Journal of Urban Health: Bulletin of the New York Academy of Medicine, Vol. 93, No. 2
doi:10.1007/s11524-016-0043-z

Behavior- and Partner-Based HIV Risk Perception and Sexual Risk Behaviors in Men Who Have Sex with Men (MSM) Who Use Geosocial-Networking Smartphone Applications in New York City

William C. Goedel, Perry N. Halkitis, and Dustin T. Duncan

INTRODUCTION

Men who have sex with men (MSM) in the USA continue to be impacted disproportionately by HIV. MSM represent only 2 % of the male population in the USA, yet comprised 66.7 % of all new HIV infections diagnosed in 2014.[1] As of 2014, there were an estimated 119,550 people living with HIV in New York City, where 72.6 % were male and 2718 new HIV diagnoses, where 80.7 % were male. In New York City, MSM represent 53.3 % of all males living with HIV and 73.8 % of all new HIV diagnoses among males.[2]

HIV is transmitted predominantly through sexual activity and its spread from individual to individual is affected by choices of partners, sexual behaviors, and condom use. Sexually active persons can reduce their risks of acquiring HIV by choosing a partner who has recently tested negative for HIV, by choosing sexual behaviors that are less likely to transmit HIV infection, and by choosing to use condoms or pre-exposure prophylaxis (PrEP). In gauging risk, MSM often make assumptions regarding HIV status based on stereotypes about HIV-positive people,[3,4] but these assumptions may frequently be inaccurate.[5]

Sexual encounters between MSM, especially those that are facilitated by the use of geosocial-networking smartphone applications, may occur quickly with little discussion of each partner's HIV status or sexual history beforehand, so users may rely on incorrect perceptions of what types of people are HIV-positive to make decisions regarding their sexual practices with their potential partners. Because these applications utilize global positioning system (GPS) technologies to connect users based on proximity and attraction, they have generated easier ways for MSM to meet casual sex partners. The use of these applications among MSM to meet sexual partners is pervasive, particularly in urban epicenters like New York City.[6–9]

Goedel, Halkitis, and Duncan are with the Department of Population, School of Medicine, New York University, 227 East 30th Street, New York, NY 10016, USA; Goedel, Halkitis, and Duncan are with the College of Global Public Health, New York University, New York, NY, USA; Goedel is with the Department of Sociology, College of Arts and Science, New York University, New York, NY, USA; Halkitis and Duncan are with the Center for Health, Identity, Behavior, and Prevention Studies, New York University, New York, NY, USA; Halkitis and Duncan are with the Center for Drug Use and HIV Research, College of Nursing, New York University, New York, NY, USA; Halkitis and Duncan are with the Population Center, College of Arts and Science, New York University, New York, NY, USA; Duncan is with the Center for Data Science, New York University, New York, NY, USA.

Correspondence: William C. Goedel, Department of Population, School of Medicine, New York University, 227 East 30th Street, New York, NY 10016, USA. (E-mail: william.goedel@nyu.edu)

However, little is known about behavior- and partner-based risk perceptions among MSM who use geosocial-networking smartphone applications. As such, the purpose of the current study was to evaluate the perceptions of risk for acquiring HIV based on an individual's own behaviors and on the group characteristics of potential partners and the associations of these beliefs with condomless anal intercourse behaviors among a sample of HIV-uninfected MSM who use geosocial-networking smartphone applications in New York City.

METHODS

Sample Recruitment

Recruitment methods for the current study have been previously described elsewhere.[10] In brief, broadcast advertisements were placed on a popular geosocial-networking smartphone application for MSM to recruit participants during two 15-h time periods on two consecutive days in March 2015. In this period, 380 users clicked through the advertisement and 175 users completed the survey, representing an overall response rate of 46.1 %. All protocols were approved via institutional review board prior to any data collection.

Measures

Recent Sexual Behaviors First, participants indicated the total number of partners with whom they had receptive anal intercourse and with whom they had insertive anal intercourse in the preceding 3 months. For both positions, participants were then asked with how many of these partners they did not use a condom in the preceding 3 months.

Behavior-Based Risk Perception Perceptions of risk for becoming infected with HIV based on one's own behaviors were assessed with two items. Respondents were first asked to evaluate their likelihood of being infected with HIV currently with five response options (no chance, very likely, unlikely, undecided, likely, and very likely). Respondents were then asked to assess to what extent they agree with a statement reading, "There is little chance that I could become infected with HIV from what I do sexually" with five response options (strongly agree, agree, neither agree/disagree, disagree, and strongly disagree).

Partner-Based Risk Perception Participants were asked to evaluate their perceptions of risk for acquiring HIV based on the characteristics of a hypothetical potential partner. All four items began, "If I have sex without a condom, I am most likely to get HIV from a partner who is…" and all included an option stating that all partners were at equally high risk of giving them HIV. These items assess perceptions of elevated HIV risk associated with particular groups with regard to age, race/ethnicity, body type, and the venue in which a partner is met. These variables were dichotomized for use in multivariable models as a perception that all partners were equally high risk or a perception that one group in each domain was higher risk than all others.

Statistical Analyses

Given that the purpose of this work was to characterize perception of risk for acquiring HIV, 23 participants (from a total of 175 participants) reporting being HIV-positive were excluded from these analyses, thus restricting the analytic sample to 152 MSM reporting being HIV-negative or HIV-unknown. First, descriptive statistics were calculated for all variables. Kruskal-Wallis tests were used to assess differences in the number of sexual partners across behavior-based risk perceptions. Negative binomial regression models were fit to assess the associations between the domains of partner-based risk perception (e.g., age, race/ethnicity, body type, meeting venue) and the number of partners for condomless insertive and receptive anal intercourse. This modeling approach was selected as the numbers of partners for each sexual behavior are count outcomes and over-dispersed with regard to the mean.[11] Statistical significance was determined at $p < .05$. All analyses were performed in IBM SPSS 21.0.

RESULTS

Sample Demographics

Sample demographics are displayed in Table 1. Participants ranged in age from 19 years old to 58 years old, with an average age of 29.6 (SD = 8.99) years. Most (93.4 %) identified as gay (82.9 %) or bisexual (10.5 %). A majority (54.7 %) identified as non-White, where 11.2 % identified as Black or African American, 25.7 % identified as Hispanic or Latino, 9.9 % identified as Asian or Pacific Islander, and 8.6 % identified as multiracial or some other race/ethnicity. Most (98.0 %) completed at least high school or an equivalent, where 56.4 % completed at least a 4-year college/university degree and 16.4 % completed a graduate degree or higher.

HIV Status and Recent Sexual Behaviors

About two-thirds (63.2 %) of respondents reported engaging in receptive anal intercourse with at least one partner in the past 3 months, with an average of 2.53 (SD = 4.31) partners. About two-fifths (37.5 %) reported engaging in condomless receptive anal intercourse with at least one partner in the past 3 months, with an average of 1.01 (SD = 2.53) partners. Almost two-thirds (67.1 %) reported engaging in insertive anal intercourse with at least one partner in the past 3 months, with an average of 3.08 (SD = 4.74) partners. Over two-fifths (41.4 %) reported engaging in condomless insertive anal intercourse with at least one partner in the past 3 months, with an average of 0.93 (SD = 1.72) partners. Most (89.5 %) respondents reported an HIV-negative serostatus, and the remaining 10.5 % reported an unknown serostatus or having never been tested for HIV.

Behavior-Based Risk Perception

A majority of participants (80.9 %) reported being very or somewhat concerned personally about becoming infected with HIV. Most respondents (88.2 %) considered it unlikely that they were currently infected with HIV, whereas 2.0 % considered it likely and 9.9 % were undecided about their likelihood of currently being infected. Individual considering themselves unlikely to be infected with HIV reported congruently lower numbers of partners for condomless receptive anal intercourse, $\chi^2(2) = 10.009$, $p = .007$.

TABLE 1 Demographics of a sample of HIV-uninfected MSM who use geosocial-networking smartphone applications in New York City

	Percent (*n*)
Age	
18 to 25 years old	42.1 (64)
26 to 30 years old	19.7 (30)
31 to 40 years old	24.3 (37)
41 to 50 years old	9.2 (14)
51 years old and older	3.3 (5)
Sexual orientation	
Homosexual/gay	82.9 (126)
Bisexual	10.5 (16)
Other	5.3 (8)
Race/ethnicity	
White/Caucasian	53.4 (66)
Black/African American	11.2 (17)
Hispanic/Latino (any race)	25.7 (39)
Asian/Pacific Islander	9.9 (15)
Multiracial/other	8.6 (13)
Educational attainment	
Less than 12th grade	0.7 (1)
High school, or equivalent	10.5 (16)
Some college	30.9 (47)
Bachelor's degree	40.1 (61)
Master's degree or higher	16.4 (25)
Past year income	
Less than $25,000	42.8 (65)
$25,000 to $49,999	25.7 (39)
$50,000 to $74,999	13.8 (21)
$75,000 or more	17.1 (26)

About half (52.0 %) agreed or strongly agreed that there was little chance that they could become infected with HIV from what they do sexually, whereas 29.0 % disagreed or strongly disagreed and 19.1 % neither agreed nor disagreed with this assessment of their risk. Individuals agreeing that there was little chance they could become HIV-positive from their current sexual behaviors reported congruently lower numbers of partners for condomless receptive intercourse, $\chi^2(2) = 8.351$, $p = .015$.

Partner-Based Risk Perception

With regard to a potential partner's age, 77.0 % of respondents considered all potential partners at equally high risk for transmitting HIV if they had sex without a condom and 23.0 % believed one group of partners to be higher risk than others, where 10.5 % believed that they were most likely to get HIV from a partner who is more than 4 years older than themselves. In multivariable models, endorsement of an age-based risk perception (compared to the endorsement of a belief that all partners are equally high risk) was associated with higher numbers of partners for condomless receptive anal intercourse (IRR = 2.285; 95 % CI 1.237, 4.220; $p = .008$).

Approximately three-fourths (74.3 %) of respondents considered all potential partners at equally high risk for transmitting HIV if they engaged in condomless

sexual behaviors with regard to race/ethnicity, and 25.7 % believed one group of partners to be higher risk than the others, where 15.8 % believed that they were most likely to get HIV from a Black or African American partner. In multivariable models, endorsement of a race-based risk perception (compared to the endorsement of a belief that all partners are equally high risk) was associated with higher numbers of partners for condomless receptive anal intercourse (IRR = 2.027; 95% CI 1.149, 3.577; $p = .015$).

A majority (90.8 %) believed all potential partners were at equally high risk for transmitting HIV regardless of body type, and 9.2 % believed one group of partners to be higher risk than the others, where 3.9 % believed that they were most likely to get HIV from a partner who is lean and muscular with a somewhat thin build. Approximately three-fourths (73.0 %) believed all potential partners to be at equally high risk for transmitting HIV regardless of the venue in which the partner was met, and 27.0 % believed one group of partners to be higher risk than the others, where 23.7 % believed that they were most likely to get HIV from a partner they met on a geosocial-networking smartphone application. In multivariable models, neither body type- or venue-based risk perceptions were associated with the number of partners for both condomless insertive and receptive anal intercourse.

DISCUSSION

The current study provides a meaningful contribution to the literature by assessing behavior- and partner-based risk perception among MSM who use geosocial-networking smartphone applications. Individuals engaging in more frequent risk behaviors (e.g., indicating higher numbers of partners for condomless anal intercourse) perceived themselves to be at higher risk for being infected with HIV, suggesting that individuals are able to correctly perceive risk based on their behaviors.

To our knowledge, this is the first study of partner-based risk perception among MSM. Since the beginning of the HIV pandemic, individuals living with HIV and the social groups with which they are associated have been stigmatized by the general population.[12,13] Sexual stereotypes can be understood as inferred beliefs and expectations about the behaviors included in a sexual experience will take based on the characteristics (e.g., age, race) of the partner. The assessment of partner-based risk perception in this study potentially sheds light on sexual stereotypes of those believed to be at highest risk for transmitting HIV.[14] This association of age- and race-based risk perceptions with higher numbers of partners for condomless anal intercourse behaviors may reflect the avoidance of groups of partners perceived to be high risk and the engagement in high-risk behaviors with other groups. Future research should assess the factors shaping these perceptions and the implications of these partner-based perceptions on the formation of sexual networks.

The findings of this study should be considered in light of their limitations. First, our sample is a small sample of MSM recruited exclusively from a single popular geosocial-networking smartphone application in one location during a time period limited in length by cost and advertising availability. A substantial percentage of users (53.9 %) who clicked on the recruitment advertisement did not complete the survey, so the sample is likely to be biased by self-selection. The sexual behaviors in this study were assessed by self-report. While there can be some misclassification in self-report measures due to social desirability bias, the survey was conducted anonymously, so answers may be more likely to be accurate.

CONCLUSION

Findings regarding behavior-based risk perception suggest that MSM largely understand HIV risk based on their own sexual behaviors, but findings regarding partner-based risk perception and their associations with condomless sexual behaviors warrant further investigation into the factors shaping these perceptions and their implications for sexual network formation.

ACKNOWLEDGMENTS

We thank Dr. Mark L. Hatzenbuehler and an anonymous reviewer for commenting on an earlier version of this manuscript. The study presented in this manuscript was funded by an individual research grant from the New York University College of Arts and Science Dean's Undergraduate Research Fund (PI: William C. Goedel). Dr. Dustin T. Duncan was supported by his New York University School of Medicine Start-Up Research Fund to work on this project.

REFERENCES

1. Centers for Disease Control and Prevention. Diagnoses of HIV Infection in the United States and Dependent Areas, 2013. In: *HIV Surveillance Report*. 2015: 25.
2. HIV Epidemiology and Field Services Program. *New York City HIV/AIDS Annual Surveillance Statistics*. New York: New York City Department of Health and Mental Hygiene; 2015.
3. Gold RS, Skinner MJ. Judging a book by its cover: gay men's use of perceptible characteristics to infer antibody status. *Int J STD AIDS*. 1996; 7(1): 39–43.
4. Gold RS, Skinner MJ, Hinchy J. Gay men's stereotypes about who is HIV infected: a further study. *Int J STD AIDS*. 1999; 10(9): 600–605.
5. Niccolai LM, Farley TA, Ayoub MA, Magnus M, Kissinger PJ. HIV-infected persons' knowledge of their sexual partners' HIV status. *AIDS Educ Prev*. 2002; 14(3): 183–189.
6. Phillips G II, Magnus M, Kuo I, et al. Use of geosocial networking (GSN) mobile phone applications to find men for sex by men who have sex with men (MSM) in Washington, DC. *AIDS Behav*. 2014; 18(9): 1630–1637.
7. Goedel WC, Duncan DT. Geosocial-networking app usage patterns of gay, bisexual, and other men who have sex with men: survey among users of Grindr, a mobile dating app. *JMIR Public Health Surveill*. 2015; 1(1): e4.
8. Winetrobe H, Rice E, Bauermeister J, Petering R, Holloway IW. Associations of unprotected anal intercourse with Grindr-met partners among Grindr-using young men who have sex with men in Los Angeles. *AIDS Care*. 2014; 26(10): 1303–1308.
9. Beymer M, Weiss R, Bolan R, et al. Sex on demand: geosocial networking phone apps and risk of sexually transmitted infections among a cross-sectional sample of men who have sex with men in Los Angeles county. *Sex Transm Infect*. 2014; 90(7): 567–572.
10. Duncan D, Goedel W, Stults C, et al. A study of intimate partner violence, substance abuse, and sexual risk behaviors among gay, bisexual, and other men who have sex with men in a sample of geosocial-networking smartphone application users. *Am J Mens Health*. 2016.
11. Hilbe JM. *Negative binomial regression*. New York, NY: Cambridge University Press; 2011.

12. Herek GM, Capitanio JP, Widaman KF. HIV-related stigma and knowledge in the United States: prevalence and trends, 1991-1999. *Am J Public Health*. 2002; 92(3): 371–377.
13. Herek GM, Glunt EK. An epidemic of stigma: public reactions to AIDS. *Am Psychol*. 1988; 43(11): 886–891.
14. Smit PJ, Brady M, Carter M, et al. HIV-related stigma within communities of gay men: a literature review. *AIDS Care*. 2012; 24(4): 405–412.