

Acceptability and feasibility of using digital vending machines to deliver HIV self-tests to men who have sex with men

Article (Accepted Version)

Vera Rojas, Jaime H, Soni, Suneeta, Pollard, Alex, Llewellyn, Carrie, Peralta, Carlos, Rodriguez, Liliana and Dean, Gillian (2019) Acceptability and feasibility of using digital vending machines to deliver HIV self-tests to men who have sex with men. *Sexually Transmitted Infections*, 95. pp. 557-561. ISSN 1368-4973

This version is available from Sussex Research Online: <http://sro.sussex.ac.uk/id/eprint/83891/>

This document is made available in accordance with publisher policies and may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher's version. Please see the URL above for details on accessing the published version.

Copyright and reuse:

Sussex Research Online is a digital repository of the research output of the University.

Copyright and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners. To the extent reasonable and practicable, the material made available in SRO has been checked for eligibility before being made available.

Copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.

Title: Acceptability and feasibility of using digital vending machines to deliver HIV self-tests to men who have sex with men

Authors:

Jaime H Vera^{1,2}, Suneeta Soni¹, Alex Pollard³, Carrie D Llewellyn³, Carlos Peralta⁴, Liliana Rodriguez⁵, Gillian Dean^{1,5}

Affiliations:

1. Brighton and Sussex University Hospitals NHS Trust
2. Brighton and Sussex Medical School, Department of Global Health and Infection
3. Brighton and Sussex Medical School, Department of Primary Care and Public Health
4. University of Brighton, Department of Design and Architecture
5. Martin Fisher Foundation

Contact details – for correspondence

Dr Jaime H Vera, Department of Global Health and Infection, Brighton and Sussex Medical School, University of Sussex

J.Vera@bsms.ac.uk

Funding: Public Health England

Abstract: 247

Manuscript word count: 3003

Abstract

Objective: Technology-based approaches to distribute HIV self-tests (HIVST) have the potential to increase access to HIV testing in key populations. We evaluate the acceptability and feasibility of using vending machines in a community setting to distribute HIVST to men who have sex with men at high-risk of HIV.

Methods: Firstly, a pre-development survey of targeted potential users explored attitudes towards HIV self-testing and the use of a VM to deliver HIVST. Secondly, participatory design workshops between designers and community volunteers informed the production of a bespoke vending machines dispensing free BioSure© HIVST. Uptake of HIVST and user experiences were evaluated using information supplied directly from the machines interface (number of tests dispensed, user demographics), an online questionnaire and semi-structured interviews.

Results: The pre-development survey found that 32% of 232 sauna users had never tested for HIV, despite high-risk behaviours. A total of 265 testing kits were dispensed: mean age 31 range (18-70); 4%(n=7) had never tested for HIV before and 11%(n=22) had tested within the last 1-5 years. Uptake of tests was significantly higher via the vending machines compared to outreach testing by community workers in the same venue during a comparable period (34 vs 6 tests per month). Qualitative interviews and online questionnaires demonstrated high acceptability for this intervention, which was considered accessible and appropriately targeted.

Conclusions: vending machines to distribute HIVST was feasible and acceptable. This intervention could be used in different settings to improve access to HIV testing for key populations

Key messages

- HIVST distributed via vending machines among MSM was acceptable and feasible
- Fear of receiving a reactive test in isolation, and displacement of comprehensive STI testing were the main concerns stated by vending machine users
- Further work is needed to evaluate the uptake and acceptability of using vending machines in other settings and populations to distribute HIVST

Introduction

Gay, bisexual and other men who have sex with men (MSM) are at higher risk of HIV acquisition globally (1, 2). Despite the overall decline in HIV incidence, the rates of HIV diagnoses among MSM continues to increase (3), mainly because HIV testing uptake and frequency remains suboptimal. In the UK, approximately 25% of MSM have never tested for HIV and approximately 50% have not tested in the previous year (4).

Regular HIV testing is a key strategy for reducing HIV transmission and morbidity. Testing enables early access to care and treatment for those diagnosed with HIV and provides opportunities for HIV negative individuals to access prevention interventions(5). Although, there has been a substantial increase in the availability of testing options, MSM continue to face significant barriers to testing including stigma, confidentiality concerns, and long waiting times in clinics where testing is traditionally provided (6, 7). HIV self-testing (HIVST), in which the user collects a sample (oral fluid or blood), tests, and reads the results themselves, has been shown to reduce barriers and increase first-time and repeat testing in MSM (8, 9). There is evidence that HIVST is acceptable to MSM in low, middle and high-income settings (10-12). HIVST has the potential to reduce barriers for some individuals by increasing confidentiality, privacy and convenience compared to testing by health care professionals. Disaggregating HIV testing from a medical environment also provides opportunities for targeted service delivery. Technology-based approaches such as vending machines (VM) to distribute HIVST could expand access to HIV testing, increasing first-time and repeat testing in a variety of settings while reducing healthcare costs as outreach workers are not needed. HIVST distributed by VM could be available 24 hours, 7 days a week. A single pilot study exploring the acceptability of VM to dispense HIVST kits among MSM showed that this type of intervention was acceptable to users due to increased confidentiality and convenience(13). However, evidence to inform the design and implementation of technology-based HIVST interventions for MSM is lacking. There is also a lack of evidence exploring how the delivery of these approaches affect the acceptability and uptake of HIVST, particularly when free HIV testing is available through a variety of other services.

The aims of this study were to determine the acceptability and feasibility of using VM to distribute HIVST to high-risk MSM in a sex on premises venue (sauna) in the context of known barriers and facilitators to HIVST among MSM.

Methods

Study Design

Mixed methods study evaluation the VM intervention, including a cross-sectional pre-development survey

Study Setting

This study was conducted in one sex-on-premises venue (sauna) frequented by high-risk MSM in central Brighton (UK), which has a population of 273,000 and an adult HIV prevalence of 17% (14). Brighton have a good coverage of STI testing available in sexual health clinics and community venues. The sauna has approximately 400 clients each week. HIV testing (rapid point of care HIV testing) is provided in the sauna by community workers from a voluntary organisation for 3 hours twice a week. We chose this venue because previous research has demonstrated that saunas may represent important sites of HIV transmission among high-risk MSM characterised by having a high number of sexual partners and inconsistent condom use for anal sex (15, 16). During the study period community workers were precluded from encouraging the use of the VM.

Pre-development survey

Sauna users were invited to self-complete an anonymous survey to determine HIV testing history, self-reported sexual behaviour, HIV risk perceptions, and their views on HIVST. Men were recruited between September and December 2015. All men were given a study information leaflet with a link to the online survey on arrival at the sauna by reception staff.

Design of vending machine

Participatory design workshops involving LGBT community volunteers (different from those participating in the pre-development survey), product designers, and technology engineers were organised to design a bespoke digital VM to distribute HIVST. The

workshops utilised service design tools such as personas (the process of creating characters to theoretically explore individuals' thoughts and behaviours) (17), the construction of user journeys, and mock-ups for the design and likely interaction with the VM.

The outcome of these workshops was the development of a bespoke VM to distribute Biosure HIVST, free of charge, and with a simple adaptable user-friendly interface capable of capturing epidemiological and background data on users (**Figure 1**). Biosure HIVST is a second-generation rapid HIV test that detect HIV-1 and 2 antibodies, with a sensitivity and specificity of 99% with optimal performance in the hands of lay users(18)(19). It requires a blood sample from a finger prick and the result is available after 15 minutes. We selected Biosure HIVST because at the time of the study it was the only legally approved HIVST in the UK. A sticker with detailed information about linkage to care (contact for the nearest Sexual Health clinic) and support in case of a reactive result (helpline details) was developed with users and attached to the HIVST kit. Information on the HIV window period (12 weeks) and when to test next was also provided with the kit.

Vending machine evaluation

The evaluation was conducted between June 2017 and March 2018. Sauna users were faced with a digital interface providing information about the project. Users were prompted to answer a few demographic questions (age, place of residence, and time since last HIV test). Following these, users were asked to input a mobile phone number to obtain a 4-digit access code sent immediately by SMS. Once the code was entered a HIVST kit was dispensed. The purpose of the code was to allow a mobile phone number to be used only once over a period of 28-days, preventing the same user (identified by their mobile phone number) from obtaining several tests and potentially selling them for profit. The mobile phone number was encrypted in a secured server and destroyed once the SMS text was delivered to ensure the anonymity of users. Information on number and timing of kits dispensed for each user, as well as demographic data were collected via the interface through a secure website. A link to an online questionnaire was also provided within the SMS text message sent to users to gather additional

information about acceptability and user-experience of the VM and HIVST. Participants were offered £10 for completing the online questionnaire. The questionnaire also invited respondents to participate in semi-structured interviews offering an incentive of £20. Participants that wished to participate in the interviews were asked to provide an email address, so the investigators could contact them to organise the interview. We were unable to determine if some of the sauna users included in the VM evaluation also participated in the pre-development survey conducted in 2015. Semi-structured telephone interviews with the questionnaire respondents who provided contact details were conducted. Interviews were guided by topic guides exploring experience and attitudes towards the HIVST and VM. Recruitment continued until data-saturation. Interviews were audio-recorded and transcribed smart verbatim (full transcript of the recordings with the exception of fillers or repetitions). The number of tests distributed by the VM were compared with the number of tests performed by community workers during the study period.

Analysis

Demographic characteristics of participants of the pre-development survey, VM users and participants of the qualitative interviews were analysed using descriptive statistics. Interviews were analysed using framework analysis (20), which is a matrix-based approach to identifying important and recurring themes based on a combination of a-priori issues, recurring attitudes and emergent experiences generated by participants. Data was systematically classified into themes. Repeated analysis produced further sub-themes, and quotes were cross-coded to themes in an Excel framework generating a detailed referencing of interviews.

Ethical considerations

The study received ethical approval from the Brighton and Sussex Medical School Research Governance and Ethics Committee (ER/JV95/6)

Results

Vending machine pre-development survey

A total of 232 sauna clients responded to the survey. Not all respondents completed all the survey questions. 37% (n=85) of respondents were between 45–64 years old and 23% (53) between 25 and 34 years old (**Table 1**). 44% (102) felt they were not at risk of HIV infection despite evidence of high-risk sexual behaviour demonstrated by low levels of condom use. 32% (74) of respondents had never tested for HIV. 93% (215) would consider collecting a HIVST at the sauna with 40% (92) wanting to test in the venue, while 53% (122) would prefer to test at home. 77% (178) were willing to pay a small amount of money (between £5 and £10) for the convenience of accessing HIVST using a VM.

Uptake of HIV self-testing via the VM

A total of 265 HIVST kits were accessed between June 2017 and March 2018, median age of users were 31 years (18-70 years). 20 (n=53) had not tested in the last 12 months and 4% (10) had never tested for HIV despite reporting frequent unprotected anal sex. Uptake of HIV tests was six times greater via the VM compared to testing conducted by community outreach workers in the same venue and study period 265 vs 40 (34 vs 6 tests per month)

Acceptability and experience of using HIVST via VM

User experience questionnaire

Fifty-two VM users responded to the on-line questionnaire. 51% (n=26) had engaged in condomless anal sex with new or casual partners during the last 6 months, confirming the high-risk sexual behaviours of the population attending the sauna. 27% (14) had not tested during the past year and only 3 users were regularly using pre-exposure prophylaxis. 46 respondents confirmed they had a negative HIV self-test, and only one participant had a reactive test. This user was previously diagnosed with HIV and was not engage with HIV services. The participant re-engaged with HIV services following the linkage to care information provided with the HIVST. Three survey respondents did not

provide information about the result of their HIVST. The median time between obtaining the kit and testing was 17 days (0-200). 94% of respondents stated that they would use the VM again and/or recommend it to others.

Qualitative Interviews

Ten VM users consented to telephone interviews. All tested negative for HIV. The median age was 40 (26-46) years. All had tested for HIV in the past with 90% reporting a test in the last 12 months. These men had wide experience of HIV testing services (sexual health clinic, general Practice, community-based services - including HIVST), and varied patterns of STI testing.

Perceived benefits of using HIVST via VM

Overall, HIVST via the VM was highly acceptable. At least three participants intended to recommend the intervention to friends who did not test due to known barriers and suggested this informal expedited distribution as a method to encourage further self-testing.

...Friends often say they're a bit worried, they need to get a test done and they haven't been in a STI clinic. They find there's that barrier to going in, and you might just say 'I've got a self-test here, do you want it?'. (Gay man, 34 years, last test: 4 months ago)

The 'convenience' of eliminating barriers posed by sexual health clinics were valued. But this term ('convenient') frequently contained references to both the time-demands of using clinics and the stigma/embarrassment-related dynamics of attending clinical services.

...I think pros definitely were the convenience - the fact that I could just do it at home, I didn't have to make an appointment and I didn't have to wait... and I also didn't have to talk to anyone about it. (Gay man, 45 years, last test: 1 month ago)

The HIVST kits were routinely used by the users within a few hours or a few days of using the VM, although some participants also took kits home for future use: after a sexual risk (with various understandings of the window period); to displace future clinic attendance; to test sexual partners prior to condomless sex; or for secondary distribution. All participants suggested additional sites for VM: gay bars/clubs; medical

settings (high-street pharmacies and General Practices); universities/colleges; and sexual health clinics, with two rationales: so that those faced with a long wait could take away an HIVST, and/or to self-test at clinics (in privacy, but with support available).

... It might be an idea to have something like that for starters at the clinic's drop in. Instead of me taking up 15 minutes of a nurse's time and waiting for hours, I could just literally walk in and use a machine there?. (Gay man, 33 years, last test: 5 months ago)

Perceived concerns of using HIVST via VM

Several participants had concerns about receiving a reactive result in isolation without immediate personal support.

I think I would freak out 100%.. That would happen regardless of whether I was doing it at home or in a clinical setting. I would hope that wouldn't be a reason for people not to do it at home. (Gay man, 26 years, last test: 5 months ago)

Another concern related to the potential risks of displacing comprehensive screening for other STIs. Two participants pointed out that the twice weekly community outreach testing service offered at the same sauna, included instant-result syphilis tests as well as HIV, swabs for bacterial STIs, and they suggested that the VM's limitation of supplying only HIVST risked being counter-productive in STI prevention. For at least three participants, access to the HIVST had already displaced STI screening at clinics. One participant (who had used several HIVST) acknowledged this effect and stated that they would now only attend a clinic if they recognised STI symptoms.

.. HIV tests as a portable kit is fine but then people aren't being checked for other things as well. (Gay man, 48 years, last test: 10 months ago)

Several users had used the HIVST for risk assessment prior to condomless sex, and these men either underestimated or were unaware of the window period. At least one participant felt this would become normalised. Another had been given the kit by a sexual partner who had previously used a kit themselves. Knowledge and understanding of the window period was poor overall.

... if you're in a relationship and you know that you're going to start having sex on a regular basis without condoms, then you can proactively use that at home in your own comfort to show each other you both haven't got HIV and then get on with what you want to get on with. (Gay man, 34 years, last test: 3 months ago)

Discussion

In this study of MSM attending a community sex-on-premises venue in a city with a high prevalence for HIV infection, we found that uptake of HIVST distributed via VM was greater than current HIV testing provided by community volunteers in the same setting. HIVST in this setting was highly acceptable. Users thought that the intervention would facilitate more frequent testing. They particularly valued the convenience and privacy of the intervention, suggesting that the intervention has the potential to increase the proportion and frequency of testing among MSM. Fear of receiving a reactive test in isolation, and displacement of comprehensive STI testing (as uptake of accessible HIVST might discourage full screening) were the main concerns. Another concern was the potential use of HIVST to screen partners and inform decisions about condomless sex. In this context, the poor understanding of the window period among users of the HIVST kit dispensed by the VM, could lead to individuals with acute HIV infection unknowingly transmitting HIV to sexual partners. The concerns about HIVST are in keeping with previous studies looking at barriers and facilitators of HIVST among MSM (21, 22) (12). We found no concerns about individuals' capacity to navigate the digital interface, any expectation of pre-test counselling, or the ability of individuals to perform the HIVST.

This study has several limitations. First the intervention was designed to reduce as many barriers to testing as possible such as users having to provide personal information to facilitate linkage to care, a barrier for those that don't engage with sexual health services due to confidentiality concerns. Therefore, it was not possible to quantify how many VM users accessed post-test counselling, what difficulties they had if any with the interpretation of the tests, and whether individuals with reactive or negative results linked up with services for confirmatory testing or to access prevention services. However, further development of this technology platform to distribute HIVST can

address some of these barriers to some extent. For example, the VM could be adapted to deliver STI self-sampling kits along with HIVST kits. The digital interface could offer a link to sexual health services where users could get an appointment for further testing and counselling. Similarly, the VM interface could interact with a mobile application that allows direct communication (videoconferencing) with health care professionals in case of difficulties interpreting results or when support is needed for a reactive result (23, 24). The VM was placed in a venue frequented by MSM, and therefore it is unclear how another setting would affect effectiveness and acceptability. Finally, although there was a willingness from most sauna users to pay a small amount of money for the convenience of accessing HIVST, the HIVST in this study were provided free of charge. Further work is needed to evaluate the impact of charging on HIVST uptake and acceptability. Our results must be interpreted with caution as they represent the perceptions of an intervention in a specific population of MSM attending a sexual venue. MSM are likely to use a range of services to test for HIV not only HIVST. Regardless of the platform of distribution HIVST should be considered a complementary option, which should be embedded among existing care pathways to ensure that linkage to care and access to counselling, STI screening, HIV care, and prevention services are readily available. Further research is needed to evaluate the use of this intervention in other settings, and explore the unintended consequences of emergent technologies among other key populations that are not currently accessing testing services, such as ethnic minorities in high-income settings, and younger people in low and middle-income settings.

Authors' contributions

JHV, GD, SS contributed to study concept and design, JHV contributed to the analysis interpretation of data and drafting of manuscript. CP, LR, CL, AP contributed to the design and qualitative analysis, interpretation of data and critical revision of manuscript. JHV, GD, AP, LR, CP and CL contributed to the acquisition of data and revision of manuscript. All authors read and approved the final manuscript. This study was funded by an HIV innovation grant by Public Health England.

The Corresponding Author has the right to grant on behalf of all authors and does grant on behalf of all authors, an exclusive licence (or non exclusive for government employees) on a worldwide basis to the BMJ Publishing Group Ltd to permit this article (if accepted) to be published in STI and any other BMJPG products and sub-licences such use and exploit all subsidiary rights, as set out in our licence

<http://group.bmj.com/products/journals/instructions-for-authors/licence-forms>".

Figure 1. Bespoke VM to distribute HIV self-test



Table 1. Demographic information of participants of the VM pre-development survey (n=232)

Demographic features		Number of responses
Age group, n (%)	25-34 years	64
	35-44 years	44
	44-65 years	103
Recency of HIV Testing, n (%)	In last 12 months	102
	1 to 5 years	36
	> 5 years	19
	Never	74
	No answer	50
Past HIV testing locations (multiple allowed)	Sexual health clinic	98
	GP	5
	Community PoCT	24
	Self-sampling	0
	Self-testing	1
	Hospital	13
	Other	30
	No answer	110
Preferred method of testing in the community	Self-sampling	17
	Self-testing	128
	Any of the above	15
	None of the above	45
	No answer	76

References

1. Beyrer C, Baral SD, van Griensven F, Goodreau SM, Chariyalertsak S, Wirtz AL, et al. Global epidemiology of HIV infection in men who have sex with men. *Lancet*. 2012;380(9839):367-77.
2. Beyrer C, Sullivan P, Sanchez J, Baral SD, Collins C, Wirtz AL, et al. The increase in global HIV epidemics in MSM. *AIDS*. 2013;27(17):2665-78.
3. Stahlman S, Lyons C, Sullivan PS, Mayer KH, Hosein S, Beyrer C, et al. HIV incidence among gay men and other men who have sex with men in 2020: where is the epidemic heading? *Sex Health*. 2017;14(1):5-17.
4. McDaid LM, Aghaizu A, Frankis J, Riddell J, Nardone A, Mercey D, et al. Frequency of HIV testing among gay and bisexual men in the UK: implications for HIV prevention. *HIV Med*. 2016;17(9):683-93.
5. Stromdahl S, Hickson F, Pharris A, Sabido M, Baral S, Thorson A. A systematic review of evidence to inform HIV prevention interventions among men who have sex with men in Europe. *Euro Surveill*. 2015;20(15).
6. Lorenc T, Marrero-Guillamón I, Aggleton P, Cooper C, Llewellyn A, Lehmann A, et al. Promoting the uptake of HIV testing among men who have sex with men: systematic review of effectiveness and cost-effectiveness. *Sex Transm Infect*. 2011;87(4):272-8.
7. Fay H, Baral SD, Trapence G, Motimedi F, Umar E, Lipinge S, et al. Stigma, health care access, and HIV knowledge among men who have sex with men in Malawi, Namibia, and Botswana. *AIDS Behav*. 2011;15(6):1088-97.
8. Jamil MS, Prestage G, Fairley CK, Grulich AE, Smith KS, Chen M, et al. Effect of availability of HIV self-testing on HIV testing frequency in gay and bisexual men at high-risk of infection (FORTH): a waiting-list randomised controlled trial. *Lancet HIV*. 2017;4(6):e241-e50.
9. Katz DA, Golden MR, Hughes JP, Farquhar C, Stekler JD. HIV Self-Testing Increases HIV Testing Frequency in High-risk Men Who Have Sex with Men: A Randomized Controlled Trial. *J Acquir Immune Defic Syndr*. 2018.
10. Krause J, Subklew-Sehume F, Kenyon C, Colebunders R. Acceptability of HIV self-testing: a systematic literature review. *BMC Public Health*. 2013;13:735.
11. Pant Pai N, Sharma J, Shivkumar S, Pillay S, Vadnais C, Joseph L, et al. Supervised and unsupervised self-testing for HIV in high- and low-risk populations: a systematic review. *PLoS Med*. 2013;10(4):e1001414.
12. Figueroa C, Johnson C, Verster A, Baggaley R. Attitudes and Acceptability on HIV Self-testing Among Key Populations: A Literature Review. *AIDS Behav*. 2015;19(11):1949-65.
13. Young SD, Daniels J, Chiu CJ, Bolan RK, Flynn RP, Kwok J, et al. Acceptability of using electronic VM to deliver oral rapid HIV self-testing kits: a qualitative study. *PLoS One*. 2014;9(7):e103790.
14. Mirandola M, Gios L, Sherriff N, Pachankis J, Toskin I, Ferrer L, et al. Socio-demographic Characteristics, Sexual and Test-Seeking Behaviours Amongst Men Who

have Sex with Both Men and Women: Results from a Bio-behavioural Survey in 13 European Cities. *AIDS Behav.* 2017;21(10):3013-25.

15. Binson D, Woods WJ, Pollack L, Paul J, Stall R, Catania JA. Differential HIV risk in bathhouses and public cruising areas. *Am J Public Health.* 2001;91(9):1482-6.

16. Grov C, Crow T. Attitudes about and HIV risk related to the "most common place" MSM meet their sex partners: comparing men from bathhouses, bars/clubs, and Craigslist.org. *AIDS Educ Prev.* 2012;24(2):102-16.

17. Nielsen L. Persons The encyclopaedia of human-computer interaction.: *Mads Soegaard and Rikke Friis* 2013.

18. Figueroa C, Johnson C, Ford N, Sands A, Dalal S, Meurant R, et al. Reliability of HIV rapid diagnostic tests for self-testing compared with testing by health-care workers: a systematic review and meta-analysis. *Lancet HIV.* 2018;5(6):e277-e90.

19. Saunders J, Brima N, Orzol M, Phillips L, Milinkovic A, Carpenter G, et al. Prospective observational study to evaluate the performance of the BioSure HIV Self-Test in the hands of lay users. *Sex Transm Infect.* 2018;94(3):169-73.

20. Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol.* 2013;13:117.

21. Witzel TC, Rodger AJ, Burns FM, Rhodes T, Weatherburn P. HIV Self-Testing among Men Who Have Sex with Men (MSM) in the UK: A Qualitative Study of Barriers and Facilitators, Intervention Preferences and Perceived Impacts. *PLoS One.* 2016;11(9):e0162713.

22. Witzel TC, Weatherburn P, Rodger AJ, Bourne AH, Burns FM. Risk, reassurance and routine: a qualitative study of narrative understandings of the potential for HIV self-testing among men who have sex with men in England. *BMC Public Health.* 2017;17(1):491.

23. Sullivan PS, Grey JA, Simon Rosser BR. Emerging technologies for HIV prevention for MSM: what we have learned, and ways forward. *J Acquir Immune Defic Syndr.* 2013;63 Suppl 1:S102-7.

24. Maksut JL, Eaton LA, Siembida EJ, Driffin DD, Baldwin R. A Test of Concept Study of At-Home, Self-Administered HIV Testing With Web-Based Peer Counseling Via Video Chat for Men Who Have Sex With Men. *JMIR Public Health Surveill.* 2016;2(2):e170.