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Acceptability of Long-Acting Injectable PrEP (LAI PrEP) Among Men Who Have Sex with Men (MSM) in the Southern United States, 2022

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Abstract

Acceptability of Long-Acting Injectable PrEP (LAI PrEP) Among Men Who Have Sex with Men (MSM) in the Southern United States, 2022

By Paige Schoenberg

Introduction

Ending the HIV epidemic in the United States relies on increasing use of pre-exposure prophylaxis (PrEP) medication to prevent HIV infection among men who have sex with men (MSM). A novel long-acting injectable (LAI) form of cabotegravir PrEP was approved for use in the U.S. in December 2021 under the brand name Apretude. Because the drug is so new and relatively few studies have examined acceptability of LAI PrEP among MSM, we aimed to describe willingness to use LAI PrEP and preference for PrEP form among MSM from 16 states in the southern U.S., plus Washington, D.C.

Methods

Combine is an online survey of cisgender men who have sex with men and transgender and gender expansive people who have sex with men aged 15-34 years who live in the southern region of the U.S. We analyzed outcomes related to acceptability of LAI PrEP (willingness to use LAI PrEP and preference for PrEP form) in a sample of 575 HIV-negative/unknown status MSM from 2021. We assessed bivariate associations between demographic characteristics of the study population and outcomes, and applied binomial logistic regression using predicted margins to estimate prevalence ratios. Analyses included rurality of residence, gender identity, age, education level, annual household income, health insurance status, engaging in condomless anal intercourse (CAI) within the last six months, current PrEP use, and feelings of stigma towards PrEP use.

Results

Overall, 68% of all participants (n=393) were willing to use LAI PrEP that provides protection against HIV for three months. Fifty-six percent (n=320) indicated a preference for using LAI PrEP, compared to a daily oral pill or no preference. Willingness to use LAI PrEP was more common among men of Hispanic or other/multiracial ethnicity, cisgender males, and men who engaged in CAI in the last six months. Participants who preferred LAI PrEP were more likely to be Hispanic or of other/multiracial ethnicity.

Conclusions

LAI PrEP is an acceptable option among MSM in the southern United States. However, additional interventions or information campaigns targeted to non-Hispanic Black men, gender expansive people, and those with a high school education or less may be necessary.

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1. Introduction

In the United States, men who have sex with men (MSM) account for an estimated 24,500 new HIV infections each year, equal to 70% of all new HIV infections.[1] Preventing new HIV infections among MSM is therefore critical to ending the HIV epidemic in the U.S. For this reason, increasing uptake of pre-exposure prophylaxis (PrEP) to prevent HIV is a key pillar of the U.S. Department of Health and Human Services' Ending the HIV Epidemic initiative (EHE) to reduce the number of new HIV infections in the U.S. by at least 90% by 2030.[2] Currently, approximately one-fifth to one-third of PrEP-eligible MSM are using daily oral PrEP,[3-5] a number that has been slowly rising but that is well below numbers needed to end the HIV epidemic.

Recent innovations in PrEP delivery might increase PrEP use, in particular the development of long-acting injectable PrEP (LAI PrEP). In December 2021, the U.S. Food and Drug Administration (FDA) announced the approval of Apretude, a novel extended-release form of the HIV prevention drug cabotegravir.[6] Apretude is the first long-acting injectable option for HIV prevention, approved for use by cisgender men, cisgender women, and transgender women.[6] The development of LAI PrEP is a significant innovation in HIV prevention; previously, daily oral pills were the only medication option approved in the United States for those wanting to protect themselves against HIV.

Advantages of LAI PrEP over oral PrEP include its effectiveness and lower risk for user non-adherence. Among cisgender men and transgender women who have sex with men, Apretude is more effective than PrEP pills at preventing HIV.[7] A large clinical trial that concluded in 2020 found that the risk of HIV infection among Apretude users was 66%-69% lower than the risk of HIV infection among daily pill controls.[7] Also, whereas daily oral PrEP adherence can be a challenge,[8,9] LAI PrEP is more forgiving because it is administered via intramuscular injections every two months, following two initial doses given one month apart.[6] The injections can be given within seven days before or after a scheduled

dose and if a person misses an injection by more than seven days, daily cabotegravir pills can be substituted for up to two months.[6]

Although clinically superior, LAI PrEP's potential for widespread use hinges on its acceptability to consumers. Prior to FDA approval of Apretude, a handful of studies investigated acceptability of LAI PrEP. These studies found LAI PrEP to be acceptable and even preferable to oral PrEP among transgender women and cisgender MSM. One 2017 study of MSM in Washington, D.C. reported that 62% of MSM were interested in LAI PrEP, with differences by race and ethnicity.[4] Another 2016 study of MSM in New York City reported that just over half of participants had heard of LAI PrEP and almost one-third preferred it to oral PrEP, while 35% preferred whichever was most effective and 8% had no preference; only a little more than one-quarter of participants preferred oral PrEP.[10] For comparison with oral PrEP, a study in 2017 (when only oral PrEP was available) that was based on a nationally representative sample found that 60% of MSM were generally willing to use PrEP.[5] However, the same study found that PrEP use among MSM was only 20% nationally[5] (other studies have estimated PrEP use to be up to 35%[3,4]) and that PrEP use varied by population density.[5] In non-urban areas, PrEP use was much lower and MSM in non-urban areas were up to 65% less likely to use PrEP.[5]

The studies in our literature review indicate high acceptability of LAI PrEP among MSM. However, these studies conducted prior to LAI PrEP coming onto the market are either outdated or focused on coastal urban populations such as Washington, D.C., New York City, and San Francisco. Our review revealed a gap in the literature of more recent studies pertaining to acceptability of LAI PrEP among non-urban MSM, as well as among men in urban centers in the South. Such studies may obscure regional differences and differences between urban and non-urban participants. In the South and outside of urban centers, there is a possibility that acceptability of LAI PrEP may be lower, possibly because barriers to use may be higher. These barriers include the six clinical visits required annually for LAI PrEP

(seven in the first year of use),[6] the estimated cost of LAI PrEP (around $25,850 per year without insurance),[11] and cultural norms and experiences of stigma in healthcare settings.[12]

The objective of this study was therefore to determine whether upward trends over time in willingness to use LAI PrEP hold true among MSM in urban and non-urban areas in the South. To determine whether LAI PrEP will be a viable method of HIV prevention for this population, we conducted a cross-sectional survey to gauge acceptability of and preferences for LAI PrEP. We also aimed to describe differences in willingness to use LAI PrEP and preference for PrEP form based on demographics including race and ethnicity, gender identity, age, socio-demographic characteristics, and sexual health history.

2. Methods

2.1 Study Population

This cross-sectional study used data from Combine, an online survey of cisgender men who have sex with men and transgender and gender expansive people who have sex with men. Participants were aged 15-34 years and lived in the southern region of the U.S. Recruitment and data collection took place between April and December 2021. The study adhered to federal human subjects regulations and was reviewed and approved by Emory University's human subjects research review board (protocol IRB001268).

Participants were recruited through convenience sampling via online social and sexual networking sites (e.g. Instagram, Grindr). After clicking on an ad, participants were taken to a screening survey hosted on HIPAA-compliant servers (Alchemer, Boulder, CO). After consenting to screen, participants completed a brief eligibility survey. If eligible and consenting to the full survey, participants could begin the Combine survey immediately or have a unique link sent to their email address. Once they began the survey, participants could pause the survey and receive a unique URL via email to return and

complete the survey within two weeks. Survey topics included demographics; sexual behaviors; substance use; HIV and sexually transmitted infection (STI) testing, attitudes, and beliefs; and use of HIV prevention services. Participants were not compensated for participating in the survey.

Participants were eligible for Combine if they were assigned male at birth regardless of gender identity or assigned female at birth and identify as transgender or non-binary, were age 18-34, resided in the southern U.S. (Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, Washington, D.C., or West Virginia), had an Android or iOS phone with active service and were willing to download a study app to their phone, spoke English, and reported being HIV-negative at their last HIV test or never having been tested for HIV.

2.2 Measures

We examined two outcome measures related to acceptability of LAI PrEP: willingness to use LAI PrEP and preferred method of PrEP. Questions about PrEP were only asked of participants who did not report having been previously diagnosed with HIV. To measure willingness to use LAI PrEP, participants were asked if they would be willing to use a new form of PrEP that is delivered via injection and provides protection for three months. Response options included yes, no, and not sure, which were dichotomized as yes or no/not sure for analysis. To measure preferences for the form of PrEP, specifically whether participants would prefer to take LAI PrEP versus the currently available daily oral PrEP, participants were asked, “Would you prefer to take LAI PrEP that would provide protection against HIV for three months, or daily oral PrEP?” Response options included LAI PrEP, daily oral PrEP, and no preference, which were dichotomized for analysis as preferring LAI PrEP or preferring oral PrEP/having no preference.

Independent measures included rurality of residence, gender identity, age, education level, annual household income before taxes, health insurance status, condomless anal intercourse (CAI) within the last six months, current PrEP use, and feelings of stigma towards PrEP use. Rurality was based on the Index of Relative Rurality (IRR) rural classification system.[13] The IRR classifies rural areas based on population size, density, remoteness, and built-up area, assigning a continuous score from 0.0 (most urban) to 1.0 (most rural). IRR values ≥ 0.4 were considered to be rural based on recommendations from the developers of the scale[14] and a prior study demonstrating that this cutoff effectively differentiates rural and non-rural MSM.[15] To determine IRR, participant ZIP codes were cross-walked to county of residence using an established algorithm.[16] Health insurance status was categorized as private, public, combination private/public, other, or none. Participants were dichotomized as having insurance or not; participants who reported "other" were excluded from the analysis. Participants who reported insertive or receptive anal sex without a condom in the past six months were classified as engaging in CAI. Feelings of stigma towards PrEP use was a derived variable created by summing dichotomized answers to Likert scale questions about stigmatic attitudes towards PrEP. Participants were asked to agree or disagree with five statements about PrEP and stigma, such as, "I would feel dirty if a doctor recommended PrEP to me." Answers were then dichotomized; participants who answered, "strongly agree" or "agree" were categorized as "yes, agree" and participants who answered, "neutral," "disagree," or "strongly disagree" were categorized as "no, disagree." Those who agreed with two or more out of five statements were classified as having feelings of stigma towards PrEP use.

For the regression analyses, all categorical variables except race/ethnicity and income level were dichotomized. Age was dichotomized as 18-24 years and 25-34 years. Education level was dichotomized as high school education or less and at least some college education. Gender identity was dichotomized as cisgender male and transgender or non-binary.

2.3 Statistical analyses

All statistical analyses were performed using SAS 9.4 and SAS-callable SUDAAN. We assessed bivariate associations between demographic characteristics of the study population and the outcomes of willingness to use LAI PrEP and preference for PrEP method. Fisher's exact test was used to assess bivariate relationships between demographic characteristics of the study population and the outcomes.

Binomial logistic regression using predicted margins was used to estimate prevalence ratios for demographic and behavioral factors for the outcomes of willingness to use LAI PrEP and preferred form of PrEP. Adjusted models included the following covariates: rurality of residence, gender identity, age, education level, annual household income before taxes, health insurance status, engaging in CAI within the last six months, current PrEP use, and feelings of stigma towards PrEP use.

3. Results

There were 583 Combine-eligible MSM participants recruited from 16 southern states plus Washington, D.C. After removing participants with missing or invalid data on rurality, willingness to use PrEP, and annual household income, the final analytic sample included 575 study participants. Most participants (68%) were from non-rural areas. Although the majority of participants identified as cisgender male, 16% of participants identified as transgender or non-binary. The median age of participants was 27 years. Participants were most commonly college graduates or higher, had health insurance, and had an annual household income of $20-39,000. Nearly all participants reported engaging in CAI in the last six months. Thirty-six percent of participants reported ever using PrEP and 23% of participants were currently on PrEP, which is in line with previous studies.

Table 1. Willingness to Use LAI PrEP by Demographic Characteristic (Dichotomous)

N= 575	Total N(%)	Not Sure/No N(%)	Yes N(%)	Fisher's Exact Test
Total	575	182 (32%)	393 (68%)	
Rurality				0.4425
Non-Rural	392 (68%)	120 (66%)	272 (69%)	
Rural	183 (32%)	62 (34%)	121 (31%)	
Race/Ethnicity (n=573)				0.0043
Hispanic	105 (18%)	26 (14%)	79 (20%)	
Non-Hispanic Black	129 (23%)	54 (30%)	75 (19%)	
Non-Hispanic White	292 (51%)	92 (51%)	200 (51%)	
Other/Multiracial	47 (8%)	8 (4%)	39 (10%)	
Gender Identity (n=574)				0.7802
Male	481 (84%)	156 (86%)	325 (83%)	
Female	3 (1%)	2 (1%)	1 (0%)	
Transgender woman/transfeminine	8 (1%)	2 (1%)	6 (2%)	
Transgender man/transmasculine	9 (2%)	3 (2%)	6 (2%)	
Non-binary/gender non-conforming	39 (7%)	10 (5%)	29 (7%)	
Other	2 (<1%)	0 (0%)	2 (1%)	
Multiple	32 (6%)	9 (5%)	23 (6%)	
Age, median	-	27	27	-
Age Group				0.5018
15-17 years	4 (1%)	2 (1%)	2 (1%)	
18-24 years	171 (30%)	48 (26%)	123 (31%)	
25-29 years	226 (39%)	76 (42%)	150 (38%)	
30-34 years	174 (30%)	56 (31%)	118 (30%)	
Education Level (n=574)				0.4094
High school or lower	109 (19%)	40 (22%)	69 (18%)	
Some college	197 (34%)	58 (31%)	139 (35%)	
College graduate or more	268 (47%)	84 (46%)	184 (47%)	
Annual Household Income Before Taxes (n=535)				0.6923
$0 to $19,999	135 (23%)	49 (27%)	86 (22%)	
$20,000 to $39,000	145 (25%)	45 (25%)	100 (25%)	
$40,000 to $74,999	140 (24%)	43 (23%)	98 (25%)	
$75,000 or more	115 (20%)	36 (20%)	79 (20%)	
Don't know	23 (4%)	6 (3%)	17 (4%)	
I prefer not to answer	17 (3%)	4 (2%)	13 (3%)	
Insurance Status (n=570)				0.1653
No	131 (23%)	35 (19%)	96 (25%)	
Yes	439 (77%)	147 (81%)	292 (75%)	
Condomless Anal Intercourse (CAI) in Last 6 Months (n=521)				0.0008
No	89 (17%)	40 (26%)	49 (13%)	
Yes	432 (83%)	114 (74%)	318 (87%)	
Currently on PrEP (n=570)				0.0052
No	440 (77%)	152 (84%)	288 (74%)	
Yes	130 (23%)	28 (16%)	102 (26%)	

3.1 Characteristics associated with willingness to use long-acting injectable (LAI) PrEP

Sixty-eight percent of all participants were willing to use LAI PrEP that provides protection against HIV for three months, 18% were not sure if they were willing, and 13% were not willing to use LAI PrEP. Of those who had never taken PrEP, 64% were willing to use LAI PrEP, compared to 76% of those who had previously used PrEP. Demographic characteristics that were most strongly associated with willingness to use LAI PrEP were rurality, race/ethnicity, and insurance status, though the Fisher's exact tests for rurality and insurance were non-significant. Although the percentage of participants who said they were willing to use LAI PrEP were relatively similar between those in non-rural areas and rural areas, a greater proportion of participants in rural areas were not sure if they were willing to use LAI PrEP (22% rural vs. 17% non-rural). Fisher's exact tests showed a statistically significant association between CAI and willingness to use LAI PrEP, current PrEP use and willingness to use LAI PrEP, race/ethnicity and willingness to use LAI PrEP, and previous PrEP use. Eighty-two percent of participants who were of other/multiracial ethnicity and 74% of those who were of Hispanic ethnicity were willing to use LAI PrEP, compared to just 57% of non-Hispanic Black participants. Those who were of other/multiracial or Hispanic race and ethnicity, had health insurance, and reported CAI in the last six months were more likely to be willing to use LAI PrEP. Those who were non-Hispanic Black, had a high school education or less, were in the lowest household income bracket, and did not have health insurance were less likely to be willing to use LAI PrEP.

Table 2. Preference for PrEP Form by Demographic Characteristic (Dichotomous)

N = 575	Total N(%)	Daily Pill/No Preference N(%)	LAI N(%)	Fisher's Exact Test
Total	575	255 (44%)	320 (56%)	-
Rurality				0.6525
Non-Rural	392 (68%)	171 (67%)	221 (69%)	
Rural	183 (32%)	84 (33%)	99 (31%)	
Race/Ethnicity (n=573)				0.0285
Hispanic	105 (18%)	43 (17%)	52 (19%)	
Non-Hispanic Black	129 (23%)	59 (23%)	70 (22%)	
Non-Hispanic White	292 (51%)	140 (55%)	152 (48%)	
Other/Multiracial	47 (8%)	12 (5%)	35 (11%)	
Gender Identity (n=574)				0.8805
Male	481 (84%)	214 (84%)	267 (83%)	
Female	3 (1%)	2 (1%)	1 (<1%)	
Transgender woman/transfeminine	8 (1%)	3 (1%)	5 (2%)	
Transgender man/transmasculine	9 (2%)	4 (2%)	5 (2%)	
Non-binary/gender non-conforming	39 (7%)	19 (7%)	20 (6%)	
Other	2 (<1%)	1 (<1%)	1 (<1%)	
Multiple	32 (6%)	11 (4%)	21 (7%)	
Age, median	-	27	27	-
Age Group				0.6833
15-17 years	4 (1%)	3 (1%)	1 (<1%)	
18-24 years	171 (30%)	76 (30%)	95 (30%)	
25-29 years	226 (39%)	101 (40%)	125 (39%)	
30-34 years	174 (30%)	75 (29%)	99 (31%)	
Education Level (n=574)				0.0507
High school or lower	109 (19%)	59 (23%)	50 (16%)	
Some college	197 (34%)	87 (34%)	110 (34%)	
College graduate or more	268 (47%)	108 (43%)	160 (50%)	
Annual Household Income Before Taxes (n=535)				0.2356
$0 to $19,999	135 (25%)	64 (27%)	71 (24%)	
$20,000 to $39,000	145 (27%)	67 (29%)	78 (26%)	
$40,000 to $74,999	140 (26%)	63 (27%)	77 (26%)	
$75,000 or more	115 (22%)	41 (17%)	74 (25%)	
Insurance Status (n=570)				0.6895
No	131 (23%)	60 (24%)	71 (22%)	
Yes	439 (77%)	192 (76%)	247 (78%)	
Condomless Anal Intercourse (CAI) in Last 6 Months (n=521)				0.2412
No	89 (17%)	44 (19%)	45 (15%)	
Yes	432 (83%)	183 (81%)	249 (85%)	
Currently on PrEP (n=570)				0.1917
No	440 (77%)	203 (80%)	237 (75%)	
Yes	130 (23%)	51 (20%)	79 (25%)	

3.2 Characteristics associated with preference for LAI PrEP form over daily pill form

When asked which form of PrEP they would hypothetically prefer, 56% of all participants indicated a preference for using LAI PrEP, compared to 27% who would prefer a daily pill and 17% who would have no preference. Preference for LAI PrEP was slightly higher among those with a history of PrEP use; 51% of MSM who had never taken PrEP preferred LAI PrEP, compared to 63% of those who had previously used PrEP. Preferences for the form of PrEP were highly similar between rural and non-rural residents (53% rural vs. 56% non-rural). As with willingness to use LAI PrEP, the race/ethnicity groups most likely to prefer LAI PrEP over a daily pill were of other/multiracial or Hispanic ethnicity. Preference for LAI PrEP was also associated with a higher income and reporting CAI in the last six months. Fisher's exact tests showed a statistically significant association between race/ethnicity and preference for LAI PrEP and between previous PrEP use and preference for LAI PrEP. Unlike for willingness to use LAI PrEP, insurance status did not appear to have much of an effect on preference for PrEP form.

Table 3. Regression Analysis of Willingness to use LAI PrEP

Model	Unadjusted PR/RR		Adjusted PR/RR	
	PR Point estimates	95% CI	PR Point estimates	95% CI
Rurality (ref = non-rural)				
Rural vs. Non-Rural	1.0	0.8, 1.1	1.0	0.9, 1.2
Race/ethnicity (ref= Non-Hispanic White)				
Hispanic	1.1	1.1, 1.3	1.1	0.9, 1.2
Non-Hispanic Black	0.9	0.7, 1.0	0.9	0.7, 1.0
Other/Multiracial	1.2	1.0, 1.4	1.2	1.1, 1.4
Gender (ref=cisgender male)				
Trans or non-binary	0.9	0.8, 1.1	0.8	0.7, 1.0⊥
Age Group (ref=<=24 years)				
25-34 years	0.9	0.8, 1.1	0.9	0.8, 1.1
Education Level (ref= some college or more)				
High school education or less	1.1	0.9, 1.3	1.2	1.0, 1.5
Annual Household Income Before Taxes (ref=$0-19,999)				
$20,000 to $39,999	1.1	0.9, 1.3	1.0	0.9, 1.2
$40,000 to $74,999	1.1	0.9, 1.3	1.0	0.9, 1,2
$75,000 or more	1.1	0.9, 1.3	1.0	0.8, 1.2
Insurance Status (ref=no)				
Yes	0.9	0.8, 1.0	0.9	0.8, 1.0
Condomless Anal Intercourse (CAI) in Last 6 Months (ref=no)				
Yes	1.3	1.1, 1.6	1.3	1.1, 1.6
Currently on PrEP (ref=no)				
Yes	1.2	1.1, 1.3	1.1	1.0, 1.3

*Adjusted for rurality, race/ethnicity, gender, age group, education level, household income, insurance status, condom-less sex, PrEP stigma, and current PrEP status
**Yes vs. Not Sure/Not willing
⊥ Upper or lower 95% confidence limit rounded up to 1.0

Participants of other/multiracial ethnicity (aPR = 1.2, 95% CI 1.1, 1.4) and those who had engaged in CAI in the last six months (aPR = 1.3, 95% CI 1.1, 1.6) were significantly more likely to be willing to use LAI PrEP. Participants who were transgender or non-binary were significantly less likely to be willing to use LAI PrEP (aPR = 0.8, 95% CI 0.7, 1.0). There was no difference in willingness to use LAI PrEP among rural residents compared to non-rural residents (aPR = 1.0, 95% CI 0.9, 1.2). In unadjusted analyses, current PrEP use was associated with willingness to use LAI PrEP, but this association was attenuated in the adjusted model.

Table 4. Regression Analysis of Preference for LAI vs. Oral PrEP or No Preference

Model	Unadjusted PR/RR		Adjusted PR/RR	
	PR Point estimates	95% CI	PR Point estimates	95% CI
Rurality (ref = non-rural)				
Rural vs. Non-Rural	1.0	0.8, 1.1	1.1	0.9, 1.3
Race/ethnicity (ref= Non-Hispanic White)				
Hispanic	1.1	0.9, 1.4	1.3	1.0, 1.6⊥
Non-Hispanic Black	1.0	0.9, 1.3	1.2	1.0, 1.5
Other/Multiracial	1.4	1.2, 1.8	1.5	1.2, 1.9
Gender Identity (ref=cisgender male)				
Trans or non-binary	1.0	0.8, 1.2	0.9	0.7, 1.3
Age Group (ref=<=24 years)				
25-34 years	1.0	0.9, 1.2	1.0	0.9, 1.2
Education Level (ref= some college or college graduate or more)				
High school or less	1.3	1.0, 1.6	1.3	1.0, 1.8
Annual Household Income Before Taxes (ref=$0-19,999)				
$20,000 to $39,999	1.0	0.8, 1.3	1.0	0.8, 1.2
$40,000 to $74,999	1.1	0.8, 1.3	1.0	0.8, 1.3
$75,000 or more	1.2	1.0, 1.5	1.1	0.9, 1.4
Insurance Status (ref=no)				
Yes	1.0	0.9, 1.3	1.0	0.8, 1.3
Condom-less Anal Intercourse (CAI) in Last 6 Months (ref=no)				
Yes	1.1	0.9, 1.4	1.1	0.9, 1.3
Currently on PrEP (ref=no)				
Yes	1.1	1.0, 1.3	1.0	0.9, 1.2

*Adjusted for rurality, race/ethnicity, gender, age group, education level, household income, insurance status, condom-less sex, PrEP stigma, and current PrEP status
**Yes vs. Not Sure/Not willing
⊥ Upper or lower 95% confidence limit rounded up to 1.0

Covariates significantly associated with preference for LAI PrEP were being of Hispanic ethnicity (aPR 1.3, 95% CI 1.0, 1.6) or of other/multiracial ethnicity (aPR 1.5, 95% CI 1.2, 1.9). There was no association between preference for LAI PrEP and rurality, race/ethnicity, gender identity, age, education level, income, insurance status, CAI, or current PrEP use.

4. Discussion

We examined willingness to use LAI PrEP and preferences for oral versus LAI PrEP among cisgender MSM and transgender and nonbinary people who have sex with men in the southern United States. Overall, we observed high willingness to use LAI PrEP and a preference for LAI PrEP. Being of Hispanic or other/multiracial ethnicity, being cisgender male, and having engaged in CAI in the last six months were factors associated with willingness to use LAI PrEP. Being of Hispanic or other/multiracial ethnicity was associated with a preference for LAI PrEP over oral PrEP or no preference.

In addition to being highly effective, LAI PrEP mitigates issues of non-adherence frequently associated with daily oral PrEP.[8,9] FDA approval of LAI PrEP is an encouraging development in HIV prevention, but only if at-risk clients are willing to use it. It is thus a positive sign for PrEP expansion efforts that two-thirds of participants in our study said they would use LAI PrEP. Not only were most participants willing to use LAI PrEP, but a majority preferred it over the currently available oral form. These findings are in line with that of previous studies, such as one 2017 study of MSM in Washington, D.C. which found that 62% of MSM were interested in LAI PrEP.[4] The slight increase in overall willingness to use LAI PrEP may be attributed to the recent approval of, and growing awareness of,[3] this form of PrEP.

Our study found important differences in willingness to use LAI PrEP by race/ethnicity, gender identity, and socio-economic characteristics. Seventy-four percent of Hispanic participants were willing to use LAI PrEP, compared to just 57% of non-Hispanic Black participants. These numbers are similar to findings from the Washington, D.C. study, which found that 68% of Hispanic participants and 61% of non-Hispanic Black participants were interested in LAI PrEP.[4] Non-Hispanic Black MSM are consistently less willing to use or less interested in LAI PrEP, which may be due in part to a long history of medical mistrust among Black Americans stemming from a history of systemic racism in medicine and public health.[17-20] To increase overall PrEP uptake and LAI PrEP uptake among non-Hispanic Black

MSM specifically, additional interventions or information campaigns targeted to these groups may be necessary. Our study also found a stronger association between being of other/multiracial ethnicity and being willing to use LAI PrEP; however, the small sample size of participants of other/multiracial ethnicity (n=47) reduces our statistical power to examine this association.

Transgender or non-binary participants were 20% less likely than cisgender male participants to be willing to use LAI PrEP. This may be due to a lack of information about the effectiveness of LAI PrEP for transgender men and women. Transgender men and women are at high risk for HIV, so increasing acceptability of LAI PrEP among transgender populations through information campaigns could be an effective strategy for increasing PrEP coverage. Additional studies that are able to enroll larger and more diverse samples of transgender and non-binary people are needed to substantiate these results.

Those who had a high school education or less, were in the lowest household income bracket, and did not have health insurance were less likely to be willing to use LAI PrEP. The study did not ask if cost would be a concern, but cost is a major barrier to PrEP uptake and persistence.[21] In a cost-benefit analysis of LAI PrEP, researchers determined that the clinical superiority of LAI PrEP over daily oral PrEP would not justify the significantly higher price for Apretude compared to oral pills.[11] Apretude is estimated to cost $25,850 annually, compared to $360 for generic and $16,800 for branded daily oral pills.[11] If study participants were informed of the cost of LAI PrEP when completing the survey, the proportion willing to use it might be lower.

One demographic characteristic that was not associated with willingness to use LAI PrEP was rurality. Previous studies have established that although PrEP awareness does not differ by rurality, PrEP use is lower among non-urban MSM.[22] Similarly, our study found that 42% of urban and 24% of non-urban MSM had ever used PrEP and 27% of urban and 15% of non-urban MSM were currently on PrEP.

Despite disparities in PrEP use by rurality, we observed no differences in willingness to use LAI PrEP nor in preference for LAI PrEP form. However, our study included only residents of southern states, so there remains a gap in the literature on LAI PrEP acceptability in rural areas outside the South.

A strength of the study is the inclusion of participants from minority groups. Half of study participants were from non-White racial and ethnic groups, which is an over-representation compared to the overall U.S. population. A large proportion (23% compared to 13% in the general U.S. population[23]) of our study participants were non-Hispanic Black, a group that is often underrepresented in studies despite having the highest prevalence of HIV of all racial and ethnic groups.[24] The study also included a number of transgender or non-binary participants, who comprised 16% of the study population.

Given the nature of online surveys, the study is subject to common limitations. The sample was a convenience sample and is not representative of all MSM or gender minority populations in the United States. Additionally, the study asked participants about their PrEP preferences without considering possible deterrents to LAI PrEP, such as its high cost. Further, we asked participants to consider a LAI PrEP that required injections every three months, whereas the FDA-approved Apretude is given every two months following two initiation injections administered one month apart. Instead of requiring four injections annually, the drug requires six injections, which may deter potential users.

5. Conclusions

Our study, conducted just before FDA approval of Apretude, found LAI PrEP to be an acceptable option among MSM in the southern United States. The majority of MSM surveyed were both willing to use LAI PrEP and preferred it over daily oral pills, or they had no preference for PrEP form. LAI PrEP may be of particular interest to those who wish to protect themselves against HIV but have trouble adhering to a daily pill. However, additional interventions or information campaigns targeted to non-Hispanic Black men, transgender men and women, and non-binary persons, and those with a high school

education or less may be necessary to increase uptake of LAI PrEP among these groups. Additional studies on acceptability of LAI PrEP among transgender and non-binary populations is needed to verify our results.

Appendices

Appendix 1. Willingness to Use LAI PrEP by Demographic Characteristic (Categorical)

N = 575	No N(%)	Yes N(%)	Not Sure N(%)
Total	76 (13%)	393 (68%)	106 (18%)
Rurality			
Non-Rural	54 (71%)	272 (69%)	66 (62%)
Rural	22 (29%)	121 (31%)	40 (38%)
Race/Ethnicity (n=573)			
Hispanic	13 (17%)	79 (20%)	13 (13%)
Non-Hispanic Black	21 (28%)	75 (19%)	33 (32%)
Non-Hispanic White	38 (50%)	200 (51%)	54 (52%)
Other/Multiracial	4 (5%)	39 (10%)	4 (4%)
Gender Identity (n=574)			
Male	63 (83%)	325 (83%)	93 (88%)
Female	1 (1%)	1 (<1%)	1 (1%)
Transgender woman/transfeminine	0 (0%)	6 (2%)	2 (2%)
Transgender man/transmasculine	2 (3%)	6 (2%)	1 (1%)
Non-binary/gender non-conforming	6 (8%)	29 (7%)	4 (4%)
Other	0 (0%)	2 (1%)	0 (0%)
Multiple	4 (5%)	23 (6%)	5 (5%)
Age Group			
15-17 years	1 (1%)	2 (1%)	1 (1%)
18-24 years	22 (29%)	123 (31%)	26 (25%)
25-29 years	29 (38%)	150 (38%)	47 (44%)
30-34 years	24 (32%)	118 (30%)	32 (30%)
Education Level (n=574)			
High school or lower	19 (25%)	69 (18%)	21 (20%)
Some college	22 (29%)	139 (35%)	36 (34%)
College graduate or more	35 (46%)	184 (47%)	49 (46%)
Annual Household Income Before Taxes (n=557)			
$0 to $19,999	21 (30%)	86 (24%)	28 (27%)
$20,000 to $39,000	20 (29%)	100 (28%)	25 (25%)
$40,000 to $74,999	13 (19%)	98 (27%)	29 (28%)
$75,000 or more	16 (23%)	79 (22%)	20 (20%)
Insurance Status (n=570)			
No	14 (18%)	96 (25%)	21 (20%)
Yes	62 (82%)	292 (75%)	85 (80%)
Condomless Anal Intercourse (CAI) in Last 6 Months (n=521)			
No	16 (26%)	49 (13%)	24 (26%)
Yes	45 (74%)	318 (87%)	69 (74%)
Currently on PrEP (n=570)			
No	66 (87%)	288 (74%)	86 (83%)
Yes	10 (13%)	102 (26%)	18 (17%)

Appendix 2. Preference for Daily Pill or LAI by Demographic Characteristic (Categorical)

N = 575	Daily Pill N(%)	LAI N(%)	No Preference N(%)
Total	155 (27%)	320 (56%)	100 (17%)
Rurality			
Non-Rural	105 (68%)	221 (69%)	66 (66%)
Rural	50 (32%)	99 (31%)	34 (34%)
Race/Ethnicity (n=573)			
Hispanic	22 (14%)	62 (19%)	21 (21%)
Non-Hispanic Black	37 (24%)	70 (22%)	22 (22%)
Non-Hispanic White	86 (56%)	152 (48%)	54 (54%)
Other/Multiracial	9 (6%)	35 (11%)	3 (3%)
Gender Identity (n=574)			
Male	131 (85%)	267 (83%)	83 (83%)
Female	1 (1%)	1 (<1%)	1 (1%)
Transgender woman/transfeminine	2 (1%)	5 (2%)	1 (1%)
Transgender man/transmasculine	3 (2%)	5 (2%)	1 (1%)
Non-binary/gender non-conforming	13 (8%)	20 (6%)	6 (6%)
Other	1 (1%)	1 (<1%)	0 (0%)
Multiple	3 (2%)	21 (7%)	8 (8%)
Age Group			
15-17 years	2 (1%)	1 (<1%)	1 (1%)
18-24 years	45 (29%)	95 (30%)	31 (31%)
25-29 years	61 (39%)	125 (39%)	40 (40%)
30-34 years	47 (30%)	99 (31%)	28 (28%)
Education Level (n=574)			
High school or lower	31 (20%)	50 (16%)	28 (28%)
Some college	53 (34%)	110 (34%)	34 (34%)
College graduate or more	70 (45%)	160 (50%)	38 (38%)
Annual Household Income Before Taxes (n=557)			
$0 to $19,999	38 (27%)	71 (24%)	26 (28%)
$20,000 to $39,000	43 (30%)	78 (26%)	24 (26%)
$40,000 to $74,999	33 (23%)	77 (26%)	30 (32%)
$75,000 or more	28 (20%)	74 (25%)	13 (14%)
Insurance Status (n=570)			
No	32 (21%)	71 (22%)	28 (28%)
Yes	120 (79%)	247 (78%)	72 (72%)
Condomless Anal Intercourse (CAI) in Last 6 Months (n=521)			
No	26 (19%)	45 (15%)	18 (20%)
Yes	109 (81%)	249 (85%)	74 (80%)
Currently on PrEP (n=570)			
No	120 (78%)	237 (75%)	83 (83%)
Yes	34 (22%)	79 (25%)	17 (17%)

References

1. Centers for Disease Control and Prevention. *HIV Surveillance Report.* May 2021 2019.
2. U.S. Department of Health and Human Services Office of Infectious Disease and HIV/AIDS Policy. Ending the HIV Epidemic in the U.S. : Key Strategies in the Plan. 2020; https://www.hiv.gov/federal-response/ending-the-hiv-epidemic/key-strategies.
3. Finlayson T CS, Xia M, et al. *Changes in HIV Preexposure Prophylaxis Awareness and Use Among Men Who Have Sex with Men — 20 Urban Areas, 2014 and 2017.* 2019.
4. Levy ME, Agopian A, Magnus M, et al. Is Long-Acting Injectable Cabotegravir Likely to Expand PrEP Coverage Among MSM in the District of Columbia? *Journal of acquired immune deficiency syndromes (1999).* 2021;86(3):e80-e82.
5. Sullivan PS, Sanchez TH, Zlotorzynska M, et al. National trends in HIV pre-exposure prophylaxis awareness, willingness and use among United States men who have sex with men recruited online, 2013 through 2017. *Journal of the International AIDS Society.* 2020;23(3):e25461-e25461.
6. FDA Approves First Injectable Treatment for HIV Pre-Exposure Prevention [press release]. U.S. Food and Drug Administration, December 20, 2021 2021.
7. Landovitz RJ, Donnell D, Clement ME, et al. Cabotegravir for HIV Prevention in Cisgender Men and Transgender Women. *New England Journal of Medicine.* 2021;385(7):595-608.
8. Centers for Disease Control and Prevention. *Preexposure Prophylaxis for the Prevention of HIV Infection in the United States – 2021 Update Clinical Practice Guideline.* 2021.
9. Wray TB, Chan PA, Kahler CW, Simpanen EM, Liu T, Mayer KH. Vulnerable Periods: Characterizing Patterns of Sexual Risk and Substance Use During Lapses in Adherence to HIV Pre-exposure Prophylaxis Among Men Who Have Sex With Men. *J Acquir Immune Defic Syndr.* 2019;80(3):276-283.
10. John SA, Whitfield THF, Rendina HJ, Parsons JT, Grov C. Will Gay and Bisexual Men Taking Oral Pre-exposure Prophylaxis (PrEP) Switch to Long-Acting Injectable PrEP Should It Become Available? *AIDS and behavior.* 2018;22(4):1184-1189.
11. Neilan AM LR, Le MH, et al. Cost-Effectiveness of Long-Acting Injectable HIV Preexposure Prophylaxis in the United States. *Annals of Internal Medicine.* 2022.
12. Institute of Medicine (IOM). *The Health of Lesbian, Gay, Bisexual, and Transgender People: Building a Foundation for Better Understanding.* Washington, DC: The National Academies Press; 2011.
13. Waldorf B, Kim A. The Index of Relative Rurality (IRR) : US County Data for 2000 and 2010. In:2018.
14. Waldorf BS. A Continuous Multi-dimensional Measure of Rurality: Moving Beyond Threshold Measures. Selected Paper; 2006, 2006.
15. Jones J, Zlotorzynska M, Villarino X, Sanchez T. Where is Rural? Examining the Effect of Rural Classification Method on Disparities in HIV and STI Testing Uptake Among Men Who Have Sex with Men in the United States. *AIDS Behav.* 2022:1-10.
16. Wilson RaD, Alexander. HUD USPS ZIP Code Crosswalk Files. In: U.S. Department of Health and Human Services Office of Policy Development and Research, ed. U.S. Department of Health and Human Services, trans2018.

17. Tekeste M, Hull S, Dovidio JF, et al. Differences in Medical Mistrust Between Black and White Women: Implications for Patient–Provider Communication About PrEP. *AIDS and Behavior.* 2019;23(7):1737-1748.

18. Bogart LM, Ransome Y, Allen W, Higgins-Biddle M, Ojikutu BO. HIV-Related Medical Mistrust, HIV Testing, and HIV Risk in the National Survey on HIV in the Black Community. *Behavioral Medicine.* 2019;45(2):134-142.

19. Jacobs EA, Rolle I, Ferrans CE, Whitaker EE, Warnecke RB. Understanding African Americans' views of the trustworthiness of physicians. *Journal of general internal medicine.* 2006;21(6):642-647.

20. Cahill S, Taylor SW, Elsesser SA, Mena L, Hickson D, Mayer KH. Stigma, medical mistrust, and perceived racism may affect PrEP awareness and uptake in black compared to white gay and bisexual men in Jackson, Mississippi and Boston, Massachusetts. *AIDS care.* 2017;29(11):1351-1358.

21. Marcus JL, Hurley LB, Dentoni-Lasofsky D, et al. Barriers to preexposure prophylaxis use among individuals with recently acquired HIV infection in Northern California. *AIDS Care.* 2019;31(5):536-544.

22. Rossiter S, Sharpe JD, Pampati S, Sanchez T, Zlotorzynska M, Jones J. Differences in PrEP Awareness, Discussions with Healthcare Providers, and Use Among Men Who Have Sex with Men in the United States by Urbanicity and Region: A Cross-sectional Analysis. *AIDS Behav.* 2021;25(12):4102-4114.

23. QuickFacts. In: Bureau USC, ed2021.

24. Centers for Disease Control and Prevention. *Estimated HIV incidence and prevalence in the United States, 2015–2019.* May 2021 2021.