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A Memo on Factors Associated with Perception of Stigma Attached to PrEP: Evidence from the Keeping It LITE Study

Shahin Davoudpour [1,*], Gregory L. Phillips II [1], Pedro A. Serrano [1], Audrey L. French [2] and Sybil G. Hosek [3]

[1] Feinberg School of Medicine, Northwestern University, Chicago, IL 60611, USA
[2] Stroger Hospital of Cook County, Chicago, IL 60612, USA
[3] College of Medicine, University of Illinois Chicago, Chicago, IL 60612, USA
* Correspondence: shahin.davoudpour@northwestern.edu

Abstract: Although perception of stigma (PS) has been dubbed as a key barrier to the optimal uptake of PrEP, research on PS is sparse. More specifically, no scholarly work has explored factors associated with the expression of PS toward PrEP use. This study addresses the literature gap by investigating factors associated with PS toward PrEP use. Data were drawn from the baseline survey (2017–2019) of the "Keeping It LITE Study", involving a large cohort (n = 3330) of young sexual minority men, transgender men and women, and non-binary individuals in the US. Participants' ages ranged from 13 to 34 years, with the majority (87%) assigned male at birth. The racial composition of the sample was diverse, with 53.9% identifying as white, 19.8% as Latinx, 10.7% as Black or African American, and smaller proportions as Asian, American Indian or Alaska Native, Native Hawaiian or other Pacific Islander, and another race/ethnicity. Logistic regression models were utilized to examine two common measures of PS in PrEP use: (1) the perception that PrEP users are seen as promiscuous and (2) the perception that PrEP users are assumed to be HIV-positive. Two sets of models were developed to account for the correlation between gender identity and sex assigned at birth. The results suggest strong PS among current PrEP users, which can explain the weak PrEP adherence reported among this group. The findings underscore the need for targeted interventions to mitigate PS and enhance PrEP uptake and adherence in vulnerable populations. Social and practical implications of the results and directions for future research are discussed.

Keywords: pre-exposure prophylaxis; PrEP; perception of stigma

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1. Introduction

Despite numerous advances in treatment and prevention modalities, HIV remains an ongoing pandemic. According to Centers for Disease Control and Prevention (CDC) estimates, by the end of 2019, more than 1.2 million people in the United States (US) were living with HIV, and 34,800 had a new diagnosis [1]. The CDC report also highlights that, in 2019, the annual number of new diagnoses was 9% lower compared with preceding years. This decline in new diagnoses has motivated initiatives like the Ending the HIV Epidemic (EHE) Plan [2]. The use of pre-exposure prophylaxis (PrEP) as a preventive measure is deemed as a key instrument in obtaining EHE goals by the year 2030 [3]. However, any medical intervention, especially those designed to control a pandemic, is most effective when it is optimally used. Alas, this has not been the case with PrEP usage, as most researchers [4–6] report a slower-than-expected uptake and inconsistent use by those eligible, with a variety of reasons proposed. Chief among these explanations is the existence of perceived stigma (PS) attached to PrEP use [7]. Defined as the anticipation or fear of being discriminated against [8], PS is a powerful agent that can motivate one to modify their behavior to avoid social consequences of PS.

The relationship between PrEP and stigma has been extensively studied. Golub and colleagues conducted qualitative studies revealing that stigma directed toward PrEP users

often stems from misconceptions about their sexual behavior and perceived HIV risk, which can lead to social judgment and discrimination [9]. This stigma is particularly pronounced among marginalized groups such as sexual minority men (SMM), transgender individuals, and racial and ethnic minorities, exacerbating existing health disparities. Similarly, research by Cahill and colleagues as well as Calabrese and colleagues underscores how PrEP-related stigma intersects with broader social determinants of health, including homophobia, transphobia, and racism [10–12]. These factors contribute to hesitancy in PrEP uptake and adherence among affected communities. Aligned with this, Rael and co-authors investigated cultural factors among Latino men who have sex with men (MSM) and transgender women, highlighting fears of social exclusion and negative labeling within their communities due to PrEP use [13]. This might be why those from Latinx and Black communities are less likely than their white counterparts to fill a second PrEP prescription [14]. Dubov and colleagues further explored healthcare provider perspectives, noting concerns about PrEP reinforcing stereotypes or promoting risky behavior, which can influence provider–patient interactions and access to PrEP services [15]. Similarly, research by Arnold and colleagues contributed insights into healthcare settings, documenting provider biases that may undermine patient trust and access to PrEP services [16]. Other works, like that of Bauermeister and colleagues, focused on social network influences, revealing peer attitudes that could deter PrEP initiation [17]. Specifically, researchers found that some peers within these networks held negative views or misconceptions about PrEP, such as concerns about its effectiveness, fears of side effects, or stigmatizing assumptions about the sexual behavior of those using PrEP.

Ultimately, past research [7,18–20] has identified fear of being falsely labeled as promiscuous and erroneously deemed to be living with HIV as the top two PS concerns of PrEP users, which are also the key barriers to the uptake and use of PrEP [12].

Addressing PrEP-related stigma requires multifaceted approaches [21]. As a result, there has been an explosion of interest in the study of stigma attached to PrEP use. Thus far, most scholarship has focused on stigma itself, with little to no attention given to PS among PrEP users. Therefore, our knowledge on the factors that predict PS among those eligible for PrEP is incomplete, and thus is the focus of this study. Understanding such perception and its correlates can inform our strategies to reduce PS among PrEP-eligible individuals and vulnerable populations.

1.1. Theoretical Expectations

Demographic variables:

Demographic differences account for variation in attitudes toward PrEP, which, in part, explain the reason why HIV prevention messaging and activities are tailored differently based on gender and sexual orientation [22]. Hammack and colleagues reported most gay and bisexual men (68.4%) to be in favor of taking PrEP as a precautionary measure [22]. They also reported that younger men are more willing to take PrEP compared with their older counterparts [22]. Others have found similar numbers for interest in PrEP among cisgender men (60%), but interest is noticeably lower among cisgender women (46.6%) [23]. Therefore, it is expected that men, especially younger men, will express lower PS toward PrEP, compared with women and older individuals. There is also a clear linear association between higher educational attainment and lower PS for most stigmas [24]. Past research has linked education and attitudes toward PrEP. Accordingly, we expect those with higher educational attainment to express less PS toward PrEP use compared with their counterparts with less education.

PrEP-specific variables:

In studying stigma related to PrEP use, attention to PrEP-specific variables such as knowledge of PrEP, awareness of stigma consequences, prior social contact with PrEP users, higher behavioral risk of HIV, seeing responsibility in PrEP use, and PrEP use history is crucial for a comprehensive analysis. Knowledge of PrEP directly influences individuals' attitudes and beliefs about its efficacy and necessity, shaping their attitudes toward PrEP.

Awareness of stigma consequences informs how individuals perceive and navigate potential social repercussions, affecting their decision making regarding PrEP uptake and adherence. Prior social contact with PrEP users can mitigate stigma by providing positive role models and reducing misconceptions. Higher behavioral risk of HIV correlates with increased stigma and may deter individuals from seeking PrEP. Seeing responsibility in PrEP use reflects perceptions of personal agency and community health responsibility, which are pivotal in combating stigma. Finally, PrEP use history reveals patterns of adherence, discontinuation, and experiences with stigma, providing insights into the long-term impact of stigma on PrEP utilization and adherence rates. Without integrating these variables into our analysis, our understanding of the multifaceted dynamics surrounding PrEP use stigma would be incomplete. What follows is an elaboration of our theoretical expectations on these variables.

Knowledge of PrEP. One of the well-established drivers of PS is lack of knowledge about the target of the stigma [25]. So far, the literature has shown a similar relationship between knowledge and general positive attitude toward PrEP [7,26]. Ergo, it would not be surprising if those who are more knowledgeable about PrEP and its efficacy would be less likely hold PS toward PrEP than those who have inaccurate knowledge on PrEP.

Awareness of stigma consequences. Past research has shown that awareness of the consequences and challenges of social stigma increases PS [27]. Therefore, it is expected that those who are aware of these consequences and challenges would be more likely to express PS against PrEP use.

Prior Social Contact with PrEP users. The influence of prior social contact on PS is undeniable [28]. In short, those who have ties to the stigmatized are less likely to express PS. Therefore, it is expected that those who had prior social contact with PrEP users would be less likely to hold PS against PrEP use.

Higher Behavioral Risk of HIV. Those with self-identified behaviors linked to higher HIV risk are more likely to express positive attitudes toward PrEP usage [26,29]. Aligned with this, we expect the same group to be less likely to report PS toward PrEP use.

Seeing responsibility in PrEP use. Researchers [30] have reported that PrEP users may be seen as "irresponsible" with their sexual behavior. Based on this, it is not unexpected that more PS is expressed by those who see such "irresponsibility" in PrEP use.

PrEP use history. Prior use of PrEP, or even post-exposure prophylaxis (PEP), can create a favorable bias in respondents, as experiences with a treatment often impact users' attitudes [31]. Hence, all models in this study control for participants' PrEP (or PEP) use history.

1.2. Data

Data for this study come from the baseline survey (Participants enrolled on a rolling basis between December 2017 and December 2019) of "The Keeping It LITE Study". The data were collected via an online survey from a large (n = 3444) cohort of young sexual minority men and transgender men and women and non-binary individuals in the US [32]. The collected data assess factors associated with PrEP use and PrEP persistence and have been used to address research questions related to attitudes toward PrEP [33].

1.3. Analysis

Logistic regressions were used to model the impact of demographic, behavioral, and attitudinal factors on two measures of PS against PrEP (i.e., PrEP users are seen as promiscuous; PrEP users are seen as HIV-positive). Since gender identity and sex assigned at birth are closely correlated (~0.68 in this sample), two sets of models were developed. Model 1 (Table 2) controls for sex assigned at birth, whereas Model 2 (Table 3) controls for gender identity. Not all cases were included in the final sample, as 114 participants did not provide responses to either stigma measure. These participants were excluded from final analyses since multiple imputation or other stochastic methods are not useful when cases

are systematically missing (e.g., no answers provided) [34]. Therefore, the final sample size for the presented models is limited to 3330.

1.4. Analytic Sample

Table 1 highlights the full descriptive status of the analytic sample. The age of the participants were between 13 and 34 years, and the majority (87%) were assigned male at birth. Further, 75.6% of the individuals in the sample were cisgender men, 8.3% were transgender men, 1.9% were transgender women, and 14.17% reported another gender. Nearly 53.9% of the individuals in the sample were white; the remainder were Latinx (19.76%), Black or African American (10.72%), another race/ethnicity (10.36%), Asian (4.47%), American Indian or Alaska Native (0.66%), or Native Hawaiian or other Pacific Islander (0.12%). The majority of the sample identified as gay/lesbian (66.84%), with a smaller proportion of the sample identifying as bisexual (12.85%), straight (0.96%), or another sexual identity (19.49%). Most of the sample completed high school or had equivalent education (39.13%) or held a bachelor's degree (29.64%). The remainder reported master's degrees (15.08%) or doctoral degrees (3.96%), had completed some college (6.13%), or had less than a high school education (6.07%). Lastly, most of the sample (82.04%) reported not married as their marital status.

Table 1. Descriptive statistics for dependent and independent.

Variable	N	%	Mean	Std. Dev.
Demographic variables				
Age	3330	24.81	24.57	4.81
Sex Assigned At Birth	3330			
Female	422	12.67		
Male	2908	87.33		
Gender	3330			
Man	2518	75.62		
Other	472	14.17		
Transgender man	276	8.29		
Transgender woman	64	1.92		
Sexual Orientation	3330			
Gay/lesbian	2221	66.70		
Other	649	19.49		
Bisexual	428	12.85		
Straight, that is, not gay or lesbian, etc.	32	0.96		
Educational Attainment	3330			
Less than high school	202	6.07		
High school graduate or GED complete	1303	39.13		
Some college level/technical/vocational	204	6.13		
Bachelor's degree	987	29.64		
Master's degree	502	15.08		
Doctoral degree	132	3.96		
Race	3330			
White	1795	53.90		
Hispanic, Latino, or Spanish origin	658	19.76		
Black or African American	357	10.72		
Other	345	10.36		
Asian	149	4.47		
American Indian or Alaska Native	22	0.66		
Native Hawaiian or other Pacific Islander	4	0.12		

Table 1. *Cont.*

Variable	N	%	Mean	Std. Dev.
Are you currently partnered/married? (Marital status)	3330			
Not married	2732	82.04		
Married	598	17.96		
What is the extent of your experience with actually using PrEP at this time?	3330			
PrEP naïve	2349	70.54		
Former PrEP user	246	7.39		
Current PrEP user	735	22.07		

Source: Keeping It LITE Study, 2017–2019.

2. Results

2.1. Demographics

Sex assigned at birth. Per Model 1, sex assigned at birth shows a significant result for both PS that PrEP users are promiscuous (adjusted odds ratio [aOR] = 0.61; 95% confidence interval [CI]: 0.44, 0.86) and assigning HIV-positive status to PrEP users (aOR = 0.61; 95% CI: 0.46, 0.81). This means that participants assigned female at birth are significantly less likely to hold PS toward PrEP use compared with their counterparts assigned male at birth. This finding is aligned with theoretical expectations.

Age. Younger age is significantly associated with assigning promiscuity to PrEP users in Model 1 (aOR = 0.97; 95% CI: 0.95, 0.995), while no significant results were reported for those assigning HIV-positive status to PrEP users. This means that younger participants (in a sample of 13–34) are more likely to express PS that PrEP users are promiscuous, while age plays no significant role in PS related to assumed HIV-positive status of PrEP users.

Educational attainment. When controlled for age, educational attainment presents interesting results. Compared with those with less than high school education, those who completed high school or earned a GED (aOR = 1.62; 95% CI: 1.12, 2.36), master's (aOR = 2.03; 95% CI: 1.29, 3.19), or doctoral degrees (aOR = 3.46; 95% CI: 1.76, 6.80) are significantly more likely to express PS that PrEP users are promiscuous, while only those with doctoral degrees (aOR = 1.86; 95% CI: 1.05, 3.29) are significantly more likely to express PS that PrEP users are HIV-positive. This suggests that PS attached to PrEP use can increase in those with higher educational attainment, which is contrary to the mainstream narrative that expects lower stigmatizing attitudes from those with higher educational attainment. Controlling for gender identity in Model 2 does not change these findings.

Race and ethnicity. White participants are more likely to express PS than participants of other races/ethnicities. More specifically, those who identified as Latinx (aOR = 0.74; 95% CI: 0.60, 0.93) and Native Hawaiian/Pacific Islander (aOR = 0.06; 95% CI: 0.004, 0.87) are significantly less likely to express PS that associates promiscuity with PrEP usage. Those who identified as Latinx (aOR = 0.81; 95% CI: 0.67, 0.99) are less likely to express PS that PrEP users are HIV-positive. When controlled for gender identity (Model 2), in addition to the above-mentioned ethnicities, those who identified as Black or African American (aOR = 0.76; 95% CI: 0.57, 0.998) are significantly less likely to express PS assigning promiscuity to PrEP users compared with their white counterparts. Perhaps this acceptance of PrEP can be explained by HIV education and prevention resources dedicated to Black and Latinx communities as they continue to bear a significant burden of HIV.

Marital status. Those who identified as married are significantly more likely to express PS that PrEP users are promiscuous (aOR = 1.17; 95% CI: 1.34, 2.23) or HIV-positive (aOR = 1.47; 95% CI: 1.19, 1.81). Model 2 shows similar results for this variable. Perhaps this is because individuals who are married, particularly if they adhere to monogamous ideals, perceive PrEP use as unnecessary due to their lower HIV risk, hence seeing its use as indicative of promiscuity instead of a proactive step against HIV.

2.2. PrEP-Specific Variables

PrEP knowledge. Having accurate knowledge of PrEP is not significantly associated with PS linking PrEP and promiscuity, while it is significantly associated with the expression of PS that assigns a positive HIV status to PrEP users (aOR = 0.85; 95% CI: 0.73, 0.99). However, when controlling for gender identity in Model 2, this variable shows no significant results for either PS. This finding suggests that accurate knowledge of PrEP helps dispel common myths and misconceptions about HIV transmission and prevention. This includes understanding that using PrEP does not mean an individual has HIV, but that they are proactively taking steps to prevent acquiring HIV. On the other hand, perhaps the reason why this accurate knowledge does not reduce the perception of PrEP users' promiscuity is tightly related to the idea that PrEP enables its users to engage in sexual behaviors that increase the risk of HIV.

Perceived HIV risk. Those who believe that their sexual behavior puts them at risk of acquiring HIV are more likely to express PS related to promiscuity (aOR = 1.42; 95% CI: 1.27, 1.59) and HIV-positive status (aOR = 1.29; 95% CI: 1.17, 1.43). Controlling for gender identity does not change these outcomes. Perhaps people who perceive themselves at higher risk of HIV also assess HIV risk differently and hold beliefs about sexual behaviors and practices that they associate with its increased risk.

Knowledge of challenges faced by PrEP users. Those who show awareness of challenges faced by the stigmatized are more likely to express PS related to both promiscuity (aOR = 1.27; 95% CI: 1.16, 1.40) and HIV-positive status (aOR = 1.18; 95% CI: 1.09, 1.29). Results presented in Model 2 are consistent with the aforementioned results. Those who are aware of societal stigma and challenges faced by stigmatized groups, like PrEP users, may internalize these stigmas themselves, which in part will influence their perceptions and attitudes toward PrEP users, whom they may view through the lens of negative stereotypes including promiscuity and HIV-positive status.

Perception of responsibility in sexual behavior. Seeing PrEP use as a responsible sexual behavior is significantly associated with PS related to promiscuity of PrEP users (aOR = 1.29; 95% CI: 1.16, 1.40) but not PS related to HIV-positive status across both models. In other words, those who believe that PrEP users are showing responsibility in sexual behavior are more likely to also express PS that PrEP users are seen as promiscuous. Possibly this finding is also related to the fact that PrEP, when used properly, enables individuals to engage in behaviors that are associated with higher HIV risk with a higher degree of protection.

Prior social contact with PrEP users. Interestingly, knowing other PrEP users shows no significant results for either PS measures across both models. In other words, having personal interactions with other PrEP users does not appear to shape or influence one's attitudes toward PrEP and its use, suggesting that PS related to PrEP cannot be simply mitigated with more mixed interactions between PrEP users and PrEP-naïve people.

PrEP use history. Current PrEP users are more likely to express PS that PrEP users are promiscuous (aOR = 1.34; 95% CI: 1.07, 1.69), while no significant effects are shown for PS assigning an HIV-positive status to PrEP users across all dimensions of PrEP use history. Results are consistent across both models. Current PrEP users might perceive their own sexual behavior as more open or varied while on PrEP, which could lead them to generalize this perception to other PrEP users [35].

Table 2. Adjusted odds ratios controlled for sex assigned at birth for stigmatizing attitudes toward PrEP users.

	Model 1					
	PrEP Users Are Promiscuous			PrEP Users Are Living with HIV		
	AOR	95% CI		AOR	95% CI	
Demographic variables						
Sex assigned at birth	0.612 **	0.437	0.856	0.607 ***	0.455	0.808
Sexual orientation (ref: gay/lesbian)						
Bisexual	1.186	0.902	1.561	1.183	0.927	1.510
Straight, that is, not gay or lesbian, etc.	1.539	0.555	4.268	0.974	0.436	2.175
Other	1.054	0.825	1.346	1.070	0.862	1.329
Age	0.973 *	0.952	0.995	0.982	0.964	1.001
Educational attainment (ref: less than high school)						
High school graduate or GED complete	1.623 *	1.115	2.362	1.075	0.758	1.524
Some college level/technical/vocational	1.524	0.924	2.512	1.450	0.907	2.319
Bachelor's degree	1.303	0.867	1.957	0.964	0.661	1.404
Master's degree	2.026 **	1.288	3.187	1.208	0.799	1.825
Doctoral degree	3.461 ***	1.762	6.798	1.860 *	1.052	3.291
Race/ethnicity (ref: white)						
Latinx	0.744 **	0.596	0.927	0.812 *	0.666	0.989
Black or African American	0.774	0.585	1.025	0.846	0.658	1.088
Asian	1.063	0.691	1.637	0.875	0.606	1.263
American Indian or Alaska Native	1.172	0.316	4.343	0.855	0.319	2.290
Native Hawaiian or other Pacific Islander	0.055 *	0.003	0.898	0.361	0.036	3.666
Other	1.222	0.887	1.683	0.977	0.751	1.271
Marital status (ref: single)	1.173 ***	1.335	2.228	1.465 ***	1.186	1.811
PrEP-specific variables						
Knowledge of PrEP	1.056	0.886	1.259	0.851 *	0.728	0.994
Risk of HIV	1.420 ***	1.272	1.586	1.293 ***	1.172	1.425
Contact with a PrEP user	0.903	0.741	1.100	1.114	0.937	1.324
Knowledge of challenges faced by PrEP users	1.273 ***	1.157	1.399	1.184 ***	1.091	1.285
Sees responsibility in PrEP use	1.288 ***	1.109	1.496	1.010	0.880	1.159
PrEP use (ref: PrEP naïve)						
Current PrEP user	1.344 *	1.070	1.687	1.174	0.961	1.435
Former PrEP user	1.001	0.429	2.334	1.167	0.532	2.560
N	3330			3330		
Standard Errors Are Robust						

Source: Keeping It LITE Study, 2017–2019. *** $p > 0.001$, ** $p > 0.01$, * $p > 0.05$.

Transgender status. There are not many differences in significance or odds ratios across both models with a few exceptions. Per Table 3, gender identity shows significant results for PS assigning promiscuity to PrEP users. With this, transgender men (aOR = 1.51; 95% CI: 1.02, 2.25) and transgender women (aOR = 2.46; 95% CI: 1.11, 5.49) are more likely to express PS that PrEP users are promiscuous compared with their cisgender male counterparts. Results indicate that transgender men and transgender women are more likely to think negatively about PrEP compared with cisgender men, which might be due to experiences of stigma, discrimination, or differing perceptions of HIV risk between transgender individuals and cisgender men.

Table 3. Adjusted odds ratios controlled for gender identity for stigmatizing attitudes toward PrEP users.

	Model 2					
	PrEP Users Are Promiscuous			PrEP Users Are HIV+		
	AOR	95% CI		AOR	95% CI	
Demographic variables						
Gender (ref: cisgender men)						
Transgender men	1.510 *	1.016	2.245	1.830	1.283	2.610
Transgender women	2.464 *	1.107	5.485	1.494	0.816	2.737
Other	1.261	0.937	1.696	1.457	1.125	1.892
Sexual orientation (ref: gay/lesbian)						
Bisexual	1.159	0.879	1.529	1.147	0.897	1.467
Straight, that is, not gay or lesbian, etc.	1.207	0.430	3.390	0.852	0.375	1.939
Other	1.012	0.777	1.320	0.970	0.765	1.231
Age	0.972 *	0.951	0.994	0.984	0.965	1.003
Educational attainment (ref: less than high school)						
High school graduate or GED complete	1.589 *	1.094	2.310	1.060	0.747	1.505
Some college level/technical/vocational	1.521	0.922	2.508	1.454	0.909	2.327
Bachelor's degree	1.290	0.859	1.937	0.962	0.660	1.404
Master's degree	1.998 **	1.269	3.145	1.196	0.790	1.809
Doctoral degree	3.355 ***	1.708	6.591	1.834 *	1.036	3.246
Race (ref: white)						
Latinx	0.736 **	0.591	0.918	0.809 *	0.664	0.986
Black or African American	0.755 *	0.571	0.998	0.829	0.645	1.065
Asian	1.058	0.888	1.686	0.872	0.603	1.260
American Indian or Alaska Native	1.193	0.688	1.626	0.858	0.316	2.327
Native Hawaiian or other Pacific Islander	0.051	0.319	4.454	0.333	0.028	3.956
Other	1.234	0.571	0.998	0.978	0.750	1.275
Marital status (ref: single)	1.754 ***	0.003	0.879	1.483 ***	1.200	1.833
PrEP-specific variables						
Knowledge of PrEP	1.063	1.357	2.267	0.861	0.736	1.006
Belief that current sexual behavior would lead to HIV infection	1.419	0.892	1.268	1.289 ***	1.169	1.421
Contact with a PrEP user	0.895	1.270	1.585	1.115	0.938	1.327
Knowledge of challenges faced by PrEP users	1.281	0.734	1.091	1.195 ***	1.101	1.298
Sees responsibility in PrEP use	1.286 ***	1.165	1.409	1.006	0.876	1.155
PrEP use (ref: PrEP naïve)						
Current PrEP user	1.328 *	1.056	1.671	1.172	0.959	1.433
Former PrEP user	0.985	0.425	2.288	1.173	0.537	2.561
N	3330			3330		
	Standard Errors Are Robust					

Source: Keeping It LITE Study, 2017–2019. *** $p > 0.001$, ** $p > 0.01$, * $p > 0.05$

3. Discussion

HIV remains a significant global health challenge, with profound implications for individuals, communities, and public health systems worldwide. Despite advances in treatment and prevention, stigma, or negative sentiment and attitudes, surrounding HIV persists as a formidable barrier [36]. Stigma not only affects people with HIV (PWH) but also influences broader societal attitudes and behaviors related to HIV prevention strategies, including the use of PrEP [37]. PrEP represents a critical advancement in HIV prevention, offering a highly effective biomedical approach to reducing transmission risk among vulnerable populations [14]. However, alongside its promise, PrEP has also been accompanied by stigma that consistently undermines its uptake and adherence [7].

PrEP stigma manifests in various forms, including erroneous perceptions that PrEP users are promiscuous or already HIV-positive [12]. These misperceptions stem from broader societal biases and misinformation about sexual behavior and practices and HIV risk [38,39]. Such stigmas not only perpetuate negative stereotypes but also create barriers for individuals seeking access or adhering to PrEP [9]. Fear of judgment or discrimination can deter individuals from discussing PrEP with their healthcare providers or from using it consistently, thereby limiting its public health impact [40]. Understanding and addressing perceptions of PrEP stigma is crucial for enhancing its uptake and effectiveness. By identifying factors that contribute to stigma and exploring how these perceptions vary across different demographic groups, interventions can be tailored to mitigate stigma's negative effects. This study, which is part of the "Keeping It LITE Study [41]", aims to fill this gap by comprehensively examining perceptions and attitudes toward PrEP use among a diverse cohort. By elucidating the factors associated with PrEP-related stigma, this research seeks to inform targeted interventions, educational campaigns, and policy initiatives aimed at promoting PrEP acceptance among key populations vulnerable to HIV.

The findings of this study shed light on the complex landscape of PrEP stigma among a diverse cohort of young sexual minority men, transgender individuals, and non-binary persons in the US. Our analysis reveals significant associations between demographic factors and stigmatizing attitudes toward PrEP users, offering insights that can inform targeted interventions and policy initiatives.

3.1. Demographic Influences on Stigmatizing Attitudes

Several demographic variables emerged as significant predictors of stigmatizing attitudes toward PrEP and its use. Notably, participants assigned male at birth exhibited higher odds of associating PrEP use with promiscuity and assigning HIV-positive status to its users. This aligns with existing literature that suggests that societal norms around masculinity and sexual behavior contribute to stigmatizing perceptions of HIV prevention strategies [42]. Conversely, those assigned female at birth are less likely to hold stigmatizing attitudes, highlighting gender disparities in perceptions of sexual health practices and HIV risk.

Age also plays a role, with younger participants more likely to stigmatize PrEP users as promiscuous. This finding underscores generational differences in attitudes toward HIV prevention and points to the importance of targeted educational efforts to dispel HIV myths and provide accurate information about PrEP efficacy and safety.

Educational attainment emerges as a significant factor influencing stigmatizing attitudes toward PrEP and its users. Contrary to initial assumptions, individuals with higher educational attainment, particularly those holding master's and doctoral degrees, exhibit a higher likelihood of perceiving PrEP users as promiscuous. This trend intensifies with advanced degrees, suggesting a complex interaction between education and perceptions of sexual health practices. One plausible explanation for this finding is that individuals with higher educational attainment may understand PrEP as a preventive measure that enables its users to engage in high-risk sexual behavior including sex without condom and/or with multiple partners, which could otherwise dramatically increase the risk of HIV infection. This nuanced understanding, potentially stemming from an outdated training in public health, epidemiology, and infectious diseases during their educational journeys, may influence perceptions of PrEP users as engaging in behaviors traditionally associated with increased HIV risk. While higher educational attainment is generally associated with critical thinking and evidence-based decision making, challenging stigmas around sexual health [43], this finding suggests that even individuals with the highest levels of education may benefit from targeted and updated training on HIV risks and prevention, particularly concerning PrEP. The perception that PrEP use enables high-risk sexual behavior among highly educated individuals underscores the necessity for comprehensive education specific to HIV prevention strategies. Despite their advanced education in their own professional fields, ongoing education in fields such as public health and epidemiology can enhance

understanding and combat lingering misconceptions about PrEP. To effectively reduce stigma and promote accurate perceptions, continuous education campaigns tailored to the nuances of HIV prevention and PrEP use are crucial. Such initiatives can ensure that even the most educated members of society remain abreast of current research and best practices in the fight against HIV and PrEP stigma.

Racial and ethnic identities are also associated with stigmatizing attitudes toward PrEP. White participants exhibited higher levels of PS compared with Latinx, Native Hawaiian/Pacific Islander, and Black or African American participants. Perhaps this is rooted in the differential prevalence of HIV within racial and ethnic communities in the United States [44]. HIV has disproportionately affected Black and Latinx communities, leading to higher rates of infection and a stronger emphasis on HIV prevention and treatment within these populations [45]. As a result, individuals from these communities may be more knowledgeable about preventive measures like PrEP and more accepting of its use, potentially reducing stigma associated with its adoption. Conversely, white participants may perceive HIV primarily as a disease affecting minoritized populations due to its historical prevalence trends [46]. This perception could contribute to higher levels of stigma toward PrEP among white individuals, stemming from misconceptions or stereotypes about the communities most affected by HIV. This finding resonates with research highlighting the intersection of race, ethnicity, and stigma in healthcare settings [47]. Cultural competence in healthcare delivery and tailored messaging strategies are essential to address racial disparities in PrEP uptake and adherence, emphasizing the need for inclusive practices that respect diverse beliefs and values [14].

3.2. PrEP-Specific Variables and Perceptions of HIV Risk

One unexpected finding of this study is the lack of association between personal acquaintance with PrEP users and decreased PS among participants. Contrary to prevailing assumptions that personal contact with individuals who use PrEP would reduce stigma [48], this finding suggests that familiarity with PrEP users does not necessarily mitigate negative attitudes toward PrEP and its use. Several factors may contribute to this counterintuitive finding. First, stigma is deeply ingrained in societal attitudes and beliefs about HIV and sexual health, which can persist despite personal relationships or direct experiences [49]. Individuals may internalize stigmatizing beliefs from broader mainstream narratives, which outweigh personal interactions with PrEP users. Moreover, the nature of personal relationships with PrEP users could influence stigma perceptions. Participants may know PrEP users in specific contexts (e.g., friends, colleagues, acquaintances) that do not challenge their pre-existing stereotypes or misconceptions about PrEP. Limited exposure to diverse experiences and perspectives of PrEP users may hinder the transformation of stigma-related attitudes. Additionally, the study's findings underscore the complexity of stigma dynamics, suggesting that reducing stigma toward PrEP requires more than individual-level contact alone. Structural and systemic factors, such as healthcare policies, institutional practices, and public health messaging, play significant roles in shaping societal attitudes toward HIV prevention strategies, including PrEP use. Addressing PS effectively requires comprehensive approaches that encompass both interpersonal relationships and broader socio-cultural influences.

Knowledge of PrEP and perceived HIV risk are also significant factors influencing stigmatizing attitudes. Accurate knowledge about PrEP reduces stigma related to assuming HIV-positive status among users, reflecting the pivotal role of education in shaping public perceptions of HIV prevention strategies [38]. On the contrary, participants who perceived themselves to be at higher risk of HIV acquisition were more likely to stigmatize PrEP users, highlighting the interconnectedness of perceived risk, stigma, and personal health behaviors. This phenomenon reflects a broader socio-psychological dynamic where perceptions of personal risk of HIV influence attitudes toward HIV prevention strategies [50], such as PrEP. One potential explanation for this relationship is rooted in psychological defense mechanisms and cognitive biases. Individuals who perceive themselves to be at higher risk

of HIV may experience heightened anxiety or fear related to their own vulnerability. In response, they may engage in cognitive processes that seek to reduce this anxiety, such as distancing themselves from behaviors or individuals associated with HIV risk. This cognitive dissonance can manifest as stigma toward PrEP users, where PrEP use is perceived as confirming the reality of HIV risk rather than as a proactive preventive measure.

A notable finding of this study is regarding the influence of current PrEP use on PS. Specifically, current PrEP users are more likely to express PS associating PrEP use with promiscuity, which highlights a paradoxical relationship where current PrEP users themselves hold stigmatizing beliefs about PrEP and its use. Several factors may contribute to this unexpected finding. First, societal norms and cultural beliefs surrounding sexuality and HIV prevention can perpetuate stigmatizing attitudes toward individuals who use PrEP. Despite PrEP being a highly effective tool in preventing HIV transmission, misunderstandings or misinformation about its purpose and usage may lead to negative perceptions, even among those who benefit from its protective effects. Perhaps the historical context of PrEP's introduction may have contributed to the persistence of stigmatizing beliefs among both users and non-users. PrEP was initially positioned as a preventive measure primarily for individuals engaging in high-risk sexual behavior, such as condomless sex and sex with multiple partners. This historical framing, though effective in targeting those at highest risk of HIV transmission, inadvertently reinforced stereotypes linking PrEP use with promiscuity and risk-taking behavior. Although PrEP has become more widely recognized and utilized across diverse populations, including individuals in stable serodiscordant and mixed-status relationships, the association with risk behavior persists in public perception. Alternatively, PS among current PrEP users may be influenced by personal or internalized stigma or even changes in sexual behavior or status of their relationships. Individuals may internalize societal prejudices or fears about being labeled as sexually promiscuous or at higher risk of HIV due to their PrEP use. This internalized stigma can affect self-perception and contribute to the perpetuation of stigmatizing beliefs within the community.

These misconceptions overlook the broader spectrum of reasons why individuals may choose PrEP, such as proactive sexual health management. Addressing these lingering perceptions is crucial for reducing stigma and promoting equitable access to PrEP. Education campaigns must emphasize that PrEP is a tool for everyone at risk of HIV, regardless of their sexual behavior, relationship status, or identity. By reframing PrEP as a proactive and responsible choice in HIV prevention, stakeholders can challenge stereotypes and empower individuals to make informed decisions about their sexual health.

Finally, the finding that perception of responsible sexual behavior among PrEP users is significantly associated with perceiving them as promiscuous sheds light on complex attitudes toward sexual health practices and HIV prevention strategies. Individuals who perceive PrEP users as responsible in their sexual behavior may paradoxically harbor stigmatizing beliefs that PrEP use signifies promiscuity. Perhaps this perception stems from societal norms and stereotypes surrounding sexual health, where the use of preventative measures like PrEP may be misinterpreted as indicative of multiple sexual partners and other risky sexual behaviors. One possible explanation for this finding is the intersection of moral judgments and perceptions of risk in sexual behavior [51]. Those who view PrEP users as responsible in their sexual health practices may hold higher expectations regarding sexual behavior norms, perceiving any deviation from these norms, such as PrEP use, as evidence of promiscuity. This dichotomy reflects broader societal attitudes toward sexuality and health-seeking behaviors, where individuals who take proactive measures to protect themselves against HIV may still face moral scrutiny and stigma.

3.3. Practical Implications and Recommendations

The findings from this study highlight critical avenues for addressing PrEP use stigma through targeted interventions, educational initiatives, and policy measures. Educational programs should prioritize reaching younger individuals, who were found to associate PrEP use with promiscuity more frequently. This demographic's perceptions underscore the

importance of dispelling misconceptions through comprehensive education campaigns that emphasize the role of PrEP in HIV prevention without perpetuating stereotypes. Previous research in HIV stigma literature suggests that misinformation and negative perceptions can hinder the uptake of preventive measures like PrEP [52]. Therefore, interventions should focus on correcting these misperceptions to encourage informed decision making and promote PrEP acceptance. Further, improving PrEP literacy is essential in combating stigma related to assumed HIV-positive status among users. Studies indicate that accurate knowledge about PrEP can mitigate fears and misconceptions about its implications for HIV status and sexual behavior [53,54]. Efforts to enhance PrEP knowledge should target both the general population and healthcare providers, ensuring that they are equipped to provide accurate information and support to current, former, and potential PrEP users. Building on existing HIV stigma research, interventions should integrate strategies to enhance public understanding of PrEP's efficacy and safety, thereby fostering a supportive environment conducive to PrEP uptake.

Cultural competence in messaging is crucial, as evidenced by variations in stigma across racial and ethnic groups identified in the study [55]. White participants were more likely to hold stigmatizing views compared with Latinx, Native Hawaiian/Pacific Islander, and Black or African American participants. Literature on HIV and PrEP use stigmas emphasizes the role of cultural beliefs and community norms in shaping attitudes toward preventive measures. Tailoring messages to resonate with diverse cultural backgrounds can enhance receptivity to PrEP, emphasizing its benefits while respecting cultural values and addressing specific concerns that contribute to stigma.

Addressing perceived HIV risk is another critical component of stigma reduction efforts. Participants who perceived themselves to be at higher risk of HIV acquisition were more likely to stigmatize PrEP users based on assumptions about sexual behavior and HIV status. Interventions should incorporate personalized risk assessments to empower individuals in making informed decisions about HIV prevention strategies, including PrEP. By addressing misconceptions and fears related to HIV risk, these efforts can help diminish stigma associated with PrEP use and promote its uptake and adherence among those who could benefit most from it.

Supporting marginalized groups, particularly transgender individuals who exhibit higher levels of stigma toward PrEP use in this study, requires tailored interventions that recognize and address unique challenges faced by these communities. The literature emphasizes the intersectionality of stigma, where gender identity, race, and socioeconomic status intersect to shape experiences of discrimination and healthcare access. Policy initiatives should advocate for inclusive healthcare practices and legal protections against stigma based on sexual orientation, gender identity, and HIV status, aligning with recommendations from HIV stigma research to promote equity in healthcare and support services [42].

In sum, by correcting misconceptions, promoting cultural competence in messaging, enhancing PrEP literacy, addressing perceived HIV risk, and supporting marginalized communities, public health efforts can create a more supportive environment for PrEP users. These initiatives not only contribute to reducing HIV transmission but also advance broader goals of health equity and social justice in HIV prevention.

4. Limitations

This study is not without limitations. A significant limitation of this study is the inclusion of a mixed-age sample ranging from adolescents to adults (13–34 years old). While this age range captures a broad spectrum of perspectives on PrEP use stigma, it also introduces variability in life experiences, developmental stages, and legal capacities across participants. Adolescents and young adults may perceive PrEP, its use, and its associated stigma differently than older adults, influenced by factors such as social norms, parental influence, and access to sexual health information. Future research should consider

stratifying samples by age to better understand age-specific perceptions and experiences of PrEP use stigma.

Another limitation is the reliance on self-reported data, which may introduce response biases and inaccuracies. Participants' willingness to disclose sensitive information about their attitudes toward PrEP and HIV-related stigma could be influenced by social desirability bias or fear of judgment. Future studies could employ mixed-method approaches, combining quantitative surveys with qualitative inquiries, to triangulate findings and enhance the validity and reliability of results.

Moreover, the study's data collection method via online surveys may have limited the inclusion of individuals who lack internet access or digital literacy skills, potentially excluding marginalized populations who face higher levels of stigma or barriers to healthcare access. Utilizing diverse recruitment strategies, such as community-based participatory research or outreach programs, can help mitigate sampling biases and ensure broader representation of PrEP users from diverse socio-economic backgrounds and identities.

Further, another important consideration is the nature of participants' contact with PrEP users, which may influence PS. Despite expectations, this study found that knowing people who use PrEP did not decrease participants' perception of stigma toward PrEP. However, due to its limitations, this study did not properly capture the quality and depth of relationships with PrEP users, which might influence the effectiveness of personal contact in reducing stigma. Future research could explore how different types of relationships and contexts of interaction with PrEP users impact PS.

One more limitation of this study is the lack of data on several crucial and potentially confounding socio-demographic variables, including income, healthcare access and utilization, health insurance status, geographic location, religiosity, social support, and personal experiences related to PrEP usage [21]. These variables are known to play critical roles in influencing not only the uptake and adherence to PrEP but also its overall effectiveness in HIV prevention. The absence of these variables as potential confounders in this study restricted our analysis. Future research should prioritize incorporating these socio-demographic factors to better elucidate their role as potential confounders and to understand their direct influence on PrEP usage outcomes.

Lastly, the study's cross-sectional design restricts the ability to establish causal relationships between variables. Longitudinal studies tracking changes in PS over time among PrEP users could provide valuable insights into the dynamic nature of stigma and its impact on PrEP adherence. Additionally, examining contextual factors such as policy changes and community-level interventions can elucidate how external influences shape PS related to PrEP.

5. Conclusions

This study focused on perception of stigma attached to PrEP users. Three of our findings are interesting and somewhat alarming. First, contrary to expectations, knowing people who use PrEP does not decrease perception of stigma among participants. Hence, strategies that seek to normalize the sharing of one's PrEP use history [56,57] might not be as effective as is currently assumed. Second, and the more worrisome outcome, is the perception of stigma expressed by PrEP users. This shows that those using PrEP are more likely to hold negative expectations associated with their PrEP use, which can explain the weak adherence among young PrEP users. Perhaps this perception of stigma is enforced or validated by PrEP advertising campaigns that seek to reach out to those who engage in behaviors that increase their vulnerability to HIV. If so, it is best to reframe these campaigns with the subsequent goal of PrEP, which is to significantly reduce new HIV infections by 2030. This way, PrEP will appear as a tool to combat a decades-long epidemic instead of a treatment to accommodate those with high-risk sexual behavior. Finally, perception of stigma is strong among those who believe that their sexual behavior puts them at risk of acquiring HIV. This finding is particularly important for public health messaging campaigns that encourage PrEP uptake. Perhaps, instead of highlighting the benefits of

PrEP repeatedly, public health messaging can shift its focus to decreasing the perception of PrEP stigma among those vulnerable to HIV. This can be achieved via sex-positive messaging with the goal of disassociating PrEP from promiscuity while emphasizing its use among those vulnerable to HIV.

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Institutional Review Board Statement: All study activities were approved and overseen by Cook County Health's (CCH) Institutional Review Board (IRB #17-555-CORE) on 19 April 2022, and are in accordance with the Helsinki Declaration of 1964 and its later amendments or comparable ethical standards. The study operated under a federal certificate of confidentiality issued y the US National Institute of Health.

Informed Consent Statement: Potential participants who met the inclusion criteria were directed to an electronic consent form to read and sign. Only one enrollment was allowed per IP address to ensure that individuals were enrolled only once. In addition, participants agreed to disclose their name, date of birth, street address, phone number, and email through a secure, Health Insurance Portability and Accountability Act-compliant system. This information was reviewed by the study staff to ensure that the participant was not previously enrolled before a unique participant ID number was assigned.

Data Availability Statement: The data presented in this study may be made available by request, but are not publicly available due to privacy restrictions.

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