CHARACTERISTICS OF SEX PARTNERS AND SEXUAL PARTNERSHIP CORRELATES OF INCONSISTENT CONDOM USE AMONG MALE INJECTION DRUG USERS IN INDIA

Waimar Tun[1], Avina Sarna[2], Aruna Bhattacharya[3], Louis Apicella[3], Yumnam Shasikumar Singh[4] and Dean Lewis[5]

[1]Population Council, Washington, DC, USA; [2]Population Council, Delhi; [3]Indian Institute of Public Health, Delhi; [4]Social Awareness Service Organisation, Imphal, India; [5]Asian Network of People Who Use Drugs, Bangkok, Thailand

Abstract. Previous studies have established the risky behaviors of IDUs in India, and that IDUs are sexually active; however, there is a need to better understand the nature of sexual partnerships of IDUs. A total of 783 (Delhi) and 766 (Imphal) male IDUs were recruited into the study through respondent-driven sampling. We examined characteristics of sex partners of male IDUs and individual and sexual partnership characteristics associated with unprotected sex in Delhi and Imphal. While 16.8% of sexual partnerships in Delhi were male-to-male, there were almost no male-to-male partnerships in Imphal. The majority of partners of male IDUs in Delhi (82.5%) and Imphal (92.3%) do not inject drugs, with the exception of male partners of male IDUs in Delhi. Commercial partners (females: 58.3%; males: 71.3%) were the most common type of sex partners of male IDUs in Delhi, while regular partners (65.2%) were the most common type of sex partners in Imphal. In Delhi, characteristics of sex partners significantly associated with unprotected sex were being male/transgender (AOR 2.2; 95% CI: 1.2-4.0), being a regular (AOR 5.1; 95% CI: 2.8-9.4) or non-regular partner (AOR 2.7; 95% CI: 1.7-4.5), and sharing needles/syringes with the index IDU (AOR 2.8; 95% CI: 1.4-5.3). In Imphal, partner characteristics associated with unprotected sex were being a regular (AOR 10.1; 95% CI: 4.1-25.1) or non-regular partner (AOR 3.4; 95% CI: 1.5-7.6), and living outside of town or state (AOR 3.3; 95% CI: 1.2-9.6). Enhanced understanding of disassortative sexual mixing and context of unprotected sex within sexual partnerships may enhance sexual risk reduction interventions for IDUs.

Keywords: injection drug users, sex partners, sexual mixing, India

Correspondence: Waimar Tun, Population Council, 4301 Connecticut Avenue, NW, Suite 280, Washington DC 20008, USA.
Tel: +1 202 237 9400; Fax: +1 202 237 8410
E-mail: wtun@popcouncil.org; waimartun@yahoo.com

INTRODUCTION

India has one of the largest HIV epidemics in the world. While sexual transmission is the primary mode of HIV transmission in India, injection drug users (IDUs) are disproportionately affected by

the epidemic (NACO, 2010). HIV seroprevalence among IDUs is estimated to be 7.2% nationally, while the seroprevalence in the general adult population is 0.3% (NACO, 2008, 2012). HIV seroprevalence among IDUs is estimated to be 10.1% in Delhi and 17.9% in the northeastern state of Manipur (NACO, 2008). The number of active IDUs has been estimated at 163,000 nationally, and 17,000 in Delhi and 12,000 in Manipur alone (NACO, 2012).

Studies from India have established that IDUs are sexually active and have sex with both injecting and non-injecting partners (Sarkar *et al,* 1993; Jain *et al,* 1994; Panda *et al,* 2000; Sarna *et al,* 2012). However, there is limited understanding of the nature of sexual partnerships of IDUs that facilitate high-risk sexual behaviors, particularly in India. Previous research on sexual partnerships, the majority of which were conducted in the West, suggests that disassortative sexual mixing (partnerships between individuals of different groups such as by age or risk profile) and concurrency are important risk factors for HIV and other STIs (Aral *et al,* 1999; Fenton *et al,* 2001; Gregson *et al,* 2002).

Understanding sexual partnerships is extremely important because: i) IDUs have sexual risk in addition to their injection-related risk, ii) sexual behaviors are more difficult to change than injection risk behaviors among IDUs (Des Jarlais and Semaan, 2005; Copenhaver *et al,* 2006), and iii) risky sexual practices of IDUs with non-injecting drug users act as a 'bridge' for facilitating the transmission of HIV into the non-injecting population (Panda *et al,* 2000; Pisani *et al,* 2003).

An understanding of the sexual partnerships such as characteristics of sex partners of IDUs and the interpersonal context, and the partnership characteristics is necessary to guide the development of tailored behavior change messages and strategies that go beyond individual characteristics into a deeper level of influence for reducing sexual risk between the sexual pair.

This paper describes the sex partners and the sexual partnerships of male IDUs in Delhi and Imphal, the nature of these sexual partnerships, and individual and partnership factors associated with unprotected sex in these partnerships.

MATERIALS AND METHODS

Study population and recruitment

Delhi and Imphal cities were selected for this study due to contrasts in the injection drug use and HIV epidemic, which allow for a richer understanding of the social and behavioral characteristics of the populations and provide important insights for designing interventions tailored to the local contexts. Imphal, a small city in northeastern India with little migration, has a very high prevalence of injection drug use and HIV, and a greater acceptance of drug use and HIV infection in the state. In contrast, Delhi is a large metropolitan city with a diverse population of locals and immigrants from other states. The prevalence of HIV in the general population is relatively low in Delhi with a lower level of awareness of the HIV problem.

Respondent-driven sampling (RDS) was used to recruit study participants. Recruitment started with one male and one female 'seed' participants in both cities with subsequent addition of three seeds in Delhi and two seeds in Imphal. Seed participants were selected based on diverse characteristics with respect to sex, age, and location of residence within the

respective cities, and their socio-metric characteristics (that is, having a large social network of IDUs and being well integrated and influential in the IDU community).

Eligibility criteria included having injected non-prescription drugs in the past 6 months, greater than 16 years of age, and willingness to provide informed consent for study participation. Each participant was asked to recruit three other male or female IDUs who they knew by name and know how to contact, and have seen in the last one month. Participants received INR60 (approximately USD1.30 at time of study) for completing the survey and INR40 (approximately USD0.88 at time of study) for each eligible peer they recruited.

Eligible participants were interviewed face-to-face using a structured questionnaire on socio-demographics, sexual and drug injection behaviors, and HIV prevention knowledge. The questionnaire also asked details about the last three sex partners in the last 12 months, including socio-demographic characteristics, type and sex of partner, and risk behaviors with these partners. We refer to these last three sex partners as the 'nominated sex partners.'

Therefore, index respondents based the nominated sex partners' characteristics on self-reports. Interviews were conducted in Hindi (Delhi) and Manipuri (Imphal) by trained interviewers using handheld computers (DELL Axim X51) with Perseus MobileSurvey 7.0.044 software (Perseus Development Corporation; Braintree, MA). The use of handheld computers not only improves data quality and eliminates the need for data entry, but it was logistically more convenient using handhelds as interviews had to be conducted in spaces where desks and chairs were not available.

Sample size

The required sample size for the main objective of the study of understanding risk behaviors of IDUs was 760 for each city based on an expected change in consistent condom use with non-regular partners from pre-intervention to post-intervention (45% to 55%), a design effect of 1.5 to account for the correlation associated with RDS, and an inflation factor to account for 30% of the population not being sexually active. The sample attained exceeded the target by 40 people as IDUs continued to come into the study site with valid recruitment coupons. The results of the main study examining risk behaviors of IDUs are presented elsewhere (Sarna *et al*, 2012).

Between September and December 2006, 800 IDUs in Delhi and 800 IDUs in Imphal were recruited into the study. Because the majority of the respondents were male (Delhi: 97.9%; Imphal: 95.8%) and since this paper is an analysis of sexual behaviors of IDUs and their sex partners, the analytic sample is limited to male IDUs who reported having had sex in the last 12 months.

Of the 783 and 766 male IDUs in Delhi and Imphal, 552 (70.5%) and 435 (56.8%) reported having sex in the last 12 months, respectively. The 38 IDUs (3.9%) who did not provide data about their sex partners in the last 12 months were excluded from the analysis.

The resulting sample of 547 (Delhi) and 402 (Imphal) index IDUs reported having 850 (Delhi) and 571 (Imphal) sex partners in the last 12 months – an average of 1.6 and 1.4 partners per index IDU, respectively. The description of the index IDUs is based on the sample size of 547 (Delhi) and 402 (Imphal) index IDUs; the description of sexual partnerships is

based on the 850 (Delhi) and 571 (Imphal) partnerships.

Ethical considerations

The Population Council Institutional Review Board approved this study (Protocol Nº 384; 2006 Jul 31).

Measures

Sexual activity was defined as having vaginal or anal intercourse at least once in the past 12 months. A regular partner was defined as a spouse or a cohabiting partner. A commercial partner was defined as someone the respondent had sex with in exchange for money, drugs, or gifts. A non-regular partner was defined as a partner the respondent was not living with and was not a commercial partner.

Questions about each sexual partnership (that is, index IDU with his sex partner) referred to the 'time period of their sexual relationship.' Inconsistent condom use with the nominated sex partner was defined as 'not using a condom during any act of sexual intercourse during the period of their sexual relationship.'

Risky drug injection practice was defined as 'sharing needles or syringes (N/S), vials, cookers, containers, cotton/filter or rinse water with someone else, receiving injection from a pre-filled syringe that was filled by someone else,' injecting drugs using a syringe after someone else had squirted drugs into it from his used syringe (frontloading, backloading, splitting),' or 'injecting after drawing up drug solution from a common container.'

An index respondent was considered to have engaged in risky injection with the nominated sex partner if he 'engaged in any of the aforementioned activities with that partner.' Risky injection with nominated partner was treated as a categorical variable ('Partner does not inject,' 'Injects with partner,' 'Partner injects but not index does not inject with partner,' 'Does not know if partner injects').

HIV status of the index IDU was self-reported and categorized as 'Never tested,' 'Tested and known positive,' 'Tested and known negative,' or 'Tested and result unknown.'

Data analysis

Descriptive characteristics of the index male IDUs are reported as sample percentages and population-based estimates with 95% confidence intervals. Population-based estimates were calculated in RDS Analysis Tool (RDSAT®) (version 5.6.0; Cornell University, Ithaca, NY). All other analyses were conducted using Stata® (version 9.1; Stata Corp, College Station, TX). Descriptive characteristics of the partners of the index IDUs and the sexual partnerships were examined, and χ^2 tests were used to detect associations between categorical variables comparing male and female partners of index IDUs (Delhi only). Comparisons between male and female partners were not examined in Imphal as the majority of the partners reported by index IDUs were females.

To determine factors associated with inconsistent condom use during sexual relationships within sexual partnerships, logistic regression analysis with cluster effect was used. This takes into account the correlation between sex partners of the same index IDU. We used index IDU's ID as the clustering variable.

The regression analysis was conducted on the 850 (Delhi) and 571 (Imphal) sexual partnerships. Variables included in the initial model were selected on the basis of *a priori* knowledge and included individual level factors (sociodemographic characteristics, HIV testing history, sexual and injection behaviors), partner

characteristics, and sexual partnership characteristics (place of meeting partner, unprotected sex, concurrency, risky injection). A backwards stepwise procedure was used and variables were retained in the final model if they were associated with the outcome at a level of $p<0.10$ level (Hosmer and Lemeshow, 2000).

RESULTS

Characteristics of index IDUs

Table 1 shows the socio-demographic and injection and sexual behavioral characteristics of male index IDUs who had sex in the last 12 months. The socio-demographic and sexual and drug use risk profiles of IDUs are very different in Delhi and Imphal. While 61.5% of sexually active male IDUs in Delhi were living on the streets, none of the IDUs in Imphal reported doing so. Delhi IDUs were less likely than Imphal IDUs to be married or cohabiting (36.1% *vs* 68.6%). A high proportion of IDUs in Imphal reported having been tested HIV positive previously (23.8%). However, in Delhi, the majority of IDUs had never tested for HIV, 3.3% reported testing HIV positive, and 18.4% reported testing HIV negative.

Thirty-five percent of Delhi IDUs reported having had two or more partners in the last 12 months and 20.1% reported concurrent partners (Table 1). In Imphal, 20.6% reported two or more partners and 9.2% had concurrent partners. Among index respondents in Delhi, 11% reported sex only with male partners, and 6% reported sex with both male and female partners in the last 12 months (data not shown). Five percent of IDUs in Delhi and 12% in Imphal reported having at least one non-regular or commercial female partner in addition to a regular female partner in the past 12 months (data not shown).

Characteristics of sex partners of male index IDUs

In Delhi, of the 547 index IDUs, 348 reported one partner, 92 reported two partners, and 107 reported three partners. In Imphal, of the 402 index IDUs, 287 reported one partner, 56 reported two partners, and 59 reported three partners. Table 2 shows the characteristics of the sex partners reported by the 547 Delhi IDUs and 402 Imphal IDUs. While 16.8% (143/850) of sexual partnerships in Delhi were male-to-male, there were almost no male-to-male partnerships in Imphal.

In both cities, the partners were mostly within ten years in age of the index IDUs. The majority of partners of male IDUs in both Delhi (82.5%) and Imphal (92.3%) do not inject drugs, with the exception of male partners of male IDUs in Delhi. Male partners of index IDUs were significantly more likely than female partners to inject drugs with index IDUs (33.6% versus 8.4%), as well as inject drugs but not necessarily with the index IDU (10.5% versus 5.4%) during the period of their sexual relationship ($p<0.01$).

Commercial partners (females: 58.3%; males: 71.3%) were the most common type of sex partners of male IDUs in Delhi, while regular partners (65.2%) were most common type of sex partners in Imphal. In Delhi, male partners were significantly more likely than female partners to be commercial partners (71.3% versus 58.3%; $p<0.01$) and less likely to be regular partners (11.9% versus 26.7%; $p<0.01$). Inconsistent condom use was high in all types of partnerships in both cities.

In Delhi, inconsistent condom use with female partners was highest with regular (88.9%) and non-regular partners (71.7%) compared to condom use with commercial partners (51.7%) ($p<0.01$).

Table 1
Characteristics of male IDUs who reported having sex in the last 12 months in Delhi (*N*=547) and Imphal (*N*=402).

Variable	Delhi		Imphal	
	N=547 %	Population-based estimates (95% CI)	*N*=402 %	Population-based estimates (95% CI)
Age (years)				
≤25	26.9	31.9 (25.6-38.7)	15.2	14.4 (10.6-19.6)
26-35	40.4	38.7 (32.1-43.9)	59.7	61.2 (54.5-67.1)
>35	32.7	29.4 (24.3-36.0)	25.1	24.3 (18.8-30.1)
Education				
≤5 years	75.7	78.2 (72.5-82.8)	12.9	13.2 (9.5-18.8)
>5 years	24.3	21.8 (17.2-27.5)	87.1	86.8 (81.2-90.5)
Living situation				
Home-based	28.0	36.4 (28.1-46.4)	98.8	99.4 (98.7-99.8)
Shelter	3.5	2.1 (1.0-3.5)	1.2	0.6 (0.2-1.3)
Street-based	68.5	61.5 (51.7-69.6)	0.0	0.0
Married or cohabiting				
No	67.0	63.9 (57.0-69.9)	34.1	31.4 (26.1-38.0)
Yes	34.0	36.1 (30.1-43.0)	65.9	68.6 (62.0-73.9)
Currently earn money				
Yes	83.7	89.6 (86.4-92.5)	48.8	53.7 (47.9-60.8)
No	16.3	10.4 (7.5-13.6)	51.2	46.3 (39.2-52.1)
HIV testing				
Never tested	65.3	74.6 (68.6-78.7)	39.8	45.0 (38.9-52.4)
Tested and positive	6.0	3.3 (1.8-6.2)	26.6	23.8 (18.8-29.5)
Tested and negative	22.7	18.4 (14.6-23.0)	23.9	23.7 (17.3-28.8)
Tested, do not know result	6.0	3.8 (2.2-5.8)	9.7	7.6 (4.8-10.6)
Drug injection duration				
0-5 years	70.4	75.9 (71.1-81.2)	35.3	38.8 (33.2-46.8)
6-10 years	23.4	19.8 (15.3-24.5)	28.9	28.4 (22.6-34.0)
>10 years	6.2	4.3 (2.1-6.3)	35.8	32.8 (26.1-38.0)
Drug injection frequency in last 1 month				
Never to once/week	18.5	14.3 (10.5-18.3)	37.6	37.5 (31.7-44.6)
Twice/week to once daily	18.6	22.6 (17.2-27.6)	25.9	28.2 (22.3-35.0)
More than once/day	62.9	63.1 (57.5-69.5)	36.6	34.3 (27.3-39.7)
Any risky injection in last 1 month				
No	26.5	30.5 (24.5-36.6)	22.9	20.7 (15.3-29.5)
Yes	73.5	69.5 (63.4-75.5)	77.1	79.3 (70.5-84.7)
Number of sex partners in last 12 months				
1	63.6	65.0 (58.9-70.7)	71.4	79.4 (74.2-83.8)
2 +	36.4	35.0 (29.3-41.1)	28.6	20.6 (16.2-25.8)
Had concurrent partners in last 12 months				
No	80.8	79.8 (74.1-84.8)	86.8	90.8 (87.6-93.6)
Yes	19.2	20.1 (15.2-25.9)	13.2	9.2 (6.4-12.4)
Consume alcohol during sex in general				
No	55.0	58.9 (53.2-66.4)	52.6	53.0 (43.8-59.3)
Yes	45.0	41.1 (33.6-46.8)	47.4	47.0 (40.7-56.2)

Table 2
Characteristics of partners and partnerships, Delhi (N= 850) and Imphal (N = 571).

Partners of male IDUs	Delhi %		p-value[a]	Imphal %
Sex of partners				
Female		83.2		97.4
Male		16.8		2.6
	Female partner (n=707)	Male partner (n=143)		
Age difference with index IDU				
Partner ≥10 years younger	24.9	35.0		12.3
Partner within 10 years	73.1	58.0	<0.01	86.7
Partner ≥10 years older	2.0	7.0		0.9
Location of first meeting partner				
Same part of town	62.1	64.3	0.295	51.1
Different part of town	30	31.5		35.9
Outside of town or state	7.9	4.2		12.4
Partner injection drug use				
Partner does not inject	82.5	55.2		92.3
Partner injects with index	8.4	33.6	<0.01[b]	2.6
Partner injects but not with index	5.4	10.5		0.9
Do not know if partner injects	3.8	0.7		4.2
Type of partners				
Regular	26.7	11.9	<0.01	65.2
Commercial	58.3	71.3		19.6
Non-regular	15	16.8		15.2
Inconsistent condom use with partners (by partner type)				
Regular	88.9	52.9	<0.0[c] <0.05[c]	89.8
Commercial	51.7	81.4		50.9
Non-regular	71.7	79.2		75.9
Dyads in which index had sex with another partner during time of relationship	31.1	43.4	<0.01	19.6
Partner used force to have sex with index	7.1	13.3	<0.05	5.3

[a]p-values are for comparison of differences between male and female partners. In Imphal, due to few male-male sexual dyads (n=15), results are not stratified by sex.
[b]Fishers exact test.
[c]Compares inconsistent condom use by different types of partners separately among the female and male partners of index IDUs.

Similar percentages were reported for partnerships in Imphal. However, among male-to-male partnerships in Delhi, inconsistent condom use was highest with male commercial partners (81.4%) and non-regular partners (79.2%) compared to condom use with regular partners (52.9%) (p<0.05).

The proportion of sexual partnerships in which the index reported having sex with another partner at the same time was also striking (31.1% with female partner-

Table 3
Unadjusted and adjusted odds ratios for inconsistent condom use in sexual dyads of male IDUs in Delhi and Imphal.

Index IDU characteristics	Delhi		Imphal	
	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Age (years)				
≤25	1	1	1	1
26-35	1.2 (0.8-1.9)	1.5 (0.9-2.4)	1.3 (0.6-2.8)	1.0 (0.4-2.1)
>35	1.8 (1.1-3.0) [a]	1.9 (1.1-3.3) [a]	0.7 (0.3-1.6)	0.4 (0.2-0.9) [a]
Education				
≤5 years	1		1	
>5 years	0.8 (0.5-1.2)		0.5 (0.2-1.1)	
Living situation				
Home-based shelter	1	1	1	
Street-based	0.4 (0.2-0.9) [a]	0.5 (0.2-1.3)	0.3 (0.1-1.6)	
	1.0 (0.7-1.6)	1.7 (1.0-2.8) [a]	-	
Married or cohabiting				
No	1	1	1	1
Yes	2.5 (1.6-3.9) [b]	1.8 (1.0-3.1) [a]	2.0 (1.2-3.4) [a]	1.2 (0.6-2.4)
Currently earn money				
Yes	1		1	
No	1.8 (1.0-3.3) [a]		0.5 (0.3-0.9) [a]	
HIV testing				
Never tested	1	1	1	
Tested and positive	0.5 (0.2-1.1)	0.4 (0.2-0.9) [a]	0.8 (0.5-1.6)	
Tested and negative	0.6 (0.4-1.0) [a]	0.6 (0.4-0.9) [a]	1.4 (0.7-3.0)	
Tested, do not know result	1.6 (0.6-4.3)	1.4 (0.5-4.4)	1.5 (0.6-3.9)	
Drug injection duration				
0-5 years	1		1	
6-10 years	1.2 (0.8-1.8)		1.0 (0.5-2.0)	
>10 years	2.0 (0.9-4.6)		0.9 (0.5-1.6)	
Drug injection frequency in last 1 month				
Never to once/week	1		1	
Twice/week to once daily	0.6 (0.3-1.1)		1.9 (1.0-3.7) [a]	
More than once/day	0.9 (0.5-1.4)		1.9 (1.0-3.4) [a]	
Any risky injection in last 1 month				
No	1		1	
Yes	1.5 (1.0-2.3)		0.8 (0.5-1.6)	
Consume alcohol during sex in general				
No	1		1	
Yes	1.2 (0.8-1.7)		0.9 (0.6-1.6)	
Number of sex partners in last 12 months				
1 partner	1	1	1	1
2 or more partners	0.6 (0.4-0.9) [a]	1.0 (0.7-1.5)	0.5 (0.3-0.8) [a]	1.1 (0.6-2.0)

Table 3 (Continued).

Index IDU characteristics	Delhi		Imphal	
	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Sex partner characteristics and sexual dyad characteristics				
Sex of partner				
Female	1	1	1	
Male/Transgender	1.9 (1.1-3.2) [a]	2.2 (1.2-4.0) [a]	0.3 (0.1-0.9) [a]	
Type of sex partner				
Commercial sex worker	1	1	1	1
Regular	4.5 (2.9-7.1) [b]	5.1 (2.8-9.4) [b]	8.5 (4.7-15.4) [b]	10.1 (4.1-25.1) [b]
Non-regular	2.0 (1.2-3.3) [a]	2.7 (1.7-4.5) [b]	3.0 (1.5-6.1)	3.4 (1.5-7.6)
Partner age difference				
Partner >10 years younger	1		1	
Partner within 10 years	0.8 (0.5-1.2)		2.3 (1.2-4.4) [a]	
Partner >10 years older	0.8 (0.3-2.2)		-	
Place of first meeting partner				
Same part of town	1	1	1	1
Different part of town	1.0 (0.6-1.4)	1.3 (0.9-2.0)	0.7 (0.4-1.2)	0.9 (0.5-1.6)
Outside of town or state	3.5 (1.6-7.7)	2.2 (0.9-5.1)	1.0 (0.4-2.2)	3.3 (1.2-9.6) [a]
Dyad occurred concurrently with another sexual relationship				
Yes	1		1	
No	1.1 (0.7-1.7)		0.4 (0.2-0.7) [b]	
Risky injection with partner				
Partner does not inject	1	1	1	1
Partner shares N/S with index IDU	2.6 (1.5-4.7) [b]	2.8 (1.4-5.3) [b]	0.6 (0.2-2.0)	1.7 (0.4-7.7)
Partner injects but does not share N/S with index IDU	1.1 (0.5-2.4)	1.3 (0.6-3.0)	0.3 (0.1-1.9)	1.0 (0.2-6.2)
Index does not know if partner injects	0.3 (0.1-0.7) [a]	0.4 (0.2-0.9) [a]	0.1 (0.0-0.2)	0.2 (0.1-0.6) [a]

[a] $p<0.05$; [b] $p<0.01$; CI, confidence interval. All bivariate and multivariate logistic regression models were conducted with the index IDU as the cluster variable.

ships and 43.4% with male partnerships in Delhi, $p<0.01$; 19.6% in Imphal). Forced sex with index IDU was not common in sexual partnerships with the exception of male-to-male partnerships, in which 13.3% of the male partners had used force to have sex with the index IDUs.

Factors associated with inconsistent condom use in sexual dyads (Table 3)

Delhi. In multivariate analysis, index IDU characteristics associated with unprotected sex were age older than 35 year (AOR 1.9; 95% CI: 1.1-3.3), living on the street (AOR 1.7; 95% CI: 1.0-2.8), and being married (AOR 1.8; 95% CI: 1.0-3.1). Those who had previously tested positive for HIV (AOR 0.4; 95% CI: 0.2-0.9) and those who had previously tested negative for HIV (AOR 0.6; 95% CI: 0.4-0.9) were significantly less likely to have had unprotected sex with their sex partners

compared to untested index IDUs and those who tested but did not know their test results.

Characteristics of sex partners significantly associated with unprotected sex were being male/transgender (AOR 2.2; 95% CI: 1.2-4.0), being a regular (AOR 5.1; 95% CI: 2.8-9.4) or non-regular partner (AOR 2.7; 95% CI: 1.7-4.5) compared to being a commercial partner, and sharing needles/syringes with the index IDU (AOR 2.8; 95% CI: 1.4-5.3) compared to partner being a non-injector. Unprotected sex was less likely in partnerships where index did not know whether the partner injects drugs or not (AOR 0.4; 95% CI: 0.2-0.9).

Imphal. In multivariate analysis for Imphal, unlike Delhi, older IDUs were less likely to have unprotected sex (AOR 0.4; 95% CI: 0.2-0.9). Partner characteristics associated with unprotected sex were being a regular (AOR 10.1; 95% CI: 4.1-25.1) or non-regular partner (AOR 3.4; 95% CI: 1.5-7.6) compared to being a commercial partner, and living outside of town or state (AOR 3.3; 95% CI: 1.2-9.6). Unprotected sex was less likely in partnerships in which the index IDU did not know whether the partner injected drugs or not (AOR 0.2; 95% CI: 0.1-0.6) compared to partner being a non-injector.

DISCUSSION

This study identified a set of characteristics of sexual partnerships and sex partners that influence unprotected sex between male IDUs and their partners. We identified differences in sexual partnership characteristics and factors associated with unprotected sex between IDUs in Delhi and Imphal. The study also found that the majority of partners of IDUs were non-injectors, placing these non-injectors at great risk of HIV and STI transmission.

Male-to-male partnerships and commercial partnerships were much more common in Delhi than in Imphal, where the majority of partnerships were with regular partners. While there were similarities in factors associated with unprotected sex between IDUs in Delhi and Imphal, there were also important differences that need to be taken into account for sexual risk reduction counseling. For example, in Delhi, unprotected sex was common within partnerships where partners shared needles and syringes when injecting; in Imphal, unprotected sex was common in partnerships where the partner lived outside of Imphal.

Although the majority of female sex partners of IDUs are non-injectors, they have a high risk of HIV and STI infection from unprotected sex with IDUs. In Delhi, married men were more likely to have unprotected sex. Given that a large proportion of IDUs are married, many married women are at risk for HIV and STIs as has been shown in other studies in India (Chakrabarti *et al*, 2000; Panda *et al*, 2000, 2005, 2007; Kumar *et al*, 2008).

Because of the high potential for sexual transmission of HIV from IDUs to their sex partners (Chakrabarti *et al*, 2000; Kumar *et al*, 2008), interventions targeted at IDUs must include services for the non-injecting female partners of IDUs, including HIV and STI testing, and counseling for domestic violence as they often face abuse in relationships where the partner is involved with substance abuse. Women are often not in a position to negotiate safer sex due to fear of partner's reaction, hence placing themselves at risk for HIV and STIs (Go *et al*, 2003). Female partners of IDUs have been successfully reached through the use of female outreach workers and peer volunteers (Kumar *et al*,

2008). While India's current National AIDS Control Programme (NACP) III does include services for partners of IDUs, they have not been fully implemented in the field (NACO, 2007).

Some IDUs did have partners who also injected, primarily when the partner was another male. This type of relationship in which both partners inject can be risky as our results showed that unprotected sex was significantly more likely to occur when the index IDU and his partner share needles and syringes. These IDUs and their partners have the dual risk from risky sexual and injection practices. Previous studies suggest that these two behaviors may intersect due to higher levels of trust and familiarity within such intimate relationships (Unger *et al*, 2006; Gyarmathy and Neaigus, 2009). A perceived inevitability of getting HIV from unprotected sex may be used as a justification among IDUs who share needles, thus thinking that there is no additional risk of engaging unprotected sex or needle sharing. Programs need to address the risk of sharing injection equipment within the context of sexual partnerships where both partners inject drugs.

In both cities, condom use was less common in partnerships in which the partner was a regular or non-regular partner as opposed to a commercial partner. Stable or regular sexual partnerships are not necessarily protective for HIV and STIs, particularly when the relationship is with a high-risk partner. This is of particular concern in Imphal where a fairly sizeable percent (12%) of partnerships occurred in the context of multiple partnerships in which the index IDU had sex with a non-regular or commercial partner in addition to their regular partner. This sexual heterogeneity can facilitate the spread of HIV and other STIs within a population and spread between higher (commercial or non-regular partners) and lower risk groups (regular partners).

We also found that street-based IDUs in Delhi were more likely to have unprotected sex. Their unstable lifestyle and poor living conditions likely make it difficult for them to have condoms on hand. This finding is evidence for the need to have strong street-based outreach programs for IDUs, which has been shown to be effective in reducing HIV-related risk behaviors (Kumar *et al*, 1998; Needle *et al*, 2005).

Imphal is a relatively small city, and migration within and outside the city as well as state is not common due to political insurgency and ethnic conflicts. However, for those who did travel outside and met their partners outside of town, our results showed that unprotected sex was more likely. Many of the IDUs in Imphal were married; therefore, partners they met outside of town or state were most likely non-regular partners, with whom condom use was uncommon. Further, condoms are more difficult to obtain outside of Imphal where there are fewer pharmacies and HIV prevention services.

In Delhi, male-to-male sexual partnerships were common, and consistent condom use was low within these partnerships. Approximately 1-in-10 sexually active male IDUs in Delhi had only male partners, and a small subset engaged in sex with both male and females. Although these two groups may be a small subset of IDUs in Delhi, it can potentially be a very high-risk group in a context where male-to-male sex is often hidden, condom use is low, and the majority of HIV and STI prevention efforts focus largely on heterosexual transmission. According to the 2007 HIV sentinel surveillance estimates for Delhi, the HIV seroprevalence among

MSM (11.7%) is equally as high as the HIV seroprevalence among IDUs (10.1%), and Delhi is one of five Indian states with the highest HIV prevalence among MSM in the country (NACO, 2008). Programs must address the dual risk from injection and homosexual transmission that some of their target populations may have. It is also important for programs to recognize that the majority of the male-to-male sex occurred in exchange for money, drugs or gifts and in the context of forced sex. It is encouraging that the 2007 NACP-III includes MSM and transgendered persons as a strategic high-risk group for targeted interventions for HIV prevention and recognizes that these high-risk men have sex with both male and female partners (NACO, 2007).

We also found that partnerships in which the index IDU had previously tested for HIV (whether they knew they were positive or negative) had lower likelihood of inconsistent condom use. Previous studies have shown IDUs who had ever tested were more likely to have exposure to HIV prevention messages, and have higher self-perceived risk of acquiring HIV (Khera *et al*, 2008). Studies have also shown that HIV positive IDUs reduce their risky behaviors upon learning their HIV status (Vanichseni *et al*, 1992; Desenclos *et al*, 1993; Des Jarlais *et al*, 2004; Des Jarlais and Semaan, 2005. This may explain increased condom use among those who previously tested, even among those who tested HIV negative. Hence, greater efforts should be made to study how to increase HIV testing among IDUs.

An important limitation of this study is that we do not know the reliability and validity of partner characteristics as reported by the index subject. However, it has been shown that IDUs were reliable in reporting peer's age, sex and race/ethnicity, shared behaviors such as injecting drugs together and having sex with each other, and peer's injection behaviors (Neaigus *et al*, 1995). Second, our regression analysis did not account for the correlation between recruiters and recruits, which is required for data collected using RDS and is addressed when analysis is conducted in (RDSAT©) software. However, it was not possible to use RDSAT software for regression analysis since the analytic sample was restricted to the subsample of sexually active IDUs. However, because the unit of analysis of the regression analysis of unprotected sex was the partnerships, it was more appropriate to account for the correlation between partners of the index IDU.

Despite these limitations, this study has enhanced our understanding of the importance of sexual partnerships that have often been shown to increase the vulnerability to HIV and other STIs. It also illuminated differences in partnership characteristics between IDUs in Delhi and Imphal that must be accounted for when implementing sexual risk reduction strategies in these two cities. Further, this study also highlighted the importance of disassortative sexual mixing, which has the potential to act as an epidemiologic bridge as it increases sexual transmission risk of HIV to partners. Intervention efforts targeting sexual behaviors of IDUs may benefit from addressing the sexual partnership context in addition to individual level factors to prevent onward HIV transmission to partners.

ACKNOWLEDGEMENTS

The Department for International Development, UK provided financial support for this study.

REFERENCES

Aral SO, Hughes JP, Stoner B, *et al.* Sexual mixing patterns in the spread of gonococcal and chlamydial infections. *Am J Public Health* 1999; 89: 825-33.

Chakrabarti S, Panda S, Chatterjee A, *et al.* HIV-1 subtypes in injecting drug users & their non-injecting wives in Manipur, India. *Indian J Med Res* 2000; 111: 189-94.

Copenhaver MM, Johnson BT, Lee IC, Harman JJ, Carey MP. SHARP Research Team. Behavioral HIV risk reduction among people who inject drugs: meta-analytic evidence of efficacy. *J Subst Abuse Treat* 2006; 31: 163-71.

Des Jarlais DC, Perlis T, Poznyak V. Characteristics of injecting drug users (IDUs) in different regions of the world: WHO Phase II Study. Melbourne: International Conference on the Reduction of Drug Related Harm, 2004.

Des Jarlais DC, Semaan S. Interventions to reduce the sexual risk behaviour of injecting drug users. *Int J Drug Policy* 2005; 16 (suppl): 58-66.

Desenclos JC, Papaevangelou G, Ancelle-Park R. Knowledge of HIV serostatus and preventive behaviour among European injecting drug users. The European Community Study Group on HIV in Injecting Drug Users. *AIDS* 1993; 7: 1371-7.

Fenton KA, Korovessis C, Johnson AM, *et al.* Sexual behaviour in Britain: reported sexually transmitted infections and prevalent genital *Chlamydia trachomatis* infection. *Lancet* 2001; 358: 1851-4.

Go VF, Sethulakshmi CJ, Bentley ME, *et al.* When HIV-prevention messages and gender norms clash: the impact of domestic violence on women's HIV risk in slums of Chennai, India. *AIDS Behav* 2003; 7: 263-72.

Gregson S, Nyamukapa CA, Garnett GP, *et al.* Sexual mixing patterns and sex-differentials in teenage exposure to HIV infection in rural Zimbabwe. *Lancet* 2002; 359: 1896-903.

Gyarmathy VA, Neaigus A. The relationship of sexual dyad and personal network characteristics and individual attributes to unprotected sex among young injecting drug users. *AIDS Behav* 2009; 13: 196-206.

Hosmer DW Jr, Lemeshow S. Applied logistic regression. 2nd ed. New York: John Wiley and Sons, 2000.

Jain MK, John TJ, Keusch GT. Epidemiology of HIV and AIDS in India. *AIDS* 1994; 8 (suppl): 61-75.

Khera A, Haldar P, Garg R, Pinnameni YR, Chan P. Factors associated with HIV testing among populations at high risk of infection, India. [Poster presentation]. Mexico City: XVII International AIDS Conference, 2008.

Kumar MS, Mudaliar S, Daniels D. Community-based outreach HIV intervention for street-recruited drug users in Madras, India. *Public Health Rep* 1998; 113 (suppl): 58-66.

Kumar MS, Virk HK, Chaudhuri A, Mittal A, Lewis G. A rapid situation and response assessment of the female regular sex partners of male drug users in South Asia: factors associated with condom use during the last sexual intercourse. *Int J Drug Policy* 2008; 19: 148-58.

National AIDS Ccontrol Organization (NACO). National AIDS control organization. In: Targeted Intervention Under NACP III: Operational Guidelines (Volume I - Core High Risk Groups). New Delhi: Ministry of Health and Family Welfare, Government of India, 2007.

NationalAIDS Control Organisation (NACO). HIV sentinel surveillance and HIV estimation in India 2007: a technical brief. New Delhi: NACO, Ministry of Health and Family Welfare, 2008.

NationalAIDS Control Organisation (NACO). UNGASS Country Progress Report, India. New Delhi: NACO , Ministry of Health and Family Welfare, Government of India, 2010.

National AIDS Control Organization (NACO), Government of India. National AIDS

Control Programme, Phase III, State Fact Sheets. New Delhi: NACO, Ministry of Health and Welfare, Government of India, 2012.

Neaigus AI, Friedman SR, Goldstein M, Ildefonso G, Curtis R, Jose B.Using dyadic data for a network analysis of HIV infection and risk behaviors among injecting drug users. *NIDA Res Monogr* 1995; 151: 20-37.

Needle HR, Burrows D, Friedman SR, *et al.* Effectiveness of community-based outreach in preventing HIV/AIDS among injecting drug users. *Int J Drug Policy* 2005; 16: 45-57.

Panda S, Chatterjee A, Bhattacharya SK, *et al.* Transmission of HIV from injecting drug users to their wives in India. *Int J STD AIDS* 2000; 11: 468-73.

Panda S, Kumar MS, Lokabiraman S, *et al.* Risk factors for HIV infection in injection drug users and evidence for onward transmission of HIV to their sexual partners in Chennai, India. *J Acquir Immune Defic Syndr* 2005; 39: 9-15.

Panda S, Kumar MS, Saravanamurthy PS, *et al.* Sexually transmitted infections and sexual practices in injection drug users and their regular sex partners in Chennai, India. *Sex Transm Dis* 2007; 34: 250-3.

Pisani E, Dadun, Sucahya PK, Kamil O, Jazan S. Sexual behavior among injection drug users in 3 Indonesian cities carries a high potential for HIV spread to noninjectors. *J Acquir Immune Defic Syndr* 2003; 34: 403-6.

Sarkar S, Das N, Panda S, *et al.* Rapid spread of HIV among injecting drug users in northeastern states of India. *Bull Narc* 1993; 45: 91-105.

Sarna A, Tun W, Bhattacharya A, Lewis D, Singh YS, Apicella L. Assessment of unsafe injection practices and sexual behaviors among male injecting drug users in two urban cities of India using respondent driven sampling. *Southeast Asian J Trop Med Public Health* 2012; 43: 652-67.

Unger JB, Kipke MD, De Rosa CJ, Hyde J, Ritt-Olson A, Montgomery S. Needle-sharing among young IV drug users and their social network members: the influence of the injection partner's characteristics on HIV risk behavior. *Addict Behav* 2006; 31: 1607-18.

Vanichseni S, Choopanya K, Des Jarlais DC, *et al*. HIV testing and sexual behavior among intravenous drug users in Bangkok, Thailand. *J Acquir Immune Defic Syndr* 1992; 5: 1119-23.