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Perceived likelihood of using HIV Pre-Exposure Prophylaxis Medications Among Young Men Who Have Sex With Men

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Abstract

Pre-exposure prophylaxis (PrEP) is a new strategy for reducing the risk of HIV infection; however, questions about the likelihood of use remain. As part of an ongoing longitudinal study of YMSM, interest in PrEP use under various conditions of side-effects, dosing, and effectiveness were assessed. Participants aged 16–20 living in Chicago and the surrounding areas were recruited beginning December 2009, using a modified form of respondent driven sampling. A cross-sectional sample of 171 HIV negative YMSM interviewed approximately 6 months after initial enrollment was analyzed. This sample was somewhat interested in adopting PrEP as an HIV prevention strategy, particularly if the dosing and side-effects burden was low and the perceived benefits were high. PrEP interest was unrelated with drug use and number of sexual partners, but negatively correlated with number of unprotected anal sex acts. The scale was positively associated with intentions for use in specific risk situations.

Keywords

pre-exposure prophylaxis; biomedical HIV prevention; young MSM; gay; bisexual

INTRODUCTION

Pre-exposure prophylaxis (PrEP) is a new biomedical intervention for primary HIV prevention. Data released in November 2010 from the multi-national iPrEx study showed that men who have sex with men (MSM) who took a daily tablet containing emtricitabine (FTC) and tenofovirdisoproxilfumarate(TDF) or Truvada® (FTC/TDF) experienced an average of 43.8% fewer HIV infections than those who received a placebo pill (1). The results of two additional PrEP studies, one among serodiscordant heterosexual couples in Kenya and Uganda and the other in sexually-active young men and women in Botswana each demonstrated the potential promise of this novel HIV prevention strategy (2, 3).

With established efficacy in some adult trials, in July 2012 the U.S. Food and Drug Administration's decided to approve the use of Truvada (a combination of 300 milligrams of tenofovir and 200 milligrams of emtricitabine) to reduce the risk of acquiring HIV. However, important questions remain regarding effectiveness and successful implementation of PrEP, especially among adolescents and young adults not widely included in the above-mentioned adult trials and particularly in racial and ethnic minority

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young MSM (YMSM) who are disproportionately impacted by HIV in the United States (4, 5). This is particularly true since across studies the protective efficacy of PrEP appeared highly correlated with the level of adherence, which is known to be a significant challenge for youth (6). Questions about whether the availability of PrEP might influence the sexual risk behavior of youth still arise, even though there has been no evidence of behavioral disinhibition in PrEP adult clinical trials to date (7). In addition, while there has been some emerging evidence of racial differences in PrEP-related constructs (e.g. condom-use decision making in the context of PrEP efficacy, lifetime PrEP use and number of times PrEP was used in past year) (8), these have not been well studied especially among YMSM. In fact, no PrEP trial to date has included a sizeable sample of U.S. YMSM and as such our knowledge about the feasibility of this strategy among the population is extremely limited.

The purpose of the current study was to describe PrEP interests among racially and ethnically diverse YMSM ages 16–20 years using a new measure that may have utility in future studies. We describe demographic differences and examine if interests in PrEP changed after the high profile announcement of the iPrEx results. We hypothesize that PrEP would be of interest to the study population given their high rate of HIV infections, and that interest would be particularly high if PrEP were to be offered as part of a simple dosing schedule (e.g. single dose proximal to having unprotected sex). In addition, as part of this exploratory study, we report the relationship between PrEP interests and substance use, sexual risk taking, perceived likelihood of using condoms if on PrEP, and use of the medication in serious and casual sexual relationships. These data help provide greater understanding of perceived likelihood of using PrEP by different demographic and risk groups of YMSM, which can be used to help tailor and target prevention messaging about PrEP.

METHODS

Data was collected as part of *Crew 450*, an ongoing longitudinal cohort study of YMSM recruited from Chicago and the surrounding areas beginning December 16, 2009. Crew 450 was designed to analyze the prevalence, course, and predictors of a syndemic of psychosocial health issues linked to HIV among YMSM. Participants were eligible for the study if they were between the ages of 16 and 20 at baseline, assigned a male sex at birth, spoke English, have had a sexual encounter with a male or identify as gay/bisexual, and available for follow-up for 2 years. YMSM were recruited through a modified form of respondent driven sampling (9) that allowed for a higher proportion of the sample to be initial recruits (AKA “seeds”). Seeds were recruited through outreach to community and school organizations and flyers in community settings frequented by the target population.

Cross-sectional data was analyzed from the wave 2 time point which began July 6, 2010 (approximately 6 months after baseline), since this was the only survey period where the PrEP interest questions were administered. Participants completed the self-administered interview using a computer assisted self-interview with audio instructions. This interview assessment was only available in English. At the time of analyses, the survey had been administered to 184 participants, with 25 participants missing this assessment point, which represents an 88% retention rate. Of this sample, 13 (7.1%) participants indicated they had received a positive result on their last HIV test, which excluded them from answering these questions, resulting in an analytic sample of 171. Table 1 summarizes the demographic characteristics of the sample.

The wave 2 self-administered assessment lasted approximately 1 hour, and participants were compensated $45 for their time and travel. The study was approved by the Institutional Review Boards (IRBs).

Measures

Demographic information such as race/ethnicity, age, and sexual orientation were all self-reported at the time of the interview.

PrEP interests—An 8-item scale was administered to determine participant's interest in taking a PrEP medication under various conditions of side-effects, dosing schedules, and effectiveness. These items were modeled on a measure used in the Adolescent Trial Network 082 PrEP Study, and extensively adapted based on the literature and our experience with the population and PrEP. In addition to the PrEP interests scale, additional items were included asking about likelihood of using condoms while on a PrEP medication, likelihood of using PrEP while in a serodiscordant monogamous relationship, and likelihood of using PrEP if all sex was with casual partners. Refer to the appendix for the complete listing of items and instructions.

Drug use—To assess the prevalence of drug use, participants were asked to report if they had ever used each of the following drugs in the 6 months prior to the interview: marijuana, cocaine, heroin, methamphetamines, opiates, prescription depressants, prescription stimulants, psychedelics, ecstasy, ketamine, inhalants, and poppers. A count variable of the total number of drugs used was created.

Sex partners—Participants were asked to report the total number of male and female sexual partners they have had in the 6 months prior to completing the survey. A sexual partner was defined as someone they engaged in oral, vaginal or anal sex with. A count variable of the total number of male unprotected anal sex partners was used in analyses.

Sex acts—For each of the respondent's last 3 sex partners, the total number of sex acts and frequency of condom use measured on a 5-point scale were reported. Frequency of condom use was recoded into a percentage of time the respondent did not use a condom (Always=0%, More than half the time=25%, Half the time=50%, Less than half the item=75%, Never=100%). This percentage was then multiplied by the total number of sex acts to estimate the number of unprotected sex acts. This process was applied to each of the last 3 sex partners whom were either male or male-to-female (MTF) transgender and then summed.

HIV knowledge—Participant's level of knowledge about HIV transmission and self-protecting behaviors was assessed by administering a 28-item questionnaire. Sixteen items were taken from the HIV Knowledge Questionnaire (HIV-KQ) (10) with slight wording modifications included in order to better fit our study population. The other 12 items were developed by our research team based on HIV myths frequently found during open ended interviews used in the development of a separate HIV intervention (11). Participant's response options were: True, False, or Unsure. All "Unsure" responses were coded as incorrect for the purpose of this analysis.

An initial factor analysis using maximum likelihood extraction with an oblique rotation produced a 7 factor solution with eigenvalues greater than 1. However, only 4 factors (eigenvalues=10.2, 1.7, 1.5, and 1.2) explaining 52% of the variance were retained since the scree plot indicated the eigenvalues leveled off after the fourth factor was extracted. The factor scores were significantly inter-correlated ($.57 \leq r \leq .71$) and all were highly correlated with the total score (i.e., percentage of all 28 items answered correctly; $r > .76$). Since these 4 factors could not be easily interpreted and were highly intercorrelated, a second order factor analysis was conducted using the factor scores. This is the same approach used during initial analysis of the 45-item HIV-KQ (12). This factor analysis produced a single factor

with an eigenvalue greater than 1 and each of the original 4 factors had high loadings (.72 – .85). In addition, the factor score produced by this second order factor analysis strongly correlated with the percentage of all 28 items answered correctly (r=.99). Due to these findings, a single factor solution was used and the percentage of all 28 items answered correctly was calculated. The coefficient alpha for all items was .93.

Date of iPrEx Results—In order to examine how PrEP participant interests may have changed with the announcement of iPrEx study results, several dates of relevance were examined. November 23rd, 2010 was the date in which the NIH announced the results of the iPrEx trial in MSM (1), January 27th, 2011 was the date the CDC issued guidelines for PrEP with MSM. And finally, July 13, 2011, which was the date in which the CDC and the University of Washington announced trial results of PrEP in heterosexuals.

RESULTS

Psychometric Analyses

Exploratory factor analysis was conducted to determine the underlying structure of the new PrEP interest scale. Using maximum likelihood, two factors with eigenvalue greater than 1.00 were extracted (Factor 1= 3.85; Factor 2 = 1.06). The total variance explained was 61.4%. However, an eigenvalue greater than 1.0 may at times over-estimate the most suitable number of factors (13), therefore other criterion considered were the theoretical interpretability of the solution and the scree test (14). Based on these criteria, a one-factor solution was selected as most appropriate, in which all eight items were included and the factor loadings ranged from 0.38 – 0.87. The mean of these items was then calculated to create an overall score of the likelihood of using PrEP. Follow up analyses showed good internal consistency for the 8-item scale, with a Cronbach's alpha of 0.84 and the deletion of any of the scale items was shown to lower the reliability of the scale. Statistical analyses were conducted using SPSS 20.0 and there was no missing data.

Mean PrEP Interest

On average, participants answered 73.7% (SD=24.7) of the HIV knowledge items correctly, reported using 0.8 (SD=1.2) different types of drugs, and having 3.9 (SD=9.1) sexual partners (male and female) and 0.7 (SD=1.7) male unprotected anal sex partners, and engaging in 8.7 (SD=21.2) unprotected anal sex acts in the past 6 months. Table 2 displays the individual item means and standard deviations for the PrEP interest questions. Means of individual items ranged from 1.70 to 2.58 and the mean of the scale was 2.13 (SD = .51) with tertiles of 1.00–1.88, 1.89–2.38, and 2.39–3.00. These mean scores indicate that on average YMSM in our study were slightly above "somewhat likely" to be interested in using PrEP. The items with the highest mean endorsement included overall interest, with dosage of 3 times per week, and a single dosage prior to unprotected sex. Endorsement was lower under conditions of side-effects, post-exposure usage, and when effectiveness was at 50%.

Demographic Differences

In terms of demographic differences, there was not a significant Pearson's correlation between mean PrEP interests and age. No significant differences in PrEP interest were found by race/ethnicity ($F(3,166) = .84$, $p = .47$) or sexual identity ($F(2,159) = 1.47$, $p = .23$). To determine if mean PrEP interests significantly differed by the level of educational attainment, a multivariate linear regression analysis was conducted while controlling for age and HIV knowledge. Those with high school diplomas or equivalent (i.e., GED) were found to have had less interest in PrEP than those who pursued education after high school (Beta = −.20, $p < .05$). Participants with better HIV knowledge did have significantly higher interests in PrEP (Beta = .15, $p < .05$).

Associations with risk behaviors and PrEP news

There were no significant Spearman's rho coefficients between mean PrEP interests and drug use, number of sexual partners or number of male unprotected anal sex partners. However, mean PrEP interests and the number of unprotected anal sex acts with male and MTF partners had a significant negative correlation (Spearman's rho = −.22, p< .05). To further understand variability in PrEP interest within the window in which data were collected, mean PrEP interest was examined pre- and post- several high profile announcements of PrEP research to determine if these notifications influenced respondent's responses. No differences were found in PrEP interests before and after the iPrEx trial results ($t(169) = .70$, $p > .05$), with similar non-significant results for the two other PrEP announcement dates.

Intentions to use PrEP in risk situations and with condoms

The PrEP scale was then further analyzed to examine its relationship to three single item outcome measures related to safe sex in specific risk situations. Three binary logistic regression models were run with these specific risk situations as dichotomous outcomes ("not at all likely"=0; "somewhat likely" and "very likely"=1) and the mean PrEP scale as the independent variable. The PrEP interests score was positively associated with willingness to use condoms when on PrEP (OR = 3.86, 95% CI [1.96, 7.61], p < .001), willingness to use PrEP in a serodiscordant monogamous relationship (OR = 8.39, 95% CI [3.67, 19.16], p < .001), and willingness to use PrEP when only having casual partners (OR = 14.03, 95% CI [5.84, 33.73], p < .001).

DISCUSSION

As part of a comprehensive HIV prevention effort, PrEP is partially effective at reducing HIV infection in high risk HIV-negative adult MSM populations (1). However, little is known about the interests in PrEP in young adults, specifically YMSM, one of the most at-risk groups for HIV infection (5, 15). In this paper we reported on the psychometrics of a new measure of PrEP interest among YMSM. Overall, participants were slightly more than "somewhat likely" to be interested in taking PrEP. Of particular relevance, YMSM were asked about interest in PrEP if it reduced their risk of infection by 50%, which is similar to the effectiveness found in the iPrEx trial. Under this level of effectiveness, participants were on average "somewhat likely" to take PrEP—a lower mean response than for the overall scale. In other words, interest in taking PrEP is moderate among YMSM at its current level of effectiveness. We also found that YMSM reported greater interest in using PrEP if the regimen and medication burden was low and the perceived benefits were high (i.e., high efficacy rate).

Of importance, we found no differences in mean likelihood score based on the race/ethnicity of participants. This lack of difference may indicate high levels of interest in biomedical interventions across all racial/ethnic groups of YMSM, particularly if they are proven to be effective. Likewise, a higher level of education was related to an increased likelihood of taking PrEP, which may indicate a greater understanding of the medication or greater overall health literacy (16). We also found that participants with greater knowledge about HIV had a higher interest in PrEP usage compared to those with lower levels of HIV knowledge. Thus, efforts to promote the use of PrEP among YMSM may need to be tailored based on individual characteristics, including HIV knowledge and education level.

We explored the relationship between specific risk factors (age, drug use, number of sexual partners, and number of unprotected anal sex partners) and mean PrEP interest scores. Our results demonstrate that, in our sample, there was no relationship between most of the

reported risk behaviors (drug use, number of sexual partners, and number of male unprotected anal sex partners) and mean PrEP interest scores. The exception to this was the negative association between number of unprotected anal sex acts with a male partner and PrEP interest. The more unprotected anal sex acts the less interest participants had in taking PrEP. This pattern may be due to a lower interest or knowledge about the need for HIV prevention among these young men or due to a specific disinterest for PrEP. Because there was no association with the number of unprotected partners, it is also possible this pattern reflects that these YMSM are in serious relationships and therefore have higher numbers of sex acts (17) and less interest in condoms and PrEP. Further research to disentangle these possibilities is important because if the first two possible explanations are true (i.e. riskiest YMSM are less interested in PrEP), then this presents an important barrier to the adoption of PrEP among the highest risk YMSM.

Surveys were completing before and after the high profile announcements of the iPrEx results. However, the dates of these announcements were not associated with mean PrEP interest scores. This finding may indicate a lack of knowledge about the results of the iPrEx study or that hearing about the study did not alter interest in PrEP. In either case it suggests the types of news that were disseminated about PrEP during this time did not alter interest in this intervention among the YMSM participants. Future efforts to disseminate information about PrEP to YMSM may need to utilize more intensive and targeted approaches. We must also acknowledge that we did not directly assess knowledge of the study results, but rather used the dates of the announcements as proxies for possible exposure.

YMSM participants reported on average that they were somewhat to very likely to use condoms while also taking PrEP. Our study also found that higher mean PrEP interest scores were associated with increased willingness to use condoms while taking PrEP. Importantly, these results suggest that use of PrEP may not increase YMSM's intentions to engage in sex without condoms. Participants also reported on average that they were somewhat to very likely to use PrEP in two specific risk situations: a monogamous serodiscordant relationship and if they only had casual sex partners. Furthermore, individuals higher in mean PrEP interest were much more likely to endorse interest in using PrEP in these specific risk situations. PrEP may initially be targeted at HIV negative individuals in serodiscordant relationships so it is useful to know the level of interest and how it is associated with overall interest in PrEP. Of course intentions about future behavior may not match actual behavior in those situations.

Several limitations should be considered when interpreting the results from our study. The cross-sectional nature of the data does not allow us to infer causality. We also only measure sexual risk by self-report, which may suffer from social desirability, and further our design would benefit from the assessment of bio-markers such as STIs. The PrEP likelihood scale was only administered at the second wave of data collection in the larger study, therefore we have missing data for 25 of the baseline participants who were lost to follow-up. Key items may be missing from our scale as we developed it prior to the literature on the landmark PrEP trials, for example, future revisions to the scale may include items assessing likelihood of PrEP use if it requires 1)Hepatitis B testing with treatment for positives and vaccines for negatives; 2) regular adherence assessments via blood draw, pill count or self-report; and 3) 90 day supplies with refills contingent on HIV status confirmation and risk reduction counseling by a provider. Despite these limitations, we believe our study contributes to the literature examining the interest in PrEP usage in a population at high risk for HIV acquisition. Future studies should explore how learning about PrEP and other biomedical prevention approaches may change attitudes towards condom use in order to inform health communication efforts about these strategies. Additionally, future studies should explore how our scale predicts actual PrEP use when it is offered to YMSM.

Overall, the young MSM in our study were somewhat interested in the usage of PrEP as a HIV prevention tool. Our study establishes the psychometric reliability and validity of a PrEP likelihood scale, which can be used in future research endeavors. Further study needs to focus on implementation of PrEP and the reality of adherence issues, long term health effects, and impact on risk behavior for youth populations. Young MSM should be prioritized in future efforts to assess efficacy of PrEP.

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Appendix. Pre-Exposure Prophylaxis Questionnaire

Although there is no drug which can protect you from getting HIV, scientists are busy researching ways to make one. The following questions are about how you would feel about taking a medication which could prevent you from getting HIV, if it was created.

When answering these questions, remember that in order for any drug to be effective, you have to take it as prescribed. You would always have to take the medication as prescribed or it might not work. Also bear in mind that this medication would only work to protect you from HIV, it would not protect you from other sexually transmitted infections like gonorrhea and chlamydia.

Response options: 1 = Not at all likely, 2 = Somewhat likely, 3 = Very likely.

1 If there was a drug available that would keep you from getting HIV, how likely is it that you would take it?

2 How likely would you be to take a drug that protects you from getting HIV if it caused side effects like dizziness, diarrhea, vomiting, headaches, rash, gas or skin discoloration?

3 How likely would you be to take a drug that protects you from getting HIV if you had to take it every day in order for it to be effective?

4 How likely would you be to take a drug that protects you from getting HIV if you had to take it 3 times a week in order for it to be effective?

5 How likely would you be to take a drug that protects you from getting HIV if you had to take more than 1 pill a day in order for it to be effective?

6 How likely would you be to take a single dose of a drug that protects you from getting HIV the day before you had unprotected sex?

7 How likely would you be to take a drug that protects you from getting HIV if you had to take it for 28 days after unprotected sex?

8 How likely would you be to take a drug that reduces your risk of getting HIV by 50%?

9 How likely would you be to use a condom when having sex if you were taking a medication that reduced your risk of getting HIV?

10 How likely would you be to take a drug that protects you from getting HIV if you were in a monogamous relationship with a partner you knew was HIV-infected?

11 How likely would you be to take a drug that protects you from getting HIV if you only had casual sexual partners?

Table 1

Sample Characteristics (n=171)

	N	%	Mean PrEP Scale Score
Assigned sex at birth			
Male	171	100.0	2.13
Age [a] (M=19.2; SD=1.3)			
16 – 18	67	39.2	2.12
19 – 20	104	60.8	2.13
Race [b]			
Black	81	47.4	2.09
Hispanic/Latino	40	23.4	2.11
White	31	18.1	2.11
Other	18	10.6	2.25
Education			
Less than HS diploma	53	31.0	2.14
HS diploma/GED	46	26.9	1.91
Greater than HS diploma	72	42.1	2.24
Sexual identity			
Only/Mostly homosexual	128	74.8	2.13
Bisexual	29	17.0	2.03
Only/Mostly heterosexual	5	3.0	2.38
Other	9	5.3	2.25
Total sex partners in past 6 month (male & female)			
Zero	32	18.7	2.01
One	43	25.1	2.11
Two	32	18.7	2.19
Three or Four	36	21.1	2.22
Five or more	28	16.4	2.10
Total unprotected anal sex partners in past 6 months (males only)			
Zero	112	65.5	2.15
One	41	24.0	2.04
Two	11	6.4	2.20
Three or more	7	4.1	2.20

[a] Age is being reported as both a categorical and continuous variable here; however, all analyses only use age as a continuous variable.

[b] One participant refused to report race.

Table 2

Pre-Exposure Prophylaxis (PrEP) Interest Scale Item Descriptives and Factor Analysis (n=171)

PrEP Item[a]	Mean	SD	Factor Loading
Likelihood of taking drug if……			
there was a drug available	2.58	0.62	0.60
it caused side effects like dizziness, diarrhea, etc.	1.70	0.66	0.44
you had to take it every day to be effective	2.13	0.71	0.87
you had to take it 3 times a week to be effective	2.42	0.70	0.82
you had to take more than 1 pill a day to be effective	1.79	0.78	0.75
you had to take a single dose of a drug the day before unprotected sex	2.32	0.79	0.50
you had to take it for 28 days after unprotected sex	2.00	0.83	0.38
if it reduced your risk of getting HIV by 50%	2.09	0.79	0.60
if you were in a monogamous relationship with HIV+ partner	2.58	0.72	NA
if you only had casual sexual partners	2.37	0.75	NA
Likelihood of using condom while taking drug to reduced risk of getting HIV	2.48	0.71	NA

[a] See appendix for full wording of PrEP interest items. Factor loadings estimated using maximum likelihood with solution constrained to one factor.