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Pre-Exposure Prophylaxis Stigma and Beliefs in the Efficacy of Pre-Exposure Prophylaxis: An Analysis of a Cross-Sectional Survey of Male Couples in the United States

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Abstract

Increasing the use of pre-exposure prophylaxis (PrEP) among male couples is critical to the success of the United States' *Ending the HIV Epidemic* campaign. By leveraging dyadic data from a larger cross-sectional study of male couples, the present analysis examined individual, partner, and relationship characteristics associated with PrEP stigma and perceived efficacy of PrEP. Actor–Partner Independence Models were fit separately for both outcomes. Individual and partner risk behaviors, including substance use, binge drinking, and higher number of condomless casual sex partners, were associated with lower levels of both PrEP stigma and belief in the efficacy of PrEP. Networks that supported PrEP use were associated with decreased PrEP stigma and increased belief in PrEP efficacy. Stigma-informed PrEP interventions for couples should be considered foundational to the success of the United States' *Ending the HIV Epidemic* campaign.

Key words: male couples, HIV, PrEP, stigma

Central to the success of the U.S. Department of Health and Human Services' *Ending the HIV Epidemic: A Plan for America* (Centers for Disease Control and Prevention [CDC], 2020) initiative to reduce new HIV infections in the United States by 90% by 2030 is achieving significant increases in pre-exposure prophylaxis (PrEP) use among gay, bisexual, and other men who have sex with men (GBMSM). Recently, there are indications that PrEP knowledge has increased among GBMSM, with increases in PrEP awareness of approximately 50% between 2014 and 2017. The use of PrEP increased among GBMSM during 2014 and 2017 by approximately 500%, from 6% to 35% (Finlayson et al., 2019). During this period, significant increases in PrEP use were observed among African American/Black, Hispanic, and young (ages 18–29 years) GBMSM (Finlayson et al., 2019). By 2017, differences in PrEP use between Hispanic (30%) and White (42%) GBMSM and between young (<29 years, 32%) and older (>30 years, 38%) GBMSM were no longer apparent controlling for income, health insurance, and geographic region (Finlayson et al., 2019). However, a wide disparity continues in PrEP use between African American/Black (26%) and White (42%) GBMSM (Finlayson et al., 2019). Furthermore, levels of PrEP use remain suboptimal among all GBMSM, and annual new HIV diagnoses have only decreased by 5% among GBMSM (CDC, 2019).

Significant research attention has focused on the role of PrEP stigma as a barrier to the uptake of PrEP among GBMSM (Calabrese et al., 2012; Eaton et al., 2017; Elopre et al., 2017; Kanny et al., 2019). PrEP stigma may take the form of anticipated stigma (i.e., beliefs that PrEP is associated with sexual promiscuity) or enacted stigma (i.e., negative attitudes from providers when discussing PrEP; Mustanski et al., 2014; Mutchler et al., 2015; Philbin et al., 2016). PrEP stigma has been shown to directly affect PrEP behaviors, including PrEP adoption, suboptimal adherence, discontinuation, and a lack of disclosure of PrEP use to peers (Brooks et al., 2019; Collins et al., 2017; Dubov et al., 2018; Eaton et al., 2017; Mimiaga et al., 2014). Brooks et al. (2019) demonstrated in their interviews with 29 Latino GBMSM that stigmatizing beliefs included issues of behavioral

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decompensation (perceptions that PrEP users engage in risky sexual behaviors), shaming (that PrEP users are living with HIV), and provider attitudes (experiences of judgment or homophobia from medical providers). Similarly, Eaton et al. (2015) surveyed GBMSM at a large gay pride event in Atlanta, Georgia (USA) and found that many GBMSM were not interested in adopting PrEP because they associated it with sexual promiscuity. These negative stereotypes around PrEP have been shown to be a significant deterrent to PrEP uptake (Ayala et al., 2013). However, the presence of social support has been shown to ameliorate the effect of PrEP stigma on PrEP uptake. Kuhns et al. (2017) demonstrated that young GBMSM with social networks that comprised other young GBMSM were more likely to use PrEP, suggesting that social networks may provide a source of social support, information sharing, and resource sharing for PrEP use (Holt et al., 2019; Khanna et al., 2016; Pulsipher et al., 2016).

Mistrust about the efficacy of PrEP may diminish potential users' beliefs in the validity of PrEP as an effective HIV prevention option. Several studies have identified medical mistrust as a barrier to uptake among GBMSM (Cahill et al., 2017; Tekeste et al., 2019). Olansky et al. (2020) found that conspiracy beliefs (e.g., the PrEP was a method for controlling sexual behavior) around PrEP were more common among African American/Black than Latino GBMSM, and among younger (18–29 years) men than older men (30–39 years).

With the recognition that between one third to two thirds of incident HIV infections among GBMSM were from their primary partners (Goodreau et al., 2012; Sullivan et al., 2009)—although these modeling estimates are now a decade old—there has been an increased focus of research on understanding how stigma may influence PrEP adoption among male couples (Gamarel & Golub, 2020). PrEP use has been shown to be higher among couples who are serodiscordant for HIV than for couples where both individuals are without HIV (Golub et al., 2019), reflecting the use of PrEP as a strategy for the prevention of HIV within dyads. Evidence to date suggests that many partnered men do not support PrEP use due to fears that it would undermine the fidelity of their relationship. In focus group discussions with young African American/Black GBMSM, Quinn et al. (2020) showed that participants perceived PrEP use as an indication of distrust and infidelity. Similarly, Starks et al. (2019) in their study of 67 male couples reported that although all types of couples identified some circumstances in which they would consider PrEP, concerns remained that PrEP use may be seen as threatening the trust and legitimacy of the relationship. PrEP use among couples has also been shown to be related to the presence and form of their sexual agreements—the rules that men make about sex that is or is not allowed outside of their relationship (Kahle et al., 2020). John et al. (2018) noted that men in monogamous relationships perceive PrEP use to be less important for their partner compared with men in nonmonogamous relationships, and Mimiaga et al. (2014) demonstrated that some GBMSM express concerns that PrEP use will lead to violations of their sexual agreements.

In this article, we build on this literature through analysis of dyadic data from a large cross-sectional survey of male couples to examine factors associated with perceptions of PrEP stigma and perceived efficacy of PrEP. With suboptimal uptake of PrEP among GBMSM, particularly among male couples, this information is vital to inform the content of HIV prevention messaging and prevention interventions that aim to increase PrEP use among male couples.

Methods

The present analysis uses data from Project Couples Health and Attitudes toward PrEP (CHAPS), an online survey with U.S. male couples who are either concordant HIV seronegative or serodiscordant. Specifically, a subsample of CHAPS, representing 750 individuals/375 male couples (Table 1), was used to assess interdependent dyadic associations with PrEP stigma and PrEP efficacy via two Actor–Partner Independence Models (APIM; Cook & Kenny, 2005). Information on the recruitment and verification processes used to enroll male couples for the parent study has been previously described (Mitchell et al., 2020a; Stephenson et al., 2020). The study protocol for CHAPS was approved by the University of Michigan Institutional Review Board (HUM00125711).

Recruitment

Briefly, participants were recruited online, with advertisements placed on both social media websites (i.e., Facebook, Instagram) and dating websites/mobile apps (i.e., Scruff and Grindr). Social media advertisements included visual representations of a diverse range of male couples, with diversity in age, race, and ethnicity represented in the advertisements. The text in the advertisements did not mention PrEP, so as to avoid selection bias, and instead referred to the study as a study on the health of same-sex male couples (i.e., "Are you and your man on the same page about HIV prevention? We want to know, take our survey!").

Table 1. Demographic, Relationship Characteristics, and Behavioral Risk Factors Among Partnered Gay, Bisexual and Other Men Who Have Sex With Men (n = 750 Individuals/N = 375 Male Couples)

	Individual	Couple
	n (%)	Partners Report the Same Characteristic, *n* (%)[a]
Age (years)		251 (67.0)
18–24	114 (15.2)	
25–34	448 (59.8)	
35–44	143 (19.1)	
≥45	45 (6.0)	
Education		178 (47.4)
Up to high school	45 (6.4)	
Some college/technical school	169 (22.5)	
College graduate	271 (36.1)	
Graduate education and above	262 (34.9)	
Employment		266 (70.8)
Full time	611 (81.4)	
Part time	85 (11.3)	
Unemployed/retired	25 (3.3)	
Race/ethnicity		244 (65.1)
Non-Hispanic White	560 (74.7)	
African American	107 (14.2)	
Asian American	28 (3.7)	
Hispanic White	55 (7.3)	
Sexual orientation		329 (87.9)
Gay/homosexual	691 (92.1)	
Bisexual/queer/other[b]	59 (79)	
Reports binge drinking in the past 3 months		227 (60.5)
Yes	552 (73.6)	
No	198 (26.4)	
Reports substance use in the past 3 months		288 (76.7)
Yes	401 (53.4)	
No	349 (46.6)	
Number of partners with whom they have had condomless anal sex partners in the past 6 months	4.2 (0–50)	18 (4.7)
Relationship length		375 (92.0)

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Table 1. (*continued*)

	Individual	Couple
	n (%)	Partners Report the Same Characteristic, *n* (%)[a]
More than 3 months but less than 1 year	92 (12.3)	
1 year to less than 3 years	250 (33.3)	
3 years to less than 5 years	159 (21.2)	
More than 5 years	249 (33.2)	
Currently cohabits with their partner		375 (100.0)
Yes	614 (81.8)	
No	136 (18.2)	
Relationship HIV status		375 (100.0)
Both partners are without HIV	623 (83.0)	
One partner is living with HIV	127 (17.0)	
Interracial relationship		375 (100.0)
Yes	250 (33.3)	
No	500 (66.7)	
Sexual agreement with partner		48 (12.9)
No agreement	304 (40.5)	
Closed	212 (28.3)	
Open with or without guidelines	235 (31.3)	
Has ever used PrEP	164 (21.8)	31 (8.2)
Willingness to use PrEP in the future		63 (16.9)
Very unlikely	170 (22.6)	
Unlikely	281 (37.4)	
Likely	194 (25.9)	
Very likely	104 (13.9)	
Perceived effectiveness of PrEP for preventing HIV (efficacious prevention strategy)		70 (18.7)
Minimally effective	57 (7.6)	
Somewhat effective	224 (29.8)	
Very effective	470 (62.6)	
	***M*, Range**	**Partners Report the Same Characteristic, *n* (%)[a]**
Depressive symptomology	17.9, 12–27	49 (13.1)
Recent experiences of internalized homophobia	18.3, 8–37	49 (13.1)

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Table 1. (*continued*)

	M, Range	Partners Report the Same Characteristic, *n* (%)[a]
Recent experiences of sexuality-based stigma	23.5, 13–57	250 (66.6)
PrEP stigma	21.02, 5–25	189 (50.4)

Note. PrEP = pre-exposure prophylaxis.
[a] Partner reports the same characteristic: for example, if Partner A reports that they are unemployed and Partner B reports they are also unemployed, then they report the same characteristic. Or, if Partner A reports they are White and their partner is African American/Black and their partner reports the same information, then they have agreement on this variable.
[b] Other sexuality refers to any other identity written in the survey by participants.

Eligibility

Each member of the couple had to screen and achieve eligibility individually. Eligibility included: (a) cisgender male identity (assigned male at birth and currently identifies as male), (b) being in a relationship with another cisgender male for 3 or more months, and (c) having had condomless anal sex (CAS) with their primary relationship partner within the last 3 months (Mitchell et al., 2020a; Stephenson et al., 2020). Once the individual participant had provided consent, they were directed to the partner referral system, in which they entered contact information and a name for their partner (Partner B). Partner B then received an email informing him that his partner (Partner A) had signed up for the study and had provided his contact information along with a link to a landing page to access the same screener and consent process (Mitchell et al., 2020a; Stephenson et al., 2020). The link provided to Partner B was connected to Partner A's metadata such that their survey responses were both assigned the same randomly generated study ID number as a hidden data field (a couple level ID number). After both partners were consented, individual emails were sent to each partner asking them to complete an online survey via a unique link with their study ID embedded. Each partner was compensated $50; compensation was not dependent on both partners completing the survey.

Advertisements on social media generated 221,258 impressions (number of times the advertisements were shown on a social medial page) between October 2017 and January 2018, resulting in 4,589 clicks (clicks are not necessarily unique to individuals). Of the 4,589 clicks, 3,826 individuals (83.3%) were assessed for eligibility. Of these, 2,740 were either unmatched or ineligible: 1,293 (33.8%) were unlinked due to their partner not enrolling into the screening, 48 (2.0%) had incomplete partner data because at least one partner did not finish the survey, 22 (0.9%) were ineligible due to one partner not meeting the eligibility criteria, 492 individuals (12.9%) were fraudulent (as determined using the Spokeo software, a search engine that checks social media and public records to verify identity), and 885 (23.2%) started the screening but did not provide any responses and were therefore deemed invalid. In total, 1,086 individuals, representing 543 complete couples (28.4%), were matched, met all eligibility criteria, and completed the survey. To better understand the factors associated with perceptions of PrEP stigma and PrEP efficacy, a subsample consisting of 750 individuals/375 male couples was used for the present analysis (see Analysis).

Survey Measures

The survey took approximately 35 min to complete and included measures of individual characteristics of age, race, ethnicity, education attainment, employment status, sexual orientation, and self-reported HIV status. Participants were asked if they had heard of PrEP ("PrEP refers to taking a pill called PrEP–also called Truvada–everyday to reduce your risk of acquiring HIV"; the survey was conducted before the availability of Descovy). All participants, regardless of PrEP use, were asked to report on perceptions of PrEP stigma and efficacy of PrEP. PrEP stigma was measured using the five-item, validated PrEP Stigma Scale (sample Cronbach alpha = 0.77) with response options of *strongly agree* (1), *strongly disagree* (2), *neither agree nor disagree* (3), *agree* (4), and *strongly agree* (5; Fortenberry et al., 2002). The five scale items were: (a) *I would feel dirty if a doctor recommended PrEP to me*, (b) *Someone who takes PrEP is probably promiscuous*, (c) *Most people I know think that taking PrEP is a sign of a weak character*, (d) *If you're on PrEP you probably have a sexually-transmitted infection*, and (e) *Taking PrEP means you have poor morals*. PrEP efficacy was measured using the item, *How effective do you think PrEP is at preventing HIV?*, with response options of *very effective* (1), *somewhat effective* (2), and *minimally effective* (3).

Relationship characteristics included relationship length, cohabitation status, and dyadic variables calculated to measure differences between partners. Participants were asked whether they and their partner had a sexual agreement (Hoff & Beougher, 2010; Mitchell, 2014): Those who reported having a sexual agreement were asked if the agreement was "closed" (sex with outside partners was not allowed) or "open" (sex with outside partners was allowed with or without restrictions). Participants also reported on their sexual behavior in the preceding 6 months, including sex with their primary partner and any casual sex partners. Participants were asked to report on their level of trust in their partner using the 8-item Dyadic Trust Scale (Larzelere & Huston, 1980; sample Cronbach alpha = 0.68) and their communication style with their partner using the 11-item Communication Patterns Questionnaire Short Form (Christensen, 1987, 1988; Christensen & Sullaway, 1984; sample Cronbach alpha = 0.74).

Two forms of experience of sexuality-based stigma were measured: enacted stigma (Szymanski, 2006; sample Cronbach alpha = 0.73) and internalized homophobia (Smolenski et al., 2010; sample Cronbach alpha = 0.84). Individual experiences of depressive symptomology were measured using the 11-item Iowa short form of the Center for Epidemiologic Studies Depression Scale (sample Cronbach alpha = 0.72; Carpenter et al., 1998). Participants reported their recent (3 months) use of nonprescription drugs and alcohol using the ASSIST scale (sample Cronbach alpha = 0.70) and AUDIT scale (Bush et al., 1998; Saunders et al., 1993; World Health Organization, 2001; sample Cronbach alpha = 0.88).

Knowledge of the HIV epidemic and HIV prevention were also measured. Knowledge of HIV prevention was measured using the 15-item HIV Knowledge scale (Carey & Schroder, 2002; sample Cronbach alpha = 0.87). Perceptions of individual risk for acquiring HIV were measured using the 8-item Perceived Risk of HIV scale (Napper et al., 2012; sample Cronbach alpha = 0.78). Participants were asked to estimate the prevalence of HIV among GBMSM in the United States using a sliding scale from 0% to 100%. Perceived support from friends for PrEP use was measured using two items, *How many of your gay or bisexual friends are currently using PrEP*? and *How many of your gay and bisexual friends would support you using PrEP?*, with response options of *none of them* (1), *a few of them* (2), *almost all of them* (3), and *all of them* (4).

Analysis

Analysis considered two outcomes: (a) perceptions of PrEP stigma (continuous) and (b) perceptions of PrEP efficacy (ordinal). Perceptions of PrEP stigma is measured as a continuous variable, with a range of 5–25 (5 items, each scored from 1 to 5). Perceptions of PrEP efficacy are measured as an ordinal variable, with a range of 1–3 (1 = *very effective*, 2 = *somewhat effective*, and 3 = *minimally effective*). Of the 1,086 individuals/543 couples, 120 participants (11% of the sample) had missing data on potential correlates (e.g., substance use) of the outcomes, resulting in a potential analysis sample of 966 individuals/483 couples. There were no demographic differences (age, education, or race/ethnicity) or behavioral differences (recent sexual behavior, substance use, or use of PrEP) between the complete sample of 1,086 and the sample of 966 without missing data. Further, 216 individuals (22%) reported ever using PrEP. To understand factors associated with PrEP stigma and efficacy among those not using PrEP—so as to understand potential barriers to PrEP use—the present analysis further restricted the sample to include only those who reported not ever using PrEP, resulting in an analytic subsample of 750 individuals/375 couples for the APIMs. Sensitivity analysis showed no demographic (race [$p = .471$], ethnicity [$p = .148$], age [$p = .714$], employment [$p = .621$], education [$p = .713$]), behavioral (recent risky sex [$p = .357$], substance use [$p = .178$]), and engagement in HIV prevention (recent HIV testing [$p = .513$] and knowledge of PrEP [$p = .846$]) between the total sample and the sample of 750 individuals/375 couples who had never used PrEP.

To assess interdependent dyadic associations with PrEP stigma and efficacy, the analysis employed an APIM approach to simultaneously estimate the effect of an individual's characteristics (actor effects: Partner A) and his partner's characteristics (partner effect: Partner B) on each of the outcomes (Cook & Kenny, 2005). An APIM model recognizes the interdependence in two-person relationships with the appropriate statistical techniques to measure and test actor and partner effects (Cook & Kenny, 2005; Kenny et al., 2006). APIMs are used in dyadic analysis when the data set consists of indistinguishable dyads (in this case, male couple) and allows the assessment of the variance, not only between dyads but also within the dyad when members are distinguishable on a known variable. APIM models estimate two effects, the actor and the partner.

An actor effect estimates the affect that Partner A's characteristics has on one of the PrEP outcomes for Partner A. A partner effect estimates the affect that Partner B's characteristics has on one of the PrEP outcomes for Partner A or the affect that Partner A's characteristics has on one of the PrEP outcomes for Partner B (Cook & Kenny, 2005; Kenny et al., 2006). For

example, an APIM can consider the effect of Partner A's race on their own PrEP use but also the independent effect of their partner's race on their own PrEP use. Multilevel generalized linear mixed models were used to estimate actor effects of characteristics for both PrEP outcomes, as well as to estimate partner effects of characteristics for both PrEP outcomes: PrEP stigma and PrEP efficacy. Two models were fit: one model to the outcome of perceptions of PrEP stigma and one model to the outcome of perceptions of PrEP efficacy. Each of the models included all the actor, partner, and relationship factors. All models accounted for the interdependence of individual participants nested within indistinguishable dyads and included a random intercept for the dyad. Statistical analyses were conducted using STATA v15.

Sample power. An effective N strategy in power analysis was used to account for the intraclass correlation associated with individuals being nested within a couple. With continuous PrEP outcomes, the analytic sample has 80% power to uncover a small effect of $f^2 = 0.027–0.029$ depending on the intraclass correlation. This equates to 2.6–2.8% shared variance. Statistical analysis was conducted assuming a two-sided 5% level of significance. We calculated the sample size for a mixed linear hierarchical model: The minimum desired sample size was 129, hence the sample size of 750 individuals/375 couples provides 80% statistical power to detect a small effect size (0.2), with probability of 0.5, and the inclusion of 38 explanatory variables in a nested model (with individuals nested within couples).

Results

Characteristics of 750 Individuals and 375 Male Couples

The subsample of partnered men was mostly non-Hispanic White (74.7%), between the ages of 25 and 34 years (59.8%) and employed fulltime (81.4%). More than two thirds of men had a Bachelor's or graduate degree. Many of the participants identified as gay (92.1%). The largest proportion of relationship lengths was between 1 and 3 years (33.3%), and those greater than 5 years (33.2%). Most men reported cohabiting with their partner (81.8%). Almost one-in-five men reported being in an HIV serodiscordant relationship (17.0%).

In sexual agreements, 40.5% of participants reported not having a sexual agreement; 28.3% reported they had a closed agreement; and 31.3% reported they had an open sexual agreement with their partner. Men reported high levels of HIV-related risk behaviors: Almost three quarters of participants reported at least one episode of binge drinking in the past 3 months (73.6%) and 53.4% reported some substance use in the past 3 months (more than 60% of all reported substance use was marijuana). Within couples, partners had high concurrence on several key relationship factors: relationship length (92.0%), cohabitation, HIV status, and interracial relationship (all 100% concurrence). Partners reported relatively similar levels of binge drinking and substance use (60.5 and 76.7% concurrence, respectively). However, partners reported widely different levels of number of recent CAS partners (4.7% concurrence), depressive symptomology (13.1% concurrence), and recent experience of sexuality-based stigma (internalized homophobia 13.1% and experiences of stigma 8.5% concurrence). In PrEP, 34.9% of the sample included couples in which both partners report the same perceived ability to adhere to PrEP.

Perceptions of PrEP Stigma and Efficacy and Willingness to Use PrEP

In future likelihood of PrEP use, 13.9% reported that they were very likely to use PrEP, 25.9% were likely, 37.4% unlikely, and 22.6% very unlikely. The average score on the PrEP stigma scale was 21.02 (range, 5–25). The majority of participants reported that PrEP was very effective (62.6%); 29.8% reported it to be somewhat effective; and 7.6% reported it to be minimally effective.

Actor–Partner Effects on PrEP Stigma and Perceptions of PrEP Efficacy

Men older than 45 years reported significantly greater perceived efficacy of PrEP than younger men (ages 18–24 years; $p = .007$), and there was no relationship between age and perceived PrEP stigma (Table 2). Men with college level education or higher reported greater perceptions of PrEP stigma (college graduate, $p = .003$; greater than college graduate, $p = .004$); although education was not significantly associated with perceptions of PrEP efficacy. African American/Black ($p = .021$) and Hispanic White ($p = .013$) reported significantly greater perceptions of PrEP stigma than non-Hispanic White men, and African American/Black men reported lower perceptions of PrEP efficacy than non-Hispanic White men ($p = .010$).

Men who reported recent substance use or binge drinking reported lower levels of perception of PrEP stigma (substance use, $p = .003$; binge drinking, $p = .012$) but also reported lower levels of perceptions of PrEP efficacy (substance use, $p = .011$; binge drinking, $p \leq .001$). The same patterns were observed with partners'

Table 2. Individual, Partner, and Relationship Correlates of Perceived PrEP Stigma and Perceived Efficacy of PrEP Among Male Couples (n = 750 Individuals/N = 375 Couples)

	Perceived PrEP Stigma Beta Coefficient (SE), p Value	Perceived Efficacy of PrEP Beta Coefficient (SE), p Value
Actor effects		
Age (years)		
18–24	—	—
25–34	−0.311 (0.365), 0.391	0.02 (0.087), 0.784
35–44	−0.251 (0.464), 0.588	−0.188 (0.111), 0.090
≥45	−0.113 (0.650), 0.862	*0.275* (*0.123*), *0.007*
Education		
Up to high school	—	—
Some college/technical school	0.891 (0.551), 0.100	−0.050 (0.133), 0.760
College graduate	*1.058* (*0.341*), *0.003*	−0.003 (0.130), 0.977
Graduate education and above	*1.331* (*0.243*), *0.004*	−0.193 (1.334), 0.148
Employment		
Full time	—	—
Part time	0.349 (0.418), 0.403	0.013 (0.091), 0.880
Unemployed/retired	0.542 (0.439), 0.218	0.093 (0.097), 0.338
Race/ethnicity		
Non-Hispanic White	—	—
African American, Asian, and other	*0.776* (*0.341*), *0.021*	*−0.208* (*0.080*), *0.010*
Hispanic White	*0.294* (*0.132*), *0.013*	−0.043 (0.111), 0.698
Sexual orientation		
Gay/homosexual	—	—
Bisexual/queer/other[a]	0.417 (0.409), 0.719	0.054 (0.098), 0.579
Reported binge drinking in past 3 months	*−0.141* (*0.063*), *0.012*	*−0.881* (*0.076*), *0.000*
Reported substance use in past 3 months	*−0.337* (*0.097*), *0.003*	*−0.687* (*0.056*), *0.011*
Testing history for HIV		
Past 3 months	—	—
6 months to 1 year	0.008 (0.282), 0.998	−0.026 (0.063), 0.696
1–2 years	*−0.555* (*0.212*), *0.040*	−0.004 (0.084), 0.956
≥3 years	*−0.593* (*0.142*), *0.018*	*0.274* (*0.101*), *0.007*
Number of partners with whom they have had condomless anal sex in the past 6 months	*−0.046* (*0.013*), *0.000*	0.020 (0.021), 0.330

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Table 2. (*continued*)

	Perceived PrEP Stigma	Perceived Efficacy of PrEP
	Beta Coefficient (SE), *p* Value	**Beta Coefficient (SE), *p* Value**
HIV knowledge scale	0.073 (0.081), 0.559	*0.075* (*0.019*), *0.000*
HIV stigma scale	*0.110* (*0.045*), *0.016*	0.003 (0.004), 0.484
Perceived risk of HIV acquisition	*−0.254* (*0.025*), *0.000*	*−0.075* (*0.005*), *0.011*
Recent experience of internalized homonegativity	*0.138* (*0.033*), *0.000*	−0.005 (0.008), 0.947
Recent experience of enacted sexuality-based stigma scale	0.002 (0.016), 0.886	*0.008* (*0.003*), *0.004*
Perception of number of gay male friends who are currently using PrEP	−0.061 (0.066), 0.355	*0.031* (*0.014*), *0.004*
Perception of number of gay male friends who would support PrEP use	*−0.318* (*0.074*), *0.000*	*0.034* (*0.015*), *0.005*
Perceived HIV positive rate among GBMSM nationally	*−0.223* (*0.076*), *0.005*	0.020 (0.039), 0.604
Recent experience of depressive symptomology	−0.085 (0.053), 0.121	0.004 (0.009), 0.670
Relationship length		
More than 3 months but less than 1 year	—	—
1 year to less than 3 years	−0.054 (0.401), 0.891	0.093 (0.096), 0.330
3 years to less than 5 years	−0.092 (0.452), 0.839	0.124 (0.108), 0.252
More than 5 years	−0.001 (0.454), 0.997	0.037 (0.108), 0.727
Currently cohabits with their partner	−0.74 (0.347), 0.829	*0.171* (*0.083*), *0.041*
Relationship HIV status		
Both partners are without HIV	—	—
One partner is living with HIV	*0.830* (*0.401*), *0.040*	0.166 (0.099), 0.095
Interracial relationship	*−0.456* (*0.201*), *0.013*	−0.059 (0.063), 0.346
Sexual agreement with partner		
No agreement	—	—
Closed	*0.240* (*0.045*), *0.009*	*−0.632* (*0.073*), *0.026*
Open with or without guidelines	*0.267* (*0.028*), *0.007*	*−0.154* (*0.068*), *0.024*
Communication patterns	−0.086 (0.057), 0.162	−0.012 (0.013), 0.350
Dyadic trust (toward partner)	*−0.129* (*0.051*), *0.011*	−0.007 (0.012), 0.520
Partner effects		
Partner reported binge drinking in past 3 months	*−0.326* (*0.015*), *0.000*	*−0.234* (*0.101*), *0.004*

(*continued on next page*)

Table 2. (*continued*)

	Perceived PrEP Stigma Beta Coefficient (SE), *p* Value	Perceived Efficacy of PrEP Beta Coefficient (SE), *p* Value
Partner reported substance use in past 3 months	*−0.098* (*0.034*), *0.014*	*0.265* (*0.076*), *0.003*
Partner's HIV knowledge scale	−0.027 (0.345), 0.678	0.078 (0.045), 0.458
Partner's HIV stigma scale	*1.342* (*0.115*), *0.000*	*−0.345* (*0.056*), *0.029*
Partner's perceived risk of HIV acquisition	−0.271 (0.235), 0.587	0.067 (0.034), 0.067
Partner's recent experience of internalized homonegativity	0.034 (0.145), 0.762	0.067 (0.045), 0.237
Partner's recent experience of enacted sexuality-based stigma scale	0.456 (0.321), 0.654	*0.012* (*0.003*), *0.002*
Partner's perception of number of gay male friends who are currently using PrEP	*−0.472* (*0.176*), *0.011*	0.123 (0.256), 0.876
Partner's perception of number of gay male friends who would support PrEP use	*−0.345* (*0.086*), *0.005*	0.327 (0.256), 0.987
Partner's perceived HIV positive rate among GBMSM nationally	*−0.452* (*0.137*), *0.007*	0.245 (0.325), 0.187
Partner's number of CAS with casual sex partners	*−0.231* (*0.089*), *0.017*	*−0.276* (*0.067*), *0.005*
Partner's recent experience of depressive symptomology	0.387 (0.237), 0.764	−0.003 (0.013), 0.567

Note. CAS = condomless anal sex; GBMSM = gay, bisexual, men who have sex with men; PrEP = pre-exposure prophylaxis.
[a] Other sexuality refers to any other identity written in the survey by participants. Values in italic are significant ($p < .05$).

reports of recent substance use and binge drinking (perceptions of PrEP stigma: partners' substance use, $p = .014$; partners' binge drinking, $p \leq .001$; perceptions of PrEP efficacy: partners' substance use, $p = .003$; partners' binge drinking, $p = .004$).

Several measures of perceptions of HIV and engagement in HIV prevention were significantly associated with perceptions of PrEP stigma and efficacy. Men who reported not testing for HIV for more than 3 years reported lower levels of perceptions of PrEP stigma ($p = .018$) and higher levels of perceptions of PrEP efficacy ($p = .007$). Men's higher levels of HIV knowledge were associated with increased perceptions of PrEP efficacy ($p \leq .001$), but there was no association with their partners' levels of HIV knowledge. Men and their partners who reported higher levels of anticipated HIV stigma reported higher levels of perceptions of PrEP stigma (men, $p = .016$; partners, $p \leq .001$), but only partners' perceptions of HIV stigma were associated with individual lowered perceptions of PrEP efficacy ($p = .029$). Individual perceptions of HIV acquisition risk were associated with decreased levels of perceptions of PrEP stigma ($p \leq .001$) and perceptions of PrEP efficacy ($p = .011$), but no associations with partners' perceived risk of HIV infection were significant. Men and their partners who reported more condomless outside sex partners in the past 3 months reported lower levels of perceptions of PrEP stigma ($p \leq .001$; partner: $p = .017$), but only the partners' number of recent sex partners was associated with decreased perceptions of PrEP efficacy ($p = .005$).

Men who reported higher levels of internalized homophobia reported higher levels of perceptions of PrEP stigma ($p \leq .001$), but not PrEP efficacy, and there were no associations between the partners' experience of internalized homophobia and perceptions of PrEP stigma and efficacy. However, for both men and their partners,

increased reporting of experiences of external sexuality-based stigma were associated with increased perceptions of PrEP efficacy (men, $p = .004$; partners', $p = .002$). Men who reported that more of their GBMSM friends were using PrEP reported higher levels of perceptions of PrEP efficacy ($p = .004$). For both men and their partners, reporting that more of their GBMSM friends would support PrEP use was associated with reduced perceptions of PrEP stigma (men, $p \leq .001$; partners, $p = .005$). Men and their partners who reported higher levels of HIV prevalence among GBMSM in the United States reported lower levels of perceptions of PrEP stigma (men, $p = .005$; partners, $p = .007$), but there were no associations with perceptions of PrEP efficacy.

In relationship characteristics, men who cohabited reported higher levels of perceptions of PrEP efficacy ($p = .041$). Men in serodiscordant relationships reported greater perceptions of PrEP stigma ($p = .013$) but did not differ to men in concordant negative relationships in their reporting of perceptions of PrEP efficacy. Men in interracial relationships reported lower levels of perceptions of PrEP stigma ($p = .013$). Relative to men in relationships with no sexual agreements, men with monogamous or open relationships reported higher levels of perceptions of PrEP stigma (monogamous, $p = .009$; open, $p = .007$) and decreased levels of perceptions of PrEP efficacy (monogamous, $p = .026$; open, $p = .024$). Men who reported higher levels of trust with their partner reported lower levels of perceptions of PrEP stigma ($p = .011$). The random intercepts for the dyad were not significant after controlling for the actor and partner effects included in the models, indicating that the two outcomes did not have significant clustering within dyads after controlling for the multiple actor and partner effects.

Discussion

Partnered men in this sample reported high levels of HIV risk, with over 50% reporting recent substance use or binge drinking, almost one-third having an agreement for an open relationship, and an average of 4.7 having external sex partners in the past 6 months. Men also reported they perceived PrEP to be an effective strategy for preventing HIV yet also noting that high levels of stigma toward PrEP existed (i.e., an average of 21 on a scale with a range of 5–25).

The correlates of stigma and beliefs in PrEP efficacy identified to some degree corroborate those found in earlier studies. Findings that men with more friends who are using PrEP or they whom they believed would support PrEP had lower PrEP stigma and increased belief in the efficacy of PrEP, which likely reflect the valuable impact of support from friends that provide opportunities to talk through PrEP concerns and share information or resources (Kuhns et al., 2017; Lelutiu-Weinberger et al., 2020). Recent work has shown that GBMSM who perceive higher prevalence of HIV are more likely to test for HIV regularly (Sullivan & Stephenson, 2018), which may provide additional opportunities for them to learn about the effectiveness of PrEP and receive support about it. Although we do not know if men were accurate in their perception of the rate of HIV prevalence among GBMSM, these results may reflect either men with a greater functional knowledge of the HIV epidemic being more likely to engage in HIV prevention, or may represent the "worry-wells," those who perceive heightened risk independent of their own risk behavior.

In this analysis, men who perceived higher prevalence of HIV among GBMSM reported lower levels of PrEP stigma: Perceiving HIV to be highly prevalent may indicate a higher perceived need for PrEP, with these men believing that PrEP is necessary for HIV prevention and thus reducing their perceptions of PrEP stigma. Previous studies have highlighted the increased structural (lack of insurance, institutional racism) and individual (mistrust of medical institutions) barriers to PrEP use experienced by African American/Black GBMSM (Cohen et al., 2015; Eaton et al., 2015; Galindo et al., 2012), and the results presented here show that partnered African American/Black GBMSM also report more PrEP stigma and lower beliefs in the efficacy of PrEP than White men.

Partnered men with higher levels of HIV knowledge in this sample had stronger beliefs in the efficacy of PrEP, reflecting the need to continue to provide them with functional knowledge on HIV transmission and the epidemic to further encourage their engagement in prevention. Risk behavior and perceptions were associated with PrEP attitudes: Men who saw themselves at greater risk of HIV had lowered levels of PrEP stigma but also had lowered beliefs in the efficacy of PrEP. Men with more CAS casual sex partners had lower stigma about PrEP, but their partners' number of CAS partners was associated with less belief in the efficacy of PrEP. Similarly, men and their partners' substance use or binge drinking was associated with reduced stigma and reduced perceptions of efficacy. Also, men with any form of sexual agreement reported greater PrEP stigma and lowered belief in the efficacy of PrEP than men without a sexual agreement. In each of these results, it seems that high-risk behaviors may lower stigma but do not translate to an increase in beliefs about the efficacy of PrEP.

Men's own assessment of their risks of HIV is a strong predictor of their desire to use PrEP (Bil et al., 2016; Highleyman, 2016; Kesler et al., 2016). However, it seems in these results that although risk perceptions may help reduce stigma by framing PrEP as a potential protector against their perceived risks, there is evidence that partnered men may also be undervaluing the efficacy of PrEP. For men who see themselves at risk of HIV, disbeliefs in the efficacy of PrEP are an important, yet malleable, barrier to PrEP adoption (Zimmermann et al., 2019) that can be challenged by providing culturally appropriate psychoeducation. Providing this information to couples provides an opportunity for them to learn together and talk through their concerns about PrEP and their potential to use it.

The results also showed evidence of experiences of multiple forms of stigma among partnered men that may limit their PrEP use. Men who perceived higher levels of HIV stigma and experiences of internalized homonegativity also reported higher levels of PrEP stigma, reflecting previous studies linking stigma to lower levels of PrEP use (Bosco et al., 2021). This makes sense, given the closeness of the items in each scale that measure beliefs in negative stereotypes around sexual behavior, identity, and associations with HIV infection. For partners, perception of HIV stigma was associated with decreased belief in the efficacy of PrEP, indicating that for some endorsing negative beliefs around HIV and living with HIV may extend to negative beliefs around HIV prevention. Of interest, men and their partners' increased experiences of external sexuality-based stigma were associated with increased belief in PrEP efficacy, perhaps explained as resiliency with men framing the efficacy of PrEP as a means for countering their negative experiences as gay men.

Two of the CDC's three PrEP guidelines pertain to those who are in a relationship (CDC, 2018): being (a) in an ongoing relationship with an HIV-positive partner (i.e., discordant male couple) or (b) not in a mutually exclusive monogamous relationship with a partner who recently tested HIV-negative. In this sample, men in serodiscordant relationships reported higher levels of PrEP stigma. Such stigma may be encountered if and when men discuss prevention options with their providers or disclose their serostatus or PrEP use to family and friends: This experience of PrEP stigma may also be reflecting a larger degree of discrimination against serodiscordant couples (Persson, 2016; Persson & Hughes, 2017).

There are several important limitations to the current analysis. As noted, the sample was largely White, highly educated, and gay-identifying, limiting generalization to all GBMSM. Further research is warranted with more diverse samples of GBMSM–in terms of race and ethnicity–who may experience differing levels and forms of stigma, which may lead to significantly different results to those observed here. The sample was recruited online and is limited to those with internet access and social media presence, and couples in which both partners chose to consent to participate in the study. Recent work has demonstrated that online samples of GBMSM are demographically and behaviorally comparable with those recruited through venue-based sampling (Hernandez-Romieu et al., 2014). The cross-sectional study design precludes identifying causality, and longitudinal studies are clearly needed with male couples to disentangle the nature of several of the associations identified.

Conclusion

Partnered men in this sample reported high levels of HIV-related risk behaviors and simultaneously high levels of PrEP stigma and beliefs in the efficacy of PrEP. The results indicate several areas of potential intervention for improving PrEP use among at-risk male couples. High levels of risk behavior were linked to reduced PrEP stigma, suggesting partnered men with HIV-related risks are pragmatic about the need for HIV prevention, yet these risk factors were often associated with lowered beliefs in the efficacy of PrEP. Existing dyadic HIV prevention interventions, such as Couples HIV testing and counseling—in which both members of the dyad receive pretest counseling, HIV testing, and posttest counseling together (Bazzi et al., 2016; Stephenson et al., 2017)—should be considered for adaptation to ensure that the PrEP content adequately addresses the concerns of male couples and provides functional knowledge on the potential for PrEP to avert HIV infection. High levels of stigma around PrEP continue and have the potential to suppress PrEP use, particularly for serodiscordant couples who face additional forms of stigma. Given the noted risk of HIV transmission from main partners among male couples, stigma-informed PrEP interventions for this population should be considered foundational to the success of the U.S. *Ending the HIV Epidemic* campaign. Several interventions are currently being tested that aim to teach male couples the communication skills to develop HIV prevention plans together (Gamarel et al., 2019; Macapagal et al., 2019; Mitchell et al., 2020b); yet further work is needed to ensure that these, and future interventions, address PrEP use for couples through a stigma informed lens.

Key Considerations

- We found that men's perceptions of their partners' risk behaviors affected their perceptions of PrEP, which suggests that existing dyadic prevention interventions, such as Couples HIV testing and counseling, should be considered for adaptation to ensure that the PrEP content adequately addresses the concerns of male couples and provides functional knowledge on the potential for PrEP to avert HIV infection.
- We found that stigma was a significant correlate of perceptions of PrEP efficacy and stigma: Stigma-informed PrEP interventions for this population should be considered foundational to the success of the U.S. *Ending the HIV Epidemic* campaign—the primary plan for ending the HIV epidemic in the United States.
- Many men seek PrEP from their medical providers: There is a need to train providers on how to communicate with men about PrEP and the efficacy of PrEP, using a stigma-informed lens that allows providers to help men surmount their interpersonal and structural barriers to PrEP use.

Disclosures

The authors report no real or perceived vested interests related to this article that could be construed as a conflict of interest.

Author Contributions

All authors on this article meet the four criteria for authorship as identified by the International Committee of Medical Journal Editors (ICMJE); all authors have contributed to the conception and design of the study, drafted or have been involved in revising this manuscript, reviewed the final version of this manuscript before submission, and agreed to be accountable for all aspects of the work. Specifically, using the CRediT taxonomy, the specific contributions of each author is as follows: Conceptualization: R. Stephenson, J. W. Mitchell; Formal analysis: R. Stephenson; Funding acquisition: R. Stephenson, J. W. Mitchell; Methodology: R. Stephenson, S. P. Sullivan, and J. W. Mitchell; Project administration: T. M. D. Chavanduka and S. Sullivan; Writing–original draft: R. Stephenson, T. M. D. Chavanduka, S. P. Sullivan, and J. W. Mitchell; and Writing–review and editing: R. Stephenson, T. M. D. Chavanduka, S. P. Sullivan, and J. W. Mitchell.

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