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# Perceptions of an HIV self-testing intervention and its potential role in addressing the barriers to HIV testing among at-risk heterosexual men: a qualitative analysis

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## ABSTRACT

**Objectives** Voluntary HIV testing rates are still low in several Asian countries including Singapore. HIV self-testing (HIVST) has the potential to increase testing, leading to earlier diagnosis and better prognosis. However, the views of at-risk individuals, especially heterosexual men (HSM), who are not coming forward for testing are still poorly understood. In this study, we examined the barriers and facilitators to and delivery preferences for HIVST in order to implement an effective intervention in Singapore.

**Methods** From May 2017 to June 2018, 48 in-depth interviews were conducted with HSM aged 21–66 years and at risk of HIV infection. Participants were purposively sampled based on ethnicity, age and testing behaviour. Recruitment was done mainly at brothels and entertainment establishments in Singapore. Participants gave their views on HIV testing, factors affecting HIVST use and their preferred HIVST service delivery model.

**Results** Most participants preferred HIVST over conventional testing for its convenience, privacy, anonymity and autonomy, but older men still preferred conventional testing. Low self-perceived risk, low awareness and self-efficacy for HIVST, and non-comprehensive test for other STIs were reported as barriers to HIVST. There were mixed opinions on kit preference. A blood-based kit was favoured for higher accuracy, while the oral-fluid-based kit was favoured for ease of use. Participants wanted a human touch for post-test counselling and linkage to care only if they self-tested positive. Traditional media, internet and social media, and venue-based outreach were potential advertising platforms mentioned.

**Conclusions** A locally acceptable and feasible HIVST intervention must address the barriers and facilitators of using HIVST in order to improve HIV testing rates among this at-risk population who might otherwise delay or fail to present for testing.

## INTRODUCTION

To end the HIV/AIDS epidemic by 2030, the Joint United Nations Programme on HIV/AIDS has established the ambitious 90–90–90 targets, aiming for 90% of all people living with HIV to

know their HIV status; 90% of those diagnosed with HIV to receive antiretroviral therapy; 90% of those receiving treatment to achieve viral suppression by 2020.<sup>1</sup> In Singapore, the proportion living with HIV aware of their serostatus has been estimated to be only 71.7%,<sup>2</sup> and about half of new cases among Singapore residents were still diagnosed late. It has been estimated that 51.1% of HIV infections in Singapore are attributable to heterosexual men (HSMs), with HSMs being 2.54 times more likely to present late.<sup>3–4</sup> Only 16% of the cases were detected through voluntary screening, with this proportion substantially lower in HSM (5%) as compared with men who have sex with men (MSM) and men who have sex with men and women (25%).<sup>3</sup> This phenomenon is also common in other Asian countries<sup>5</sup>; thus, interventions are needed to improve HIV testing rates in this population. However, limited studies have been done to understand the testing practices of HSMs in Asia.<sup>6</sup>

Majority of the Singapore population are Chinese (74.4%), with Malays (13.4%) and Indians (9.0%) being the main minority ethnic groups.<sup>7</sup> The percentage of HSMs engaging in risky sexual behaviour has increased from 4.7% in 1989 to 18.5% in 2007.<sup>8</sup> Brothels and entertainment establishments (EEs) are common places where casual and paid sex takes place in Singapore. An estimated 50 brothels operate legally, while illegal commercial sex services can be found at approximately 400 licensed EEs—mainly nightclubs, drinking bars and karaoke lounges.<sup>8–10</sup>

In Singapore, attempts to increase HIV testing rates through strategies such as the HIV opt-out screening for hospitalised adults have been unsuccessful, with only 4.9% of eligible patients agreeing to testing. Common reasons for opting out included low self-perceived risk, high costs and an aversion to venepuncture.<sup>11</sup> A study among HSMs who engaged in casual or paid sex in Singapore found that top barriers to testing included perceived practice of safe sex, fear of stigma and discrimination from testing and fear of a positive diagnosis.<sup>8</sup> Stigma and



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discrimination surrounding HIV remains prevalent in Asian countries.<sup>9 12 13</sup>

The role of HIV self-testing (HIVST) in increasing screening rates and early detection of HIV is promising. Globally, studies found a high acceptability of HIVST and that self-testers can achieve high sensitivity and specificity with minimal errors.<sup>14–16</sup> However, most HIVST studies have been on MSM populations in middle-income to high-income settings or on the general population in Africa. There are comparatively fewer studies on other at-risk populations, particularly HSM in Asia.<sup>17</sup> In Singapore, HIV rapid test kits are registered as ‘professional use only’ medical devices, and previous studies on HIVST focused on clinic-based participants.<sup>18 19</sup> As such, the views of at-risk individuals who are not coming forward for testing are still poorly understood.

To inform the implementation of a HIVST intervention, this study explored the acceptability of HIVST to HSMs who are at risk of HIV infection. Its specific objectives were to understand (1) HIV testing preferences, (2) factors affecting HIVST use and (3) specific HIVST service delivery preferences.

## METHODS

### Study design and participants

This study was conducted in Singapore between May 2017 and June 2018 and recruited 48 self-identified HSMs who (1) are Singapore citizens or permanent residents aged 18 years and above; (2) at risk of HIV infection, defined as having unprotected sex without a condom and/or multiple female sexual partners in the past 12 months; and (3) were self-reported to be HIV negative, including those who have never tested. Participants were purposively sampled based on ethnicity, age and testing behaviour, until information saturation was reached. They were recruited from the Department of Sexually Transmitted Infections Control clinic, EEs, brothels, ‘getai’ (live stage performance held during the Chinese Ghost Festival) and word of mouth. Interested individuals completed a self-administered demographic questionnaire to screen for eligibility. Eligible individuals who provided verbal consent were interviewed.

In-depth interviews were conducted in either English and/or Mandarin in a private environment. All interviewers were qualitative-trained and proficient in English and/or Mandarin, including two female researchers working on infectious disease research (Y-RT and NK); two female Master of Public Health students (AJY and YZ); and a male student intern (JXZL). The participants and interviewers had no prior relationship. A semistructured interview guide was developed and pilot tested using information from existing literature and with the help of local experts. Participants first shared their views on HIV testing. They were then asked about their awareness of HIVST before interviewers demonstrated how to use and interpret the test results of an oral fluid-based kit (OraQuick) and a blood-based kit (BioSure). Lastly, they shared their perceptions of the two kits, ranked attributes for an HIVST intervention and provided suggestions for advertising HIVST. All interviews were audio-recorded except for two, as participants were uncomfortable with being audio-recorded. The interviews averaged 1 hour in length.

### Data analysis

All audio files were transcribed verbatim, and expanded notes accompanying in-verbatim quotes were developed for the two interviews that were pen-and-paper recorded. Interviews

**Table 1** Participant characteristics stratified by age

Participant characteristics	Younger men (<40 years old) n (%)	Older men (≥40 years old) n (%)	Total n (%)
<b>Age (years)</b>			
21–29	16 (66.7)		16 (33.3)
30–39	8 (33.3)		8 (16.7)
40–49		8 (33.3)	8 (16.7)
50–59		10 (41.7)	10 (20.8)
60–66		6 (25.0)	6 (12.5)
<b>Ethnicity</b>			
Chinese	15 (62.5)	18 (75.0)	33 (68.8)
Malay	5 (20.8)	6 (25.0)	11 (22.9)
Indian	2 (8.3)	0	2 (4.2)
Others	2 (8.3)	0	2 (4.2)
<b>Marital status</b>			
Never married	20 (83.3)	9 (37.5)	29 (60.4)
Married	3 (12.5)	10 (41.2)	13 (27.1)
Separated	1 (4.2)	0	1 (2.1)
Divorced	0	5 (20.8)	5 (10.4)
<b>Education level</b>			
Primary	1 (4.2)	8 (33.3)	9 (18.8)
Secondary	4 (16.7)	7 (29.2)	11 (22.9)
Diploma	16 (66.7)	5 (20.8)	21 (43.8)
Degree/postgraduate	3 (12.5)	4 (16.7)	7 (14.6)
<b>Number of sexual partners in the past 12 months*</b>			
0–1	11 (45.8)	2 (8.3)	13 (27.1)
2–3	8 (33.3)	10 (41.7)	18 (37.5)
4–5	4 (16.7)	8 (33.3)	12 (25.0)
≥6	1 (4.2)	4 (16.7)	5 (10.4)
<b>HIV testing behaviour</b>			
Never tested	11 (45.8)	11 (45.8)	22 (45.8)
Tested >12 months ago	4 (16.7)	4 (16.7)	8 (16.7)
Tested in the past 12 months	9 (37.5)	9 (37.5)	18 (37.5)

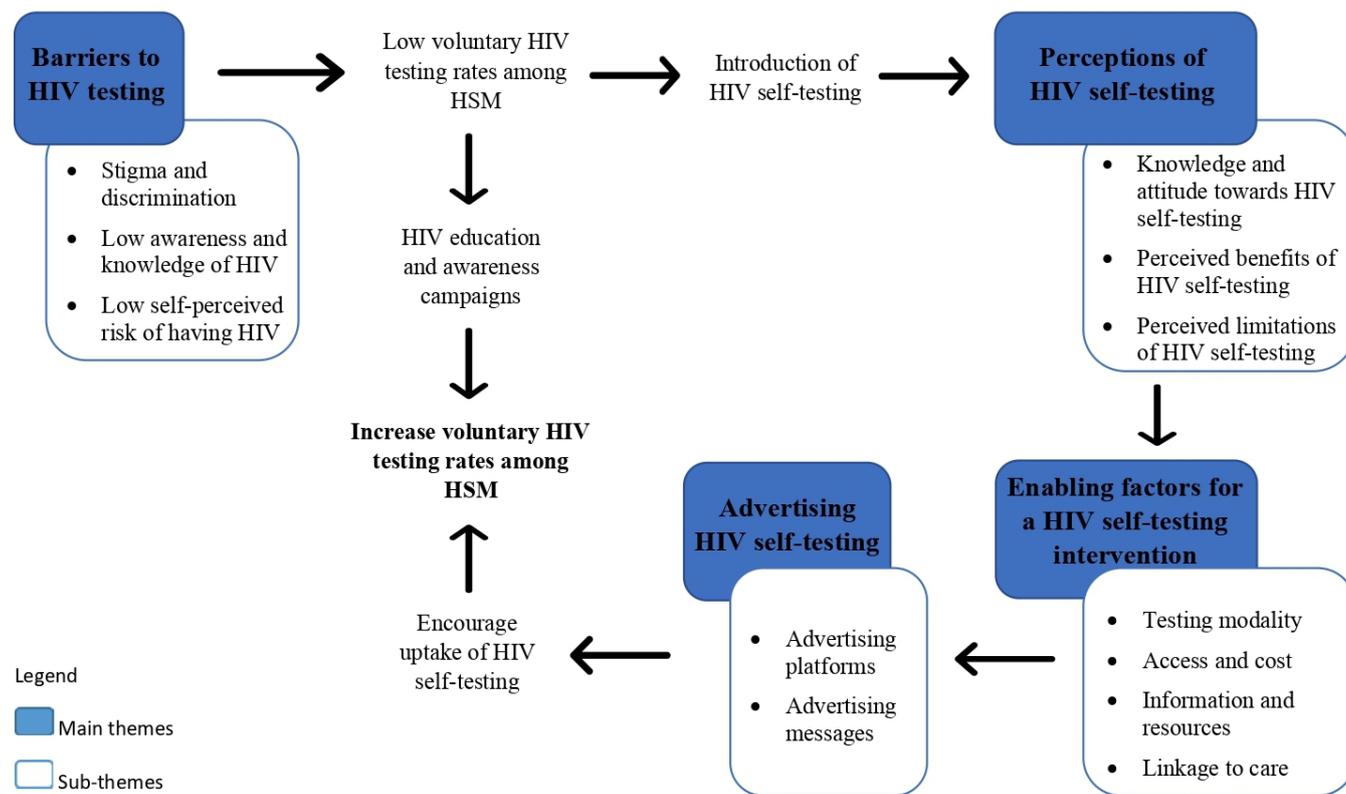
\*Included both casual and regular sex partners.

conducted in Mandarin were concurrently translated and transcribed into English. Thematic analysis was performed. Seven transcripts were independently coded by the study team members to establish intercoder reliability and to develop an initial coding frame, which was then used to code all remaining transcripts with NVivo V.12. Data reduction techniques were used to examine codes in detail for themes. Analysis was stratified by age because we hypothesised that there was a difference in terms of sexual behaviour, HIV testing behaviour, and perceptions surrounding HIVST between younger and older men. The age of 40 was chosen as the cut-off after discussion with our community partners who observe differences on the ground around this age group. Thematic saturation was reached when no new codes or themes emerged. Given the cultural heterogeneity of Singapore’s multiethnic population, we also examined any ethnic differences.

## RESULTS

### Participant characteristics

A total of 119 men were invited to participate. Forty-eight (40.3%) completed the interview and 71 declined, citing a lack of interest or time. Table 1 provides a summary of participants’ characteristics.



**Figure 1** Overview of the barriers to HIV testing, perceptions of HIV self-testing and its potential role in increasing voluntary HIV testing rates among at-risk HSMs. HSM, heterosexual man.

### In-depth interview results

We first identified barriers to HIV testing, which led to low voluntary HIV testing rates among HSMs. After being introduced to the two HIVST kits, participants gave their perceptions of HIVST and identified enabling factors of an HIVST intervention that will increase their likelihood of HIVST uptake. Lastly, potential platforms and messages to advertise HIVST were described. Figure 1 depicts the pathway of findings from our interviews, and table 2 provides a summary of all themes, subthemes and illustrative quotes.

#### Barriers to HIV Testing

Psychological barriers to testing were repeatedly mentioned. Participants expressed that social stigma against HIV/AIDS is still widely prevalent in Singapore. They were afraid of being judged by their family and friends and held self-stigma towards HIV. The fear of discrimination from testing positive prevented several participants from getting tested, with older men in particular holding the view that HIV is a shameful illness and they would rather die than face the judgement of others.

Several participants did not even think of testing for HIV because of a lack of awareness of the disease and its testing. Some cited their normal health screening results without realising that these routine health checks usually do not include HIV tests. A few participants were not sure where to go for testing despite having the intention to test. Some still felt there was no treatment for HIV, while others had misconceptions about transmission and prevention.

A common reason mentioned for not testing for HIV was a low perceived risk of having HIV despite engaging in risky sexual behaviours. Several participants incorrectly believed they were at low risk of HIV because they were in good health and displayed

no overt symptoms, while others felt protected because they knew how to use condoms or checked for symptoms on partners prior to engaging in sex. Some externalised the risk for HIV to other groups such as MSM and sex workers, and this largely stemmed from the men's low self-perceived risk, although all our participants were at risk of HIV infection.

#### Perceptions of HIV self-testing

Majority of the men did not know much about HIVST prior to the interviews. After being introduced to HIVST, many older men still preferred conventional HIV testing as they placed more trust in healthcare providers. On the other hand, almost all the younger participants favoured HIVST due to its advantage in overcoming structural barriers and stigma faced in getting an HIV test.

Privacy, anonymity and convenience were commonly cited as benefits of HIVST. Participants felt HIVST would minimise embarrassing situations of meeting someone they knew at test sites or having to speak with a healthcare professional about their sexual activities. They also liked that no one would know they were testing for HIV or their test results. Having autonomy and control over their own health situations and decisions was another important benefit cited, especially since notification of HIV diagnosis to the National HIV Registry is mandated by the Infectious Disease Act in Singapore.

However, almost all participants expressed concerns about the lack of post-test linkage to care for users who tested positive. Autonomy over results would indicate no official follow-up of people who test positive using HIVST; thus, they are fearful that these individuals may continue to transmit the infection to others, while those who repeatedly test negative may get complacent. Some highlighted the test kits' inability to test for

Table 2 Summary of themes, subthemes and illustrative quotes

Theme	Subtheme	Illustrative quote
Barriers to HIV testing	Stigma and discrimination	'People might be cursing you (...)every time go and play with girls, outside have many sex with other girls'. (28 years old, never tested, Chinese) 'If I got this kind of sickness [HIV] I am so old already, might as well I jump down die early better'. (54 years old, never tested, Chinese)
	Low awareness and knowledge of HIV	'I got no sickness (...)I got go for medical check-up every month. Doctor tell me 'your blood test all okay, nothing to be worry'. (54 years old, never tested, Malay) 'Vitamin E, fruits and coconut water can help to "cleanse" the body after multiple sex (...)wash such bacteria or virus away' (39 years old, never tested, Malay)
	Low self-perceived risk of having HIV	'My body can tell [if I have HIV]. I grew fatter what. Since I have no sickness then can eat right, then urine no pain'. (51 years old, never tested, Chinese) 'Homosexual – higher chance of getting it[HIV] and second thing, hookers, especially other country hookers, Singapore is still ok'. (39 years old, never tested, Malay)
Perceptions of HIVST	Knowledge and attitude towards HIVST	'Clinic, the people there are professional, there are doctors there. If the test is positive at least there is someone who can guide us, comfort us, tell us what are the options'. (51 years old, never tested, Chinese)
	Perceived benefits of HIVST	'A lot of people don't go and check because they are scared of other people finding out (...)they will all go and buy this(self-testing kit)because nobody knows [that they are testing]. I buy it myself and I test myself'. (26 years old, tested in the past 12 months, Chinese) 'It's more accessible for me. I can just drop by if it(self-testing kit)is available at any pharmacy, get it back home, use it, instead of making an appointment, waste my time, have to skip work (...)I can test as and when I want'. (27 years old, tested in the past 12 months, Indian)
	Perceived limitations of HIVST	'(For those who self-test positive)To revenge and go around and play around so they will spread the disease [HIV] you see'. (44 years old, tested in the past 12 months, Chinese) 'Last time always take precautionary action. Scared of this, of this. Now it's not the same anymore. Check(using self-testing kit)and don't have, then check again, don't worry, don't have'. (60 years old, tested in the past 12 months, Chinese)
Enabling factors for an HIVST intervention	Testing modality	'I'm more keen to use this kit [BioSure] because it's a higher percentage of getting it right (...)cause it's HIV so I wouldn't want to live in doubt, I'd rather just be sure'. (30 years old, tested in the past 12 months, Javanese) 'I feel that I must poke my finger, no advantage already. Even is given free I may not want it'. (50 years old, never tested, Chinese) 'If you feel a little uncomfortable, you'd buy the basic kit [OraQuick] first to test, to see that you're alright (...)But if I'm really scared that I have an infection, I would go for the blood-based test'. (26 years old, tested in the past 12 months, Chinese)
	Access and cost	'The first important thing is staying anonymous because if I really have this disease [HIV], I wouldn't want anyone to know it first'. (22 years old, tested >12 months ago, Chinese) 'If the cost difference was going to be 10 dollars, I might as well just go to a GP (...)having somebody do it [HIV testing] for you as a service, someone who is well-trained, who will give you professional advice'. (31 years old, never tested, Malay)
	Information and resources	'I would prefer both [written and video instructions], I wouldn't want to make a mistake and waste my \$53 (...)I would read what is written on it, see the video and I would know what to do'. (39 years old, never tested, Chinese)
	Linkage to care	'They know this kind of kit will tell you like 90% that you are having HIV so I don't think they will stop there, they will confirm go to the next step for they want to know what's going on, what's going to happen, how long can they like live and how about their family members'. (41 years old, never tested, Malay)
Advertising HIVST	Advertising platforms	'I think having them on the shelves is a reminder [to test]. Have sex, I buy a condom and then next to it is a pregnancy test, sometimes it doesn't even cross my mind, but I do just gaze over. So similarly, I think the test(self-testing kit)should be there as well (...)I know it's a scare tactic, but it works'. (31 years old, never tested, Malay)
	Advertising messages	'Test earlier is better because earlier get treatment to suppress HIV disease before it becomes full blown (...)Protect your family because if you got HIV you should do some precaution yourself, you won't affect your family (...)Then maybe say that HIV is not deadly, it's not incurable'. (51 years old, never tested, Chinese)

HIVST, HIV self-testing.

other STIs, so they would rather visit a healthcare facility for more comprehensive tests for both HIV and other STIs.

### Enabling factors for an HIV self-testing intervention

Blood-based kits were generally preferred over oral fluid-based kits. Despite being more invasive and costly, most men trusted BioSure because of its higher accuracy of 99.7%. A key disadvantage of OraQuick was its 91% accuracy which was perceived to be too low. However, several men, especially those who were older, found BioSure difficult to use. Many men fear blood and pricking their own finger; hence, they would not feel confident to perform the test. They fear that incorrect use of the test kits might result in inaccurate results. On the other hand, most participants found OraQuick easy to use and convenient to carry around. Given the mixed opinions, some participants felt that both types of test kit should be made available to cater to different testing preferences, depending on their situation.

Regardless of age, most participants wanted these test kits available in both clinic and retail pharmacies, where the kits could easily be bought off-the-shelf. While many of the young men wanted an online option, some of them, and most of the older men, expressed caution of counterfeit test kits and the possible breach in confidentiality through the tracing of credit card and delivery details or through the contact of mail by family members. Overall, it was evident that when purchasing test kits, almost all participants wanted privacy and anonymity. They wanted to buy the kits from convenient yet discreet venues to avoid being seen and judged by others. The price of self-test kits was a decisive factor for several participants. Most of the older men were reluctant to pay the quoted price of SGD30 and SGD53 for OraQuick and BioSure respectively. Considering that these test kits are for single use and require confirmatory testing if one tests positive, several participants were only prepared to

pay up to SGD20 and SGD45 for OraQuick and BioSure, respectively. Many older men felt there was a lack of value for money compared with in-clinic testing by healthcare professionals and would rather opt for conventional testing.

Due to a general lack of awareness on HIVST in Singapore, majority of the participants felt that access to information about HIVST was most important when contemplating the purchase of a test kit. Older men preferred general practitioners to inform them about HIVST, whereas younger men preferred to obtain information from the internet. Participants also expressed a need for some form of support before using the test kit. While older men preferred pretest counselling conducted via a hotline, younger men opted to complete a pretest assessment online. In terms of instructions for test administration and results interpretation, participants felt that step-by-step written instructions alongside graphical illustrations should be available in different languages. Some men, especially the older ones, wanted video instructions.

All participants wanted post-test support only if they test positive with the self-testing kits, and they believed most people who test positive would want to seek help. Younger men wanted printed information on linkage to care in the test kits, while older men preferred post-test counselling through a hotline.

### Advertising HIV Self-Testing

Older men favoured traditional media such as the radio and newspaper, while younger men frequently mentioned social media (figure 2A). Participants also thought that having a nationwide publicity campaign, institution-based kit promotions and advertisements in locations frequented by at-risk populations would raise awareness of HIVST. Encouragement from celebrities or friends to test together as a peer group or physically

<b>A Platforms</b>	
Internet-based	<ul style="list-style-type: none"> <li>• Adult/dating websites</li> <li>• Government/Non-governmental organisation websites<sup>a</sup></li> <li>• Social media<sup>b</sup></li> <li>• Online videos/games<sup>b</sup></li> </ul>
Nationwide publicity campaign	<ul style="list-style-type: none"> <li>• Traditional media (newspaper, television)<sup>a</sup></li> <li>• Public posters<sup>b</sup></li> <li>• Celebrities<sup>b</sup></li> </ul>
Institution-based	<ul style="list-style-type: none"> <li>• Pharmacies</li> <li>• Healthcare institutions (clinics, hospitals)<sup>a</sup></li> <li>• Army<sup>a</sup></li> <li>• Schools<sup>b</sup></li> </ul>
Locations frequented by at-risk population	<ul style="list-style-type: none"> <li>• Entertainment establishments (night clubs, pubs)</li> <li>• Red-light district coffeeshop<sup>a</sup></li> <li>• Mobile-testing van<sup>a</sup></li> <li>• Brothels<sup>b</sup></li> </ul>
<b>B Messages</b>	
Promote HIVST features	<ul style="list-style-type: none"> <li>• Privacy, Anonymity</li> <li>• Convenient</li> <li>• "Test by yourself, no need to go clinic"<sup>a</sup></li> <li>• "Don't have to waste time"<sup>b</sup></li> </ul>
Educate on HIV	<ul style="list-style-type: none"> <li>• Teach about prevention, testing</li> <li>• Raise awareness</li> <li>• "Prevention better than cure"<sup>a</sup></li> <li>• Remove stigma<sup>b</sup></li> </ul>
Emotional appeal	<ul style="list-style-type: none"> <li>• "Protect your family and loved ones"</li> <li>• "Peace of mind"<sup>a</sup></li> <li>• "Be safe, feel safe"<sup>b</sup></li> </ul>
Cues to action	<ul style="list-style-type: none"> <li>• "Get yourself tested early", "Don't wait to get tested"</li> <li>• "Better to know early than late"<sup>a</sup></li> <li>• "Be responsible, test for HIV"<sup>a</sup></li> <li>• "Treasure your life, get tested"<sup>b</sup></li> </ul>

**Figure 2** Platforms (A) and messages (B) for advertising HIV self-testing in Singapore as suggested by heterosexual men.<sup>a</sup>Mentioned by older men. <sup>b</sup>Mentioned by younger men.

displaying HIVST kits in stores was also noted as a potential visual cue to action.

Besides promoting the benefits of HIVST, educating the public on HIV and reducing stigma, using an emotional appeal and issuing cues to action were other potentially effective advertising strategies mentioned (figure 2B).

## DISCUSSION

Overall, our study revealed three key barriers to HIV testing among HSMs in Singapore, namely, stigma and discrimination, low awareness and knowledge of HIV, and low self-perceived risk of having HIV. Some participants felt that they were not the target population of HIVST which they thought should be for extremely high-risk HSMs and MSM, even though all our participants had engaged in risky sexual behaviour. This externalised risk is consistent with the men's low self-perceived risk of having HIV. Misperception among HSM about their risks for HIV, as well as internalised stigma, have been consistently demonstrated in other studies.<sup>8 20 21</sup> The interplay of the above-described factors explains, at least in part, the reasons for late presentation for HIV testing among at-risk HSMs in high-income Asian countries such as Singapore.<sup>8</sup> There is thus an urgent need to educate

the public on HIV and its risk assessment, and this should be done in conjunction with the HIVST advertising campaigns.

Our study found that almost all participants were unaware of HIVST prior to the interviews. This low awareness is surprising, given that a previous local study reported that 56.4% of participants have heard of HIV rapid test kits.<sup>19</sup> This discrepancy might be explained by the fact that our study recruited participants mainly from the community, while the 2012 study recruited from clinics offering HIV testing. Previous studies have shown that a lack of awareness of HIVST could deter its use.<sup>22</sup> Therefore, devising a tailored HIVST advertising plan based on findings from our study should be the first step towards creating awareness in the community.

Previous local studies reported a high level of acceptability of HIVST, but to date, there has been no in-depth understanding of why HIVST is favoured over conventional testing.<sup>18 19</sup> Our study showed that most men preferred HIVST for its perceived benefits of privacy and anonymity, convenience, and autonomy. However, when analysed by age groups, many older men still preferred conventional testing. This could be because of a higher technological affinity among young adults. Studies have shown self-efficacy being associated with higher HIV testing frequency

and perceived likelihood to test.<sup>23 24</sup> Hence, beyond increasing awareness of HIVST, a successful HIVST intervention should look to improve potential users self-efficacy. Pre-HIVST counselling provided at point of purchase, together with assistance on test administration and result interpretation, has been associated with better overall HIVST acceptability and feasibility.<sup>25 26</sup> Since most of our participants preferred over-the-counter purchase of the HIVST kit, the intervention could leverage on a trained salesperson to provide the required assistance.

All our participants acknowledged that post-test support is necessary when self-test result is positive. This was similarly reported in other studies.<sup>17 25</sup> There remains a need to find the trade-off between preserving the anonymity of HIVST and the need for post-test linkage to care. As our participants indicated preference for an initial non-intrusive follow-up via hotline, printed information on follow-up actions and a hotline could be included in the test kit. Most participants suggested that education is the key to encourage people who test positive to seek care, but ultimately it is up to the individual to act. There is a need to educate the public on the efficacy of HIV treatment, as several participants still thought that 'HIV is a death sentence' and were not motivated to seek care if tested positive. Studies done in the African region demonstrated that availability of HIV treatment was a reason for men to access HIV testing services and to seek care if their self-test results were to be positive, as treatment would enable them to lead normal lives and play familial roles.<sup>27–29</sup> Although the lack of linkage to care has always been a cause for concern with HIVST, a review of studies comparing HIVST to standard HIV testing found no additional harm attributable to HIVST.<sup>30</sup>

Although HSMs significantly contribute to the at-risk population in Singapore and other high-income Asian countries, they are inadequately studied for HIV-related issues as compared with other at-risk groups.<sup>8</sup> This is the first known qualitative study exploring the barriers to HIV testing, opinions and receptivity of HSM on HIVST in Singapore, and also in a higher-income Asian country. In recent years, there has been a clear shift from direct sex work (brothels) to indirect sex work (EEs) in Asian countries.<sup>31</sup> Thus, the purposive inclusion of HSMs patronising EEs for casual or paid sex in this study will contribute to the evidence base for HIV-related issues among HSMs in Asian countries with similar context.

Several limitations should be highlighted. Due to participants' lack of knowledge of HIVST, their opinions of the self-test kits were shaped by interviewers. We minimised such biases by having our interviewers convey HIVST information factually in a standardised manner. The men were also not assessed on their ability to use the kits; thus, their perceived self-efficacy might not be an accurate representation of their actual performance.

## CONCLUSIONS

For HIVST to promote regular and early testing, the service delivery model must appeal to its target population by addressing the barriers and facilitators of using HIVST as found in this study. While HIVST can play to its strengths by offering anonymity, autonomy and accessibility for its users, general HIV education must still be done to address other barriers to testing, such as low self-perceived risk, that will not be resolved solely by the introduction of HIVST. A tailored HIVST advertising campaign, through platforms such as traditional media, internet and social media, and venue-based outreach, will be necessary to ensure successful implementation of an HIVST intervention.

## Key messages

- ▶ HIV self-testing (HIVST) has the potential to increase testing among heterosexual men visiting entertainment establishments for casual or paid sex who are not coming forward for testing.
- ▶ HIVST is preferred for its anonymity, autonomy and accessibility, but older men prefer conventional testing. Men wanted post-test linkage to care only if self-tested positive.
- ▶ General HIV education must be done in conjunction with an HIVST advertising campaign.
- ▶ A successful HIVST intervention would need to incorporate the enabling factors to appeal to its target population.

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