Published in final edited form as:

AIDS Behav. 2017 April ; 21(4): 1219–1227. doi:10.1007/s10461-016-1454-2.

Multiplex Relationships and HIV: Implications for Network-based Interventions

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Abstract

The number of network members and the roles they play can influence risk behaviors and consequently intervention strategies to reduce HIV transmission. We recruited 652 people who use drugs (PWUD) from socially disadvantaged neighborhoods in New York City (07/2006–06/2009). Interviewer-administered surveys ascertained demographic, behavioral, and network data. We used logistic regression, stratified by exchange sex, to assess the relationship between HIV status and the number of network members with different roles, treated as independent and multiplex (i.e., drug+sex). Those with more multiplex risk ties were significantly more likely to be HIV positive, but only among those not reporting exchange sex (AOR=3.2). Among those reporting exchange sex, men reporting recent male sex partners were more likely to report HIV positive status (AOR=12.6). These data suggest that sex and drug relationships among PWUD are interrelated. Interventions that target multiplex rather than single-role relationships may be more effective in influencing behavior change.

Abstract

El número de personas en una red social y las funciones de cada persona en esa misma red pueden influir sus comportamientos de riesgo y en consecuencia las estrategias de intervención para reducir la transmisión del VIH. 652 personas que usan drogas fueron reclutadas de barrios socialmente desfavorecidos en New York City (07/2006-06/2009). Las encuestas recabaron

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

Compliance with Ethical Standards

Disclosure of potential conflicts of interest

Research involving human participants and/or animals

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

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

características demográficas, comportamientos de riesgo, e información sobre la red social. Regresión logística (estratificada por género) evaluó la asociación entre el estatus serológico de VIH y el número de personas de la red social, con funciones diferentes tratadas como relaciones independiente y multiplex (i.e., drogas + sexos). Los que tienen más “relaciones riesgos multiplex” presentan una mayor probabilidad de estar infectados con el VIH, pero sólo entre los que no han participado en el intercambio de sexo (AOR = 3.2). Entre los que han participado en el intercambio de sexo, hombres que recientemente tuvieron relaciones sexuales con hombres presentaron mayor propensión a estar infectados con el VIH (AOR = 12.6). Estos datos sugieren que las relaciones sexuales y drogas entre personas que usan drogas están interrelacionados. Las intervenciones que se dirigen a relaciones multiplex en vez de relaciones de sólo una función pueden ser más adecuadas para influir cambios de comportamiento.

Keywords

social networks; multiplexity; risk networks; exchange sex

INTRODUCTION

Because network characteristics, structures, and norms influence individual-level behaviors and HIV transmission, social network analysis has played a prominent role in HIV prevention and intervention research. To date, social network analyses using personal network data (i.e., egocentric network data) have focused primarily on the relationships (1) between network norms and drug-(1-6)/sex-related(7, 8) HIV risk behaviors and (2) between personal network characteristics and HIV status or risk(9)/health-seeking behaviors.(10) While many studies suggest that individuals with a greater number and proportion of risk network members have higher risk sexual and drug use behaviors,(11, 12) the presence of multiplex relationships (i.e., relationships that fill more than one role), may also influence risk and health-seeking behaviors. Studies among people who use drugs (PWUD) have shown that individuals interact with many of their network members in multiple ways, and that individuals with more multiplex network relationships often engage in higher risk drug use and sex behaviors. For example, in a Baltimore study, 64% of people who injected drugs had overlapping risk and social support networks (i.e., multiplex networks), and multiplexity was associated with more frequent injection drug use.(13) Multiplex relationships characterized by both sex and drug use include both relationships where there is co-use of drugs and sex and relationships where sex is exchanged for drugs. Prior studies among women have demonstrated that exchanging sex for drugs may increase one's vulnerability to risk behaviors.(14) Further, participation in exchange sex has been consistently associated with higher risk drug use and sexual behaviors and has been reported as a risk factor for HIV.(15-19) Even though a network member who is only a drug sharing partner may have a very different relationship with an individual than a drug sharing partner who is also a sexual partner or a drug sharing partner who is a sexual partner and who provides emotional support, multiplexity is seldom considered in epidemiologic studies of risk behaviors. Another rationale for examining the role of multiplex relationships is that behaviors, health information, and HIV may flow more easily through networks with more overlapping relationships because there are more paths connecting any two members of the network.(20,

21) Individual risk behaviors with particular risk network members may also be more difficult to change when a relationship is multi-faceted. For these reasons, it is important to examine not only the presence or absence of risk and/or social support network members in one's network, but also the presence of multiplex relationships and how the specific types of multiple roles that network members play can in turn influence individual-level risk behaviors and disease transmission.

Findings from social network studies can inform the development of network-based interventions, such as peer-driven interventions (PDIs). PDIs are effective, low-cost, culturally appropriate interventions that target key mediators of behavior change (e.g., self-efficacy, knowledge, and motivation)(22) and rely primarily on peer influence to change network social norms. PDIs have produced significant reductions in sexual risk behaviors, (23) drug use,(24) and injection risk behaviors (i.e., injection frequency,(23, 25-39) equipment sharing,(23, 27, 29, 32, 33, 37, 40) and increases in injection equipment sterilization(28, 31, 33, 37, 41, 42)) and drug treatment enrollment(31, 36, 38, 42, 43) among PWUD. They have also effectively recruited particularly difficult to reach subgroups of PWUD to participate in existing harm reduction programs, thereby expanding the reach of currently available intervention services to those that would otherwise not have participated. (44) The success of PDIs is often attributed to the fact that they capitalize and expand upon the norms that sustain relationships between individuals.(45, 46) Given that multiplex relationships (i.e., both the number of multiplex relationships and the types of roles that these network members play) have implications for HIV risk behaviors,(8, 47) it is possible that PDI effects could be optimized by targeting specific types of multiplex relationships or network members who have specific multiplex roles (i.e., both drug sharing and sexual partners), rather than risk relationships more generally (i.e., drug use or sexual partners). Thus, this paper will examine the association between the number of risk network members and HIV status when risk relationships are evaluated independently and as multiplex relationships.

METHODS

Between July 2006 and June 2009, 652 PWUD were recruited from socially disadvantaged neighborhoods in New York City using targeted street outreach and respondent-driven sampling. These methods have been described previously.(48) In brief, participants were eligible to participate if they were between 18 and 40 years of age and reported a) use of non-injection heroin, crack, or cocaine for at least one year and at least 2-3 times per week in the last three months or b) first injection within the last three years and self-reported use of injection drugs at least once in the past 6 months. Interviewer-administered surveys collected demographic and social contextual characteristics, self-reported HIV status, and drug/sex risk behaviors. Egocentric data was ascertained through a personal network inventory(49) which elicited the names/nicknames of social support (i.e., monetary, instrumental, and emotional), informational support (i.e., information about how to use drugs safely, medical services, and social services), and risk (i.e., drug and sex) network members over the past year. We categorized each alter listed in the database (n=2400) according to whether or not he/she fulfilled the following roles: (1) provided financial support, (2) provided housing support, (3) provided emotional support (i.e., someone whom

the participant talked to about personal or private matters), (4) provided information about how to use drugs safely, (5) provided information on medical services, (6) provided information on social services, (7) provided any informational support (items 4-6), (8) drug use partner, (9) sex partner, (10) drug use and sex partner, (11) drug use partner but not sex partner, (12) sex partner but not drug use partner, and (13) drug use or sex partner. Using cross-tabulations, we also explored overlap between (a) drug use partners, (b) sex partners, and (c) drug use and sex partners with (1) informational support, (2) emotional support, (3) financial support, and (4) housing support. We then calculated the number of alters listed by each person and the number of alters that fulfilled each of the individual roles or multiplex roles defined above. All study procedures were approved by both Columbia University and the New York Academy of Medicine institutional review boards.

The purpose of this analysis was to identify network relationship roles (evaluated independently and as multiplex relationships) associated with self-reported HIV positive disease status. Using the network domains listed above, we calculated summary statistics to represent the total number of network members listed by each participant (a) overall, (b) for each individual role, and (c) for multiplex roles. Logistic regression models (adjusted for individual-level correlates of HIV) that accounted for network roles as independent and as multiplex (i.e., counts of network members with each role(s)) were compared. Individual-level covariates included demographic characteristics (i.e., age, gender, race, ethnicity, income, educational attainment, homelessness in the past six months), drug use (crack use, heroin use, cocaine use, and injection drug use) in the past six months, and sexual risk behaviors (condom use in the past six months, reported exchanging sex for money or drugs in the past year, and sex partner gender in the past two months). As exchanging sex (a) was reported by 29% of the sample (50% of women and 20% of men), (b) was significantly correlated with the outcome of interest (20.4% of those who reported exchange sex compared with 5.0% of those did not reported HIV-positive status; $p<0.001$), and (c) could account for multiplex ties involving both drug use and sex in the past year, we stratified our findings by participation in exchange sex in the past year ($N=609$). Within each strata, demographic, behavioral, and network correlates of HIV positive status were examined using t-tests for continuous variables and chi-square statistics (or Fisher Exact tests, where appropriate) for binary variables. Those significant at $p<0.05$ in the bivariate comparisons were included in the multivariable logistic regression analyses. All analyses were conducted using SAS v. 9.4.(50)

RESULTS

As seen in Table I, there were 2400 network members listed by the 609 participants included in our analysis. Almost half (46%) of network members were named as fulfilling two or more different network roles (Table II). There was extensive overlap in network member roles with regard to (a) financial, housing, and emotional support; (b) across the three types of informational support; and (c) risk roles (i.e., both sex and drug use). Table II provides (a) the number of network members listed overall and (b) the number of network members listed for each network role. Table II additionally provides the number of network members listed as fulfilling each role according to the number of different types of network roles they play ($n=1-8$ different roles). For example, of the 2400 network members listed, 54% fulfilled

only one role and 21% fulfilled two different roles. As seen in the bottom row of Table II, sex partners were the most frequently listed type of network member (n=925), followed by drug use partners (n=728). The fewest number of network members were listed as those who provided informational support about using drugs safely (n=381). Although network members who provided financial (n=709), housing (n=585), and emotional support (n=649) were less frequently listed than drug use and sexual partners, these network members were more likely to play multiple roles. For example, 77% of network members providing financial support, 83% of those providing housing support, and 87% of those providing emotional support played at least one other role. On the contrary, sex partners and drug use partners were the least likely to fulfill more than one network role (43% and 61%, respectively). However, as seen in Table I, when they were listed as playing more than one role, sex partners were most likely to also be listed as drug use partners (30%) and drug use network members were most likely to also be listed as sex partners (39%). Of the 281 individuals who were both drug use and sex partners, 45.9% played at least one additional role (i.e., 15.3% played one additional role, 12.5% played two additional roles, 6.8% played three additional roles, 5.3% played four additional roles, 3.2% played 5 additional roles, and 3.9% played 6 additional roles). Of the 281 network members who were both drug use and sex partners, 18.5% also provided financial support, 14.9% also provided housing support, 22.8% also provided emotional support, 21.0% also provided informational support about how to use drugs safely, 15.7% also provided informational support about medical services, and 11.0% also provided informational support about social services (data not shown in tables). Although there was some overlap in social support and risk network member roles, self-reported HIV positive status was not significantly correlated with multiplex roles which included both risk and support roles.

Table III provides individual and network level correlates of HIV positive status, stratified by whether or not participants reported exchanging sex in the last year. Regardless of one's participation in exchange sex (Table III), those reporting HIV positive status were significantly older. Of note, there were also differences in the correlates of self-reported HIV status among those who did and did not report exchanging sex in the past year. For example, men who reported exchanging sex were more likely to report HIV positive status than women who reported exchanging sex; whereas gender was not associated with HIV status among those not reporting exchange sex. Reporting a greater number of network members who were both drug use and sex partners (defined as "multiplex risk network members", hereafter) was positively associated with HIV status only among those who did not report exchanging sex in the past year. Of note, the number of network members who were either drug use OR sex partners was not significantly associated with HIV status (Table III). Table IV presents a series of multivariable logistic regression models (adjusting for individual-level confounders), each with different strategies for model building. For example, Models 1-3 examine the association between HIV status and the number of network members who are (1) sex but not drug use partners, (2) drug use but not sex partners, and (3) drug use and sex partners. Of note, before adjusting for exchange sex (Models 1-3), only the number of multiplex risk relationships (Model 3) was significantly associated with HIV positive status. Because multiplex relationships may represent relationships where sex is exchanged for drugs, we adjusted for participation in exchange sex (during the same time frame) in Model

4. As seen in Model 4, the number of multiplex risk network members was NOT significantly associated with HIV positive status after adjusting for exchange sex. In order to determine the extent to which exchange sex accounts for the association between multiplex risk relationships and HIV status, we stratified Model 5 by exchange sex; if the association remained in the group without exchange sex, it would suggest that the two variables were measuring different constructs. As seen in Model 5, the number of multiplex risk network members was significantly associated with HIV positive status among those who had not exchanged sex for money or drugs in the past year (AOR: 3.23; 95%CI: 1.64-6.33). Among those who did report exchange sex in the past year, there was no statistically significant association between HIV positive status and the number of multiplex risk network members (AOR:1.22; 95%CI: 0.80-1.86). However, there was a statistically significant interaction between gender and gender of sex partners; men reporting sex with men were the most likely to report being HIV positive (AOR: 12.57; 95%CI: 1.00-157.70). Of note, 6.7% of the sample reported being male and having a male sex partner in the past two months.

DISCUSSION

In this sample, having more overlapping sex and drug use network members was significantly associated with self-reported HIV positive status, but when stratified by participation in exchange sex, the relationship persisted only among those who did not report exchanging sex. Overall, the prevalence of HIV was 9.25% and the mean duration of infection was self-reported as 10.4 years. Of note, the number of years reported to be living with HIV was not significantly different between those who did and did not report exchange sex ($p=0.82$). Consequently, it is unknown whether those with current multiplex risk networks had similar risk networks at the time of seroconversion. However, because those in the sample who are HIV positive are more likely to have a greater number of network members with whom they report having sex and using drugs, there are consequently more potential paths for disease transmission to others in their network. As the Federal guidelines recommend that pre-exposure prophylaxis (PrEP) be considered for people who are HIV-negative and at very high risk for infection, analyses which assess multiplex relationship roles could be used to help identify those who might benefit most from biomedical prevention strategies.

Although PDIs have typically out-performed traditional outreach interventions with respect to reductions in HIV-related risk behaviors over the intervention period,(51) most PDIs aim to reduce drug and sex risk behaviors with drug use partners and sex partners, but do not focus specifically on strategies to reduce risk behaviors with network members that fulfill more than one relationship role (i.e., both drug use and sex partners). As noted in the results section of this paper, the number of network members who were either drug use OR sex partners was not significantly associated with HIV status, but the number of network members who were both drug use AND sex partners was significantly associated with HIV status in this analysis. Because behavior change may be more difficult with network members that play more than one role, interventions may benefit from including strategies to reduce risk in multiplex relationships (i.e., drug and sex, drug and social support, social support and drug, etc.). In our sample, we observed no statistically significant associations between multiplex relationships comprised of risk and social support roles and HIV positive

disease status. Instead, only the number of multiplex risk network members was associated with HIV positive disease status. Of note, the fact that we observed no significant associations between the number of multiplex relationships involving risk and supportive relationships was likely due to lack of statistical power. For example, the mean number of network members reported by individuals was 3.84 (range: 1-19), the mean number of drug use partners was 1.2 (range: 0-10), the mean number of sex partners was 1.5 (range: 0-10), and the mean number of drug AND sex partners was 0.4 (range: 0-9). Further, as seen in Table I, the overlap between drug use and informational support networks and between sex partners and informational support networks was very low. As a result, the majority of participants reported NO network members who were both risk and support relationships, reducing our statistical power to detect a significant difference. We therefore recommend that our approach be repeated in samples where the overlap is greater to determine if there is a significant association between HIV status and the number of multiplex relationships involving risk and supportive roles in different contexts. Nonetheless, our findings suggest that if intervention strategies focused on interactions with network members who have both sexual and drug use roles, rather than drug use partners or sexual partners more generally, there could potentially be larger and longer lasting behavior changes and greater reductions in ongoing HIV transmission.

There are a few limitations of this analysis which should be acknowledged. First, because HIV status was measured via self-report, those reporting unknown or negative status may have been HIV positive but unaware of or unwilling to disclose their HIV status. However, self-reported unknown HIV status was not significantly different by group. Additionally, relationships where sex is exchanged for drugs or vice versa could also be considered multiplex risk relationships. As we did not have partner-level information on exchange sex, we attempted to determine the extent to which this observed association was confounded by exchanging sex by stratifying our analysis by self-reported exchange of sex for money or drugs in the past year (the same time period over which drug use and sex network relationships are reported). The relationship between multiplex risk relationships and HIV positive status remained significant only in the group who did not report exchanging sex for money or drugs, suggesting that exchange sex is not the primary explanation for our finding. Another possible explanation is that among those who did not report exchanging sex for money or drugs, multiplex risk relationships may confer an elevated risk similar to those involving sex exchange. For example, relationships not categorized by participants as exchange relationships may similarly involve many other aspects of support (i.e., social, financial, etc.), which may make negotiating safer sexual behaviors more complex. Our findings suggest that sex and drug use relationships (and consequently risk behaviors) among PWUD are interrelated. Our analysis also lacked information on the direction of exchange (i.e., whether participants were giving or receiving money or drugs in exchange for sex). Future research is needed to better characterize exchange sex partners and to describe how they differ from other partners. Finally, because our data reflect multiplex relationships among PWUD recruited between 2006 and 2009 in New York City, we recommend that our analysis be repeated in studies that are currently enrolling PWUD and other HIV-at-risk populations. Although the HIV epidemic has changed since the time our data were collected, high risk sexual practices (including exchanging sex for money, drugs, housing, etc.) still

drive the epidemic, particularly among black women. For example, in a recent study of women enrolled in substance abuse treatment, over 40% of women reported exchange sex and those reporting exchange sex were more likely to be African American and HIV-positive and less likely to respond well to treatment.(52) The implications of our findings extend beyond epidemiologic evaluations to the development and evaluation of interventions (both domestically and internationally), as multiplexity may also impede or promote HIV-related medication adherence. Our findings suggest that interventions targeting drug use and sexual risk behaviors among PWUD should account for network contextual differences including overlapping risk roles, participation in exchange sex, direction of exchange, and gender. Future research should also explore the stability of multiplex relationships over time compared with single-role relationships and how the combination of roles that a particular person plays could be beneficial or deleterious to assisting PWUD living with HIV.

Acknowledgments

Source of Funding: This research was supported by the National Institute on Drug Abuse Grants R01 DA022144 (PI: Lewis, CF) and K01 DA033879 (PI: Rudolph, AE).

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Prevalence of overlapping network roles (among network members as reported by study participants) among a sample of persons who use drugs in New York City, 2006-2009 (N=2400 network members reported by 609 participants)

Table 1

	Social Support Network Members						Risk Network Members	
	Tangible Support		Emotional Support	Informational Support			Drug	Sex
	Financial	Housing	Talk to about personal/private matters	Using drugs safely	Medical Services	Social Services	Drug Use	Sex Partner
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Financial		359 (61)	347 (54)	133 (35)	150 (37)	127 (37)	148 (20)	117 (13)
Housing	359 (51)		314 (48)	117 (31)	132 (33)	112 (32)	130 (18)	91 (10)
Emotional	347 (49)	314 (54)		194 (51)	209 (52)	155 (45)	188 (26)	165 (18)
Drug Information	133 (19)	117 (20)	194 (30)		247 (61)	230 (67)	96 (13)	91 (10)
Medical Information	150 (21)	132 (23)	209 (32)	247 (65)		228 (66)	76 (10)	84 (9)
Social Services Information	127 (18)	112 (19)	155 (24)	230 (60)	228 (57)		57 (8)	62 (7)
Drug Use	148 (21)	130 (22)	188 (29)	96 (25)	76 (19)	57 (17)		281 (30)
Sex Partner	117 (17)	91 (16)	165 (25)	91 (24)	84 (21)	62 (18)	281 (39)	
TOTAL	709	585	648	381	402	345	728	925

Multiplexity in network roles among network members (as reported by study participants) overall and by network role among persons who use drugs in New York City, 2006-2009 (N=2400 network members reported by 609 study participants)

Table II

Number of different roles	Total number of network members	Social Support Network Members					Risk Network Members				
		Social Support Network Members					Risk Network Members				
		Tangible	Emotional	Provide informational support about	Using drugs safely	Medical Services	Social Services	Drug Use	Sex Partners	Sex	Sex
		Financial Support	Housing Support	Talk to about personal/private matters							
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
1	1297 (54)	163 (23)	99 (17)	86 (13)	36 (9)	58 (14)	47 (14)	281 (39)	527 (57)		
2	499 (21)	183 (26)	154 (26)	115 (18)	57 (15)	39 (10)	43 (12)	220 (30)	187 (20)		
3	288 (12)	145 (20)	131 (22)	171 (26)	83 (22)	92 (23)	77 (22)	85 (12)	80 (9)		
4	149 (6)	82 (12)	79 (14)	118 (18)	65 (17)	74 (18)	59 (17)	63 (9)	56 (6)		
5	74 (3)	56 (8)	45 (8)	68 (10)	49 (13)	53 (13)	37 (11)	31 (4)	31 (3)		
6	61 (3)	50 (7)	48 (8)	59 (9)	60 (16)	55 (14)	51 (15)	23 (3)	20 (2)		
7	24 (1)	22 (3)	21 (4)	23 (4)	23 (6)	23 (6)	23 (7)	17 (2)	16 (2)		
8	8 (0)	8 (1)	8 (1)	8 (1)	8 (2)	8 (2)	8 (2)	8 (1)	8 (1)		
TOTAL	2400	709	585	649	381	402	345	728	925		

Demographic, behavioral, and network correlates of HIV positive status stratified by participation in exchange sex among persons who use drugs in New York City, 2006-2009

Table III

	Had not exchanged sex for money or drugs in the last year (N=433)			Exchanged sex for money or drugs in the last year (N=176)		
	HIV Positive N=20 N (%)	HIV Negative N=379 N (%)	P-Value	HIV Positive N=32 N (%)	HIV Negative N=125 N (%)	P-Value
Age, median (IQR)	36 (34-38)	33 (28-37)	0.03	35 (33-39)	33 (28-38)	0.05
Male	15 (75.0)	302 (79.9)	0.57 ^a	20 (64.5)	54 (43.9)	0.04
Crack use (past 6 months)	17 (85.0)	275 (72.8)	0.23	32 (100.0)	111 (88.8)	0.07 ^a
Cocaine use (past 6 months)	13 (65.0)	287 (76.3)	0.28 ^a	18 (56.3)	93 (75.0)	0.04
Homeless (past 6 months)	3 (15.0)	234 (61.7)	<.0001	14 (43.8)	93 (74.4)	<0.01
High school education	12 (60.0)	199 (52.5)	0.51	20 (62.5)	56 (45.2)	0.08
Income (>10,000)	2 (11.8)	65 (18.0)	0.75 ^a	5 (17.2)	21 (17.4)	0.99
Inject drugs	1 (5.0)	103 (27.2)	0.03	1 (3.1)	13 (10.4)	0.30 ^a
Race			0.42			0.13
Hispanic vs. White/Other	9 (45.0)	162 (42.7)		5 (15.6)	28 (22.4)	
Black vs. White/Other	10 (50.0)	158 (41.7)		26 (81.3)	80 (64.0)	
Always use a condom	4 (20.0)	84 (22.5)	1.00 ^a	10 (31.3)	44 (35.5)	0.65
Network size, median (IQR)						
Number of drug use partners	1 (0.5-1)	1 (0-1)	0.48	1 (0-2)	1 (0.5-2.5)	0.43
Number of sex partners	1 (1-1)	1 (1-1)	0.14	1 (1-3)	1 (1-2)	0.15
Number of network members who are sex partners OR drug use partners	1 (1-2)	1 (1-2)	0.37	2 (1-3)	2 (1-4)	0.42
Number of network members who are both sex AND drug use partners	0 (0-1)	0 (0-1)	0.03	0 (0-1)	0.5 (0-1)	0.87
Number of network members who are sex but NOT drug use partners	1 (0-1)	1 (0-1)	0.62	1 (0-2)	0 (0-1)	0.11
Number of network members who are drug use but NOT sex partners	0 (0-1)	1 (0-1)	0.63	0 (0-1)	0.5 (0-1)	0.32

^aFisher's Exact test

Table IV

Network correlates of HIV positive status among persons who use drugs in New York City, 2006-2009

	MODEL 1 ^a	MODEL 2 ^a	MODEL 3 ^a	MODEL 4 ^a	MODEL 5 (Stratified Analysis)	
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	Had not exchanged sex for money or drugs in the last year ^b (N=433) AOR (95% CI)	Exchanged sex for money or drugs in the last year ^c (N=176) AOR (95% CI)
Number of network members who are sex but NOT drug use partners	1.13 (0.88, 1.45)			1.13 (0.86, 1.48)		
Number of network members who are drug use but NOT sex partners		1.07 (0.88, 1.31)		0.93 (0.74, 1.17)		
Number of network members who are sex AND drug use partners			1.50 (1.13, 2.00)	1.22 (0.90, 1.66)	3.23 (1.64, 6.33)	1.22 (0.80, 1.86)
Exchange sex (last year)				5.17 (2.59, 10.30)		
Interaction between gender and gender of sex partners (reference group is women without male sex partners)						
Men with male sex partners						12.57 (1.00, 157.70)
Men without male sex partners						1.29 (0.12, 14.08)
Women with male sex partners						0.59 (0.06, 5.39)

^a Adjusted for age and recent (past 6 months) homelessness, cocaine use, and crack use

^b Adjusted for age and homelessness in the past 6 months

^c Adjusted for homelessness and cocaine use in the past 6 months