Near final version

# The Preferred Qualities of Human Immunodeficiency Virus Testing and Self-Testing Among Men Who Have Sex With Men: A Discrete Choice Experiment

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**ABSTRACT**

**Objective:** HIV self-testing (HIVST) is a promising approach to improve HIV testing coverage. We aimed to understand HIV testing preferences of men who have sex with men (MSM) to optimize HIVST implementation.

**Methods:** Discrete choice experiments (DCEs) were conducted among HIV-negative MSM living in Australia and aged ≥18 years. Men completed one of two DCEs: DCETest for preferred qualities of HIV testing (price, speed, window period, test type, collector of specimen) and DCEKits for preferred qualities of HIVST kits (price, location of access, packaging and usage instructions). Latent class conditional logit regression was used to explore similarities (or “classes”) in preference behaviour.

**Results:** Overall, the study recruited 1606 men: 62% born in Australia, who had an average age of 36.0 years (SD 11.7), and a self-reported median of four (IQR 2-8) sexual partners in the last six months. The respondents to DCETest was described by four classes: ‘prefer shorter window period’ (36%); ‘prefer self-testing’ (27%), ‘prefer highly accurate tests’ (22%); and ‘prefer low prices’ (15%). Respondents to DCEKits were described by four classes: ‘prefer low prices’ (48%), ‘prefer retail access (from pharmacy or online stores)’ (29%), ‘prefer access at sex-venues’ (15%), and ‘prefer to buy from healthcare staff’ (12%). Preferences varied by when someone migrated to Australia, age, frequency of testing and number of sexual partners.

**Conclusion:** A subset of MSM, particularly infrequent testers, value access to HIVST. Expanding access to HIVST kits through online portals, pharmacies and at sex-venues (vending machines or buy from staff in sex-venues) should be considered.

**INTRODUCTION**

HIV disproportionately affects gay, bisexual and other men who have sex with men (MSM) globally. It is estimated that compared with heterosexual men, MSM have a 28-fold greater risk for HIV.(1) Key strategies for HIV control involve providing access to antiretroviral treatment as prevention (TasP) interventions and pre-exposure prophylaxis (PrEP), both of which require knowledge of HIV status. Undiagnosed HIV disproportionately contributes to onward transmission in a number of high income settings.(2, 3) In Australia, recent modelling suggests that an estimated 8.8% of MSM who are undiagnosed contribute to 59% of transmissions.(4)

A systematic review summarizes the barriers to HIV testing arising from health provider and institutional levels.(5) In Australia, the main reasons for MSM to avoid or delay testing related to low risk perception for HIV and the need to return to a clinic for receiving their results.(6, 7) HIV self-testing (HIVST) allows individuals to test themselves and interpret their own result prior to seeking medical care and has the potential to reduce barriers to testing in these populations. It is recommended by the World Health Organization (WHO) as a screening method to reach those who may not otherwise seek HIV testing and is acceptable among at risk populations including MSM.(8) Although use of HIVST is effective in increasing HIV testing rates in MSM within trial settings,(9, 10) less is known about the optimal ways to promote HIVST among MSM in the community.

A key aim of introducing HIVST is to increase the uptake of testing among those who test infrequently or not at all. The success of this strategy requires a greater understanding of what models of testing are preferred by MSM, and particularly subpopulations who have lower rates of testing uptake. For instance, in some countries it has been observed that MSM who were recent-arrivals (i.e. migrated to the country within 5 years) or young (i.e. less than 25 years old) may be at higher risk for HIV compared with other MSM subgroups,(11, 12) so it would be useful to establish if there are testing methods or strategies that increase the likelihood of uptake in this group. The conventional medical research approach to determining characteristics would be to conduct a prospective trial, empirically comparing outcomes of several different options. This approach can produce strong evidence on preferences, but is expensive and time-consuming, and could only be applied to a small number of alternative options. An alternative approach to more quickly and systematically acquire quantitative preference data is through discrete choice experiments (DCEs), a method developed in marketing and economics that is increasingly used in health research and has been recognized by the WHO as a useful methodology to design preference-sensitive interventions.(13, 14) A DCE invites participants to choose their preference among two or more hypothetical alternatives. Participants choose the alternative that maximizes their utility, that is the combination of attributes from which the participant expects the most value. Trade-offs can then be observed as the participant completes a series of choice tasks.

In HIV research, the majority of DCEs have been conducted in low- and middle-income countries (LMIC) to explore preferences for HIV testing services(15-26) and linkage to HIV care and treatment.(27, 28) Comparatively fewer DCEs in HIV research have been conducted in high-income countries.(29-31) To our best knowledge, only one other DCE assessed MSM’s preferences for HIV testing services.(31) This study aims to extend this literature by focusing on the preferences for the implementation of HIV self-testing among MSM living in a high-income country.

**METHODS**

**Study population and recruitment procedures**

We recruited those who identified as gay, bisexual or other men who have sex with men (MSM), residing in Australia, age over 18 years and not previously diagnosed with HIV. For online recruitment, we advertised the survey through a weekly banner ad in Grindr (a smartphone dating application for MSM) from December 2017 to January 2018. Two community-based organizations, ACON (formerly known as the AIDS Council of New South Wales) and Thorne Harbour Health (formerly known as the AIDS Council of Victoria), provided the survey link on their Facebook page. In addition, MSM who attended Melbourne Sexual Health Centre (MSHC) and Sydney Sexual Health Centre (SSHC), the two largest public sexual health clinics in Victoria and New South Wales respectively, from March 2018 to September 2018 were invited to participate in the survey. Men who attended these clinics routinely complete a computer-assisted self-interview (CASI) about their demographic and sexual history. During the study period, an additional page at the end invited men to participate in the DCE study. If interested, the online survey link was sent to their registered mobile phone number or email. Electronic consent was collected after men read the participant information online. All men who agreed to participate were randomly assigned through the online survey system to one of two separate DCEs: DCETest investigated preferences for different aspects of HIV testing, including self-testing, while DCEKits investigated preferences for the different aspects of HIVST and delivery. No financial incentives were offered for the completion of the survey.

**Design of the DCE**

The formative stage of the DCE followed a series of steps. First, a scoping literature review was performed to identify potential attributes of HIV testing that might influence MSM’s likelihood to test. Qualitative interviews with 20 MSM were conducted to understand motivations to test for HIV and preferences for qualities of HIVST.(32) The final list of attributes and levels were chosen based on the literature review, qualitative interviews and policy relevance (see Table 1). We considered but did not include the following attributes as they were deemed less influential on the choice to test for HIV for someone living in a high-income country: testing of other sexually transmitted infections (often routinely performed with HIV testing), availability of HIV medications in the testing site (rapid linkage to care is not usually an issue), and offering financial incentives to test (not a usual practice). The survey was pilot tested among 20 MSM and minor changes were made to improve comprehension. Further information about the experimental design is provided in Appendix 1.Each participant was presented with 16 choice sets (Figure 1). All choice sets consisted of two unlabeled options, and respondents had to choose one of the two options that they preferred.

**Statistical Analysis**

Descriptive statistics using STATA statistical software (version 13.1, StataCorp, USA) were used to summarize the sociodemographic characteristics of the sample. We compared sociodemographic characteristics of participants with those of participants in the Australian Gay Community Periodic Survey.(33) We conducted a latent class analysis (LCA) using the software NLOGIT (version 6) to identify clustering of preferences among men, and used interactions terms to test if these could be defined according to the following *a priori* hypothesisedobservable characteristics: recent arrivals to Australia (arriving <5 years ago), young age (<25 years), infrequent partner change (one sexual partner in the last 6 months), and infrequent HIV testing (last test >2 years ago or never tested). For the LCA results, the positive signs of coefficients indicate men were more likely to choose to test for HIV if that attribute level is present, relative to the reference attribute. The magnitude of the coefficients indicates the contribution of the corresponding attribute level to the overall utility. Statistical significance was determined by a p-value < 0.05. It is possible that several attributes may be important within a class of men, so we also determined which attribute was the most influential for each class of men. More details of these calculations are provided in Appendix 1.

**Ethics approval**

Ethical approval was obtained from the New South Wales South Eastern Sydney Local District Human Research Ethics Committee (17/147). We present our study according to the STROBE statement. We did not register our study protocol.

**RESULTS**

Overall, the study recruited 1606 men: 62% born in Australia, who had an average age of 36.0 (SD 11.7), and a self-reported median of four (IQR 2-8) sexual partners in the last six months. Supplementary Table S1 summarizes the sociodemographic characteristics of the study population alongside the Gay Community Periodic Survey (*n*=10,505) showing the study sample had similar characteristics. There were no significant differences between sociodemographic characteristics of participants in DCETest and DCEKits, indicating randomization was successful.

Table 2 shows the results for DCETest and Supplementary Figure 1 shows the AIC by number of classes. The relative importance of each attribute according to classes is shown in Figure 2. Together, these findings indicate that the largest class (‘Time is of the essence’, 36% of men) were most influenced by the window period and were men in the reference class (i.e. age over 25, one partner in the last 6 months, not a recent arrival, and tested for HIV in the last two years). They preferred self-testing using the finger-prick method, and faster, cheaper and more accurate tests. The second largest class (‘Self-testers’, 27%) were most influenced by who was collecting the specimen (preferring self-testing – oral tests over finger-prick) and were more likely to be aged above 25 years or an infrequent tester. They also preferred faster, accurate tests with shorter window periods. The third largest class (‘Accuracy is key’, 22%) were most influenced by the accuracy of the test and were more likely to be recent arrivals or infrequent testers. They also preferred cheaper and faster tests and not to be tested by peers. The smallest class (‘Money matters’, 15%) were most influenced by cost and were more likely to have more than one sexual partner in the last six months, to be a recent arrival or infrequent tester. They preferred oral tests over finger-prick, tests that were faster, more accurate, with shorter window periods and they least preferred testing by peers (relative to healthcare workers).

Table 3 shows the results for DCEKits and Supplementary Figure 2 shows the AIC by number of classes. The relative importance of each attribute according to classes is shown in Figure 3. Together, these findings indicate that the largest class (‘Cheap kits’, 45% of men) were most influenced by the cost of the test. They preferred online distribution or kits available off the shelf and did not prefer kits from staff of sex-venues. The second-largest class (‘Retail access’, 29% of men) were most influenced by location of access to the test (preferring kits off the pharmacy shelf or asking for a kit from pharmacy staff). They least preferred kits from staff of community-based organizations (CBOs) or sex-venues, or from vending machines. They least preferred large branded packaging. The third-largest class (‘Cheap, sex venue access’, 15% of men) were also most influenced by cost of the test. They preferred kits from vending machines, from staff of sex-venues or online distribution. They least preferred large branded packaging. The smallest class (‘Healthcare staff’, 12% of men) were most influenced by the location of where to access the test, preferring kits off the shelf from a pharmacy, and kits from staff at a pharmacy, medical clinic or CBOs. They least preferred online distribution, public vending machines or kits from sex-venues. They also least preferred large branded packaging. None of the *a priori* subgroups were significantly associated with these four classes, suggesting that preferences for HIVST distribution access did not vary according to these subgroup characteristics (age, number of sexual partners, recent arrivals, and testing history). We explored several other factors in a *post hoc* analysis including reporting an Anglo-Australian ethnicity, education level, identifying as gay, being a pensioner, unemployed, student, PrEP user, any casual partners in the last 6 months, and condom use with the last casual partner. We found that self-identifying as ‘gay’ was significantly associated with the classes in the DCEKits model (Supplementary Table S2).

**DISCUSSION**

In a setting with ready access to facility-based HIV testing, Australian MSM see HIVST as of potential value to them. In contrast to previous research suggesting the majority of Australian MSM are ‘likely’ (37%) or ‘very likely’ (34%) to use HIVST if it was available,(34) our results provides a more nuanced understanding of possible HIVST use, as it accounts for how men trade-off use of HIVST with existing HIV testing services. Encouragingly, we found that HIVST was particularly appealing to infrequent and first-time testers. This is consistent with research reporting that HIVST reached infrequent and first-time testers in trial settings in Australia,(9) the Netherlands(35) and the United Kingdom.(36) To our best knowledge, there is only one other DCE examining the preferences for HIVST in a high-income setting.(31) We report new data for implementers by showing that cost was a major driver to access HIVST kits for about half of men (45%) with a preference for kits costing less than AUD$40. We also identified subgroups of men who wanted to purchase HIVST kits online or from pharmacies (29%) or to access them in sex-venues (15%), with only a small proportion (12%) preferring to purchase HIVST kits from healthcare staff.

HIV testing is already available through a variety of facility-based settings, and with the advent of the option of HIVST, it is unclear who will be the main users and whether scaling up HIVST would complement or substitute for current HIV testing practices. We found that HIVST is appealing to approximately a quarter of Australian MSM (27%), and importantly, these were men who were more likely to have the lowest HIV testing history. Our findings concur with the role of HIVST as an additional HIV testing strategy to reach those who are not accessing traditional HIV testing strategies.(8) Our DCE revealed four classes of preference behaviors for different attributes of HIV testing. This understanding of preference heterogeneity may help optimize how advertising may be targeted to MSM subpopulations to stress certain attributes to groups that favour these attributes, inform product development, or the ways in which governments prioritise access to different test kits, ideally increasing its attractiveness across a variety of market segments.

We uncovered a diverse range of preferred qualities of HIVST kits. These findings may be helpful to predict potential market shares and provide guidance on which distribution methods should be prioritized. Currently only one HIVST kit is available and approved by the Australian Therapeutics Goods Administration for online purchase in Australia for $25 excluding shipping costs (www.atomohivtest.com.au/). We found that nearly half of men (45%) did not display strong preferences for how to access HIVST but were most influenced by the price-point of the test kit. This is consistent with a range of other preference research from different settings showing that the price of a self-test kit was the most influential factor to test for HIV.(18, 20, 25) Making HIVST accessible through retail outlets i.e. online purchasing mechanisms or off-the-shelf in pharmacies would be attractive to nearly a third of men (29%). Unlike the UK,(37) HIVST kits are not available from Australian pharmacies. This could be an avenue worth exploring if we want to increase HIVST use in Australian MSM. We also show that there could be a market for making HIVST available from sex-venues or vending machines (15% of men preferred this). This distribution method has been successfully trialed in the UK among MSM.(38) There was less preference for making HIVST available only through staff (from medical facilities, pharmacies or CBOs, only 11% of men preferred this). Together, this reinforces the appeal of HIVST (i.e. privacy, confidentiality and convenience) also extends to how men prefer to access the kits (i.e. online, off-the-shelf from pharmacies or vending machines).

Our study has policy implications as HIVST is increasingly scaled-up globally. The aspiration is to move away from “one size fits all” health interventions or products towards differentiated approaches(39) i.e. developing services that deliver the right health intervention, at the right time, and to the right person or population. So, practical methods for implementers to effectively collect preference data from under-represented groups could help tailor HIVST implementation programs and help with resource allocation and demand creation. Policy makers can use our research to prioritize HIV testing strategies, particularly in focusing on the potential attractiveness of alternative means of distributing HIVST kits. We provide evidence to support how HIVST particularly appeals to MSM who are infrequent and first-time testers. We also show how HIVST could be implemented in a way that is most consistent with the preferences of MSM. As costs were a major driver of MSM’s preferences, there is a need to carefully consider the direct user fees to access HIVST kits if uptake is to be optimized. An important area for future research will also be to evaluate the cost-effectiveness of various HIVST distribution models in specific settings.

A strength of our study is the large number of MSM who participated in the survey through recruitment strategies. We show the comparability of our study population with men surveyed through the Gay Community Periodic Surveys, Australia’s long-term, large scale data collection system on HIV-related issues in MSM, that primarily recruits gay-community attached men. Second, we were able to recruit substantial proportions of harder-to-reach subpopulations of MSM such as infrequent testers and MSM not born in Australia/recent arrivals. Our study should be interpreted in light of some limitations, which are inherent in the DCE method. Consistent with other stated preference research, findings may not reflect actual behaviours as men are not obliged to actually make the choices presented in the DCE, although there is evidence for a reasonably close mapping between the two in other contexts.(40) Second, we were able to identify sociodemographic characteristics for the classes of men in DCETest, but not DCEKits. There is a potential that the sample size was too small but there is no consensus on how to determine sample sizes for LCA *a priori*.(41) Alternatively, our findings may be the true effect i.e. homogenous preferences which are not affected by the observable sociodemographic characteristics tested in our analysis. This implies that the attributes were broadly appealing to MSM regardless of the observed traits included in the analysis. Further psychometric market segmentation may be helpful to developing targeted delivery approaches. Third, we randomized the attribute order within a choice set to avoid participants only paying attention to the first few attributes. However, this might affect the attentiveness of participants, lead to simplified heuristics utilized by participants, or respondent fatigue.

**CONCLUSIONS**

We used a DCE, still a novel tool in HIV research, to show how HIVST may be prioritized, packaged and implemented taking into account user preference heterogeneity. We highlight that HIVST has a role in increasing HIV testing among MSM and was particularly appealing to infrequent testers. We also demonstrate the heterogeneity in how men would like to access HIVST kits, with costs and location (e.g. purchasing online or off-the-shelf from pharmacies) as major drivers of HIVST use. We encourage wider use of DCEs particularly in the early stages of designing or choosing a new product or service where there is uncertainty about potential usage or likely uptake.

**Conflict of interest statement**

All authors state they do not have any competing interests.

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**Authors’ contributions**

JJO, RG, MJ, RL, DS, FTP contributed to the conception and design of the study. KS and MJ provided oversight for data collection. CKF, AM, AH, KJ, and EPFC assisted in the data collection. JJO analysed the data and drafted the paper. All authors revised the manuscript and approved the final version to be published.

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