Published in final edited form as:
*Sex Transm Dis*. 2011 June ; 38(6): 543–547. doi:10.1097/OLQ.0b013e318205e449.

# Concurrent Sexual Partnerships and Sexually Transmitted Diseases in Russia

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## Abstract

**Background—**Sexual concurrency is associated with higher prevalence of sexually transmitted diseases (STDs) including HIV. However, most studies have focused only on the concurrency of the individual participant (individual concurrency) and not on concurrency of their sexual partners (partner concurrency). Furthermore, limited concurrency information is available in Russia where HIV epidemic is growing rapidly. We therefore examine the prevalence and correlates of individual and partner concurrency, and determine whether either type of concurrency is associated with diagnosed STDs among STD clinic attendees in St. Petersburg, Russia.

**Methods—**In total, 799 attendees were recruited into a cross-sectional study between 2006 and 2008. A questionnaire collected information on demographics, medical history, sexual behaviors, and up to 3 sexual partners during the preceding year.

**Results—**The prevalence of individual and partner concurrency was 24.7% and 45.4%, respectively. Both were correlated with marital status, weekly alcohol consumption, age at first sex, and number of lifetime sexual partners. Partner concurrency was significantly associated with diagnosed STDs (odds ratio = 2.06; 95% confidence interval = 1.35–3.15). No significant association between individual concurrency and STDs was observed.

**Conclusions—**Partner concurrency, not individual concurrency, is independently associated with increased odds of having an STD in the studied population.

Sexually transmitted diseases (STDs) are a major public health problem in Russia.[1] Although recent research demonstrates a decreasing incidence for syphilis and gonorrhea, and a stable incidence of genital chlamydial infection from mid-1990s to 2005 in Russia, these incidences are still higher than those of western European countries.[1] The number of people living with HIV is also an important public health problem and has increased rapidly since mid-1990s.[2,3] It is estimated that approximately 940,000 adults are currently living with HIV and the adult prevalence reaches 1.1%.[4] In Russia, the HIV epidemic has been



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observed primarily among injection drug users.[2] However, concerns have been raised that the epidemic is spreading to the general population through heterosexual transmission, which may exacerbate the HIV epidemic in Russia.[2] The relatively higher incidence of STDs might have contributed, and continue contributing, to the prevalence of HIV in Russia because STDs facilitate HIV sexual transmission.[5]

Concurrent sexual partnerships play an important role in the spread of STDs and HIV.[6–8] Results from mathematical models demonstrated that concurrent sexual partnerships may accelerate the spread of STDs and HIV by increasing the likelihood of exposure to infected persons and reducing the time between sexual contacts among infected and susceptible persons.[9–11] Empirical studies have found that sexual concurrency is associated with a higher risk of STDs.[12,13] For example, a study conducted among adolescents attending a municipal STD clinic in San Francisco showed that the odds of having STDs for adolescents with concurrent partnerships were 60% higher than those without concurrent partnerships after adjusting for the number of sexual partners.[13] In addition, sexual concurrency has been hypothesized to contribute to the generalized epidemics of HIV in sub-Saharan Africa.[14,15]

Most concurrency studies focus on individual's practice of having concurrent partners (individual concurrency). There are relatively few studies that consider the effect of having partners who engage in concurrent sexual partnerships (partner concurrency) on an individual's risk for STDs. However, an individual's risk for STDs is associated with risk behaviors of both members of a sexual partnership which means that if an individual has a sexual partner who engages in concurrent sexual partnerships, this individual's risk of STDs may be high even if he/she only has 1 sexual partner for a long time.

Because data on sexual concurrency (either an individual's or a person's sexual partner's concurrency) are very limited in Russia, we conducted a study in St. Petersburg, Russia, during 2006 to 2008 to investigate the following aims: (1) to examine the prevalence and correlates of both individual and partner concurrency among adults attending 2 STD clinics, and (2) to identify whether individual or partner concurrent sexual partnerships are associated with STDs.

## MATERIALS AND METHODS

### Participants and Procedures

Between July 2006 and February 2008, attendees aged 18 years and older of 2 STD clinics in St. Petersburg of Russia were asked to participate in the study, and 805 participants gave written informed consent. Of the 805 participants recruited, 6 had no sexual activities in the past year and were excluded from the analysis. The study was approved by the Human Investigation Committees of Yale University, USA and the Biomedical Center in St Petersburg, Russia.

Data were collected through a self-administrated questionnaire in a private area of the clinic. Participants were assured that their answers were strictly confidential. To assure confidentiality, questionnaire contained no names or other identifying information from participants and was only identified by a tracking number linked to patient charts and accessible only to the dermatovenereology specialist. The questionnaire included demographic characteristics, medical information, knowledge and beliefs about HIV/STDs, risk behaviors and safe sex, drug use information, and sexual partner module. In the sexual partner module, we asked about up to 3 of the last partners with whom the participant had sexual contact during the last year. Sexual partner's demographic characteristics and sexual activities including dates of first and last sex with partner(s) were collected in this module.

Unprotected sex was defined as reporting at least 1 episode of sexual intercourse without a condom during the last month preceding the interview.

We defined individual concurrency as overlapping sexual partnerships in which the participant reported at least 1 sexual intercourse with a partner between 2 acts of intercourse with another partner at any point within 12 months preceding the interview, according to the suggestion of UNAIDS Reference Group on Estimates, Modeling, and Projections.[6] Partner concurrency was defined as having at least 1 partner who had other sexual partner(s) during the time that the partner was having sex with the participant, as reported by study participants based on the question: "How many other sex partners do you think this partner had while he or she was (or is) with you."

The presence of diagnosed STDs was defined as either having reported any 1 of the following STDs in the last year: syphilis, *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, *Trichomonas vaginalis*, and genital herpes (i.e., self reported STDs) or the diagnosis of 1 of these infections at the time the participant enrolled into this study, as obtained from clinic medical charts (i.e., current STDs). The 2 groups of data were combined so as to maximize the validity of the measurement of diagnosed STDs.[16] These particular STDs were chosen because they have commonly been associated with sexual risk for HIV transmission[17–19] and are routinely diagnosed at the clinic. STD diagnoses registered in medical charts were performed according to standard clinic procedures in Russia. Patients' biologic samples were collected primarily according to their presented symptoms and/or medical examination findings, and were tested either at the clinic or transported to another laboratory facility for testing. When a laboratory test was not requested by the physician, the participant was considered negative for a current STD.

### Statistical Analysis

Descriptive statistics were used to describe the study population, and chi-square tests were used to assess whether participant's characteristics differed by gender and by concurrency status.

To assess the relationship between concurrency and STDs, a series of bivariate logistic regression analyses were conducted to determine other variables included in the multivariate analysis. Variables with a $P \geq 0.25$ in the bivariate analyses were excluded from multivariate analysis. Individual and partner concurrency status were included in the models because they were the primary predictors of interest. Correlation analysis was performed to determine if there were highly correlated variables. Any covariate with a correlation coefficient with individual concurrency or partner concurrency higher than 0.6 was not included in the model-building process to avoid collinearity. A manual backward selection procedure was further used to sequentially eliminate covariates that did not remain significant ($P \geq 0.05$). Data were analyzed using SAS software (version 9.1, SAS Institute Inc, Cary, NC).

## RESULTS

Among the 799 participants, 533 (66.7%) were men and 266 (33.3%) were women. The mean age for the participants was 27 years, with a median of 25 (interquartile range, 21–30) (Table 1). The group was predominantly employed (78.9%); nearly half of the participants were currently married; and more than three-quarters of participants reported engaging in unprotected sex in the past month. Men were more than twice as likely as women to drink alcohol at least once a week (45% in men vs. 19% in women) and to report 11 or more lifetime sexual partners (61% in men vs. 24% in women).

Individual concurrency was reported by 24.7% of participants for whom concurrency could be assessed (n = 699). Individual concurrency was significantly correlated with gender, marital status, weekly alcohol consumption, age of first time sex, and number of lifetime sexual partners (Table 2).

Partner concurrency was reported by 45.4% of participants for whom concurrency could be assessed (n = 584). Partner concurrency was significantly correlated with marital status, education, weekly alcohol consumption, age of first time sex, men who have sex with men, and lifetime number of sexual partners (Table 3).

Among 531 participants for whom both individual and partner concurrency could be determined, 111 (20.9%) had both individual and partner concurrency and 116 (21.9%) had partner concurrency but not individual concurrency. Among 323 participants who had 1 sexual partner in the past year, 75 (23.2%) participants reported partner concurrency.

In total, 17.6% (138/782) participants self-reported having had at least one of the 5 selected STDs in the prior year and 24.7% (193/780) participants were diagnosed as having a current STD during the visit when they completed the questionnaire. A total of 37% (286/769) of participants were diagnosed with one of these STDs at the clinic or self-reported of having had one of these STDs in the previous year.

The associations between individual and partner concurrency and STDs were further examined (Table 4). Independent variables with a $P < 0.25$ in the bivariate analyses were gender, marital status, employment status, education, weekly alcohol drinking, injection drug users, and number of lifetime sexual partners. Partner concurrency was significantly associated with STDs (odds ratio [OR], 2.06; 95% confidence interval [CI], 1.35–3.15), although no significant association between individual concurrency and STDs was observed. In addition, we found that men were 2.54 times (OR, 2.54; 95% CI, 1.65–3.91) as likely as women to have an STD.

We further examined how the adjustment of number of sexual partners in the past year affected the association between partner concurrency and STDs. In Table 4, we did not include this predictor in the multivariate model to avoid collinearity because of strong correlation between number of sexual partners in the past year and individual concurrency (correlation coefficient = 0.7). The significance of the association between partner concurrency and STDs remained and the odds ratio slightly decreased from 2.06 to 1.79 (95% CI, 1.15–2.77).

## DISCUSSION

Sexual concurrency was common among attendees investigated in the current study, which is consistent with findings from other studies.[20–25] However, the magnitude of this behavior may vary significantly across studies because of different definitions and populations used in the different studies. In our study, nearly one-fourth of the attendees had concurrent sexual partnerships in the 12 months before the interview. In the United States, the 1-year prevalence of concurrency was about 11% among men, whereas the 5-year prevalence of concurrency was 12% among women.[20,21] Both estimates were based on a nationally representative sample and the concurrency was defined by overlapping dates. Concurrency rates are often higher among patients from STD clinics than those for people from the general population. For example, a study conducted in a public STD clinic in New York State reported 64% patients having concurrent partnership (defined by having other sexual partners in the past 3 months, in addition to their steady partner).[25] To facilitate the comparison of prevalence of concurrency, a standard measure is important. In addition, the use of a standard measure of concurrency is essential to compare the role of concurrency

across populations because different measures of concurrency may not capture the same thing.[6,24]

Similar to other studies, sexual concurrency was strongly correlated with marital status, alcohol consumption, and early age at first sex.[20,21,25] The strong correlation between marital status and concurrency is expected as marriage may limit sexual contacts with other partners.[20] In contrast to the direct link between marital status and concurrency, the pathway between early age at first sex and concurrency seems more complicated. Mah indicated that high-risk sexual behaviors tend to cluster in the same individuals and earlier age of first sexual debut is one of such risk behaviors.[26] Mah further argued that people having first sex at an earlier age have a longer time for possible concurrent partnerships than those who initiate sexual activity at a later age.[26] Alcohol consumption, particularly alcohol intoxication, may increase the likelihood of sexual contacts with casual partners through the impaired judgment and the lack of restraint of social norms.[27] However, in our study, we neither assessed the quantity of alcohol consumption, nor did we ask a direct question about alcohol intoxication.

In the current study, nearly half of study participants reported that at least 1 of their 3 most recent sexual partners in the past year had concurrent partnerships. The prevalence of partner concurrency was nearly twice as high as that of individual concurrency. The main reason that might explain the discrepancy lies in the different methods we used to define concurrency. Individual concurrency contained only 1 person's concurrency status (the participant), while partner concurrency status accounted for up to 3 persons concurrency status (up to 3 most recent sexual partners of the participant). We found the odds of having an STD for participants with partner concurrency were twice as likely as those without partner concurrency. The association remained significant even after adjusting for number of sexual partners in the past year. This suggests that partner concurrency rather than individual concurrency may be an important risk factor for having an STD in this study. This finding was consistent with that from the study by Drumright et al. in which the odds of having a current STD (defined as *C. trachomatis*, *N. gonorrhoeae*,or *T. vaginalis*) for patients with partner concurrency were 3.6 times as likely as those without partner concurrency after controlling for potential confounders.[22] It should be noted that in the study by Drumright et al., partner concurrency status was reported by partners themselves, and thus may be more accurate than that in our study. Similar to the study by Drumright et al., individual concurrency was not significantly associated with STDs in the current study, indicating that partner concurrency may play a more important role than individual concurrency in some populations. Furthermore, partner concurrency may be a key route to acquire STDs for participants who had 1 sexual partner in the past year. Therefore, it is highly recommended to include both individual and partner concurrency status in future research to better understand the role that concurrency may play in STDs. The results also emphasize the importance that programs to prevent HIV/STD transmission target individuals whose partner has concurrent sexual partnerships with others, in addition to individuals who have casual or multiple sexual partners as suggested in previous studies.[28]

Several limitations of the study should be noted. First, the study participants represented neither the general population in St. Petersburg nor all patients attending the 2 STD clinics, and thus the study results may not be generalized to other groups. Second, misclassification is possible because it might be difficult for participants to accurately recall first and last sex dates with each partner. Moreover, partner concurrency status was not reported by partners themselves and was dependent on accurate knowledge of participants about their sexual partners, which may be imperfect. The prevalence of diagnosed STDs may be underestimated because attendees with asymptomatic infection may not be detected. Nevertheless, such underestimation would tend to bias the association toward the null.

Third, individual concurrency status for more than 12% of participants could not be determined, and 27% participants did not know about partner concurrency, which may have affected the results.[29] Important supplemental information may be obtained by asking participants a direct question, such as, "During the time you have been sexually involved with 1 partner, have you engaged in sexual activity with anyone else?" Future research should assess the accuracy and completeness of different concurrency measures.

In summary, sexual concurrency (either individual or partner concurrency) was common among the study population. Partner concurrency, not individual concurrency, being independently associated with STDs suggests that it is a more important risk factor than individual concurrency for having an STD in this studied population from St. Petersburg, Russia. Large, population-based longitudinal studies may provide more insight into the relationship between concurrency and STDs. Interventions to reduce STD risk in this population should address issues of partner concurrency to attain maximum health benefits.

## Acknowledgments

Supported by grant number RO3 DA020384 from the National Institute of Drug Abuse (to PI: N.A.).

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## TABLE 1

Characteristics of Study Participants, St. Petersburg, Russia, 2006–2008 (N = 799)

| Characteristic | Overall (Men + Women) | Men (n = 533) | Women (n = 266) |
|---|---|---|---|
| Age* (25 yr or less) | 412 (52.1%) | 266 (50.7%) | 146 (54.9%) |
| Currently married | 376 (47.1%) | 233 (43.7%)† | 143 (53.8%) |
| Currently employed | 628 (78.9%) | 430 (81.1%)† | 198 (74.4%) |
| Education (completed university) | 387 (48.9%) | 264 (49.8%) | 123 (47.0%) |
| Weekly drinking alcohol | 283 (36.7%) | 235 (45.3%)† | 48 (19.1%) |
| Ever injected drugs | 37 (4.7%) | 26 (4.9%) | 11 (4.2%) |
| Age of first time sex (<16 yr) | 198 (25.2%) | 153 (29.3%)† | 45 (17.1%) |
| Ever traded sex | 17 (2.1%) | 7 (1.3%)† | 10 (3.8%) |
| Men who have sex with men | — | 28 (5.3%) | — |
| Having unprotected sex in the past month | 583 (75.8%) | 392 (76.3%) | 191 (74.9%) |
| Lifetime no. sexual partners (11 or more) | 330 (48.0%) | 272 (61.1%)† | 58 (24.0%) |

*Mean = 27.0, standard deviation = 7.4, median = 25.0 years; interquartile range, 21–30 years.

†Significantly different from women.

## TABLE 2

Correlates of Individual Concurrency Among STD Clinic Patients in St. Petersburg, Russia, 2006–2008 (N = 699)

| Characteristic | Individual's Concurrency (n = 173) | No Individual's Concurrency (n = 526) | P* |
|---|---|---|---|
| Age (25 yr or less) | 97 (56.7%) | 253 (48.6%) | 0.06 |
| Male sex | 127 (73.4%) | 330 (62.7%) | 0.01 |
| Currently married | 56 (32.4%) | 290 (55.1%) | <0.0001 |
| Currently employed | 135 (78.5%) | 414 (79.0%) | 0.88 |
| Education (completed university) | 79 (46.2%) | 269 (51.5%) | 0.23 |
| Weekly drinking alcohol | 80 (47.9%) | 161 (31.7%) | 0.0001 |
| Ever injected drugs | 12 (7.0%) | 21 (4.0%) | 0.11 |
| Age of first time sex (<16 yr) | 60 (34.9%) | 108 (20.9%) | 0.0002 |
| Men who have sex with men† | 7 (5.6%) | 10 (3.1%) | 0.20 |
| Lifetime no. sexual partners (11 or more) | 108 (71.5%) | 183 (40.1%) | <0.0001 |

STD indicates sexually transmitted disease.

*$P$ value was based on chi-square test.

†Analyzed only among men.

## TABLE 3

Correlates of Partner Concurrency Among STD Clinic Patients in St. Petersburg, Russia, 2006–2008 (N = 584)

| Characteristic | Partner Concurrency (n = 265) | No Partner Concurrency (n = 319) | P* |
|---|---|---|---|
| Age (≤25 yr) | 139 (52.9%) | 163 (51.9%) | 0.82 |
| Male sex | 180 (67.9%) | 219 (68.7%) | 0.85 |
| Currently married | 83 (31.3%) | 205 (64.3%) | <0.0001 |
| Currently employed | 209 (78.9%) | 261 (82.3%) | 0.29 |
| Education (completed university) | 130 (49.6%) | 184 (57.9%) | 0.047 |
| Weekly drinking alcohol | 114 (44.4%) | 98 (32.1%) | 0.003 |
| Ever injected drugs | 15 (5.7%) | 11 (3.5%) | 0.20 |
| Age of first time sex (<16 yr) | 80 (30.5%) | 62 (19.8%) | 0.003 |
| Men who have sex with men† | 16 (9.1%) | 6 (2.8%) | 0.006 |
| Lifetime no. sexual partners (11 or more) | 138 (59.5%) | 114 (40.7%) | <0.0001 |

STD indicates sexually transmitted disease.

*P value was based on chi-square test.

†Analyzed only among men.

## TABLE 4

Characteristics of Study Participants by Status of Diagnosed Sexually Transmitted Diseases in the Past Year in St. Petersburg, Russia, 2006–2008 (N = 769)

| Characteristic | Having STD (n = 286) | No STD (n = 483) | Crude OR (95% CI) | Adjusted OR (95% CI)* |
|---|---|---|---|---|
| Age (≤25 yr) | 153 (53.9%) | 244 (51.0%) | 1.12 (0.84–1.50) | NS |
| Male sex | 219 (76.6%) | 290 (60.0%) | 2.18 (1.57–3.02) | 2.54 (1.65–3.91) |
| Currently married | 171 (59.8%) | 237 (49.1%) | 0.65 (0.48–0.87) | NS |
| Currently employed | 215 (76.0%) | 390 (80.7%) | 0.75 (0.53–1.08) | 0.53 (0.33–0.84) |
| Education (completed university) | 124 (43.7%) | 255 (53.2%) | 0.68 (0.51–0.92) | NS |
| Weekly drinking alcohol | 121 (43.4%) | 148 (32.0%) | 1.63 (1.20–2.21) | NS |
| Ever injected drugs | 18 (6.3%) | 17 (3.6%) | 1.82 (0.92–3.59) | NS |
| Age of first time sex (<16 yr) | 66 (23.4%) | 124 (26.1%) | 0.87 (0.61–1.22) | NS |
| Men who have sex with men† | 8 (3.7%) | 17 (5.9%) | 0.61 (0.26–1.45) | NS |
| Ever traded sex | 5 (1.8%) | 12 (2.5%) | 0.70 (0.25–2.01) | NS |
| Having unprotected sex in the past month | 203 (73.6%) | 357 (76.9%) | 0.83 (0.59–1.18) | NS |
| Lifetime no. sexual partners (≥11) | 134 (55.4%) | 183 (44.0%) | 1.58 (1.15–2.17) | NS |
| Individual concurrency | 67 (26.8%) | 98 (23.1%) | 1.22 (0.85–1.75) | 0.78 (0.49–1.25) |
| Partner concurrency | 106 (53.8%) | 149 (40.6%) | 1.70 (1.20–2.42) | 2.06 (1.35–3.15) |

STD indicates sexually transmitted disease; OR, odds ratio; CI, confidence interval; NS, nonsignificant.

*Only significant factors were included in the model except that individual concurrency and partner concurrency were retained in the model no matter the significance level they had.

†Analyzed only among men.