
Had sex with wife	121 (93.1)	9 (6.9)	130 (100.0)	1.2 (0.6–2.8)	0.098
Does not have wife/didn't have sex with wife (RC)	226 (91.5)	21 (8.5)	247 (100.0)	1.0	–
Ever had sex with another women (other than wife or FSW)					
Yes	98 (93.3)	7 (6.7)	105 (100.0)	1.3 (0.5–3.1)	0.104
No (RC)	249 (91.5)	23 (8.5)	272 (100.0)	1.0	–
Total number of partners in last month					
No partner	56 (96.6)	2 (3.4)	58 (100.0)	2.9 (0.6–13.1)	0.216
1 partner	155 (90.6)	16 (9.4)	171 (100.0)	1.0	–
≥2 partner	136 (91.9)	12 (8.1)	148 (100.0)	1.2 (0.5–2.6)	0.640
Reported at least one symptom of STI in the last year					
Yes (RC)	60 (90.9)	6 (9.1)	66 (100.0)	1.0	–

(continued on next page)

Table 4 (continued)

Factors	Bivariate Analysis				
	Yes	No	Total	UOR (95 % CI)	p value
	n (Row %)	n (Row %)	N (Row %)		
No	287 (92.3)	24 (7.7)	311 (100.0)	1.2 (0.5–3.1)	0.709
Took drugs in last year					
Yes	117 (92.9)	9 (7.1)	126 (100.0)	1.2 (0.5–2.7)	0.719
No (RC)	230 (91.6)	21 (8.4)	251 (100.0)	1.0	–
Assessing own risk of HIV					
High	22 (91.7)	2 (8.3)	24 (100.0)	1.1 (0.2–5.4)	0.897
Medium	58 (95.1)	3 (4.9)	61 (100.0)	1.9 (0.5–7.3)	0.321
Low	151 (91.5)	14 (8.5)	165 (100.0)	1.1 (0.5–2.5)	0.841
None at all (RC)	109 (90.8)	11 (9.2)	120 (100.0)	1.0	–
Unable to assess own risk	7 (100.0)	0 (0.0)	7 (100.0)	1.0	–
Other risk					
History of Depression					
Past or Present History	39 (95.1)	2 (4.9)	41 (100.0)	1.8 (0.4–7.8)	0.358
No History (RC)	308 (91.7)	28 (8.3)	336 (100.0)	1.0	–
History of Anxiety					
Past or Present History (RC)	7 (77.8)	2 (22.2)	9 (100.0)	1.0	–
No History	340 (92.4)	28 (7.6)	368 (100.0)	3.5 (0.7–17.6)	0.206
History of other mental health problem					
Past or Present History (RC)	4 (80.0)	1 (20.0)	5 (100.0)	1.0	–
No History	343 (92.2)	29 (7.8)	372 (100.0)	2.9 (0.3–27.6)	0.085
History of self-harm					
Yes	31 (93.9)	2 (6.1)	33 (100.0)	1.4 (0.3–6.1)	0.675
No (RC)	316 (91.9)	28 (8.1)	344 (100.0)	1.0	–
Ever heard about HIV/AIDS					
Yes (RC)	345 (92.0)	30 (8.0)	375 (100.0)	1.0	–
No	2 (100.0)	0 (0.0)	2 (100.0)	1.0	–
Comprehensive knowledge of HIV					
Yes	137 (93.2)	10 (6.8)	147 (100.0)	1.2 (0.5–2.8)	0.501
No (RC)	210 (91.3)	20 (8.7)	230 (100.0)	1.0	–
Confidence about doing test process as well interpreting result correctly**					
Very Confident	283 (95.3)	14 (4.7)	297 (100.0)	5.0 (2.3–10.9)	0.000
Not very confident (RC)	64 (80.0)	16 (20.0)	80 (100.0)	1.0	–
Willing to encourage partner to test					
Yes	267 (92.4)	22 (7.6)	289 (100.0)	1.2 (0.5–2.8)	0.557
No (RC)	80 (90.9)	8 (9.1)	88 (100.0)	1.0	–
Willingness to buy test kit					
Yes (RC)	327 (91.8)	29 (8.2)	356 (100.0)	1.0	–
No	19 (95.0)	1 (5.0)	20 (100.0)	1.8 (0.2–13.8)	0.617
Use of social media					
Yes	236 (92.9)	18 (7.1)	254 (100.0)	1.4 (0.7–3.1)	0.536
No (RC)	110 (90.2)	12 (9.8)	122 (100.0)	1.0	–

Notes: RC refers to reference category.

**This is a composite variable of the following questions.

¹How confident were you about doing the test process correctly?

²How confident were you about interpreting the result correctly on your own?

^βMetropolitan area included Dhaka and Chattogram and Peri-urban area included Tangail, Sirajganj, and Belkuchi.

3.7.1. Insights on acceptability of HIVST among MSM and hijra in Bangladesh

3.7.1.1. Reasons of acceptance. Accepting HIVST was not merely a gesture of agreeing to the testing process, taking the kit and conducting the test by themselves. Rather, the gesture is the cumulative effect of many considerations that drove the participants to take HIVST. Participants accepted supervised HIVST, hoping that this would create an opportunity for them to undertake future HIV tests alone and as per their convenience.

3.7.1.1.1. Painless and easy. The painless procedure was perceived as an attraction as opposed to blood-based testing and participants compared the quickness of the procedure as almost similar to the conventional testing. A DIC Manager added, “I frequently observe program participants panicking to get needle prick for testing. But in oral fluid-based self-testing, they did not face any challenge because they had no fear of needle prick” (KII, DIC manager, age 38 years).

3.7.1.1.2. Felt empowered. Participants expressed the HIVST procedure as an empowering feeling, as they could actively engage with the HIV testing process rather than serve as a passive recipient of provider-initiated HIV testing. “I feel proud that I can do the HIV test by myself. We used to get a test report from providers that many of us interpreted as good (negative result) or bad (positive result). But now I can understand the meaning of the red line on the kits (Test or Control) and I feel like a doctor (laughs).” (IDI, MSM-kothi, 23 years).

3.7.1.1.3. Convenient to working hours. Participants perceived HIVST as a tool that could match their work schedule to test

Table 5

Factors associated with doing all steps correctly (Feasibility): Results from multivariable analysis.

Factors	Multivariable Analysis		
	Yes n (Row %)	AOR (95 % CI)	p value
Area^β			
Metropolitan area	176 (95.1)	3.4 (1.2–9.6)	0.018
Peri-urban area (RC)	171 (89.1)	–	–
Socio-economic Characteristics			
Age (in years)			
18–24	130 (90.9)	1.7 (0.4–7.6)	0.355
25–34	172 (96.1)	4.0 (1.1–14.8)	0.038
≥35 (RC)	45 (83.7)	–	–
Years of schooling			
No education	37 (84.1)	1.2 (0.4–3.8)	0.490
Primary (1–5) (RC)	72 (83.7)	–	–
Secondary (6–10)	119 (96.0)	3.4 (1.1–10.1)	0.032
Higher secondary (11–12)	52 (96.3)	2.4 (0.5–12.2)	0.248
University (>12)	67 (97.1)	4.0 (0.8–19.2)	0.175
Current Marital Status			
Married	113 (94.2)	5.1 (1.0–25.8)	0.046
Unmarried	226 (91.9)	2.1 (0.5–9.4)	0.147
Widowed/divorced (RC)	8 (72.7)	–	–
Confidence about doing test process as well interpreting result correctly**			
Very Confident	283 (95.3)	4.3 (1.8–10.7)	0.001
Not very confident (RC)	64 (80.0)	–	–

Notes: RC refers to reference category.

**This is a composite variable of the following questions.

¹How confident were you about doing the test process correctly?²How confident were you about interpreting the result correctly on your own?^βMetropolitan area included Dhaka and Chattogram and Peri-urban area included Tangail, Sirajganj, and Belkuchi.**Table 6**Mixed method findings on acceptability of HIVST among MSM and *hijra*.

Major quantitative findings (N = 377)	Qualitative findings
Reasons of acceptance	Thematic categories
Interest in independent testing (84.3 %)	<ul style="list-style-type: none"> • Self-risk perceptions • Empowering feeling • MSM prefers it to avoid social stigma • Complement working hours • Preferable in COVID-19 pandemic era
Suggestion from peers (57.3 %)	<ul style="list-style-type: none"> • Positive feedback from peers • Trust on service providers
Quick and very easy (54.9 %)	<ul style="list-style-type: none"> • Easiness of the procedure more highlighted
Painless (52.5 %)	<ul style="list-style-type: none"> • Painless compared to blood-based test • Avoid HIV test in fear of needle prick
Free of cost (21.0 %)	<ul style="list-style-type: none"> • Majority want free of cost kits • Setting a price may demotivate

Table 7

Mixed-method findings on participants attitude on HIVST conduction.

Quantitative findings (N = 377)	Qualitative findings	
Feasibility aspects	Thematic categories	
Mentioned test as easy	99.7 %	FOB7 Procedure was easy to conduct
Confident to do the test	92.8 %	FOB7 Video demonstration was most helpful among supporting tools
Confident to interpret the result	80.6 %	FOB7 Supervision was necessary for first HIVST to learn correctly
		FOB7 Supervision more important in new HIV positive cases
		FOB7 Result could be trusted

conveniently. For example, *hijra* remain involved in collecting money from *hijra* works (*badhai* or *cholla*) and both *kothi* and *hijra* get involved in transactional sex at night (*night kora*), therefore it is challenging to visit testing facilities during the daytime. As a *hijra* expressed, “Going for HIV test is difficult for us, even guru (leader) becomes irritated to hear HIV tests as it will lessen the earnings. We want to

Table 8
Mixed method data on correct test conduction challenges.

Quantitative findings (N = 377)	Qualitative findings	
	n (%)	Thematic categories
Forget checking the instruction manual	2 (0.5)	FOB7 Less confident participants tend to make more mistakes throughout test
Inappropriately collected oral fluid sample	6 (1.6)	FOB7 Participants forget to collect sample both from upper and lower gum
Incorrectly placed the strip into buffer solution	9 (2.4)	FOB7 Some participants could not use clock to maintain time record
Did not wait the required time (20 min) before interpreting result	10 (2.7)	FOB7 Interpretation of result remained the trickiest part of HIVST
Interpreted the result incorrectly	14 (3.7)	FOB7 Less educated participants found it difficult to use instruction manual

Table 9
Mixed-method findings on future testing preferences.

Quantitative findings* (N = 377)	Qualitative findings	
	%	Thematic categories
Future test alone at home	83.2 %	FOB7 Prefers to conduct future HIVST independently at home
Prefer in-person counselling	88.9 %	FOB7 Feels in-person counselling or over-phone helpline is necessary
Currently has cell phone	98.7 %	FOB7 Mobile technology and social media can be useful in accessing HIVST information and demonstration
Currently uses social media	67.6 %	video
Interested in social media-based approach	84.0 %	

test here (home) at our convenient time, so we prefer self-test.” (IDI, Hijra, age 45 years).

3.7.1.1.4. *Tackle social stigma.* Social stigma attached to coming to MSM and hijra service centers for conventional HTS was another reason participants, especially MSM considered accepting HIVST. As one MSM participant said, “Whenever I come here (DIC), I was always worried that someone might see me entering the hijra office and might ask so many questions. I cannot risk my social life as I live with dignity and my family should not become suspicious of my sexual practices. I want to do the test at home alone, and don’t want to come here (DIC) often.” (IDI, MSM-panthi, age 38 years).

3.7.1.1.5. *Avoid crowd in pandemic environment.* Both MSM and hijra cited HIVST as a viable alternative for HIV testing during the COVID-19 pandemic situations during movement restrictions, as opined by an MSM, “My life is more important than HIV testing! You can see most people are hardly following any precautionary measures! Many are not wearing masks, they are coming so close to me when I get into the bus to come here and the road is full of people in careless attitude. I have no problem learning self-test from you and doing it at home afterwards. But to come here every now and then for services is too risky.” (IDI, MSM-kothi, age 38 years). The staff members of DICs echoed the same notion, considering that HIVST should have more potential and acceptability within the COVID-19 era.

3.7.1.1.6. *Preferred free test kits.* Almost all participants appreciated the free of cost kits provided in the study and for future testing they strongly suggested to make the kit available free of cost similar to other services they receive from service centers. However, if they had no option of getting free kits for testing, they contemplated spending some money on HIVST kits, but warned that setting a price for the kit might ultimately dissuade them from using a kit. “We expect this to be free so that we can easily test ourselves. But if someday I somehow have sex without a condom (dhurpit) with a person I suspect to be infected, I would probably become mad to know if something is happening inside me. If I am getting HIV, then money would be the least of my concerns, rather I would go to a pharmacy (drug shop) and buy a kit and test myself.” (IDI, MSM-kothi, age 29 years).

3.7.1.2. *Suggestion from peers.* Participants were found to highly appreciate this new testing method in the service centers that was recommended by peers who already taken the test. MSW and hijra who were regularly involved in condomless anal or oral sex due to the client’s insistence considered this as a convenient tool for checking their status. “I am at risk so I want to know what’s happening inside my body. Moreover, if I can learn this, maybe I can test myself in the future whenever I feel I am at risk and would not have to come to the DIC for this.” (IDI, Hijra, 28 years).

3.7.1.2.1. *Trust towards service providers.* Moreover, it had been observed that, both group of participants had faith on the service providers due to their long-serving relationships that helped them decide about accepting HIVST. According to one of the MSM participants, “these guys (DIC staff) always take care of us and we consider this place (DIC) really safe. So, when they offered me a self-test here, I thought ... this must be good and safe.” (MSM-kothi, 38 years, IDI).

3.7.1.2.2. *Concerns were not a barrier for accepting HIVST.* Few participants raised concerns about the authenticity of the test kit in detecting HIV as one MSM said, “I cannot figure out how HIV comes to my oral-fluid! I never had oral sex and now they are telling me to mix oral-fluid in the kit for HIV test.” (IDI, MSM-panthi, age 30 years). Whereas, few others questioned whether the ingredients of the test kit could do any harm to them when they insert it into the oral cavity as saying, “Here I have to insert this unknown thing into my mouth. When I put the kit in my mouth I felt salty, and I became a bit concerned as eyes and mouth are very sensitive organs. So, I prefer to use blood-based HIV test in the future to avoid any health problem”. (IDI, MSM-panthi, age 30 years). Nevertheless, it had been found that, these concerns did not deter them from accepting HIVST.

3.7.2. Insights on feasibility of HIVST among MSM and hijra in Bangladesh

3.7.2.1. Supervision was necessary. As HIVST was absolutely new to this group, the supervision was essential to conduct and interpret the result, especially for less educated participants as they were unable to follow the instruction manual, and also particularly for *hijra* groups due to their relative inattention to such procedural tests. *“First, the counsellor briefly described the importance of the test and then gave verbal instructions for doing the test properly. I asked him (counsellor) again about the process to be sure and I conducted the test really well. For my future self-tests, I may not need a counsellor but for my first test, I cannot confidently do it alone”* (IDI, MSM-panthi, age 24 years). Supervision was crucial for newly diagnosed HIV cases to settle down emotionally and link them to confirmatory testing and subsequent care and support. As shared by one of the participants, *“When I saw the two red lines in the kit, my body was literally shaking with anxiety. All the bad thoughts were coming into my mind (silence). Then he (the counsellor) told me not to be worried. Getting reactive here does not mean I’m HIV positive as I need to confirm this. He said he will arrange the confirmatory test for me and even if I get finally positive, he will link me to the centers where I can get medicine (anti-retroviral) and care. It was so assuring to me in that moment”*. (IDI, MSM-kothi, age 33 years).

3.7.2.2. Video more helpful than texts. Among the supervision materials, video demonstration was highlighted as an important aid in better comprehension of the procedure which participants could understand more easily than verbal or detailed instructions. *“I had never been to school and never learned how to read. So, the illustrated manual was beyond my understanding. Even though the counsellor was explaining the process, I was not so sure if I could do this and felt really stressed. But once he showed me the video, it felt like I could do this! I think anybody can do this. If he (counsellor) showed me the video first, I don’t think he would need to talk that much.”* (IDI, MSM, age 38 years).

3.7.2.3. Result interpretation was trickiest. Even though the test procedure was labeled as easy, most participants pinpointed the interpretation as the trickiest part as some participants expressed becoming confused while interpreting and tried to memorize what they had seen in the video or heard from the verbal instructions. As one participant mentioned, *“While I could do all steps smoothly, when the red line came in the kit I became confused about whether I am positive or negative. Then I matched it with the picture in the paper (manual) and correctly understood my result. I am afraid, if I were uneducated, I would not be able to read the manual myself and interpret it correctly”*. (IDI, Hijra, age 33 years).

3.7.2.4. Trust on this new method. The information about the test kit and active participation in the test procedure made participants develop trust on the accuracy of the result as one participant said, *“I heard that it was an approved kit globally and also from our government. And whatever I did, whatever result appeared, everything happened before my very eyes. So, yes, I have trust on the result I got.”* (IDI, MSM, 29 years).

3.7.2.5. Mistakes were part of the process. A range of mistakes had been observed in test conduction, particularly with participants who were not so confident from the beginning of the procedure and often forget one or more steps. *“To be honest, I was nervous when I started the test I forgot whatever I heard before. Maybe I was a bit inattentive ... I don’t know (unsure). I took the sample from my mouth and looked at the counsellor, he was silent and did not say anything. Then I was waiting for the red lines but suddenly I remember I need to put it (strip) into the solution tube but in a hurry I spilled the solution while opening it. Later he (counsellor) said I took the sample only from the upper gum. It was a total mess (looked sad).”* (IDI, MSW, 23 years). Findings also revealed that less educated participants struggled to use the instruction manual when they were unsure of the procedure and some participants couldn’t keep a record of time as they didn’t know how to use a clock.

3.7.3. Future HIVST prospects among MSM and hijra in Bangladesh

The concept of feasibility often has other perspectives beyond the correct conduction of HIVST. In that respect, a few more issues were qualitatively evaluated such as future self-test preferences, and willingness to spend on HIVST kits under the feasibility section.

3.7.3.1. Test independently at home. Most participants wanted to undertake future HIVST at home alone as they felt it would maintain their privacy and confidentiality. However, many of them felt the provision of counselling services either in-person or over the phone would be absolutely necessary in such cases. *“I can do it alone at my home ... simple ... but you must give me a number or something where I can talk. It’s not a game for me ... if I get positive it’s like a life and death situation.”* (IDI, MSM, 38 years).

3.7.3.2. Social media can help. Participants emphasized the role of social media not only to create HIV related awareness but also to distribute HIVST kits, provide demonstration videos on popular video streaming sites, and virtually navigate to confirmatory tests and linkages to care. *“As you can see, nowadays almost everyone maintains social media accounts. You may not watch TV or radio, but you must check your social media account several times a day. Why not use this to let people know about self-testing? Many people who feel shy to go to hospitals or DICs for an HIV test would instead try to get a kit and use it with online instructions”*. (IDI, MSM-panthi, age 26 years).

3.7.3.3. Service providers unsure about kit storage. Service providers discussed about whether the HIVST kit could provide accurate results in future testings if stored in normal temperature compared to the storing of conventional rapid HIV test kits in cool temperature. *“Bangladesh is a warm country. Here in the summer, we experience burning heat (high temperature). We always keep HIV testing kits*

at freezers of DIC to keep them fine. Now if self-test kits are distributed to clients and they use it after few days and store it outside freezers, this could hamper the quality of the kit" (KII, DIC manager, age 36 years). This observations highlighted service providers need of information about storing HIVST kits.

4. Discussion

This cross-sectional study examined the acceptability and feasibility of HIVST first time among MSM and *hijra* in Bangladesh. The findings underscored HIVST as a highly acceptable and feasible HIV testing process, which can be used as a complementary approach to increase the coverage of existing conventional HIV testing facilities. Most participants appreciated the provision of in-person counselling (88.9 %) during the supervised HIVST, labeled it as necessary to get a clear and correct idea about the testing procedure and linkage to confirmatory testing and care process. The multivariable logistic regression analysis revealed that the likelihood of correct completion of all HIVST steps was higher among participants from metropolitan area compared to peri-urban or rural areas, younger age group, married participants, with higher education, and who reported being confident to complete HIVST procedure as well as interpret the result.

High acceptability of oral fluid-based HIVST among MSM and *hijra* was observed in this study, which was also reflected in different population groups and KPs in various settings including Low- and Middle-Income Countries (LMIC) in Sub-Saharan Africa [12,25]. However, unlike other studies, participants' interest/curiosity towards independent testing to know their HIV status played a major role in the acceptance of HIVST (84.3 %) in this study. Very few studies reported such interest as a motivating factor and this study had identified participants perceived susceptibility to HIV due to risk behaviors and willingness to enact changes had played a major role that probably developed due to their prolonged attachment with ongoing HIV programs [25,26].

The other major reasons for acceptance included easy-to-use approach and ability to yield quick results (54.9 %), and painless procedure (52.5 %) that had also been mentioned in similar studies [27–30]. One reason for acceptance that was found particularly important was the strong recommendation of HIVST from peers which delineates the highly networked pattern of MSM and *hijra* here and the benefits of accessible DIC-based services that raised their awareness and provided a platform for exchanging ideas amongst themselves [31]. Such peer-based approaches can be particularly useful to introduce the community with HIVST approach, clarify issues like reasons of detection of HIV from oral fluid or dispel fear of getting harm from kit ingredients and may aid in further scale up.

Avoiding stigmatizing situations such as risk of getting recognized by a healthcare provider when coming for a HIV test was previously cited as a reason for choosing HIVST [32,33]. However, in this study, a unique dimension of social stigma was identified where participants were afraid of being labeled as 'Gay' or '*hijra*' by the locals if they access the community based DICs, thus citing HIVST as a preferable option. Another important acceptability aspect was their fear of getting COVID-19 infection while travelling and accessing the service centers for HTS due to increased exposure. In this pandemic setting, HIVST could be a great alternative to facility based testing that also has been advocated by major implementing bodies [34].

In this study, the high proportion of participants (92 %) had completed all steps of HIVST correctly and the concordance of results between participants and the counsellor was particularly encouraging for this setting where literacy and self-management skills were presumed to be low. While even higher levels of concordance were reported in some studies, less than expected errors were documented here such as incorrect specimen collection technique from the oral swab, spillage of buffer solution, and errors in interpretation of results from this group of participants [13,25,35–38]. The supervised modality had been appreciated by participants as HIVST was never introduced in Bangladesh before. Evidence from other countries also showed that particularly for settings with less awareness and literacy, supervised HIVST would be preferable [14,39,40].

In the multivariable analysis, higher test performance among participants from metropolitan areas were found compared to rural or semi-urban areas. Even though extremely limited global literature was found reporting urban-rural HIVST performance differences, some studies showed significant procedural errors among rural residents. In this context, they advocated supervised HIVST as more feasible for rural settings [12,38,41,42]. HIV-related literacy and awareness among the rural population had been found low in various settings as well as among the Bangladeshi population that might influence the test performance [43,44].

Moreover, reasons behind better test performance among married participants in this study could not be adequately explained by the global literature. Studies in China reported higher HIVST uptake among married people in the general population, and it can be hypothesized that married people in this study were probably more attentive to learn the process, and uptake kit for female partners to conduct at-home testing [45]. This can be considered as a facilitating factor in accessing the female partners of married MSM in Bangladesh. Furthermore, younger age participants were more likely to complete HIVST steps correctly compared to older age participants which was consistent with findings from different settings assumed to be due to their increased ability to recall the procedure and to act accordingly [12,38]. Older participants here might require more supervision during the test procedure and result interpretation.

Relatively higher educational status had been found as a facilitating factor to correctly complete all HIVST steps. Level of education can be considered a critical factor in the interpretation of test results and less educated participants were more likely to misinterpret results [38,46,47]. Better educational level may logically make verbal, pictorial, text-based and video instructions on HIVST easy to understand and follow more conveniently. Participants' higher confidence about following the procedure and interpret the test result was also a facilitating factor for correctly completing the test. Participants pointed out interpretation of test result as the most tricky part of HIVST, and often used the illustrated manual to remember and match the result interpretation. As such, developing simplified testing instructions to build the confidence of MSM and *hijra* to conduct the test independently was repeatedly emphasized [38,48,49]. Easily understandable instruction manuals with illustrations or video demonstrations used in the current study were found beneficial especially for less-educated participants who might find it difficult to follow and interpret results using text-based manuals [13,20,36].

For future testing, study participants expressed their willingness to spend a certain amount of money to purchase HIVST kits at subsidized prices as their expected median purchase price (USD 1.8) was much lower than the kit price procured for this study (USD 5.9). Participants' willingness to receive HIVST related information and procedural details through social media (84 %) was also encouraging as particularly for MSM, social media-based distribution and conduction of HIVST had been found highly effective [50, 51]. This would be more beneficial in LMIC settings, where MSM and TGW face barriers in accessing HIV testing services and would welcome social media-based HIVST that will maintain anonymity within politically and religiously adverse settings [50]. All participants showed a willingness to undertake HIVST in the future, while they felt that after the initial supervised HIVST, they were confident to undertake the next HIVST at home (83.2 %) to be conducted alone. This finding might open a window of opportunity for introducing unsupervised HIVST followed by supervised HIVST that could sustain this approach in the long term.

4.1. Policy implications

Due to uniqueness of HIVST to ensure HIV testing within the convenient and private setting and its proven ability to yield correct and trustworthy results, HIVST became a useful tool to increase HIV testing coverage among hard to reach groups including MSM and *hijra* in Bangladesh and potentially to other KPs [11]. Linkage to care following supervised HIVST had been ensured in the study, however, potential challenges remain for future un-supervised testing and more evidence is required to establish feasible linkage to care pathways [12,14]. Even though international policies provide less emphasis on the provision of pre-test counselling, participants of the current study and studies from different settings repeatedly highlighted the need for in-person or over-phone counselling which is sometimes missing in HIVST approaches [52–54]. Moreover, regulatory guidelines for marketing and distribution, quality assurance, limiting human rights violation from coercive testing and explicit pathways for linkage to care are crucial for facilitating acceptability and feasibility of HIVST in settings particularly naïve to self-testing approaches like Bangladesh [55–57]. The more this community gets accustomed to self-testing services, the higher the prospects of such innovative testing approaches will be ensured [58].

4.2. Limitations

Participants for the study were recruited through convenient sampling from five service centers in Bangladesh in different geographical regions combining urban and rural settings. Yet, the findings may not represent the overall MSM and *hijra* community in Bangladesh. More so for the population who remained out of the HIV prevention service coverage, the acceptability to HIVST could be different from the participants of the study who received regular HIV prevention services from DICs. Moreover, the MSM and *hijra* sub-culture in Bangladesh closely resembles that of India as the culture descended from there with frequent movement across the border. Considerable fluidity in respect to sexual/gender identity of MSM-*Kothi* and *hijra* had been observed that often made it difficult to differentiate between these groups. As this was the first HIVST study targeting these population groups in Bangladesh, therefore, the intention was not to adopt differentiated approaches to different sub-groups rather consider them as a combined group of sexual and gender diverse population in Bangladesh. So, to convey the findings in a simpler way and considering difficulties in analysing and interpreting a smaller sample size of *hijra*, the sample size calculation and representation of data had been presented combinedly. Finally, the responses related to HIVST acceptance and future testing preferences were self-reported, therefore opening the possibility of social desirability bias [59]. Despite these limitations, the study was conducted among a relatively larger sample size from various geographical areas, with a high acceptance rate and the study team with expertise in HIV interventions among MSM and *hijra* community acted as the strength of the study.

5. Conclusion

HIVST had been found as an acceptable and feasible approach for the MSM and *hijra* populations in Bangladesh. The supervised HIVST was highly appreciated by the participants as an introduction to the self-testing process which paved the way for future un-supervised HIVST that would be particularly helpful for COVID-19 pandemic conditions. The study also highlighted facets of future scale-up and sustainability by elaborating participants' willingness to buy HIVST kits in subsidized prices and interest to adopt social media-based HIVST approaches. Policymakers should consider the findings of the study for scale-up among MSM and *hijra*, and inauguration of HIVST among other KPs as well as the general population who are at-risk but remain out of HIV testing coverage, while ensuring linkage to care process.

Ethics declaration

The study protocol was reviewed and approved by the Research Review Committee (RRC) and Ethical Review Committee (ERC) of icddr,b which are part of the Institutional Review Board (IRB, protocol no: PR-19112).

Data availability statement

Data associated with this study had not been deposited into any publicly available repository. According to the institutional data policy of the icddr,b, only summary of data can be publicly displayed or made publicly accessible. To protect intellectual property rights of primary data, icddr,b cannot make primary data publicly available. However, upon request, Institutional Data Access Committee of icddr,b can provide access to primary data to any individual, upon reviewing the nature and potential use of the data.

CRediT authorship contribution statement

Muhammad Manwar Morshed Hemel: Writing – original draft, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Md Masud Reza:** Writing – review & editing, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Gazi Sakir Mohammad Pritom:** Writing – original draft, Software, Project administration, Data curation. **Golam Sarwar:** Writing – review & editing, Conceptualization. **Mohammad Niaz Morshed Khan:** Writing – review & editing, Methodology. **Saima Khan:** Writing – review & editing. **AKM Masud Rana:** Writing – review & editing, Supervision. **Sharful Islam Khan:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This study received funding from The Global Fund to Fight Against AIDS, Tuberculosis and Malaria (BGD-H-ICDDRB #1403). We want to acknowledge the contribution of icddr,b to permit writing this research article. We also would like to acknowledge the donors providing unrestricted support to icddr,b's research efforts. icddr,b is grateful to the Governments of Bangladesh and Canada for providing core/unrestricted support. Also, we would like to express our gratitude to Samira Dishti Irfan for her support in editing and reviewing the manuscript.

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