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ORIGINAL PAPER

Youth Preferences for HIV Testing in South Africa: Findings from the Youth Action for Health (YA4H) Study Using a Discrete Choice Experiment

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Abstract

We conducted a discrete choice experiment (DCE) and quantified preferences for HIV testing among South African youth (Nov 2018 to Mar 2019). Six attributes and levels were identified through qualitative methods: source of HIV information; incentive amount and type; social support; testing method; and location. Each participant chose one of two options that comprised six attributes across 18 questions. Conditional logistic regression estimated the degree of preference [β]. Of 130 participants, median age was 21 years (interquartile range 19–23 years), majority female (58%), and 85% previously tested for HIV. Testing alone over accompanied by a friend ($\beta = 0.22$ vs. -0.35; $p < 0.01$); SMS text over paper brochures ($\beta = 0.13$ vs. -0.10; $p < 0.01$); higher incentive values (R50) over no incentive ($\beta = 0.09$ vs. -0.07; $p = 0.01$); and food vouchers over cash ($\beta = 0.06$ vs. $\beta = -0.08$; $p = 0.01$) were preferred. Testing at a clinic or home and family encouragement were important. Tailoring HTS to youth preferences may increase HIV testing.

Keywords Discrete choice experiment · Youth · HIV testing uptake · Cellphone technology · Incentives N = 149

Introduction

The UNAIDS 2016 global report indicated that 20% of new HIV infections in sub-Saharan Africa were among youth aged between 15 to 24 years old [1]. In South Africa, the HIV prevalence among youth (15 to 24 years) remains high [2–8], where a recent household survey documented HIV prevalence in males and females aged 15–19 years to be 0.7% and 5.6%, respectively [8]. Youth remain at the highest risk for new HIV infections and young women are particularly vulnerable to HIV infection, compared to men in the same age group [4, 7, 9]. The 2017 HSRC report further indicated that a high proportion of youth did not know their status and had low levels of ART use [8].

Despite the vulnerability to HIV infection, only an estimated 67% of youth have received HIV testing in South Africa [5, 10–14]. Some of the dominant barriers to HIV testing among youth include limited knowledge of HIV [2, 15], fear of confidentiality being violated [16, 17] or receiving a positive diagnosis [12, 16], perceived stigma [16, 18], and the need for parental or guardian consent [12, 19, 20]. Although there are national efforts to engage youth for HIV testing services (HTS) through youth-friendly health services [21, 22], uptake of HIV testing remains inadequate. The suboptimal rates of HIV testing uptake among youth confirm that traditional methods, such as printed material, internet searches, advertisements or drama [23, 24] are not fully reaching youth for necessary HTS.

Untapped opportunities include the use of cellphone technology to engage youth for public health interventions, such

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as HIV testing. Mobile phones are easily accessible among youth in South Africa [25] and widely used for communication and social networking. In South Africa, approximately 72% of 15- to 24-year-olds have a cellphone [26, 27] where the short message service (SMS) platform has been widely used to provide information on access to healthcare [36, 45] or reminders of clinic appointments and medication [6, 7].

Financial incentives are an additional avenue for health behaviour change [28] where monetary [25, 29–31] and non-monetary [29, 32] incentivised approaches have been used to encourage individuals to access and remain in HIV care [25, 29, 30]. Youth have greater reward responsiveness compared to adults [33], and incentives could be highly effective in behaviour change among youth [33, 34].

Discrete choice experiments (DCE) are a quantitative method to elicit individual preferences and have been increasingly used in public health research to understand the drivers of choice and underlying utilities for health programs or services [35–37]. In the surveys, participants are asked to choose between varied options in hypothetical scenarios consisting of several attributes and multiple levels [38, 39]. Recent studies evaluated preferences for HIV service delivery and treatment services in various populations in high HIV prevalent settings in sub-Saharan Africa [35, 36, 38, 40]. However, understanding the preferences of youth for HIV testing in South Africa is limited and not extensively explored using the DCE. The objective of this study was to quantify HTS preferences among youth to inform the design of HTS services for better uptake and acceptability.

Methods

Description of the Study Area

The study, conducted in Ekurhuleni North, a peri-urban area in the Gauteng Province of South Africa, took place between November 2018 and March 2019. During study implementation, the DREAMS (Determined, Resilient, Empowered, AIDS-free, Mentored and Safe) project [41], a service aimed at reducing new HIV infections among young people, was active in the same municipality. We worked with the DREAMS project to recruit youth from multiple sites. Recruitment took place during DREAMS information sessions, at schools, door-to-door, family planning departments, public health clinics, referral from a medical male circumcision programme and via snowball recruitment.

Study Design

We conducted a DCE, which is a way to elicit participant preferences, assuming that youth can make a rational choice to reflect their preferences in hypothetical scenarios. Formative findings from in-depth interviews (IDIs) and focus group discussions (FGDs) informed development of the DCE.

Sample Size

We estimated our sample size using a general Choice-Based Conjoint rule for the choice experiment [$N \geq 500*I/(J*S)$], where I is the largest number of levels for an attribute, J is the number of alternatives in each choice task, and S is the number of tasks [27]. With three levels for each of the five attributes (source of HIV information, incentive amount, incentive type, social support for HIV testing and testing location) and two levels for the attribute testing method, our study required a minimum sample size of 47. Considering the uncertainty and potential heterogeneity in the preference parameters, we targeted to enrol 125 participants.

Selection of Attributes

Through literature review, IDIs, and FGDs about youth's perceptions and preferences related to HIV testing, we identified key attributes related to youth's decision making on the uptake of HIV testing. We used the Health Beliefs Model framework [42, 43], to explore perceived susceptibility to HIV, barriers and motivators to HIV testing, attitudes and preferences toward incentives, enablers for and challenges to using cellphone technology, and preferences for using social media for health education. IDIs were conducted with youth who never tested for HIV, while those who previously tested for HIV participated in the FGDs. Findings from the qualitative work will be published elsewhere. When determining the attributes, we considered both conventional ways and innovative options for HIV testing. Vignettes and relevant descriptions were used to explain the attributes to participants (see Fig. 1). Participants completed the DCE questionnaire on paper forms (see Text S1). Participants responded to one question at a time choosing between Test A or Test B, based on the options that they most preferred. Identification and refinement of attributes followed the framework for instrument development of a choice experiment [44]. We pilot tested the first version of the DCE among 32 participants to test acceptability and validity of the attributes and levels [39]. The initial design had five attributes with three levels per attribute and one attribute with two levels. From the preliminary analysis of the pilot data, the directionality of preference regarding receiving a higher incentive suggested lack of understanding of the question. Based on verbal feedback from research assistants and study participants, we further refined the DCE design and questions (see Text S2). Although participants started to lose some interest after question 10, all participants understood the questions and choice experiments well, and were able to complete the

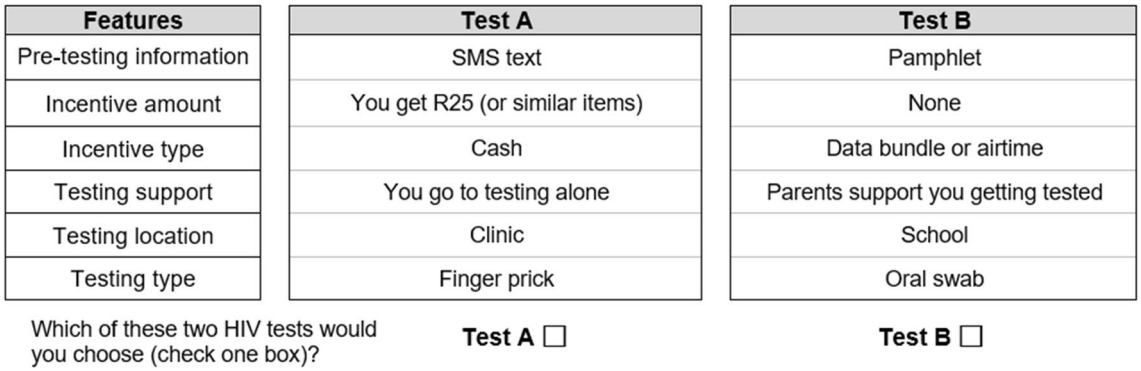

Fig. 1 Example of vignettes and relevant descriptions

18 questions. On closer examination of the responses, participant choices were fairly divided between the two options that were provided throughout the questions. In addition, 18 choice sets are commonly used in DCE surveys [35, 45, 46].

Experimental Design

Out of 486 unique pairs of all possible combinations of the six attributes, 36 subsets were selected and 18 questions developed with two alternatives per choice task. Each participant was asked to choose one preferred option (see Text S1). We used the optimal D-efficient design for the DCE, which estimated parameters with minimum variance without bias [47, 48]. The design was balanced and orthogonal (i.e., each attribute and pair of two attributes appeared the same number of times across all questions). It also had zero correlation among the attributes and no overlap between two alternatives, allowing maximum efficiency. We assumed no interactions between attributes. The design was created using SAS macros [47].

Based on the changes from the pilot, we updated the initial design and improved the final design to achieve balance and orthogonality with zero correlation among all attribute pairs. The variance–covariance matrix showed that the correlation among attributes were all < 0.25. The updated design was further improved by achieving balance and orthogonality with zero correlation among all attribute pairs. For the final version, six attributes were selected as follows: source of HIV information, incentive amount, type of incentive, social support for HIV testing, location of HIV testing, and testing method (see Table 1).

Screening and Enrolment Procedures

Youth (15–24 years old) were enrolled in the study if they had a valid identification document to confirm age, were willing to participate and provide written informed assent (if aged 15–17 years) or consent (if aged 18–24 years), and were able to communicate in one of the study approved languages (English, isiZulu and Setswana). Written informed consent from a parent or a legal guardian was required for those aged 15–17 years. If youth were not immediately available to complete the DCE or did not have a valid form of identification, appointments were set at the place of recruitment and telephone contact information collected. For those aged 15–17 years old, appointments were set telephonically with parents or guardians.

After consenting, youth completed the DCE independently or with the assistance of a research assistant. Research assistants explained instructions of the DCE to participants prior to DCE administration (see Text S1—Section B and Instructions). Adolescents (15–17 years old) did not complete the DCE in the presence of their parents or legal

Table 1 List of six attributes with levels relevant to HIV testing among youth

Attribute	Levels
Source of HIV information	Social media
	SMS text
	Pamphlet
Incentive amount	None
	You get R25 (or similar items)
	You get R50 (or similar items)
Type of incentive	Food voucher
	Data bundle or airtime
	Cash
Support for HIV testing	You go to testing alone
	A friend goes with you to testing
	Parents support you getting tested
Location of HIV testing	Clinic
	Home
	School
Testing method	Oral swab
	Finger prick

guardians. All DCE questionnaires were checked for completion and errors before data entry.

Ethics Statement

Approval was obtained from the University of the Witwatersrand Human Research Ethics Committee (180,203) and the Gauteng Province Ekurhuleni health district (GP_201804_010).

Data Analysis

The dependent variable was the participants' choice in each question. We calculated preference weights (i.e., coefficients) using conditional logistic regression which assumed that the underlying utility was homogeneous for all participants. We also explored the preference heterogeneity across the participants using mixed (random-parameter) logit models. Mixed logit models provide an estimate of the mean preference weights of attributes and their standard deviations, representing the heterogeneity of the underlying preference weights across the participants [48–50]. For both conditional logit and mixed logit models, we used effect coding to estimate the preference weights relative to the mean utility per attribute. We compared the coefficients using Wald tests, assuming a null hypothesis that coefficients would not be significantly different from zero. We calculated the relative importance of each attribute as the difference between the maximum and minimum preference weight for each attribute divided by the sum of the differences in all six attributes. All analyses were conducted in STATA 13.

Results

Baseline Patient Characteristics

The study team approached 426 participants. Over a third of participants 162 (38%) agreed to complete the DCE. Figure 2 highlights all reasons for exclusion. About one-third of those approached were unavailable or not interested in participating (118, 28%), and others could not be contacted telephonically (49, 12%). Out of the 162 enrolled youth, 32 (20%) participants were included in the pilot thus excluded from the final analysis. Table 2 shows the baseline characteristics of 130 participants who completed the DCE questionnaire for the final analysis: majority were between 18 to 24 years old (112, 86%), female (76, 58%), with secondary education being the highest level completed at school (94, 72%) and reported following Christianity as a religion (122, 94%). There were 110 (85%) who self-reported that they previously tested for HIV, and the majority of them were 18–24 years old (89%).

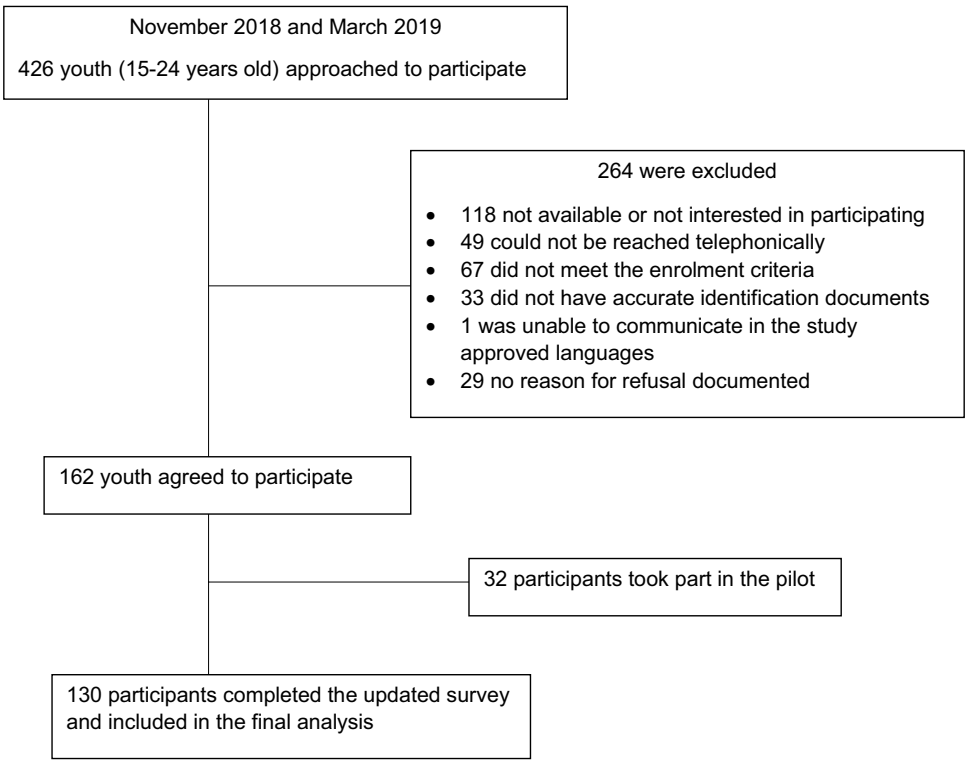

Fig. 2 Flow of enrolments for a discrete choice experiment survey conducted among youth (15 to 24 years old) in Ekurhuleni, Gauteng Province

Table 2 Baseline characteristics of 130 youth (15 to 24 years old) who completed the DCE survey in South Africa

	Total enrolled (n = 130)	
	n	%
Age		
15 to 17 years old	18	14
18 to 24 years old	112	86
Gender		
Male	54	42
Female	76	58
Education		
No formal education	2	2
Secondary education	94	72
Tertiary education	34	26
Religion		
Chrictianity	122	94
Other	8	6
Ever tested for HIV		
No	20	15
Yes	110	85

Preference Weights for HIV Testing Among Youth

Each participant completed eighteen questions, resulting in 2340 choices from the 130 participants. There were seven invalid questions where participants did not make any choice. Table 3 and Fig. 3 show preference weights for the six attributes. Compared to going to HIV testing with a friend ($\beta = -0.35$; 95% CI $-0.45, -0.25$), youth significantly preferred parental support for HIV testing ($\beta = 0.13$; 95% CI 0.04, 0.23; $p < 0.001$) and going to HIV testing alone ($\beta = 0.22$; 95% CI 0.12, 0.31; $p < 0.001$). Youth preferred receiving HIV-related information via SMS text ($\beta = 0.13$; 95% CI 0.06, 0.19) than via a pamphlet ($\beta = -0.10$; 95% CI $-0.17, -0.04$; $p < 0.001$) or social media pages ($\beta = 0.03$, 95% CI -0.10, 0.05; $p = 0.01$). A financial incentive of R50 or equivalent non-monetary item was significantly preferred to no incentive ($\beta = 0.09$; 95% CI 0.02, 0.17 vs $\beta = -0.07$; 95% CI -0.16, 0.02, $p = 0.03$). The degree of preference weights for smaller amount of incentive (R25 or equivalent non-monetary item) and no incentive did not significantly differ.

Receiving a food voucher was more preferred to getting cash directly ($\beta = 0.06$; 95% CI -0.01, 0.13 vs $\beta = -0.08$; 95% CI $-0.14, -0.02$; $p = 0.02$). However, there was no significant difference in the preference weights between receiving a food voucher or data bundle or airtime ($\beta = 0.01$; 95% CI $-0.05, -0.08$, $p = 0.64$). HIV testing at school was significantly less preferred than HIV testing at a regular clinic ($\beta = 0.09$; 95% CI -0.02, 0.16, $p < 0.001$) or home ($\beta = 0.09$; 95% CI 0.01, 0.16, $p < 0.001$). Use of finger prick was preferred to oral swab as a HIV testing method. The results from the mixed logit remained similar to those from the conditional logit (see Table S3).

Overall, when we examined the differences in preference weights ($\Delta\beta$) across the levels per attribute, going to test for HIV alone ($\Delta\beta = 0.57$) or parental support ($\Delta\beta = 0.48$) relative to going with a friend had the highest utilities. Participants were willing to trade off a R50 food voucher (relative to none; $\Delta\beta = 0.16$) and SMS text messages to receive HIV information (relative to pamphlet; $\Delta\beta = 0.23$) in order to access HIV testing alone or with parental support. When

Table 3 Preference weights and conditional logistic regression model coefficients

Attributes	Levels	Coefficients	95% CI
Source of HIV information	Social media	−0.03	−0.10, 0.05
	SMS text	0.13	0.06, 0.19
	Pamphlet	−0.10	−0.17, −0.04
Incentive amount	None	−0.07	−0.16, 0.02
	You get R25 (or similar items)	−0.03	−0.09, 0.04
	You get R50 (or similar items)	0.09	0.02, 0.17
Type of incentive	Food voucher	0.06	−0.01, 0.13
	Data bundle or airtime	0.01	−0.05, 0.08
	Cash	−0.08	−0.14, −0.02
Support for HIV testing	You go to testing alone	0.22	0.12, 0.31
	A friend goes with you to testing	−0.35	−0.45, −0.25
	Parents support you getting tested	0.13	0.04, 0.23
Location of HIV testing	Clinic	0.09	0.02, 0.16
	Home	0.09	0.01, 0.16
	School	−0.18	−0.26, −0.1
Testing method	Oral swab	−0.09	−0.14, −0.03
	Finger prick	0.09	0.03, 0.14

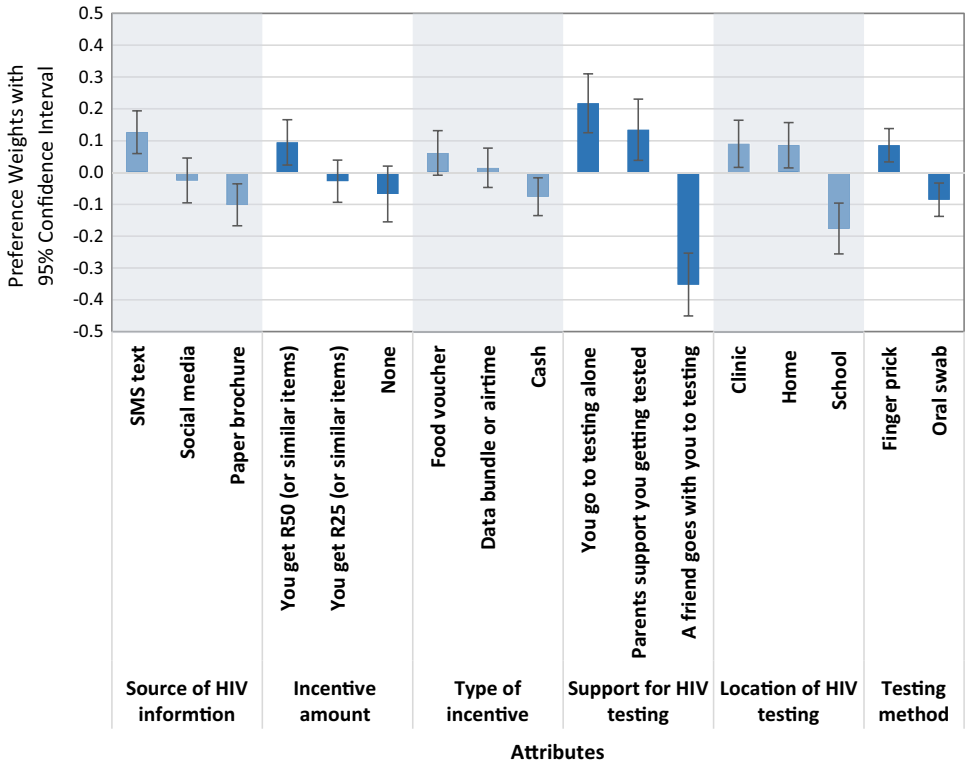

Fig. 3 Preference weights with 95% confidence intervals. Bar represents preference weights, and error bars presents 95% confidence interval. All estimates are from conditional logistic regression

Table 4 Relative importance of six attributes

Attributes	Difference in preference weights	Relative importance, (%)
Source of HIV information	0.23	15
Incentive amount	0.16	11
Type of incentive	0.14	9
Support for HIV testing	0.57	37
Location of HIV testing	0.27	17
Testing method	0.17	11

we normalized to the scale of 100%, social support for HIV testing had the highest relative attribute importance (37%), followed by location of HIV testing (17%) and source of HIV information (15%) (Table 4). Incentive amount or type of incentive had lower relative attribute importance at 11% and 9%, respectively.

Discussion

In this study, we assessed preferences for HIV testing among youth in a peri-urban area of South Africa. There was a clear need for privacy and confidentiality when testing for HIV. Youth preferred accessing testing alone to being accompanied by a friend and showed greater preference for testing at home or clinic than testing at schools. However, youth desired parental encouragement to test for HIV. Youth valued monetary and non-monetary incentives especially in the form of food vouchers. SMS text was the most preferred digital modality of receiving HIV information. These results demonstrate the importance of using a person-centred approach when reaching youth for HIV testing.

Although HIV testing has been offered to youth at schools [51, 52], clinics [53] and through partner involvement [51, 52] in South Africa, rates of HIV testing among youth [5, 10–14] have remained low. In addition, there is a lack of data on preferences to inform "nudge-type interventions" [54] that could motivate youth to change their behaviour. In this study, youth attributed prominent value to privacy and confidentiality during HIV testing. It is possible that youth did not want to test for HIV at schools due to potential stigma; embarrassment or fear of forced disclosure of their HIV test results to peers; or bad experiences from testing at schools and were mainly voicing a preference to be tested outside of the school setting. Our study participants seemed to have more trust in clinical procedures and services by professional nursing staff rather than the services offered at schools or in the community that is often done by lay HIV testing counsellors. A qualitative study in Cape Town, South Africa, showed that fear of being seen going to test for HIV or concerns of confidentiality were the major concerns among youth (13–21 years old) [53]. In addition, youth also wanted experienced trained staff to treat them [53]. Findings

from our study support the need for youth friendly services at public health facilities [22] as this could be a preferred environment for youth to access HTS.

Youth identified parental encouragement as an important influencer to their decision to test for HIV. In other studies, parental support helped youth overcome their fear of HIV testing or receiving a positive diagnosis, which were known barriers that deterred youth from HIV testing [12, 16]. The vital role of parents and family in health behaviour should not be under-estimated. Fostering active participation of parents by increasing awareness of support and respecting the decisions of young adults during the HIV testing process could encourage youth to test for HIV.

One surprising finding was that the incentive amount and type of incentive seemed to have relatively lower importance than other attributes. If incentives were to be given for HIV testing, a food voucher appeared more salient with our youth population than cash transfer. In contrast, other studies have reported that monetary incentives were highly valued [17] and successfully used to motivate individuals to access HIV services [25, 29, 30]. It is possible that youth enrolled in our study came from impoverished settings, therefore meeting their essential needs was important to them. Adapting current HIV testing options to include immediate rewards that address physiological needs could motivate youth to test for HIV.

Digital modalities could also increase HIV testing uptake in youth. Youth in our study preferred communication on HIV testing services via SMS text. Although paper brochures may be widely available, most youth in South Africa also have access to cellphones [55]. Youth prefer modes of communication, such as SMS, which are already well-established and easily accessible [13, 56]. MomConnect and B-wise are successful digital platforms that have been used in South Africa to extend health information to pregnant women and youth respectively [57]. Therefore, tailoring SMS text messaging to provide education on HIV testing and creating awareness about HIV testing at youth friendly clinics could be used as contemporary platforms to reach youth.

In our study, the self-reported rate of HIV testing was higher compared to the national HIV testing rates among youth in South Africa [5, 10–14] and more young adults (18–24 years old) self-reported testing for HIV compared to adolescents (15–17 years old) . One possible reason for the high self-reported rate of HIV testing was that youth were recruited from the same area where the DREAMS project [41] offered HIV testing to youth. The DREAMS project was implemented to provide multi-level interventions and multiple HIV testing service options to increase access to HIV testing and reduce new HIV infections among youth [51, 52]. The acceptance and uptake of HIV testing during the DREAMS project is not yet known, although such assessments and its impact on HIV incidence and reduction in risk is on-going [52]. Another possible reason is that self-report is unreliable and participants are prone to over-reporting socially desirable behaviour. However, knowing the types of interventions and locations that promoted HIV testing among youth could further inform the adaptation of current HTS services to young people.

This study had some limitations. First, this study was conducted in only one metropolitan of the Gauteng Province, South Africa and the sample size was small. Therefore, generalizability to other settings could be limited. Second, preferences are inherently context-specific and subjective, thus our findings might not represent all youth groups. We estimated substantial preference heterogeneity for the attributes across the participants using the mixed logit model. It is possible that preference heterogeneity is associated with certain sociodemographic characteristics such as age groups and location settings. Further studies on understanding preference heterogeneity and differentiating HIV testing strategies among youth would be instructive and could increase HIV testing uptake. Lastly, direct electronic entry by participants may be an advantage for DCE. Although we collected data manually we did not identify a clear limitation with this approach. Despite these limitations, the strength of our study is that the findings on youth preferences could inform the development of interventions to increase the uptake of HIV testing among youth.

In conclusion, we quantified the relative preferences across the key important attributes for youth's decisions on the uptake of HIV testing. Framing choices to promote confidentiality of HIV testing procedures, encouraging parental or family support, reaching youth through technology and using a motivation enhancement route could increase HIV testing uptake in South Africa.

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Author Contributions CMK, Designed the study, conducted the analysis and wrote the first draft of the manuscript; HC, Designed the study, reviewed the analysis and the draft manuscripts; B, Managed recruitment for study, reviewed the analysis and the draft manuscripts; NN, Involved with recruitment, data collection and review of the draft manuscripts.

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References

1. HIV/AIDS JUNP on. GLOBAL AIDS UPDATE [Internet]. 2016. https://www.unaids.org
2. Idele P, Gillespie A, Porth T, Suzuki C, Mahy M, Kasedde S, et al. Epidemiology of HIV and AIDS among adolescents. JAIDS J Acquir Immune Defic Syndr. 2014;66(2):S144–S153153.
3. UNAIDS. The gap report-Beginning of the end of the AIDS epidemic [Internet]. Unaids. 2014. https://files.unaids.org/.../unaidspublication/2014/UNAIDS_Gap_report_com/doi/full/1
4. Pettifor AE, Rees HV, Kleinschmidt I, Annie E, Macphail C, Hlongwa-madikizela L, et al. Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey. AIDS. 2005;19:1525–34.
5. Shisana O, Rehle T, Simbayi L, Zuma K, Jooste S, Zungu N, et al. South African National HIV prevalence, incidence and behaviour survey, 2012. 2014.
6. Rehle TM, Zuma K, Zungu N, Simbayi LC, Labadarios D, Abdullah F, et al. New insights into HIV epidemic in South Africa: key findings from the National HIV prevalence, incidence and behaviour survey, 2012. Afr J AIDS Res. 2016;15(1):67–75.
7. Gouws E, Stanecki KA, Lyerla R, Ghys PD. The epidemiology of HIV infection among young people aged 15–24 years in southern Africa. AIDS. 2008;22(4):S5–16.
8. Simbayi L, Zuma K, Zungu N, Moyo S, Marinda E, Jooste S, et al. South African National HIV prevalence, incidence, behaviour and communication survey, 2017. 2019
9. Harrison A, Colvin CJ, Kuo C, Swartz A, Lurie M. Sustained high HIV incidence in young women in Southern Africa: social, behavioral and structural factors and emerging intervention approaches. Curr HIV/AIDS Rep. 2016;12(2):207–15.
10. DOH. South Africa Demographic and Health Survey 2003. 2007.
11. Ramirez-Avila L, Nixon K, Noubary F, Giddy J, Losina E, Walensky RP, et al. Routine HIV testing in adolescents and young adults presenting to an outpatient clinic in Durban South Africa. PLoS ONE. 2012;7(9):5–9.
12. Sam-Agudu NA, Folayan MO, Ezeanolue EE. Seeking wider access to HIV testing for adolescents in sub-Saharan Africa. Pediatr Res. 2016;79(6):838–45.
13. Zanoni BC, Elliott RJ, Neilan AM, Haberer JE. Screening for HIV and linkage to care in adolescents: insights from a systematic review of recent interventions in high- versus low- and middle-income settings. Adolesc Health Med Ther. 2018;9:211–35.
14. HSRC. HIV impact assessment summary July 2018 the fifth South African National HIV prevalence, incidence, behaviour and communication survey, 2017. 2018;2017(July):5–8.
15. Tuysuzoglu S, Corliss HL, Fitzgerald SM, Abascal BR, Samples CL. Acceptability and feasibility of rapid HIV testing in an adolescent clinic setting: youth testing attitudes, knowledge, and behaviors. J Adolesc Health. 2011;49(6):609–14. https://doi.org/10.1016/j.jadohealth.2011.03.007.
16. Strauss M, Rhodes B, George G. A qualitative analysis of the barriers and facilitators of HIV counselling and testing perceived by adolescents in South Africa. BMC Health Serv Res. 2015;15(250):1–12. https://doi.org/10.1186/s12913-015-0922-0.
17. Strauss M, George GL, Rhodes BD. Determining preferences related to HIV counselling and testing services among high school learners in KwaZulu-Natal: a discrete choice experiment. AIDS Behav. 2018;22:64–766.
18. Chikwari CD, Dringus S, Ferrand RA. Barriers to, and emerging strategies for, HIV testing among adolescents in sub-Saharan Africa. Curr Opin HIV AIDS. 2018;31:257–64.
19. Kurth AE, Lally MA, Choko AT, Inwani IW, Fortenberry JD. HIV testing and linkage to services for youth. J Int AIDS Soc. 2015;18(Suppl 1):19433.
20. Thokoane C. Ethical challenges for piloting sexual health programs for youth in Hammanskraal, South Africa: bridging the gap between rights and services. Ethics Behav. 2015;25(2):169–79.
21. Phelps BR, Vermund SH, Wong VJ, McCarraher DR, Murray KR. Adolescents, young people, and the 90–90–90 goals. AIDS. 2017;31:S191–S194194.
22. Ashton J, Dickson K, Pleaner M. Evolution of the national adolescent-friendly clinic initiative in South Africa [Internet]. 2009. http://apps.who.int/iris/bitstream/10665/44154/1/9789241598361_eng.pdf%0A. https://extranet.who.int/iris/restricted/handle/10665/44154
23. Harvey B, Tony JS. Evaluation of a drama-in-education programme to increase AIDS awareness in South African high schools: a randomized community intervention trial. Int J STD AIDS. 2000;11:105–11.
24. Thokoane C. Ethical challenges for piloting sexual health programs for youth in Hammanskraal, South Africa: bridging the gap between rights. Ethics Behav. 2015;25(2):169–79.
25. Kranzer K, Govindasamy D, van Schaik N, Thebus E, Davies N, Zimmermann M, et al. incentivized recruitment of a population sample to a mobile HIV testing. HIV Med. 2013;13(2):132–7.
26. Mukund Bahadur KC, Murrayb PJ. Cell phone short messaging service (SMS) for HIV/AIDS in South Africa: a literature review. Stud Health Technol Inform. 2010;160(PART 1):530–4.
27. Uhrig JD, Lewis MA, Harris JL, Coomes CM, Bann CM, Furberg RD. Beyond reminders: a conceptual framework for using short message service to promote prevention and improve healthcare quality and clinical outcomes for people living with HIV. AIDS Care. 2011;24(3):348–57.
28. Amon KL, Campbell AJ, Hawke C, Steinbeck K. Facebook as a recruitment tool for adolescent health research: a systematic review. Acad Pediatr. 2014;14(5):439–47.
29. Hall E, Sanchez T, Stephenson R, Stein AD, Sineath RC, Zlotorzynska M, et al. Randomised controlled trial of incentives to improve online survey completion among internet-using men who have sex with men. J Epidemiol Community Health. 2019;73:156–61.
30. Nglazi MD, Van Schaik N, Kranzer K, Lawn SD, Wood R, Bekker LG. An incentivized HIV counseling and testing program targeting hard-to-reach unemployed men in Cape Town South Africa. J Acquir Immune Defic Syndr. 2012;59(3):e28–e34.
31. Pettifor A, MacPhail C, Nguyen N, Rosenberg M. Can money prevent the spread of HIV? A review of cash payments for HIV prevention. AIDS Behav. 2012;16(7):1729–38.
32. Lee R, Cui RR, Muessig KE, Thirumurthy H, Tucker JD. Incentivizing HIV/STI testing: a systematic review of the literature. AIDS Behav. 2014;18(5):905–12.
33. Luciana M, Collins PF. Incentive motivation, cognitive control, and the adolescent brain: is it time for a paradigm shift? Child Dev Perspect. 2012;6(4):392–9.
34. Giles EL, Becker F, Ternent L, Sniehotta FF, McColl E, Adams J. Acceptability of financial incentives for health behaviours: a discrete choice experiment. PLoS ONE. 2016;11(6):1–19.
35. Kim HY, Dowdy DW, Martinson NA, Kerrigan D, Tudor C, Golub J, et al. Maternal motivation to take preventive therapy in antepartum and postpartum among HIV-positive pregnant women in South Africa: a choice experiment. AIDS Behav. 2018. https://doi.org/10.1007/s10461-018-2324-x.
36. Quaife M, Eakle R, Cabrera Escobar MA, Vickerman P, Kilbourne-Brook M, Mvundura M, et al. Divergent preferences for HIV prevention: a discrete choice experiment for multipurpose HIV prevention products in South Africa. Med Decis Making. 2018;38(1):120–33.
37. Terris-prestholt F, Neke N, Grund JM, Plotkin M, Kuringe E, Osaki H, et al. Using discrete choice experiments to inform the design of complex interventions. BMC Trials. 2019;20(157):1–11.

38. Brunie A, Chen M, Akol A. Qualitative assessment of the application of a discrete choice experiment with community health workers in Uganda: aligning incentives with preferences. Glob Health Sci Pract. 2016;4(4):684–93.
39. Mangham LJ, Hanson K, McPake B. How to do (or not to do) Designing a discrete choice experiment for application in a low-income country. Health Policy Plan. 2009;24(2):151–8.
40. Eshun-wilson I, Mukumbwa-mwenechanya M, Kim H, Zannolini A, Mwamba CP, Dowdy D, et al. Differentiated care preferences of stable patients on antiretroviral therapy in Zambia : a discrete choice experiment. JAIDS J Acquir Immune Defic Syndr. 2019;81(5):540–6.
41. US Embassy. Dream South Africa gauteng fact sheet 2016 [Internet]. 2016. https://za.usembassy.gov/wp-content/uploads/sites/19/2016/12/DREAMS-SA_FactSheet_October_-2016.pdf
42. Hall KS. The health belief model can guide modern contraceptive behavior research and practice. J Midwifery Women's Heal. 2012;57(1):74–81.
43. Tarkang EE, Zotor FB. Application of the health belief model (HBM) in HIV prevention: a literature review. Sci Publ Gr. 2015;1(1):1–8. https://www.sciencepublishinggroup.com/journal/paperinfo.aspx?journalid=326&doi=10.11648/j.cajph.20150101.11
44. Janssen EM, Segal JB, Bridges JFP. A framework for instrument development of a choice experiment: an application to type 2 diabetes. Patient. 2016;9(5):465–79.
45. Janssen EM, Hauber AB, Bridges JFP. Conducting a discrete-choice experiment study following recommendations for good research practices: an application for eliciting patient preferences for diabetes treatments. Value Heal. 2018;21(1):59–68. https://doi.org/10.1016/j.jval.2017.07.001.
46. Hollin IL, Peay HL, Bridges JFP. Caregiver preferences for emerging duchenne muscular dystrophy treatments: a comparison of best-worst scaling and conjoint analysis. Patient. 2014;8(1):19–27.
47. Kuhfeld WF. Marketing research methods in SAS. Marketing research methods in SAS: experimental design, choice, conjoint, and graphical techniques. USA: SAS Institute Inc; 2010.
48. Johnson FR, Lancsar E, Marshall D, Kilambi V, Mühlbacher A, Regier DA, et al. Constructing experimental designs for discrete-choice experiments: report of the ISPOR conjoint analysis experimental design good research practices task force. Value Heal. 2013;16(1):3–13.
49. Train KE. Discrete choice methods with simulation. 2nd ed. Cambridge: Cambridge University Press; 2009.
50. Hole AR. Fitting mixed logit models by using maximum simulated likelihood. Stata J. 2007;7:388–401.
51. Saul J, Bachman G, Allen S, Toiv NF, Cooney C, Beamon T. The DREAMS core package of interventions: a comprehensive approach to preventing HIV among adolescent girls and young women. PLoS ONE. 2018;13(12):1–18.
52. George G, Cawood C, Puren A, Khanyile D, Gerritsen A, Govender K, et al. Evaluating DREAMS HIV prevention interventions targeting adolescent girls and young women in high HIV prevalence districts in South Africa: protocol for a cross-sectional study. BMC Womens Health. 2020;20(1):7.
53. Lawrence E, Struthers P, Van Hove G. HIV counselling and testing in secondary schools: what students want. South Afr J HIV Med. 2015;16(1):1–6.
54. Perry C, Chhatralia K, Damesick D, Hobden S, Volpe L. Behavioural insights in health care Nudging to reduce inefficiency and waste. London: Health Foundation; 2015.
55. Beger G, Sinha A, Pawelczyk K. South African mobile generation Study on South African young people on mobiles [Internet]. UNICEF. 2012. https://www.unicef.org/southafrica/SAF_resources_mobilegeneration.pdf
56. Ronen K, Unger JA, Drake AL, Perrier T, Akinyi P, Osborn L, et al. SMS messaging to improve ART adherence: perspectives of pregnant HIV-infected women in Kenya on HIV-related message content. AIDS Care Psychol Socio-Medical Asp AIDS/HIV. 2018;30(4):500–5.
57. Peter J, Barron P, Pillay Y. Using mobile technology to improve maternal, child and youth health and treatment of HIV patients. S Afr Med J. 2016;106(1):3–4.