ORIGINAL RESEARCH ARTICLE

Acceptability of pre-exposure prophylaxis as an HIV prevention strategy: barriers and facilitators to pre-exposure prophylaxis uptake among at-risk Peruvian populations

J T Galea MSW*, **J J Kinsler** PhD†, **X Salazar** MA‡, **S-J Lee** PhD MPH§, **M Giron** MA‡, **J N Sayles** MD MPH†, **C Cáceres** MD PhD‡ **and W E Cunningham** MD MPH†**

*Program in Global Health; †Division of General Internal Medicine and Health Services Research, David Geffen School of Medicine, University of California, Los Angeles, CA, USA; ‡Unit of Health, Sexuality and Human Development, Cayetano Heredia University School of Public Health, Lima, Peru; §Semel Institute for Neuroscience and Human Behavior, Center for Community Health; **Department of Health Services, School of Public Health, University of California, Los Angeles, Los Angeles, CA, USA

Summary: This study examined pre-exposure prophylaxis (PrEP) acceptability among female sex workers, male-to-female transgendered persons and men who have sex with men in Lima, Peru. Focus groups explored social issues associated with PrEP acceptability and conjoint analysis assessed preferences among eight hypothetical PrEP scenarios with varying attribute profiles and their relative impact on acceptability. Conjoint analysis revealed that PrEP acceptability ranged from 19.8 to 82.5 out of a possible score of 100 across the eight hypothetical PrEP scenarios. Out-of-pocket cost had the greatest impact on PrEP acceptability (25.2, $P < 0.001$), followed by efficacy (21.4, $P < 0.001$) and potential side-effects (14.7, $P < 0.001$). Focus group data supported these findings, and also revealed that potential sexual risk disinhibition, stigma and discrimination associated with PrEP use, and mistrust of health-care professionals were also concerns. These issues will require careful attention when planning for PrEP roll-out.

Keywords: pre-exposure prophylaxis (PrEP), South America, HIV, MSM, FSW, acceptability

INTRODUCTION

The HIV prevention field continues to seek both behavioural and biomedical interventions to reduce the transmission of HIV.[1] Behavioural interventions have not been able to contain the pandemic[2] and recent biomedical approaches such as the use of the topical vaginal microbicides have had disappointing results.[3] Pre-exposure prophylaxis (PrEP) is a biomedical approach generating considerable interest, and could be an important additional HIV prevention tool.[2,4–8] PrEP involves taking antiretroviral medications (ARVs) before potential HIV exposure to prevent infection in contrast to post-exposure prophylaxis (PEP), the use of ARVs after exposure to prevent infection. In practice, PrEP becomes PEP once exposure occurs; however, for convenience we use the term 'PrEP' to encompass the regular use of ARVs by sero-negative individuals to prevent HIV infection independent of potential exposure. Currently, ARVs are used to prevent mother-to-child transmission of HIV during childbirth[9,10] but the efficacy of their daily use among HIV-uninfected individuals to prevent HIV infection during sexual intercourse is not yet known and is the subject of multiple international studies, including Botswana (young adults), Thailand (injection drug users), and Ecuador, Peru, Brazil and USA (men who have sex with men [MSM]).[2,8,11–13] In the Peru study, a daily dose of the ARVs emtricitabine and tenofovir disoproxil fumarate, coformulated into one pill that is marketed as Truvada, is being tested.

Correspondence to: J T Galea, UCLA Program in Global Health, 9911 West Pico Blvd, Suite 955, Los Angeles, CA 90035, USA
Email: jgalea@ucla.edu

As the clinical trials work to establish PrEP clinical efficacy, a parallel body of research is investigating its acceptability among potential users. For example, studies among MSM in California and New York found that overall knowledge of PrEP was modest, with concerns related to potential side-effects and degree of effectiveness.[8,14,15] There are no published studies of which we are aware that examine PrEP acceptability among non-USA populations, who account for 96% of adults and children living with HIV globally.[16]

The purpose of this pilot study was to examine PrEP acceptability among female sex workers (FSW), male-to-female transgendered persons (TG) and MSM in Lima, Peru. These groups, when compared with the general population (HIV prevalence <1%[16]), are at elevated risk for HIV infection with HIV prevalences of 1.6%[17] and potentially has high as 4.7%[18] among FSW and 18–22% among MSM/TG.[16] Since PrEP clinical trials are underway in Peru, data regarding its acceptability and potential impact on HIV risk behaviours are needed in order to plan for roll-out should the strategy prove efficacious. To address this, we conducted focus groups and conjoint analyses with the above three at-risk populations; implications of our findings on future PrEP dissemination strategies in Peru are discussed.

MATERIALS AND METHODS

Participants

Recruitment was based on convenience sampling, and was conducted by community Peer Outreach Workers who went to venues such as parks, beauty salons, volleyball courts and certain community-based organizations in Lima where FSW, TG and MSM were known to frequent. The Peer Outreach Workers explained the study to potential participants and referred those interested to the study staff. Participants were compensated 15 Nuevos Soles (approximately US$5.00) for transportation. Institutional Review Boards at the University of California, Los Angeles and the Universidad Peruana Cayetano Heredia reviewed and approved the study prior to implementation.

Procedures

Seven groups of four to eight individuals (total $n = 45$) were formed (3 FSW, 2 TG and 2 MSM). Each group met once for approximately two hours when focus groups and conjoint analyses were conducted. The focus groups were conducted prior to the conjoint analysis exercise as these allowed for participants to freely discuss their understanding and knowledge of PrEP and gave the facilitators the chance to correct any erroneous information about PrEP before the conjoint analysis exercise so that all participants were completing the exercise with the same, correct information. Both procedures were conducted in Spanish by two, female, bilingual (Spanish-English) masters-level facilitators who have extensive experience working with our target population.

Focus groups

Group facilitators led participants through a 45-minute discussion about PrEP using a semistructured guide (Table 1) examining general knowledge and awareness; social and community concerns; ideal characteristics of PrEP; and, possible behavioural changes as a result of PrEP, patterned after similar work our group completed on HIV vaccine acceptability.[19] The following description of PrEP was given to ensure that all participants understood the approach and could differentiate it from PEP: 'PrEP is a hypothetical approach currently under investigation that involves HIV-negative individuals taking ARVs daily in order to reduce the chance of HIV infection should he/she be exposed to the virus'. ARVs were described as medications

Table 1 **Focus group interview guide**

#	Questions	Probes
1	**PrEP in general** What have you heard about antiretroviral medication used for HIV prevention (PrEP)?	Examples, analogies • Like malaria prophylaxis • Like contraception
2	What do you know about PrEP or about how it works?	• Understand that PrEP is before you are exposed, like a vaccine, different from PEP, that you take after you are exposed, like the morning after pill.
3	How would you feel about taking a medication everyday to prevent HIV infection?	Possible issues: • Remembering to take it • Finding a place to get it • Finding someone to prescribe it • People seeing you take it
4	**Receptiveness to PrEP and explanation** Would you or your close friends be willing to take PrEP?	• Do you think your friends would be (very likely, somewhat likely, somewhat unlikely or not likely) to take PrEP?
5	What would be the reasons you or your close friends would want to take PrEP?	• To protect against getting ill from HIV? • So you or your close friends could have unprotected sex?
6	What would be the reasons you or your close friends would NOT want to take PrEP?	• Fears, worries, barriers
7	**Social and community concerns** What are possible social concerns that may discourage you or your close friends from taking PrEP?	• Stigma • Discrimination • Disclosure • What would your family think? • What would your acquaintances think? • What would your sexual partners think? • Any other possible social or community concerns?
8	**Health-care provider concerns** What are possible concerns about health-care providers that may discourage you or your close friends from taking PrEP?	• People recognizing you when you get the medication • Provider judging you • Difficulty accessing it • Difficulty getting information • Being embarrassed to ask for it from providers
9	**PrEP characteristics**	
	• Side-effects	• Nausea, vomiting
	• Places (where) of dissemination	• Pharmacy, doctor's office, HIV clinic
	• Person who dispenses	• Pharmacist, doctor or other professional
	• Duration of taking PrEP	• Days, weeks, years, lifetime
	• Efficacy	• What percentage of efficacy should PrEP have in order for people to use it?
	• Frequency of administration (QD versus before sex acts)	
	• Cost	
10	**Behavioural change after PrEP**	
	• How would having PrEP available change your or your friends' sexual behaviours?	• How much might they change their behaviours? (A little? A lot? Not at all?) • How would taking PrEP or having it available change your or your close friends' use of condoms? (A little? A lot? Not at all?)
	• How would taking PrEP change your or your close friends' use of condoms?	• Are there things we might be able to tell your friends to prevent them from increasing their risk behaviours if PrEP were available? What might we say?

PrEP = pre-exposure prophylaxis

for the treatment of HIV. Participants were asked to discuss both their own opinions of PrEP as well as their perceptions of the opinions and attitudes of their peers. Basic demographic information was collected at the conclusion of the discussion.

Focus groups were recorded, transcribed and translated into English for the USA-based research team. The English transcript was then back-translated to Spanish by a second, blind translator and compared with the original Spanish transcript in order to confirm its fidelity. To increase reliability, two investigators (one from Lima and one from Los Angeles) independently coded the transcripts and reviewed the codes with a third investigator.[20] After several iterations, 20 codes in six 'families' (key themes) were created using ATLAS.ti 5.0.[21] Analysis was further refined by identifying the most frequently occurring themes for each of the three target populations.

Conjoint analysis

We used conjoint analysis to assess the acceptability of hypothetical PrEP scenarios and to quantify the impact of various PrEP attributes on acceptability. Conjoint analysis is often used to elicit consumer preferences and has been widely applied in economics and market research[22–25] and is gaining popularity in the health domain for assessing consumer acceptability of health-care services[25–27] and pharmaceuticals.[24,25] In this study, conjoint analysis was used to describe PrEP as a 'bundle' of attributes. Participants rated composite hypothetical PrEP scenarios, thus requiring decisions regarding the relative importance of different PrEP attributes, which more closely approximates real-world decision-making than a series of disparate single item questions. Our group has successfully used conjoint analysis to assess HIV vaccine acceptability[28,29] and willingness to participate in HIV vaccine trials.[30] Seven PrEP attributes were identified by integrating input from PrEP experts, PrEP acceptability research[8,14] and the need to present meaningful alternatives from a consumer perspective.[23,27,31]

PrEP attributes were out-of-pocket cost per month (US$10 versus US$250), efficacy (75% versus 95%), side-effects (none versus nausea/dizziness), duration of use (1 year versus 10 years), dosing frequency (before sex versus every day), dispensing venue (general clinic versus HIV clinic) and person dispensing (pharmacist versus doctor/nurse). The range of cost was chosen to be sufficient to produce an impact on acceptability. We selected 75% versus 95% efficacy because the literature suggests that our target population expects PrEP to be completely efficacious; thus our objective was to determine the effect of partial efficacy (75%) versus almost complete efficacy (95%) on acceptability.[8,14] The one year versus 10 years administration of duration was selected to assess preferences regarding short-term use of PrEP (1 year) versus long-term use (10 years).

A full factorial design for eight PrEP scenarios, each with seven dichotomous attributes, would yield 128 different PrEP scenarios ($2^7 = 128$). We applied a fractional factorial orthogonal design to reduce the number to eight hypothetical PrEP scenarios.[32]

Following the focus groups, the hypothetical PrEP scenarios were presented simultaneously to each individual participant on laminated cards. Participants rated their likelihood of accepting each PrEP scenario on a 5-point Likert-type scale ranging from 'definitely would accept' to 'definitely would not accept'. Ratings were transformed into a 0 to 100 scale, whereby 'definitely would accept' = 100 and 'definitely would not accept = 0.

We derived the acceptability of each hypothetical scenario by averaging individual PrEP acceptability ratings across respondents. Next, a one-way analysis of variance (ANOVA) model was applied to fit each respondent's acceptability ratings across the eight PrEP scenarios. The seven PrEP attributes served as independent variables in the model. The effect for each PrEP attribute from the ANOVA model is the impact score of the attribute on PrEP acceptability for the individual respondent. We then averaged individual impact scores across respondents for each attribute to compute its impact on overall PrEP acceptability. A one-sample *t*-test was used to determine the statistical significance of the impact of each attribute on PrEP acceptability.

RESULTS

Demographics

We recruited 45 participants comprising 15 FSW in three groups, 13 TG in two groups and 17 MSM in two groups. The mean age of participants was 40 (FSW), 28 (TG) and 33 years (MSM).

Focus groups

Six key themes were identified regarding PrEP: knowledge/awareness; attitudes/expectations; social/community concerns; concerns regarding health-care professionals; ideal characteristics and behavioural changes. Results are organized by theme; see Table 2 for representative quotes.

PrEP knowledge/awareness

All three populations reported little or no knowledge/awareness of PrEP, although one transgendered participant had heard of preparations for a PrEP study in Peru (Quote 1).

PrEP attitudes/expectations

All three populations were generally supportive of using PrEP; however, there were concerns regarding the need for a daily regimen and remembering to take the pills (Quotes 2, 3) or the necessity to take the pills daily if not regularly having sexual relations (Quote 4). Side-effects were a concern among FSW and TG participants, particularly with regards to other concomitant health conditions (Quotes 5, 6). MSM suggested that lifestyle issues such as going to a party and alcohol use could interfere with taking PrEP (Quote 7). All three populations expressed high expectations for PrEP as a method of self-care (Quote 8), as backup protection when condoms are forgotten or break (Quote 9), or for casual sex (Quote 10).

Social and community concerns regarding PrEP use

All groups were supportive of selective disclosure of PrEP use within their specific social networks, for example to other sex workers (Quote 11) or friends (Quotes 12, 13), while disclosure of use to clients or one-night stands was not supported (Quotes 14, 15). In particular, MSM reported disclosure to family as unlikely due to fear of rejection or being seen as 'promiscuous' (Quote 16).

Concerns about health-care professionals

While FSW and TG participants spoke of the potential lack of sensitivity on the part of health-care professionals dispensing

Table 2 **Representative quotes from target populations**

Theme	Representative quotes	Group
1. Awareness	1. 'Well, I have heard about it through a [local NGO]. . .they talked about some pre-exposure pills studies. And I know it was an antiretroviral and I know it is being used as a treatment'	TG
2. Attitudes/expectations	2. 'I think that if you put it right next to your night table, when you go to bed, for you to take it next to the night table, with your little glass of water and take it'	FSW
	3. 'I think that at the beginning yes, a week and that, but from there on out, they won't take it and that's that'	TG
	4. 'Well, if I am a person who has continuous [sexual] relationships yes, I'd take it, but if I [didn't]. . .why would I take it?'	MSM
	5. '. . .there's also some people who suffer from high blood pressure, or who are diabetic, so [an exam would be necessary]. . .so that that kind of problem won't exist with the pills'	FSW
	6. 'If it's going to have a lot of side-effects in my body, I would leave it, I wouldn't accept it'	TG
	7. '. . .on Saturdays, if you have a party let's say, you know you are going to drink and then you don't take the pill'	MSM
	8. '. . .well we will take care of ourselves and see that everyone takes it, because if we get infected we could infect others'	FSW
	9. 'It would be good when I am drunk and suddenly I don't use the condom or it breaks'	TG
	10. 'I think that most of my friends are going to want to take it. . .and be more secure when a "one-night stand" appears'	MSM
3. Social/community concerns	11. 'I may tell the ones who are in this business, but not to others who aren't'	FSW
	12. 'I would tell my transvestite friends about the treatment'	TG
	13. 'If I tell you that I am starting to take PrEP, I would say that it is my own caring about myself, something which is only mine'	MSM
	14. '[I would not tell my clients]. . . because they may feel scared'	FSW
	15. 'If it is just a "one-night stand", no'	MSM
	16. 'I think that there would be some kind of rejection from my family. . .they would think I am a promiscuous person'	MSM
4. Concerns about health-care professionals	17. 'There is an order from [the Public Health Department to conduct] workshops for all the personnel. . .because complaints were received from girls who had been psychologically mistreated'	FSW
	18. 'It's because of the stigma that they have with us, because we are transvestites, because gays and sex workers have HIV. There are still medical personnel who keep on thinking like that and with that discrimination, they aren't mentally skilled to treat us'	TG
5. PrEP's ideal characteristics	19. 'In the health center, because medicines are usually of the same quality and they are a little bit cheaper. In the drugstores, there are differences between one and the other; you have to look for the cheapest. . .'	FSW
	20. '. . .if it were available at any drug store, there could be people who misuse it. . .and they wouldn't take care of themselves'	TG
	21. '. . .better in the health center, because sometimes people don't go to the drugstores. . .in their neighborhood. . .because they are afraid of being identified as a person who has sexual relationships'	MSM
	22. '[I prefer that they are free]. . . that they are like the contraception pill they give us in the health centers'	FSW
	23. '[If free]. . .they would get used to have it for free all the time and when it is unavailable, they just won't buy it'	MSM
	24. 'Yes, of course [I would pay for PrEP]. . .something that says that at least I am paying some of my own money. . .for my health'	MSM
	25. 'I think that [I would use it] until I stop working'	FSW
	26. 'To me, forever, because if I have a sexual intercourse I need it. But I would take it all my life while I have sexual activity. . .'	MSM
	27. 'A hundred percent'	TG
	28. 'It would have to be 100% effective, I think that everyone would demand 100%'	MSM
	29. '[Every day] because you go to work but if you don't work, you have to take it the same, yes everyday. . .'	FSW
	30. 'I think that it wouldn't work taking the pills every day because most people are not like that. . .they live in the moment. But the idea of taking it once a month, or every three months. I think that they could do it as if it were a contraceptive pill'	TG
	31. 'If they ask me to choose, I'd rather have it weekly or twice a week, by tablet, by capsule, by shot or whatever, it is far more likely than doing it daily'	MSM
	32. 'When you are in the moment having sex, you forget and then suddenly you don't take it. . .you're not going to be carrying your little bag with your pill in it [laughs] at the disco!'	MSM
	33. 'Yes, but it could also be through the psychologist who talks to us, orientates us and gives us information'	FSW
	34. '. . .your doctor or your counsellor is going to tell you something or ask you questions like, "how are you feeling? how has your body reacted?" I think that is a good thing and it should be like that too'	TG
	35. 'I think that it should be right there with the doctor or the counsellor who delivers the pills directly. It should be the doctor because you enter his office and nobody knows what you are there for'	MSM
6. Behaviour changes after PrEP	36. '[Behaviours would not change], because that is only for HIV'	FSW
	37. 'I think that they would take the pills but they wouldn't use the condom anymore'	TG
	38. 'If you tell someone, "Look, take this pill and it will prevent you from getting HIV," I can assure you that the next day, that person won't use a condom anymore'	MSM
	39. 'There should be a lot of information and say that it is something additional to the condom and which is going to give you some extra protection; . . .if you tell them that [PrEP] is 100% secure, they won't use [a condom] anymore'	MSM

PrEP = pre-exposure prophylaxis; TG = transgendered person; FSW = female sex worker; MSM = men who have sex with men

PrEP, they also mentioned that the Peruvian Ministry Of Health was conducting sensitivity workshops for all health-care staff to improve communication and trust with patients of diverse sexual orientations and risk behaviours (Quotes 17, 18).

PrEP's ideal characteristics

Accessibility: all three populations preferred PrEP being available in health-care centres as opposed to pharmacies, citing higher costs (Quote 19), increased potential for patient misuse

(Quote 20) and privacy risks (Quote 21) if the drugs were dispensed in neighbourhood pharmacies.

Cost: TG and FSW thought that PrEP should be free like contraception pills given out at health centres (Quote 22). Conversely, MSM felt that PrEP should cost something, citing a risk for habituating the population to something free which eventually may be charged for (Quote 23), or that paying for PrEP is part of investing in one's own health (Quote 24).

Duration of use: acceptability views ranged from taking PrEP as a time-limited activity dependent on the duration of being a sex worker (Quote 25), to a lifetime commitment by MSM (Quote 26).

Effectiveness: 100% effectiveness was desired by all three populations (Quotes 27, 28).

Frequency of dosing: daily dosing was endorsed by FSW who saw it as commensurate with their type of work (Quote 29), but not by TG or MSM who viewed daily dosing as impractical or incompatible with a lifestyle where most people 'live in the moment' (Quotes 30, 31, 32).

Provider: all groups agreed that PrEP should be delivered by health-care professionals, as these were seen as people who already were interacting with the population, could handle other health concerns (Quotes 33, 34) and offered the most privacy (Quote 35).

Behavioural changes after PrEP

Only FSW participants felt that PrEP would not change sexual risk-taking behaviours since it would only protect against HIV and not other sexually transmitted infections (STIs) (Quote 36). TG and MSM participants, however, felt that condom use would decrease as a result of PrEP (Quotes 37, 38, 39).

Conjoint analysis

PrEP acceptability ranged from 19.8 to 82.5 on the 0–100 point scale, with a mean acceptability of 53.4 out of 100 across the eight hypothetical PrEP scenarios. The scenario with the highest acceptability (scenario 1) had the following attributes: US$10 per month, 95% efficacy, no side-effects, 10 years duration of administration, use before sex and dispensed at an HIV clinic by a doctor/nurse. Table 3 shows the acceptability of all eight PrEP scenarios and their attribute profiles.

Table 4 shows the impact of each of the seven PrEP attributes on PrEP acceptability, and acceptability with the preferred versus the non-preferred value of each attribute. Cost had the single greatest impact on acceptability across the seven PrEP attributes, controlling for all other PrEP attributes. Participants reported significantly higher PrEP acceptability with a cost of US$10 (acceptability = 62.0), compared with a cost of US$250 (acceptability = 36.8), yielding a net impact score of 25.2 ($P < 0.001$). Efficacy had the second greatest impact on PrEP acceptability. Participants reported significantly higher PrEP acceptability with a 95% efficacious PrEP (acceptability = 60.0 out of 100), compared with PrEP with a 75% efficacy (acceptability = 38.7 out of 100), yielding a net impact score of 21.4 ($P < 0.001$). In addition, side-effects had a significant impact on PrEP acceptability. The acceptability of PrEP with no side-effects was 56.7 on the 0–100 point scale, in contrast to the mean score of 42.0 ($P < 0.001$) for PrEP with minor side-effects of nausea and dizziness. While not statistically significant, there was a notable preference for PrEP being dispensed by a health-care professional (versus pharmacist).

DISCUSSION

In this convenience sample of FSW, TG and MSM in Peru, we found a wide range of attitudes and opinions regarding PrEP acceptability. Important potential barriers to PrEP found in both the focus group and conjoint analysis data included high out-of-pocket cost, partial efficacy and fear of side-effects. Stigma and discrimination associated with PrEP use, mistrust of health-care professionals and a belief that PrEP would result in a decrease in condom use were concerns for MSM and TG. These potential barriers will require careful attention when planning for PrEP dissemination.

Acceptability of the best possible PrEP scenario (82.5 out of 100) suggests the potential for widespread use in our target population with an optimal product. Nevertheless, the average acceptability of 53.4 on the 0–100 scale across the eight hypothetical PrEP scenarios may be a more realistic estimate of its probable uptake and indicates that the eventual degree of acceptability of PrEP is likely to be influenced by its specific characteristics.

Both conjoint analysis and focus group data revealed concerns regarding PrEP use. Cost had the single greatest impact on PrEP acceptability in the conjoint analysis; participants were significantly more likely to indicate acceptance of PrEP with a low out-of-pocket cost. Focus group data supported this finding,

Table 3 **Acceptability (mean/SD) of hypothetical pre-exposure prophylaxis (PrEP) with different attributes in order of decreasing acceptability ($n = 45$)**

		PrEP attributes						
PrEP scenario	PrEP acceptability mean (SD)*	Cost (US$)/	Efficacy (%)	Side-effects	Duration of administration	Frequency	Location where PrEP dispensed	Person dispensing PrEP
1	82.56 (28.10)	10	95	None	10 years	Before sex	HIV clinic	Doctor/nurse
2	64.53 (37.08)	10	95	Nausea/dizziness	1 year	Every day	HIV clinic	Pharmacist
3	59.30 (36.60)	10	75	None	1 year	Every day	General clinic	Doctor/nurse
4	50.58 (32.95)	250	95	None	1 year	Before sex	General clinic	Pharmacist
5	42.44 (38.01)	250	95	Nausea/dizziness	10 years	Every day	General clinic	Doctor/nurse
6	41.28 (32.22)	10	75	Nausea/dizziness	10 years	Before sex	General clinic	Pharmacist
7	34.30 (34.94)	250	75	None	10 years	Every day	HIV clinic	Pharmacist
8	19.77 (28.64)	250	75	Nausea/dizziness	1 year	Before sex	HIV clinic	Doctor/nurse

SD = standard deviation

*PrEP acceptability score is based on a 5-point Likert scale converted to a 0–100 scale

Table 4 **Impact of pre-exposure prophylaxis (PrEP) attributes on hypothetical PrEP acceptability in Peru ($n = 45$)**

PrEP impact on PrEP acceptability	Attribute values	Acceptability of PrEP with preferred attribute (mean)	Acceptability of PrEP with non-preferred attribute (mean)	Impact on PrEP acceptability mean (SD)
Cost per month*	US$10 versus US$250	61.92	36.77	25.15 (29.30)
Efficacy*	95% versus 75%	60.03	38.66	21.37 (26.31)
Side-effects*	None versus nausea/dizziness	56.69	42.01	14.68 (30.95)
Duration of administration	1 year versus 10 years	48.55	50.15	−1.60 (19.39)
Frequency	Before sex versus every day	48.55	50.15	−1.60 (20.60)
Location PrEP is dispensed	General clinic versus HIV clinic	48.40	50.29	−1.89 (22.64)
Person dispensing PrEP	Pharmacist versus doctor/nurse	47.67	51.02	−3.34 (13.46)

SD = standard deviation
*$P < 0.001$ for one sample *t*-tests

with some participants expecting PrEP to be free or low-cost (like contraception pills) while others feared that if PrEP was initially free but then later charged for use would decrease. Efficacy had the second greatest impact on PrEP acceptability in the conjoint analysis. Participants were significantly more likely to indicate acceptance of PrEP with a 95% efficacy than a 75% efficacy. Focus group findings revealed that 100% efficacy (understandably) was desired by all three study populations; however, even an optimistic estimate of potential PrEP efficacy places it at 90%;[33] thus participant expectations may be unrealistically high. Side-effects such as nausea and dizziness had a significant impact on PrEP acceptability in the conjoint analysis. Focus group data supported this finding, with all three populations expressing concerns about the potential side-effects of PrEP particularly with regard to existing health conditions. While not statistically significant, there was a notable preference for PrEP being dispensed by a health-care professional (versus pharmacist) in the conjoint analysis. Focus group findings also showed a preference for PrEP being dispensed by health-care professionals (versus pharmacists). While all groups voiced concerns about health-care professionals that might discourage them from using PrEP, such fear of being mistreated, lack of sensitivity, and stigma and discrimination regarding sexual orientation (MSM and TG) and lifestyle (FSW), they maintained that health-care professionals were better qualified than pharmacists to dispense PrEP.

Focus groups revealed some information regarding PrEP characteristics not identified in the conjoint analysis. For example, all three populations preferred PrEP being dispensed in health-care clinics (versus pharmacies). In Peru, neighbourhood drugstores are numerous and many are family-operated, thus making privacy a potential issue if PrEP were dispensed at such establishments. We also found that daily use of PrEP would not be acceptable to MSM and TG, while FSW seemed more willing to accept PrEP on a daily basis comparing it to a contraception pill also taken daily.

Information regarding social barriers related to the disclosure of PrEP use emerged in the focus group data. All three populations reported being hesitant to disclose PrEP use with anyone outside of their social networks, with fears stemming from the potential of stigma and discrimination that could be associated with their lifestyles or behaviours by parents, friends or clients. Similar findings have been shown in previous studies.[34,35] It is unknown how social barriers will impact the acceptability of PrEP, but the very fact that it is a relatively 'invisible' prevention method compared with condoms, and could be used without others' knowledge may in fact be considered an important potential strength of PrEP as an HIV prevention strategy.

One issue we hoped to assess in this study was the possible impact of PrEP on behavioural risk disinhibition. Concerns regarding risk disinhibition hypothesize that new HIV prevention technologies like PrEP may foster an overly optimistic sense of protection among users and lead to increased risk behaviours (e.g. by reduced condom use; feelings of 'immunity' to HIV, etc.).[34–36] The data for MSM and TG in our study suggest that this was, in fact, a concern but interestingly not for FSW. While this discrepancy requires further exploration, it is possible that FSW may view PrEP specifically as added security against the occupational hazards of their work.

There were limitations to our study. First, we chose focus groups as one of our methods to explore PrEP acceptability. This methodology facilitates in-depth discussion of individual perspectives within the context of a larger group but may over-represent specific participant contributions; therefore, aggregate group data may not reflect equally the specific concerns of every group participant. Second, the small sample size ($n = 45$), convenience sampling and selection bias limits the ability to generalize our results to others. The purpose of this study was to elicit and explore reactions to hypothetical PrEP among select consumers at potential risk for HIV rather than to generalize our findings to all persons at risk. Third, the variables modelled in the conjoint analysis included physical characteristics of PrEP. We consulted PrEP experts in creating seven of the most critical characteristics of PrEP, which was based on current knowledge at the time the study was conducted. Social issues (e.g. perception of HIV risk, HIV testing practices, relationship issues, trust in providers, stigma/discrimination,[37–39] and social saturation[40]) were not included in the model, and may also impact PrEP acceptability. Further investigation of the impact of social issues on PrEP acceptability using conjoint analysis is warranted. Finally, it is important to note that conjoint analysis need not reflect the exact characteristics of a future PrEP to yield meaningful data. Rather, the purpose is to present a meaningful range to consumers within each PrEP attribute in order to estimate the likely impact of PrEP attributes on product acceptability.[23,27]

PrEP studies are underway, and within the next few years efficacy data will continue to emerge. With hope and scientific data mounting, it is essential to prepare for the possible roll-out of PrEP should it be shown to be efficacious. Our study demonstrated that clear differences were observed between groups, particularly the FSW versus the TG and MSM, pointing to the necessity of much deeper exploration of the intended target

groups in each environment – or microenvironments – where PrEP is introduced.

ACKNOWLEDGEMENTS

Dr Cunningham received partial support from the NIH/NCMHD, UCLA/Drew Project Export (P30AG021684) and NIH/NIA, UCLA/Drew Center for Health Improvement of Minority Elderly/Resource Centers for Minority Aging Research, (P30AG021684). The authors would also like to express their gratitude to the men and woman who participated in this study.

REFERENCES

1 Steinbrook R. One step forward, two steps back–will there ever be an AIDS vaccine? *N Engl J Med* 2007;**357**:2653–5
2 Vissers DC, Voeten HA, Nagelkerke NJ, *et al.* The impact of pre-exposure prophylaxis (PrEP) on HIV epidemics in Africa and India: a simulation study. *PLoS One* 2008;**3**:e2077
3 Skoler-Karpoff S, Ramjee G, Ahmed K, *et al.* Efficacy of Carraguard for prevention of HIV infection in women in South Africa: a randomised, double-blind, placebo-controlled trial. *Lancet* 2008;**372**:1977–87
4 Youle M, Wainberg MA. Pre-exposure chemoprophylaxis (PREP) as an HIV prevention strategy. *J Int Assoc Physicians AIDS Care* (Chic Ill) 2003;**2**:102–5
5 Smith SM. Pre-exposure chemoprophylaxis for HIV: it is time. *Retrovirology* 2004;**1**:16
6 Stephenson J. New HIV prevention strategies urged: averting new infections key to controlling pandemic. *JAMA* 2004;**292**:1163–4
7 Cohen MS, Gay C, Kashuba AD, *et al.* Narrative review: antiretroviral therapy to prevent the sexual transmission of HIV-1. *Ann Intern Med* 2007;**146**:591–601
8 Liu AY, Kittredge PV, Vittinghoff E, *et al.* Limited knowledge and use of HIV post- and pre-exposure prophylaxis among gay and bisexual men. *J Acquir Immune Defic Syndr* 2008;**47**:241–7
9 Guay LA, Musoke P, Fleming T, *et al.* Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: HIVNET 012 randomised trial. *Lancet* 1999;**354**:795–802
10 Lallemant M, Jourdain G, Le Coeur S, *et al.* Single-dose perinatal nevirapine plus standard zidovudine to prevent mother-to-child transmission of HIV-1 in Thailand. *N Engl J Med* 2004;**351**:217–28
11 PrEP-Watch. Ongoing and Planned PrEP Trials as of December 2008. See http://www.PrEPwatch.org/pdf/Trials/PrEP_trials_table.pdf (last checked 2 March 2009)
12 Goicohea P, Lama JR, Leon R, Grant RM. Reducing participant's information gap in HIV prevention clinical research. AIDS 2008 – XVII International AIDS Conference, 2008
13 Lama JR, Guanira J, Goicochea P, *et al.* Willingness to participate in a HIV pre-exposure prophylaxis efficacy trial among high risk men who have sex with men in the Andean region. 4th IAS Conference on HIV Pathogenesis, Treatment and Prevention, 2007
14 Nodin N, Carballo-Dieguez A, Ventuneac AM, *et al.* Knowledge and acceptability of alternative HIV prevention bio-medical products among MSM who bareback. *AIDS Care* 2008;**20**:106–15
15 Kellerman SE, Hutchinson AB, Begley EB, *et al.* Knowledge and use of HIV pre-exposure prophylaxis among attendees of minority gay pride events, 2004. *J Acquir Immune Defic Syndr* 2006;**43**:376–7
16 UNAIDS. *Report on the global AIDS epidemic*. Geneva, Switzerland: UNIAIDS, 2008
17 Montano SM, Sanchez JL, Laguna-Torres A, *et al.* Prevalences, genotypes, and risk factors for HIV transmission in South America. *J Acquir Immune Defic Syndr* 2005;**40**:57–64
18 Miller GA, Mendoza W, Krone MR, *et al.* Clients of female sex workers in Lima, Peru: a bridge population for sexually transmitted disease/HIV transmission? *Sex Transm Dis* 2004;**31**:337–42
19 Sayles JN, Macphail C, Newman P, Cunningham WE. Future HIV vaccine acceptability among young adults in South Africa. *J Health Educ Behav* 2010;**37**:193–210
20 Sandelowski M. The problem of rigor in qualitative research. *Adv Nurs Sci* 1986;**8**:27–37
21 Muhr T. *User's Manual for ATLAS.ti 5.0*. Berlin: ATLAS.ti Scientific Software Development, 2004
22 Green PE, Srinivasan V. Conjoint analysis in consumer research: issues and outlook. *J Consumer Res* 1978;**5**:103–23
23 Green PE, Srinivasan V. Conjoint analysis in marketing: new developments with implications for research and practice. *J Marketing* 1990;**54**:3–19
24 Luce RD, Tukey JW. Simultaneous conjoint measurement: a new type of fundamental measurement. *J Math Psychol* 1964;**1**:1–27
25 Hay J. Conjoint analysis in pharmaceutical research. *J Manag Care Pharm* 2002;**8**:206–8
26 Phillips KA, Maddala T, Johnson FR. Measuring preferences for health care interventions using conjoint analysis: an application to HIV testing. *Health Serv Res* 2002;**37**:1681–705
27 Ryan M, Farrar S. Using conjoint analysis to elicit preferences for health care. *BMJ* 2000;**320**:1530–3
28 Newman PA, Duan N, Lee SJ, *et al.* HIV vaccine acceptability among communities at risk: the impact of vaccine characteristics. *Vaccine* 2006;**24**:2094–101
29 Lee SJ, Brooks RA, Newman PA, *et al.* HIV vaccine acceptability among immigrant Thai residents in Los Angeles: a mixed-method approach. *AIDS Care* 2008;**20**:1161–8
30 Newman PA, Duan N, Lee SJ, *et al.* Willingness to participate in HIV vaccine trials: the impact of trial attributes. *Prev Med* 2007;**44**:554–7
31 Duan N. Listening to consumers and HIV vaccine PrEParedness. *Lancet* 2005;**365**:1119–21
32 Ryan M, McIntosh E, Shackley P. Methodological issues in the application of conjoint analysis in health care. *Health Econ* 1988;**7**:373–8
33 Valencia-Garcia D, Starks H, Strick L, *et al.* After the fall from grace: negotiation of new identities among HIV-positive women in Peru. *Cult Health Sex* 2008;**10**:739–52
34 Clark JL, Long CM, Giron JM, *et al.* Partner notification for sexually transmitted diseases in Peru: knowledge, attitudes, and practices in a high risk community. *sex Transm Dis* 2007;**34**:309–13
35 Abbas UL, Anderson RM, Mellors JW. Potential impact of antiretroviral chemoprophylaxis on HIV-1 transmission in resource-limited settings. *PLoS ONE* 2007;**2**:e875
36 Guest G, Johnson L, Burke H, *et al.* Changes in sexual behavior during a safety and feasibility trial of a microbicide/diaphragm combination: an integrated qualitative and quantitative analysis. *AIDS Educ Prev* 2007;**19**:310–20
37 Cassell M, Halperin D, Shelton J, *et al.* Risk compensation: the Achilles' heel of innovations in HIV prevention. *BMJ* 2006;**332**:605–7
38 Pinkerton S. Sexual risk compensation and HIV/STD transmission: empirical evidence and theoretical considerations. *Risk Anal* 2001;**21**:727–36
39 Newman PA, Duan N, Rudy ET, Roberts KJ, Swendeman D. Posttrial HIV vaccine adoption: concerns, motivators, and intentions among persons at risk for HIV. *J Acquir Immune Defic Syndr* 2004;**37**:1393–403
40 Liau A, Zimet GD. The acceptability of HIV immunization: examining vaccine characteristics as determining factors. *AIDS Care* 2001;**13**:643–50

(Accepted 10 August 2009)