HIV risk behaviour patterns, predictors, and sexually transmitted disease prevalence in the social networks of young men who have sex with men in St Petersburg, Russia

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Summary

HIV seroconversions and sexually transmitted diseases (STDs) are often clustered in social networks within community populations. The present study was carried out among men who have sex with men in Russia, where a major HIV epidemic is unfolding, and where social networks have played a historically important role. In all, 38 social networks were recruited into the study, and members of all networks (*n* = 187) completed risk behaviour assessments and were tested for STDs. About 17% of participants had STDs, and 10% of men had syphilis. Over 64% of men had recent unprotected anal intercourse (UAI), including 51% who did so with main partners, 30% who did so with casual partners, and 32% who had UAI with multiple male partners. The strongest predictor of all risk behaviour indicators and STDs was the social network, to which an individual belonged, supplemented by peer norm perceptions and intentions to practise safer sex. There was a high level of correspondence in behaviour between the social leader of a network and its other members. Social networks should be directly targeted in HIV prevention efforts.

Keywords

HIV/AIDS; social networks; men who have sex with men; gay/bisexual men; sexually transmitted diseases; risk behaviour

Introduction

HIV prevention studies have evaluated the effectiveness of individual, small-group, and community-level interventions.[1,2] An understudied level of HIV prevention involving approaches directed towards high-risk social networks, or clusters of interconnected persons within a community population who remain at elevated risk, accounts for a disproportionate number of HIV infections, and must now be more effectively reached if we are to reduce HIV incidence. Network approaches are needed because HIV and sexually transmitted disease (STD) risk is not uniform across a community population, and social networks at elevated risk can be identified and targeted for intervention.[3,4] Young people often use their social networks to find new sexual partners,[5] and sexual risk behaviour is predicted by the attitudes and norms

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of peers toward condom use.[6–9] Many of these norms are probably transmitted through the values and actions of members of one's social network. Social networks and HIV risk behaviour have mainly been studied among injection drug-users (IDUs).[10–12] By contrast, this paper reports on the prevalence of STDs, and predictors of HIV risk behaviour among social networks of young men who have sex with men (MSM) in St Petersburg, Russia.

Russia has one of the highest HIV incidence rates in the world, with 318,394 infections officially diagnosed.[13] However, the true number of infections is probably between one and two million.[14] HIV prevalence in St Petersburg increased 100-fold – from 0.013% to 1.3% – between 1998 and 2003,[15] mostly affecting young drug-users. STDs are also prevalent among young people in Russia; syphilis rates rose from 4.2 to 165 cases per 100,000 population between 1988 and 2001.[16] The emergence of drug use and STDs has occurred against a background of fundamental social, cultural, and economic transitions. Sustained economic crises have profoundly worsened quality of life. Poverty, joblessness, refugee migration, and fatalism concerning the future are widespread, and lifestyle value changes in Russia have led to the social acceptance of prostitution, temporary sexual relationships among young people, and declining age at first sex.[5,17]

MSM are among the most vulnerable populations at an early stage of a sexual HIV epidemic. Surveys of young MSM in Russia show that unprotected sex is common, consistent condom use is low, a large proportion of men exchange or gain sex for money or valuables, and many MSM engage in sex with both men and women.[9] Targeted HIV prevention campaigns of the kind typical in western gay communities have not yet been undertaken in most countries in Eastern Europe, and homosexual behaviour – although no longer illegal – remains highly stigmatized and hidden.

There is a long legacy of public distrust in former Soviet countries of government pronouncements, which are often considered as ideological propaganda.[3] When governmental information is not seen as personally relevant, individuals may rely on their social networks for advice. Social network members are likely to be trusted, provide mutual support, and also share common norms. Across the Eastern Europe, individuals have historically identified themselves as belonging to a social network, and turned to their network members for support.[18,19] During the Soviet era, with widespread deficiencies in even basic services and goods, social networks played an important role in meeting individuals' support and survival needs. Social networks continue to help individuals adapt to the difficult economic and social circumstances now confronting the region. Therefore, HIV prevention interventions that work within existing social networks are well-suited to cultural circumstances in post-Soviet countries. This study determined the extent to which individuals' AIDS-related psychosocial characteristics, and also social network factors predicted levels of sexual risk behaviour, and presence of STDs among young MSM in Russia.

Methods

During spring 2003, 38 young MSM networks were systematically recruited. Ethnographers conducted field observations in gay community-social gathering venues to identify and establish initial contacts with individuals, who could serve as access points to social networks. 'Social circles'[20] – defined as socializing groups of at least three persons characterized by stability, close proximity, and frequent conversational interactions with positive affect – were identified. The centre of attention among others in the circle (the 'index') was identified, approached, and provided with a brief study description. About 50% of approached indexes participated in the study.

During brief interviews, indexes were asked to provide the first names of their own network members ('egocentric' networks), defined as the friends with whom they most liked to spend time, talk, and felt close in their 'gay life'. Indexes were then asked to invite these persons to participate in the study. While most network members were MSM, some network members were women and heterosexual men. In all, 93% of social network members named by indexes were recruited into the study, receiving modest incentive payments for completing assessments.

Demographic characteristics

The study's 38 social networks included a total of 187 participants (mean = 5.0, range from three to 10 members per network). Most social network members (*n* = 146) were men, 95% of whom had same-sex experience in the past year. The sample also included 41 women. Participants' mean age was 22.1 years, mean education was 13.1 years, and 88% were unmarried. In all, 46% were students, and 53% were steadily employed.

Sociometric assessment and analysis to identify the social leadership of each recruited network

All network members completed a sociometric interview to determine the leader of each social network. From a list of all members of the same network, participants specified who they most – and least – preferred in five leadership areas (spending time together, inviting to a party, psychological support, trust, and discussing important matters). Using sociometric analysis software,[21] a 'social status' indicator ranked each network member, balancing positive and negative nominations received from other members of the same network in each leadership area. The one person with the highest indicator score across most leadership areas was designated as the social network's leader. (Procedures used in field observations, index identification, and sociometric analysis calculations to determine leaders of the social networks are described more fully in Amirkhanian *et al.*[3])

HIV risk behaviour baseline assessment of network members

Study measures, adapted from our previous HIV behavioural epidemiology research studies in Russia,[3,9] were developed, translated from, and back-translated into English. Individual assessment interviews usually lasted less than 1 h.

Psychosocial scales

The interview included five AIDS-related psychosocial measures. A 15-item scale measured *knowledge about AIDS risk and risk reduction steps* (sample item: 'If a man pulls out before orgasm, it protects from getting AIDS and venereal diseases'). Scores could range from zero to 15, reflecting the number of correct answers. A seven-item scale measured perceptions about *safer sex peer norms* (sample item: 'Condom use is accepted by my friends'). For each statement, respondents answered 'yes', 'somewhat', or 'no', yielding scores between zero and 14 (Cronbach's $\alpha = 0.84$). The same response options were used to measure *attitudes towards condoms and safer sex* (10 items, sample item: 'Using condoms interrupts the pleasure of sex'). Scores could range from zero to 20 (Cronbach's $\alpha = 0.71$). A 12-item scale with the same response format measured *risk reduction behavioural intentions* (sample item: 'A condom will be used if I have sexual intercourse with a casual partner'), with scores ranging from zero to 24 (Cronbach's $\alpha = 0.82$). Perceived *risk reduction self-efficacy* was assessed using a nine-item scale with the same response format (sample item: 'I am sure that I can overcome my partner's objections to safer sex or condoms'). Scores could range from zero to 18 (Cronbach's $\alpha = 0.63$).

Sexual risk background and sexual practices during lifetime, past year, and past three months

For both lifetime and the previous year, participants reported their number of male and female sexual partners, number of STD infections, and whether they had given, or received money, or valuables in exchange for sex. Participants then described specific behaviours occurring during the past three months. Partner-by-partner questions inquired about sexual practices with up to five men – and up to five women – of participants' most recent partners during this time period. Respondents indicated whether each partner was main or casual, the number of occurrences of anal and vaginal intercourse with each partner, and the number of times condoms were used. (The risk assessment interview used with men elicited information about other sexual practices with male partners (such as oral sex), but the analyses reported here focus only on unprotected anal and vaginal intercourse because of their known and high association with HIV transmission.) Participants with more than five partners of a given gender summarized their behaviour with all additional partners.

Substance use during the past three months

Participants reported on how many days in the past three months they used alcohol, marijuana, hallucinogens, ecstasy, heroin or opiates, or cocaine, and to specify any other substances that they used.

STD specimen collection and analysis

Participants provided blood serum and urine specimens for STD testing. Appropriate antibiotic treatment was provided to participants who had any infection.

Syphilis—Blood samples were initially tested for anti-treponemal antibodies by enzyme-linked immunosorbent assay (ELISA) (RecombiBest Antipallidum; Vector Best, Novosibirsk, Russia). All ELISA-positive specimens were refrigerated, and later tested by Wasserman reaction using sheep red blood cells. Results for the Wasserman reaction assay were scored as negative, or as positive from two to four, depending on the degree of haemolysis. Confirmatory testing was performed by a specific *Treponema pallidum* antigen-passive haemagglutination assay.

Chlamydia and gonorrhoea—Urine samples were used for polymerase chain rection (PCR) assays. After not urinating for at least 2 h, a 10-mL portion of initial-stream urine was collected in sterile polypropylene tubes. *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) DNA were extracted using Amplicor CT/NG specimen preparation kits (Roche Molecular Systems, Inc., USA). Amplification and detection of *C. trachomatis* and *N. gonorrhoeae* DNA were performed using Amplicor CT/NG amplification, Cobas Amplicor CT detection, and Cobas Amplicor NG detection kits. An automatic PCR analyzer Cobas Amplicor was used following standard procedures (Roche Molecular Systems Inc., USA).

Statistical procedures

Descriptive analyses examined STD prevalence and sexual risk characteristics. Next, we examined the degree to which variations in sexual risk behaviour were associated with social networks. General linear models (GLM) tested the univariate relationship (*eta*) between networks, entered as a random factor, and sexual risk outcome measures. A series of intra-class correlations (*r*), comparing leaders versus other network members on each sexual risk variable, estimated the level of within-network consistency in risk behaviour. To reduce skewness, counts for sexual partners, and unprotected intercourse occasions were transformed according to the formula, $\log_{10} + 1$. Lastly, we examined the relative contributions of individual demographic background, substance use, and psychosocial risk-related characteristics in

predicting sexual risk behaviour, controlling for social network. Stepwise regression models (linear or logistic) were fit to the data for each sexual risk variable. All predictors achieving a significance level of at least $P<0.10$ in the regression analysis were then included as covariates in a GLM for the same sexual risk outcome, with social network entered as a random (grouping) factor. Partial eta^2 coefficients measured the variance in sexual risk explained by each predictor. This two-stage approach limited the number of covariates in the final predictive models, in relation to the sample size.

Results

Prevalence of STDs in MSM social networks

As Table 1 shows, approximately 17% of participants had one of the tested STDs. The two most prevalent diseases in the sample were syphilis (in 10.4% of men) and chlamydia (in 15.2% of women). Almost 23% of men and 15% of women said that they had also contracted an STD at some prior time, during their lives.

Prevalence of risk behaviour in MSM social networks

Men—Men reported lifetime means of 80.2 (median = 15) male and 24.1 (median = 3) female sexual partners, and over 69% of men had partners of both genders. In the year prior to the interview, men had means of 14.9 (median = 5) male and 1.6 (median = 0) female partners. Almost 27% ($n = 39$) of men had both male and female partners in the past year.

During the most recent three months, 82% of men had a main partner, but only 25% ($n = 37$) of them had sex exclusively with this partner. Instead, most men (56%, $n = 82$) had sex with both a main partner, and also with one or more casual partners. Approximately 16% ($n = 23$) of men had sex only with casual partners, and approximately 3% ($n = 4$) did not have sex in the past three months.

Unprotected sexual practices were highly prevalent even with non-main partners. Men had a mean of 33.7 (median = 15) unprotected anal and vaginal intercourse acts in the past three months. (Based on 105 men who reported any unprotected vaginal or anal intercourse.) Information on sexual partner type was obtained only for the five most recent partners of each gender during the past three months. Because some participants had more than five partners, the mean and median values for 'Any Partners' are sometimes higher than the sum of 'Main Partners' plus 'Casual Partners'. Figure 1 shows the proportions of men engaged in unprotected anal and vaginal sex (broken down also by main, casual, and multiple partners). Exchanging sex for money or valuables was also common. Almost 31% ($n = 45$) of men were paid for sex in their lifetimes, 15% ($n = 22$) in the past year. In all, 24% of men ($n = 35$) paid someone for sex in their lifetimes, 16% ($n = 23$) in the past year.

Women—Female members in young MSM social networks had a mean of 10.3 (median = 7) lifetime and 2.6 (median = 2) past-year male partners. Nearly one-third ($n = 13$) of women had sex with both a main male partner and also other male partners, and about 15% ($n = 6$) had sex with multiple casual partners in the past three months. Women had a mean of 31.5 (median = 21.5) of unprotected intercourse acts in the same timeframe. (Based on 18 women who reported any unprotected vaginal or anal intercourse.) Although not necessarily representative of women in the general population, female members of young MSM social networks were also at high HIV risk.

Within- and between-network variations in sexual risk behaviours

Correlation analyses, presented in Table 2, determined the extent to which variability in sexual risk behaviours was associated with social network factors. The first set of these analyses

assessed differences in the levels of sexual risk between networks. Significant correlation coefficients (*eta*) resulted in eight out of nine of these associations. Numbers of sexual partners – in the past year and in the past three months – varied significantly across social networks. There were also significant differences between networks in the prevalence, frequency, and having any unprotected (vaginal and/or anal) intercourse in the past three months. A significant correlation also resulted between network and having any unprotected anal sex, but the coefficient for the relationship between the three-month frequency measure for anal sex and social network was not significant. STDs prevalence was significantly higher within some social networks than others. Networks varied significantly in how often members bought or sold sex in the past year, and also lifetime.

A series of intra-class correlations (Table 2, righthand column) then explored patterns of within-group consistency, by comparing the sexual risk levels of members in each social network with those of the network's sociometric leader. Although the sizes of the coefficients were more modest than in the between-networks analyses, significant and positive intra-class correlations were found between leader and member behaviour for prevalence and frequency unprotected anal sex, as well as combined unprotected vaginal and anal intercourse. Consistency between network leaders and members was also revealed having an STD infection, and engaging in commercial sex.

Individual- and network-level predictors of sexual HIV risk behaviour and prevalence of STDs

Predictors of engaging in sexual risk practices in the past three months—As
Table 3 shows, the social network to which one belonged explained from 27% to 29% (partial $eta^2 = 0.27$–0.29) of the variance in having any unprotected vaginal or anal intercourse, one's number of sexual partners, and frequency of unprotected sex. Social network remained significantly associated with any unprotected intercourse ($P = 0.02$), and number of sexual partners ($P = 0.05$) in the GLM analysis. Individual-level variables were weaker predictors of all risk behaviour outcomes than social network, with partial eta^2 coefficients accounting for only 3–8% of the variance in each outcome.

Predictors of positive STD diagnoses and engaging in commercial sex in the
past year—Social network was the only significant predictor of having a positive STD test result (partial $eta^2 = 0.36$, $P=0.005$). Social network also was a strong predictor of engaging in commercial sex during the previous year (partial $eta^2 = 0.35$, $P = 0.001$), after adjusting for individual-level covariates. Participants with more positive perceptions of peer norms about safer sex were less likely ($eta^2 = 0.05$; $P = 0.007$) to have engaged in commercial sex during the past year.

Discussion

To the best of our knowledge, this is the first study of HIV risk behaviour and STD prevalence in young MSM social networks in Russia. Over 10% of men had syphilis, an alarming disease level. Risk behaviour levels in young MSM networks were also high. Most men recently engaged in either anal or vaginal unprotected intercourse, often with casual or multiple partners. Participants rarely used condoms with their main partners, perhaps because of feelings of trust and familiarity. However, most men also had sex with other partners even in a short retrospective period, either outside of their main relationships, or in brief serially monogamous relationships.

Theoretical models applied to HIV sexual risk behaviour[22,23] and previous research studies among MSM in Eastern Europe[3,9,24] emphasize the role of individual-level factors – including HIV/AIDS knowledge, safer sex norms, attitudes, intentions, and self-efficacy – as influences on risky or safer behaviour. Our findings revealed that beyond these individual factors, the

social network to which participants belonged was an even stronger predictor of HIV risk behaviour indicators, including recently engaging in unprotected intercourse, exchanging sex for money, or having an STD. Social network was the predictor responsible for the largest percentages of variance in all tested risk outcomes, and over-rode the influence of 'traditional' individual-level risk behaviour predictors such as attitudes, self-efficacy, and AIDS knowledge. While safer sex peer norms and behavioural intentions remained significant, they accounted for less variance in risk behaviour outcomes.

Correlations and multivariate models showed that higher risk was clustered among members within a network, and that overall risk levels significantly varied across social networks. The risk characteristics of a network leader and other members of the same network were also significantly related. This may be due to leader influence over others, or because like-minded people tend to associate with one another. Additional research is needed to determine the mechanisms responsible for a social network's influence on the individual behaviours of its members.

Social networks in the study, although mostly composed of MSM, also included some women and heterosexual men. The role of female members in MSM networks is understudied. A large proportion of women in the sample engaged in sex with other women as well as men. It is possible that these women were sexual partners of bisexual male network members. Alternatively, women in MSM social networks may play important social roles with gay men because they are – to each other – close mutual friends rather than potential sexual partners.

The study has some limitations. Detailed, partner- by-partner data on sexual activities were collected for 92% of the respondents' total sexual partners over the three-month period. Consequently, our data may under-estimate the true risk behaviour levels of the sample. In addition, retrospectively determining the main or casual status of a sexual partner may be biased, because evaluation of a former partner's status might be different from the one perceived, when the relationship with that partner was current. Risk behaviour questions are sensitive, and this might have caused under-reporting of stigmatized sexual or substance-use behaviours. Finally, gonorrhoea and chlamydia were diagnosed only from urine specimens, and this would have missed oral and rectal infections.

Our findings underscore the importance of carrying out HIV prevention interventions with high-risk social networks which constitute structures found across multiple types of societies or communities. Reliance on one's social network plays an especially important role in former Soviet countries experiencing political, economic, and cultural transitions, and in stigmatized communities like MSM. Networks constitute an environment of shared peer norms, including those related to condoms and safer sex. For that reason, HIV risk reduction interventions may be especially promising when they target entire social networks of vulnerable populations, and focus on prevention activities within these networks. Some interventions have carried out small-group sessions attended by all members of intact social networks.[10,11] Another strategy is to identify and train social network leaders to convey HIV prevention messages to members of their own networks.[3] In this way, leaders of social networks can help to establish new safer behaviour norms, and help network members to overcome negative condom attitudes, establish plans for practicing safer sex, and problem-solve barriers to behaviour change efforts. While these theoretical components establish the content for interventions, social networks constitute important vehicles for framing intervention programmes. Randomized trials are needed to evaluate the efficacy of social network-based interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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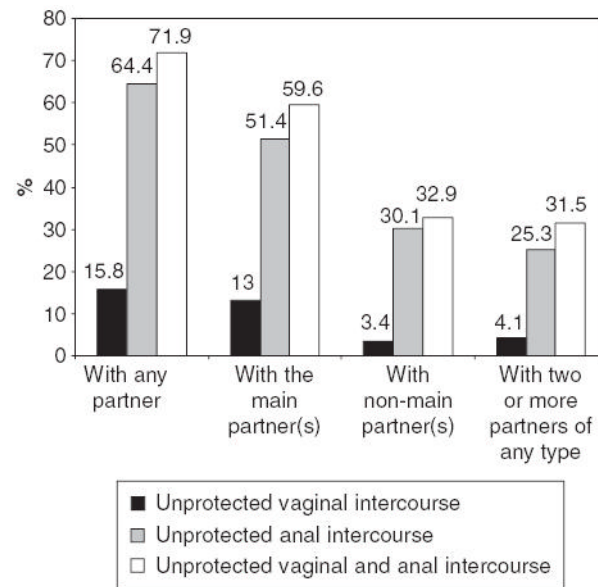
Figure 1.
Percentage of male participants reporting unprotected vaginal or anal intercourse during the past three months, by partner type (*n* = 146)

Table 1

Prevalence of sexually transmitted diseases (STDs) by gender in young MSM social networks

Variable	Total sample (*n*=158)[a]	Males (*n*=125)	Females (*n*=33)
Specific STDs at baseline: (%)			
Gonorrhoea	1.9% (*n*=3)	2.4% (*n*=3)	0.0% (*n*=0)
Chlamydia	7.0% (*n*=11)	4.8% (*n*=6)	15.2% (*n*=5)
Syphilis	8.9% (*n*=14)	10.4% (*n*=13)	3.1% (*n*=1)
Tested positive for any STD (%)	17.1% (*n*=27)	16.8% (*n*=21)	18.2% (*n*=6)

[a]Based on test results for 158 participants who were tested. One participant refused the blood test for syphilis resulting in *n*=157 for this STD

Table 2

Variations in sexual risk behaviours associated with social networks

Sexual risk variable	Correlations of sexual risk behaviour:	
	With social network[a]	Among network leaders and members[b]
Total sex partners in the past year	0.53[*]	0.10
Total sex partners in the past three months	0.54[*]	0.12
Had unprotected vaginal or anal sex, past three months	0.59[***]	0.25[**]
No. unprotected vaginal or anal acts, past three months	0.54[*]	0.26[***]
Had unprotected anal sex, past three months	0.55[*]	0.25[**]
No. unprotected anal acts, past three months	0.50	0.19[**]
Tested positive for an STD at baseline	0.60[**]	0.20[**]
Paid or received money for sex, lifetime	0.64[***]	0.26[**]
Paid or received money for sex, past year	0.59[**]	0.23[**]

[*]
$P<0.05$;

[**]
$P<0.01$;

[***]
$P<0.001$

[a]The correlation coefficients (*eta*) were obtained from GLM of each risk measure on social network, entered as a random factor

[b]Coefficients (*r*) were obtained from intra-class correlation analysis of the sexual risk behaviour of social network leaders (determined by sociometric analyses) versus the risk data of other members within each network. Leaders were excluded from consideration; so, these analyses were based on 149 cases

Table 3

Predicting sexual risk behaviour by social network and individual-level covariates

Outcome/predictors	Coefficient *B*	Partial *eta*^{2}	*P* value[*]
No. of sex partners, past three months:			
Social network	—	0.27	0.05
Gender (male)	0.12	0.04	0.02
Safer sex peer norms	-0.02	0.08	0.001
Had unprotected vaginal or anal sex, past three months:			
Social network	—	0.29	0.02
Gender (male)	0.16	0.03	0.05
Safer sex peer norms	-0.02	0.03	0.03
Safer sex and condom intentions	-0.02	0.05	0.01
No. of unprotected vaginal and anal sex acts, past three months:			
Social network	—	0.27	0.17
Safer sex peer norms	-0.03	0.03	0.04
Safer sex and condom intentions	-0.04	0.07	0.001
Tested positive for an STD at baseline:			
Social network	—[†]	0.36	0.005
Paid or received money for sex, past year:			
Social network	—	0.35	0.001
Safer sex peer norms	-0.02	0.05	0.007
AIDS risk-related knowledge	-0.02	0.01	0.34

[*] *P* values were based on *F*-ratios, with 37 degrees of freedom used for social network, and one degree of freedom used for each of the other predictors in each model

[†]The coefficients for social network were omitted, given the impracticality of listing 38 parameter estimates for each model