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ORIGINAL ARTICLE

Intimacy Motivations and Pre-exposure Prophylaxis (PrEP) Adoption Intentions Among HIV-Negative Men Who Have Sex with Men (MSM) in Romantic Relationships

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Abstract
Background In the USA, men who have sex with men (MSM) in primary partnerships are at elevated risk for human immunodeficiency virus (HIV) infection. Pre-exposure prophylaxis (PrEP), a new biomedical prevention strategy, has potential to reduce HIV transmission. This study examined predictors of PrEP adoption intentions among HIV-negative MSM in primary partnerships.
Methods The sample included HIV-negative MSM (n=164) who participated in an ongoing cross-sectional study with an in-person interview examining PrEP adoption intentions.
Results Higher HIV risk perception, intimacy motivations for condomless sex, recent condomless anal sex with outside partners, education, and age were each independently associated with PrEP adoption intentions. In a multivariate model, only age, education, and intimacy motivations for condomless sex were significantly associated with PrEP adoption intentions.
Conclusions Intimacy motivations may play a central role in PrEP adoption for MSM couples. Incorporating relationship dynamics into biomedical strategies is a promising avenue for research and intervention.

Keywords MSM · Couples · HIV prevention · Pre-exposure prophylaxis · Intimacy

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In the USA, gay, bisexual, and other men who have sex with men (MSM) are a group most critically affected by human immunodeficiency syndrome (HIV). In 2010, MSM accounted for approximately 63 % of new HIV infections [1] and accounted for over half of all persons living with HIV infection in the USA. [2]. Researchers have noted that a substantial proportion of new HIV infections among MSM are occurring within the context of primary partnerships [3, 4]. This finding is likely attributable to an increased likelihood of condomless sex with primary partners [3, 5], as studies suggest several dynamics that make managing HIV risk within the context of partnership more difficult.

First, data suggest that relationship factors—most importantly intimacy—may be a powerful motivator for condomless sex within primary partnerships [6–8]. Within the context of a relationship, men may be reluctant to give up certain aspects of sexual and emotional intimacy associated with condomless anal sex [6, 9–12]. A qualitative study of African-American MSM found that the most commonly cited reason for forgoing condom use was to be intimate with their partners [13]; a quantitative analysis of motivations for condomless sex among gay and bisexual men found that concerns that condoms interfered with intimacy were more important than concerns that they interfered with pleasure [6]. Ironically, HIV prevention messages that promote condom use by emphasizing the extent to which men cannot trust their partners may reinforce an underlying belief that condoms are antithetical to intimacy. As such, some MSM may consider condomless sex with a primary partner as an act through which they express their commitment, trust, and love [14, 15].

Condomless sex within the context of a primary partnership is not inherently risky, except to the extent that both partners do not know their true HIV status. Modeling studies suggest that about a third of transmissions in the USA are due to undiagnosed infection [4]. Because condomless sex is more common and frequent in primary

partnerships, an undiagnosed HIV-positive individual is more likely to transmit the infection to his primary partner than to any given casual partner. Further complicating this issue is the challenge of deciding when a partnership has become primary *enough* to warrant a shift to condomless sex [16]. Individuals may stop using condoms as soon as they consider themselves to be in a primary partnership, regardless of their own or their partner's HIV testing history or knowledge about their HIV status [16].

Third, sexual agreements among couples may be designed to reduce HIV risk, but may also present additional challenges. Sexual agreements are described as the decisions couples make about whether they allow sex with outside partners and the sexual behaviors they engage in together [17–19]. Sexual agreements are observed in heterosexual couples, but tend to be more accepted within gay communities [18, 20], and several community-based samples of MSM have found that at least half of the men in primary relationship have some form of sexual agreement that allows sex with outside partners [16]. To the extent that one or both members of a couple are also having condomless sex with outside partners, the increased frequency of condomless sex within the primary partners may increase the possibility of transmission. Although some sexual agreements prohibit condomless sex outside the primary relationship, data suggest that violations of sexual agreements and a lack of communication about sexual safety are not uncommon [21, 22]. Because sexual agreements may symbolize trust and intimacy for couples, individuals may not disclose such violations to avoid conflict and may even experience increased pressure to continue condomless sex with the primary partner so that he does not suspect the violation [17, 18, 22]. As such, sexual agreements—especially among partners who believe themselves to be in a seroconcordant negative relationship—have the potential to place the couple at risk for HIV and other sexually transmitted infections (STIs) [22].

In the absence of an effective vaccine, HIV prevention research has focused on the development of other biomedical prevention strategies as a way to curtail the HIV epidemic. At present, one of the most promising strategies is pre-exposure prophylaxis (PrEP), which is the daily oral administration of antiretroviral therapy (ART) designed to protect high-risk HIV-negative individuals from infection. In 2010, the first efficacy trial results were released (iPrEx Study), indicating a 44 % reduction in HIV incidence associated with PrEP use and estimating even higher rates of protection—up to 73 % or even 92 % among MSM with the highest PrEP adherence rates [23]. Two additional trials, the Partners PrEP study and the CDC TDF2 study provided further evidence that PrEP can reduce the risk of HIV infection [24, 25]. As a result, the FDA approved the use of PrEP to reduce risk of sexual HIV acquisition among adults, including MSM [26], and the CDC recently issued guidance recommending PrEP for use by individuals at "substantial risk" for infection [27]. While PrEP is not widely available at this time, demonstration projects are underway and healthcare providers in a variety of settings are beginning to prescribe it to their patients [28, 29].

With the enthusiasm for PrEP as a viable prevention strategy, many studies have examined correlates of PrEP adoption among MSM. To date, studies have focused almost exclusively on individual-level correlates of PrEP adoption intentions among high-risk HIV-negative MSM, such as risk perception, risk behavior with outside sexual partners, and sociodemographic variables, such as older age and lower socioeconomic status [30–33]. Due to the inherent risk of HIV transmission within HIV serodiscordant couples, qualitative studies have examined attitudes towards PrEP among MSM in HIV serodiscordant relationships and found high levels of PrEP adoption intentions [34, 35].

To date, there is limited research on MSM couples in HIV seroconcordant negative relationships. Golub and colleagues [32] observed no difference in PrEP adoption intentions among MSM in romantic relationships compared to single MSM. In a recent qualitative study, Mimiaga and colleagues [36] found that some HIV-negative MSM reported interest in taking PrEP to protect themselves against the potential of future transmission from their HIV-negative primary partner, regardless of whether they had a monogamous or open sexual agreement with this partner. To the extent that HIV-negative MSM in relationships with partners they believe to be HIV-negative remain at risk for infection, it is important to understand their motivations for PrEP adoption in the context of their motivation for condomless sex. Despite the attention devoted to issues of intimacy within studies of condom use, researchers have yet to directly examine the ways in which intimacy motivations for condomless sex enter into decisions about PrEP adoption among men in primary partnerships.

The present study is designed to examine the role of different types of condom use motivations in predicting PrEP adoption intentions among a sample of sexually active MSM in seroconcordant negative relationships. Given their relational nature, we were specifically interested in examining the relative importance of intimacy motivations for condomless sex and feeling pressured to not use condoms (i.e., sexual pressure) to that of other existing correlates of PrEP adoption intentions, such as risk perception. As PrEP is beginning to be disseminated in clinical settings, it is imperative to understand how relationship dynamics may influence sexual health decisions for MSM in primary relationships.

Methods

Data were drawn from an ongoing cross-sectional study examining the impact of PrEP messaging and communication strategies on PrEP adoption intentions. Between January 2012 and October 2013, participants in the study (N=384) completed in-person interviews and received educational information about PrEP, including data on efficacy and side effects based on iPrEx study results [23]. Participants then answered questions related to PrEP adoption intentions. All procedures were reviewed and approved by the senior author's Institutional Review Board.

Participants were recruited in New York City using passive recruitment methods (i.e., flyers), active recruitment methods (i.e., outreach at bars, events, community-based organizations), and participant referral. To be eligible for the parent project, participants (1) were born male, (2) were at least 18 years old, (3) self-reported an HIV-negative serostatus, and (4) reported at least one act of unprotected sex with a male partner in the last 30 days. Analyses for the current paper were further restricted to participants who reported (5) a male gender identity and (6) an HIV-negative primary partner, defined as "someone to whom you feel committed above anyone else and with whom you have had a sexual relationship." The analytic sample included 164 HIV-negative MSM in HIV seroconcordant negative primary partnerships who were not taking PrEP at the time of their study visit.

Measures

Demographics

Participants reported their HIV status, age, sexual identity, race/ethnicity, education level, income level, and their partners' HIV status.

Perceived Risk

Participants were asked "How likely do you think you are to get HIV in your lifetime?" Partners were asked to respond on a scale ranging from 0 (*Not at all*) to 100 (*I will definitely get HIV in my lifetime*).

HIV Testing Behavior

Participants were asked to respond to the following item: "When was the last time you received an HIV test?" Responses were dichotomized as 1=within the last 6 months (i.e., consistent with CDC guidelines) and 0= more than 6 months ago.

Sexual Risk and Substance Use behavior

A modified version of the semi-structured timeline follow-back was used for the assessment of sexual risk and substance use behavior [37]. Data were collected for the previous 30 days. Using a calendar, interviewers asked participants to report the type of sexual activity (anal or vaginal intercourse; protected or unprotected) by partner type (primary or outside) on each day of the preceding 30 days. Participants were also asked to report any substance use, including illicit drug use (i.e., ecstasy, methamphetamine, coke/crack) and heavy alcohol use (five or more standard drinks) on each of the 30 days. We created a series of dichotomous variables as follows: (1) whether or not the participant engaged in anal sex without a condom in the past 30 days with a primary partner; (2) whether or not the participant engaged in anal sex without a condom in the past 30 days with an outside sexual partner; (3) whether or not the participant engaged in vaginal sex without a condom in the past 30 days with an outside partner; (4) whether or not the participant had engaged in heavy alcohol use in the past 30 days; and (5) whether or not the participant had used any stimulants in the past 30 days, including ecstasy, coke, and methamphetamine.

Condom Use Motivations

The Condom Use Motivation scale assesses different attitudes towards condom use [6]. The 21-item scale consists of four condom attitude subscales, each assessing different aspects of motivations or barriers to condom use. The Intimacy Interference subscale consists of four items and assessed beliefs that condoms reduce intimacy and closeness (alpha=0.83; example item "Not using a condom with a partner shows him that I trust him"). The Risk Reduction subscale consists of five items and measured beliefs that condoms reduce risk associated with sexual activity (alpha=0.74; example item "Having sex without a condom could cause me to get HIV"). The Pleasure Reduction subscale consists of four items and measured beliefs that condoms reduce pleasure associated with sex (alpha=0.69; example item "It feels better to have sex without a condom"). The Sexual Pressure subscale consists of four items and assessed the belief that not using a condom is a result of pressure from sexual partners (alpha=0.78; example item "I worry my partner would leave if I suggested using a condom"). For each subscale, participants rated items on a 5-point Likert-type scale, with higher scores indicating higher levels of risk reduction, pleasure reduction, intimacy interference, and sexual pressure beliefs about condom use during sex.

PrEP Adoption Intentions

To assess PrEP adoption intentions, participants were asked how likely they would be to take PrEP if it were available for free. Responses were gathered on a five-point scale. The item was highly positively skewed and thus dichotomized at the median such that responses were classified into "likely to take PrEP" (i.e., those who responded with a 4 or higher, indicating that they would "probably" or "definitely" take PrEP) and "not likely to take PrEP" (i.e., those who responded with a 3 or below on the scale, indicating that they "might," "probably would not," or "definitely would not" take PrEP).

Statistical Analyses

Descriptive statistics were obtained for all variables included in the analyses, including the distribution of scale scores, with appropriate tests for normality. We then examined associations between study variables and PrEP adoption intentions. Next, bivariate analyses were conducted to assess differences in MSM who engaged in condomless anal sex with outside sexual partners compared to those who engaged in condomless anal sex only with their primary partner. We then fit a hierarchal stepwise logistic regression to assess whether intimacy motivations for condomless sex were associated with PrEP adoption intentions over and above the impact of demographic characteristics, engaging in condomless anal sex with outside partners, and HIV risk perception. We also examined whether the association between intimacy motivations for condomless sex and PrEP adoption intentions was moderated by whether or not the participant reported engaging in condomless sex with an outside partner.

In order to more fully understand the association between intimacy motivations for condomless sex and PrEP adoption intentions, we conducted two additional analyses. First, we fit a logistic regression model examining whether these same associations existed among single men in the larger study (n=220). Second, an analysis-of-variance (ANOVA) test was used to assess whether intimacy motivations for condomless sex differed by four typologies of sexual behaviors in the current sample: (1) those who had condomless anal sex with only their primary partner and did not report any sex with outside partners (n=92), (2) those who had condomless anal sex with both their primary partner and outside partners (n=23), (3) those who had condomless anal sex with their primary partner but used condoms for anal sex with outside partners (n=27), and (4) those who had condomless anal sex with outside partners but used condoms for anal sex with their primary partner (n=16).

Results

Demographics

The sample ranged in age from 18 to 61 (M=32.49; SD=10.32), with almost half of the sample between the ages of 18 and 29 (48.2 %, n=79). As shown in Table 1, over half of the sample consisted of MSM of color (60.0 %, n=98), including 30.5 % (n=50) who identified as Black and 22.0 % (n=36) who identified as Latino. Approximately 70 % of the sample self-identified as gay (n=114) and 23.2 % (n=38) self-identified as bisexual. The majority of the sample (n=142) reported that their primary partner was a cisgender man (i.e., someone who identifies as the gender/sex they were assigned at birth) and 13.4 % (n=22) reported that their primary partner was a transgender woman. The sample was relatively diverse in regard to socioeconomic status, with 42.7 % (n=70) reporting less than a college education and 52.4 % (n=86) reporting an annual income of less than $20,000 per year. Over 60 % of the sample (n=106) reported having an HIV test within the past 6 months. In regard to substance use, 63.4 % (n=104) reported engaging in heavy drinking in the past 30 days and 18.3 % (n=30) reported using stimulants. The majority of the sample (90 %, n=148) reported engaging in condomless anal sex with their primary partner, 34 % (n=56) reported engaging in condomless anal sex with an outside partner, and 7.9 % (n=13) reported engaging in condomless vaginal sex with an outside partner in the past 30 days.

Bivariate Differences in PrEP Adoption Intentions

Associations between study variables and PrEP adoption intentions are also presented in Table 1. PrEP adoption intentions were positively associated with the following variables: earning less than a bachelor's degree, older age, higher HIV risk perception, any sex with outside partners, condomless anal sex with outside partners, and higher intimacy motivations for condomless sex.

Bivariate Differences in Condomless Anal Sex with Outside Partners

Because participants who reported condomless sex with outside partners were significantly more likely to report PrEP adoption intentions, we examined other correlates of this behavior to identify potential mechanisms for this relationship. Bivariate analyses examining differences between men who engaged in condomless anal sex with outside partners and those who did not are presented in Table 2. Reporting condomless sex with outside partners was associated with the following variables: being more likely to self-identify as

Table 1 Characteristics of the study sample by PrEP adoption intentions (N=164)

	Overall	Likely to take PrEP		
		Yes (n=93, 56.7 %)	No (n=71, 43.3 %)	
	N (%)	*n* (%)	*n* (%)	Test statistic
Sexual identity				$\chi2(2)=4.18$
Gay	114 (69.5)	60 (52.6)	54 (47.4)	
Bisexual	38 (23.2)	27 (71.1)	11 (28.9)	
Other	12 (7.3)	6 (50.0)	6 (50.0)	
Race				$\chi2(3)=5.67$
Black	50 (30.5)	29 (58.0)	21 (42.0)	
Latino	36 (22.0)	24 (66.7)	12 (33.3)	
White	66 (40.2)	31 (47.0)	35 (53.0)	
Other	12 (7.3)	9 (75.0)	3 (25.0)	
Income				$\chi2(1)=3.87$
More than $20,000	78 (47.6)	38 (48.7)	40 (51.3)	
Less than $20,000	86 (52.4)	55 (64.0)	31 (36.0)	
Education				$\chi2(1)=7.68$**
Bachelors' degree or more	94 (57.3)	62 (66.0)	32 (34.0)	
Less than a bachelors' degree	70 (42.7)	31 (44.3)	39 (55.7)	
Any sex with OP, past 30 days[a]	72 (43.9)	49 (68.1)	23 (31.9)	$\chi2(1)=6.73$**
Any condomless anal sex with OP, past 30 days[a]	56 (34.1)	41 (73.2)	15 (26.8)	$\chi2(1)=9.44$**
Any condomless vaginal sex with OP, past 30 days[a]	13 (7.9)	9 (69.2)	4 (30.8)	$\chi2(1)=0.90$
Any condomless anal sex with PP, past 30 days[b]	148 (90.2)	85 (57.4)	63 (42.6)	$\chi2(1)=1.67$
Primary partner's HIV status				$\chi2(1)=1.48$
Unknown	17 (10.4)	11 (64.7)	6 (35.3)	
I think HIV-	124 (75.6)	67 (54.0)	57 (46.0)	
I know HIV-	23 (14.0)	15 (65.2)	8 (34.8)	
Partner gender identity				$\chi2(1)=1.36$
Cisgender man	142 (86.6)	78 (54.9)	64 (45.1)	
Transgender woman	22 (13.4)	15 (68.2)	7 (31.8)	
Last HIV test				$\chi2(1)=1.64$
Within past 6 months	106 (64.6)	64 (60.4)	42 (39.6)	
More than 6 months	58 (35.4)	29 (50.0)	29 (50.0)	
Any stimulant use, past 30 days	30 (18.3)	16 (53.3)	14 (46.7)	$\chi2(1)=0.17$
Any heavy drinking, past 30 days	104 (63.4)	61 (58.7)	43 (41.3)	$\chi2(1)=0.44$
	M (SD)	M (SD)	M (SD)	Test statistic
Age	32.49 (10.32)	33.93 (10.99)	30.58 (9.03)	$t(162)=2.08$*
Risk perception	26.98 (23.97)	31.62 (24.57)	20.89 (2.60)	$t(162)=2.91$**
Pleasure interference motivations	3.26 (1.00)	3.33 (1.00)	3.19 (1.00)	$t(162)=0.89$
Intimacy interference motivations	2.47 (0.88)	2.60 (0.85)	2.32 (0.91)	$t(163)=2.07$*
Sexual pressure motivations	2.07 (0.93)	2.17 (1.03)	1.94 (0.76)	$t(162)=1.60$
Risk reduction motivations	4.13 (0.74)	4.20 (0.76)	4.04 (0.69)	$t(162)=1.35$

*p<0.05, **p<0.01

[a] *OP* outside partner

[b] *PP* primary partner

Latino, less likely to self-identify as white, less likely to self-identify as gay, lower education, lower income, less likely to report stimulant use in the past 30 days, and more likely to have had an HIV test within the past 6 months. Additionally, participants who reported condomless sex with outside partners reported higher risk perception,

Table 2 Characteristics of the sample by those who reported condomless anal sex with outside partners (OP) (N=164)

	Overall	Condomless anal sex with OP		
		Yes (n=56)	No (n=108)	
	N (%)	n (%)	n (%)	Test statistic
Sexual identity				$\chi 2(1)=26.00$***
Gay	114 (69.5)	25 (44.6)	89 (82.4)	
Bisexual	38 (23.2)	22 (39.3)	16 (14.8)	
Other	12 (7.3)	9 (16.1)	3 (3.8)	
Race				$\chi 2(3)=16.63$**
Black	50(30.5)	20 (35.7)	30 (27.8)	
Latino	36 (22.0)	19 (52.8)	17 (15.7)	
White	66 (40.2)	11 (16.7)	55 (83.3)	
Other	12 (7.3)	6 (10.7)	6 (5.6)	
Income				$\chi 2(1)=8.11$**
More than 20 K	78 (47.6)	18 (32.1)	60 (556.)	
Less than 20 K	86 (52.4)	38 (67.9)	48 (44.2)	
Education				$\chi 2(1)=13.18$**
BA or more	94 (57.3)	57 (52.8)	13 (23.2)	
Less than BA	70 (42.7)	51 (47.2)	43 (76.8)	
Any condomless anal sex with PP, past 30 days[a]				$\chi 2(1)=2.99$
No	33 (20.1)	33 (58.9)	0	
Yes	131 (79.9)	23 (41.1)	108 (100.0)	
Last HIV test				$\chi 2(1)=5.49$*
Within past 6 months	106 (64.6)	43 (76.8)	63 (58.3)	
More than 6 months	58 (35.4)	13 (23.2)	45 (41.7)	
Any stimulant use, past 30 days				$\chi 2(1)=6.01$*
No	134 (81.7)	40 (29.9)	94 (87.0)	
Yes	30 (18.3)	16 (28.6)	14 (46.7)	
Any heavy drinking, past 30 days				$\chi 2(1)=0.03$
No	60 (36.6)	39 (36.1)	21 (37.5)	
Yes	104 (63.4)	69 (63.9)	35 (62.5)	
	M (SD)	M (SD)	M (SD)	Test statistic
Age	32.49 (10.32)	33.57 (11.80)	31.91 (9.43)	$t(92.3)=0.91$
Risk perception	26.98 (23.97)	37.13 (21.71)	21.71(20.64)	$t(89.8)=3.77$***
Pleasure interference motivations	3.26 (1.00)	3.60 (0.94)	3.10 (1.00)	$t(162)=3.04$**
Intimacy interference motivations	2.47 (0.88)	2.65 (1.08)	2.40 (0.76)	$t(84.5)=1.64$
Sexual pressure motivations	2.07 (0.93)	2.31 (1.03)	1.95 (0.85)	$t(94.9)=2.28$*
Risk reduction motivations	4.13 (0.74)	4.13 (0.74)	4.13 (0.74)	$t(162)=0.05$

*p<0.05, **p<0.01

[a] *PP* primary partner

greater pleasure interference motivations for condom use, and greater sexual pressure motivations for condom use.

Model Predicting PrEP Adoption Intentions from Intimacy Interference Condom Motivations

The next step was to examine whether intimacy motivations for condomless sex were significantly associated with PrEP adoption intentions, adjusting for sociodemographics and behavioral factors associated with PrEP adoption intentions in bivariate analyses. Results of the hierarchal logistic regression model are presented in Table 3. In step 1, we entered age, education, condomless anal sex with outside partners, and HIV risk perception. The step was significant (p<0.01), and older age (aOR=1.03; 95 % CI 1.00, 1.07; p<0.05), earning less than a bachelors' degree (aOR=0.49; 95 % CI 0.25, 0.96;

Table 3 Hierarchal logistic regression predicting PrEP adoption intentions (N=164)

	Step 1		Step 2	
	aOR	95 % CI	aOR	95 % CI
Age	1.03*	1.00, 1.07	1.04*	1.00, 1.07
Less than bachelors'	0.49*	0.25, 0.96	0.46*	0.23, 0.92
Condomless anal sex with OP, past 30 days[a]	1.71	0.85, 3.44	1.52	0.75, 3.11
Lifetime HIV risk perception	1.01*	1.00, 1.07	1.01	0.99, 1.03
Intimacy interference condom motivations	–	–	1.55*	1.02, 2.34
	Log likelihood, $\chi^2(4)=19.74$***		Log likelihood, $\chi^2(1)=4.51$*	

*$p<0.05$, **$p<0.01$

[a] *OP* outside partner

$p<0.05$), and higher risk perception scores (aOR=1.01, 95 % CI 1.00, 1.07; $p<0.05$) were each associated with PrEP adoption intentions. In step 2, we added intimacy motivations for condomless sex, which resulted in a significant improvement in model fit, Log likelihood $\chi^2(1)=4.25$, $p<0.05$. There was a significant association between intimacy interference and PrEP adoption intentions (aOR=1.55; 95 % CI 1.02, 2.34; $p<0.05$). The addition of the interaction between intimacy motivations and engaging in condomless sex with outside partners did not contribute significantly to overall model fit and did not change adjusted odds ratios of significant variables in the previous model (results not shown).

In order to more fully understand the associations between intimacy motivations for condomless sex and PrEP adoptions intentions, we fit a logistic regression to examine these associations among the single men (n=220) in the larger study. There were no significant association between PrEP adoption intentions and intimacy motivations for condomless sex among single men (aOR=1.14; 95 % CI 0.91, 1.41). Results of an ANOVA examining whether intimacy motivations differed by the four typologies of sexual behaviors (based on patterns of condom use with primary and outside partners) were marginally significant, $F(3, 154)=2.54$, $p=0.059$. Post-hoc LSD comparisons indicated that the group of men who engaged in condomless anal sex with *both* their primary partners and outside partners had the highest scores on intimacy motivations for condomless sex (M=2.90, SD=1.07), while the group of men who reported condomless sex with only their primary partner and did not report any sex with outside partners had the lowest scores on this measure (M=2.36, SD=0.74).

Discussion

Primary HIV prevention remains an essential priority. Consistent with previous research on MSM more generally [32, 33], our study found that over half this sample of gay and bisexual men in primary partnerships with HIV-negative partners reported that they would like to use PrEP if it were available to them. The results of this study highlight the relevance of intimacy motivations for condomless sex in partnered men's decisions to take PrEP as a prevention strategy. Men who reported anal sex with an outside partner and those who perceived themselves to be at greater risk for HIV were more likely to report willingness to use PrEP; however, both these factors fell out of a multivariate model that included intimacy motivations. In this model, there was no interaction between intimacy motivations and having condomless sex with outside partners; in other words, the role of intimacy motivations in predicting PrEP intentions was equally strong regardless of whether men reported condomless sex outside the relationship. It is important to note that intimacy motivations were not associated with PrEP intentions among a comparison group of single men, suggesting that this intimacy factor may be of particular importance for men in primary partnerships.

Although intimacy motivations did not differ between men who reported condomless sex with an outside partner and those who did not, these motivations were highest among men who reported condomless sex with *both* their primary and outside partners and lowest among men who had sex only with their primary partner. Although not associated with PrEP intentions, it is important to note that men who reported condomless sex with outside partners reported significantly higher sexual pressure motivations for condomless sex. While PrEP is an important prevention tool, it is also important to address unique barriers to condom use experienced by men in primary partnerships, including the dynamics of sexual agreements and the role they may play in promoting or impeding risk reduction.

Interdependence theory provides a useful framework for understanding how intimacy motivations for condomless sex may be linked to PrEP adoption intentions among HIV-negative MSM in primary partnerships. Interdependence

theory [38] posits that health-enhancing behaviors undertaken by members of a couple (i.e., uptake of PrEP) are more likely to occur when partners believe that a health threat (i.e., HIV infection) is important not only to themselves but also to their partner and their relationship [38]. Although we did not include a broader measure of intimacy or relationship satisfaction, we might hypothesize that greater intimacy motivations for condomless sex may also be associated with greater intimacy motivations within the relationship in general. Interdependence theory would predict that couples with higher levels of intimacy motivations would be more motivated to take PrEP in order to both preserve intimacy during sexual encounters with their partner and also protect themselves and their partner from infection. Future research is warranted to better understand how both partners in primary relationships appraise HIV risk, define sexual health goals, and utilize communal coping strategies to reduce the potential threat of HIV on their relationship.

Consistent with previous research, older age was significantly associated with willingness to use PrEP [30–32]. Developmental considerations warrant future attention in PrEP research, including research with MSMs primary partners. Young MSM continue to be at an increased risk for the acquisition and transmission of HIV. Between 2001 and 2008, 73 % of new HIV infections in New York City were among young MSM [39]. We found no age differences in condomless anal sex with outside partners; however, research has attributed HIV incidence among young MSM to engaging in condomless anal sex with primary partners in which the partnerships tend to be short-lived and relationship dynamics, such as wanting romantic relationships to last and feeling less sexual decision-making power [40]. Thus, young MSM may not perceive themselves at risk for contracting HIV within their current primary relationships. Understanding the relationship dynamics and unique developmental factors associated with sexual risk behavior may offer promising directions for appropriate and effective HIV prevention interventions for young MSM in primary partnerships.

Our results found that lower education was associated with desire to take PrEP, and both lower education and lower income were associated with engaging in condomless anal sex with outside partners. The family stress model of romantic relationships describes how socioeconomic status impacts couples through increased economic pressures or strains, and these pressures or strains are, in turn, related to increased emotional distress [41]. Environmental constraints, such as lower income or unemployment, may mean fewer resources of support for couples [42], making it seem easier for MSM to take PrEP rather than engaging in conversations with their primary partner about their sexual health and/or relationship concerns. However, the efficacy of PrEP rests on optimal adherence and socioeconomic status has been documented to be a critical barrier to treatment engagement and medication compliance among HIV-positive individuals [43]. Researchers and practitioners working with MSM in primary partnerships need to consider the complex relational issues that couples face, such as tensions in relationships and communication problems as well as the socioeconomic contexts in which these struggles may occur to ensure that PrEP is the best option for these men.

We also found that MSM who engaged in condomless anal sex with outside partners were more likely to have an HIV test within the past 6 months as compared to those who only reported condomless anal sex with their primary partner. These results are promising as HIV testing is a key component to ensuring that individuals are aware of their HIV serostatus, linked to care, and provided with appropriate medications [44]. The CDC's guidelines for PrEP dissemination require that individuals get tested prior to initiating PrEP [27]. The World Health Organization (WHO) has recently endorsed Couples HIV Voluntary Counseling and Testing as an optimal prevention strategy for couples [45]. Couples HIV Voluntary Counseling and Testing protocols involve couples testing and receiving HIV status results together and participating in a facilitated discussion of sexual agreements. In the USA, Couples HIV Voluntary Counseling and Testing has now been adapted and shown to be both acceptable and feasible for MSM couples [46, 47]. Our findings suggest Couples HIV Voluntary Counseling and Testing may be an important vehicle for the dissemination of PrEP to MSM couples. Providers can utilize this platform to foster open communication about sexual agreements and relationship dynamics in order to help MSM with primary partners make the most optimal and informed decisions about their sexual health and prevention strategies.

Several limitations are important to consider in light of the current findings. First, participant responses to PrEP adoption intentions were based on a hypothetical situation rather than actual experiences taking PrEP. Second, we did not directly ask participants about sexual agreements with their primary partners or other aspects of relationship quality (i.e., sexual communication, sexual health goals, sexual decision-making power), which may influence decision-making around sexual health, including the uptake of PrEP as a prevention strategy. Third, we only collected data from one partner, which limits our ability to draw inferences about the specific dynamics between couples and how these dynamics influence PrEP adoption intentions. It is also possible that both members of a couple were enrolled in our study. Although we did not recruit couples, we also did not ask participants whether or not their partner had participated, so it is possible that fewer than 164 independent partnerships are represented in these data. Fifth, our assessment of sexual behavior captured only the 30 days prior to their assessment. Intensive longitudinal diary studies are recommended in future research

to capture the associations between relationship dynamics, condomless anal sex, and the adoption of and persistence to PrEP overtime [48, 49]. For example, sexual behavior with primary partners and/or outside partners may change overtime [40]. Better measurement using daily diary methods may allow for more dynamic investigation and understanding of couples' relationship dynamics, including whether and how condomless anal sex, sexual agreements, and sexual health goals affect couples' decisions to take and persistence with PrEP.

Despite these limitations, our findings suggest that biomedical HIV prevention strategies could benefit from more research with MSM couples. While PrEP holds promise in reducing HIV infections among MSM, it will be important to address not only the individual-level risk factors but also the interpersonal context within which MSM in relationships make decisions about their sexual health [16]. Our study found that intimacy motivations for condomless sex were related to MSM's likelihood of PrEP adoption intentions. Couples HIV Voluntary Counseling and Testing may be a successful means to facilitate discussions of PrEP to MSM couples by allowing them to get HIV tested together, discuss sexual agreements and sexual health goals, and determine whether PrEP is the best prevention strategy for themselves and their relationship. Given the complexity of relationship dynamics and sexual decision making, we need more research to understand how best to provide appropriate and effective HIV prevention strategies to MSM couples.

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Conflict of Interest Drs. Kristi Gamarel and Sarit Golub declare that they have no conflict of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

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