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Social support network characteristics and sexual risk taking among a racially/ethnically diverse sample of young, urban men who have sex with men

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Abstract

Associations between social support network characteristics and sexual risk among racially/ethnically diverse young men who have sex with men (YMSM) were examined using egocentric network data from a prospective cohort study of YMSM (n=501) recruited in New York City. Bivariate and multivariable logistic regression analyses examined associations between social support network characteristics and sexual risk taking behaviors in Black, Hispanic/Latino, and White YMSM. Bivariate analyses indicated key differences in network size, composition, communication frequency and average relationship duration by race/ethnicity. In multivariable analyses, controlling for individual level sociodemographic, psychosocial and relationship factors, having a sexual partner in one's social support network was associated with unprotected sexual behavior for both Hispanic/Latino (AOR=3.90) and White YMSM (AOR=4.93). Further examination of key network characteristics across racial/ethnic groups are warranted in order to better understand the extant mechanisms for provision of HIV prevention programming to racially/ethnically diverse YMSM at risk for HIV.

Keywords

HIV; social networks; prevention; YMSM

INTRODUCTION

Among young adults, young men who have sex with men (YMSM) are over-represented among HIV diagnoses; in fact, new HIV diagnoses in YMSM increased between 2007 and 2010 while declining in heterosexual adolescents during the same time period(1). Closer examination of these national data also reveal stark racial/ethnic disparities in HIV/AIDS acquisition among YMSM, with the majority of new HIV diagnoses (63%) reported among Black YMSM as compared to White (18%) and Latino (16%) YMSM(2). Similar trends also exist at the local level in New York City, where YMSM overall, and particularly Black and Latino YMSM contribute to a disproportionately larger number of HIV/AIDS cases(3).

A higher prevalence of HIV-related sexual risk behaviors among YMSM, as a whole, account for the increased rate of HIV infection in this group compared to heterosexual

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adolescents. However, similar differences in individual-level risk behaviors do not fully account for racial/ethnic disparity in HIV infection particularly between Black and Latino YMSM compared with White YMSM. Specifically, two recent reviews of the extant literature (4;5) examining potential reasons for racial/ethnic disparities in HIV infection consistently indicate that higher rates of HIV among Black and Latino YMSM compared with White YMSM are not explained by a higher prevalence of risky sexual practices or illicit substance use, HIV testing history, commercial sex work, gay identification or disclosure of sexual orientation.

To date, evidence from a growing body of empirical research highlights the salience of understanding and elucidating the role that social network characteristics play in groups at heightened risk for HIV and other sexually transmitted infections (6–10). Specifically, social network based analyses have been a key component in explaining the higher risk of HIV/AIDS among heterosexual African Americans, where higher rates of partner concurrency and social network characteristics such as size, composition and density have been associated with a range of HIV related sexual and injection drug use behaviors (11–17). Finally, there is substantial body of literature examining a number of social network characteristics in relation to injection drug use and sexual risk taking behaviors among IDUs (18–30).

Among MSM, studies exploring the role of social support network characteristics and HIV related risk are relatively sparse and where available, narrow in focus. Early studies among MSM focused predominantly on the sexual networks of subgroups such as drug using MSM(31–33) or Black MSM(34–36). In terms of general, social network based investigations, a qualitative investigation of 21 Black MSM found that this group tended to report more non-MSM male friends and more female sex partners; among those that reported other MSM as friends, these were often sexual partners.(37) A more recent study examining social and sexual network characteristics among Black MSM found that while both MSM and men and who had sex with men and women (MSMW) reported similar proportions of family as network members, MSMW were more likely to engage in riskier sexual behaviors by having denser sexual networks, greater partner concurrency as well number of sexual partners (36). In addition, there is evidence from network-level interventions among adult MSM, that intervening on the network level by seeking opinion leaders to provide HIV/AIDS risk reduction information within their social networks may help to promote social norms supporting safer sexual behaviors.(38;39)

Among YMSM, a study by Amirikhan and colleagues (2003) in Russia and Bulgaria found that use of a social network leader to disseminate HIV related information, yielded significant improvements in HIV/AIDS related knowledge and norms at the network-level. However, less clear is what types of network characteristics were associated with such increases in knowledge, attitudes and norms around sexual risk reduction.

In summary, these studies provide additional detail on HIV related risk beyond individual-level characteristics in addition to some evidence that intervening on the level of the network may hold promise for stemming HIV transmission and acquisition in this population. However, the majority of this information is not specific to this newer generation of YMSM; as such, more nuanced information on how social support network characteristics may increase HIV risk among YMSM, in particular, is warranted given the heightened HIV risk in this generation of young men. Further, understanding how such network characteristics differ across race/ethnicity as well as how these differences relate to sexual risk taking among racially/ethnically diverse YMSM is particularly pressing given the disparities in HIV risk across race/ethnicity among YMSM. Thus, understanding differences in social support network characteristics such as network size, composition of

network memberships, and frequency of contact and other salient network factors by race/ethnicity is critical to understanding whether and how HIV intervention programming may harness the power of social support networks to create and sustain social norms that support safer sexual behaviors. Finally, such information would be relevant to informing the development of appropriate effective HIV intervention programming for racially/ethnically diverse YMSM at greater risk for HIV as well as sustaining the effectiveness of such programs over time. Thus, the objective of the present study is to understand differences in social support network characteristics among Black, Latino/Hispanic and White YMSM as well as to examine the extent to which social support network characteristics are associated with sexual risk taking behaviors after controlling for individual and psychosocial characteristics among this racially/ethnically diverse sample of YMSM.

METHODS

Study design & sample

These data are derived from the baseline visit of a prospective cohort study of racially/ethnically diverse YMSM in New York City, the details of which are previously published(40). Briefly, to be eligible for this study, potential participants had to be born biologically male, be 18–19 years of age at time of study entry, report having sex with another man in the 6 months preceding screening, and self-report an HIV-negative serostatus. Participants were recruited from across New York City from 2009 – 2011 using both active (e.g. approaching individuals to solicit study participation at venues such as community events, after-school events, service agencies, bars, clubs, etc.) and passive (e.g., flyer posting and website advertisements on popular youth websites, social networking websites, dating websites, etc.) recruitment strategies. At baseline, all participants completed an ACASI based assessment on individual-level sociodemographics and behaviors, psychosocial characteristics and social factors. Data on recent sexual behaviors, including recent sexual activity, were collected using a 30-day calendar-based approach(41). A social network inventory, based upon our prior work(42) was also administered at the baseline visit by trained interviewers to collect information on up to 10 network members who study participants considered to be ‘significant or important’ in their lives.

Among the n=592 participants in this study, a sub-sample of n=501 YMSM who provided complete information on race/ethnicity and self-identified as either Black (n=97), Hispanic/Latino (n=225) or White (n=179) were included in the present study in order to examine racial/ethnic differences in network characteristics, overall and whether and how these differences were associated with recent sexual risk behaviors among YMSM. This study protocol was approved by New York University’s Institutional Review Board (IRB), and a Certificate of Confidentiality was obtained from the Department of Health and Human Services. All participants were remunerated for their time and effort in accordance with local community guidelines.

Dependent variables

The main dependent variable of interest, unprotected anal intercourse is based on self-report and refers to the 30 days preceding the baseline visit. Unprotected anal intercourse (UAI) is one comprehensive measure that includes self-report of both insertive and receptive anal intercourse. In this study, UAI is examined dichotomously as ‘ever’ versus ‘never’.

Independent variables

For the present study, the main independent variables of interest were social support network characteristics. First, to describe their social networks, participants were initially asked to “...list each significant person in your [sic] life... Consider all persons who provide

personal support for you or who are important to you now.” Next, participants were asked to specify the type of relationship to each nominated network member (e.g. family/relative, friends, work associates, sexual partner, etc.). While a list of categories was presented to participants, it is important to note that our definition of family member was broader than that used in standard social network analyses and includes family of choice in addition to biological family members due to the rejection that many YMSM, particularly Black and Latino/Hispanic YMSM may experience(43). This information was used to understand overall network size as well as network composition. Further, based on initial exploration of the distribution of individuals reported as network members, the median network size was 8 (standard deviation = 2.3, interquartile range 6 – 10); as such, network size was dichotomized as <8 versus ≥ 8. Next, participants provided information on the duration of each relationship by responding to the question *“How long have you known this person”* (responses ranged from <6 months to >5 years). For the present study, we examined the average duration of network relationships dichotomized as < 2 years versus ≥ 2 years. This dichotomization was based both on empirical and conceptual reasoning. First, 2 years was the median length of reported relationships and this cut-point also allowed an examination of differences in recently formed networks versus those of longer duration. Finally, participants were asked to identify the frequency of communication between themselves and each network member on a 5-point scale ranging from ‘daily’ to ‘once a year or less’; for the present analysis, frequency of communication was dichotomized as monthly versus weekly. This dichotomization was also supported by empirical (on average, participants reported communicating with network members on a weekly basis) as well as conceptual reasoning (more frequent communication is associated with stronger network ties than less frequent communication).

Additional covariates of interest fell into the domains of sociodemographic characteristics and psychosocial factors. Sociodemographic characteristics included information on current school enrollment and perceived socioeconomic status (SES); for the present analysis, perceived SES was categorized as lower, middle or upper class. Sexual identity was measured using the Kinsey scale which ranges from 0 to 6 (exclusively heterosexual to exclusively homosexual). For the present study, sexual identity was dichotomized as ‘exclusively homosexual’ versus ‘not exclusively homosexual’. Foreign born status was determined by ascertaining birth in the US versus outside the US. With regard to psychosocial factors, participants self-reported their ethnic identity affiliation using the 12-item Multigroup Ethnic Identity Measure (e.g. ‘I have a lot of pride in my ethnic group’, etc.) assessed on a 4-point likert scale (‘strongly agree’ to ‘strongly disagree’). Participant scores for this ethnic identity measure were dichotomized as low (≤ 2) versus high (>2). Gay community affinity was assessed with the following single item measure: ‘I feel a part of the gay community in New York City’ with responses on a 5-point scale ranging from ‘strongly agree’ to ‘strongly disagree’. Responses were dichotomized as high (≥ 2) compared with moderate/low (< 2). Finally, internalized homophobia was ascertained via a 4-item measure (e.g. ‘Sometimes I dislike myself for being gay/bisexual’, etc.) on a 5 point likert scale; scores were dichotomized as high (≥ 12) versus low (<12).

Statistical analysis

First, exploratory data analysis were conducted to describe social support network characteristics in this overall sample of YMSM. Second, bivariate associations between network level characteristics and the main outcome of interest –UAI were examined using chi-square statistics. In addition, bivariate associations between network level factors and social support with race/ethnicity as well as salient sociodemographic and psychosocial factors were also assessed using Fishers exact and chi-square statistics, as appropriate. Third, unadjusted and adjusted multivariable logistic regression analysis was separately

conducted for each race/ethnicity group (Black, White, Hispanic/Latino) to identify factors independently associated with UAI for each racial/ethnic group in this sample. The final multivariable model for each race/ethnicity group was constructed by first including network level characteristics found to significantly associated ($p < 0.10$) with UAI or race/ethnicity in unadjusted analysis. Next, sociodemographics and psychosocial characteristics, found to be significant at $p < 0.05$ or based on a priori knowledge, were added to the model in conceptually related groups to assess the relative importance of network-level factors in comparison to sociodemographic and psychosocial characteristics with UAI for each race/ethnicity subgroup. Separate regression models were built for each race/ethnicity group – Black, Hispanic/Latino and White to examine the differences in associations between network level characteristics and UAI across race/ethnicity sub-groups. Models were compared using the $-2 \log$ likelihood value to obtain the final, model of best fit.

RESULTS

In this sample of urban YMSM between the ages of 18 – 19 years old, 45% self-identified as Hispanic/Latino, 19% as Black and 36% as White. There were a number of differences in key social support network characteristics by race/ethnicity (Table 1). First, more than half of Black and Hispanic/Latino YMSM were more likely to report networks of smaller size compared with slightly more than one third of White YMSM ($p < 0.000$). Additional comparison of average network size across race/ethnicity also indicate that White YMSM reported larger networks (mean=8.55, SD=1.55) compared with their Black (mean=7.37, SD=2.55) and Hispanic/Latino (mean=7.38, SD=2.46) counterparts ($p < 0.000$). While a smaller proportion of Black YMSM (17.5%) reported a sexual partner as part of their network compared with Hispanic/Latino YMSM (22.7%) and White YMSM (24.6%), this difference was not statistically significant. Across all three race/ethnicity groups, >90% of YMSM reported a family member (e.g. mother, sibling, etc.) as part of their networks. In addition, a higher proportion of White YMSM reported having friends as part of their networks as compared to Black and Hispanic/Latino YMSM ($p=0.042$). In terms of reports of communication between participants and their network members, Hispanic/Latino YMSM (87.5%) were more likely to report more frequent communication with their peers compared with Black and White YMSM (76% and 76.5%, respectively; $p=0.006$). However, Black YMSM reported, on average, relationships with their network members of longer duration compared with White and Hispanic/Latino YMSM ($p=0.041$).

With regard to sociodemographic characteristics, Hispanic/Latino and Black YMSM were more likely to report a lower perceived SES ($p < 0.000$) as well as a lower likelihood of being currently enrolled in school at time of survey administration ($p < 0.000$). Although a larger proportion of Hispanic/Latino YMSM reported a foreign born status ($p=0.010$), Black YMSM were more likely to report a higher level of ethnic identity ($p < 0.000$). Hispanic/Latino YMSM were more likely to report higher levels of gay community affinity ($p=0.003$) and lower levels of internalized homophobia ($p=0.026$) compared to Black and White YMSM.

An examination of network characteristics by sexual risk taking indicated that individuals who reported, on average, smaller network were more likely to report UAI compared to individuals reporting larger networks ($p=0.080$) (Table 2). Additionally, individuals reporting a sexual partner as a member of their networks were more likely to report engaging in UAI ($p < 0.000$). There were no statistically significant associations between communication frequency and relationship duration with UAI. In terms of sociodemographic characteristics, Black YMSM were, on average, less likely to report UAI compared with Hispanic/Latino and White YMSM; while these data are consistent with the published literature(4;5;44–47), in the present study, this association did not reach statistical

significance. In addition, current school enrollment was marginally associated with a lower likelihood of engaging in UAI ($p=0.086$) whereas self-identifying as exclusively homosexual was associated with higher proportion reporting UAI ($p=0.082$). YMSM in a relationship at time of the baseline assessment were more likely to report engaging in UAI ($p<0.000$). Finally, whereas a higher level of gay community affinity was associated with engaging in UAI ($p=0.017$), a higher level of internalized homophobia was associated with a lower likelihood of engaging in UAI ($p=0.061$).

In multivariable analysis, separate logistic regression models for each racial/ethnic group were built to examine the distinct associations between network level characteristics and UAI within each racial/ethnic group (Table 3). In doing so, these results indicate that for Hispanic/Latino YMSM, larger network size was associated with a lower likelihood of engaging in UAI (AOR=0.45; 95% CI 0.20, 0.97). In addition, current school enrollment was also related to a reduced odds of UAI (AOR=0.42, 95% CI 0.18, 1.01) although this association was marginally statistically significant. Furthermore, Hispanic/Latino YMSM who reported a sexual partner as part of their networks were more likely to report engaging in UAI (AOR=3.90, 95% CI 1.30, 11.72). However, while the odds of engaging in UAI were higher among Hispanic/Latino YMSM who reported being in a relationship with a man as well as those with higher levels of gay community affinity, these associations were not statistically significant. For White YMSM, having sexual partner in one's network was associated with an increased odds of UAI (AOR=4.93, 95% CI 1.54, 15.86) as was being in a relationship with a man (AOR=3.34, 95% CI 1.06, 10.49). Similar to that seen among Hispanic/Latino YMSM, odds of engaging in UAI were higher among those with higher levels of gay community affinity although this association was again marginally statistically significant. Finally, current enrollment in school was associated with a reduced likelihood of engaging in UAI among White YMSM (AOR=0.15, 95% CI 0.03, 0.66). Among Black YMSM, the crude odds of engaging in UAI were higher among those who reported having a sexual partner in their social network ($OR_{crude}=4.30$, 95% CI 1.28, 14.47) as well as among those who reported currently being in a relationship with a man ($OR_{crude}=4.25$, 95% CI 1.32, 13.64) (data not shown). However, as a small proportion of the overall sample of Black YMSM reported engaging in UAI (15.6%; $n=15$), multivariable models for Black YMSM did not converge.

DISCUSSION

The findings of this study reveal distinct differences in key social support network characteristics between Black, Hispanic/Latino and White YMSM. First, Black and Hispanic/Latino YMSM tended to report smaller networks of longer duration compared with White YMSM. Moreover, Black YMSM were less likely to report a sexual partner as a member of their social network. These latter, empirical findings are in contrast to the qualitative work by Miller et al (37) which suggested that Black MSM were more likely to report having MSM identified network members with whom they had sex. One explanation for the current finding may be the higher rates of both ethnic identity and gay community affiliation among Black and Hispanic/Latino YMSM compared with White YMSM. Thus, it seems that for racial/ethnic minority YMSM, there may be more network building with a smaller group of peers, family members and sexual contacts due to experiences with homophobia and discrimination related to sexual orientation. In comparison, White YMSM, tended to report larger network sizes, were more likely to report having friends within their networks and networks of shorter duration. In addition this group reported lower rates of gay community affinity suggesting that their network members maybe comprised of a broader range of relationship categories.

Finally, despite, on average, smaller network sizes, Hispanic/Latino YMSM reported more frequent communication with network members. This is a particularly important finding as frequency of communication is often used as an indicator of relationship strength(48) and provides additional evidence for the value of supportive social networks. Thus, networks characterized by more frequent communication are critical in HIV prevention as they may be able to transmit knowledge and information around HIV prevention as well as create and sustain norms supporting safer sexual behaviors more effectively(49).

In terms of HIV related sexual risk taking behaviors, specifically UAI, having a sexual partner as a member of one's network was most strongly associated with UAI for both Hispanic/Latino and White YMSM in multivariable analysis as well as for Black YMSM in unadjusted analysis. For Hispanic/Latino YMSM, this association persisted even after controlling for being in a current relationship with a man, thereby, suggesting that the role of sexual partners in social networks may be more powerful in terms of UAI than in a primary relationship.

In terms of individual level characteristics, participants still in school were less likely to engage in UAI. However, it is important to note that this association was significant in multivariable analysis only for White YMSM and marginally significant for Hispanic/Latino YMSM. In addition, given that Black and Hispanic/Latino YMSM reported lower perceived SES (52% and 41%, respectively) compared with White YMSM (14%), this suggests that the higher likelihood of socioeconomic disadvantage among racial/ethnic minority YMSM would require structural as well as network based HIV prevention efforts as part of a comprehensive prevention programming. A summary report by Grossman and colleagues offers an overview of structural interventions that are warranted(50). Examples of such structural interventions would include those that address housing instability, incarceration, and educational disparities among racial/ethnic minorities. Additionally, policies that promote efforts to reduce bullying, in both school and community contexts, could play a role in reducing the higher rates of internalized homophobia among racial/ethnic minority YMSM.

Finally, it is important to note that while higher levels of gay community affinity were associated with UAI in bivariate models, these associations were only marginally significant in multivariable models. While some early research suggests that attachment to the gay community acted as a protective factor(51), there is a growing body of literature to suggest that, in fact, attachment to the gay community may be associated with sexual- and drug-related risk behaviors in a newer, younger generation of MSM(52–55) as behavioral norms may be more tolerant of riskier sexual behaviors. Moreover, for Hispanic/Latino and black YMSM, ethnic community identity may be a more salient predictor of less risky behaviors than gay community attachment(56). As such, the development and evolution of network structures and characteristics warrant further exploration as this new generation of YMSM come of age in a community whose own norms around sexual behaviors are evolving.

Before conclusion can be drawn, study limitations and their potential impact on the results obtained here ought to be addressed. First, as these results are derived from self-reported data of a cross-sectional, baseline assessment, the ability to draw causal inference is limited. Second, although sample sizes were sufficient for examining multivariable models among Hispanic/Latino and White YMSM and providing statistically significant results, confidence intervals for estimates in some cases were wide. Moreover, the small sample size of Black YMSM in this study precluded the ability to examine multiple comparisons and also limited the ability to make inferences about racial associations. Third, although a strength of this study is the ability to describe network factors in relation to sexual risk behaviors across race/ethnicity among YMSM, additional data on the sociodemographic characteristics and

sexual risk taking behaviors of network members would provide more comprehensive information on degree of homophily within networks across these factors. On a similar note, more information on the strength of ties between participants and network members would provide a better understanding on network connections and their ability to potentially influence HIV related sexual risk behavior. This information, in turn, would also be valuable in creating risk and resilience profiles of networks. Finally, the social networks of these young men are dynamic and likely to evolve and develop over time, as such a longitudinal exploration of how these networks change is critical to understanding how these natural shifts impact and alter HIV risk related behaviors.

CONCLUSION

In summary, to our knowledge this is one of the first studies to examine network characteristics across racial/ethnic groups. First, this information is critical given the stark racial/ethnic disparities in HIV risk among YMSM. Second, a more comprehensive understanding of the similarities and differences in key network characteristics across racial/ethnic groups allows for a better understanding of the extant mechanisms for provision of HIV related support or whether and how those mechanisms can be bolstered to provide support to racially/ethnically diverse YMSM at risk for HIV.

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References

- Centers for Disease Control & Prevention. HIV surveillance in adolescents and young adults. Sep 21.2012
- Centers for Disease Control & Prevention. Fact sheet: HIV and young men who have sex with men. Sep 28.2012
- New York City Department of Health and Mental Hygiene. Annual report: pediatric and adolescent HIV/AIDS. HIV epidemiology program. 2012
- Millett GA, Flores SA, Peterson JL, Bakeman R. Explaining disparities in HIV infection among black and white men who have sex with men: a meta-analysis of HIV risk behaviors. *AIDS*. 2007 Oct 1; 21(15):2083–91. [PubMed: 17885299]
- Feldman MB. A critical literature review to identify possible causes of higher rates of HIV infection among young black and Latino men who have sex with men. *J Natl Med Assoc*. 2010 Dec; 102(12): 1206–21. [PubMed: 21287902]
- Christakis NA. When networks can teach us about drug use. *BMJ*. 2008 Feb 23.336(7641):420. [PubMed: 18292167]
- Friedman SR, Kottiri BJ, Neaigus A, Curtis R, Vermund SH, Des Jarlais DC. Network-related mechanisms may help explain long-term HIV-1 seroprevalence levels that remain high but do not approach population-group saturation. *Am J Epidemiol*. 2000 Nov 15; 152(10):913–22. [PubMed: 11092433]
- Friedman SR, Aral S. Social networks, risk-potential networks, health, and disease. *J Urban Health*. 2001 Sep; 78(3):411–8. [PubMed: 11564845]
- Friedman SR, Bolyard M, Maslow C, Mateu-Gelabert P, Sandoval M. Harnessing the power of social networks to reduce HIV risk. *Focus*. 2005 Jan; 20(1):5–6. [PubMed: 15776521]
- Perisse AR, Langenberg P, Hungerford L, Boulay M, Charurat M, Schechter M, et al. Egocentric network data provide additional information for characterizing an individual's HIV risk profile. *AIDS*. 2010 Jan 16; 24(2):291–8. [PubMed: 19904198]
- Curtis R, Friedman S, Neaigus A, Jose B, Goldstein M, Ildefonso G. Street-level drug markets—network structure and HIV risk. *Soc Netw*. 1995; 17(3–4):229–49.

12. Neaigus A, Friedman SR, Goldstein M, Ildefonso G, Curtis R, Jose B. Using dyadic data for a network analysis of HIV infection and risk behaviors among injecting drug users. *NIDA Res Monogr.* 1995; 151:20–37. [PubMed: 8742759]
13. Adimora AA, Schoenbach VJ. Social context, sexual networks, and racial disparities in rates of sexually transmitted infections. *J Infect Dis.* 2005 Feb 1; 191(Suppl 1):S115–22. [PubMed: 15627221]
14. Adimora AA, Schoenbach VJ, Doherty IA. HIV and African Americans in the southern United States: sexual networks and social context. *Sex Transm Dis.* 2006 Jul; 33(7 Suppl):S39–S45. [PubMed: 16794554]
15. Luke DA, Harris JK. Network analysis in public health: history, methods, and applications. *Annu Rev Public Health.* 2007; 28:69–93. [PubMed: 17222078]
16. Mimiaga MJ, Reisner SL, Cranston K, Isenberg D, Bright D, Daffin G, et al. Sexual mixing patterns and partner characteristics of black MSM in Massachusetts at increased risk for HIV infection and transmission. *J Urban Health.* 2009 Jul; 86(4):602–23. [PubMed: 19466554]
17. Doherty IA, Serre ML, Gesink D, Adimora AA, Muth SQ, Leone PA, et al. Sexual networks, surveillance, and geographical space during syphilis outbreaks in rural north Carolina. *Epidemiology.* 2012 Nov; 23(6):845–51. [PubMed: 23007041]
18. Tobin KE, Tang AM, Gilbert SH, Latkin CA. Correlates of HIV antibody testing among a sample of injection drug users: the role of social and contextual factors. *AIDS Behav.* 2004 Sep; 8(3):303–10. [PubMed: 15475677]
19. Neaigus A, Friedman SR, Curtis R, Des Jarlais DC, Furst RT, Jose B, et al. The relevance of drug injectors' social and risk networks for understanding and preventing HIV infection. *Soc Sci Med.* 1994 Jan; 38(1):67–78. [PubMed: 8146717]
20. Friedman SR, Neaigus A, Jose B, Curtis R, Goldstein M, Ildefonso G, et al. Sociometric risk networks and risk for HIV infection. *Am J Public Health.* 1997 Aug; 87(8):1289–96. [PubMed: 9279263]
21. Kottiri BJ, Friedman SR, Neaigus A, Curtis R, Des Jarlais DC. Risk networks and racial/ethnic differences in the prevalence of HIV infection among injection drug users. *J Acquir Immune Defic Syndr.* 2002 May 1; 30(1):95–104. [PubMed: 12048369]
22. Latkin CA, Hua W, Forman VL. The relationship between social network characteristics and exchanging sex for drugs or money among drug users in Baltimore, MD, USA. *Int J STD AIDS.* 2003 Nov; 14(11):770–5. [PubMed: 14624742]
23. Latkin CA, Hua W, Tobin K. Social network correlates of self-reported non-fatal overdose. *Drug Alcohol Depend.* 2004 Jan 7; 73(1):61–7. [PubMed: 14687960]
24. Rhodes T, Singer M, Bourgois P, Friedman SR, Strathdee SA. The social structural production of HIV risk among injecting drug users. *Soc Sci Med.* 2005 Sep; 61(5):1026–44. [PubMed: 15955404]
25. Costenbader EC, Astone NM, Latkin CA. The dynamics of injection drug users' personal networks and HIV risk behaviors. *Addiction.* 2006 Jul; 101(7):1003–13. [PubMed: 16771892]
26. Bohnert AS, German D, Knowlton AR, Latkin CA. Friendship networks of inner-city adults: a latent class analysis and multi-level regression of supporter types and the association of supporter latent class membership with supporter and recipient drug use. *Drug Alcohol Depend.* 2010 Mar 1; 107(2–3):134–40. [PubMed: 19939586]
27. Latkin CA, Kuramoto SJ, Davey-Rothwell MA, Tobin KE. Social norms, social networks, and HIV risk behavior among injection drug users. *AIDS Behav.* 2010 Oct; 14(5):1159–68. [PubMed: 19466537]
28. Havens JR, Lofwall MR, Frost SD, Oser CB, Leukefeld CG, Crosby RA. Individual and Network Factors Associated With Prevalent Hepatitis C Infection Among Rural Appalachian Injection Drug Users. *Am J Public Health.* 2012 Nov 15.
29. Havens JR, Oser CB, Knudsen HK, Lofwall M, Stoops WW, Walsh SL, et al. Individual and network factors associated with non-fatal overdose among rural Appalachian drug users. *Drug Alcohol Depend.* 2011 May 1; 115(1–2):107–12. [PubMed: 21126831]
30. Young AM, Jonas AB, Mullins UL, Halgin DS, Havens JR. Network Structure and the Risk for HIV Transmission Among Rural Drug Users. *AIDS Behav.* 2012 Nov 27.

31. Halkitis PN, Moeller RW, Siconolfi DE, Jerome RC, Rogers M, Schillinger J. Methamphetamine and poly-substance use among gym-attending men who have sex with men in New York City. *Ann Behav Med.* 2008 Feb; 35(1):41–8. [PubMed: 18347903]
32. Tobin KE, Latkin CA. An examination of social network characteristics of men who have sex with men who use drugs. *Sex Transm Infect.* 2008 Nov; 84(6):420–4. [PubMed: 19028939]
33. Tobin KE, German D, Spikes P, Patterson J, Latkin C. A comparison of the social and sexual networks of crack-using and non-crack using African American men who have sex with men. *J Urban Health.* 2011 Dec; 88(6):1052–62. [PubMed: 21882072]
34. Schneider JA, Cornwell B, Ostrow D, Michaels S, Schumm P, Laumann EO, et al. Network Mixing and Network Influences Most Linked to HIV Infection and Risk Behavior in the HIV Epidemic Among Black Men Who Have Sex With Men. *Am J Public Health.* 2012 Nov 15.
35. Schneider J, Michaels S, Bouris A. Family network proportion and HIV risk among Black men who have sex with men. *J Acquir Immune Defic Syndr.* 2012 Sep 22.
36. Latkin C, Yang C, Tobin K, Penniman T, Patterson J, Spikes P. Differences in the social networks of African American men who have sex with men only and those who have sex with men and women. *Am J Public Health.* 2011 Oct; 101(10):e18–e23. [PubMed: 21852650]
37. Miller M, Serner M, Wagner M. Sexual diversity among black men who have sex with men in an inner-city community. *J Urban Health.* 2005 Mar; 82(1 Suppl 1):i26–i34. [PubMed: 15738323]
38. Kelly JA, Murphy DA, Sikkema KJ, McAuliffe TL, Roffman RA, Solomon LJ, et al. Randomised, controlled, community-level HIV-prevention intervention for sexual-risk behaviour among homosexual men in US cities. Community HIV Prevention Research Collaborative. *Lancet.* 1997 Nov 22; 350(9090):1500–5. [PubMed: 9388397]
39. Jones KT, Gray P, Whiteside YO, Wang T, Bost D, Dunbar E, et al. Evaluation of an HIV prevention intervention adapted for Black men who have sex with men. *Am J Public Health.* 2008 Jun; 98(6):1043–50. [PubMed: 18445795]
40. Halkitis PN, Kapadia F, Siconolfi DE, Moeller RM, Perez Figueroa R, Barton S, et al. Individual, psychosocial and social correlates of unprotected anal intercourse in a new generation of young men who have sex with men in New York City. *Am J Public Health.* 2013 In press.
41. Sobell, LC.; Sobell, MB. Alcohol Timeline Followback Users' Manual. Toronto, Canada: Addiction Research Foundation; 1995.
42. Kapadia F, Frye V, Bonner S, Emmanuel PJ, Samples CL, Latka MH. Perceived peer safer sex norms and sexual risk behaviors among substance-using Latino adolescents. *AIDS Educ Prev.* 2012 Feb; 24(1):27–40. [PubMed: 22339143]
43. Serovich JM, Grafsky EL, Craft SM. Does family matter to HIV-positive men who have sex with men? *J Marital Fam Ther.* 2011 Jul; 37(3):290–8. [PubMed: 21745231]
44. Crosby R, Holtgrave DR, Stall R, Peterson JL, Shouse L. Differences in HIV risk behaviors among black and white men who have sex with men. *Sex Transm Dis.* 2007 Oct; 34(10):744–8. [PubMed: 17565334]
45. Magnus M, Kuo I, Phillips G, Shelley K, Rawls A, Montanez L, et al. Elevated HIV prevalence despite lower rates of sexual risk behaviors among black men in the District of Columbia who have sex with men. *AIDS Patient Care STDS.* 2010 Oct; 24(10):615–22. [PubMed: 20863246]
46. Wei C, Raymond HF, Guadamuz TE, Stall R, Colfax GN, Snowden JM, et al. Racial/Ethnic differences in seroadaptive and serodisclosure behaviors among men who have sex with men. *AIDS Behav.* 2011 Jan; 15(1):22–9. [PubMed: 20217468]
47. Rosenberg ES, Khosropour CM, Sullivan PS. High prevalence of sexual concurrency and concurrent unprotected anal intercourse across racial/ethnic groups among a national, Web-based study of men who have sex with men in the United States. *Sex Transm Dis.* 2012 Oct; 39(10):741–6. [PubMed: 23001260]
48. Smith KP, Christakis NA. Social networks and health. *Annu Rev Sociol.* 2008; 34:405–29.
49. Friedman SR, Mateu-Gelabert P, Curtis R, Maslow C, Bolyard M, Sandoval M, et al. Social capital or networks, negotiations, and norms? A neighborhood case study. *Am J Prev Med.* 2007 Jun; 32(6 Suppl):S160–S170. [PubMed: 17543707]

50. Grossman CI, Forsyth A, Purcell DW, Allison S, Toledo C, Gordon CM. Advancing novel HIV prevention intervention research with MSM--meeting report. *Public Health Rep.* 2011 Jul; 126(4): 472–9. [PubMed: 21800742]
51. Martin JL, Dean L, Garcia M, Hall W. Barbara Snell Dohrenwend memorial lecture. The impact of AIDS on a gay community: changes in sexual behavior, substance use, and mental health. *Am J Community Psychol.* 1989 Jun; 17(3):269–93. [PubMed: 2801626]
52. Klitzman RL, Greenberg JD, Pollack LM, Dolezal C. MDMA ('ecstasy') use, and its association with high risk behaviors, mental health, and other factors among gay/bisexual men in New York City. *Drug Alcohol Depend.* 2002 Apr 1; 66(2):115–25. [PubMed: 11906799]
53. Wong W, Chaw JK, Kent CK, Klausner JD. Risk factors for early syphilis among gay and bisexual men seen in an STD clinic: San Francisco, 2002–2003. *Sex Transm Dis.* 2005 Jul; 32(7):458–63. [PubMed: 15976605]
54. Flores SA, Mansergh G, Marks G, Guzman R, Colfax G. Gay identity-related factors and sexual risk among men who have sex with men in San Francisco. *AIDS Educ Prev.* 2009 Apr; 21(2):91–103. [PubMed: 19397432]
55. Holt M. Gay men and ambivalence about 'gay community': from gay community attachment to personal communities. *Cult Health Sex.* 2011 Sep; 13(8):857–71. [PubMed: 21644116]
56. O'Donnell L, Agronick G, San DA, Duran R, Myint U, Stueve A. Ethnic and gay community attachments and sexual risk behaviors among urban Latino young men who have sex with men. *AIDS Educ Prev.* 2002 Dec; 14(6):457–71. [PubMed: 12512847]

Table 1

Baseline network level factors, sociodemographics and psychosocial characteristics by race/ethnicity among YMSM ages 18–19 years old, New York City, 2009 – 2011, n=501

	Total	Hispanic/Latino (n=225)	Black (n=97)	White (n=179)	p-value
	% (n)	% (n)	% (n)		
Network level factors					
Network Size					
8 members	50.3 (252)	58.7 (132)	56.7 (55)	36.3 (65)	<0.001
>8 members	49.7 (249)	41.3 (93)	43.3 (42)	63.7 (114)	
Network composition*					
Sexual Partner	22.4 (112)	22.7 (51)	17.5 (17)	24.6 (44)	0.401
Family members	94.8 (475)	94.2 (212)	94.8 (92)	95.5 (171)	0.841
Friends	93.0 (466)	90.2 (203)	92.8 (90)	96.6 (173)	0.042
Frequency of communication					
monthly	18.6 (93)	12.5 (28)	24.0 (23)	23.5 (42)	0.006
weekly	81.4 (406)	87.5 (196)	76.0 (73)	76.5 (137)	
Average duration of relationships					
< 2 years	32.7 (163)	29.5 (66)	27.1 (26)	39.7 (71)	0.041
2 years	67.3 (336)	70.5 (158)	72.9 (70)	60.3 (108)	
Individual level sociodemographic characteristics					
Perceived SES					
Lower	33.9 (170)	41.3 (93)	52.6 (51)	14.5 (26)	<0.001
Middle	36.7 (184)	41.3 (93)	34.0 (33)	32.4 (58)	
Upper	29.3 (147)	17.3 (39)	13.4 (13)	53.1 (95)	
Currently enrolled in school (yes)	85.2 (427)	81.8 (184)	76.3 (74)	94.4 (169)	<0.001
Foreign born status (no)	89.8 (450)	85.8 (193)	89.7 (87)	95.0 (170)	0.010

	Total	Hispanic/Latino (n=225)	Black (n=97)	White (n=179)	p-value
	% (n)	% (n)	%(n)		
Currently in a relationship (yes)	25.7 (129)	28.0 (63)	21.6 (21)	25.1 (45)	0.476
Sexual orientation (<i>exclusively homosexual</i>)	42.1 (211)	40.0 (90)	36.1 (35)	48.0 (86)	0.108
Individual level psychosocial factors					
Ethnic identity (<i>high</i>)	38.1 (191)	48.0 (108)	52.6 (51)	17.9 (32)	<0.001
Gay community affinity (<i>high</i>)	42.9 (215)	48.9 (110)	47.4 (46)	33.0 (59)	0.003
Internalized homophobia (<i>high</i>)	25.3 (127)	22.7 (51)	36.1 (35)	22.9 (41)	0.026

* not mutually exclusive categories.

Table 2

Baseline network level factors, sociodemographics and psychosocial characteristics by sexual risk taking behavior among YMSM ages 18–19 years old, New York City, 2009 – 2011, n=501

	Total	No UAI (n=405)	UAI (n=96)	p-value
	% (n)	% (n)	%(n)	
Network level factors				
Network Size				
<i>8 members</i>	50.3 (252)	48.4 (196)	58.3 (56)	0.080
<i>>8 members</i>	49.7 (249)	51.6 (209)	41.7 (40)	
Network composition *				
<i>Sexual Partner</i>	22.4 (112)	14.8 (60)	54.2 (52)	<0.001
<i>Family members</i>	94.8 (475)	94.6 (383)	95.8 (92)	0.615
<i>Friends</i>	93.0 (476)	93.1 (377)	92.7 (89)	0.896
Frequency of communication				
<i>monthly</i>	18.6 (93)	17.6 (71)	22.9 (22)	0.231
<i>weekly</i>	81.4 (406)	82.4 (332)	77.1 (74)	
Average duration of relationships				
<i>< 2 years</i>	32.7 (163)	33.3 (134)	30.2 (29)	0.568
<i>2 years</i>	67.3 (336)	66.7 (269)	69.8 (67)	
Individual level sociodemographic characteristics				
Race				
<i>Hispanic/Latino</i>	44.9 (225)	44.9 (182)	44.8 (43)	0.509
<i>Black</i>	19.4 (97)	20.2 (82)	15.6 (15)	
<i>White</i>	35.7 (179)	34.8 (141)	39.6 (38)	
Perceived SES				
<i>Lower</i>	33.9 (170)	33.6 (136)	35.4 (34)	0.419
<i>Middle</i>	36.7 (184)	35.8 (145)	40.6 (39)	
<i>Upper</i>	29.3 (147)	30.6 (124)	24.0 (23)	
Currently enrolled in school (<i>yes</i>)	85.2 (427)	86.4 (350)	80.2 (77)	0.086
Foreign born status (<i>no</i>)	89.8 (450)	89.4 (362)	91.7 (88)	0.506
Currently in a relationship (<i>yes</i>)	25.7 (129)	18.5 (75)	56.2 (54)	<0.001
Sexual orientation (<i>exclusively homosexual</i>)	42.1 (211)	40.5 (164)	49.0 (47)	0.082
Individual level psychosocial factors				
Ethnic identity (<i>high</i>)	38.1 (191)	36.8 (149)	43.8 (42)	0.126

	Total	No UAI (n=405)	UAI (n=96)	p-value
	% (n)	% (n)	%(n)	
Gay community affinity (<i>high</i>)	42.9 (215)	40.5 (164)	53.1 (51)	0.017
Internalized homophobia (<i>high</i>)	25.3 (127)	21.8 (109)	3.6 (18)	0.061

* not mutually exclusive categories.

Table 3

Separate unadjusted and adjusted binary logistic regression models examining the associations between network level factors and sexual risk taking behavior in Hispanic/Latino and White YMSM; New York City, 2009 – 2011; n=501.

	Hispanic/Latino YMSM		White YMSM	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Network level factors				
Network Size				
<i>8 members</i>	1.00	1.00	1.00	--
<i>>8 members</i>	0.48 (0.23, 0.99)*	0.44 (0.20, 0.97)	0.64 (0.31, 1.32)	
Network composition				
<i>Sex partner</i>	6.33 (3.07, 13.02)**	3.90 (1.30, 11.72)	8.76 (3.94, 19.48)**	4.93 (1.54, 15.86)
<i>Friends</i>	0.78 (0.27, 2.26)	--	0.53 (0.09, 2.98)	--
Frequency of communication				
<i>monthly</i>	1.00	--	1.00	--
<i>weekly</i>	0.85 (0.32, 2.25)		0.59 (0.27, 1.30)	
Average duration of relationships				
<i>< 2 years</i>	1.27 (0.60, 2.70)	--	0.88 (0.43, 1.82)	--
<i>2 years</i>				
Individual level sociodemographic characteristics				
Perceived SES				
<i>Lower</i>	1.10 (0.42, 2.88)	--	1.82 (0.66, 5.04)	--
<i>Middle</i>	1.10 (0.42, 2.88)		1.72 (0.78, 3.82)	
<i>Upper</i>	1.00		1.00	
Currently enrolled in school (<i>yes</i>)	0.57 (0.26, 1.26)	0.42 (0.18, 1.01)	0.24 (0.07, 0.89)*	0.15 (0.03, 0.66)
Foreign born status (<i>yes</i>)	0.67 (0.28, 1.60)	--	n/a	--
Currently in a relationship (<i>yes</i>)	4.63 (2.30, 9.31)**	1.96 (0.65, 5.88)	8.29 (3.75, 18.34)**	3.34 (1.06, 10.49)
Sexual orientation (<i>exclusively homosexual</i>)	1.76 (0.90, 3.43)	--	1.44 (0.70, 2.97)	--
Individual level psychosocial factors				
Ethnic identity (<i>high</i>)	1.47 (0.76, 2.88)	--	1.30 (0.53, 3.18)	--
Gay community affinity (<i>high</i>)	2.01 (1.02, 3.99)*	1.72 (0.81, 3.63)	1.91 (0.92, 3.98)	2.28 (0.94, 5.50)
Internalized homophobia (<i>high</i>)	0.74 (0.32, 1.72)	--	0.71 (0.29, 1.76)	--

*p<0.05;

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p<0.001