



Role of Social and Sexual Network Factors in PrEP Utilization Among YMSM and Transgender Women in Chicago

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Abstract

Despite demonstrated efficacy, uptake of HIV pre-exposure prophylaxis (PrEP) remains low, particularly among high-risk demographics such as transgender women, Black men who have sex with men (BMSM), and young MSM (YMSM). Research thus far has largely focused on individual factors that may impede PrEP uptake in these demographics, leaving social network factors relatively unexplored. The present study used data collected from participants within RADAR, a longitudinal cohort study in Chicago focused on understanding the individual, dyadic, network, social, and biologic factors associated with HIV infection within YMSM. Of the 906 study participants who did not report an HIV diagnosis at baseline, 7.0% reported using PrEP in the prior 6 months. Recent PrEP use was associated with both individual-level (age and gender) and network-level factors (mean relationship strength, sexual network degree, etc.). These findings highlight the need to expand beyond focusing on individual-level drivers of PrEP uptake, as well as changing our understanding of who is most important within a network (centrality vs. strength of weak ties). Future work is needed to determine whether variables associated with PrEP uptake are similarly connected to PrEP adherence.

Keywords HIV · PrEP · YMSM · Social networks · Sexual networks

Introduction

HIV infection in the USA disproportionately affects men who have sex with men (MSM), who accounted for 70% of new infections in 2016, according to a recent Centers for Disease Control and Prevention (CDC) surveillance report (Centers for Disease Control and Prevention 2017b). Of all new infections among MSM, the highest rates by far are observable among individuals 20–29 years old, while rates have been increasing for MSM between the ages of 13 and 34 years overall (Centers for Disease Control and Prevention 2017a, b). Further, among 24,730 adolescent males living with HIV, male-to-male sexual contact accounted for 85% of all infections (Centers for Disease Control and Prevention 2017a, b).

In addition to disparities by transmission category and age, other demographic factors have been shown to significantly impact HIV risk. Black MSM (BMSM) remain at increased

risk for HIV, accounting for the majority of new HIV diagnoses in 2016 among known disparity populations; the same report demonstrates that although new HIV infections in Black Americans decreased between 2011 and 2015, they remained stable in BMSM overall, and increased by 30% among BMSM aged 25–34 years (Centers for Disease Control and Prevention 2017a, b). These patterns serve to highlight the compounding impact of race and sexual orientation on HIV risk. Most critically, young Black MSM (YBMSM) between the ages of 13 and 25 years are at higher risk of HIV infection than any other demographic (Centers for Disease Control and Prevention 2017a, b), emphasizing the unique burden of HIV risk and disease in this subpopulation. Finally, although some surveillance reports do not specifically highlight transgender individuals, extant research has demonstrated that transgender women are at significantly elevated risk of HIV acquisition, and that racial disparities evident among MSM are reflected within the transgender community as well (Baral et al. 2013; Brennan et al. 2012; Centers for Disease Control and Prevention 2018; Clark et al. 2017).

To combat HIV spread, the CDC recommends pre-exposure prophylaxis (PrEP) for populations at high risk for HIV infection (Baeten et al. 2012). Despite its demonstrated high efficacy (Baeten et al. 2012; Deutsch et al. 2015; Grant

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et al. 2010; McCormack et al. 2016; Thigpen et al. 2012; Volk et al. 2015), PrEP uptake remains low, particularly among transgender women (Wilson et al. 2016; Wilson et al. 2015), and among YMSM and BMSM; Strauss et al. estimate that only 2% of high-risk candidates have been linked to PrEP care (Strauss et al. 2017).

Most research into the causes of low PrEP uptake has focused on identifying associations with individual-level attributes. This approach has identified a number of potential contributing factors, including low awareness (Bauermeister et al. 2013; Sevelius et al. 2016), concerns about side effects (Bauermeister et al. 2013; Fisher et al. 2017; Holloway et al. 2017), medical mistrust (Brooks et al. 2018), disinterest in regimen adherence (Perez-Figueroa et al. 2015), and low perceived risk for infection (Holloway et al. 2017). Other approaches have taken structural factors into account, highlighting how costs and barriers to access (Perez-Figueroa et al. 2015) or housing and employment instability (Marshall and Mimiaga 2015; Philbin et al. 2016) may prevent PrEP uptake, and how insurance concerns, particularly as related to issues of confidentiality when on parental insurance, may also serve as a barrier to PrEP initiation (Moore et al. 2018). Research among BMSM and transgender women in particular has highlighted how competing needs may lead to deprioritization of sexual health in favor of concerns such as stable housing (Philbin et al. 2016), employment (Levy et al. 2014), or mental health treatment (Maksut et al. 2016; Marshall and Mimiaga 2015).

Despite the extensive body of research into factors associated with PrEP uptake and adherence, social network analysis represents an understudied area of PrEP research. In particular, the ways in which an individual's social connections or network structure may promote PrEP uptake deserves significant attention. Extant literature suggests that this approach may yield important results. Network analyses in MSM populations have revealed that social networks (individuals' networks of close friends or family) and sexual networks (individuals' networks of sexual partners) influence a number of crucial HIV-related behaviors from disclosure of sexual behavior and serostatus (Latkin et al. 2012) to testing uptake and sexual risk behaviors directly (Amirkhanian 2014). Further, social network analyses have demonstrated their utility in explaining patterns of patient medication use and healthcare engagement. Among individuals living with HIV, patient support networks have been found to increase clinic attendance and antiretroviral therapy (ART) uptake and adherence (Haberer et al. 2017), as well as improve testing and preventive efforts and, perhaps of particular interest, linking the individual and structural factors which impact HIV risk and protective behaviors (Latkin et al. 2013).

Initial network studies of PrEP use among YMSM have found positive associations between peer network size and PrEP usage (Kuhns et al. 2017), and prior research has

connected PrEP awareness to social network characteristics including connections to specific gay subpopulations (i.e., house/ball culture) (Khanna et al. 2016), and having PrEP-aware friends or peers whom one perceives as influential (Garcia and Harris 2017; Khanna et al. 2017; Young et al. 2018). While these results indicate that social network analyses could help explain disparities in PrEP uptake rates, there remains a relative dearth of research into the relationship between PrEP use and network characteristics among MSM, and an even greater gap in literature regarding transgender women, who are often inappropriately conflated with MSM in surveillance and analysis (Poteat et al. 2016; Sevelius et al. 2016). Further, existing research on PrEP and network characteristics explores this relationship in limited detail. To date, relatively little has been discovered regarding how network factors, such as degree (the number of individuals in a person's network), are associated with PrEP uptake, particularly over and above individual-level factors. The potential relationship between support networks and PrEP usage is deserving of greater attention and may provide critical insight into how best to optimize PrEP care among high-risk populations. Therefore, we investigate whether social and/or sexual network factors are associated with PrEP usage in a sample of YMSM and young transgender women, and if network-level factors remain significant after controlling for demographics known to be associated with uptake (age, gender, race/ethnicity, and education).

Methods

Data for this study were collected within RADAR, a longitudinal cohort study in Chicago focused on understanding the individual, dyadic, network, social, and biologic factors associated with HIV infection within YMSM (Morgan et al. 2018; Mustanski et al. 2018). At baseline, study participants complete an initial assessment that includes a network survey, an individual-level psychosocial survey, and collection of biological samples for HIV and STI testing. Data collection for RADAR is ongoing; all data for this report come from study participants who completed a baseline study visit between February 25, 2015, and February 5, 2018, and who indicated an HIV-negative status ($n = 927$).

Participants

In order to be enrolled in the RADAR cohort, participants had to meet the following criteria: between 16 and 29 years of age, assigned a male sex at birth, English-speaking, and either report a sexual encounter with a man in the previous year or a gay or bisexual identity. Participants were recruited in three ways: (1) through their involvement in a cohort of YMSM and/or sexual and gender minority youth such as Project Q2 (Mustanski et al. 2010), or Crew 450 (Mustanski et al. 2013)

(details about these previous cohorts can be found elsewhere (Mustanski et al. 2010; Mustanski et al. 2013)); (2) using venue-based, peer-referral, and online recruitment methods; (3) through being a serious partner of an existing RADAR cohort member (i.e., being in a current serious relationship with a RADAR cohort member) (Feinstein et al. 2018); or (4) through peer recruitment by an existing RADAR cohort member. Although all serious partners were eligible for a one-time visit, they were required to meet the above criteria for enrollment in the cohort. Similarly, peer recruits needed to meet the same criteria, plus they needed to be between 16 and 20 years of age. Age was restricted for peer recruits to match the recruitment design of the previous cohorts (i.e., Project Q2 and Crew 450), which at the time of the current study also had older participants (i.e., ages 20–29) and the overall RADAR sample needed to represent a full range of ages to achieve the multiple cohort, accelerated longitudinal design (Miyazaki and Raudenbush 2000).

Measures

Demographics

At baseline, participants were asked to report their racial identity, and whether they identified as Hispanic or Latino. Following the 2007 United States Department of Education (USED) guidelines for combining ethnicity and race data, anyone who identified as Hispanic/Latino regardless of race was classified as Hispanic/Latino (Education 2007). All non-Hispanic/Latino individuals who identify as a single race were classified as that race; anyone who identified as two or more races was classified as multiracial. Other demographic information collected includes age, gender identity, educational attainment, and sexual orientation.

PrEP Utilization

PrEP use in the prior 6 months was assessed through two questions: “*In your entire life, have you ever taken any pre-exposure prophylaxis (PrEP) medication such as Truvada to reduce your risk of HIV transmission?*” Anyone who said “*Yes*” was asked a follow-up question: “*In the past 6 months have you taken any pre-exposure prophylaxis (PrEP) medication such as Truvada to reduce your risk of HIV transmission?*”

Network-Level Statistics

All network data were collected using an interviewer-assisted touchscreen data capture tool (netCanvas-R) (Hogan et al. 2016). Briefly, netCanvas-R is structured to first collect the names of an individual’s network members (i.e., the people they know). For this study, the names of all individuals with

whom a participant had had sex (sexual network members) or had a close relationship (social network members) within the prior 6 months were collected. The netCanvas-R software then asks participants to report information on their network members—commonly referred to as “alters”—and identify connections between named alters.

All alters who were indicated on the screen with instructions “*Tap on all of the people with whom you had sex in the past six months*” were considered sexual network members. Participants were then asked if they had anal sex with these alters in the prior 6 months; anyone who indicated “*Yes*” was asked for the number of times they engaged in anal sex with this partner, and the number of times they had anal sex without using a condom. All alters for which there was at least one instance of condomless anal sex (CAS) were deemed CAS partners. Additionally, the number of condomless anal sex acts (CASA) was used as a measure of frequency with each partner.

Anyone who was named on the screen “*Who are the people you are closest to? That is, people you see or talk to regularly and share your personal thoughts and feelings with*” were considered social network members. Strength of relationship with alters was measured on a three-point scale: 1 = “*Not close at all*,” 2 = “*Somewhat close*,” and 3 = “*Very close*.”

Furthermore, two network statistics were calculated for both social and sexual connections. The first feature, *degree*, represents the number of social and/or sexual partners a study participant has, and it captures individual popularity. The second feature, *triadic closure*, represents the number of triangles in a network. For example, if participant A reports a connection with both B and C, then B and C have a tendency to be connected, resulting in triadic closure. The number of triangles in a network therefore reflects the extent of clustering in the local network structure (Wasserman and Faust 1994).

Statistical Analysis

A total of 927 cohort members did not report an HIV-positive diagnosis at baseline and were asked PrEP questions. Of the 84 (9.1%) who reported any use of PrEP, 21 (25.0%) who had not used PrEP in the prior 6 months were excluded from analyses to ensure timing of PrEP utilization matched with the 6-month time frame used within the network survey. Therefore, the final analytic sample used in this manuscript was 906 (97.7%).

Individual-level univariate and bivariable analyses to assess associations with PrEP use in the prior 6 months were conducted using SAS v9.4 (Cary, NC). Calculation of all network metrics was performed in R (Csardi and Nepusz 2006; R Core Team 2017). Then, a series of bivariable logistic regressions were conducted to assess the association between a variety of network statistics for social, sexual, and social/sexual networks and PrEP use in the prior 6 months. Two multivariable logistic regressions were then constructed for individual

+ social network predictors of recent PrEP use and individual + sexual network predictors of recent PrEP use using all variables with $p < 0.10$ in bivariable analyses to look at adjusted associations with PrEP use.

Results

The 906 participants in this study were predominantly male-identified (92.4%) and reported a gay/lesbian identity (68.1%). Nearly equal proportions identified as Black (28.4%), White (29.1%), or Latino (30.9%), and they were a median of 20.2 years of age (Table 1).

A total of 63 participants (7.0%) reported using PrEP within the prior 6 months. Median age of participants who had used PrEP in the last 6 months was nearly 1.5 years greater than for those who had never used PrEP (21.5 vs. 20.2, respectively; Table 1). Additionally, bisexual participants were 59% less likely to have used PrEP compared with gay participants (odds ratio [OR] = 0.41; 95% confidence interval [CI] 0.18, 0.92). Although marginally insignificant ($p = 0.06$), transgender women were more than twice as likely to have used PrEP compared with cisgender men (OR = 2.37; 95% CI 0.96, 5.87). Although slight differences were seen in PrEP

usage by race/ethnicity and educational attainment, none of these associations were significant.

Mean degree of participant sexual networks was 3.52; those who used PrEP in the prior 6 months had significantly higher degree than those who had never used PrEP (5.40 vs. 3.38, respectively; Table 2). Similarly, mean number of triangles was significantly greater in those who had used PrEP (0.67 vs. 0.19, respectively). Although there was no difference in CASA frequency with sexual network members, individuals who used PrEP had significantly more CAS partners than those who did not (3.63 vs. 2.75, respectively).

When looking at social network characteristics, participants reported three times as many social as sexual network members (mean degree = 11.63), but there were no differences based on PrEP utilization. Conversely from what was seen in the sexual networks, individuals who used PrEP in the prior 6 months had significantly fewer mean triangles (10.02 vs. 13.98, respectively). Individuals who used PrEP also had significantly weaker relationships with their social network (1.13 vs. 1.27, respectively). Finally, there were no significant differences in mean degree when looking at network members who were both social and sexual alters.

Within the multivariable model containing individual and social network characteristics, both age and gender were

Table 1 Individual-level demographic characteristics associated with PrEP use in the prior six months among HIV-negative study participants

	Total* (<i>n</i> = 906)		PrEP users** (<i>n</i> = 63)		Non-PrEP users** (<i>n</i> = 843)		χ^2 (<i>p</i> value)
	<i>n</i>	%	<i>N</i>	%	<i>n</i>	%	
Race/ethnicity							3.89 (0.42)
Black	257	28.4	20	7.8	237	92.2	
White	264	29.1	21	8.0	243	92.1	
Latino	280	30.9	13	4.6	267	95.4	
Multiracial	72	8.0	7	9.7	65	90.3	
Other	33	3.6	2	6.1	31	93.9	
Gender							3.69 (0.16)
Cisgender male	837	92.4	55	6.6	782	93.4	
Transgender female	42	4.6	6	14.3	36	85.7	
Not listed	27	3.0	2	7.4	25	92.6	
Education							1.24 (0.74)
Less than high school	163	18.0	12	7.4	151	92.6	
High school/GED	204	22.5	15	7.4	189	92.7	
Some college	453	50.0	28	6.2	425	93.8	
At least undergraduate degree	86	9.5	8	9.3	78	90.7	
Sexual Orientation							5.06 (0.08)
Gay/Lesbian	617	68.1	49	7.9	568	92.1	
Bisexual	204	22.5	7	3.4	197	96.6	
Queer/questioning/straight/not listed	85	9.4	7	8.2	78	91.8	
Age, years (median, IQR)	20.2	3.7	21.5	4.4	20.2	3.6	10.2 (0.001)

*column percents; **row percents

Table 2 Sexual and social network characteristics associated with PrEP use in the prior 6 months

	OR	95% CI	Mean	Range
Sexual network				
Degree***	1.117	1.054, 1.184	3.527	1–35
Triangles***	1.468	1.180, 1.828	0.231	0–9
CASA frequency	0.999	0.987, 1.005	7.633	0–635
CAS degree*	1.133	1.007, 1.269	2.824	0–12
Social network				
Degree	0.986	0.937, 1.031	11.631	2–44
Triangles	0.973	0.944, 0.997	13.715	0–149
Strength of relationship**	0.271	0.118, 0.618	1.202	0–2
Social and sexual				
Degree	1.069	0.868, 1.266	1.750	1–11

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

significantly associated with PrEP usage (Table 3). In addition, mean relationship strength and number of triangles were inversely associated with PrEP uptake; no associations were found for social degrees or sexual identity.

Within the multivariable model containing individual and sexual network characteristics, age and gender remained significant correlates. Although no sexual network variables were significantly associated with PrEP usage, number of triangles approached statistical significance ($p = 0.068$).

Discussion

Aside from age and sexual orientation, there were no individual-level factors significantly associated with PrEP use in the prior 6 months. Neither of these were surprising; younger participants are less likely to use PrEP because, if they are under 18 years of age, FDA guidelines had not approved PrEP for adolescents at the time of survey; they are also less likely to engage in healthcare and thus less likely to be linked into PrEP services. Messaging around PrEP also tends to focus on gay men and MSM, which may be exclusionary for bisexual men who then focus less on the importance of PrEP than their gay counterparts. Unexpectedly, we saw that there were no racial/ethnic differences in PrEP uptake—much of the extant literature has shown marked disparities (Strauss et al. 2017), in that White MSM comprise the majority of PrEP users. The data at hand does not explain the lack of racial disparities observed; however, the fact that participants were attending study interviews at a large LGBT community health center, and some participants had engaged in prior cohort studies, indicates that they may have had greater exposure to PrEP and PrEP messaging than comparable peers. Additionally, a known barrier to PrEP uptake and adherence is attendance at regular clinical visits (Ojikutu et al.

2018; Pinto et al. 2018; Syed et al. 2013). Since participants were regularly attending research interviews, this likely was not a concern for this population. Similar future cohort studies should directly assess such barriers to guarantee confidence in data interpretation. Finally, although marginally insignificant, elevated PrEP use among transgender women in our sample was unexpected and encouraging. Much like with racial/ethnic differences, the data at hand did not explain this phenomenon, although the same mitigating factors above apply to transgender women in our sample. These results, combined with limited extant data and literature, highlight a need for increased research on PrEP use among transgender women.

There were a number of significant network-level characteristics in unadjusted analysis, for both social and sexual networks. Participants who used PrEP had significantly higher mean degree, mean CAS degree, and more triangles. The degree differences indicate that PrEP users tended to have more sexual partners, as well as more partners with whom they engaged in CAS, than non-PrEP users. Although this may lend some credibility to the notion of risk compensation, prior research has largely failed to establish a significant direct link between PrEP use and increased reported sexual risk behaviors (Blumenthal and Haubrich 2014; Freeborn and Portillo 2018). However, some studies have observed increased rate of other STIs in PrEP users, perhaps supporting the presence of risk compensation behavior (Harawa et al. 2017; Nguyen et al. 2018). Unfortunately, we are unable to assess temporality within this study and therefore cannot infer a causal relationship without longitudinal data. Thus, conversely, these results may indicate that individuals who are taking PrEP are simply those at greatest risk. Future research will need to examine whether differences in degree are seen prior to or after PrEP uptake within this population in order to satisfactorily test the direction of this association. Finally, the detection of more triangles within the sexual networks of PrEP users indicates their sex partners are more embedded within their networks. For example, someone would likely be unable to report that two one-night stands had sex with each other, but may be more likely to know if two of their casual sex partners had sex with each other. There are several potential implications for this finding. Embeddedness facilitates social support and influence, which can then help facilitate PrEP adherence through enforcing norms and expectations around PrEP use in these peer groups. Further, PrEP use within this scenario could impact network formation and ultimately disease spread by keeping a component of the sexual system protected from HIV acquisition.

Several of our findings within the social network data contradicted what we may have expected to observe based on extant scientific literature. Individuals who were using PrEP had weaker relationships and fewer triangles than those not on PrEP. Traditionally, having a strong support system has been seen to help with medication uptake and adherence, but

Table 3 Multivariable models with individual- and network-level characteristics associated with PrEP utilization in the prior 6 months

	Social network model <i>N</i> = 857		Sexual network model <i>N</i> = 761	
	OR	95% CI	OR	95% CI
Individual-level				
Age (years)	<i>1.146</i>	<i>1.045, 1.254</i>	1.127	1.022, 1.238
Gender				
Cisgender male	REF		REF	–
Transgender female	3.340	1.020, 9.907	3.418	0.943, 10.736
Not listed	1.551	0.225, 6.415	1.903	0.260, 8.715
Sexual identity				
Gay/lesbian	REF		REF	
Bisexual	<i>0.436</i>	<i>0.174, 0.948</i>	<i>0.434</i>	<i>0.161, 0.987</i>
Queer/questioning/straight/not listed	0.503	0.154, 1.396	0.551	0.161, 1.630
Network-level				
Social				
Mean relationship strength	<i>0.287</i>	<i>0.124, 0.656</i>		
Degree	<i>1.068</i>	<i>0.991, 1.148</i>		
Triangles	0.952	0.907, 0.991		
Sexual				
Degree			1.063	0.974, 1.150
Triangles			<i>1.288</i>	<i>0.972, 1.690</i>
CAS degree			1.032	0.992, 1.076

Bold-italics: $p < 0.01$; bold: $p < 0.05$; italics: $p < 0.10$

that may not be the case here. One potential explanation for this finding could be “strength of weak ties”—people who are less embedded in a group are more likely to be exposed to new ideas, such as PrEP (Granovetter 1973). Perhaps more attention should be paid to the role of these individuals, rather than to the most central individuals, in an effort to ramp up PrEP use within social groups (Young et al. 2018). Additional research is also needed to see if social network strength and interconnectedness are associated with PrEP adherence, as the literature around support and adherence is better developed than that around support and uptake.

Within both of our adjusted multivariable models, we found that individual- and network-level predictors were associated with PrEP use. As we anticipated, only looking at individual characteristics did not fully explain PrEP initiation. Between the two models, social network factors were much stronger predictors than sexual network ones after controlling for individual demographics. As network interventions such as popular opinion leader have been shown to be effective in HIV prevention (Jeffries et al. 2017; Theall et al. 2015), and social networks may be particularly important in PrEP adherence among minority MSM (Garcia and Harris 2017; Young et al. 2018), our work highlights the need to extend this research to stimulate PrEP uptake.

In addition to the inability to assess temporality, this study had a number of limitations. All data were self-reported within

an interviewer-administered survey. Although this could result in social desirability bias, study staff is extensively trained to build rapport with participants before and during the interview, which would likely minimize their fear of fully reporting their risk behaviors. Further, there is the potential for recall bias, in that individuals may not fully remember all of their interactions and behaviors; however, all survey questions are time anchored (i.e., last 6 months) and include prompts about significant activities that occurred around that time point to bolster memory. Data were also collected within the Chicago area, and results may not be generalizable to other regions, particularly non-urban settings in the US. Finally, this study focused primarily on YMSM but also included young transgender women. Prior research indicates not only that transgender women have different patterns of risk and protective factors compared to MSM, but also that the longstanding inclusion of transgender women within the broad category MSM is problematic both politically and in terms of ensuring study validity (Baral et al. 2013; Poteat et al. 2016; Sevelius et al. 2016). Due to low power, transgender women were included in this study but we were unable to directly assess network factors associated with PrEP use among transgender women alone. To verify the validity of our findings to exclusively YMSM, we conducted a sensitivity analysis that only included cisgender males. Although there were slight fluctuations in magnitude of associations, the overall significance within the

multivariable models remained the same after limiting the sample size.

These limitations support the importance of increased PrEP research focused directly on transgender populations, and emphasize that future work in this area should prioritize the study of unique network factors associated with PrEP use among transgender women in addition to those among MSM.

Despite limitations, our work provides important insights, and highlights several areas of focus for expanding this critical field of research going forward. First and foremost, this is one of the first studies to examine whether network factors such as degree and closure themselves, as opposed to individual network member characteristics, influence PrEP use among YMSM and young transgender women. Our results add to important literature and provide potential guidance for future research and intervention development. Further, the netCanvas-R data collection tool exhibited significant promise in study implementation and could be used to gain deeper insight into individuals' social, sexual, and even drug use networks by expanding the data collected on alters. For example, collecting information on whether or not a network alter knows about or uses PrEP would provide valuable insight. Further, this is one of the first studies to look at the role that both individual and network variables have on PrEP utilization among YMSM, and demonstrates the importance of using a multilevel lens to understand who will successfully initiate PrEP. Future and ongoing cohort studies of PrEP use and associations should consider adding or expanding current network data collection.

In sum, the present study found that social network factors are more strongly associated with PrEP use than sexual network factors, and that individuals who are less connected within their networks are more likely to have taken PrEP in the prior 6 months. Research and intervention development should expand their focus on network factors in HIV prevention activities. Although future investigation is needed into the role of network factors in PrEP adherence, these data provide important context for understanding the structures needed for an individual to initiate PrEP and should be explicitly considered in the development and implementation of PrEP interventions.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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