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PrEP service delivery preferences of black Cis-gender women living in the Southern United States

Latesha Elopre[1] · Alexander Boutwell[1] · Bretia Gordon[2] · Bernadette Johnson[1] · Jeanne Marrazzo[1] · Barbara Van Der Pol[1] · Michael J. Mugavero[1]

Abstract

To assess PrEP service delivery preferences among Black cis-gender women living in urban and rural settings in Alabama, we conducted a cross-sectional discrete choice experiment survey. Discrete choice experiments included five attributes. Hierarchical Bayes (HB) modeling and latent class analyses (LCA) were used to evaluate attribute preferences. Among 795 Black cis-gender HIV-negative women, almost two-thirds lived in urban settings and reported having at least some college; about a third reported a household income less than $25,000 annually; and reported willingness to use PrEP. Respondents placed the greatest importance on PrEP medication formulation and healthcare facility. LCA showed the group with the highest rural proportion preferred for on-line visits. Black women in the Deep South had distinct preferences regarding PrEP service delivery. These findings can inform tailored interventions to improve PrEP uptake among Black cis-gender women across diverse settings in the South.

Keywords PrEP · Black · Cis-gender · Women

Introduction

Despite advances in antiretroviral therapy (ART), HIV infection continues to disproportionately impact disenfranchised populations, accentuating health disparities. Black Americans constitute 13% of the United States (U.S.) population, but account for 39% of new HIV diagnoses. [1] These disparities are pronounced in the South, a region where over half (57%) of new HIV diagnoses occur among Black people. While the highest HIV infection rates occur in Black men who have sex with men (BMSM) nationally, cis-gender women account for 19% of all new infections primarily due to heterosexual transmission, among which 57% are Black cis-gender women. [1] Furthermore, rural communities in the South have high HIV infection rates. [2] This is reflected in Alabama's local HIV epidemiology,

as Black cis-gender women are nine times more likely to be diagnosed with HIV compared to White women, and rural counties have the highest HIV incidence rates. [3] Taken together, these epidemiological data suggest tailored prevention strategies for Black women living in urban and rural settings in the Deep South are needed.

U.S. federal agencies are working in a coordinated manner to End the HIV Epidemic (EHE) with a mandate to focus on vulnerable populations and geographic hotspots. The plan includes prioritization of biomedical prevention tools like HIV pre-exposure prophylaxis (PrEP) that reduce HIV transmission up to 92% with consistent use. [4–7] However, almost two-thirds of people prescribed PrEP are white and the modest number of prescriptions for cis-gender women are declining. [8–10] Estimates suggest that in AL, a state prioritized for EHE due to a higher proportion of people living with HIV in non-urban areas, an estimated 3,640 of 11,840 individuals (31%) have a PrEP indication based on heterosexual transmission, and 80% with an indication are Black.[1112] In 2019, Alabama only had 2,504 PrEP users with only 7% being cis-gender women, resulting in a PrEP-to-Need ratio (defined as the ratio of the number of PrEP users in 2019 to the number of people newly diagnosed with HIV in 2018) of 1.46 for women, indicating a high degree of

✉ Latesha Elopre
lelopre@uabmc.edu

1   Department of Medicine, University of Alabama at Birmingham, Birmingham, United States

2   Medical Advocacy and Outreach, Birmingham, AL, United States

unmet need among women being prescribed PrEP who may be vulnerable to infection. [13] Increasing uptake of PrEP among Black cis-gender women in Southern states like Alabama presents an opportunity to ameliorate inequities based upon race and geography. However, lack of PrEP awareness, stigma associated with HIV and its prevention, low perceived risks for HIV and poor health care access present individual-, interpersonal-, and community-level barriers to PrEP uptake among Black cis-gender women. [14–16] Overcoming these barriers will require innovative strategies that engage Black cis-gender women in delivery of PrEP services tailored to their preferences and to their unique needs. A "patient-centered" approach to improve PrEP utilization, recognizes the needs of end-users and the context within which they live to inform development of interventions and implementation strategies to improve adoption of evidence-based practices. [17].

Discrete choice experiments (DCE), a behavioral economics technique used to understand medical decision making, provides a novel, "patient centered" approach to developing PrEP interventions for Black cis-gender women that is consumer facing. Research on medical decision-making has increasingly used DCE to evaluate intervention development for prevention tools, including HIV testing and HPV vaccination. [18–20] We conducted a prospective study in 2 urban and 4 rural counties with high HIV burden in Alabama, aimed at understanding PrEP service delivery preferences among Black cis-gender women. DCE allowed Black cis-gender female participants to select different choice sets – a series of attributes for service delivery of PrEP – to determine desired characteristics of care and variability in preferences, with latent class analysis identifying subgroups with shared prioritized preferences.

Methods

Study Design and participants

Self-administered electronic surveys were conducted from September of 2019 to March of 2020 in the state of Alabama. The community-based organization Medical Advocacy and Outreach (MAO), located in Montgomery, collaborated with the University of Alabama at Birmingham (UAB) research team on study design, procedures, recruitment materials and survey piloting. MAO has expertise in HIV care and prevention through services provided to rural counties throughout the state and, thus was an ideal collaborator for this purpose. We recruited Black cis-gender women from two urban counties (Jefferson, which includes the city of Birmingham, and Montgomery) and four rural counties located in the Black Belt (Wilcox, Dallas, Macon

and Lowndes). (Supplemental 1. Alabama HIV Incidence Map). Rurality was determined based on the Rural-Urban Community Area (RUCA) codes, which are utilized by the AL department of public health to define rural counties. The counties selected had the highest HIV incidence for the state with case rates ranging from 20.4 to 36.2 per 100,000 population, and are among its most impoverished as well. [3].

Participant inclusion criteria were the following, self-reported: (1) HIV-negative status, (2) Black women (gender assigned at birth and personal identity), (3) English speaking, (4) Age18-65 years. Participants were recruited through social media ads, flyers placed at sexual health clinics and through direct referral from Black cis-gender opinion leaders (especially in rural communities) as well as from MAO providers and staff. If inclusion criteria were met, participants underwent study consent through electronic documentation. Those who provided consent were then able to gain access to electronic surveys through unique survey links that expired after one-use. Surveys lasted approximately 20 min and, upon completion, participants were compensated $50. DCE surveys were programed using Sawtooth®. This study was approved by the UAB Institutional Review Board.

Surveys included sociodemographic questions regarding ethnicity, education, median household income, employment, insurance status, and living in an urban vs. rural county (determined based on zip code data from participants). All participants were provided a general definition of PrEP at the beginning of the survey as a "medication(s) used by people to prevent getting HIV called Pre-exposure Prophylaxis or PrEP" prior to further assessments. PrEP indication was defined as having more than one sex partner in the past six months and any of the following: infrequent condom use (< 100% condom use during sex); having a sexual partner with unknown HIV status, living with HIV, or an anonymous sexual partner; exchanging sex for drugs, money, etc.; having gonorrhea, syphilis or an unknown STI in the past 6 months. [21] PrEP willingness was assessed with the following survey question, "Would you be willing to take anti-HIV medicines (PrEP) every day to lower your chances of getting HIV?" and participants could respond with yes (i.e. willing), no (i.e. unwilling) or unsure. In order to assess contextual factors that may influence PrEP service delivery preferences, we included validated scales that mapped to domains from our focus group findings. [22] The Duke University Religion Index (DUREL) assessed participants' religiosity. [23,24] The DUREL includes 5 items, divided into three subscales to assess major dimensions of religiosity (organizational, non-organizational and intrinsic religiosity). [23] Organizational religious activity (ORA) is defined as outward actions, such as attending church services. Non-organizational religiosity (NORA) includes activities that are done privately to express one's spiritual beliefs such as

prayer. Finally, intrinsic religiosity (IRA) is related to one's personal degree of pursuing religion for internal satisfaction and beliefs. Each dimension is evaluated individually with its own sub-scale with scores ranging from 5 to 15. Each scale has been validated to be used in separate regression models, due to collinearity that would occur if all three subscales are used in the same model. Other scales used included: the Experiences of Discrimination Scale, which measures dimensions of racism (11 items; Cronbach's alpha 0.74) [25]; Multidimensional Scale of Perceived Social Support to measure three dimensions of social support (12 items; Cronbach alpha 0.84) [26]; HIV knowledge (18 items; Cronbach's alpha 0.89) [27]; Hurt, Insult, Threaten and Screen (HITS) scale to assess intimate partner violence (4 items; Cronbach's alpha 0.8); and the Attitudes Toward Women with HIV/AIDS Scale (ATWAS), Myths and Negative Stereotypes sub-scale to stigma towards people living with HIV (6 items; Cronbach's alpha 0.84) [28].

Discrete Choice Attributes and Design

Service delivery attribute selection and response categories were based on qualitative focus group findings as well as review of the literature. [14,22,29,30] Based on our findings, we chose five attributes to include for our DCE: healthcare facility (location where PrEP was obtained), medical professional (provider who delivered PrEP services), medication delivery (location where PrEP was dispensed), medication form (PrEP formulation), and frequency of visits. Healthcare facility included six levels: doctor's office, family planning office, on-line, pharmacy, STD Clinic and telehealth. Four levels were included for medical professional (general or family practitioner, nurse practitioner or physician assistant, obstetrician/gynecologist, and pharmacist) and medication form (implant, long-acting shot, daily pill and vaginal ring). Lastly, three levels were included for frequency of visits (every 3 months, 6 months or yearly) and means of delivery (doctor's office, mail order, and pharmacy). Participants were instructed that they could receive definitions for all attributes and levels within the survey software by hovering over the terms. Additionally, the surveys included pictures of different PrEP medication forms. Choice experiments were offered to all participants, regardless of their reported willingness to use PrEP.

The DCE yielded 864 potential choice combinations (from the five attributes, with levels between attributes varying between 3 and 6 options). Sawtooth® was used to maintain an orthogonal DCE design since the total combinations exceeded the coverage provided by the planned sample size of the study. A survey that included 12 choice sets per respondent was selected in an attempt to maximize information elicited from the sample without introducing bias due to respondent fatigue. Options for each attribute were randomly generated, including 12 choice sets with three alternatives per set. We used an orthogonal main effects plan, to compare attribute levels across all possible attributes. Therefore, we were able to determine difference in preferences within attribute, but were not able to compare differences across attributes. We did not include an opt-out response category; respondents were required to select a preferred choice set. Based on Johnson and Orme's equation for sample size, we aimed to recruit 1000 Black cis-gender women total (500 women each from rural and urban settings) to determine any differences in PrEP service delivery preferences between geographical groups. [31] Given the timing of study recruitment occurring during the beginning of the COVID-19 pandemic in March 2020, we decided to end recruitment despite not meeting enrollment goals of 500 participants within rural settings (stopping enrollment at 304). This decision was made in advance of conducting the discrete choice analyses.

Statistical analyses

Descriptive statistics Independent variables are summarized overall and by willingness to use PrEP. Chi-square or Fisher's exact tests were used to test differences in categorical variables. Two-tailed sample t-tests or non-parametric Wilcoxon Rank-Sum tests were used to test for differences in continuous variables.

Conjoint analyses Hierarchical Bayes modeling ascertained preferences. Hierarchical Bayes (HB) analysis was performed on the DCE data using Sawtooth® to evaluate respondents' prioritization of importance between attributes and preferences within attribute levels. Utility data was calculated separately for urban and rural populations based on á priori assumptions that preferences among these groups would be different, due to contextual factors, as well as between each group of PrEP willingness, categorized as "yes", "I don't know" or "no". From Sawtooth® we were able to gather data on attribute importance, percentage weights describing the weight each attribute has on a respondent's decision-making, to create average importance values for each group. In addition, for each attribute we examined average utilities, which represent the appeal each level within an attribute has on a respondent's decision. The levels within an attribute with the largest positive values represent the most attractive choice options, levels with the largest negative values represent the least attractive options, which are likely to push group members away from a choice

set, and the magnitude of levels represent how impactful each attribute was on the group's decision-making.

Latent class analysis Latent Class Analysis (LCA) was performed on the full dataset specifically including contextual factors that may influence PrEP service delivery preferences. Each respondent was assigned to a group that best matched their preferences generated by the DCE. LCA was performed using two, three, four, and five class solutions. Each solution sorts survey respondents into best-fit groups based on their DCE answers alone, not taking into account responses to demographic questions. While several number of classes yields a viable and interesting grouping of respondents, we chose to closely examine the 5-group

Table 1 Characteristics of Cis-gender Black Women living in Alabama, by PrEP Willingness (N = 769)

Characteristics	I Don't Know n = 277 n (%)	No n = 283 n (%)	Yes n = 235 n (%)
Urban	166 (60)	174 (62)	151 (64)
Rural	111 (40)	109 (38)	84 (34)
Non-Hispanic	265 (96)	270 (95)	223 (95)
Age, mean(SD)**	**37.9 (11.95)**	**37.9 (12.39)**	**33.9 (10.74)**
Prior HIV Testing	221 (80)	218 (77)	194 (83)
Sexual identity reported as Heterosexual	259 (94)	264 (93)	216 (92)
Monogamous relationship status	150 (54)	166 (59)	138 (59)
Unstable Housing or Homeless	6 (2)	13 (5)	7 (3)
Stable Housing	271 (98)	270 (95)	228 (97)
Education			
High School or Less	62 (22)	75 (27)	46 (20)
Some College or Associates	100 (36)	103 (36)	97 (41)
Bachelor's Degree or Higher	115 (42)	105 (37)	92 (39)
Employment			
Out of Work	24 (9)	34 (12)	14 (6)
Part-Time / Other	60 (21)	56 (20)	53 (22)
Full-Time Employment or Military	193 (70)	193 (68)	168 (72)
Income > $25,000	190 (69)	199 (70)	161 (69)
Insurance Status			
Uninsured	35 (13)	19 (7)	23 (10)
Medicaid	32 (11)	36 (13)	28 (12)
Private/Medicare	210 (76)	228 (80)	184 (78)
Personal Automobile	255 (92)	258 (91)	212 (90)
Regular Doctor	218 (79)	229 (81)	192 (82)
HITS, mean(SD)	4.87 (1.7)	4.80 (2.0)	4.71 (1.4)
DUREL, Total Religiosity, mean(SD)	18.56 (4.30)	18.62 (4.41)	18.18 (4.26)
Non-organized Religiosity	3.33 (1.05)	3.36 (1.06)	3.17 (1.06)
Intrinsic Religiosity *	**2.76 (1.71)**	**2.69 (1.65)**	**2.42 (1.47)**
Organized Religiosity	12.48 (2.82)	12.58 (2.89)	12.60 (2.75)
Perceived Social Support (PSS), Total. mean(SD)	5.38 (1.44)	5.63 (1.48)	5.56 (1.41)
PSS from Significant Others*	**5.42 (1.59)**	**5.78 (1.59)**	**5.73 (1.52)**
PSS from Family	5.30 (1.64)	5.56 (1.68)	5.40 (1.68)
PSS from Friends	5.42 (1.54)	5.55 (1.63)	5.56 (1.58)
Experiences of Discrimination, mean(SD)**	**39.18 (7.75)**	**40.65 (7.89)**	**38.44 (9.17)**
HIV Knowledge, mean(SD)**	**12.12 (4.65)**	**12.04 (4.61)**	**13.32 (3.49)**
Perceived HIV Risk**			
No Chance	**136 (49)**	**167 (59)**	**93 (40)**
Slight Chance	**65 (23)**	**58 (20)**	**67 (28)**
Even Odds	**71 (26)**	**56 (20)**	**71 (30)**
Great Chance	**5 (2)**	**2 (1)**	**4 (2)**
Reported Need for PrEP (Yes vs. No)**	**11 (4)**	**8 (3)**	**43 (18)**
Number of Sex Partners, past 6 months, mean(SD)*	**1.09 (0.9)**	**1.10 (1.5)**	**1.32 (1.0)**
HIV Stigma Score, mean(SD)	23.05 (4.72)	22.48 (5.12)	22.22 (5.56)
No PrEP Indication**	**199 (72)**	**219 (77)**	**154 (65)**

* indicates a p-value < 0.05 and ** indicates p-value < 0.01

solution based on a combination of the Bayesian information criterion (BIC) and lowest fitness score. [32,33] This choice revealed a unique and useful grouping of respondents, which may have been lost when looking at the data as a whole or restricting to a smaller number of groups.

Results

Of the 795 Black cis-gender women enrolled, more than two-thirds reported that they were not willing or did not know if they would be willing to use PrEP [Table I, detailed demographics table]. Overall, the majority of participants (64%) lived in urban areas. The mean age of participants was 36.5 years and most identified as heterosexual. Almost even percentages of participants reported having some college or a bachelor's degree or higher, 39.0% and 40.5% respectively. Additionally, most participants (72.0%) reported having a full-time job. Lastly, participants reported high organized religiosity, perceived social support from significant others and stigma-related to HIV. About a quarter of participants (25.6%) had a PrEP indication, but overall perceived need for PrEP (n = 62, 7.8%) and perception of being at high risk for HIV (n = 11, 1.3%) was low. Participants reporting willingness to use PrEP were significantly different from other participants based on the following attributes: younger age (mean age 33.9), lower intrinsic religiosity (mean score 2.42), lower experiences of discrimination (mean score 38.44), higher HIV knowledge (mean score 13.32), higher perceived need for PrEP (n = 43), and higher mean number

of sexual partners (mean 1.32). Participants not willing to use PrEP significant differed in reporting higher perceived social support from significant others (mean score 5.78) and not having a PrEP indication (n = 219).

Hierarchical Bayesian analysis of the full dataset showed that respondents placed the greatest importance on PrEP medication form (37.5% importance), followed by Healthcare Facility (23.6%), Frequency of Visits (17.6%), Medical Professional (11.4%) and the lowest on Medication Delivery (9.9%). Among Healthcare Facility options, doctor's office was heavily preferred followed by family planning clinics, pharmacies, on-line, and telehealth; whereas STD Clinics were not desirable. Among medical professional type, OB/GYN was strongly valued compared to General or Family Practitioners, Nurse Practitioners or Physician Assistants and pharmacists. Among medication delivery methods, most preferred to pick up at the doctor's office. Among PrEP medication forms, the long-acting injectable (LAI) (41.4%) and the daily pill (40.0%) were strongly preferred. Finally, frequency of visit showed an expected increase in utility with longer duration, with once a year visits being preferred. Average utilities among options are comparable both within and across attributes, and reflect the corresponding importance scores for each attribute. PrEP service delivery preferences based on reported willingness to use PrEP are illustrated in Fig. 1.

LCA identified five classes, or groups, of respondents based upon their preferences across attributes. (Table II. LCA group characteristics) Notably, the composition of these classes significantly differed based on rurality, education, perceived social support, HIV knowledge and willingness

Fig. 1 Hierarchical Bayes Analysis of PrEP Service Delivery Preferences, Black Cis-gender Participants
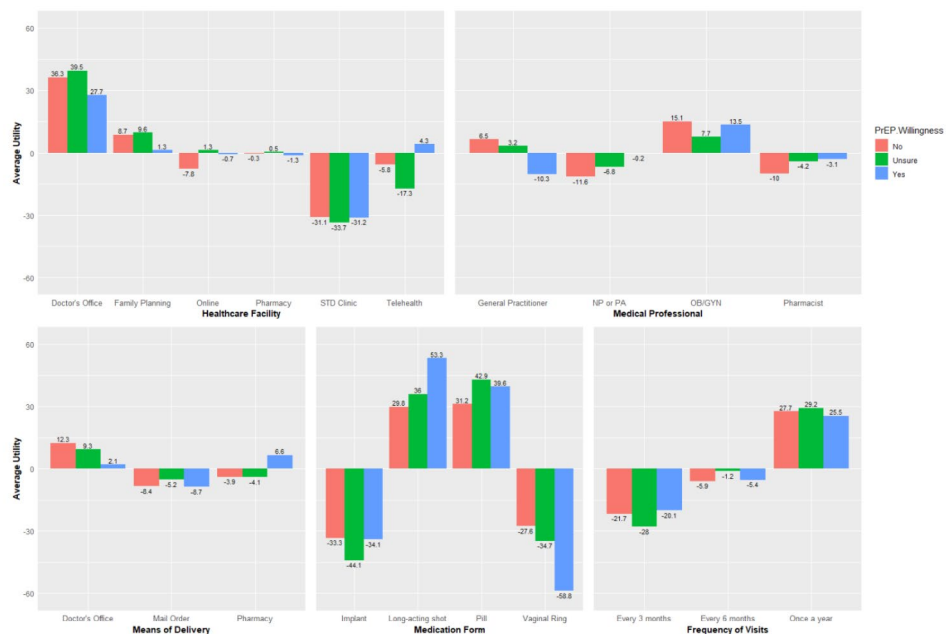
Table II Characteristics of Participant Latent Class Groups (N = 769)

Characteristics	Group 1 (n = 93) n(%)	Group 2 (n = 136) n(%)	Group 3 (n = 65) n(%)	Group 4 (n = 436) n(%)	Group 5 (n = 65) n(%)
Urban**	**64 (69)**	**91(67)**	**50(77)**	**239(55)**	**47(72)**
Age, mean(SD)	35.7 (10.5)	34.7 (11.5)	39.3(11.6)	37.3 (12.2)	36.4 (12.1)
Prior HIV Testing	80 (86.0)	108 (79.4)	53 (81.5)	339 (77.8)	53 (81.5)
Heterosexual Sexual Identity	86 (92.5)	124 (91.2)	64 (98.5)	402 (92.2)	63 (96.9)
Monogamous Relationship Status	46 (49.5)	79 (58.1)	42 (64.6)	247 (56.7)	40 (61.5)
Unstable Housing or Homeless	2 (2.2)	4 (2.5)	1 (1.5)	18 (4.1)	1 (1.5)
Stable Housing	91 (97.8)	132 (97.1)	64 (98.5)	418 (95.9)	64(98.5)
Education**	**15 (16.1)**	**17 (12.5)**	**14 (21.5)**	**128 (29.4)**	**9 (13.8)**
High School or Less	**38 (40.9)**	**58 (42.6)**	**29 (44.6)**	**150 (34.4)**	**25 (38.5)**
Some College or Associates	**40 (43.0)**	**61 (44.9)**	**22 (33.8)**	**158 (36.2)**	**31 (47.7)**
Bachelor's Degree or Higher					
Employment					
Out of Work	7 (7.5)	10 (7.4)	4 (6.2)	44 (10.1)	7 (10.8)
Part-Time / Other	17 (18.3)	33 (24.3)	10 (15.4)	96 (22.0)	13 (20.0)
Full-Time Employment or Military	69 (74.2)	93 (68.4)	51 (78.5)	296 (67.9)	45 (69.2)
Income > $25,000	63 (67.7)	100 (73.5)	52 (80.0)	286 (65.6)	49 (75.4)
Insurance Status	11 (11.8)	10 (7.4)	5 (7.7)	42 (9.6)	9 (13.8)
Uninsured	8 (8.6)	14 (10.3)	3 (4.6)	65 (14.9)	6 (9.2)
Medicaid	74 (79.6)	112 (82.4)	57 (87.7)	329 (75.5)	50 (76.9)
Private/Medicare					
Personal Automobile	84 (90.3)	119 (87.5)	62 (95.4)	398 (91.3)	62 (95.4)
Regular Doctor	68 (73.1)	108 (79.4)	55 (84.6)	357 (81.9)	51 (78.5)
HITS, mean(SD)	4.57 (1.15)	4.62 (1.38)	4.52 (1.34)	4.93 (1.99)	4.88 (1.88)
DUREL, Total Religiosity, mean(SD)	18.81(4.40)	18.15(4.22)	18.49(4.14)	18.38(4.43)	19.26(3.87)
Non-organized Religiosity	3.30 (0.91)	3.10 (1.10)	3.34 (0.97)	3.34 (1.09)	3.32 (1.03)
Intrinsic Religiosity	2.90 (1.78)	2.40 (1.59)	2.54 (1.55)	2.64 (1.60)	2.75 (1.67)
Organized Religiosity	12.60(2.98)	12.65(2.65)	12.62(2.64)	12.40(2.95)	13.18(2.14)
PSS Total, mean(SD)*	**5.50 (1.23)**	**5.79 (1.17)**	**5.87 (1.30)**	**5.40 (1.54)**	**5.49 (1.67)**
PSS from Significant Others	5.72 (1.45)	5.79 (1.40)	6.01 (1.43)	5.52 (1.64)	5.63 (1.74)
PSS from Family**	**5.46 (1.54)**	**5.75 (1.45)**	**5.83 (1.67)**	**5.26 (1.71)**	**5.43 (1.83)**
PSS from Friends*	**5.30 (1.58)**	**5.83 (1.27)**	**5.77 (1.44)**	**5.43 (1.66)**	**5.40 (1.74)**
Experiences of Discrimination, mean(SD)*	**36.99(8.54)**	**39.82(7.07)**	**40.69(8.00)**	**39.77(8.59)**	**39.22(7.98)**
HIV Knowledge, mean(SD)**	**13.47(3.94)**	**13.50(3.33)**	**11.86(4.41)**	**11.89(4.63)**	**13.09(4.24)**
Perceived HIV Risk					
No Chance	44 (47.3)	54 (39.7)	43 (66.2)	226 (51.8)	29 (44.6)
Slight Chance	26 (28.0)	36 (26.5)	12 (18.5)	100 (22.9)	16 (24.6)
Even Odds	23 (24.7)	43 (31.6)	10 (15.4)	102 (23.4)	20 (30.8)
Great Chance	0 (0.0)	3 (2.2)	0 (0.0)	8 (1.8)	0 (0.0)
Reported Need for PrEP (Yes vs. No)	8 (8.6)	9 (6.6)	2 (3.1)	39 (8.9)	4 (6.2)
Number of Sex Partners, past 6 months, mean(SD)	1.04 (0.86)	1.12 (0.89)	1.03 (0.66)	1.22 (1.38)	1.17 (0.98)
HIV Stigma Score, mean(SD)	23.32(4.94)	23.09(4.34)	21.78(5.04)	22.42(5.40)	22.63(5.08)
No PrEP Indication	65 (69.9)	89 (65.4)	50 (76.9)	318 (72.9)	50 (76.9)
Willing to use PrEP (Yes)**	**45 (45.2)**	**46 (33.8)**	**9 (13.8)**	**118 (27.1)**	**20 (30.8)**

* indicates a p-value < 0.05 and ** indicates p-value < 0.01

to use PrEP. (See Table III. for pairwise analysis) In this analysis, Group 1 (12.1% of the population with the highest percentage of participants willing to use PrEP) placed high value on PrEP Medication Form (68.8% importance) and strongly preferred the LAI to any alternative forms of medication. Group 2 (17% of the population with high HIV knowledge) also placed high value of PrEP Medication Form (68.7% importance), but strongly preferred the Pill to any

alternatives. Group 3 (8.5% of the population with reported highest levels of perceived social support and experiences of discrimination as well as lowest HIV knowledge) placed high value on Healthcare Facility (53.5% importance) and strongly preferred the Doctor's Office to other healthcare facilities. Group 4 (54.2% of the population had the largest percentage of rural participants and lowest perceived social support) also placed high value on Healthcare Facility, but

in this group respondents preferred both the Doctor's Office as well as Online visits. Finally, Group 5 (8.2% of the population) placed highest value on Frequency of Visits (62.1% importance) and strongly preferred less frequent visits as their main factor of decision-making. Average utilities of latent class groups are illustrated in Fig. 2.

Discussion

To our knowledge, this is the largest study to date to evaluate PrEP service delivery preferences among Black cis-gender women. Our study population were more willing to use PrEP if they were younger, had greater HIV knowledge, perceived a need for PrEP and reported a greater number of recent sex partners. Those having greater experiences of discrimination, without a PrEP indication (based on CDC definition), and higher intrinsic religiosity were less willing to use PrEP. Overall, these factors are important determinants that influence whether Black cis-gender women accept PrEP. Through discrete choice experiments, our study adds a more nuanced understanding of how these factors may interplay with key attributes of PrEP formulation, service delivery, and provider characteristics preferences among Black cis-gender women living in the South.

PrEP formulation had the greatest weight in driving decisions among choice sets in DCE and most participants favored a daily pill or LAI. Notably, participants reporting willingness to use PrEP were more likely to prefer a LAI agent, which has been supported by other research in the literature. [34] In LCA, it was apparent that LAIs were particularly attractive among participants living in urban settings, who had high HIV knowledge as well as reported willingness to use PrEP. There is growing interests in the ability to improve adherence and willingness to engage in PrEP care among populations with significant barriers through innovation in long-acting PrEP formulations like LAI, especially since the recent approval of LAI anti-retroviral therapy as an HIV treatment. [35] In qualitative research with cis-gender women, LAI compared to a daily pill was perceived to be more effective, convenient and enabled confidentiality. [36] In addition, prior research has shown that familiarity with use of long-acting contraceptive modalities may influence willingness to use long-acting PrEP modalities and current production is underway for dual delivery modalities for reproductive and HIV prevention. [37–39] While this was not assessed in our study, our findings add to the literature supporting that LAIs may be a viable PrEP formulation for cis-gender women willing to utilize PrEP. In addition, implementation of PrEP long-acting formulations may lend itself to care practices that routinely offer contraceptive care and are moving to engaging with women

in counseling around sexual health in addition to reproductive health. [40,41] However, in our study while all groups reported some level of willingness to use LAIs, almost none found other long-acting PrEP formulations attractive such as vaginal rings and implants. Interestingly, the main group of participants that preferred long acting PrEP formulations like LAI and implants (to a lesser degree), had a significantly high number of urban women who obtained at least a bachelor's degree. More work is needed to provide a more granular understanding of why some long-acting formulations were not found attractive, especially in our goal to end inequities in the HIV epidemic by reaching the most vulnerable communities.

In an EHE state like Alabama recognized for its rural HIV epidemiology, understanding the preferences of cis-gender women in rural counties is paramount. LCA in our study revealed that in the group with the largest proportion of rural women, as well as reported experiences of discrimination (i.e. Group 4), on-line PrEP service delivery was found to be attractive (only slightly less than being seen in an office for care). This is highly impactful, especially with growing research investigating how technology-based PrEP programs can close gaps in the PrEP care continuum. [42] Telehealth and on-line PrEP care may provide a level of confidentiality not afforded through office visits addressing some of the stigmatization of HIV and PrEP. [42] However, there is more research needed in how these types of initiatives can be scaled-up in resource poor settings with higher numbers of uninsured or under-insured people. Rural counties included in this study were located in the Black Belt, so named for the black fertile soil manually labored by slaves and later sharecroppers. To date, persons living within the Black Belt face unparalleled social injustices represented by the high levels of unemployment, poor education and food insecurity among Black people living within this region compared to other geographic regions in the country. [43] Public health initiatives, implementation studies and policy change are needed to better understand how to improve access to on-line PrEP service delivery in such locales.

The type of healthcare facility and provider type also emerged as important factors driving PrEP service delivery preferences. Of note, participants reporting a willingness to use PrEP did not want to receive PrEP at STD Clinics and a small minority reported preferences for receiving care at family planning clinics. Most participants preferred to receive care in an office and from obstetrician/gynecologists. Stigma related to STI testing and care as well as specialized reproductive services provided at family planning clinics may play a role in these preferences. Further research is needed to explore these findings that do not support these settings as favored for delivery of PrEP services, despite prior research showing high PrEP acceptability

Table III Pairwise p-value comparisons for Latent Class Groups

Latent Class Groups	1	2	3	4	5
Rurality(χ2 with Yates' Correction)					
1	-				
2	$\chi2=0.03$; p=0.88	-			
3	$\chi2=0.88$; p=0.35	$\chi2=1.65$; p=0.20	-		
4	$\chi2=5.58$; **p=0.018**	$\chi2=5.73$; **p=0.017**	$\chi2=10.44$; **p=0.001**	-	
5	$\chi2=0.09$; p=0.77	$\chi2=0.37$; p=0.54	$\chi2=0.16$; p=0.69	$\chi2=6.37$; **p=0.012**	-
Education(χ2 with Yates' Correction)					
1	-				
2	$\chi2=0.61$; p=0.74	-			
3	$\chi2=1.56$; p=0.46	$\chi2=3.66$; p=0.16	-		
4	$\chi2=6.80$; **p=0.033**	$\chi2=15.57$; **p=0.0004**	$\chi2=2.96$; p=0.23	-	
5	$\chi2=0.37$; p=0.83	$\chi2=0.33$; p=0.85	$\chi2=2.91$; p=0.23	$\chi2=7.21$; **p=0.027**	-
Perceived Social Support, Total(Wilcoxon rank sum test with continuity correction)					
1	-				
2	W=5452.5; p=0.08	-			
3	**W=2360; p=0.019**	W=4078.5; p=0.37	-		
4	W=20,102; p=0.90	**W=24046.5; p=0.032**	**W=11,552; p=0.016**	-	
5	W=2819.5; p=0.47	W=4153; p=0.49	W=1834; p=0.192	W=13,317; p=0.432	-
Perceived Social Support, Friends(Wilcoxon rank sum test with continuity correction)					
1	-				
2	**W=5098.5; p=0.012**	-			
3	**W=2446; p=0.038**	W=4343.5; p=0.84	-		
4	W=18777.5; p=0.26	**W=26,357; p=0.047**	W=12,490; p=0.12	-	
5	W=2791.5; p=0.41	W=3902; p=0.17	W=1856.5; p=0.23	W=14,126; p=0.97	-
Perceived Social Support, Family(Wilcoxon rank sum test with continuity correction)					
1	-				
2	W=5484.5; p=0.09	-			
3	**W=2363; p=0.018**	W=4001; p=0.27	-		
4	W=19237.5; p=0.44	**W=24,752; p=0.003**	**W=10748.5; p=0.002**	-	
5	W=2873.5; p=0.60	W=4078.5; p=0.37	W=1772; p=0.11	W=12,997; p=0.28	-
Experiences of Discrimination(Wilcoxon rank sum test with continuity correction)					
1	-				
2	**W=5102.5; p=0.013**	-			
3	**W=2203.5; p=0.004**	W=3934.5; p=0.21	-		
4	**W=15,910; p=0.001**	W=28295.5; p=0.42	W=13423.5; p=0.49	-	
5	W=2576.5; p=0.11	W=4296.5; p=0.75	W=1869; p=0.25	W=13,357; p=0.45	-
HIV Knowledge(Wilcoxon rank sum test with continuity correction)					

Table III (continued)

Latent Class Groups	1	2	3	4	5
1	-				
2	W=6014; p=0.53	-			
3	W=2307; p=0.011	W=3468; p=0.013	-		
4	W=15,935; p=0.001	W=24143.5; p=0.001	W=13895.5; p=0.80	-	
5	W=2881.5; p=0.62	W=4409.5; p=0.98	W=1718.5; p=0.07	W=11,829; p=0.031	-
PrEP Willingness ($\chi2$ with Yates' Correction)					
1	-				
2	$\chi2=4.30$; p=0.038	-			
3	$\chi2=18.78$; p<0.0001	$\chi2=7.85$; p=0.005	-		
4	$\chi2=15.36$; p<0.0001	$\chi2=2.00$; p=0.16	$\chi2=4.55$; p=0.033	-	
5	$\chi2=4.20$; p=0.040	$\chi2=0.07$; p=0.79	$\chi2=4.44$; p=0.035	$\chi2=0.23$; p=0.63	-

among family planning clinic clientele. [44] While we continue to augment PrEP service delivery in safety-net clinical settings that provide crucial reproductive and sexual healthcare, we should also consider exploring settings like OB/GYN offices where many women receive routine healthcare services. [45] Additionally, 81% of patients seen by gynecologists are of reproductive age (18–44 years), which also reflects the age range with greatest risk for HIV acquisition among cis-gender women. [46] More research is needed to understand how to integrate PrEP services in to routine gynecologic care, because gynecologists may represent an important group of providers who can improve PrEP utilization among Black cis-gender women.

This study has several limitations. This study was conducted in the Southeastern U.S. and, as such, may not be generalizable to the larger population. However, in light of the current HIV epidemiology, creating tailored interventions for HIV prevention in the Deep South is indicated. Also, no causality can be determined from findings presented, because this is an observational study. Further, recruitment methods leveraged social media outlets and direct referrals from participants, which could have introduced sampling bias resulting in a greater likelihood of participants having shared beliefs and service delivery preferences. This is evident in the majority of our sample reporting stable housing, employment and at least some college education, which contrasts to census data for these counties. [47] Additionally, participants' stated preferences may not predict behavior and future research should evaluate if implementing PrEP based on study findings results in greater utilization of PrEP. Lastly, our goal was to have a larger representation of rural women in the study to better evaluate differences in preferences based on rurality. Our findings only showed limited differences in attribute preferences among rural women, which may be due to our modest sample size of rural women (n=304).

Conclusions

The CDC recently presented data at the 2021 Conference on Retroviruses and Opportunistic Infections showing that in a multi-state demonstration project only 3% (142 out of 6762) of Black women with an indication received a PrEP prescription. [48] This study underscores the need for more intentional research and initiatives dedicated to understanding how to improve PrEP access to a group facing substantial inequities in both HIV and STI rates. Most importantly, our community-engaged research is a valuable addition to the literature because it is "consumer-centered", focusing on the end-user to inform future implementation strategies to improve uptake of PrEP among Black cis-gender women.

Fig. 2 Average Utilities of Latent Class Group by Attribute
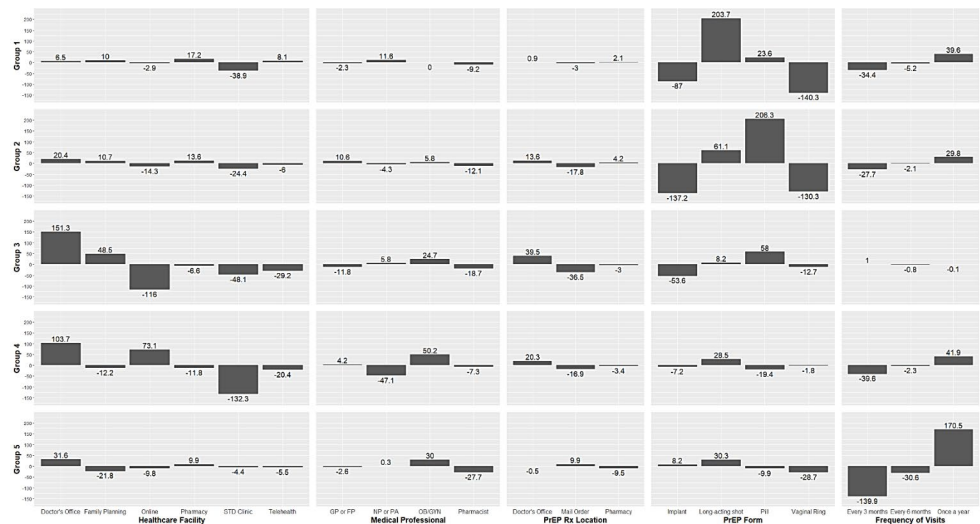
This study included women living in rural Southern communities, which continue to trail behind other regions in the nation in regards to HIV-related outcomes and PrEP prescriptions. Future research should investigate strategies to implement PrEP service delivery programs for cis-gender Black women within routine gynecological care, with LAI and oral PrEP formulations, and providing on-line service options in rural areas that face heightened structural and contextual barriers.

References

1. Centers for Disease Control and Prevention. Surveillance HIV, Report. 2018 (Updated); vol 31. http://cdc.gov/hiv/library/reports/hiv-surveillance.html. Published May 2020. Accessed December 8, 2021.
2. Reif S, Pence BW, Hall I, Hu X, Whetten K, Wilson E. HIV Diagnoses, Prevalence and Outcomes in Nine Southern States. J Community Health Aug. 2015;40(4):642–51.
3. Alabama Department of Public Health. 2019 State of Alabama HIV Surveillance Annual Report. https://www.alabamapublichealth.gov/std/assets/std_annualreport_2019.pdf. Accessed December 8, 2021.
4. Fauci AS, Redfield RR, Sigounas G, Weahkee MD, Giroir BP. Ending the HIV Epidemic: A Plan for the United States. *JAMA.* Feb 7 2019.
5. Murnane PM, Celum C, Nelly M, et al. Efficacy of pre-exposure prophylaxis for HIV-1 prevention among high risk heterosexuals: subgroup analyses from the Partners PrEP Study. AIDS (London, England). 2013;27(13).
6. Baeten JM, Donnell D, Ndase P, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. New Engl J Med. 2012;367(5):399–410.
7. Thigpen MC, Kebaabetswe PM, Paxton LA, et al. Antiretroviral preexposure prophylaxis for heterosexual HIV transmission in Botswana. New Engl J Med. 2012;367(5):423–34.
8. Tripathi A, Ogbuanu C, Monger M, Gibson JJ, Duffus WA. Pre-exposure prophylaxis for HIV infection: healthcare providers' knowledge, perception, and willingness to adopt future implementation in the southern US. South Med J Apr. 2012;105(4):199–206.
9. Smith DK, Van Handel M, Wolitski RJ, et al. Vital signs: estimated percentages and numbers of adults with indications for pre-exposure prophylaxis to prevent HIV acquisition—United States, 2015. MMWR Morb Mortal Wkly Rep. 2015;64(46):1291–5.
10. Highleyman L. PrEP use is rising fast in US, but large racial disparities remain. 2016; http://www.aidsmap.com/PrEP-use-is-rising-fast-in-US-but-large-racial-disparities-remain/page/3065545/. Accessed March 12, 2017.
11. Smith DK, Van Handel M, Grey J. Estimates of adults with indications for HIV pre-exposure prophylaxis by jurisdiction, transmission risk group, and race/ethnicity, United States, 2015. Annals of Epidemiology. 2018;28(12):850–7. e859.
12. Smith DKVHM, Grey J. Estimates of Persons with Indications for Preexposure Prophylaxis.
13. Sullivan PS, Woodyatt C, Koski C, et al. A data visualization and dissemination resource to support HIV prevention and care at the local level: analysis and uses of the AIDSVu public data resource. J Med Internet Res. 2020;22(10):e23173.
14. Bradley E, Forsberg K, Betts JE, et al. Factors Affecting Pre-Exposure Prophylaxis Implementation for Women in the United States: A Systematic Review. J Women's Health. 2019;28(9):1272–85.
15. Corneli A, Perry B, Agot K, Ahmed K, Malamatsho F, Van Damme L. Facilitators of adherence to the study pill in the FEM-PrEP clinical trial. PloS one. 2015;10(4):e0125458.
16. Rubtsova A, Wingood GM, Dunkle K, Camp C, DiClemente RJ. Young adult women and correlates of potential adoption of pre-exposure prophylaxis (PrEP): results of a national survey. Curr HIV Res Oct. 2013;11(7):543–8.

17. Giacomin J. What is human centred design? Des J. 2014;17(4):606–23.

18. Stockwell MS, Rosenthal SL, Sturm LA, Mays RM, Bair RM, Zimet GD. The effects of vaccine characteristics on adult women's attitudes about vaccination: A conjoint analysis study. Vaccine. 2011;29(27):4507–11.

19. 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(6):1681–705.

20. Smith LV, Rudy ET, Javanbakht M, et al. Client satisfaction with rapid HIV testing: comparison between an urban sexually transmitted disease clinic and a community-based testing center. AIDS Patient Care & STDs. 2006;20(10):693–700.

21. Prevention CfDCa. US Public Health Service: Preexposure prophylaxis for the prevention of HIV infection in the United States – 2017 Update: clinical practice guideline. 2018.

22. Elopre L, Mcdavid C, Johnson B, et al. P420 Understanding PrEP service delivery preferences among black women in urban and rural counties in the US deep south. BMJ Publishing Group Ltd; 2019.

23. Koenig HG, Büssing AJR. The Duke University Religion Index (DUREL): A five-item measure for use in epidemological studies. 2010;1(1):78–85.

24. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med Sep. 2001;16(9):606–13.

25. Krieger N, Smith K, Naishadham D, Hartman C, Barbeau EM. Experiences of discrimination: validity and reliability of a self-report measure for population health research on racism and health. Soc Sci Med Oct. 2005;61(7):1576–96.

26. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. J personality Assess. 1988;52(1):30–41.

27. Carey MP, Schroder KE. Development and psychometric evaluation of the brief HIV Knowledge Questionnaire. AIDS Educ prevention: official publication Int Soc AIDS Educ Apr. 2002;14(2):172–82.

28. O'Hea EL, Sytsma SE, Copeland A, Brantley PJ. The Attitudes Toward Women with HIV/AIDS Scale (ATWAS): development and validation. AIDS Educ prevention: official publication Int Soc AIDS Educ Apr. 2001;13(2):120–30.

29. Hirschhorn LR, Brown R, Friedman E, et al. Black Women's PrEP Knowledge, Attitudes, Preferences and Experience in Chicago. Paper presented at: Conference on Retroviruses and Opportunistic Infections. Chicago, IL2019.

30. Koechlin FM, Fonner VA, Dalglish SL, et al. Values and preferences on the use of oral pre-exposure prophylaxis (PrEP) for HIV prevention among multiple populations: a systematic review of the literature. AIDS and Behavior. 2017;21(5):1325–35.

31. de Bekker-Grob EW, Donkers B, Jonker MF, Stolk EA. Sample Size Requirements for Discrete-Choice Experiments in Healthcare: a Practical Guide. Patient Oct. 2015;8(5):373–84.

32. Vrieze SI. Model selection and psychological theory: a discussion of the differences between the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). Psychol methods. 2012;17(2):228.

33. Celeux G, Soromenho G. An entropy criterion for assessing the number of clusters in a mixture model. J Classif. 1996;13(2):195–212.

34. Irie WC, Calabrese SK, Patel RR, Mayer KH, Geng EH, Marcus JL. Preferences for HIV Preexposure Prophylaxis Products Among Black Women in the US. AIDS and Behavior. 2022:1–12.

35. Clement ME, Kofron R, Landovitz RJ. Long-acting injectable cabotegravir for the prevention of HIV infection. Curr Opin HIV AIDS. 2020;15(1):19–26.

36. Philbin MM, Parish C, Kinnard EN, et al. Interest in Long-Acting Injectable Pre-exposure Prophylaxis (LAI PrEP) Among Women in the Women's Interagency HIV Study (WIHS): A Qualitative Study Across Six Cities in the United States. AIDS and Behavior. 2020:1–12.

37. McNicholas C, Tessa M, Secura G, Peipert JF. The contraceptive CHOICE project round up: what we did and what we learned. Clin Obstet Gynecol. 2014;57(4):635.

38. Griffin JB, Ridgeway K, Montgomery E, et al. Vaginal ring acceptability and related preferences among women in low-and middle-income countries: a systematic review and narrative synthesis. PloS one. 2019;14(11):e0224898.

39. van der Straten A, Shapley-Quinn MK, Reddy K, et al. Favoring "Peace of Mind": A qualitative study of African women's HIV prevention product formulation preferences from the MTN-020/ASPIRE trial. AIDS Patient Care and STDs. 2017;31(7):305–14.

40. Seidman D, Weber S, Carlson K, Witt J. Family planning providers' role in offering PrEP to women. Contraception. 2018;97(6):467–70.

41. Seidman D, Logan RG, Weber S, Gandhi A, Blackstock O. Reimagining PrEP provision for women in the United States. Clinical Infectious Diseases. 2021.

42. Touger R, Wood BR. A review of telehealth innovations for HIV pre-exposure prophylaxis (PrEP). Curr HIV/AIDS Rep. 2019;16(1):113–9.

43. Wimberley RC, Morris LV. The regionalization of poverty: Assistance for the Black Belt South? J Rural Social Sci. 2002;18(1):11.

44. Garfinkel DB, Alexander KA, McDonald-Mosley R, Willie TC, Decker MR. Predictors of HIV-related risk perception and PrEP acceptability among young adult female family planning patients. AIDS care. 2017;29(6):751–8.

45. Frost JJ. US Women's use of sexual and reproductive health services: Trends, sources of care and factors associated with use, 1995–2010. New York: Guttmacher Institute; 2013.

46. Dall TM, Chakrabarti R, Storm MV, Elwell EC, Rayburn WF. Estimated demand for women's health services by 2020. J Women's Health. 2013;22(7):643–8.

47. United States Census Bureau. American Fact Finder, 2010 Census.

48. Iqbal K, Zhu W, Dominguez K, Tanner M, Henny K, Hoover K. PrEP continuum of care among MSM and TGW of color in the THRIVE demonstration project. Poster presented at: CROI. 2020:8–11.