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RESEARCH ARTICLE

HIV pre-exposure prophylaxis programme preferences among sexually active HIV-negative transgender and gender diverse adults in the United States: a conjoint analysis

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Abstract

Introduction: Current implementation efforts have failed to achieve equitable HIV pre-exposure prophylaxis (PrEP) provision for transgender and gender-diverse (trans) populations. We conducted a choice-based conjoint analysis to measure preferences for key attributes of hypothetical PrEP delivery programmes among a diverse online sample predominantly comprised of transmasculine and nonbinary individuals in the United States.

Methods: Between April 2022 and June 2022, a national online survey with an embedded conjoint analysis experiment was conducted among 304 trans individuals aged ≥18 years in the United States to assess five PrEP programme attributes: out-of-pocket cost; dispensing venue; frequency of visits for PrEP-related care; travel time to PrEP provider; and ability to bundle PrEP-related care with gender-affirming hormone therapy services. Participants responded to five questions, each of which presented two PrEP programme scenarios and one opt-out option per question and selected their preferred programme in each question. We used hierarchical Bayes estimation and multinomial logistic regression to measure part-worth utility scores for the total sample and by respondents' PrEP status.

Results: The median age was 24 years (range 18–56); 75% were assigned female sex at birth; 54% identified as transmasculine; 32% as nonbinary; 14% as transfeminine. Out-of-pocket cost had the highest attribute importance score (44.3%), followed by the ability to bundle with gender-affirming hormone therapy services (18.7%). Minimal cost-sharing ($0 out-of-pocket cost) most positively influenced the attribute importance of cost (average conjoint part-worth utility coefficient of 2.5 [95% CI 2.4–2.6]). PrEP-experienced respondents preferred PrEP delivery in primary care settings (relative utility score 4.7); however, PrEP-naïve respondents preferred pharmacies (relative utility score 5.1).

Conclusions: Participants preferred programmes that offered PrEP services without cost-sharing and bundled with gender-affirming hormone therapy services. Bolstering federal regulations to cover PrEP services and prioritizing programmes to expand low-barrier PrEP provision are critical to achieving equitable PrEP provision. Community-engaged implementation research conducted by and in close collaboration with trans community stakeholders and researchers are needed to streamline the design of patient-centred PrEP programmes and develop implementation strategies that are salient to the diverse sexual health needs of trans patients.

Keywords: choice behaviour; decision-making; HIV; pre-exposure prophylaxis; sexual and gender minorities; transgender persons

Additional information may be found under the Supporting Information tab of this article.

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1 | INTRODUCTION

Social, structural and systemic barriers, including social marginalization, stigma and structural oppression, sustain inequitable HIV pre-exposure prophylaxis (PrEP) care continuum outcomes in the United States among transgender and gender-diverse (trans) populations, which include communities of transfeminine, transmasculine, nonbinary and other gender-diverse individuals whose gender identity or expression differ from cultural expectations [1–5]. The U.S.

Centers for Disease Control and Prevention (CDC) estimated an overall HIV prevalence of 9.2% among trans people in the United States—14% for transgender women and 3% for transgender men [5–7]. Eligibility criteria outlined in the 2014 and 2017 CDC PrEP guidelines were not specifically inclusive of trans populations [8, 9]. However, if one considers eligibility based on sexual practice indications alone, studies found one-quarter of transgender men, and more than half of transgender women aged 18–29 years were eligible for PrEP. However, only 10% of PrEP-eligible transgender men and one-third of PrEP-eligible transgender women reported a history of PrEP use [7, 10, 11].

Revised 2021 CDC PrEP guidelines now recommend clinicians inform all sexually active individuals about PrEP and offer PrEP to those at risk of HIV acquisition due to sociobehavioural factors (e.g. condomless sex with a person of unknown HIV status), structural factors (e.g. member of a community with high HIV prevalence) or expressed interest [12]. In light of these recommendations, tailored implementation strategies to achieve equitable PrEP delivery for trans populations are needed [3, 13]. Regrettably, implementation studies rarely enrol trans participants in numbers sufficient to yield reliable estimates—transfeminine participants are often subsumed into study cohorts comprised predominantly of cisgender sexual minority men, while transmasculine and nonbinary individuals are rarely enrolled at all [13–18] Limited inclusion of trans participants in implementation research will hinder efforts to develop strategies that are salient and relevant to trans individuals who might otherwise benefit from PrEP due to their current sexual practices or personalized HIV prevention needs and preferences [3, 13, 15, 19]. However, prior research with trans participants across other fields of research may inform this work. Recent quantitative studies have found that anti-trans stigma, the dearth of trans-inclusive sexual health programmes and medical mistreatment pose significant barriers to PrEP-related care [2, 10, 15, 20–24]. Qualitative studies have aligned with these findings and further described how structural factors such as anti-trans discrimination and disenfranchisement (e.g. poverty, reduced educational opportunities, unstable employment, housing insecurity and carceral system involvement), and limited access to low-barrier, low-cost comprehensive healthcare (e.g. gender-affirming hormone therapy [GAHT], management of chronic medical conditions, sexual health, behavioural health services) impact access to health services and inform PrEP delivery preferences [19, 25–32].

To address these implementation challenges, researchers have integrated behavioural and social sciences research and consumer psychology strategies to inform the design of high-value PrEP programmes that meet the needs of the intended population [33, 34]. Conjoint analysis (CJA) is an experimental survey technique used to measure respondents' preferences and the degree of importance respondents assign to specific product attributes when presented with a limited number of profiles (scenarios) comprised of different combinations of attributes [35–38]. Using CJA, researchers quantitatively measure which combination is associated with product acceptability, relative attribute importance, the most preferred combination and trade-offs respondents make when selecting their most preferred profile [33, 39–44]. CJA could be leveraged to streamline the design of patient-centred PrEP programmes for trans patients and ensure trans patients have a meaningful choice of programmes for PrEP-related care [43–47]. The objective of this study was to use a choice-based CJA to measure preferences for the attributes of hypothetical PrEP programmes among a diverse online sample predominantly comprised of transmasculine and nonbinary adults in the United States.

2 | METHODS

2.1 | Setting and recruitment

Trans adults in the United States were recruited to complete an online self-administered survey with an embedded conjoint experiment between April 2022 and June 2022. Recruitment strategies were developed in consultation with our virtual community advisory board (CAB) comprised of six trans adults. Potential participants were recruited via advertisements (64%) on social media (i.e. trans-specific organizations and groups on Meta, Reddit, etc.), LGBTQ+ and transgender health listservs and word of mouth (11%), and email invitations to trans individuals who previously screened for studies within our research group (25%). Eligibility criteria included: (1) aged ≥18 years; (2) self-identified as transgender, nonbinary and/or of transgender experience; (3) negative or unknown HIV status; (4) sexual activity in the past 6 months or chlamydia, gonorrhoea or syphilis diagnosis in the past 12 months; (5) U.S. residency; (6) English fluency; and (7) internet access.

Study procedures were approved by the University of Pennsylvania Institutional Review Board. Potential participants completed an online Qualtrics eligibility screener. Research staff reviewed screeners to confirm alignment between respondents' description of their gender identity (open-ended free text), sex assigned at birth (exclusive categorical variable) and gender identity ("select all that apply" categorical variable). Unique Qualtrics links were emailed to eligible respondents, and electronic informed consent was obtained from all participants prior to completing the online Qualtrics survey. We used embedded Qualtrics anti-fraud and duplicate entry metrics, CAPTCHA and other best practices to identify duplicate, falsified and suspicious entries by manually reviewing respondents' data, including IP addresses, survey completion time, cross-checking zip code and latitude and longitude coordinates, email addresses and telephone numbers [48–50]. Participants received a $25 Amazon gift card for survey completion.

2.2 | Measures

The full survey instrument was developed by the authors, refined based on feedback from the CAB and pretested by CAB members. The parent study assessed the acceptability of next-generation PrEP modalities and whether participants' preferences were associated with gender affirmation, sexual behaviours, and barriers and facilitators to healthcare utilization. The survey included an embedded CJA experiment and measures related to socio-demographic characteristics; social, legal and medical gender affirmation; sexual behaviours;

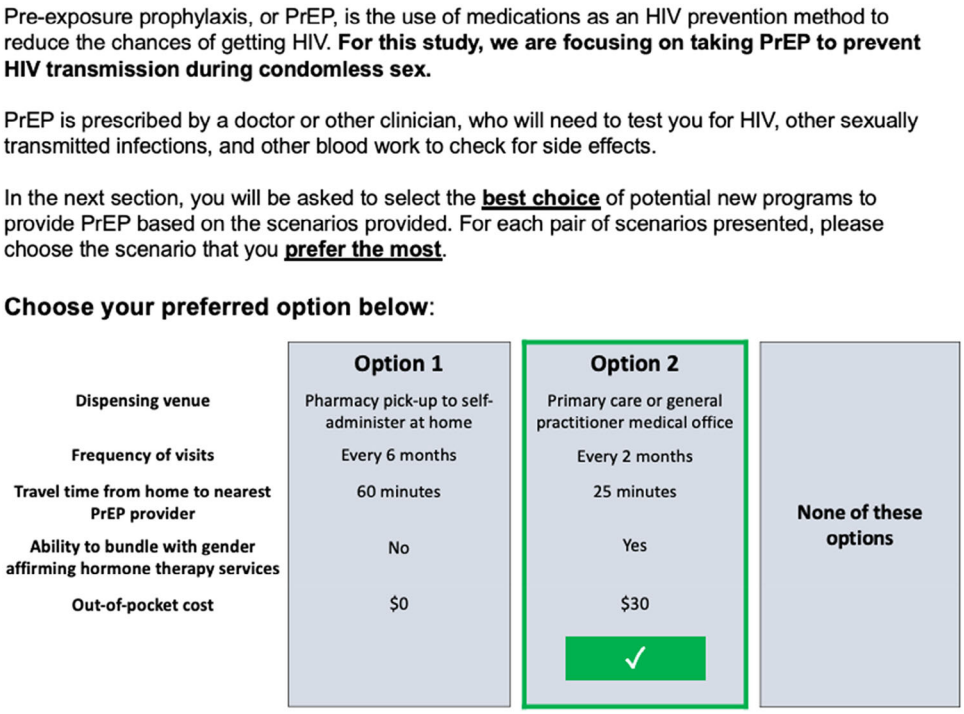

Figure 1. Example of a choice-based conjoint analysis task. Each task presents two hypothetical HIV pre-exposure prophylaxis (PrEP) programme profiles (Option 1 and Option 2) and the third option to opt-out. Each PrEP programme profile presents one level of the five attributes examined in this analysis: dispensing venue, frequency of visits for PrEP-related care, travel time to PrEP provider, ability to bundle with gender-affirming hormone therapy services and out-of-pocket cost.

knowledge, beliefs and experiences related to PrEP, HIV/STI prevention and reproductive health. The present research focused on describing the CJA results.

2.3 | Assigning PrEP programme attributes

Each programme scenario (conjoint) included five attributes selected a priori by the research team based on expert consultation and a literature review of factors shown to influence PrEP delivery among U.S. priority populations [19, 27, 33, 42, 43, 51–59]. Attributes were hypothesized to be independent from each other and relevant for developing programmes to accommodate next-generation PrEP modalities in development [60–62]. Attributes included (1) **out-of-pocket cost** ($0, $30, $150); (2) **dispensing venue** (pharmacy pick-up, HIV/STI clinic, primary care or general practitioner medical office); (3) **frequency of visits for PrEP-related services** (every 2 months, every 3 months, every 6 months); (4) **travel time from PrEP provider** (25 minutes, 60 minutes); and (5) **ability to bundle with GAHT services** (yes, no). (See Table S1.)

2.4 | CJA procedures using paired comparison methods

The CJA presented a brief description of PrEP followed by five questions, each of which presented two conjoints and one opt-out option per question, and asked respondents to select their preferred PrEP programme in each question (see Figure 1). Attributes were presented randomly to minimize effect bias. We examined the value participants assigned to different attributes as quantitatively measured by each attribute's **importance score** (i.e. *between* attribute comparison contributing to decision-making between scenarios), **average utility score** (i.e. *within* attribute comparison of participants' preferences across levels) and **relative utility score** (i.e. the likelihood that inclusion of this attribute would enhance the optimal "PrEP programme"). The CJA was executed within the proprietary Qualtrics® CJA program (Qualtrics, Provo, UT, 2020), which uses a fractional factorial design with an asymmetric orthogonal main effects plan to reduce the total number of scenarios presented to each participant while presenting each attribute level an approximately equal number of times [35, 37, 63]. In accordance with the rule proposed by Orme for choice-based conjoint analyses [64], we calculated a sample size of 300 respondents for aggregate-level estimation of main effects using the following equation:

$$N \geq \frac{(multiplier \times c)}{(t \times a)},$$

where N is the minimum number of respondents; *multiplier* = 1000; $c = 3$, largest number of levels for any attribute; $t = 5$, the number of questions; and $a = 2$; the number of choices per question.

2.5 | Conjoint analyses

The Qualtrics® CJA programme used hierarchical Bayes estimation and multinomial logistic regression to measure each

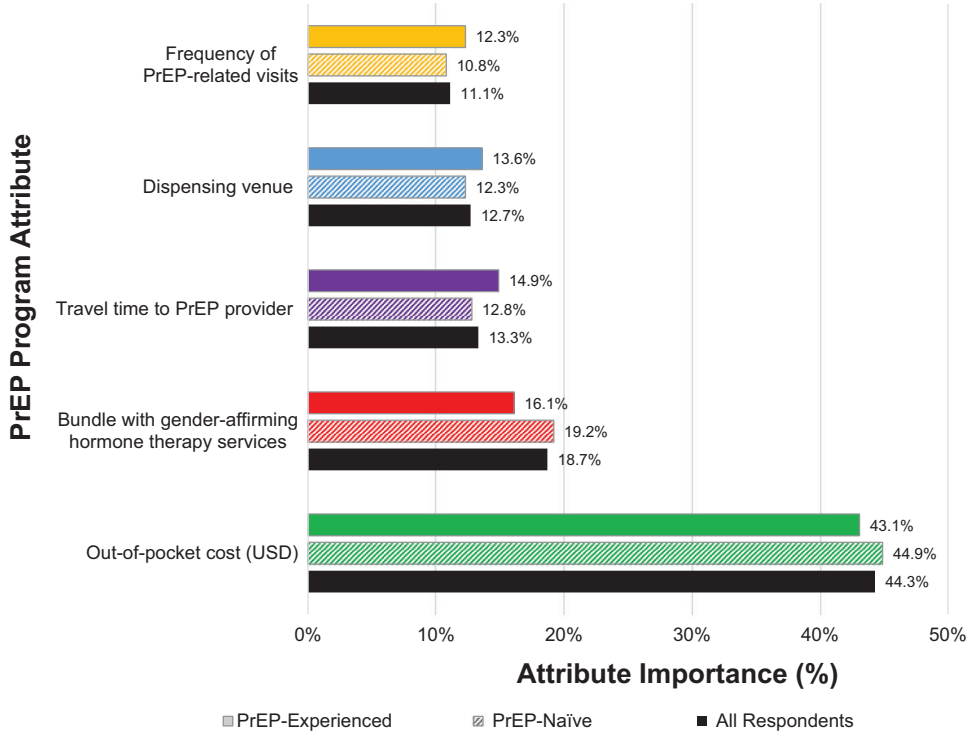

Figure 2. Utility-based PrEP programme attribute importance scores among all respondents and by respondents' PrEP status. ***Notes*****: Attribute importance is the measurement of the distance between the best and worst levels of each attribute and expressed as a percentage. Attribute importance represents the degree to which a given attribute influenced respondents' preferred programme selection with higher scores indicating greater weight in respondents' decision-making process. Abbreviations: PrEP, pre-exposure prophylaxis; USD, United States Dollar.**

respondent's part-worth utility scores (regression coefficients) and to characterize attribute importance and programme preferences. Part-worth utility scores were zero-centred ordinal scores for each attribute level with a negative score indicating a less preferred level and a positive score indicating a more preferred level [35]. Utility scores were used to calculate attribute metrics for the total study population and by respondents' PrEP status (PrEP-naïve vs. PrEP-experienced). The experimental design (a main-effects design) did not allow interactions among attributes tested [37].

2.6 | Descriptive statistics

We computed descriptive statistics for the study population and comparisons across participant characteristics using Fisher's exact tests for categorical variables and Wilcoxon rank sum tests for continuous variables by PrEP status. *p*-values < 0.05 were considered statistically significant. Statistical analyses not performed in Qualtrics were performed using Stata version 15 (StataCorp LLC, College Station, TX, 2017).

3 | RESULTS

3.1 | Sample characteristics

Demographic and other characteristics are shown in Table 1 for 304 respondents, overall and by PrEP status. The median age was 24 years (range 18–56). Overall, 228 (75%) were assigned female sex at birth; 175 (58%) identified as White; 47 (15%) as Hispanic or Latinx/e; and 33 (11%) as Black. More than half (164, 54%) identified as transmasculine, trans men and/or men; 42 (14%) as transfeminine, trans women and/or women; and 99 (32%) as nonbinary, genderqueer or another gender identity that was not transfeminine or transmasculine. One-fifth of respondents reported prior or current PrEP use, and 209 (87%) PrEP-naïve respondents reported prior awareness of PrEP. All respondents answered each CJA question, the results of which are shown in Table 2.

3.1.1 | Attribute importance scores

Out-of-pocket cost had the highest importance score (44.3%), indicating that cost was the most influential attribute during respondents' decision-making process when selecting their preferred PrEP programme (see Figure 2). The ability to bundle PrEP-related care with GAHT services (18.7%) was the second most important attribute, followed by travel time to PrEP provider (13.3%), dispensing venue (12.7%) and frequency of visits for PrEP-related care (11.1%). The magnitudes and order of attribute importance scores were similar for PrEP-experienced and PrEP-naïve respondents. The ability to bundle GAHT services with PrEP-related care had the largest difference in importance score: 16.1% for PrEP-

Table 1. Characteristics of an online sample of HIV-negative sexually active transgender and gender-diverse adults in the United States by respondents' HIV pre-exposure prophylaxis (PrEP) status (*N* = 304)

Characteristics	Total (*N* = 304)	PrEP-naïve (*n* = 241)	PrEP-experienced (*n* = 63)	*p*-value
Age, median (interquartile range), years	24 (21–29)	23 (20–28)	29 (24–32)	<0.001
Sex assigned at birth				<0.001
Female	228 (75%)	196 (81%)	32 (51%)	
Male	71 (23%)	42 (17%)	29 (46%)	
Prefer not to say	5 (2%)	3 (1%)	2 (3%)	
Gender identity				0.22
Transfeminine, trans woman and/or woman	42 (14%)	32 (13%)	10 (16%)	
Transmasculine, trans man and/or man	164 (54%)	136 (56%)	28 (44%)	
Nonbinary, genderqueer, agender or another gender identity not transfeminine or transmasculine	98 (32%)	73 (30%)	25 (40%)	
Primary sexual identity				0.03
Queer	108 (36%)	87 (36%)	21 (33%)	
Bisexual	74 (24%)	62 (26%)	12 (19%)	
Gay	58 (19%)	37 (15%)	21 (33%)	
Pansexual	28 (9%)	26 (11%)	2 (3%)	
Lesbian	19 (6%)	16 (7%)	3 (5%)	
Another sexual identity	17 (6%)	13 (5%)	4 (6%)	
Race and ethnicity				0.03
Non-Latinx/e White	175 (58%)	141 (59%)	34 (54%)	
Non-Latinx/e Black or African American	33 (11%)	19 (8%)	14 (22%)	
Non-Latinx/e More than one race	29 (10%)	26 (11%)	3 (5%)	
Non-Latinx/e Another race	20 (7%)	16 (7%)	4 (6%)	
Hispanic, Latinx/e or of Spanish origin (any race)	47 (15%)	39 (16%)	8 (13%)	
Educational attainment				0.62
Not a high school graduate	7 (2%)	5 (2%)	2 (3%)	
High school graduate	166 (55%)	135 (56%)	31 (49%)	
College graduate	101 (33%)	79 (33%)	22 (35%)	
Graduate or professional degree	30 (10%)	22 (9%)	8 (13%)	
Residence by U.S. Census Region				0.27
South	100 (33%)	76 (32%)	24 (38%)	
Northeast	82 (27%)	62 (26%)	20 (32%)	
West	66 (22%)	54 (22%)	12 (19%)	
Midwest	56 (18%)	49 (20%)	7 (11%)	
Employment status				<0.01
Full time (≥ 35 hours per week)	144 (47%)	106 (44%)	38 (60%)	
Part time (< 35 hours per week)	70 (23%)	64 (27%)	6 (10%)	
Unemployed	52 (17%)	44 (18%)	8 (13%)	
Student	21 (7%)	16 (7%)	5 (8%)	
Another employment status	17 (6%)	11 (5%)	6 (10%)	
Health insurance coverage status				<0.01
Insurance paid by study participant	154 (51%)	112 (46%)	42 (67%)	
Insurance paid by family member or guardian	124 (41%)	109 (45%)	15 (24%)	
No insurance or unsure of insurance status	26 (9%)	20 (8%)	6 (10%)	
Had a primary care provider	236 (78%)	181 (75%)	55 (87%)	0.04
Reported taking gender-affirming hormone therapy	152 (50%)	126 (52%)	26 (41%)	0.16
Obtained ≥ 1 gender-affirming surgical procedure	93 (31%)	74 (31%)	19 (30%)	1.00

(*Continued*)

Table 1. (Continued)

Characteristics	Total (N = 304)	PrEP-naïve (n = 241)	PrEP-experienced (n = 63)	p-value
Ever diagnosed with a bacterial sexually transmitted infection	48 (16%)	26 (11%)	22 (35%)	<0.001
Ever had sex in exchange for money, food, drugs and so on	60 (20%)	41 (17%)	19 (30%)	0.03

Note: Comparisons were made by respondents' PrEP status using Fisher's exact tests for categorical variables and Wilcoxon rank sum tests for continuous variables. Statistical significance: p-value < 0.05, two-tailed. Data are presented as median (interquartile range) for continuous measures, and n (%) for categorical measures. PrEP-experienced = report current or prior PrEP use. Gender-affirming hormone therapy = testosterone, oestradiol, spironolactone, finasteride. Gender-affirming surgical procedure = genital surgery (e.g. phalloplasty, vaginoplasty); chest surgery (e.g. augmentation, mastectomy); another surgery (e.g. tracheal shaving, facial surgery). Bacterial sexually transmitted infection = *Neisseria gonorrhoeae* (gonorrhoea), *Chlamydia trachomatis* (chlamydia), *Treponema pallidum* (syphilis).

experienced respondents compared to 19.2% for PrEP-naïve respondents.

3.1.2 | *Average conjoint part-worth utility scores (coefficients)*

Average conjoint part-worth utility coefficients [95% confidence interval] among all respondents and by respondents' PrEP status are shown in Figures 3a and b, respectively. Across all attributes, $0 out-of-pocket cost (2.5 [95% CI 2.4–2.6]) most positively influenced the attribute importance of cost during respondents' decision-making process. The ability to bundle with GAHT services (1.1 [95% CI 1.0–1.2]), 25-minute travel time to the PrEP provider (0.8 [95% CI 0.8–0.8]), attending visits for PrEP-related services every 6 months (0.7 [95% CI 0.7–0.8]) and PrEP dispensation from the pharmacy (0.4 [95% CI 0.3–0.5]) were the preferred levels for each attribute among all respondents. Higher out-of-pocket cost ($150) most negatively influenced the attribute importance of cost (−3.0 [95% CI −3.2 to −2.9]), followed by the inability to bundle with GAHT services (−1.1 [95% CI −1.2 to −1.0]), 60-minute travel time (−0.8 [95% CI −0.8 to −0.8]), PrEP dispensation from an HIV/STI clinic (−0.7 [95% CI −0.7 to −0.6]) and attending visits every 2 months (−0.6 [95% CI −0.7 to −0.6]).

3.1.3 | *Relative utility scores for each attribute level*

As shown in Figure 4, PrEP programmes with $0 out-of-pocket cost had the highest relative utility score (20.0) among respondents overall, indicating those programmes were strongly preferred compared to programmes that offered services with $30 out-of-pocket cost (4.4) or $150 out-of-pocket cost (−24.3). Among respondents overall, relative utility scores were higher for programmes that provided bundled GAHT services, had shorter travel times to providers and required less frequent visits for PrEP-related services. Relative utility scores for dispensing venue differed by PrEP status. PrEP-experienced respondents slightly preferred PrEP service delivery in primary care settings (4.7) compared to pharmacies (4.2); however, PrEP-naïve respondents more strongly preferred pharmacies (5.1) compared to primary care settings (2.2).

4 | DISCUSSION

This study examined PrEP programme preferences among an online sample predominantly comprised of transmasculine and nonbinary individuals in the United States and quantified the degree to which key attributes contributed to the preferability of PrEP programmes. The findings may inform the design of implementation strategies to enhance the acceptability of PrEP programmes that serve this priority population.

Out-of-pocket cost was the most important attribute driving respondents' PrEP programme preferences across all attributes examined. Our findings are consistent with studies conducted with other priority populations, which found cost-sharing for PrEP-related care to be a key structural barrier to PrEP initiation and persistence [23, 43, 55, 57, 65–71]. In accordance with the U.S. Patient Protection and Affordable Care Act (ACA), most health insurance plans are required to cover the cost of PrEP-related services (i.e. medication, labs and medical visits for PrEP-specific care) without cost-sharing. However, the 2022 U.S. federal court ruling in *Braidwood Management v. Becerra* challenged the ACA mandate to provide PrEP coverage without cost-sharing [72]. If the ruling is upheld and the mandate is overturned, this structural disinvestment in PrEP-related care will likely disproportionately exacerbate PrEP inequities among trans populations. Bolstering federal regulations that cover PrEP and prioritizing programmes and policies to expand low-barrier PrEP provision will be critical to achieving PrEP equity [73, 74]. Importantly, socio-economic deprivation resulting from stigma and discrimination also impedes people's access to the resources needed to support their wellbeing, particularly among trans people experiencing multiple intersecting forms of oppression [75, 76]. For example, anti-trans stigma has been shown to disrupt people's educational trajectories and adversely affect educational attainment in adulthood, subsequently limiting access to employment opportunities and stable housing, which in turn perpetuates high rates of poverty and financial precarity relative to cisgender people [30, 70, 77–86]. This precarity may also lead to participation in sex work—thus conveying increased vulnerability to HIV transmission if engaging in condomless sex with clients and increased risk of surveillance, profiling, carceral system involvement due to the widespread criminalization of sex work [84, 87]. Future implementation strategies in the United States should prioritize PrEP provision with limited out-of-pocket cost—ideally no

Table 2. Results of choice-based conjoint analysis experiment for online sample of HIV-negative sexually active transgender and gender-diverse adults in the United States by respondents' HIV pre-exposure prophylaxis (PrEP) status (*N* = 304)

	Total sample (*N* = 304)			PrEP-naïve participants (*n* = 241)			PrEP-experienced participants (*n* = 63)		
Programme attribute	**Average utility coefficient (95% CI)**	**Relative utility score**	**Attribute importance**	**Average utility coefficient (95% CI)**	**Relative utility score**	**Attribute importance**	**Average utility coefficient (95% CI)**	**Relative utility score**	**Attribute importance**
Out-of-pocket cost (USD)			44.3%			44.9%			43.1%
$0	2.5 (2.37, 2.62)	20.0		2.6 (2.44, 2.70)	20.3		2.2 (1.87, 2.54)	19.2	
$30	0.5 (0.53, 0.56)	4.4		0.5 (0.54, 0.56)	4.3		0.5 (0.50, 0.58)	4.7	
$150	−3.0 (−3.17, −2.91)	−24.3		−3.1 (−3.26, −2.98)	−24.6		−2.7 (−3.10, −2.38)	−23.9	
Able to bundle with GAHT services			18.7%			19.2%			16.1%
Yes	1.1 (1.04, 1.21)	9.3		1.2 (1.13, 1.31)	9.6		0.8 (0.56, 0.97)	8.0	
No	−1.1 (−1.21, −1.04)	−9.3		−1.2 (−1.31, −1.13)	−9.6		−0.8 (−0.97, −0.56)	8.0	
Travel time to PrEP provider			13.3%			12.8%			14.9%
25 minutes	0.8 (0.81, 0.85)	6.6		0.8 (0.80, 0.84)	6.4		0.9 (0.83, 0.91)	7.5	
60 minutes	−0.8 (−0.85, −0.81)	−6.6		−0.8 (−0.84, −0.80)	−6.4		−0.9 (−0.91, −0.83)	−7.5	
Dispensing venue			12.7%			12.3%			13.6%
Pharmacy	0.4 (0.35, 0.53)	5.0		0.5 (0.40, 0.59)	5.1		0.2 (−0.02, 0.45)	4.2	
Primary care office	0.2 (0.19, 0.25)	2.7		0.2 (0.18, 0.24)	2.2		0.3 (0.18, 0.32)	4.7	
HIV/STI clinic	−0.7 (−0.73, −0.59)	−7.7		−0.7 (−0.78, −0.63)	−7.2		−0.5 (−0.65, −0.28)	−8.9	
Frequency of visits for PrEP-related care			11.1%			10.8%			12.3%
Every 2 months	−0.6 (−0.63, −0.53)	−5.0		−0.6 (−0.63, −0.52)	−4.9		−0.6 (−0.71, −0.48)	−5.7	
Every 3 months	−0.2 (−0.17, −0.15)	−1.0		−0.2 (−0.17, −0.16)	−1.0		−0.1 (−0.16, −0.13)	−1.0	
Every 6 months	0.7 (0.69, 0.79)	6.0		0.7 (0.69, 0.79)	5.9		0.7 (0.63, 0.85)	6.6	

Notes: Average utility coefficients with 95% confidence intervals (CI) are from multinominal regression models. Part-worth utility scores were zero-centred ordinal scores for each attribute level with a negative score indicating a less preferred level and a positive score indicating a more preferred level. Thin lines separate the different attributes assessed.
Abbreviations: CI, confidence interval; GAHT, gender-affirming hormone therapy; STI, sexually transmitted infection; USD, United States Dollar.

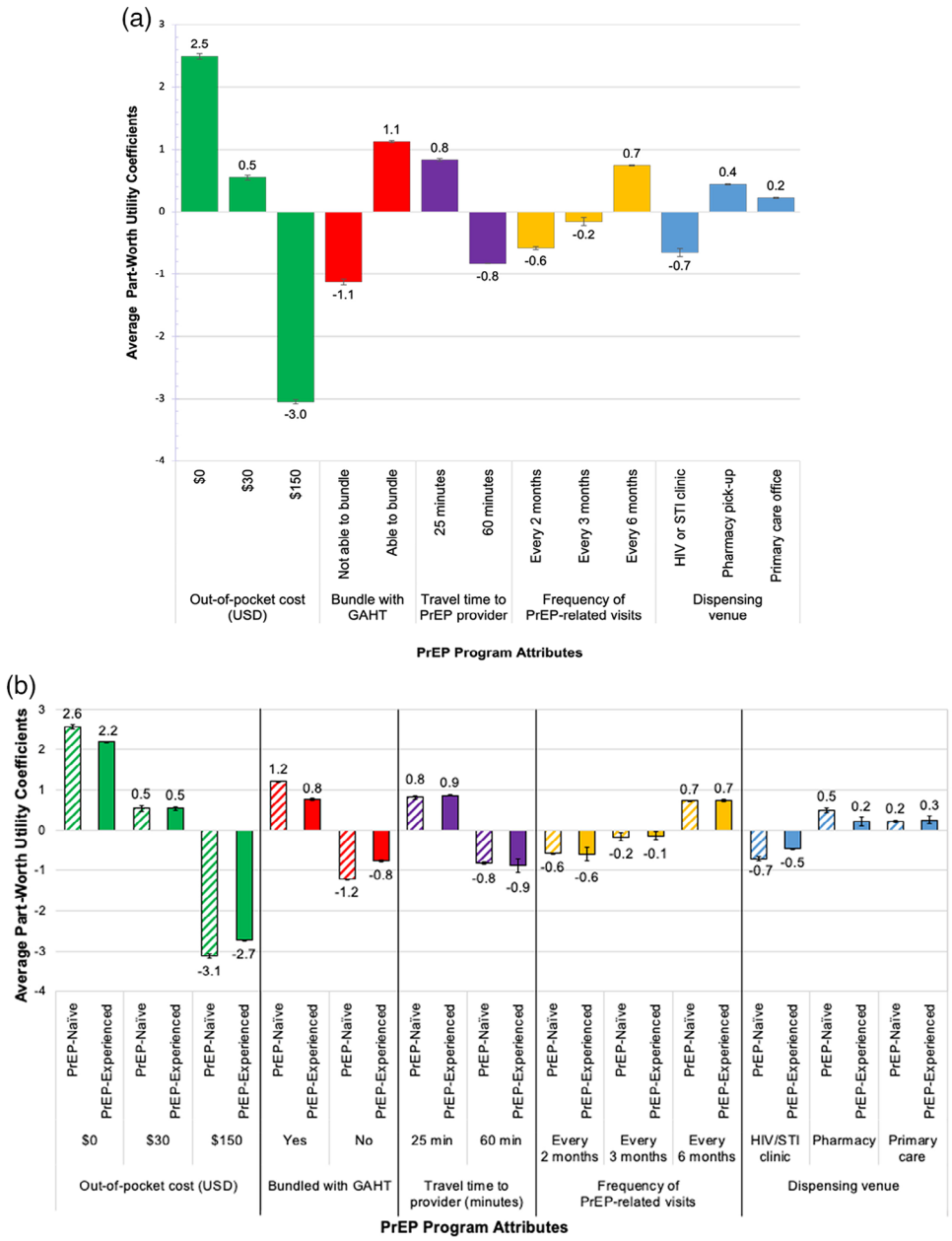

Figure 3. (a) Average part-worth utility scores (coefficients) of HIV pre-exposure prophylaxis programme attributes and corresponding levels across all respondents (*N* = 304). (b) Average part-worth utility scores (coefficients) of HIV pre-exposure prophylaxis programme attributes and corresponding levels by respondents' PrEP status (*N* = 304). *Notes*: Average part-worth utility scores (coefficients) of PrEP programme attributes and corresponding levels with 95% confidence intervals are from multinominal regression models. Average part-worth utility coefficient represents the degree to which a given level contributed to an attribute's overall attribute importance. Part-worth utility scores were zero-centred ordinal scores for each attribute level with a negative score indicating a less preferred level and a positive score indicating a more preferred level. Thin lines separate the different attributes assessed. Abbreviations: GAHT, gender-affirming hormone therapy; PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection; USD, United States Dollar.

out-of-pocket cost—to PrEP users, including those who are uninsured.

Half of the respondents reported they had not used GAHT as a component of their gender affirmation. Our findings are consistent with prior work that found not all trans adults seek gender affirmation services within formal medical institutions due to a multitude of reasons, including experiences of anti-trans discrimination, administrative burden, legislative state-level restrictions on trans healthcare, refusal of care from medical providers, preference for do-it-yourself hormone management or simply lack of desire to do so [21, 88–93]. Importantly, the ability to bundle PrEP-related services with GAHT services was still highly preferred and the second most important attribute assessed in this study. This

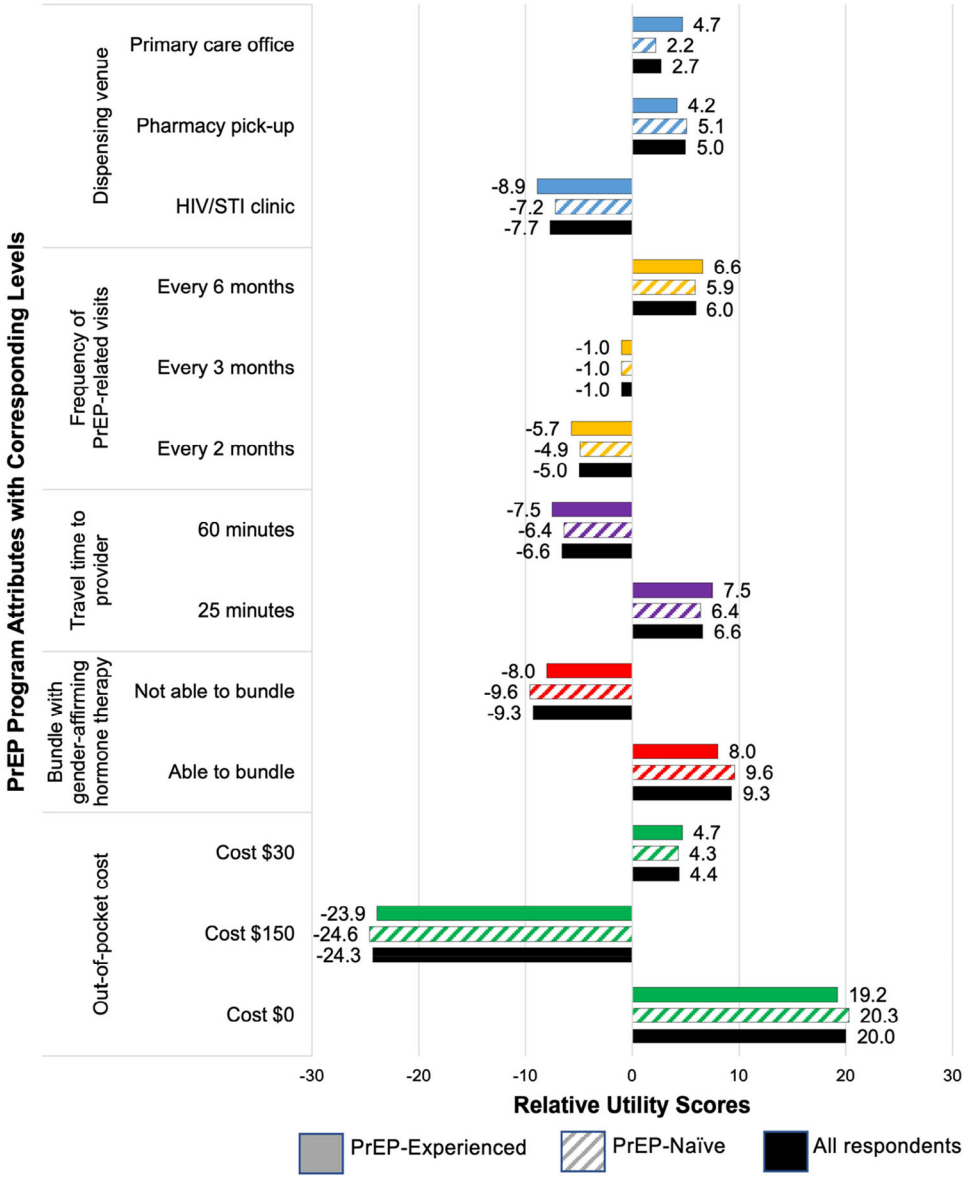

Figure 4. Relative utility scores for each attribute level among all respondents and by respondents' HIV pre-exposure prophylaxis status. ***Notes*****: Within each attribute, the relative utility score of each attribute level represents the degree to which respondents preferred a PrEP programme that had that attribute level. Relative utility scores were zero-centred ordinal scores for each level with a negative score indicating a less preferred level and a positive score indicating a more preferred level. The higher the positive relative utility score, the more that level enhanced the PrEP programme by being present. Abbreviations: GAHT, gender-affirming hormone therapy; PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection; USD, United States Dollar.**

aligns with prior studies, which found significant associations between the receipt of gender-affirming medical services and the use of sexual health services including PrEP [2, 19, 94]. Incorporation of GAHT services into PrEP-related care will require broader integration of transgender-inclusive sexual health services and training in gender-affirming healthcare delivery among healthcare providers, including trainees [26, 95–97]. Future implementation efforts should also consider how best to integrate GAHT services to ensure PrEP-related care is salient to trans patients' comprehensive sexual health needs.

HIV/STI clinics were the least preferred dispensing venue among both PrEP-naïve and PrEP-experienced respondents. Our findings align with a recent discrete choice experiment with Black cisgender women in the United States, which also found HIV/STI clinics were the least preferred location to obtain PrEP-related care [98]. In addition, prior studies have found suboptimal rates of PrEP initiation and persistence among STI clinic patients [71, 99–101]. Taken together, these findings suggest that HIV/STI clinics may not be the preferred venue for PrEP delivery for certain subgroups among priority populations. Privacy concerns and stigma associated

with accessing services from a clinic recognized by community members as a location that focuses on HIV/STI-related care may influence this preference. We also found differences in the most preferred dispensing venue by PrEP status. Among PrEP-naïve respondents, PrEP dispensation from a pharmacy was the most preferable location. In contrast, receipt of PrEP from a primary care office was the most preferable location among PrEP-experienced respondents. Our findings align with calls from community stakeholders and HIV prevention researchers to integrate PrEP delivery into settings that are not exclusively focused on HIV/STI care [23, 52, 102–111]. Furthermore, the revised 2021 CDC PrEP Guidelines recommend clinicians routinize PrEP discussions with all sexually active patients and incorporate PrEP into other preventive services to ensure greater reach and more equitable access [12]. Further investigation, including qualitative research, is needed to explore the factors driving differential preferences in PrEP provision locations.

Shorter travel time to one's PrEP provider was the third most important attribute among respondents regardless of PrEP status. Lack of geographically accessible medical services is an important barrier to attending medical visits, including visits for PrEP-related care, among people who reside in rural areas or impoverished neighbourhoods [22, 103, 112–114]. Prior studies also found that even in large metropolitan areas, trans patients often reported that ride-share services were cost-prohibitive and travelling by public transportation was time-consuming or exposed them to discrimination or violence [27, 115, 116]. Increasing geographic accessibility of PrEP-related services will be a critical systemic facilitator for ensuring equitable PrEP delivery for trans people, particularly those who must navigate additional systemic barriers, such as living in poverty, in rural areas or lack of affordable and safe transportation. Implementation efforts are ongoing to expand PrEP delivery by increasing the number of PrEP providers and diversifying PrEP delivery models (e.g. telemedicine services, pharmacy-based services and delivery in primary care practices) [3, 27, 52, 73, 74, 80, 109, 110].

Finally, the ability to decrease the frequency of PrEP-related visits to every 6 months was strongly preferred among all respondents regardless of PrEP status. Several next-generation PrEP modalities under development may be amenable to this preference [13, 60, 62, 80]. Future studies should be more inclusive and enrol more substantial numbers of trans participants to obtain more reliable findings related to product efficacy, acceptability and implementation opportunities among this priority population. The focus should be directed towards individuals for whom daily oral tenofovir-based PrEP and bimonthly injectable cabotegravir are not acceptable or feasible.

Some limitations of our study should be noted. First, although the full survey instrument was piloted and revised based on CAB feedback, we were unable to confirm the extent to which a given respondent understood each attribute while selecting their preferred scenarios. Second, participants may not represent those most vulnerable to HIV acquisition. However, our eligibility criteria aligned with the 2021 CDC PrEP clinical guidelines [12]. Third, most participants were recruited via social media and reported high rates of PrEP awareness, which may have introduced sampling bias and limited the generalizability of our findings. Fourth, it is possible that cisgender individuals were misclassified as trans and deemed eligible to participate in this study, thereby introducing bias. Fifth, our CJA examined preferred programme-level attributes rather than attributes of PrEP products (e.g. adverse drug effects, route of administration, duration of protection). Lastly, respondents' reported preferences for hypothetical programme attributes may not accurately represent their actual choice behaviours. Future research is needed to ensure implementation efforts are responsive to the evolving landscape of next-generation PrEP development and service delivery models.

5 | CONCLUSIONS

PrEP is one of the most revolutionary and highly effective methods of HIV prevention. Due to numerous social, structural and systemic barriers, current delivery models have failed to eliminate the entrenched population-level PrEP inequities among trans populations in the United States [2]. The PrEP-related needs and preferences of trans patients—and transmasculine and nonbinary patients specifically—have not been well explored. This study examined PrEP programme preferences among a diverse national online cohort of sexually active trans adults, the majority of whom identified as transmasculine or nonbinary. Key findings included high rates of PrEP awareness, an overwhelming preference for PrEP services without cost-sharing, a strong preference for PrEP services bundled with GAHT services and differential preferences in PrEP provision locations between PrEP-naïve and PrEP-experienced respondents. Community-engaged implementation and qualitative research conducted by and in collaboration with trans community stakeholders and researchers are needed to obtain a nuanced understanding of the PrEP-related needs and preferences among this diverse priority population [3]. Future implementation efforts should consider how models of PrEP delivery for next-generation PrEP may impact scale-up among current and potential trans-PrEP users and prioritize strategies that address the complex factors impeding equitable PrEP delivery, which is a public health priority.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

DLW, FMM and JAB had overall responsibility for implementing the study, conceived and designed the study, and developed the study protocol. DLW led the original drafting of the manuscript, contributed to participant recruitment, conducted data collection and data analysis, contributed to funding acquisition and supervised the overall study. LL gave feedback/revisions on earlier versions of the manuscript and contributed to participant recruitment, study implementation

and data collection. RAD and WL gave feedback/revisions on earlier versions of the manuscript and contributed to participant recruitment and study implementation. FMM gave feedback/revisions on earlier versions of the manuscript. JAB gave feedback/revisions on earlier versions of the manuscript, conducted data analysis, contributed to funding acquisition, contributed staff resources and research infrastructure, and supervised the overall study.

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DISCLAIMER

The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Allergy and Infectious Diseases or the National Institutes of Health.

DATA AVAILABILITY STATEMENT

Data are presented in aggregate form within the manuscript. Individual-level data contain potentially sensitive information and are not suitable for public repository due to ethical restrictions and to protect confidentiality. Reasonable requests to access the final de-identified data set should be submitted to the corresponding author's email, who will evaluate and approve the request.

INFORMED CONSENT

Inform consent was obtained from all individuals included in the study.

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Supporting Information