ASSESSMENT OF UNSAFE INJECTION PRACTICES AND SEXUAL BEHAVIORS AMONG MALE INJECTING DRUG USERS IN TWO URBAN CITIES OF INDIA USING RESPONDENT DRIVEN SAMPLING

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Abstract. Designing interventions to reduce HIV transmission among injecting drug users (IDU) requires reliable estimates of risk behaviors. We present population-based estimates for unsafe injection practices and sexual risk behaviors among male IDUs recruited through respondent driven sampling in India (Delhi: 783; Imphal: 766). IDUs in Delhi, mostly street-based (68%), reported injecting pharmaceutical agents and a greater frequency of injections/day. IDUs in Imphal, mostly home-based (98%), used heroin/opioids and injected less frequently. Needle sharing was common (Delhi: 33%; Imphal: 43%). Sixty-five percent of IDUs in Delhi and 55% in Imphal were sexually active during the previous year. Multiple sexual partners were more frequent in Delhi (49% *vs* 21%); IDUs in Imphal reported more regular sex partners (82% *vs* 44%). Consistent condom use with regular partners was extremely low (Delhi: 8%; Imphal: 19%). HIV testing was infrequent (Delhi: 37%; Imphal: 49%). IDUs are a heterogeneous group with different prevention needs requiring need-based tailored prevention interventions.

Keywords: injecting drug users, HIV, sexual risk behaviors, unsafe injection practices, harm reduction

INTRODUCTION

It is estimated India has about 186,000 injecting drug users (IDU) (NACO, 2010). In 2008-2009, the National AIDS Control Organization (NACO) estimated the national HIV prevalence among IDUs to be 9.2% with differenes in prevalence rates by state. HIV prevalence was >5% among IDUs in 20 districts of India in 2008-2009 (NACO, 2010).

Unsafe injecting practices pose multiple risks, including transmission of HIV infection and other blood borne viruses, such as hepatitis B and C, contributing substantially to the morbidity and mortality of IDU (Degenhardt *et al*, 2004; Solomon *et al*, 2008). Risky sexual behavior facilitates transmission of infection to sexual partners who may or may not be injecting drug users (Panda *et al*, 2005;

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Abdala *et al,* 2008; Yao *et al,* 2009). A high prevalence of HIV among IDUs raises the risk of transmission of HIV infection from IDU to the general population through sexual contact with regular and non-regular partners, and the sale and purchase of sex (Panda *et al,* 2005; Abdala, *et al,* 2008; Yao, *et al,* 2009; Solomon *et al*, 2010b). Several studies have documented unsafe injection practices and sexual risk behaviors in India (Eicher *et al,* 2000; Panda, *et al,* 2005; NACO, 2006; Mahanta *et al,* 2008). Evidence for unsafe injection practices and sexual behaviors is drawn largely from studies using convenience or purposive sampling, (Panda *et al,* 2000; Solomon *et al,* 2008) snow ball sampling, (Eicher *et al,* 2000; Sharma *et al*, 2002) or privileged access interviews (Dorabjee and Samson, 2000).

Designing comprehensive public health interventions that address the problem of injecting drug use and related transmission of HIV and other blood borne infections, requires accurate and reliable population estimates (Mathers *et al,* 2008). Injecting drug use is illegal and stigmatized making studies in this population a challenge. There has been much discussion about the different methods to recruit marginalized and hidden groups for this purpose. Purposive sampling of people recruited by indigenous field workers or peer outreach workers may miss IDUs who do not access services; privileged access interviews are subject to similar limitations (Magnani *et al*, 2005; Platt *et al,* 2006). Chain referral sampling or snowball sampling permits better penetration of the community than purposive sampling, but relies heavily on the network of a few recruiters who may recruit people like themselves. Respondent Driven Sampling (RDS), a variant of chain referral sampling, draws recruits from the personal network of initial and subsequent respondents by controlling the recruitment process at each level, permitting recruitment chains to reach deeper into the community to provide a representative sample of the target group (Heckathorn, 1997, 2002; Salganik and Heckathorn, 2004; Magnani *et al,* 2005). RDS can provide population based estimates using a mathematical model that weights the sample by taking into account the participant's network size, homophily, and recruitment success and offers practical advantages over indigenous field workers (peers) in terms of greater recruitment efficiency (Heckathorn, 2002; Magnani *et al,* 2005; Platt *et al,* 2006). The recently concluded Integrated Behavioral and Biological Assessment (IBBA) survey utilized RDS to recruit IDUs in India, but the study was limited to rural parts of Manipur and Nagaland (Mahanta *et al,* 2008). A size estimation study conducted in Punjab and Haryana also used RDS (Ambekar and Tripathi, 2008).

We undertook a cross sectional survey with current injecting drug users, recruited through RDS to explore unsafe injection practices and sexual behaviors. In this paper we report the prevalence of high-risk injecting practices and sexual behaviors among male IDUs from Imphal, the capital city of the north-eastern state of Manipur, a state with a high HIV prevalence and from Delhi, the national capital with a low HIV prevalence. In both cities the HIV epidemic is concentrated in high-risk groups. Manipur has a high prevalence of injection drug use, which has been the main route of spread of HIV infection in the state; the HIV epidemic there has been in existence for several years. It is likely there is a greater acceptance of drug use and awareness of HIV in the city's population. Imphal

is a small, well-circumscribed urban city with a predominantly Manipuri population and little or no in-migration. Delhi, on the other hand, is a large metropolis with a heterogeneous population, and a large drug user population, estimated at around 35,000 IDUs by Aceijas *et al* (2006). Delhi also has a large migrant population. The prevalence of HIV in the general population is low in Delhi and there is a lower level of awareness of drug use and HIV. These contrasting features of the two study sites allow for a deeper understanding of differences in the social and behavioral characteristics of IDU and provide important insights for designing interventions tailored to the local context.

MATERIALS AND METHODS

Between September 2006 and January 2007, 1,600 current IDUs were interviewed in Delhi (783 males and 17 females) and Imphal (766 males and 34 females). The required sample size for each city was 760 based on an expected change in consistent condom use with non-regular partners from pre-intervention to post-intervention (45% to 55%) and a design effect of 1.5 to account for the correlation inherent in RDS. An inflation factor was used to account for 30% of the population not being sexually active. The sample size achieved exceeded the target sample size by 40 as IDUs continued to come to the study site with valid recruitment coupons.

Study participants were recruited using RDS. Recruitment was initiated through four "seeds" or index cases in Imphal (2 males; 2 females) and five in Delhi (3 males; 2 females). Each seed, a current IDU, was selected based on salient socio-metric characteristics: knowing many IDUs and being well integrated in the IDU community. Each participant was provided with three coupons to recruit 3 male or female participants and received USD 1.00 (INR 40) for each eligible recruitee. A "Coupon Manager" program was used to manage the recruitment process. Seeds were not included in the study sample. Inclusion criteria consisted of being a current IDU, being over 16 years of age and able to provide consent. The protocol was approved by the Institutional Review Board (IRB) of the Population Council of New York. The Managing Boards of the service provider NGOs in Imphal and Delhi approved the protocol. All participants gave written informed consent prior to inclusion in the study.

Face-to-face interviews were conducted by trained research interviewers using a structured, close-ended survey questionnaire that assessed socio-demographic profile, injection practices, sexual behavior, self-reported sexually transmitted infections (STIs), knowledge of HIV related services, and self-reported testing for HIV, hepatitis B and C. We also assessed awareness of and utilization of services during the past 12 months. Both NGOs participating in the study were providing harm reduction services, including needle-syringe exchanges, condoms, HIV-prevention counseling, detoxification/rehabilitation and treatment of abscesses in 2006/2007. Social Awareness and Service Organization (SASO) in Imphal reached around 2,000 IDUs with harm reduction services and around 250 with oral substitution therapy. In Delhi, Sahara Centre for Residential Care and Rehabilitation (Sahara) reached around 1,200 IDUs, with harm reduction services and rehabilitation services. During the same period there were other NGOs providing these services in Delhi. HIV testing and STI services were available through government centers. Interviews were conducted

in Hindi and Manipuri. All interviews were conducted at drop-in centers. Study participants received USD1.50 (Rs 60) for completing the survey. Data were collected using hand-held computers (DELL Axim X51) using Perseus 7.0.44 software.

For the purpose of this study active injecting drug use was defined as use of non-prescription intravenous drugs at least once during the previous 6 months. The reference period for reporting drug use and injecting practices was the previous month (30 days), similar to Behavior Sentinel Surveillance (BSS) 2006 (NACO, 2006) and the IBBA (National Interim Summary Report, IBBA, 2007).

Sexual activity was defined as having sexual intercourse (vaginal or anal) at least once during the previous 12 months. A regular partner was defined as a partner who the respondent was married to or cohabited with. A commercial/sex worker partner was someone the respondent had transactional sex with in exchange for money, gifts or drugs. A non-regular or casual partner was defined as a partner the respondent was not living with and did not pay for sex. Information on condom use was elicited for each type of partner during the last episode of sex and consistent use. Consistent condom use was defined as condom use with every sexual act during the reported period of 12 months to allow cross comparison with other behavioral surveys (BSS and IBBA).

Analysis of data was done using the RDS Analysis Tool version 5.6 (RDSAT), statistical software for RDS data that provides population based estimates with 95% confidence intervals (95% CI). Sample proportions are presented for small samples where statistical estimates are not available. We report the population based estimates for prevalence of unsafe injecting and sexual behaviors for each of the two sites without making statistical comparisons between sites; however, statistically significant differences between sites are implied by non-overlapping 95% confidence intervals. We present data only of male IDUs; female participants (Delhi: 17; Imphal: 34) were excluded due to small numbers recruited.

RESULTS

The socio-demographic characteristics of the 783 male IDUs in Delhi and 766 male IDUs recruited in Imphal are shown in Table 1. The median ages of male IDUs in Delhi (31 years; IQR 25-39) and Imphal (31 years; IQR 27-35) were similar. Important differences were observed in education levels, marital status, living conditions and employment of male IDUs between the two sites. IDUs from Delhi represented a largely street-based, single population with lower levels of education compared to respondents from Imphal, half of whom were married, and the majority were home-based with at least 6 years or more of education (Table 1). The majority of male IDUs in Delhi were self-employed earning their living mostly from rag picking, while less than half the male IDUs from Imphal were employed.

Drug use behavior

IDUs in Delhi reported greater use of pharmaceutical agents than those in Imphal using antihistamines: pheniramine: 91% *vs* 1%; tranquilizers: diazepam: 83% *vs* 1%; semi-synthetic opioids: buprenorphine 93% *vs* 0%; opioid analgesics: meperidine: 13% *vs* 5%, while IDUs in Imphal reported higher use of opioids: heroin (79% *vs* 1%) and dextropropoxyphene: 22% *vs* 6%. Amphetamine and cocaine use was reported by a few, only in Delhi (<1%); crack use was not reported

Table 1
Sociodemographic characteristics of male injection drug users in Delhi and Imphal, 2006-2007.

	Delhi % (95% CI) *N* = 783	Imphal % (95% CI) *N* = 765
Age (years)		
≤25	29.6 (24.5-35.6)	20.5 (16.6-24.8)
26-35	44.0 (37.0-48.8)	55.5 (50.5-60.4)
≥36	26.3 (22.5-32.0)	24.0 (19.4-28.9)
Education		
Never attended school	45.5 (39.4-51.3)	4.9 (3.2-7.1)
1-5 years	33.5 (27.4-39.9)	6.6 (4.5-9.3)
6-12 years	20.8 (16.5-25.2)	74.4 (70.8-79.0)
Graduate or higher	0.4 (0.0-1.4)	14.1 (10.1-16.9)
Marital status		
Currently married/co-habiting	30.1 (24.3-36.8)	48.9 (43.2-53.5)
Never married	56.5 (49.4-62.2)	46.5 (41.9-52.0)
Divorced/separated/widowed	13.4 (9.3-19.6)	4.6 (3.1-6.5)
Current living situation		
Home-based	29.1 (22.4-37.7)	97.9 (95.7-99.4)
Care home/shelter	1.8 (0.7-3.4)	0
Street-based	68.2 (59.5-75.0)	0
Other	0.8 (0.2-1.9)	2.1 (0.6-4.3)
Employment status		
Employed	92.9 (90.7-94.8)	49.7 (44.8-55.0)
Not employed	7.1 (5.2-9.3)	50.3 (45.0-55.2)
Type of employment	*n* = 688	*n* = 341
Formal sector	2.7 (1.4-5.3)	28.0 (17.6-37.6)
Daily wage laborer	11.3 (7.7-14.9)	26.6 (16.4-37.9)
Self-employed	82.5 (78.1-87.0)	44.4 (34.9-56.5)
Other	3.5 (1.2-5.3)	0.9 (0.0-1.8)

CI, confidence interval

at either site (data not shown).

IDUs in Imphal were more likely to have been injecting for longer periods of time than those in Delhi, although duration of drug use (injecting and non-injecting) was similar between sites (Table 2). IDUs in Delhi were more likely to start injecting at an older age; over half of IDUs in Delhi (52%) started injecting after age 26 (Table 2). Frequency of injections was higher among IDUs in Delhi than those in Imphal; 61% of IDUs in Delhi reportedly injected two or more times per day.

High-risk injecting behaviors, such as sharing needles, not-cleaning needles previously used by others, sharing injecting equipment and drawing from common containers during the previous month were reported more frequently among IDUs in Imphal (Table 2). Practices such

Table 2
Injection behaviors of male IDUs in Delhi and Imphal, 2006-2007.

	Delhi % (95% CI)	Imphal % (95% CI)
Duration of drug use (injecting or non-injecting)	*n* = 773[a]	*n* = 748[a]
< 1 year	6.2 (2.4-11.5)	1.3 (0.5-2.5)
1-5 years	23.1 (18.1-30.1)	20.1 (16.3-24.3)
6-10 years	28.5 (23.0-32.8)	27.9 (23.6-32.0)
≥11 years	42.2 (36.3-48.1)	50.6 (45.5-55.6)
Duration of injection drug use	*n* = 773[a]	*n* = 748[a]
< 1 year	25.6 (20.1-32.0)	7.0 (4.8-9.6)
1-5 years	49.6 (43.8-55.6)	35.6 (31.0-40.6)
6-10 years	19.5 (15.4-23.6)	23.5 (19.5-27.6)
≥11 years	5.3 (3.5-7.4)	33.9 (28.7-38.8)
Age at first drug injection (years)	*n* = 773[a]	*n* = 748[a]
< 15	2.3 (1.1-3.7)	5.8 (3.8-9.0)
16-20	18.7 (14.4-23.5)	34.6 (29.3-38.2)
21-25	26.8 (21.8-31.7)	35.9 (31.6-41.4)
26-30	20.9 (15.0-26.7)	15.7 (12.3-19.2)
≥31	31.3 (26.8-37.3)	8.0 (5.7-10.8)
Frequency of injections in last 1 month	*n* = 773[a]	*n* = 748[a]
Never	1.9 (0.6-2.8)	8.7 (5.9-11.0)
1-3 times/month	9.9 (7.1-12.8)	25.9 (22.2-31.0)
Once/week	3.6 (0.4-10.0)	5.6 (3.5-8.6)
2-6 times/week	11.0 (7.4-14.2)	24.4 (20.5-29.3)
Once/day	13.0 (8.7-18.3)	8.7 (5.5-12.7)
Two or more times/day	60.6 (54.5-67.0)	26.9 (21.8-30.3)
Number of people with whom respondent shared needles[a]	*n* = 742[a]	*n* = 627[a]
0	59.1 (53.5-65.2)	35.7 (29.8-42.5)
1-5	34.2 (28.5-39.6)	53.1 (47.1-59.3)
> 5	6.8 (4.8-8.5)	6.7 (4.4-8.9)
No response	- 4.5	
Injecting with a needle used by someone else	*n* = 742[a]	*n* = 627[a]
Every time	2.1 (1.1-3.0)	0.2 (0.1-0.7)
Most of the time	2.2 (1.1-3.0)	4.0 (2.0-5.2)
Sometimes	29.2 (24.2-33.8)	38.8 (32.6-43.6)
Never	66.6 (62.0-72.0)	57.0 (52.5-64.0)
Cleaning needles previously used by someone else	*n* = 311[a]	*n* = 303[a]
Every time	69.3 (61.7-82.8)	34.9 (25.5-44.4)
Most of the time	16.8 (7.4-23.6)	24.9 (17.0-32.3)
Sometimes	12.8 (4.6-17.5)	39.3 (28.0-50.7)
Never	1.1 (0.0-6.5)	0.9 (0.1-4.4)
Lending needles to someone else after injecting with it	*n* = 742[a]	*n* = 670[a]
Every time	0.9 (0.3-1.7)	30.0 (0.1-0.3)
Most of the time	2.6 (1.1-4.2)	4.2 (2.3-5.9)
Sometimes	33.6 (27.9-38.2)	45.3 (38.1-50.1)
Never	62.5 (57.8-68.8)	50.3 (45.6-57.6)
Sharing injection equipment	*n* = 742[a]	*n* = 670[a]
Every time	4.2 (2.9-5.8)	2.2 (1.1-3.5)
Most of the time	2.2 (1.2-3.3)	16.3 (11.4-18.1)
Sometimes	21.0 (17.0-25.3)	52.4 (47.3-58.7)
Never	72.4 (67.7-76.9)	29.0 (24.5-35.7)

Table 2 (Continued).

	Delhi % (95% CI)	Imphal % (95% CI)
Drawing drugs from a common container	$n = 767$[a]	$n = 670$[a]
Every time	4.6 (3.0-6.5)	2.0 (1.0-3.5)
Most of the time	7.1 (4.7-9.7)	16.6 (12.2-19.3)
Sometimes	43.5 (37.5-49.0)	51.5 (45.6-56.9)
Never	44.6 (38.8-51.3)	30.0 (25.5-36.7)
Usual place of getting new needles	$n = 783$[a]	$n = 765$[a]
Needle exchange	54.2 (49.9-63.3)	47.9 (42.2-52.6)
Chemist's shop	37.6 (30.8-44.0)	49.2 (44.5-55.0)
Drug dealer/peddler	4.7 (1.3-9.2)	1.4 (0.6-2.4)
Other (health worker, family/spouse, friends)	1.6 (0.5-2.6)	1.5 (0.5-2.7)

CI, confidence interval

[a]Sample sizes vary slightly due to missing data. *n* values shown in table have been derived using RDS and may not correspond to sample proportions.

as receiving injections from fixers or back/front loading were reported infrequently by IDUs from both sites; 86% (95%CI 72.7-89.4) of IDUs in Imphal and 83.8% (95%CI 81.0-87.1) in Delhi reported never having received an injection from a fixer and 80.5% (95%CI 77.1-85.3) from Imphal and 77.1% (95%CI 73.4-81.9) from Delhi never back/front loaded.

A similar proportions of IDUs at both sites reported using needle syringe exchange programs (NSEP) to procure clean needles and syringes (Table 2). Safe disposal of used needles and syringes is an important part of harm reduction programs. IDUs in Imphal were significantly more likely to report throwing used needles/syringes anywhere compared to IDUs in Delhi [Imphal: 65.2% (95%CI 58.8-70.5) *vs* Delhi: 41.2% (95%CI 34.3-47.6)] and less likely to return them to NSEP [Imphal: 13.6% (95%CI 9.9-18.2) *vs* Delhi: 48.7% (95%CI 42.4-55.6)].

Alcohol use

Alcohol consumption while injecting drugs was reported more frequently by IDUs from Imphal (36.8%; 95%CI 32.7-42.0) than Delhi (23%; 95%CI 18.5-29.5). The most commonly cited reasons for combining alcohol with drugs were to enhance intoxication from drugs [Imphal 74% (95%CI 32.8-73.7) *vs* Delhi 63.5% (95%CI 64.5-83.4)] and peer influence [Imphal 21.7% (95%CI 12.1-30.5); Delhi 23% (95%CI 12.9-46)].

HIV and hepatitis B and C awareness and testing

HIV awareness was higher in Imphal than Delhi 99.8% (95%CI 99.5-99.9) *vs* 72.9% (95%CI 66.0-79.3). HIV testing was infrequently reported at both sites [Imphal: 49.2% (95%CI 43.3-53.8) *vs* Delhi: 37.1% (95%CI 31.0-42.6)]. Self-reported HIV-positive results, among those who had an HIV test, were 44.2% (95%CI 34.6-55.5) in Imphal and 23.9% (95%CI 14.2-35.9) in Delhi.

Awareness of hepatitis B was higher among IDUs in Imphal than Delhi [65.0% (95%CI 59.7-69.9) *vs* 14.1% (95%CI 11.2-18.3)]. In Imphal: 17.4% (95%CI 13.4-24.3) of IDUs and in Delhi 35.6% (95%CI:

Table 3
Sexual behaviors of male injection drug users in Delhi and Imphal, 2006-2007.

	Delhi % (95% CI) *N* = 783	Imphal % (95% CI) *N* = 765
Had sex in the last 12 months	64.7 (58.1-71.4)	54.6 (49.1-58.8)
	n = 552[a]	*n* = 435[a]
Had sex with a female partner	89.9 (87.1-93.9)	95.5 (89.8-99.6)
Number of female sex partners	*n* = 424[a]	*n* = 338[a]
1	51.0 (43.9-61.9)	78.8 (72.2-87.0)
2-5	38.0 (29.0-45.5)	19.2 (12.1-26.3)
6-20	9.2 (3.9-13.5)	2.0 (0.0-2.3)
21+	1.8 (0.8-3.4)	0
Had regular female partner	44.2 (37.4-55.4)	81.8 (77.1-88.5)
Number of regular female partners	*n* = 182[a]	*n* = 274[a]
1	93.8 (93.7-98.8)	92.1 (85.5-96.9)
2-5	4.3 (0.6-4.5)	7.9 (3.1-14.5)
6-20	1.8 (0.0-2.5)	0
21+	0	0
Condom use with regular female partners over past 12 months	*n* = 182[a]	*n* = 274[a]
Consistent	8.0 (1.4-22.0)	19.0 (12.5-37.5)
Inconsistent	33.1 (18.2-58.5)	51.5 (39.3-62.8)
Never	58.9 (30.9-74.8)	29.5 (16.1-34.1)
Condom use at last sex with regular female partner		
Yes	20.7 (8.2-35.7)	50.1 (43.6-63.1)
No	79.3 (64.3-91.8)	46.8 (35.0-54.8)
No response	-	3.1 (1.5-3.9)
Had sex with a commercial sex partner	57.9 (46.7-64.5)	20.7 (14.2-26.9)
Number of commercial female sex partners	*n* = 293[a]	*n* = 57[a]
1	36.6 (24.6-49.5)	47.4 (27/57)
2-5	48.7 (36.1-59.9)	49.1 (28/57)
6-20	11.9 (4.5-23.4)	3.5 (2/57)
21+	2.8 (0.9-6.9)	0
Condom use with commercial female partners	*n* = 293[a]	*n* = 57[a]
Consistent	46.3 (35.6-58.3)	66.7 (38/57)
Inconsistent	19.6 (11.9-35.5)	22.8 (13/57)
Never	34.1 (19.9-41.8)	10.5 (6/57)
Condom use at last sex with commercial sex partner		
Yes	65.5 (58.4-79.9)	78.9 (45/57)
No	34.5 (20.1-41.6)	21.0 (12/57)
Had anal sex with male partner	18.4 (13.2-24.7)	1.6 (0.1-3.2)
	n = 126[a]	-
Had regular male partners	16.6 (3.3-18.9)	
Condom use with regular partners[b]	*n* = 32[a]	-
Consistent	28 (9/32)	
Inconsistent	16 (5/32)	
Never	56 (18/32)	

Table 3 (Continued).

	Delhi % (95% CI) *N* = 783	Imphal % (95% CI) *N* = 765
Paid for sex with male partner	*n* = 126[a] 77.9 (72.0-97.0)	
Number of male commercial partners	*n* = 100[a]	
1	17.7 (0.0-78.0)	
2-5	38.6 (0.0-60.3)	-
6-20	33.1 (0.0-90.8)	
21+	10.6 (0.0-20.7)	
Received money for sex with male partner	*n* = 126[a] 26.0 (4.6-26.4)	-
Condom use with men from whom they received money for sex[b]	*n* = 42[a]	
Consistent	38 (16/42)	
Inconsistent	24 (10/42)	-
Never	38 (16/42)	

[a]*n* values shown in table have been derived using RDS and may not correspond to sample proportions.
[b]Sample proportions are presented as population estimates are not available for small sample sizes.

8.4-41.7) of IDus had hepatitis B testing. Of these, 6% (5/86) from Imphal and 16% (5/32) from Delhi self-reported positive test results. Awareness of hepatitis C was higher among IDUs from Imphal than Delhi [46.1% (95%CI 40.6-51.3) *vs* 8.9% (95%CI 6.5-12.3)]. Twenty point one percent of IDUs from Imphal (95%CI 13.0-27.7) and 37.4% from Delhi (95%CI: 2.1-52.7) had hepatitis C testing. Of these, 40% (57/80) of IDUs from Imphal and 44% (11/25) from Delhi reported positive test results.

Sexual behavior

In the 12 months preceding the survey, more than half the participants were sexually active, mostly with female partners (Table 3). Multiple sexual partnerships were more frequently reported in Delhi (49%) than Imphal (21%). More IDUs in Imphal reported regular partners than in Delhi. In both locations the majority of regular partners were non-IDU [Delhi: 97.1% (95%CI 96.9-100.0); Imphal: 97.2% (95%CI 93.4-100.0)] (data not shown). Self-reported consistent condom use with regular partners was extremely low at both sites (Table 3).

Sex with female partners in exchange for money, drugs or gifts (commercial sex) was more common among male IDUs in Delhi than in Imphal (58% *vs* 21%) (Table 3). In Delhi (*n*=293) 56.3% (95%CI 40.9-67.4) of IDUs picked up commercial sex partners at public places; 35.8% (95%CI 22.7-49.6) visited brothels; 5.7% (95%CI 2.3-16.2) used home based sex workers and <3% reported other venues. In Imphal (*n*=57) the distribution was more varied, 37% reported visiting brothels, 18% picked up sex workers from public places, 18% from a lodge or hotel, 12% from bars or massage parlors, 4% picked home based sex workers and the remainder (12%) from

Table 4
Exposure to HIV prevention program among male IDUs in Delhi and Imphal, 2006-2007.

	Delhi % (95% CI) N = 783	Imphal % (95% CI) N = 765
Aware of drug withdrawal programs in city	79.1 (73.3-85.8)	91.5 (88.7-94.0)
Aware of HIV/AIDS prevention programs for drug users	64.8 (58.4-71.4)	93.8 (91.8-95.5)
Encountered the following activities in last 12 months:		
Referred for HIV counselling and testing	21.8 (18.2-26.3)	60.7 (55.3-65.1)
Counselled on HIV prevention by outreach/social worker	52.5 (47.1-58.9)	75.8 (71.5-79.6)
Referred for needle exchange	61.9 (55.9-68.7)	75.2 (70.5-78.9)
Referred for medical services	24.4 (19.4-28.5)	27.4 (22.2-31.4)
Referred for detoxification rehabilitation	36.0 (30.8-42.4)	54.7 (49.1-59.6)
Received information on HIV	66.1 (59.4-72.3)	88.2 (85.5-90.8)
Knows where and how to receive the following services in city		
Needle exchange services	72.3 (65.9-79.2)	92.8 (90.2-94.8)
Treatment for abscesses	67.9 (61.7-74.4)	38.1 (33.5-43.9)
Free HIV test	52.3 (47.0-58.8)	72.9 (68.4-77.1)
Information on STI and HIV/AIDS	58.5 (52.2-65.3)	79.5 (75.1-83.2)
Medical help for HIV-infected people	33.2 (29.1-39.1)	56.7 (52.5-62.0)
STI testing	41.0 (36.5-47.6)	33.0 (28.6-38.7)
Rehabilitation/detoxification for IDUs	72.9 (68.0-79.1)	85.4 (81.4-88.7)
Receiving condoms	72.4 (65.7-79.0)	85.0 (81.7-88.9)
Drug abuse related services obtained in the last 12 months		
Treatment of abscess	30.5 (25.4-35.2)	9.0 (6.9-11.7)
Treatment for overdose	3.4 (2.1-5.1)	10.2 (7.8-12.9)
Drug substitution	28.5 (23.2-34.4)	63.0 (58.1-67.9)
Outpatient counselling	27.4 (23.2-32.5)	61.3 (56.4-66.6)
Self-help group	35.2 (30.3-40.8)	22.2 (18.2-26.8)
Detoxification	35.9 (30.0-41.8)	54.9 (49.4-59.5)
Rehabilitation	10.1 (7.6-13.0)	27.6 (23.6-32.8)

unspecified places (population-based estimates for characteristics of commercial sexual behaviors not available for Imphal due to small sample size). Public places included parks, railway tracks, under bridges, cinema halls and public toilets. Self-reported consistent condom use with commercial sex partners was higher than with regular partners at both sites (Delhi: 46% and Imphal: 67%).

Sexual partnerships with non-regular female sex partners were not commonly reported in Delhi [18% (95%CI 11.3-24.0)] or Imphal [22.9% (95%CI 16.3-29.8)] and consistent condom use with these partners was low (Delhi: 27%; Imphal: 39%) (Data not shown).

Sex with male partners. Male-to-male sexual relations were reported by a fifth of male IDUs in Delhi (*n*=126) (Table 3). Buying sex from male partners (78%) and selling sex for money or drugs (26%) was reported. Consistent condom use was low with both regular and commercial male

sex partners (Table 3). Only 5 IDUs from Imphal reported sex with a male partner (data not shown).

Self reported STIs. IDUs in Delhi reported STI related symptoms more frequently than IDUs from Imphal such as penile discharge [Delhi: 19.6% (14.2-23.8) *vs* Imphal: 4.1% (2.0-8.3)] and penile sores/ulcers [Delhi: 13.2% (95%CI: 8.9-18.4) *vs* Imphal: 5.9% (95%CI: 2.9-9.8)]. IDUs in Imphal were more likely to seek treatment for these conditions [Imphal: 72.3% (95%CI 66.7-100.0); Delhi: 41.5% (95%CI 27.0-72.3)].

Awareness and utilization of harm reduction services

Harm-reduction services, including abscess management, detoxification, management of overdose and rehabilitation, have been available in Delhi and Imphal since the early 90s. Overall, IDUs in Imphal were more aware of both rehabilitition (Imphal: 91.5%; Delhi: 79.1%) and HIV/AIDS prevention programs (Imphal: 93.8%; Delhi: 64.8%) (Table 4). IDUs in Imphal were more likely to have encountered various harm reduction and HIV prevention services during the previous 12 months, such as referral for HIV counseling and testing (60.7% *vs* 21.8%), HIV counseling by an outreach worker (75.8% *vs* 52.5%), referral for needle exchange (75.2% *vs* 61.9%) and detoxification rehabilitation (54.7% *vs* 36.0%). IDUs in Imphal were also more likely to have greater awareness of where and how to obtain these services, with the exception of abscess treatment and STI treatment. Drug substitution use (63.0% *vs* 28.5%), outpatient counseling (61.3% *vs* 27.4%), detoxification (54.9% *vs* 35.9%) and rehabilitation services (27.6% *vs* 10.1%) during the previous 12 months were more commonly sought by IDUs in Imphal than IDUs in Delhi. However, Delhi IDUs were more likely to obtain treatment for abscesses than those in Imphal (30.5% *vs* 9.0%). Seeking overdose treatment was low in both cities (Delhi: 3.4%; Imphal: 10.2%).

DISCUSSION

This study reveals two distinctly different sets of drug use patterns, living conditions and sexual risk behaviors among IDUs in two cities. IDUs in Delhi reported higher use of pharmaceutical agents associated with a greater frequency of injections, and low consistent use of sterile needles despite participation in NSEP. In contrast, IDUs in Imphal used largely heroin and opioids, injected less frequently, and reported low utilization of sterile needles. IDUs in Delhi, in contrast to those in Imphal, were found to be mostly single and street-based, a reflection of the city with its large male migrant population coming in search of work and residing in slum clusters and unstable housing. IDUs in Imphal were found to be mostly married and living with their families. Imphal is a smaller city with limited economic opportunities that can attract a migrant population. Despite higher levels of awareness of HIV infection, NSEP, and IDU targeted prevention services, living with families and accessing associated support networks, IDUs in Imphal reported higher levels of unsafe injecting practices. The unstable political environment, military presence and underground insurgency in the state affects service delivery, mobility of IDUs and their ability to access services. Mahanta *et al* (2008) report similar barriers in Bishnupur, and Churachanpur, Manipur. Additionally, IDUs in Imphal had been injecting for longer periods of

time and had established injecting practices. An intervention strongly rooted in a behavior change theory, such as social cognitive theory, that emphasizes skill building, may be needed (Bandura, 1986). For IDUs from Delhi, the barriers were lower levels of awareness of HIV, unstable housing, high level of mobility related to rag picking work and the search for cheap drugs. Unstable living conditions, high mobility and associated changing personal networks are associated with higher risk behavior among IDUs (Corneil *et al,* 2006; Costenbader *et al*, 2006; Des Jarlais *et al*, 2007). The Behaviour Sentinel Surveillance (BSS, 2006) report a similar prevalence to our study for needle sharing and drug use patterns in Delhi and Manipur (NACO, 2006). The differences between the two cities highlight the need to consider IDUs as a heterogeneous group with different prevention needs and to adapt interventions to the environment and needs of the populations involved. For example, more network service delivery points may be needed to reach and retain the unstable and highly mobile IDUs of Delhi. Different counseling methods and behavior change strategies may be required for recent injectors, as seen in Delhi, compared to long term injectors who may have severe addictions and deeply entrenched behaviors, as seen in Imphal.

The use of alcohol was reported by more IDUs in Imphal than in Delhi. This is particularly interesting as alcohol is a prohibited substance in Manipur but legally available in Delhi. A possible reason for this difference between sites could be that the majority of IDUs in Delhi were using other central nervous system (CNS) depressants, sedatives and hypnotics. Thus, IDUs at both sites used opioids and CNS depressants (alcohol in Imphal and pharmaceuticals in Delhi). This has implications for the program. Additionally, the widespread use of Buprenorphine in Delhi, has implications for oral substitution programs (OST) that are currently being scaled up. Tighter monitoring of the OST program will be required.

More than half of IDUs were sexually active in both cities. In Delhi, the majority of male IDUs were single, in unstable and multiple sexual relationships, and engaged in commercial sex with both male and female partners. Self-reported condom use was low with all partners. In contrast, IDUs in Imphal tended to be married and engaged in sex mostly with regular partners. The risk for HIV infection through sexual transmission in Delhi is from multiple sexual partnerships and low condom use with partners, while in Imphal, despite fewer sexual partners, the risk for HIV transmission remains given low condom use in the context of a high HIV prevalence. A low level of condom use with regular female partners has been reported by several studies (Vanichseni *et al,* 1992; Panda *et al,* 2000, 2005; Abdala *et al,* 2008; Yao *et al,* 2009). Additionally, the majority of the male IDUs' sex partners were non-IDUs, a fact which has major implications for the spread of HIV. Dissortative sexual mixing serves as a bridge for HIV transmission to other low-risk groups (Williams *et al*, 2003; Doherty *et al*, 2005; Hertog, 2007; Aitken *et al*, 2008). HIV transmission to non-injecting spouses/partners and children, necessitates a focus on partners of IDUs more directly, through interventions addressing couples.

Male-to-male sex, reported by a quarter of IDUs in Delhi and characterized by multiple partners and very low condom use, requires special focus in view of the high levels of unprotected sex. Sharma *et al* (2002) also reported anal sex among

a quarter of male IDUs in their study in Delhi. The perception that anal sex is less risky needs to be explored in this group. Further research exploring risk behavior associated with the sale and purchase of sex for drugs by male IDUs is needed in India; the overlap between sex work and female IDUs has been documented in India and elsewhere (Panda *et al,* 2001; Des Jarlais *et al*, 2002). IEC materials and prevention interventions need to emphasize partner reduction and consistent condom use with all type of partners for all types of sex (vaginal, anal).

Targeted interventions for harm reduction and HIV prevention, with varying levels of community outreach activities, have been in existence in Delhi and Imphal since 2000. HIV testing has been shown to effect behavior change in the general population and among IDUs (Vanichseni, *et al,* 1992; Descenclos *et al*, 1993; Weinhardt *et al*, 1999; Ruan *et al*, 2004; Solomon *et al,* 2010b). Yet more than a quarter of the IDUs in Delhi had not heard of HIV and less than half had been tested for HIV infection in Delhi and Imphal, highlighting a gap in prevention programs. Knowledge regarding hepatitis B and C was even lower. Although a small number of IDUs had been tested for hepatitis C, the prevalence of hepatitis C, based on self reports was high at 44% in Delhi and 57% in Imphal. High prevalence rates based on serological testing have been reported in India (Baveja *et al*, 2003; Mahanta *et al,* 2008; Solomon, *et al,* 2008). Des Jarlais *et al* (2005), in their review of interventions to reduce sexual risk behaviors among IDUs, noted gaps existed in most countries between the number of IDUs who could benefit from HIV prevention and outreach services and the number of IDUs who received them. Community outreach programs can advance HIV prevention efforts (Needle *et al,* 2005); a review of the current program to identify gaps and weaknesses is required. Intervention research should be undertaken to evaluate culturally adapted HIV prevention and harm reduction interventions in India. IDU prevention efforts should include testing for hepatitis B and C and the provision of hepatitis B vaccination. Both infections can be transmitted sexually and impact the outcome of HIV infection and subsequent treatment with ART.

This study was not without limitations. We aimed to reach both male and female IDUs. Despite using RDS with male and female seeds and allowing participants to bring in IDUs of both sexes, we were able to recruit only 51 female IDUs at both sites. The small number of female IDUs recruited in this study is likely a reflection of the reality of injection drug use in India rather than a failure of the sampling strategy to recruit females. This pattern has been documented in other Asian countries like Thailand (Wattan *et al,* 2007). The IBBA survey recruited only male IDUs through RDS. It is also possible female IDUs may also be poorly networked and therefore difficult to reach. RDS was successful in reaching IDUs who had not used harm reduction and HIV prevention services in the past year. Self-reported behaviors are subject to social desirability and recall biases. To overcome this, we used a 30-day recall period for injection practices. For sexual behaviors we used a comparative reference period with other surveys. Our results were similar to those of the BSS (2006) from the same period, supporting the view that IDUs report behaviors truthfully. Laboratory testing for HIV, hepatitis B and C and sexually transmitted infections would have strengthened the study.

In conclusion, this study provides population based estimates for unsafe injecting and risky sexual behavior among IDUs in two urban cities of India. Comprehensive prevention interventions that focus on both injection and sexual behavior of IDUs and their partners are required. Prevention programs need to include interventions for other blood borne viral infections, such as hepatitis B and C. A review of existing programs is urgently required to review activities and identify gaps. More importantly, prevention programs should be designed to address the specific needs of different populations in different regions of the country; a one size fits all approach may not be appropriate.

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