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HIV Disclosure, Condom Use, and Awareness of HIV Infection Among HIV-Positive, Heterosexual Drug Injectors in St. Petersburg, Russian Federation

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Abstract We examined the prevalence of HIV disclosure to sexual partners by HIV-positive drug injectors (IDUs) in St. Petersburg, Russia and compared the magnitude and direction of associations of condom use with awareness of one's HIV infection and disclosure to partners. Among 157 HIV-infected participants, awareness of infection at time of last intercourse was associated with condom use with partners perceived to be HIV-negative (aOR 6.68, 95% CI 1.60–27.88). Among the 70 participants aware of their infection prior to enrolment, disclosure to potentially uninfected sexual partners was independently and negatively associated with condom use (aOR 0.13, 95% CI 0.02–0.66). Disclosure was independently associated with having injected ≥9 years (aOR 6.04, 95% CI 1.53–23.77) and partnership with another IDU (aOR 3.61, 95% CI 1.44–9.06) or HIV-seropositive (aOR 45.12, 95% CI 2.79–730.46). Scaling up HIV testing services and interventions that increase the likelihood of individuals receiving their test results is recommended.

Keywords HIV disclosure · HIV testing · Condom use · Injection drug use · Russia

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Introduction

Russia faces one of the most rapidly expanding AIDS epidemics [1, 2], with more than 470,000 registered HIV cases at the end of 2008 and the estimated number of infections exceeding one million [3, 4]. Thus far, the overwhelming majority of those infected are injection drug users (IDUs) [1, 2, 5–8]. Estimates of HIV seroprevalence among St. Petersburg IDUs indicate a rise from 2–4% in 1998 to 11–18% in 2000 to 30% in 2002 to 49% in 2008 [9–14]. There is also evidence that HIV is spreading to the general population via heterosexual contact [7, 15–17].

In the West and particularly in the US, recent HIV prevention efforts have focused on promoting HIV counseling and testing with disclosure of HIV serostatus to prospective sexual partners [18, 19]. Estimates of the proportions of HIV-infected heterosexuals in the West who disclose to partners range from 60 to 80% [20–22]. By contrast, the issue of disclosure and its potential public health impact is largely unexplored in Russia. Only limited anonymous HIV testing is available in Russia, and lack of access to treatment as well as the pervasive stigma associated with HIV disease [23, 24] often dissuade people from being tested. Although many Russians have been tested for HIV at least once in their lives, the testing most commonly occurs as a result of incarceration or an in-patient medical visit. Only approximately one in five IDUs who self-identify as HIV-negative had been tested within the previous year [25]. Since HIV testing is not as prevalent as in the West, the relationship between awareness of one's HIV status, disclosure, and condom use is poorly understood. The current study is the first to examine these issues within a sample of IDUs in St. Petersburg, Russia.

In several US studies, disclosure appears to be influenced by contextual, temporal, and situational factors [26,

27]. Individuals disclose to primary more than to non-primary or anonymous partners [22, 26–33]. Studies suggest that the spread of HIV may be fueled by a relatively small number of infected individuals who engage in multiple high-risk behaviors (e.g., multiple partners, unprotected sex) without disclosure [27, 34–36]. Partner characteristics also influence disclosure behavior such that disclosure was less likely to occur with younger partners [37] or with those whose serostatus is understood to be negative or to be unknown [28, 38–40]. Additionally, timing of disclosure (i.e., prior or subsequent to unprotected sex) is not clearly identified [27], and therefore, sex partners may underestimate their HIV risk [38, 41, 42]. People need time to adjust to their diagnosis—typically 2–3 years—after which time disclosure is more likely to occur [39, 43–45].

The few studies assessing HIV testing awareness in Russia or other countries of the former Soviet Union suggest that fewer than 40% of Russian participants were aware of their partner's HIV status at time of sex [25, 46]. Pervasive stigma surrounding HIV in Russia [23, 24] may dissuade people from disclosing [47]. We are unaware of any scientific publications that specifically examine HIV disclosure behavior among Russian IDUs, although there is some evidence from Western Europe that IDUs' *awareness* of their HIV infection was associated with increased condom use [48]. Since the epidemic is currently concentrated among IDUs, we begin such explorations by seeking to identify individual and interpersonal factors that influence disclosure and condom use behaviors in this population. Specifically, we used data on recent sexual partnerships from HIV-infected IDUs, only some of whom had been aware of their infection at time of last intercourse to address four questions: (1) Among HIV-infected IDUs, is knowledge of their infection associated with increased condom use? (2) What individual, partner, and partnership characteristics are associated with disclosure by HIV-positive IDUs? (3) Is disclosure by HIV-positive IDUs associated with condom use? and (4) Is disclosure of positive status or awareness of positive status more strongly associated with condom use? This constitutes a first step in determining whether and the extent to which HIV disclosure should be emphasized in future prevention interventions for Russian IDUs.

Methods

As part of a larger multi-site, cross-sectional study, "Sexual Acquisition and Transmission of HIV - Cooperative Agreement Program" (SATH-CAP), data were collected in St. Petersburg from September 2005 to December 2008. SATH-CAP seeks to identify the structural, social, and individual factors associated with HIV risk behavior among

high-risk populations, one of which is users of heroin, cocaine, or amphetamine-type stimulants, and the sex partners of these participants. Sampling and recruitment procedures, data collection instruments, and other study methods have been reported in detail elsewhere [25, 49]; specifics relevant to this study are described below.

Participants

Participants were recruited using a modified version of respondent-driven sampling (RDS) [49–51]. Previous analysis found less than 5% overlap between drug users and men who have sex with men (MSM) and greater than 95% prevalence of injection among the drug users [10, 25]. The present analysis is restricted to SATH-CAP participants who (1) were 18 years or older, (2) reported injecting illicit drugs at least once in their life, (3) tested positive for HIV infection as part of the SATH-CAP serological testing, and (4) supplied information about their sex partners within the past 6 months (Fig. 1). Participants were provided incentives equivalent to US$10 for their participation and US$5 for each person they successfully referred to the study. All study and consent procedures and study
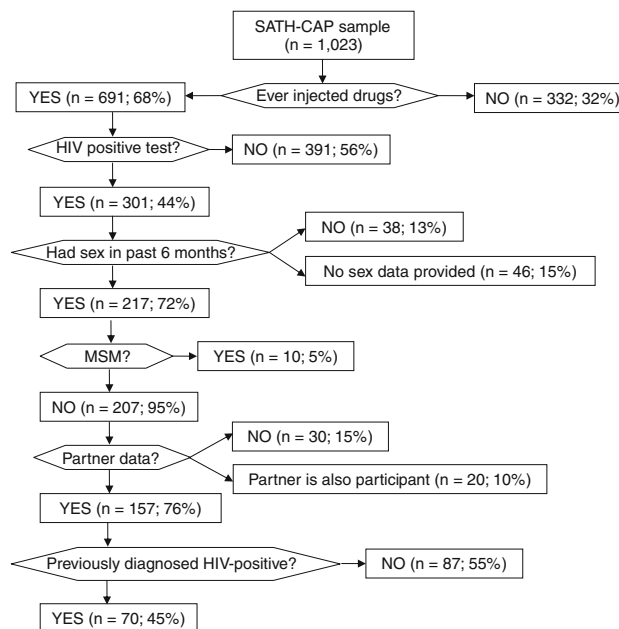

Fig. 1 Derivation from the SATH-CAP cohort of the subsample used in the current analyses. We limited the analyses to those participants who reported ever having injected drugs and who tested positive for HIV infection at enrolment (*n* = 300). We first examined the association between prior knowledge of HIV status and condom use at last intercourse in each of their sexual partnerships. Subsequently, among participants who were aware of their HIV infection prior to enrolment, we examined the association between disclosure of HIV status to and condom use with their reported sex partners

measures were approved by institutional review boards at The Biomedical Center, Yale University, and RAND Corporation.

Data Collection, Measures, and Laboratory Procedures

Participants completed a structured, computer-assisted, self-administered interview and, following pre-test HIV counseling, had blood drawn for serological testing. Data used in the present analyses included demographic, medical history, drug and sex behaviors, sex partner information, and HIV serology. Demographic variables included sex, age, marital status, living situation, educational level, current employment status, legal income (past 30 days), and history of incarceration. Medical history items included HIV testing history and whether participants had received their most recent test results. Participants reporting HIV infection were asked the month and year of their diagnosis. We define "HIV-seropositive" as seropositive test results based on the testing performed *as part of this study* and "previously aware of diagnosis" as participants who reported having been informed that they were HIV-positive *prior to enrolling in this study*. Drug use data included duration of injection drug use (median-split at 9 years), number of injections in past 30 days (median-split at 22), and unsafe injections in past 30 days (yes/no; defined as sharing needles without using bleach, using a single syringe to mix or divide drugs, or sharing cookers, cotton, or water). Sexual behavior data included number of sex partners in the prior 6 months, number of new partners in the past 6 months, partner-specific information (i.e., for main partner, up to three most recent non-main partners, and if applicable, a partner with whom they also shared drugs), and condom use at last sexual intercourse with up to five partners in the previous 6 months. Partner-specific data included each partner's age and gender, partnership type (main vs. casual/friend vs. stranger/sex trade), disclosure of HIV status to partner, and perceived injection drug use history of partner. Perceived HIV status was ascertained by asking about each partner "What is [the partner's] HIV status?" and were given as potential responses "I don't know or am not sure", "I am sure he/she is HIV negative" and "I am sure he/she is HIV-positive". Participants who responded that a partner was positive were then asked "Do you know [the partner's] HIV status because he/she told you him/herself?" Participants were also asked for each partner "Does [the partner] know your HIV status?" Those answering in the affirmative were then asked "Does [the partner] know your HIV status because you told him/her yourself?" We included all reported partnerships in these analyses except those in the previously aware of diagnosis group for whom the date of last intercourse occurred *before* they became aware of their HIV diagnosis.

Analytical Methods

Standard descriptive statistics were used to describe the sample. Continuous variables were dichotomized in order to adapt those with non-normal distributions to parametric tests and to preserve statistical power. Using Chi-square and Wilcoxon rank-sum tests, we compared the characteristics of seropositives who were aware of their HIV infection with those who were not, examined whether the demographic characteristics of participants who provided information on sexual partnerships differed from those who did not, and examined whether partner characteristics were associated with the participant's perception of their partners' serostatus. We employed population-averaged panel-data models to account for single participants' ability to report on more than one partner. This was accomplished using generalized estimating equations (GEE), under the command—gee—in Stata 10 [52]. We used the same technique to assess among participants who were aware of their infection, whether any participant, partner, or partnership characteristic was associated with disclosure within the partnership.

Among partnerships reported by HIV-infected participants, we assessed bivariate associations between the participant's awareness of being infected with HIV at the time of their last sexual encounter and condom use at that time. We assessed these associations within all reported partnerships and within a subset of partnerships with partners either perceived to be uninfected or of unknown serostatus. To estimate associations between awareness of infection and condom use, unconfounded by other available individual, partner, and partnership characteristics, we also assessed associations between condom use and participant's age, duration of injection drug use, history of incarceration, partnership type, and participant's understanding of whether partners also injected drugs and perceived serostatus of partners. In each case, covariates that were associated in bivariate analyses at $P < 0.20$ were entered into an initial multivariate model; backward selection eliminated covariates that did not remain significant at $P < 0.05$ or did not change other coefficients by >10%. This was done for all partnerships and the three aforementioned subsets.

We then limited analysis to participants who were aware of their HIV infection prior to study enrolment. Among partnerships reported by these participants, we assessed bivariate associations between participants' disclosure of positive serostatus and condom use, and produced multivariate models in the manner described above for all reported partnerships and the three aforementioned subsets.

To account for potential confounders in any association between prior awareness of HIV infection and condom use, we identified associations between prior diagnosis of HIV infection and participant characteristics using Chi-square

or Fisher's exact test; for non-normally distributed variables we used the Wilcoxon rank-sum test. For condom use, we calculated unadjusted and adjusted correlations between dependent and independent variables. In each case, covariates that were associated in bivariate analyses at $P < 0.20$ were entered into an initial multivariate model; backward selection eliminated covariates that did not remain significant at $P < 0.05$ or did not change other coefficients by >10%.

Participants could refer their sex partners to the study, raising the possibility of double-reporting of sex partnerships between two participants, once by the recruiter and once by the recruit. To account for potential correlation we nested responses by the participant who had referred the partner to the study. Therefore, partnerships reported with participants' recruiters were excluded from analysis if both participant and recruiter were present in the subset of observations analyzed.

Because participants were recruited using RDS, use of weighting procedures was considered to adjust the sample for recruitment probabilities to obtain estimates that would reflect the underlying population from which sampling was conducted. However, in prior analyses of these data, proportions of demographic and serologic characteristics did not differ substantially between weighted and unweighted distributions. Therefore, we used unweighted estimates for these analyses [25].

Results

Characteristics of the Study Sample

Of 691 participants who reported a history of drug injection, 301 (44%) tested HIV-seropositive at the time of enrolment. Among these seropositive participants, 38 reported having no sex partners, 46 participants provided no data on the number of sex partners they had in the prior 6 months (therefore not asked partner-specific items), and 30 declined to provide partnership data. We also excluded from analysis ten males who reported sex with male partners only and 20 participants who reported sex partnership only with their recruiter. Thus, we restricted analyses to the 157 heterosexual, HIV-seropositive participants who provided data on 231 non-overlapping partnerships (Fig. 1). We found no significant demographic differences between participants who provided data partnership data and those who did not.

Nearly two-thirds of the resulting sample were male (65%). The median age was 28 years (25%, 75% = 24, 32 years), with approximately twice as many single participants as married/partnered participants. Most participants (69%) lived with either their families or friends. Over

half (56%) had at least some post-secondary education. Few (37%) were currently employed; median income from legal sources was 1,625 rubles (US$50) in the last month (25%, 75% = 0, 7,000 rubles; data not shown). Fewer than half the participants (42%) reported ever having been incarcerated. The median duration of injection drug use was 9.2 years (25%, 75% = 6, 11; data not shown), and nearly all (92%) reported injecting within the prior 30 days. The median number of injections in the prior 30 days was 23 (25%, 75% = 10, 30; data not shown); the majority of participants (79%) reported injecting unsafely (e.g., sharing syringe, cooker, cotton, and/or water) at least once in the prior 30 days. In the previous 6 months, 61% reported having sex with a new partner, and 40% reported having more than one partner (Table 1).

Most participants (80%) reported having been tested for HIV at least once (Table 1), and of those tested, most (82%) reported having received their test results (data not shown). Less than half (45%) the sample reported having been aware of their HIV infection prior to enrolment. Of these, 73% had received their positive test results more than 2 years ago (data not shown); no date of diagnosis was available for 3 of the 70 participants who were previously aware of their HIV infection. No participant characteristic was significantly associated with prior diagnosis of HIV infection save marital status ($\chi^2 = 6.64$, $P = 0.042$; Table 1).

Characteristics of Participants' Reported Sex Partners

Participants reported approximately one in five partners (19%) to be HIV-seropositive, with most partners (80%) communicating this information directly to the participant (data not shown). Of the partners perceived to be seronegative (31%), participants reported asking most (71%) whether they had been tested for HIV (data not shown). Of the partners whose serostatus was "unknown" to the participant (50%), fewer than a third (29%) had been asked by the participant whether they had been tested for HIV (data not shown). Participants were no more likely to report knowing the HIV status of their primary sex partners than of their other partners. Participants were more likely to perceive IDU partners as HIV-positive than as seronegative or of unknown serostatus ($P < 0.001$; data not shown). No other partner characteristic (e.g., partner's gender, partner's age, partnership type) was associated with perception of partner's serostatus.

Association Between Previous Awareness of HIV Diagnosis and Condom Use at Last Intercourse

Participants reported using condoms at last intercourse in 115 (50%) of 231 partnerships (Table 2). Awareness of

Table 1 Characteristics of HIV seropositive drug injectors, by previous diagnosis of HIV infection, St. Petersburg, Russia (2005–2008) (n = 157 unless otherwise noted)

Characteristic	No. (%) diagnosed	No. (%) undiagnosed	Total	χ^2	P
Total	70 (45)	87 (55)	157 (100)		
Gender					
Male	44 (63)	58 (67)	102 (65)	0.247	0.619
Female	26 (37)	29 (33)	55 (35)		
Age[a]	28 (25, 32)	28 (24, 32)	28 (24, 32)	−0.540[c]	0.590
Marital status					
Married or partnered	22 (31)	37 (43)	58 (38)	6.635	0.042
Single, divorced, widowed or separated	48 (69)	50 (57)	98 (62)		
Living situation					
Alone or with partner	24 (34)	22 (25)	46 (29)	0.323[d]	0.315
With family or friends	44 (63)	64 (74)	108 (69)		
Shelter or SRO	2 (3)	1 (1)	3 (2)		
Postsecondary education					
Yes	39 (56)	49 (56)	88 (56)	0.006	0.939
No	31 (44)	38 (44)	69 (44)		
Full/part-time employment					
Yes	26 (37)	32 (37)	58 (37)	0.002	0.963
No	44 (63)	55 (65)	99 (63)		
Any legal income (past 30 days)					
Yes	44 (66)	48 (65)	90 (92)	0.009	0.926
No	22 (34)	26 (35)	48 (35)		
Ever in jail or prison					
Yes	34 (49)	32 (37)	66 (42)	2.213	0.137
No	36 (51)	55 (63)	91 (58)		
Ever tested for HIV					
Yes	70 (100)	55 (63)	125 (80)	32.338[d]	<0.001
No	0 (0)	32 (37)	32 (20)		
Injecting for past 9 years or longer					
Yes	40 (57)	39 (45)	79 (50)	2.353	0.125
No	30 (43)	48 (55)	78 (50)		
Injected last 30 days					
Yes	64 (94)	77 (91)	141 (92)	0.550[d]	0.420
No	4 (6)	8 (9)	12 (8)		
Injections/month > 22[b]					
Yes	29 (45)	42 (55)	71 (50)	1.192	0.275
No	35 (55)	35 (45)	70 (50)		
Unsafe injection 30 days[b]					
Yes	52 (81)	60 (78)	112 (79)	0.237	0.626
No	12 (19)	17 (22)	29 (21)		
New sex partner, 6 months					
Yes	43 (61)	52 (60)	95 (61)	0.045	0.833
No	27 (39)	35 (40)	62 (39)		
More than one sex partner, 6 months					
Yes	27 (39)	36 (41)	63 (40)	0.127	0.721
No	43 (61)	51 (59)	94 (60)		

[a] Median (25th percentile, 75th percentile)

[b] Excludes participants who did not report having injected in the past 30 days

[c] Z-score for Wilcoxon rank-sum test

[d] Fisher's exact Chi-square

one's HIV infection was not associated with condom use in a model that included all partners regardless of participants' perception of partner serostatus. Instead, participants were less likely to use condoms with their primary partners (aOR 0.60, 95% CI 0.38–0.96; P = 0.034) and with IDU partners (aOR 0.39, 95% CI 0.23–0.66; P < 0.001). In a

Table 2 Correlates of condom use at last sexual intercourse among drug injectors in St. Petersburg, Russia

	Total	Used condom No. (%)	uOR	95% CI	*P*-value	aOR	95% CI	*P*-value
With any partner $n_{participants} = 157$								
Total partnerships	231	115 (50)	–	–		–	–	
Awareness of infection in positive injector								
Yes	106	52 (49)	1.19	0.64–2.20	0.587			
No	125	63 (50)	Ref					
Gender								
Male	152	81 (53)	1.52	0.80–2.90	0.207			
Female	79	34 (43)	Ref					
Age 28 plus								
Yes	121	64 (53)	1.41	0.76–2.62	0.270			
No	110	51 (46)	Ref					
Inject 9 years								
Yes	115	63 (55)	1.54	0.83–2.85	0.168			
No	116	52 (45)	Ref					
IDU's perception of partner's serostatus								
Positive	44	18 (41)	Ref					
Negative	71	40 (56)	1.79	0.87–3.71	0.114			
Unknown	115	57 (50)	1.28	0.66–2.51	0.466			
Partner type								
Main	104	50 (48)	0.67	0.43–1.05	0.078	0.60	0.38–0.96	0.034
Other	100	61 (61)	Ref					
Partner injects drugs								
Yes	125	48 (38)	0.36	0.23–0.58	<0.001	0.39	0.23–0.66	<0.001
No	95	50 (63)	Ref			Ref		
With partners perceived to be seronegative $n_{participants} = 50$								
Total partnerships	71	40 (56)	–	–				
Awareness of infection in positive injector								
Yes	27	19 (70)	3.76	1.11–12.66	0.033	6.68	1.60–27.88	0.009
No	44	20 (48)	Ref			Ref		
Gender								
Male	50	30 (60)	1.75	0.55–5.52	0.344			
Female	21	10 (48)	Ref					
Age 28 plus								
Yes	33	20 (61)	1.25	0.44–3.58	0.677			
No	38	20 (53)	Ref					
Inject 9 years								
Yes	34	21 (62)	1.59	0.55–4.58	0.391			
No	37	19 (51)	Ref					
Partner type								
Main	38	19 (50)	0.52	0.22–1.20	0.125			
Other	29	20 (69)	Ref					
Partner injects								
Yes	23	10 (43)	0.42	0.17–1.06	0.060	0.29	0.11–0.74	0.009
No	48	30 (63)	Ref			Ref		

Table 2 continued

	Total	Used condom No. (%)	uOR	95% CI	*P*-value	aOR	95% CI	*P*-value
With partners of unknown status n _participants_ = 81								
Total partnerships	115	57 (50)	–	–				
Awareness of infection in positive injector								
Yes	40	19 (48)	1.01	0.41–2.46	0.989			
No	75	38 (51)	Ref					
Gender								
Male	77	40 (52)	1.67	0.66–4.33	0.278			
Female	38	17 (45)	Ref					
Age 28 plus								
Yes	61	34 (55)	1.91	0.79–4.58	0.150			
No	54	23 (43)	Ref					
Inject 9 years								
Yes	58	33 (57)	1.86	0.78–4.43	0.162			
No	57	24 (42)	Ref					
Partner type								
Main	46	23 (50)	0.76	0.38–1.49	0.419			
Other	56	32 (57)	Ref					
Partner injects								
Yes	65	25 (38)	0.32	0.17–0.62	0.001	0.32	0.17–0.62	0.001
No	39	25 (64)	Ref			Ref		

separate model of partnerships limited to partners understood to be seronegative and adjusted for the strong negative correlation of condom use with partner's injection drug use, participants' awareness of their HIV infection was associated with condom use (aOR 6.68, 95% CI 1.60–27.88; *P* = 0.009). In a model of partnerships with sex partners of unknown serostatus, participants who had been aware of their HIV infection at the time of sexual intercourse were no more likely to have used condoms than those who had been unaware. Similar to the findings for all partners, participants were less likely to use condoms with partners assumed to be an IDU (aOR 0.32, 95% CI 0.17–0.62; *P* = 0.001).

Prevalence and Correlates of Disclosure of Positive Status

The 70 participants who had been aware of their HIV infection prior to enrolment provided data on 106 partnerships. They reported disclosing their HIV status in 73% of these partnerships (data not shown). Participant disclosure was associated with having injected longer than 9 years (aOR 6.04, 95% CI 1.53, 23.77; *P* = 0.010) and with partners whom they perceived to be seropositive (aOR 45.12; 95% CI 2.79, 730.46; *P* = 0.007) or IDUs (aOR

3.61; 95% CI 1.44, 9.06; *P* = 0.006) (data not shown). No other participant characteristic (e.g., demographic, time since diagnosis, duration of drug use, incarceration history) or partnership characteristic (e.g., partnership type, partner's age) was associated with disclosure behavior.

Association Between HIV Disclosure and Condom Use Among Participants Who Had Been Previously Aware of Their HIV Infection

Participants who were previously aware of their HIV infection used condoms at last intercourse in 52 (49%) of 106 partnerships (Table 3). Condoms were used in a minority of encounters with partners perceived to be positive (36%); their use was significantly more common with partners perceived to be negative (70%) but only slightly more likely with partners whose serostatus was perceived as unknown (48%). Disclosure was not independently associated with condom use. Instead, condom use differed only by perceived negative serostatus of partner when comparing them to partners perceived to be seropositive (aOR 3.85, 95% CI 1.45–10.21, *P* = 0.007; Table 3) or to all other partners (aOR 2.95, 95% CI 1.29–6.73 *P* < 0.05; data not shown). Perception of partner status was independently associated with condom use and was not confounded by any other

Table 3 Correlates of condom use at last intercourse among drug injectors who are aware of their HIV infection, St. Petersburg, Russia

	Total	Used condom No. (%)	uOR	95% CI	*P*-value	aOR	95% CI	*P*-value
With any partner $n_{participants} = 70$								
Total partnerships	106	52 (49)	–	–				
Disclosure of status by positive injector								
Yes	77	34 (44)	0.46	0.70–0.98	0.028			
No	29	18 (62)	Ref					
Gender								
Male	67	38 (57)	2.09	0.81–5.41	0.129			
Female	39	14 (36)	Ref					
Age 28+								
Yes	69	32 (53)	1.91	0.75–4.85	0.176			
No	47	20 (43)	Ref					
Known + 2 years								
Yes	77	39 (52)	1.59	0.55–4.58	0.392			
No	26	10 (38)	Ref					
Ever in jail or prison								
Yes	50	21 (42)	0.58	0.23–1.45	0.241			
No	56	31 (55)	Ref					
Inject 9 years+								
Yes	95	49 (52)	1.98	0.78–5.03	0.150			
No	11	3 (27)	Ref					
IDU's perception of partner's serostatus								
Positive	39	14 (36)	Ref			Ref		
Negative	27	19 (70)	3.85	1.45–10.21	0.007	3.85	1.45–10.21	0.007
Unknown	40	19 (48)	1.60	0.68–3.77	0.282	1.60	0.68–3.77	0.282
Partner type								
Main	41	18 (44)	0.58	0.30–1.11	0.098			
Other	51	33 (65)	Ref					
Partner injects								
Yes	67	29 (43)	0.49	0.25–0.96	0.038			
No	33	19 (58)	Ref					
With partners perceived to be seronegative or perceived unknown $n_{participants} = 43$								
Total partnerships	67	19 (70)	–	–				
Disclosure of status by positive injector								
Yes	40	20 (50)	0.46	0.0.19–1.12	0.089	0.13	0.02–0.66	0.014
No	27	18 (67)	Ref			Ref		
Gender								
Male	46	30 (65)	3.10	0.85–11.28	0.086	23.61	1.59–349.97	0.022
Female	21	8 (38)	Ref			Ref		
Age 28+								
Yes	35	24 (69)	2.52	0.79–8.03	0.040			
No	32	14 (44)	Ref					
Known + 2 years								
Yes	49	29 (49)	2.41	0.60–9.71	0.217			
No	15	6 (40)	Ref					
Ever in jail or prison								
Yes	31	14 (45)	0.44	0.14–1.42	0.173	0.02	0.0–0.30	0.005
No	36	24 (67)	Ref					

Table 3 continued

	Total	Used condom No. (%)	uOR	95% CI	P-value	aOR	95% CI	P-value
Inject 9 years+								
Yes	37	25 (68)	2.19	0.69–6.95	0.182	25.95	2.65–253.81	0.005
No	30	13 (43)	Ref					
IDU's perception of partner's serostatus								
Negative	27	19 (70)	2.61	1.00–6.77	0.049	8.65	1.67–44.65	0.010
Unknown	40	19 (48)	Ref					
Partner type								
Main	25	12 (48)	0.61	0.26–1.42	0.249			
Other	37	25 (68)	Ref					
Partner injects								
Yes	34	18 (53)	0.60	0.26–1.41	0.244			
No	27	16 (59)	Ref					

variable. In a model limited to partners perceived to be susceptible to HIV infection (i.e., perceived to be seronegative or of unknown serostatus), disclosure was independently and negatively associated with condom use (aOR 0.13, 95% CI 0.02–0.66; $P = 0.014$). In the same model there was a positive and independent association between condom use and male gender of participant (aOR 23.61, 95% CI 1.59–349.97, $P = 0.022$). In addition, condoms were more likely to be used with partner of perceived negative serostatus compared to partner of unknown serostatus (aOR 8.65, 95% CI 1.67–44.65, $P = 0.010$).

Potential for HIV Transmission in Unprotected Serodiscordant Partnerships

We calculated the number of partnerships with the potential for HIV transmission, that is, unprotected sex partnerships between HIV-seropositive participants and partners perceived to be either seronegative or of unknown serostatus ($n = 89$). The vast majority of these were unprotected vaginal sex, with only four encounters noting the occurrence of unprotected anal sex. Among these, partnerships in which participants had been unaware of
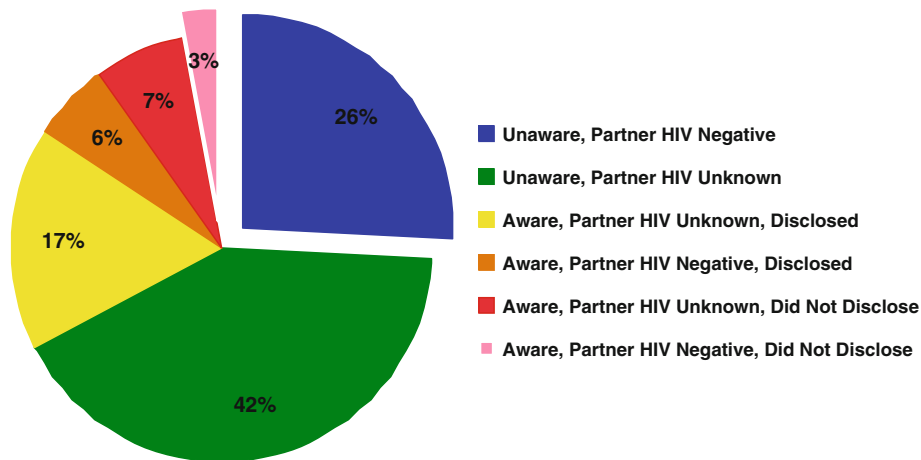

Fig. 2 Unprotected sex between HIV-seropositive participants and partners who were vulnerable to HIV infection ($n = 89$). Of the 89 unprotected sexual encounters between HIV-seropositive participants and partners perceived to be either seronegative or of unknown serostatus, 23 (26%) occurred between participants unaware of their HIV infection and seronegative partners, 37 (42%) between participants unaware of their infection and a partner of unknown serostatus, 5 (6%) between participants who knew of their infection and had disclosed to the seronegative partner, 3 (3%) between participants who knew of their infection and seronegative partners but without disclosure, 6 (7%) between participants who knew of their infection and partners of unknown status but without disclosure, and 15 (17%) between participants who knew of their infection and had disclosed to the partner of unknown serostatus. Hence, there were only approximately 3% of unprotected sexual encounters in which disclosure of serostatus may have influenced the decision to use a condom. (Color figure online)

their HIV infection and understood their partner to be HIV-negative comprised 26% (n = 23), and partnerships in which participants had been aware of their infection but had not disclosed to their seronegative partners comprised 3% (n = 3; Fig. 2).

Discussion

The study results indicate that mere awareness of one's own HIV infection is not associated with condom use. Rather, among IDUs who were aware of their HIV infection, partner's perceived serostatus was the strongest predictor of condom use at last intercourse. Compared to partnerships with partners perceived to be positive or of unknown serostatus, partnerships between IDUs who were aware of their infection and partners perceived to be seronegative were characterized by a relative lack of disclosure but more condom use. Consistent with other studies [40, 53, 54], we found that disclosure was not associated with increased condom use. Instead, disclosure to potentially negative partners was associated with *less* condom use.

Among participants who were aware of their HIV infection at time of last intercourse, disclosure was independently associated with (1) the perception that their sex partner was also HIV-positive, (2) the perception that their partner was also an IDU, and (3) the participant having injected for at least 9 years. The first finding is consistent with other studies' findings that disclosure was less likely when partners' serostatus was either seronegative or unknown [28, 38–40]. Disclosure to partners who were perceived to be fellow injectors may be related to the first finding and reflects the harsh reality of HIV in Russia: that anyone who injects drugs is likely to become infected. The fact that no other personal or partner characteristics or partnership type were associated with disclosure contrasts with studies of disclosure practices among US populations [22, 26–33, 37, 43, 44, 55]. Further research is warranted to confirm or refute our findings.

Among HIV-positive IDUs who were aware of their infection, it appears that the perception of partners as uninfected, more than the act of disclosure, was associated with condom use. Potential exposure of perceived negative partners was much more common among participants who had been unaware of their HIV infection at the time of last sexual contact. We applied the adjusted odds ratio between prior diagnosis of HIV infection and condom use with partners perceived to be negative given in Table 2 (aOR: 6.68, CI: 1.60–27.88) and the proportion of partnerships in which an undiagnosed participant with HIV infection had exposed potentially uninfected partners (0.26, binomial CI: 0.17–0.36) to a standard formula for population attributable risk percent (PAR%).

$$\text{PAR}\% = P_{\text{exposed}}(\text{RR} - 1)/[1 + P_{\text{exposed}}(\text{RR} - 1)]$$

This suggests that if half of the undiagnosed HIV-infected IDUs from the sampling frame were to learn of their HIV infection, the number of potentially uninfected partners being exposed by infected injectors would be reduced by 60% (CI 9–90%). Conversely, disclosure of HIV infection to potentially uninfected partners was associated with a somewhat lesser likelihood of using condoms. It is of interest that males who were aware of their HIV infection were significantly more likely than females to report having used a condom at time of last intercourse. This may be due to the fact that, compared to females, males can more easily opt to use a condom with minimal need for condom negotiation and no need for disclosure.

Limitations of the study included the inherent potential biases associated with self-reported data such as recall bias and social desirability. Due to the relatively small sample size, there was insufficient power to detect effect modification; under these conditions, stratification was considered to be the appropriate analytic approach. The cross-sectional nature of this study does not permit determination of causal associations. The survey questioned participants about whether they had asked their partners if they had been tested, but (1) did not follow up to ask whether partners had responded to the question or what those test results were and (2) whether discussions of serostatus happened before or after initiation of the sexual partnership. These methodological problems have been noted elsewhere [27]. We therefore cannot ascertain the degree to which a recent negative test is associated with protected sex with HIV-positive partners who are aware of their infection. Detailed data about the timing of disclosure relative to the onset of sexual relations should be collected in future studies. Further research is needed to understand the process by which individuals ascertain their partners' HIV serostatus and to identify those factors which enter into condom use decisions. Finally, the study from which the data for this analysis were taken did not inquire whether HIV-diagnosed participants had been declined by potential sexual partners due to participants' disclosure of HIV-positive status; while taking such scenarios into account would not change the proportion of partnerships in which condoms were used, it would impact the proportion of unprotected partnerships occurring post-disclosure.

Evidence from studies outside of Russia suggests that sexual risk behaviors may contribute more than injection risk behaviors to HIV transmission among IDUs when injection risks are reduced through educational, behavioral, or structural interventions [56, 57], but few interventions specifically target the reduction of sexual risk among this population [58]. Our experience working with this population in St. Petersburg indicates that condoms are readily

available and inexpensive at most convenience stores, pharmacies, and kiosks; they are also free at syringe exchanges and outreach programs. There are few published reports of condom use rates among IDUs or even within the general population of Russia, and even less is known about these rates among partner types (e.g., new, main, casual partners). However, there is some evidence that condom use rates are generally low, with 45% of injectors in one study reporting no condom use in the previous 6 months [59], another study noting consistent condom use for only 44% of a sample of Moscow youths [60], and 19–25% of respondents in a representative probability sample of Russian households reporting condom use at their last sexual encounter [61]. Elsewhere in the world the rates of unprotected sex for IDUs ranged from 28 to 77% [62–68]. Our findings suggest the need for interventions targeting increased condom use among Russian IDUs and that HIV testing—and provision of test results—should be encouraged among all members of social networks in which HIV is prevalent. In our analysis fewer than half the participants were aware of their infection, but when aware, condom use was significantly *more* likely to occur with partners perceived to be seronegative. These findings, compounded with the *negative* association between condom use and disclosure, suggest that public health benefit (in terms of decreasing sexual exposure to HIV by uninfected partners) may accrue from the scaling up HIV testing services and interventions that increase the likelihood of individuals receiving their test results.

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