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Use of conjoint analysis to assess HIV vaccine acceptability: feasibility of an innovation in the assessment of consumer health-care preferences

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Summary

Engaging consumers in prospectively shaping strategies for dissemination of health-care innovations may help to ensure acceptability. We examined the feasibility of using conjoint analysis to assess future HIV vaccine acceptability among three diverse communities: a multiethnic sample in Los Angeles, CA, USA ($n = 143$); a Thai resident sample in Los Angeles (three groups; $n = 27$) and an Aboriginal peoples sample in Toronto ($n = 13$). Efficacy had the greatest impact on acceptability for all three groups, followed by cross-clade protection, side-effects and duration of protection in the Los Angeles sample; side-effects and duration of protection in the Thai-Los Angeles sample; and number of doses and duration of protection in the Aboriginal peoples-Toronto sample. Conjoint analysis provided insights into universal and population-specific preferences among diverse end users of future HIV vaccines, with implications for evidence-informed targeting of dissemination efforts to optimize vaccine uptake.

Keywords

HIV; conjoint analysis; consumer preferences; discrete choice experiment; feasibility; HIV vaccine acceptability; partial efficacy

INTRODUCTION

Innovations in health technologies, and vaccines in particular, have vastly improved public health in the past century. Nevertheless, the availability of new products does not ensure their effectiveness; they must be deemed acceptable and utilized by the public. Acceptability studies conducted in preclinical and clinical trial stages of product development – that is,

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before a health-care innovation is ready for dissemination – are crucial to optimizing the likelihood that end users will judge the product to be useful and, ultimately, utilize it when it becomes publicly available.[1,2]

Unmitigated HIV incidence in the USA at over 55,000 new diagnoses per year,[3] and over 2.5 million new cases worldwide in 2008 alone,[4] indicate the grave need for biomedical innovations to prevent HIV infection. Ultimately, preventive vaccines offer the most ideal strategy for controlling the epidemic; however, the advent of HIV vaccines does not guarantee their acceptability.[2,5,6] In fact, UNAIDS has projected a substantial gap between estimated need and future uptake of HIV vaccines.[7] In order to ensure broad dissemination, future HIV vaccines must be acceptable to end users, including populations at elevated risk for HIV infection.[6] Beyond product acceptability, it is also ethically desirable to take into account health-care preferences of end users. In particular, the health-care preferences of individuals from ethnically and racially diverse populations may differ significantly from the mainstream and from one another,[8] yet these are precisely the populations at greatest risk for HIV who would most benefit from a vaccine.

In the present study, we sought to determine the acceptability of future HIV vaccines among ethnically diverse populations and to test the feasibility of using conjoint analysis, an innovative method for assessing consumer preferences, in measuring the acceptability of hypothetical HIV vaccines.

After hundreds of prior clinical trials, a recent large-scale Phase III HIV vaccine study (Thai RV144) was the first in which an experimental vaccine demonstrated a protective effect.[9] Although the modest (~31%) efficacy was too low to be considered for public licensure, incremental advances may lead to more efficacious vaccines that could exert a substantial impact in controlling HIV incidence and prevalence on a population level; yet such impact is contingent on end users' acceptance of a partial efficacy vaccine. Similarly, HIV vaccines may confer limited duration of protection and require multiple doses, both of which might have implications for their acceptability. Thus while recent trial results are encouraging, they also indicate the importance of examining consumers' concerns and preferences before HIV vaccines are publicly available in order to facilitate the broad uptake that would be required to be practically significant in controlling the epidemic.

Conjoint analysis is a well-established technique for assessing consumer preferences. This method enables the presentation of an array of product attributes to determine each of their impact on product acceptability.[10] Conjoint analysis has been used primarily in psychology, marketing and economics,[10 – 12] although it is increasingly being applied to health-care preferences.[13] Conjoint analysis has recently been applied to vaginal microbicide use[14] and HIV testing[15,16] in the realm of HIV, as well as to preferences for anti-inflammatory drugs,[17] hearing aids[18] and glaucoma treatment.[19]

Conjoint analysis techniques allow researchers to consider consumer preferences and product attributes beyond singular health outcomes and have been established as both internally consistent and valid.[20] As such, they are particularly appropriate for assessing preferences regarding preventive HIV vaccines[21,22] currently in development and testing. In traditional, compositional approaches, individuals are presented with a series of questions about singular product attributes. This approach has inherent limitations in that it allows individuals to select the optimal value of each and every attribute (e.g. 100% efficacy, no side-effects, 1 dose, etc.); but this is unlikely to mirror an actual product, particularly in the case of first generation HIV vaccines. In contrast, conjoint analysis requires people to make decisions that involve trade-offs between competing attributes. Furthermore, it allows for the computation of the individual utilities underlying consumer preferences, effectively

mapping the structure of their preferences;[10] that is, the impact that each of the various attributes have on overall product acceptability. An additional advantage of conjoint analysis in the evaluation of hypothetical products (particularly apropos in the case of products still in development, like HIV vaccines) is that the presentation of a whole product, entailing a bundle of attributes, most closely approximates individuals' real word decisions when faced with an actual product.

Given disproportionate HIV incidence and prevalence among various vulnerable populations, it is particularly important to assess HIV vaccine preferences with diverse subpopulations at elevated risk for HIV infection. This study utilizes conjoint analysis techniques to assess its feasibility and to compare HIV vaccine acceptability, and the impact of HIV vaccine attributes on acceptability, across three different multiethnic subpopulations in diverse urban settings in Los Angeles, California and Toronto, Canada.

The conjoint analysis results from the Thai residents in Los Angeles have been published as part of a larger mixed methods study.[23] The main focus of that prior publication was to present the substantive qualitative findings from focus groups to examine concerns and barriers to future HIV vaccine acceptability. As a primarily qualitative mixed methods study, the conjoint analysis results were presented as an adjunct to corroborate the focus group findings. The conjoint analysis results from the at-risk communities in Los Angeles has been published.[24] The goal of that paper was to explore in-depth the specific attributes of the eight vaccine scenarios presented and discuss the impact of each attribute and what implications the specific attributes have for future HIV vaccine acceptability.

The main goal of the current paper is to demonstrate the feasibility of applying conjoint analysis across three different populations, and in individual and group settings. By presenting the conjoint analysis results from these three populations together, this allows us to focus on the conjoint analysis method itself and to compare the different impact of specific attributes across the populations, in Thai as well as English, and in individual and group settings. In this paper, we present a detailed mathematical explanation of the conjoint data analytic strategy, in addition to the mathematical descriptions of how the impact scores were derived. The findings presented in this paper have broader policy implications for future HIV vaccine acceptability and dissemination.

METHODS

Participants

Three samples of participants, two in Los Angeles and one in Toronto, were recruited using venue-based sampling.[25] A multiethnic Los Angeles group (n = 143) was recruited from three gay community centres (n = 61), three needle exchange sites (n = 55) and three Latino primary care clinics (n = 27). Eligibility criteria at the venues included: at least 18 years of age, not an employee of the recruitment site and ability to read and understand English. Participants were reimbursed US$20 for engaging in a one-time, 60-minute interview, which included the conjoint scenario administration.

A Los Angeles-Thai community group (n = 27) was recruited in Thai through the two community-based organizations serving Thais in Los Angeles.[23] Contacts were made by a bilingual (English-Thai) study coordinator with two community-based organizations. The research team (including a Thai-speaking investigator [SJL]) also met with and explained the purpose of the study to the head monk of a local Thai temple – a centre of Thai community life – who provided a letter of support for the project. The conjoint scenarios were administered at the temple in Thai towards the end of the three focus groups with 8–10

participants per group (n = 27). Each participant received a US$20 incentive and lunch coupons from a local Thai venue at the temple.

Aboriginal peoples (n = 13) were recruited through a Toronto community-based organization serving Aboriginal and First Nations communities. Recruitment was coordinated through the organization, whose director approved the project after consultation within the organization. Two 90-minute focus groups were conducted among community advocates and service providers in Toronto. One group included seven Aboriginal men who have sex with men HIV/AIDS peer advocates and HIV educators. The other focus group included six female service providers working with organizations serving Aboriginal peoples. Participants were recruited using purposive sampling to identify knowledgeable community advocates and representatives.

Individual written informed consent was obtained prior to the start of each study. The two Los Angeles studies were approved by the Institutional Review Board of the University of California, Los Angeles. The Toronto study was approved by the Research Ethics Board of the University of Toronto.

Procedures

In our application of conjoint analysis with HIV vaccines as the target products, we describe a given HIV vaccine as a bundle of seven dichotomous attributes. If asked about each attribute separately, individuals might state that all the vaccine attributes are important. For example, a series of questions on each attribute might result in individuals' choosing the optimal level of each attribute (e.g. 99% efficacy, no side-effects, US$0 cost, *etc.*). Conjoint analysis enables us to determine the relative value individuals place on each of the attributes that make up the hypothetical HIV vaccines. Beyond yielding practical information about the relative importance of various HIV vaccine attributes in individuals' decisions about acceptability, conjoint analysis enables us to determine which vaccine profiles (i.e. combination of vaccine attributes) may maximize acceptability. Through integrating data on the impact of the various attributes, one can derive the acceptability of each vaccine rated by participants, as well as infer preferences for vaccine products with combinations of the given attributes that were not directly evaluated by participants.

Assigning attributes—We aimed to standardize the attributes to facilitate comparisons; however, we were also guided by the imperative to include those attributes that were most relevant to each population at the time the study was conducted. Different communities place different values on different attributes. Therefore, the specific levels of attributes were developed through a series of workgroups based on experts working with the respective populations, as well as through meetings held with community advisory groups from each population. We integrated input from 12 consumer focus groups, an advisory group of HIV vaccine experts, and published research on HIV vaccine acceptability to identify the array of attributes and the dichotomous values assigned to each attribute for the hypothetical vaccines for each of the three distinct communities.

Each hypothetical HIV vaccine is described as a bundle of seven dichotomous attributes. For the two Los Angeles studies, the attributes included: efficacy, cross-clade protection, side-effects, duration of protection, number of doses, cost and route of administration. For the Aboriginal peoples group in Toronto, 'route of administration' was replaced with 'vaccine-induced seropositivity', which emerged as a salient factor during our formative research. The diversity of the groups resulted in some variations in the attribute levels. For example, the duration of protection for the multiethnic Los Angeles and Aboriginal peoples-Toronto groups were framed as 'lifetime versus 10 years', whereas for the Los Angeles-Thai

community group, it was framed as '10 years versus 1 year'. The complete attribute profiles for the hypothetical vaccines used in each of the three groups are outlined in Table 1.

Creating conjoint scenarios—The seven dichotomous HIV vaccine attributes yielded 128 possible vaccine scenarios ($2^7 = 128$). Given that the number of possible combinations is too large to ask participants to rate every scenario, we used a method commonly employed in conjoint research to reduce the number of HIV vaccine scenarios. A fractional factorial orthogonal design enabled us to reduce the number of scenarios to eight (from a full factorial design, which would yield 128 scenarios). We estimate the main effect of each attribute on acceptability; interactions are assumed to be non-significant.[26] Scenarios were created using the Plackett–Burman method.[27]

Conjoint scenario administration—For the multiethnic Los Angeles sample, the conjoint scenarios were administered in individual face-to-face interviews. HIV vaccine conjoint scenarios were presented simultaneously in a set of eight laminated cards. The cards were presented in no particular order and were not marked with any schema that might suggest a sequence or preference rating.[25] Participants rated the acceptability of each of the eight HIV vaccines on a 5-point Likert scale, ranging from 'highly likely' to 'highly unlikely'. The ratings were then transformed into a 0–100 scale, with 'highly likely' scored as 100 and 'highly unlikely' scored as 0.

For the Los Angeles-Thai community and the Toronto Aboriginal peoples samples, the conjoint scenarios were administered to individuals in a group format (7–10 participants per group), following a focus group discussion. Each participant in the group was presented with a set of eight colour-coded laminated cards. Each participant was seated with enough distance from others to ensure privacy while rating the HIV vaccine scenarios. For each group, two trained facilitators acted as 'floaters' to answer any questions during the administration and then to record each participant's responses.

After the conjoint scenario administration for each sample, we conducted participant debriefing to assess the level of difficulty in completing the conjoint scenario exercises.

Data analysis—The acceptability of each hypothetical HIV vaccine is derived by averaging individual vaccine acceptability scores across respondents. For the multiethnic Los Angeles sample, for example, the acceptability of vaccine 1 is the average of 143 respondents' individual ratings of that vaccine. Impact scores for each attribute on vaccine acceptability, i.e. part-worth utilities, defined as amount determined by respondents regarding value or utility that is associated with vaccine attributes at different levels, are estimated in two steps. In step 1, for each respondent, a multiple regression model is fit to acceptability scores Y_i for the eight hypothetical vaccines, $i = 1, \ldots, 8$; the seven vaccine attributes A_p, $p = 1, \ldots, 7$, serve as independent variables in the model, categorized as preferred (1) or not preferred (0). The mathematical representation of the model is:

$$Y_i = \beta_0 + \Sigma \beta_p A_p + \varepsilon_i$$

where Σ is a summation over the seven regression coefficients β_p and attributes and ε_i is the residual error term. The regression coefficient for each vaccine attribute A_p (e.g. efficacy) in the model is the impact score of the attribute on vaccine acceptability for the individual respondent. Since all the independent variables are dichotomous, the mathematical representation of the impact score for each attribute simplifies to the net difference in mean acceptability between the four hypothetical HIV vaccines with the preferred value and the four hypothetical vaccines with the non-preferred value. For example, the impact of efficacy

is determined by taking the difference between the mean acceptability of the four HIV vaccine scenarios with 95% efficacy and the mean acceptability of the four HIV vaccine scenarios with 50% efficacy for each individual. In step 2, we average the individual impact scores across respondents for each attribute; the average of these individual impact scores is the impact of that attribute (e.g. efficacy) on overall HIV vaccine acceptability. We use a one-sample *t*-test to determine the statistical significance of the impact of each attribute.

RESULTS

Feasibility of administering conjoint scenarios

For the multiethnic Los Angeles group, the majority of the sample (119 out of 143; 83%) indicated that conjoint scenarios task was easy or somewhat easy to complete; (22 out of 143; 15%) indicated that it was neither easy nor difficult; and only two participants (1.4%) indicated that it was somewhat difficult. For the Los Angeles-Thai community group, 25 out of 27 participants (93%) indicated that the conjoint scenarios were easy to follow and complete. Similarly, during group debriefing of Aboriginal peoples in Toronto, participants endorsed the conjoint scenario task as relatively easy to complete and as more engaging than a paper-and-pencil questionnaire.

HIV vaccine acceptability

Table 2 shows the acceptability scores of each of the eight HIV vaccines across the three groups. In the multiethnic Los Angeles ($n = 143$) group, acceptability scores of the eight vaccines ranged from 33.2 (SD = 35.0) to 82.2 (SD = 31.8) on the 0–100 scale, with overall mean acceptability of 60.0; the vaccine with the highest rated acceptability had 95% efficacy, cross-clade protection, no side-effects, 10 years of protection, one dose, US$50 cost and was administered orally. In the Thai-Los Angeles ($n = 27$) group, acceptability of the eight HIV vaccines ranged from 7.4 (SD = 19.4) to 85.2 (SD = 24.3), with overall mean acceptability of 45.6; the vaccine with the highest acceptability score had 99% efficacy, single-clade protection, no side-effects, 10 years of protection, one dose, no cost (free) and administered by injection. In the Aboriginal peoples-Toronto ($n = 13$) group, acceptability of the eight vaccines ranged from 28.8 (SD = 32.0) to 84.6 (SD = 33.1), with overall mean acceptability of 51.7; the vaccine with the highest acceptability score had 95% efficacy, cross-clade protection, no side-effects, lifetime protection, two doses, US$10 cost and caused vaccine-induced seropositivity for two years.

Impact of HIV vaccine attributes on acceptability

The impact of HIV vaccine attributes on acceptability for each of the three groups is presented in Table 3. The mathematical derivation of the impact score for each attribute is the net difference in mean acceptability between the four HIV vaccines with the preferred value of the attribute and the four vaccines with the non-preferred value of the attribute.

Vaccine efficacy had the greatest impact on acceptability across all three groups. In the multiethnic Los Angeles group, for example, the mean acceptability of vaccines with the preferred value of efficacy (95%) was 71.3, compared with a mean acceptability of 48.7 for vaccines with 50% efficacy, yielding a net impact score of 22.6 ($P < 0.001$). Vaccine efficacy had an impact of 51.4 ($P = 0.005$) in the Los Angeles-Thai community group and 21.6 ($P = 0.004$) in the Aboriginal Canadian group.

Side-effects had the second greatest impact on acceptability among the Los Angeles-Thai community group (11.1; $P = 0.005$) and the third greatest impact among the multiethnic Los Angeles group (11.5, $P < 0.001$), but was non-significant in the Aboriginal group.

Duration of protection had a significant impact on vaccine acceptability across all three groups: 8.3 ($P = 0.005$) among the Los Angeles-Thai community group, 6.1 ($P < 0.001$) in the multiethnic Los Angeles group and 14.9 ($P < 0.05$) in the Aboriginal peoples-Toronto group.

Cross-clade protection (12.5; $P < 0.001$) was only significant in the multiethnic Los Angeles group and number of doses (19.7; $P = 0.03$) was only significant in the Aboriginal peoples-Toronto group.

DISCUSSION

In this study of HIV vaccine acceptability across three diverse communities, participants reported a wide range of acceptability in response to hypothetical HIV vaccines with different attribute profiles. This corroborates results from previous studies indicating that HIV vaccine acceptability cannot be taken for granted, even among communities with high levels of vulnerability to HIV infection.[2,6] In addition, the present results demonstrate some HIV vaccine preferences (e.g. high efficacy) that are highly influential across all groups and others that may be population-specific. On a methodological level, the successful application of conjoint analysis to assess HIV vaccine acceptability across three very different samples and two languages supports the feasibility of using this sophisticated technique to ascertain preferences for HIV vaccines across ethnically, linguistically and geographically diverse, low socioeconomic subpopulations.

Vaccine efficacy had the greatest impact on acceptability across all three groups. HIV vaccines with partial efficacy may be met with only limited acceptability among individuals from vulnerable communities, consistent with findings from previous quantitative[25] and qualitative investigations.[5,28,29] Given that first-generation HIV vaccines are expected to be only partially efficacious, the development of empirically based approaches to support the acceptability of these vaccines may be vital to the success of controlling the AIDS pandemic. Instilling in the public the conceptualization of combination HIV prevention that is not founded on any one technology or method, but that benefits from the simultaneous application of an array of less-than-perfect prevention modalities – as with many other diseases – may be central to continued efforts to control the HIV pandemic.

The wide range of impact scores for vaccine efficacy may reflect different needs and expectations by various populations. It is plausible that the very high impact of efficacy among low-risk Thai adults in contrast to the still leading yet smaller impact of efficacy among the other two groups reflects different levels of risk for HIV infection. Aboriginal peoples in Toronto and ethnic minorities in Los Angeles, at higher risk for HIV, may be more accepting of a vaccine that delivers less than sterilizing immunity in contrast to low-risk adults. Individuals with a lower risk profile may hold out for a highly efficacious and more ideal vaccine.

In addition to vaccine efficacy, duration of protection had a significant impact on acceptability across all three samples. The relatively greater impact of duration of protection on vaccine acceptability among Aboriginal peoples, combined with the significant impact of number of doses, may reflect reality-based concerns about logistical and cultural barriers in access to competent health-care services and follow-up among a marginalized population, some of whom live on reserves with even lower access to health-care services. Structural measures to increase access to care (e.g. free transportation, rural clinics, culturally competent providers) may increase acceptability of a future HIV vaccine.[30]

Although all three samples indicated a significant preference for lifetime protection, this may run counter to the realities of initial HIV vaccines. Education and social marketing

might impart the value of even a partial efficacy HIV vaccine with a 5- or 10-year duration of protection.

We found variability across the three samples in regard to the relative impact of other HIV vaccine attributes. Cross-clade protection had a significant impact on acceptability only among the multiethnic Los Angeles sample, whereas the number of doses had a significant impact only among the Aboriginal peoples-Toronto sample. These differences reflect the challenges of future HIV vaccine dissemination, which is unlikely to benefit from a one-size-fits-all approach. Given the complexities of HIV vaccine development, it is unlikely that vaccine consumers will be faced with an array of vaccines with different profiles from which to choose. The application of conjoint analysis, however, provides an empirical basis upon which to build both universal and population-specific social marketing and educational programs to facilitate the optimal uptake of HIV vaccines.

Earlier implementation of conjoint analysis in consumer research suggested that participants may require very complicated cognitive processing,[15] which casted doubt on the ability of individuals with lower socioeconomic status/lower education to reveal their preferences among an array of hypothetical, multiattribute HIV vaccines. The present analyses support the viability of conjoint analysis for assessing HIV vaccine acceptability, across both individual and group modalities, and in English as well as in Thai language. In addition, we evaluated the administration of conjoint analysis techniques by the facilitators/interviewers in each study; with initial orientation and training, the facilitators/interviewers found the administration of conjoint analysis method highly feasible.

As our aim was to test the feasibility of implementing conjoint analysis among three diverse communities, the small sample sizes (particularly Aboriginal peoples in Toronto) and non-random sampling reduce the precision of our estimates and the generalizability of the findings. Additionally, it is plausible that the difference in the values presented for high efficacy may have contributed to the higher impact of (99%) efficacy on acceptability in the Thai group. Vaccine-induced seropositivity (VISP), introduced in the Aboriginal peoples-Toronto group, was not a significant determinant of acceptability although it arose in focus group discussion. This may reflect the influence of the focus group discussion, which may have resulted in mitigating concerns about VISP by clarifying the difference between VISP and actual HIV infection and explaining the ability to differentiate the two using an appropriate (polymerase chain reaction) HIV test. Furthermore, other attributes not included in the conjoint analysis scenarios we used in this study also may have an impact on HIV vaccine acceptability. Beyond the specific preferences by community, the successful implementation of conjoint analysis, both in individual and group modalities, reflected in participants' ability to complete the tasks associated with data collection, the interviewers' positive evaluation, and meaningful results, suggests this method may lend itself to successful assessment of preferences among other communities. Further research in populations similar to those included in our study as well as among other groups will help to determine the robustness of the method.

As suggested by the Thai RV144 study, the largest HIV vaccine trial ever conducted, first-generation HIV vaccines may be imperfect products that do not attain the gold standard of sterilizing immunity; nevertheless, even such partially efficacious preventive vaccines have the potential to help control the most deadly epidemic in modern history. The effectiveness of these vaccines on a population level, however, is strongly predicated on uptake. Therefore, sociobehavioural research, including the careful evaluation of consumer preferences, is essential to ensuring the effectiveness of future HIV vaccines in controlling the AIDS pandemic.

Suboptimal uptake of existing vaccines for hepatitis B and influenza,[31–33] and contentious debates that have delayed roll-out of HPV vaccines,[34] suggest the wisdom of a proactive approach that engages the knowledge and preferences of likely end users rather than a wait-and-see approach to future HIV vaccine dissemination. To that end, the present findings suggest that a generic approach to promote HIV vaccines may inadvertently alienate certain vulnerable subpopulations as it may not correspond to their worldview of risk and their perceived needs for a vaccine. Engaging with vulnerable communities to understand existing perceptions of HIV, vaccines and risk is key to promoting acceptability.[5,6] Audience segmentation is a hallmark of social marketing that suggests certain meaningful differences among groups merit differential approaches to marketing. The decision about which of these differences merits changes in strategy, however, is best founded on empirical evidence rather than *a priori* assumptions.[5,6] Formative research using conjoint analysis may support the effective use of audience segmentation to support evidence-informed strategies for ensuring broad HIV vaccine uptake.

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Table 1

HIV vaccine attribute profiles across three groups

HIV vaccine attributes	Multiethnic Los Angeles group (*n* = 143)	Los Angeles-Thai community group (*n* = 27)	Aboriginal peoples-Toronto group (*n* = 13)
Efficacy	95% versus 50%	99% versus 50%	95% versus 50%
Cross-clade protection	Multiple types versus one type	Multiple types versus one type	Multiple types versus one type
Side-effects	None versus minor	None versus minor	None versus minor
Duration of protection	Lifetime versus 10 years	10 years versus 1 year	Lifetime versus 10 years
Numbers of doses	1 versus 3	1 versus 4	2 versus 5
Cost	US$10 versus US$50	Free versus US$250	US$10 versus US$100
Route of administration	Oral versus injection	Oral versus injection	–
Vaccine-induced seropositivity	–	–	Test HIV+ for 3 months versus test HIV+ for 2 years

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Table 2

HIV vaccine acceptability across multiethnic Los Angeles group, Los Angeles-Thai group, and Aboriginal peoples-Toronto group

Samples	HIV vaccine acceptability mean (SD)	HIV vaccine attributes							
		Efficacy (%)	Cross-clade protection	Side-effects	Duration of protection	Number of doses	Cost (US$)	Route of administration	Vaccine-induced seropositivity
Multiethnic Los Angeles group (*n* = 143)	82.2 (31.8)	95	Multiple types	None	10 years	1	50	Oral	–
	73.3 (37.8)	95	One type	None	Lifetime	1	10	Injection	–
	73.1 (35.0)	95	Multiple types	Minor	Lifetime	3	50	Injection	–
	56.6 (36.1)	95	One type	Minor	10 years	3	10	Oral	–
	55.6 (35.0)	50	Multiple types	None	10 years	3	10	Injection	–
	54.0 (35.6)	50	Multiple types	Minor	Lifetime	1	10	Oral	–
	51.7 (37.7)	50	One type	None	Lifetime	3	50	Oral	–
	33.2 (35.0)	50	One type	Minor	10 years	1	50	Injection	–
Los Angeles-Thai community group (*n* = 27)	85.2 (24.3)	99	One type	None	10 years	1	Free	Injection	–
	72.2 (32.0)	99	Multiple types	Minor	10 years	4	250	Injection	–
	70.4 (34.7)	99	Multiple types	None	1 year	1	250	Oral	–
	57.4 (36.6)	99	One type	Minor	1 year	4	Free	Oral	–
	30.6 (35.6)	50	Multiple types	None	1 year	4	Free	Injection	–
	23.2 (24.9)	50	Multiple types	Minor	10 years	1	Free	Oral	–
	18.5 (25.6)	50	One type	None	10 years	4	250	Oral	–
	7.4 (19.4)	50	One type	Minor	1 year	1	250	Injection	–
Aboriginal peoples-Toronto group (*n* = 13)	84.6 (33.1)	95	One type	None	Lifetime	2	10	–	Test + for 2 years
	67.3 (35.9)	95	Multiple types	None	10 years	2	100	–	Test + for 3 months
	55.8 (32.5)	50	Multiple types	Minor	Lifetime	2	10	–	Test + for 3 months
	55.8 (37.0)	95	Multiple types	Minor	Lifetime	5	100	–	Test + for 2 years
	42.3 (35.9)	95	One type	Minor	10 years	5	10	–	Test + for 3 months
	40.4 (41.5)	50	One type	None	Lifetime	5	100	–	Test + for 3 months
	38.5 (33.3)	50	One type	Minor	10 years	2	100	–	Test + for 2 years
	28.8 (32.0)	50	Multiple types	None	10 years	5	10	–	Test + for 2 years

SD = standard deviation

Table 3

Impact of HIV vaccine attributes on vaccine acceptability across the multiethnic Los Angeles group, Los Angeles-Thai group, and Aboriginal peoples-Toronto group

HIV vaccine attributes	Multiethnic Los Angeles group (*n* = 143)			Los Angeles-Thai community group (*n* = 27)			Aboriginal peoples-Toronto group (*n* = 13)		
	Preferred value mean acceptability†	Non-preferred value mean acceptability‡	Impact on acceptability: mean (SD)§	Preferred value mean acceptability†	Non-preferred value mean acceptability‡	Impact on acceptability: mean (SD)§	Preferred value mean acceptability†	Non-preferred value mean acceptability‡	Impact on acceptability: Mean (SD)§
Efficacy	71.3	48.7	22.6 (27.2)*	71.3	19.9	51.4 (26.4)	62.5	40.9	21.6 (21.7)
Cross-clade protection	66.2	53.7	12.5 (23.7)	49.1	42.2	6.9 (22.9)	51.9	51.4	0.5 (12.6)
Side-effects	65.7	54.2	11.5 (24.6)	51.2	40.1	11.1 (17.9)	55.3	48.1	7.2 (15.3)
Duration of protection	63.0	56.9	6.1 (17.5)	49.8	41.5	8.3 (12.6)	59.1	44.2	14.9 (24.7)
Number of doses	60.7	59.3	1.4 (14.1)	46.6	44.7	1.9 (15.7)	61.5	41.8	19.7 (29.3)
Cost	59.9	60.1	−0.2 (20.3)	49.1	42.2	6.9 (23.3)	52.9	50.5	2.4 (12.4)
Route of administration	61.2	58.8	2.4 (18.3)	42.4	48.9	−6.5 (22.5)	–	–	–
Vaccine-induced seropositivity	–	–	–	–	–	–	51.4	51.9	−0.5 (8.3)

SD = standard deviation across participants

† Mean HIV vaccine acceptability for the four vaccines with the preferred value of each attribute

‡ Mean HIV vaccine acceptability for the four vaccines with the non-preferred value of each attribute

§ Impact on acceptability = difference in mean acceptability between four hypothetical vaccines with preferred value and the four hypothetical vaccines; with non-preferred value

* $P < 0.05$ for the impact of vaccine characteristic on mean acceptability, using one-sample *t*-test