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Sexual Health of Rural and Urban Young Male Couples in the United States: Differences in HIV Testing, Pre-Exposure Prophylaxis Use, and Condom Use

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Abstract

Young men who have sex with men (YMSM) are disproportionally affected by HIV, and main partnerships account for a large proportion of new HIV infections. HIV prevention is largely focused on urban YMSM, and less is known about sexual health of rural male couples. The present study used data from a randomized controlled trial of a relationship education and HIV prevention program for male couples to test associations of rurality with HIV/STI testing, PrEP use, number of sexual partners, and condomless anal sex (CAS) acts. Participants were 430 YMSM in relationships. Rural YMSM were less likely to have been tested for HIV/STIs, and to have used PrEP, compared to urban YMSM. Although higher rurality was associated with fewer CAS acts, CAS was not infrequent among rural YMSM, highlighting the need for increased HIV prevention geared toward young male couples living in rural, less resourced areas.

Keywords

YMSM; rural; relationships; HIV; pre-exposure prophylaxis (PrEP)

INTRODUCTION

Young gay, bisexual, and other men who have sex with men (collectively referred to as YMSM) are the population most disproportionally affected by HIV in the United States. From 2012–2017, YMSM ages 25–34 had the greatest percentage increase in diagnosed HIV infection (1). YMSM also have high rates of sexually transmitted infections (STIs),

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which can increase risk for subsequent HIV infection (2). A substantial proportion of new HIV infections among YMSM, as many as 84%, occur in the context of main partnerships (3, 4). This is because YMSM are less likely to use condoms or pre-exposure prophylaxis (PrEP) when they are in serious relationships (3, 5–7). In addition, nearly half of HIV-positive YMSM are not aware of their status, and YMSM with main partners report lower levels of routine HIV testing than single YMSM (8, 9). This means that HIV-positive YMSM who are not aware of their status may be unknowingly exposing their partners to HIV when they reduce or eliminate condom or PrEP use upon entering into romantic relationships. Thus, understanding sexual and HIV prevention behaviors among YMSM in relationships is key to developing programs to reduce the burden of HIV in this population.

Estimates show that the largest YMSM populations (10), and number of YMSM living with HIV infection, reside in urban areas (1); thus, HIV prevention efforts are largely focused on urban YMSM (11–13). Sexual health researchers also tend to recruit samples of YMSM from urban and suburban areas of the United States (14–16), limiting the generalizability of their findings to YMSM residing in more rural settings. Much less research has been dedicated to exploring the unique sexual health needs and experiences of rural YMSM, and close to none has focused on rural YMSM in relationships. YMSM living in rural communities experience a number of challenges that are unique relative to, or more pronounced than, those experienced by YMSM in urban areas, including increased stigma around same-sex behavior and HIV/AIDS (17, 18). For rural YMSM, being in a relationship may buffer the effects of stigma on wellbeing and contribute to more positive outcomes in regards to mental and physical health (19–21). Understanding more about the sexual health needs of rural young male couples is important to develop interventions that maintain the protective benefits of relationships while retaining HIV prevention behaviors.

Condom Use

Rural YMSM have lower prevalence of HIV compared to urban YMSM, although they remain at elevated risk for HIV infection relative to their heterosexual peers (1). Research on differences in condom use between urban and rural YMSM, however, has yielded mixed results. Results from a national online survey showed no significant difference between rural and urban MSM in the prevalence of self-reported condomless anal intercourse in the past year or with most recent sex partner, nor was there a difference in reporting their most recent sex partner was HIV-positive or had unknown serostatus (22). In contrast, a study of internet use among rural and urban MSM found that prevalence of condomless anal intercourse at last sexual encounter was significantly higher in rural than in urban men (25% compared to 19%) (23).

Although past studies comparing urban and rural MSM have had inconsistent results, it is clear that inconsistent condom use during anal sex is common among rural MSM (23–29). For example, a study conducted with MSM residing in rural Indiana found that only 25.5% of men engaging in insertive anal intercourse and 27.5% engaging in receptive anal intercourse reported using a condom during any of the last 10 instances of anal intercourse (30). Two studies examining associations between stigma and sexual behavior among rural

MSM found that the majority of rural MSM (47% and 52%, respectively) reported having multiple sex partners and inconsistent condom use during receptive anal sex (17, 18).

HIV and STI Testing

Risk for HIV and other sexually transmitted infections (STIs) among rural YMSM is determined not only by individual sexual behaviors, but also by access to HIV prevention services, such as HIV and STI testing and pre-exposure prophylaxis (PrEP). Unfortunately, YMSM living in rural areas often face barriers to accessing HIV prevention, including geographic isolation from LGBTQ-affirming healthcare services, discrimination in healthcare settings, providers who lack cultural competence, and challenges related to disclosure of LGBTQ identity to providers (24, 30–32). As a result, MSM living in rural areas get tested for HIV less frequently than those in the general population. A recent systematic review placed the prevalence of lifetime HIV testing among the general population of MSM at 85% (33), regardless of rurality or urbanicity, but one study of rural MSM found that lifetime HIV testing prevalence was about 75% (30). It is also important to note that this reported rate of HIV testing may be inflated due to the sample's proximity to a college town and health system (30). Another study conducted with a nationwide sample of rural MSM found that 78.6% reported testing for HIV in the past year (29), while a study rural LGBTQ adults found that only 57% of those who met CDC standards for requiring an HIV test within the past 12 months had been tested (34). Recent scholarship has also shown that rural MSM are less likely to have tested for HIV in their lifetime (22, 35) and in the past year (22) than MSM in urban localities, and that rural residency has been linked to having an unknown HIV status (36). A direct link has also been drawn between disclosure of sexual orientation to healthcare providers and HIV testing in LGBTQ patients (37–39), and rural locality has been associated with less frequent disclosure in MSM (38).

Rural YMSM are also less likely to be tested for other STIs. The Centers for Disease Control (CDC) recommend that MSM screen for gonorrhea and chlamydia at least once per year, and up to once every three months for those who have multiple sex partners (40). However, in one study, only 51.5% of rural MSM had been tested for STIs in the past year, and even fewer had done so in the past six months (29). When compared to urban locality, rurality has been associated with a lower likelihood of any prior year STI testing among MSM (22). Indeed, only 45% of a sample of rural LGBTQ adults were up-to-date with CDC standards for gonorrhea and chlamydia screening (37). Taken together, these findings indicate that MSM in rural spaces test less often for HIV and STIs.

Use of Pre-Exposure Prophylaxis

Barriers faced by rural YMSM in accessing HIV/STI testing services likely extend to access to PrEP. Oral PrEP, when taken daily, is approximately 99% effective at preventing new HIV infections in MSM (41). PrEP education campaigns have led to an uptick in PrEP awareness since its FDA approval in 2012 (42), though most of these outreach efforts have targeted urban areas. PrEP use among MSM has also increased (42), though it remains underutilized in this population despite its effectiveness as an HIV prophylactic (43). However, most data on PrEP use is derived from urban populations, and little is known about PrEP use among rural populations.

The limited body of work on PrEP use in rural MSM suggests that obtaining a prescription for PrEP outside of urban centers is complicated by a lack of prescribers. So-called “PrEP deserts” (i.e., areas that lack medical professionals who prescribe PrEP drugs) tend to be located in non-urban localities (44). A recent survey of rural primary care providers in one state found that fewer than half knew of the existence of PrEP (45), and many rural doctors are reportedly reluctant to prescribe PrEP due to their lack of knowledge (31, 46, 47). This means that in order to access PrEP, many rural MSM must travel long distances to see healthcare providers located in urban centers, the cost of which is prohibitively expensive for many rural MSM (46, 47). Qualitative studies have shown that rural MSM may hesitate to talk to their providers about PrEP due to concerns about mistreatment or breaches in confidentiality that might lead to being “outed” (31). Though this previous work is important to our understanding of PrEP access for rural MSM, we are not aware of any quantitative study to date that has compared rates of PrEP use in rural versus urban male couples.

Present Study

An important methodological consideration when conducting health research on rural populations is how rurality is defined. In regards to previous research on rural YMSM, operationalization of rurality varies greatly across studies, making it difficult to make direct comparisons of their findings and generalize results. Many existing measures of rurality fall into what Waldorf calls the “threshold trap,” in which arbitrary distinctions between “rural” and “urban” group dissimilar counties together, and separate similar counties (48). Another critique of existing definitions of rurality is that they “overbound” rurality (i.e., areas that might reasonably be called urban are actually being classified as rural) (49).

In response to these limitations, Waldorf created the Index of Relative Rurality (48). This scale has several advantages over threshold-based rurality measures in conducting research on urban and rural YMSM. First, it treats rurality as a relative concept, such that it does not assess whether or not a place is rural, but how rural a place is relative to other places. For the purposes of the present study, this allows us to quantify precisely how much change in sexual and HIV prevention behaviors is associated with each unit of increase in rurality. Second, the measure captures the multi-faceted nature of rurality, taking into account defining variables such as remoteness from metropolitan areas, which is likely to affect access to resources for young male couples.

The goal of the present study was to investigate the association between rurality and sexual and HIV prevention behaviors of urban and rural YMSM. Using baseline data from a national online randomized controlled trial (RCT) of a relationship education and HIV prevention program for male couples, we examined associations between rurality and HIV/STI testing, PrEP use, number of sexual partners, and condomless anal sex (CAS) with partners outside the relationship. The current study adds to existing literature by using a continuous and multi-faceted measure of rurality, being among the first to quantitatively examine PrEP use among urban and rural YMSM, and focusing on urban and rural YMSM in relationships. We hypothesized rurality would be negatively associated with HIV/STI testing, PrEP use, number of sexual partners, and CAS with partners outside the relationship.

METHOD

Procedure

Data for this study were collected as a part of baseline assessments from an ongoing comparative effectiveness RCT of 2GETHER USA, a relationship education and HIV prevention program for young male couples. Couples were eligible for the RCT based on the following inclusion criteria: 1) both members were assigned male at birth and currently identified as male; 2) both members were at least 18 years of age and at least one member was aged 18–29; 3) the couple reported oral or anal sex with each other in the last three months; 4) at least one member reported having CAS with a known serodiscordant serious partner or with any casual sexual partner; 5) at least one member reported binge-drinking (i.e., five or more drinks on a single occasion) or illicit drug use in the last 30 days; 6) both could read and speak English at 8th grade level or better; 7) both had access to the Internet; and 8) both agreed to audio recording of intervention sessions.

Participants for the current analytic sample were recruited between March 2018 and September 2019. At the time of analysis, 3,519 individuals had completed an eligibility screener. Of these, 1,607 individuals were ineligible because their partners did not complete an eligibility screener. Of the 956 dyads in which both partners completed an eligibility screener, 467 dyads were eligible based on the criteria above. Of these eligible dyads, 204 dyads and 24 individuals (dyads in which one partner had not yet completed baseline at the time of analyses; individual $N = 430$) completed the baseline assessment, which constitutes the analytic sample. In these analyses, we included data from couples or individuals who were eligible and completed baseline but were not randomized because they were either awaiting assignment to a cohort or were lost to follow-up ($N = 152$). Participants were recruited using paid advertising on social media (e.g., Facebook, Instagram), geospatial dating/hookup apps, and organic online engagement through social media posts (e.g., Reddit, Twitter). More information about the RCT of 2GETHER USA can be found in (50).

Measures

Demographics.—The demographic questionnaire assessed participants' age, HIV-status, self-reported sexual orientation, and race/ethnicity. Additionally, participants reported on the length and legal status of their relationship.

Rurality.—Rurality was measured using the most recent 2010 county-level Index of Relative Rurality, a continuous and threshold-free measure of rurality (51). The Index of Relative Rurality is based on four dimensions of rurality: population size, density, remoteness, and built-up area. Possible scores range between 0 (most urban) and 1 (most rural). The Pearson Correlation between rurality scores for Federal Information Processing Standards (a five-digit code which uniquely identifies counties and county-equivalents in the United States; FIPS) counties in 2010 and 2000 is nearly perfect (α=0.995, p<.001), indicating this is a highly stable measure. Using ArcGIS 10.6.1, participants' residential addresses at screening were geocoded using a local composite geocoder. County boundaries obtained from an Esri layer package were plotted to derive County FIPS for each participant, then matched to unique rurality scores. For the purposes of this study, rurality scores were

multiplied by 10, increasing the interpretability of results with respect to odds and incident rate ratios without changing significance tests or statistics. Recoded rurality scores in our sample had a mean of 2.82 (SD = 1.28), and a one unit increase/decrease mapped well onto the difference between quartiles (i.e., thresholds between quartiles; Q1=1.77, Q2=2.87; Q3=3.75).

STI and HIV Testing.—Participants who reported any lifetime STI test were asked whether they had been tested for STIs in the past three months; 15 "unsure" responses were coded as missing (3.4%). Participants who had previously been tested for HIV were asked to report the month and year of their most recent test. To compute HIV testing in the past three months, the difference between the most recent test and the baseline assessment month/year was computed and dichotomized. For 28 participants who were unsure of the month or year of their most recent test, responses were coded as missing (6.5%).

PrEP Use.—PrEP use was assessed among HIV-negative participants who reported having heard of PrEP prior to baseline (N = 384). Participants were first asked: "In your entire life, have you ever taken any pre-exposure prophylaxis (PrEP) medication such as Truvada to reduce your risk of HIV transmission?" followed by an assessment of their current PrEP use. All responses were yes/no.

Number of Sexual Partners and Condomless Anal Sex Acts.—We investigated two sexual behavior outcomes using a modified version of the HIV-Risk Assessment of Sexual Partnerships (H-RASP) (52), which assesses partner-by-partner sexual behavior within a stated recall period. The present study modified the H-RASP administration to limit the partner-by-partner framework to self-reported "main" partners, while participants were asked to report on all outside partners in aggregate. First, the total number of sexual partners was computed by summing the raw numbers of partners that participants reported across both main and outside partners (Mdn = 3.00, IQR = 4.00). Second, CAS acts with outside partners was computed by summing the raw number of condomless insertive and condomless receptive sex acts (Mdn = 3.00, IQR = 5.00). If participants reported no outside partners, CAS acts were treated as missing: not applicable (N = 199; 46.3%). For both outcomes, data were winsorized to three standard deviations above the mean.

Analytic Plan

We used multilevel mixed-effects models in SPSS Version 25 to test whether baseline reports of HIV testing, STI testing, PrEP use, number of sexual partners, and CAS acts varied by relative rurality. By modeling the differences between individuals at the same time as the variance within couples and county, the multilevel mixed model controls for the non-independence of individuals within dyads and dyads within counties. For dichotomous outcomes (testing, PrEP), a binomial distribution and logit link was specified, while count-based outcomes (number of sexual partners, CAS acts) specified a negative binomial distribution and log link. For HIV and STI testing, there were no significant differences in missingness (participants who were "unsure" if they had been tested for STIs in the past three months or unsure of the month or year of their most recent HIV test) by rurality. All HIV+ participants were excluded from the analysis testing the association of rurality with

PrEP use. HIV+ participants who were diagnosed more than three months ago were excluded from tests of associations of HIV testing in the past three months and rurality. Three HIV+ participants tested positive for HIV within the past 3 months of data collection and were included in analysis of rurality with HIV testing in the past three months. All participants were included in analyses involving number of sexual partners and CAS acts, which used winsorized counts. In sensitivity analyses, we re-ran the number of sexual partners and CAS acts count models with the raw data; given that significance of results did not change, primary analyses using winsorized data are reported. All models controlled for age and race/ethnicity (dummy coded as Black, Latinx, and "other," with White as the reference group).

RESULTS

Participants

Sample characteristics for the total analytic sample, as well as for the top and bottom quartiles of rurality, are displayed in Table 1; total sample characteristics are described here. Participants' average age was 28.70 years ($SD = 7.34$), and 17.2% of couples had an age discordance of more than 10 years between partners. Based on eligibility criteria, all participants were assigned male at birth and currently identified as male. Participants identified as gay (83.7%), bisexual (10.0%), queer (5.6%), or another orientation not listed (0.7%). Regarding participant HIV status, 75.3% were HIV-negative, 10.7% were HIV-positive, and 14% were unsure of their status or had never been tested (information on how HIV status was treated in analyses is described in the Analytic Plan). Among dyads, 19.5% included at least one HIV-positive partner. Participants identified their race/ethnicity as White (60.9%), Hispanic/Latinx (20.7%), Black or African American (6.7%), Multi-racial (5.6%), Asian (4.2%), American Indian or Alaska Native (0.7%), Native Hawaiian or Other Pacific Islander (0.5%), or another identity not listed (0.7%). In terms of geographic region of the United States, participants lived in the Northeast (15.5%), Midwest (21.6%), South (38.4%), and West (24.4%). In terms of highest level of education completed, 12.8% of participants had completed a high school diploma or GED, 31.9% had a trade school certificate or some college, 36.3% had completed an undergraduate degree, and 17.4% had completed a graduate degree. Students comprised 28.1% of the sample, and 84.0% were currently employed.

Preliminary Analyses

First, we examined demographic differences by rurality. Compared to White participants, Latinx participants had significantly lower rurality scores ($M = 2.44$ vs. $M = 2.96$, $t = -3.33$, $p = 0.001$), indicating that more Latinx participants lived in urban environments than White participants. Participants who did not know their HIV status scored significantly higher on rurality than HIV-negative participants ($M = 3.34$ vs. $M = 2.77$, $t = 3.19$, $p = 0.002$). With regard to sexual orientation, participants who identified as queer tended to live in more urban settings than participants who identified as gay ($M = 2.17$ vs. $M = 2.87$, $t = -2.61$, $p = 0.009$). There were no significant differences in rurality by age.

Table 2 presents descriptive statistics for main outcomes in both the full sample as well as quartiles by rurality. The top 25% most rural participants showed universally lower HIV/STI testing and PrEP use and fewer sexual partners and CAS acts than the full sample compared to all other quartiles of rurality. For example, 41.4% of the full sample reported STI testing in the past 3 months, however there was 21.1% difference between the most urban and rural quartiles, with 53.8% and 32.7% reporting STI testing, respectively. Likewise, current PrEP use was endorsed by more than twice the number of urban participants (39.8%) than their rural counterparts (16.7%). For a complete listing of outcomes, see Table 2.

HIV and STI Testing

Results for multi-level mixed-effects models testing the association between rurality and main study variables are presented in Table 3. There was a significant association between rurality and HIV testing in the past three months (OR = 0.84, $p = 0.035$, 95% CI [0.71, 0.99]), indicating that for each quartile change in relative rurality score, the odds of having been tested for HIV were 0.84 times the odds of having been tested for HIV in the lower quartile. There was a similar association between rurality and past three month STI testing (OR = 0.76, $p = 0.001$, 95% CI [0.65, 0.90]), such that for every quartile change in rurality, the odds of engaging in STI testing were 0.76 times the odds of STI testing in the lower quartile. Age was a significant covariate in both models, with older participants reporting greater odds of having tested for HIV (OR = 1.04, $p = 0.011$, 95% CI [1.01, 1.08]) as well as STIs (OR = 1.03, $p = 0.028$, 95% CI [1.00, 1.06]) in the past three months. Compared to White participants, results also indicated odds of STI testing were nearly 3.5 times higher for Black participants (OR = 3.48, $p = 0.002$, 95% CI [1.57, 7.73]) and almost twice as high for Latinx participants (OR = 1.87, $p = 0.016$, 95% CI [1.12, 3.10]). These racial/ethnic differences were not observed in HIV testing.

PrEP Use

Relative rurality was significantly associated with lifetime PrEP use (OR = 0.70, $p < .001$, 95% CI [0.59, 0.83]), indicating the odds of having ever used PrEP were 0.70 times the odds of lifetime PrEP use in the lower quartile. Participants with higher relative rurality scores had lower odds of being current PrEP users (OR = 0.70, $p < .001$, 95% CI [0.59, 0.84]). Concerning current PrEP use, both age and race/ethnicity were significant covariates. Older participants had greater odds of being on PrEP (OR = 1.04, $p = 0.008$, 95% CI [1.01, 1.07]). Latinx participants (OR = 2.15, $p = 0.008$, 95% CI [1.23, 3.79]) and participants of other races (OR = 2.42, $p = 0.010$, 95% CI [1.23, 4.74]) had greater odds of being on PrEP than their White counterparts.

Number of Sexual Partners and Condomless Anal Sex Acts

In models of number of sexual partner and CAS acts, the random effects of relationship dyads were removed to achieve model convergence. There was a significant effect of rurality on participants' reported number of sexual partners in the past three months (IRR = 0.86 $p < .001$, 95% CI [0.79, 0.93]), indicating that with each additional unit of relative rurality the rate of sexual partners decreased by 14%. Likewise, participants in more rural areas reported a significantly lower rate of CAS acts with outside partners (IRR = 0.89 $p = 0.023$, 95% CI [0.80, 0.98]). Age and race/ethnicity were significant covariates for number of sexual

partners in the past three months. Participants reported a 3% increase in the number of partners for each additional year of age (IRR = 1.03, $p < .001$, 95% CI [1.02, 1.04]). Compared to White participants, Latinx participants reported 40% more partners in the past three months (IRR = 1.40, $p = 0.009$, 95% CI [1.09, 1.80]). There were no significant covariates for CAS acts with outside partners.

Test of Model Robustness

The specific population of focus for this study was YMSM due to their increased risk for HIV, but the sample included MSM aged 30 years or older who were partnered with younger men. Thus, we conducted tests of model robustness to investigate if the effects described above remained significant after removing participants who were 30 years or older from the analytic sample. All results remained significant and were in the same direction, with the exception of the association of rurality with HIV testing in the last three months, which was in the same direction, but no longer significant (OR = .90, $p = 0.265$, 95% CI [0.75, 1.09]).

Lastly, we also conducted post-hoc analyses to test for a quadratic effect of rurality on HIV/STI testing, PrEP use, number of sexual partners, and CAS acts, in order to examine whether the observed effects of rurality were non-linear. We did not find a statistically significant quadratic effect.

DISCUSSION

The present study analyzed baseline data from a national RCT of a relationship education and HIV prevention program for young male couples to test associations of rurality with sexual and HIV prevention behaviors. This study makes several novel contributions to the limited existing research on the sexual health of urban and rural YMSM. Namely, we operationalized rurality using the Index of Relative Rurality (51), a continuous and threshold-free measure that enabled us to examine changes in sexual and HIV prevention behaviors per unit increase in rurality. This builds on previous studies that have used thresholds based on a single variable (i.e., population) to create “urban” and “rural” groups of participants, which can be fairly heterogeneous (48). This study is also among the first to quantitatively test associations of PrEP use and rurality, adding to existing qualitative research studies that have indicated that rural YMSM experience barriers to accessing PrEP (31, 44–47).

Lastly, this study was unique in that it was focused on young male couples. Previous research has shown that as many as 84% of new HIV infections among YMSM occur in the context of main partnerships (3, 4), because of a combination of reduced HIV testing and prevention (i.e., condoms or PrEP) in serious relationships (5–9), and the proportion of HIV-positive YMSM who are not aware of their status (53). Relationships may be an important source of support for YMSM living in rural areas (19–21), who may be more likely to experience stigma and discrimination than those living in more urban environments (17, 18, 24). In contrast, however, being in a relationship may act as an indicator of their sexual minority status, and increase exposure to stigma. This creates a need for additional research and intervention efforts geared toward rural YMSM in relationships, so that they can continue to experience these benefits while also maintaining sexual health.

As hypothesized, results showed that rurality was negatively associated with HIV and STI testing in the past three months. In addition, participants who reported that they did not know their HIV status scored significantly higher rurality scores (i.e., lived in more rural areas) than those who reported a negative HIV status. This is consistent with previous research findings showing that YMSM living in rural areas are less likely to have been tested for HIV than those living in urban areas (22, 35), and that living in a rural area has been associated with having an unknown HIV status (36). Lower rates of testing and awareness of HIV status can be attributed to the lack of access to HIV prevention services in rural areas, as well as a reluctance to utilize such services for rural MSM (22). MSM living in rural areas are less likely to disclose their sexual orientation to healthcare providers (24), and, in one study, only a small proportion of participants (14%) had been directly asked by their health care provider about their sexual orientation (38). Primary care clinicians make recommendations for routine HIV testing based on knowledge of the patient's sexual behaviors, which would require disclosure of same-sex sexual behavior; thus, rural YMSM who do not feel comfortable disclosing their sexual orientation to their health care providers are less likely to be tested for HIV (37–39).

Rurality was also negatively associated with lifetime or current use of PrEP. Our study appears to be among the first to quantitatively compare use of PrEP based on rural/urban location, but is consistent with previous qualitative studies that have revealed substantial barriers to accessing PrEP for MSM living in more rural areas. The rural participants in our study may be living in "PrEP desserts," or areas that lack health care providers who prescribe PrEP, which are often in non-urban areas (44), meaning that YMSM in rural areas seeking PrEP may need to travel long distances to see health care providers in urban centers (46, 47). In addition to a lack of access, lower rates of PrEP use may be attributed to rural primary care providers' lack of knowledge of PrEP or reluctance to prescribe PrEP (31, 45–47). A systematic review of healthcare experiences of rural LGBTQ patients revealed that experiences of stigma, discrimination, and inadequate cultural competency were common, and that rural LGBTQ patients experienced more disadvantages and barriers to receiving adequate care than their non-rural counterparts (24). These experiences may explain our findings of lower rates of HIV/STI testing and PrEP use among more rural young male couples.

Findings also revealed that participants with higher relative rurality scores reported significantly fewer sexual partners and CAS acts with outside partners during the past three months compared to those in more urban areas. Rural YMSM are likely to have fewer opportunities to have partners outside of their relationship, given that populations of MSM are higher in urban areas (10), and the rate of CAS with outside partners is in part influenced by the availability of outside partners. Results of previous studies examining differences in condom use among urban and rural MSM have been mixed, with one study, for example, finding no significant differences (22), and another finding higher prevalence of CAS among rural MSM than among urban MSM (23). Although rurality was negatively associated with CAS acts with partners outside of their relationships for the YMSM in this study, condom use with outside partners was not consistent, with YMSM in the top 25% of rurality reporting an average of 4.05 CAS acts with outside partners in the past three months (compared to an average of 4.72 among those in the bottom 25% of rurality). This is

supported by previous studies that have shown that rural MSM report inconsistent condom use during anal sex (23–30, 54). Our findings add to those of previous studies to show that although their sexual behaviors are different than urban YMSM, rural YMSM nonetheless remain at risk for HIV (1).

The combination of our findings that the more rural the area in which young male couples live, the less likely they are to be tested for HIV and other STIs or to be on PrEP, and that rural YMSM use condoms inconsistently for CAS with outside partners, indicates that the sexual health needs of young male couples living in rural areas are not being met. YMSM in relationships are already at increased risk for HIV transmission because of decreased frequency of HIV testing and less PrEP and condom use compared to YMSM not in main partnerships (5–9). Our results indicate that young male couples in rural areas are even less likely to engage in these prevention behaviors than urban couples, and are in need of interventions that increase their access to needed sexual health care services.

These data were taken from a comparative effectiveness RCT of 2GETHER USA, a highly innovative and promising approach for reducing HIV risk in young male couples (50). 2GETHER is a hybrid group- and individual-level intervention that delivers three weekly online group sessions, followed by two individualized couple sessions (50). Because the intervention is administered online via videoconference and uses at-home HIV testing, it enables rural couples who lack LGBTQ-affirmative healthcare to access relationship education and sexual health services. As videoconferencing technology advances, telehealth has continued to expand, allowing patients in different locations to participate in synchronous interventions in which they can interact with healthcare providers (55). Telehealth also has the potential to overcome many common barriers experienced when intervening with couples, including that (1) coordinating multiple schedules is easier when couples can participate from home; (2) couples may be more comfortable and open to sharing their experiences when they are not in the same physical space as other couples or facilitators; and (3) stigma associated with seeking treatment in traditional brick-and-mortar locations, in which there may be concerns about disclosure of sexual minority status, is reduced (50). In addition, interventions aimed at male couples that include home-based HIV testing and counseling conducted online via videoconference also show promise in enabling increased access to these services for male couples, which represents a crucial step in prevention and linkage to care (56–58).

Although 2GETHER USA and other recently developed interventions are helping to increase access to HIV testing and counseling services (56, 57), they do not necessarily address “PrEP deserts,” or providers’ lack of knowledge or willingness to prescribe PrEP, which are substantial barriers to uptake in this population (31, 44, 45). Interventions are needed to increase providers’ knowledge of PrEP and how to identify appropriate candidates, which has been shown to increase willingness to prescribe PrEP (59). Providers are also in need of education in the treatment of LGBTQ populations, as studies have shown that many report having received inadequate training in this area (24). Providers’ increased cultural competence will hopefully allow MSM to feel more comfortable disclosing their same-sex sexual behavior, which is an important factor in providers’ recommendation for routine HIV and STI testing, as well as prescribing PrEP (37–39). In addition to focusing

specifically on providers, structural-level interventions are warranted to reduce stigma related to same-sex behavior and HIV in rural areas more broadly (60). Further research on providers' perceptions of and willingness to prescribe PrEP will be important to inform provider education and interventions.

The findings of this study must be considered in light of its limitations. The study used a national sample of couples who represented urban and rural areas from geographic regions across the United States, but is not likely to be representative of all young male couples for several reasons. First, although our sample included couples from the Northeast, Midwest, South, and West, the largest proportion of couples were located in the South, which also had the highest proportion of couples from the most rural quartile (see Table 1). Regional differences in social and political climate could have affected our results, given previous research showing that the inclusivity of state laws and policies has been associated with sexual health among sexual minority adolescents (61). Second, the study advertised that participation would include free HIV and STI testing, which may have biased the sample toward those who lacked the financial resources or local health care services to access testing themselves.

Third, an inclusion criterion of the RCT from which these data were taken was that at least one member of the couple reported having CAS with a known serodiscordant serious partner or with any casual sexual partner. This criterion was included to target the population of coupled YMSM that would be the most ideal candidates for an HIV risk reduction intervention; however, this also limits the generalizability of our results. It is possible that we would have found fewer differences in HIV prevention behaviors between urban and rural YMSM had our sample included monogamous, seroconcordant negative couples, who may have lower rates of HIV/STI testing and PrEP use, on average, regardless of location. Fourth, the majority of participants in our sample identified as White, meaning that our results may be less generalizable to all YMSM of color, who represent the population more affected by HIV than any other group in the United States (1). Future research focused on rural YMSM of color is needed to address health disparities in this population. Despite these limitations, this study makes an important contribution to the literature on sexual and HIV prevention behaviors among urban and rural YMSM in relationships. Findings of this study highlight important areas for intervention to address the unique sexual health needs of rural male couples.

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Table 1

Sample Characteristics

Individual-Level	Total Sample		Rurality Quartiles	
	N	%	Bottom 25 (Least Rural)	Top 25 (Most Rural)
Age (M = 28.70, SD = 7.34)			27.99 (5.16)	28.66 (8.89)
Under 30 years old	335	77.9%	78.5%	80.9%
30 years old and older	95	22.1%	21.5%	19.1%
HIV-status				
HIV-negative	324	75.3%	75.7%	71.8%
HIV-positive	46	10.7%	15.0%	9.1%
Unsure of status or never tested	60	14.0%	9.3%	19.1%
Race/Ethnicity				
Black or African American	29	6.7%	8.4%	7.3%
White	262	60.9%	48.6%	69.1%
Hispanic or Latinx	89	20.7%	29.0%	11.8%
Other	50	11.7%	14.0%	11.8%
Sexual Orientation				
Gay	360	83.7%	79.4%	88.2%
Bisexual	43	10.0%	9.3%	10.0%
Queer	24	5.6%	10.3%	1.8%
Not listed	3	0.7%	0.9%	0.0%
Level of Education				
Less than a 4-year undergraduate degree	199	46.3%	31.8%	60.9%
Undergraduate or graduate degree	231	53.7%	68.3%	39.1%
Geographic Region				
Northeast	67	15.5%	36.4%	5.5%
Midwest	93	21.6%	8.4%	32.7%
South	165	38.4%	42.1%	36.4%
West	105	24.4%	13.1%	25.5%
Dyad-Level	**Total Sample**		**Rurality Quartiles**	
	N	**%**	**Bottom 25 (Least Rural)**	**Top 25 (Most Rural)**
Relationship Length (M = 38.04, SD = 27.53)			36.25 (25.09)	40.74 (26.88)
1 year or less	85	19.8%	19.6%	11.8%
More than 1 year	345	80.2%	80.4%	88.2%
Age Discordance				
Less than 10 years difference	332	77.2%	86.0%	72.7%
10 or more years difference	74	17.2%	10.3%	18.2%
Missing: only one partner in dataset	24	5.6%	3.7%	9.1%
HIV Status Arrangement				
Sero-concordant negative or unknown	330	76.7%	72.9%	74.5%
At least one positive partner	80	18.6%	24.3%	16.4%
Missing: only one partner (HIV-) in dataset	20	4.7%	2.8%	9.1%

Note. Rurality = Index of Relative Rurality. Higher scores indicate higher relative rurality. Geographic Region = state recoded into region as reported in CDC HIV Surveillance Report 2016 and defined by US Census Bureau: Northeast: CT, ME, MA, NH, NJ, NY, PA, RI, VT; Midwest: IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, WI; South: AL, AR, DE, DC, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV; West: AK, AZ, CA, CO, HI, ID, MT, NV, NM, OR, UT, WA, WY.

Table 2

Descriptive Statistics for Outcomes of Interest: Total and Quartile Breakdowns

Outcomes	Total Sample		IRR Q1	IRR Q2	IRR Q3	IRR Q4
	N			%		
HIV Testing in Past 3 Months	363	46.0%	51.6%	43.8%	51.7%	37.0%
STI Testing in Past 3 Months	415	41.4%	53.8%	37.9%	41.3%	32.7%
Lifetime PrEP Use	384	37.5%	50.0%	39.8%	36.1%	24.0%
Current PrEP Use	384	29.4%	39.8%	32.3%	28.9%	16.7%
				M(SD)		
# Sex Partners in Past 3 Months	430	4.12 (4.73)	5.00 (5.57)	4.30 (4.42)	4.11 (4.85)	3.08 (3.73)
# CAS Acts (Outside Partners) in Past 3 Months	231	4.24 (4.53)	4.72 (4.96)	4.88 (5.07)	3.30 (3.62)	4.05 (4.22)
				Median (Interquartile Range)		
# Sex Partners in Past 3 Months	430	3.00 (4.00)	3.00 (5.00)	3.00 (5.00)	2.00 (5.00)	2.00 (2.25)
# CAS Acts (Outside Partners) in Past 3 Months	231	3.00 (5.00)	3.00 (8.50)	4.00 (7.00)	2.00 (4.00)	3.00 (4.00)

Note. IRR = Index of Relative Rurality. Higher scores indicate higher relative rurality. Q1 – Q4 = Quartiles 1–4.

Table 3

Adjusted Odds Ratios, Incident Rate Ratios, and 95% Confidence Intervals for Associations of Rurality and Outcomes of Interest

Predictors	HIV Testing P3M			STI Testing P3M			Lifetime PrEP Use			Current PrEP Use			# Sex Partners P3M			# CAS Acts (OP) P3M		
	N = 363[ab]			*N* = 415[b]			*N* = 384[c]			*N* = 384[c]			*N* = 430			*N* = 231[d]		
	OR	*p*	95% CI	OR	*p*	95% CI	OR	*p*	95% CI	OR	*p*	95% CI	IRR	*p*	95% CI	IRR	*p*	95% CI
IRR	0.84	0.035	[0.71, 0.99]	0.76	0.001	[0.65, 0.90]	0.70	<0.001	[0.59, 0.83]	0.70	0.000	[0.59, 0.84]	0.86	<0.001	[0.79, 0.93]	0.89	0.023	[0.80, 0.98]
Age	1.04	0.011	[1.01, 1.08]	1.03	0.028	[1.00, 1.06]	1.02	0.117	[0.99, 1.05]	1.04	0.008	[1.01, 1.07]	1.03	<0.001	[1.02, 1.04]	1.02	0.058	[1.00., 1.03]
Race - Black or African American	2.16	0.115	[0.83, 5.62]	3.48	0.002	[1.57, 7.73]	1.21	0.725	[0.42, 3.51]	1.49	0.480	[0.49, 4.51]	1.17	0.399	[0.81, 1.68]	1.18	0.514	[0.72, 1.94]
Race - Latinx	1.66	0.062	[0.97, 2.83]	1.87	0.016	[1.12, 3.10]	1.87	0.021	[1.10, 3.19]	2.15	0.008	[1.23, 3.79]	1.40	0.009	[1.09, 1.80]	0.87	0.404	[0.62, 1.21]
Race - Other	1.98	0.040	[1.03, 3.80]	1.09	0.790	[0.57, 2.12]	1.76	0.092	[0.91, 3.38]	2.42	0.010	[1.23, 4.74]	1.29	0.095	[0.96, 1.75]	1.38	0.123	[0.92, 2.09]
Intercept	0.34	0.050	[0.12, 1.00]	0.48	0.126	[0.18, 1.24]	0.07	0.444	[0.26, 1.80]	0.27	0.010	[0.10, 0.73]	2.14	0.002	[1.32, 3.48]	3.46	<0.001	[1.84, 6.51]

Note. Race reference group = White; CAS = condomless anal sex; OP = outside partners; P3M = past 3 months

[a] HIV positive participants (diagnosed more than 3 months ago) excluded from analyses

[b] Participants “unsure” of most recent test excluded from analyses

[c] HIV positive participants excluded from analyses

[d] Participants reporting 0 outside partners excluded from analyses