

Article

High prevalence associated with unsafe injection practices among male injecting drug users in Chennai city, Tamil Nadu State, India

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The intertwined epidemics of HIV/AIDS and injecting drug use are among the most emerging public health problems in India. Injecting Drug Usage (IDU) was found to be more prevalent among the ex-prisoners who were visiting the World Vision of India. The objective of this study was to determine the prevalence and correlates of HIV infection among a sub-sample of frequently incarcerated community-based injecting drug users (IDU) in Chennai city, India. 180 injecting drug users were recruited and interviewed using a structured questionnaire regarding their socio-demographics and HIV risk characteristics. Data were analyzed using χ^2 and multiple logistic regression to estimate odds ratios (OR) and 95% confidence intervals (CI). The prevalence of HIV infection was 69.4% among male injecting drug users. In the multivariable analysis, a history of shared drug injection inside prison (OR, 2.45; 95% CI, 1.01-4.3) and that of multiple incarcerations (OR, 4.15; 95% CI, 1.08-8.03); and tattooing (OR, 2.9; 95% CI, 1.80 -3.78) were associated with significantly higher prevalence of HIV infection. This study proved that incarceration-related exposures and tattooing proved to be the main correlates of HIV-1 infection. Urgent and comprehensive HIV prevention programmes and cost effective rehabilitation centres for injecting drug users in and out of prison are of prime importance to prevent further transmission of HIV infection.

Key words: HIV, injecting drug users (IDUs), intravenous drug use (IvDU), incarceration or detention in prison.

INTRODUCTION

Since the late 1980s, Asia has experienced the twin epidemics of injecting drug users (IDU) and explosive rates of HIV/AIDS. Estimates suggest that there are 13.2 million injecting drug users (IDUs) worldwide and according to UNAIDS, Asia is likely to have the most injecting drug related HIV cases in the world (Aceijas et al., 2004); the primary reason being the boom in drug production in several Asian countries and drug using populations which propel rapidly along drug trafficking routes, creating new drug markets and new HIV threats in host countries. The new 2006 estimates released recently by the National AIDS Control Organization (NACO), supported by UNAIDS and WHO, indicate that national adult HIV prevalence in India is approximately

0.36%, which corresponds to an estimated 2 million to 3.1 million people living with HIV in the country. However, the 2006 surveillance figures show an increase in HIV infection among several groups such as people who inject drugs and men who have sex with men (Bull et al., 2002; Panda et al., 2005). The HIV positivity status among injecting drug users has been found to be significantly high in cities of Chennai, Delhi, Mumbai and Chandigarh. In addition, the states of Orissa, Punjab, West Bengal, Uttar Pradesh and Kerala also show high prevalence among this group (World health Organization, 2007).

In India, the HIV infection crisis continues to deepen, as it becomes clearer that the epidemic is affecting all sectors of Indian society, with an increasing prevalence among the injecting drug users and prisoners. Drug abuse is alarmingly on the rise in India. Friedman from CDC (Center for Disease Control) reports 66% (297/447) of the IDUs, estimates were reported without technical

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information in Manipur, India. Although, IDU behavior was known to be more prevalent in the North east India, it is now on the increase in South India as well. Injecting drug users inject drugs into veins. Drug injecting is often a group activity among IDUs. The common practice is to use the same syringe and needle for all the members of the group (<http://www.who.int/mediacentre/news/releases/2007/pr37/en/index.html>). If one member of the group has HIV infection, the infection would readily enter the other members. The chances of infection through the injecting route are much higher than sexual route of transmission (Heimer,). Thus, once HIV enters into the circuit of IDU, the spread within the IDU community becomes rapid. Intake of illicit drugs is strongly disapproved in India and in many other countries where drug abuse is a criminal act and punishable under law. Criminalisation of drug abuse makes the IDUs hard to reach. The Injecting Drug Users are incarcerated often since they get involved in criminal activities such as thefts, pickpocket, chain snatching, burglary or attempts to murder an individual in pursuit of money to buy the injectable drugs. The relationship between drug abuse and incarceration has been well established in this study.

The supply of drugs in the prison is related to the consistent demand from criminal addicts who have not been brought to a halt despite the strict administration of the prison authorities.

The objective of this study is to highlight the inter-relationship of unsafe injection practices, frequency of incarceration and incidence of HIV infection among IDU male population (Injecting Drug Users) in Chennai city, Tamil Nadu.

METHODS

The survey was conducted in North Chennai city, in a relatively poor area where there was high concentration of drug users; which primarily focused on those who visit the 'drop-in centres' (mini-clinics) of the World Vision of India. In June 2005, a consecutive sample of 200 injecting drug users was recruited at the drop-in center and at parks and streets in Chennai city of Tamil Nadu. Out of the 200 selected IDU, only 80 ex-users were willing to participate in the study. The 80 ex-injecting drug users were key informants in bringing in the other identified and unidentified IDU in Chennai city, until a suitable sample size of 180 subjects was reached. This sampling technique is termed the Snow-ball sampling technique which is most appropriate for the hard-to-reach populations (UNODC and MSJE, 2004). The research protocol was approved by the Ethical Committee of the institution.

The investigator explained the aspects of the study to the recruits in their native language (Tamil) and those willing to participate were asked to sign the "Informed consent form". Each respondent was interviewed using a structured questionnaire that would elicit information on the socio-demographic characteristics, drug use characteristics, history of IDU, incarceration and tattooing. The questionnaire was developed based on the findings of the pilot study; and participants were accordingly asked if they ever used a shared needle or syringe for drug injection (receptive sharing of needle or syringe), if they were ever incarcerated (being kept in prison) in their lifetime and if they ever used a shared injection device (needle, syringe, or handmade injection device) while

incarcerated. All interviews were conducted in the Tamil language since majority of the IDU population were drop-outs from school or illiterate, abandoned and homeless.

On completion of the interview, the participants were recommended to undertake free serum HIV testing, available at the drop-in center, to obtain a confirmative clinical diagnosis. Pre-test counseling and post test counseling was provided for the subjects who consented to be tested for HIV infection. A phlebotomist took their blood samples which was tested twice for HIV-1 with enzyme-linked immunosorbent assay and repeatedly reactive enzyme-linked immunosorbent assay samples were confirmed using a Western blot test. Informed consent was obtained separately for the interview and HIV testing and no personal identifiers were recorded on the questionnaires.

Statistical analysis was performed using SPSS for Windows χ^2 or Fisher exact tests were performed to determine bivariate associations between HIV-1 status and categorical variables. Variables were entered into a multivariable model, if their association with HIV-1 infection by bivariate analyses had a p value ≤ 0.10 or if they were considered epidemiologically important. Multivariable logistic regression analysis was used to examine the associations of independent variables with the outcome, simultaneously adjusting for potential confounders, and to estimate adjusted odds ratios (OR) and 95% confidence intervals (CI).

RESULTS AND DISCUSSION

Out of the two hundred injecting drug users who were invited to participate in the study, 20 men refused to be tested for HIV. 180 IDUs consented to participate in this study. All participants were tested for HIV. Two categories of injecting drug users were identified from the field data. They were classified as 'current injectors' (subjects who had injected illicit drugs in the last 6 months) and 'ex- injectors' (subjects who had recovered from injection drug addiction or not used injectable drugs in the last one year). The subjects were also categorized based on their HIV sero-positivity.

Socio-demographic characteristics

The median age of male IDU was 32.0 and 61.1% were recruited from the drop-in center, while 38.9% were recruited from the neighboring parks and streets. 29.6% had never attended school, 65% IDU had attended primary school and only 5.6% of IDU had reached high school. About 46% of the IDUs were married, of which only 15.6% were living with their spouse (Table 1). At the time of interview, 75.6% were unemployed and one fourth (40%; 72/180) had no place other than parks, streets, or abandoned buildings to live.

Drug use characteristics and HIV prevalence

Cannabis (Ganja), heroin and buprenorphine are the commonly injected drugs in Chennai city. Ganja is widely available in India and is highly (71.1%) used by the IDUs in this study. Heroin were reported to be used by 61.1% (110/180). Propoxyphene and buprenorphine were used

Table 1. Socio- demographic characteristics of male injecting drug users recruited from drop-in centres and its neighboring areas in Chennai city in 2006 (n =180).

Characteristics	n (%)
Recruitment site	
Drop-in center	110 (61.1)
Park/street	70 (38.9)
Age at interview (years)	
<30	51 (28.3)
30-39	109 (60.6)
≥40	20 (11.1)
Education	
Uneducated	53 (29.4)
Primary school or less	117 (65)
High school or more	10 (5.6)
Marital status	
Never married	97 (53.9)
Married (not living with spouse)	55 (30.6)
Married (living with spouse)	28 (15.6)
Place of residence	
Residential place (family/friends)	55 (30.6)
Park/street/abandoned building	72 (40)
Rehabilitation units	20 (11.1)
Group living	33 (18.3)
Job situation	
Employed	44 (24.4)
Unemployed	136 (75.6)

by 51% and 54% of the IDU participants, respectively. About 8% of IDUs reported having directly started drug use via injecting. Drugs that were reported to be generally used by IDUs were cannabis, heroin, propoxyphene (spasmoproxyvon* -dextro-propoxyphene plus dicyclomine), buprenorphine alone or in combination with other drugs; injectable opiates like morphine, pethidine and pentazocine (Fortwin*), diazepam (calmpose*), promethazine (phenargan*), chlorpheniramine (avil*). The most commonly reported mixture of drugs was the combination of buprenorphine (tidigesic), avil and phenargan. The IDUs reported injecting these drugs directly into their blood stream. The chances of HIV infection through the injecting route are much higher than sexual route of HIV transmission (<http://www.who.int/mediacentre/news/releases/2007/pr37/en/index.html>). The drug use pattern of the IDUs in this study coincided with findings of the Rapid Assessment Survey of drug abuse in India.

Results in Table 2 shows that out of the 45.6% (82/180) of the IDUs who had reported having injected illicit drugs

within the last six months (current IDUs), 75.6% were infected with HIV; the HIV positivity rate of the 54.4% (98/180) of the IDUs who were termed ex-IDUs (last time of taking injectable drugs was more than 6 months to one year) was 64.3% (OR, 0.114; 95% CI, 0.02 - 0.53).

History of incarceration

As high as 98% of male IDUs had a history of incarceration in their lifetime, with most (above 85%) having experienced 2 or more prior incarcerations (multiple incarcerations). Of those who were ever incarcerated, the median number and length of lifetime incarcerations were six and eight months, respectively.

The results of Fisher exact test and students 't' test indicated a significantly higher prevalence of HIV infection among IDUs with incarceration records when compared to those who did not have any record of incarceration (70.2% vs. 0%; $z = 4.3513$, $p \leq 0.05$). Subjects who had been incarcerated for more than two times (75.6%) to more than five times (93.3%) were significantly associated with higher prevalence of HIV infection when compared to 23.5% of HIV positivity rate among subjects who were imprisoned for less than two times. The length of the incarceration period was highly associated with HIV prevalence. ($\chi^2 = 42.295$; $p \text{ value} \leq 0.01$). The HIV prevalence was highest (above 90%) for subjects who had been incarcerated more than five times (OR, 5.1; 95% CI, 1.5 - 15.1).

Among those with a history of incarceration, 14.6% reported having ever injected a drug inside prison, out of them 73.1% were HIV positive ($\chi^2 = 9.789$; $p \text{ value} \leq 0.01$; OR, 2.1; 95% CI, 1.2 - 3.3). Of the 14.6% of the IDUs who reported sharing injection devices (needles, syringes, or handmade injection devices) for injecting drugs at some time during their incarceration period, 96.2% were tested positive for HIV infection ($\chi^2 = 7.101$; $p \text{ value} \leq 0.01$; OR, 2.8; 95% CI, 1.0-4.51) compared to 69.4% of the subjects who had shared needles outside prison.

Tattooing

Tattooing was an another interesting factor which was identified to be associated with HIV-infection. About 96% of the IDUs recruited for the study had tattoos on their hands, legs and chest. Up to 45% of ever-incarcerated IDUs reported being tattooed inside prison and of them 90% tested positive for HIV infection ($\chi^2 = 5.734$; $p \text{ value} \leq 0.05$; OR, 3.2; 95% CI, 1.8 - 5.1); out of 51% of the IDUs who reported being tattooed in the community (outside prison), 54.3% were HIV sero-positive (OR, 1.8; 95% CI, 0.8 - 2.5).

The subjects reported being tattooed by the street-sides of Chennai city. Observation of tattoo artists (by street-sides) indicated re-use of needle on their clients. The tattoo artists used contaminated sharps and unsafe

Table 2. Risk characteristics of male injecting drug users in Chennai City, Tamil Nadu State, India.

Characteristics	N (%)	HIV-1 positive		Odd ratio# (95% CI)	Chi square value	p value
		N	(%)			
Overall	180	125	69		-	-
Time from last drug injection (months)						
<6	82 (45.6)	62	75.6	1.0	2.698	NS
>6	98 (54.4)	63	64.3	0.114 (0.024-0.53)		
Length of continual injecting (years)						
<6	60 (33.3)	23	38		149.878	p ≤ 0.01
>6	120 (66.7)	102	85	-		
Frequency of daily injecting during addiction						
Once a day	36 (20)	15	41.6	1.0	74.255	p ≤ 0.01
Twice a day or more	144 (80)	110	76.4	1.33 (0.15 - 1.69)		
Incarceration /history of arrests						
Yes	178 (98.9)	125	70.2	-	4.597	p ≤ 0.05 4.3513†
No	2 (1.1)	0	0			
Frequency /no. of times incarcerated						
<2	34 (19.1)	8	23.5	1.0	42.295	p ≤ 0.01
2-5	99 (55.6)	75	75.6	3.9 (1.4 - 4.1)		
>5	45 (25.3)	42	93.3	5.1 (1.5 - 15.1)		
Total length of incarceration (years)						
<2	30 (16.9)	7	23.3	1.0	42.295	p ≤ 0.01
2 - 5	96 (53.9)	71	74	2.4 (1.6 - 4.1)		
>5	52 (29.2)	47	90.4	4.4 (1.9 - 5.0)		
Ever injected a drug inside prison						
Yes	26 (14.6)	24	92.3	2.1 (1.2-3.3)	9.789	p ≤ 0.01
No	152 (85.4)	100	65.8	1.0		
Shared needle while injecting drugs in prison						
Yes	26 (14.6)	24	92.3	2.8 (1.0-4.51)	7.101	p ≤ 0.01
No	152 (85.4)	101	66.4	1.0		
Shared needle while injecting drugs outside prison						
Yes	180 (100)	125	69.4	-	6.934	p ≤ 0.01
No	0	0				
Number of needle sharing IDU partners						
<2	5 (2.8)	1	20		71.738	p ≤ 0.01
2-5	24 (13.3)	10	41.6	-		
>5	151 (83.9)	114	82.1			
Ever tattooed						
No	7 (3.9)	2	28.6	1.0	5.734	p ≤ 0.05
Yes (never inside prison)	92 (51.1)	50	54.3	1.8 (0.8 - 2.5)		
Yes (inside prison)	81 (45)	73	90.1	3.2 (1.8 - 4.1)		

*p values based on χ^2 test of proportions unless otherwise specified; p ≤ 0.01 ** Highly significant; p > 0.05; NS, Not Significant; †z-test, Two-tailed Fisher exact test; # Odd Ratio (OR) and 95% Confidence Interval (CI) was calculated for specific risk factors to be subjected for multivariate analysis to identify association with HIV infection.

Table 2. Contd.

Characteristics	N (%)	HIV-1 positive		Odd ratio# (95% CI)	Chi square value	p value
		N	(%)			
Tattoo artist used same needle for tattooing all clients						
Yes	174 (96.7)	123	70.7	-	5.734	p ≤ 0.05
No	6 (3.3)	2	33.3			
Number of clients tattooed along with you						
<2	8 (4.6)	-	-	-		p ≤ 0.01
2-5	137 (78.7)	94	68.6		34.225	
>5	29 (16.7)	29	100			
Ever had sex with another man						
Yes	16	3	18.5	0.49 (0.4-1.4)	0.5453 ^{NS}	NS
No	164	42	25	1.0		

*p values based on χ^2 test of proportions unless otherwise specified; p ≤ 0.01 ** Highly significant; p > 0.05; ^{NS}, Not Significant; †z-test, Two-tailed Fisher exact test; # Odd Ratio (OR) and 95% Confidence Interval (CI) was calculated for specific risk factors to be subjected for multivariate analysis to identify association with HIV infection.

Table 3. Multivariable analysis on the association between HIV-1 infection and risk characteristics of injecting drug users recruited from a drop-in center and its neighboring area in Chennai city in 2006.

Characteristics	Adjusted OR	95% CI	P
Ever injected using a shared device in prison	2.45	1.01 - 4.3	0.007
History of multiple incarcerations (≥2 times)	4.15	1.08 - 8.03	0.000
Ever had sex with another man	0.49	0.40 - 1.83	0.370
Ever tattooed inside prison	2.90	1.80 - 3.78	0.016

injection practices. Battery operated and manual tattooing was carried out using rusted sharps, reused needles and a dye bottle which contained residues of blood stains of the previous client. The IDUs reported being the fifth person in the line to receive his tattoo. The needle was in fact not even kept immersed in any kind of disinfectant. In an adjusted analysis (Table 3), having a tattoo still tended toward being significantly associated with HIV-infection ($\chi^2 = 5.734$, p ≤ 0.05; OR, 2.9; 95% CI, 1.80 - 3.78) which suggests that HIV probably is being transmitted via this route. If so, then IDUs with tattoos are at a higher risk for HIV infection.

Multivariable analyses

The variable related to the history of shared drug injection inside prison and that of multiple incarcerations (>2 times) and tattooing were selected as the main incarceration-related exposures to be included in the multivariable model. In the multivariable analysis controlling for basic socio-demographic characteristics, it was shown that HIV-1 infection remained associated with a history of shared drug injection inside prison (adjusted OR, 2.45; 95% CI, 1.01 - 4.3); of having had multiple

incarcerations (adjusted OR, 4.15; 95%CI, 1.08 - 8.03); of having being tattooed in prison (OR, 2.9; 95% CI, 1.80 - 3.78) (Table 3).

No significant relationship was observed between the HIV positivity status and MSM (men having sex with men) behavior of IDUs in prison. The results could reflect under-reporting of same-gender sexual practices inside prison, or other confounding factors inside prison, such as violence, which would also be contributing factors for transmission of HIV infection in prisons.

DISCUSSION

This study investigated the prevalence of HIV infection and its correlates among community-based IDUs in Chennai city. Out of the 180 subjects screened for HIV, 125 subjects were confirmed HIV positive (69.4%). Findings show that the HIV prevalence detected in Chennai city was at a high record and that it was potentially correlated with a history of shared drug injection inside prison, multiple incarcerations and tattooing.

The association between HIV infection and a history of shared drug injection inside prison has been reported in other countries and was found in our earlier study among

IDU who visited treatment centers in Chennai city. This association is also supported by our qualitative data that showed that although drugs are available in some prisons, they are much more expensive than those purchased outside of prison in Chennai city. Having obtained an expensive drug inside prison where drug use is apparently prohibited, the most cost-effective and concealing way for drug users to consume their drugs is by injecting. Meanwhile, an extreme shortage of needles and syringes inside prisons has lead incarcerated IDU to share needle/syringe or handmade injection device with a large number of partners, which, as shown in this study, puts them at great risk of HIV infection.

The prevalence of tattooing behavior was also found to be 96% among the recruited IDU. All the injecting drug users (100%; 180/180 IDUs) in this study reported that they were not aware of 'HIV transmission via tattooing' during their initial visit to the street side tattoo parlour. The results in Table 2 show a HIV positivity rate of 71% (123 tattooed IDUs were out of the total 173 /180 IDUs who had tattoos) with significantly higher incidence (90%) among subjects who reported tattooing in prison. The IDUs reported using crude means such as using razor blades or broken syringes to tattoo themselves or their friend. This was an alarming data and obviously the consequence of a lack of awareness on issues related to health, hygiene and especially HIV/AIDS with regard to IDU prisoners.

The ex-prisoners reported that the prevalence of peer pressure in the prison and perverted behavior of the life convicts imposing MSM behavior (Men having sex with men) adds to the likelihood of increasing the incidence of HIV among incarcerated IDUs. Thus, when the court of justice penalizes an IDU for criminal activities, adequate measures must be executed to check the 'needle-sharing behavior' of the IDUs, which generally persists even behind bars as per the findings of this study. The need for providing health care in prisons will soon become mandatory taking a look at the results of this study which points out the startling fact that 98.8% (178/180) of the frequently incarcerated IDU, tested positive for HIV in Chennai city. The need for safe injection practices followed in tattoo parlors and street corners in Chennai city as part of the harm reduction program for injecting drug users is mandatory.

The present study established evidence of same-gender sexual practice among drug users in Chennai, with 18.5% of IDUs having reported a history of having sex with another man in their lifetime. Although, this practice did not show any additional risk for HIV infection, health authorities in Chennai city should be encouraged to address same-gender sexual practices of IDU and to start identifying appropriate sexual risk reduction strategies.

This study had some limitations. The design of this study was cross-sectional, which precludes us from determining the exact temporal relationship between risk

behaviors and HIV infection. The findings of this study are representative of the south Indian IDU. The socio-demographic characteristics of the IDU participants in this study, such as age, gender composition, ethnicity and employment rate were comparable with those of IDUs who participated in a similar study carried out by Zamani et al. (2004) in Tehran. However, the proportion of homeless IDU was high among the IDUs (approximately 50%) in the present study which could be inclusive of the 18.3% who reported living with IDU partners ('group living') but complained that they had to vacate and remain homeless if they could not pay for the house-rent or drugs. Results reveal that the 60% of the homeless IDU indicated clinical symptoms of depression and inclination to be 'victimisers' (expressed a purposive inclination to infect others with HIV either by sharing injections or having sexual encounters).

The self-reported risk behaviors that could be biased as a result of recall ability or social desirability, given the social context where many of the HIV risk behaviors are highly stigmatized. The results reveal a startling high number in the prevalence of HIV infection among the IDU in Chennai (69.4%) when compared to a similar study conducted in Tehran, Iran where the prevalence of HIV-1 infection was 23.2% (48 of 207) among male injecting drug users (Schwartlander et al., 2001).

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This study had some limitations. The design of this study was cross-sectional, which precludes us from determining the exact temporal relationship between risk behaviors and HIV infection. The findings of this study is more representative of the south Indian IDU community. The socio-demographic characteristics of the IDU participants in this study, such as age, gender composition, ethnicity, and employment rate were comparable with those of IDU who participated in a similar study carried out by Zamani et al., 2004 in Tehran. However, the proportion of homeless IDU was high among the IDUs (approximately 50%) which is inclusive of the 18.3% who reported living with IDU partners ('group living') but complained that they had to vacate and remain homeless if they could not pay for the house-rent or drugs. Results reveal that the 60% of the homeless IDU indicated clinical symptoms of depression and inclination to be 'victimisers' (expressed a purposive inclination to infect other with HIV either by sharing injections or having sexual encounters).

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Conclusion

Results show that HIV prevalence has reached significantly higher proportions (69.4% vs 30% in 2005 as per findings of Panda et al. (2005)). It is critical to extend an extremely structured and effective rehabilitation programs to the marginalized IDU population, with special reference to IDUs living in prisons and in the community of Chennai city, India. India must come up with effective HIV awareness programs highlighting 'blood-exposures to HIV' such as tattooing which was a significant risk factor among the injecting drug users in this study.

REFERENCES

- Aceijas C, Stimson GV, Hickman M, Rhodes T (2004). United Nations Reference Group on HIV/AIDS Prevention and Care among IDU in Developing and Transitional Countries. Global overview of injecting drug use and HIV infection among injecting drug users. *AIDS*. 18: 2295-2303.
- Bull SS, Piper P, Rietmeijer C (2002). Men who have sex with men and also inject drugs profiles of risk related to the synergy of sex and drug injection behaviors. *J Homosex.*, 42: 31-51.
- Panda S, Kumar MS, Lokabiraman S, Jayashree K, Satagopan MC, Solomon S, Rao UA, Rangaiyan G, Flessenkaemper S, Grosskurth H, Gupte MD (2005). 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*. 39: 9-15.
- World health Organization (2007). Media center:: 'National AIDS Control Organization (NACO) 2007:Improved data from more sources gives better understanding of AIDS epidemic in India, (<http://www.who.int/mediacentre/news/releases/2007/pr37/en/index.html>).
- Heimer RH, Kaplan EH, Khoshnood K, Jariwala B, Cadman EC "Needle exchange decreases the prevalence of HVI-1 proviral DNA in returned syringes in New Haven, Connecticut." *Am. J. Med.*, 95(2): 214-220.
- UNODC, MSJE (2004). United Nations Office on Drugs and Crime, Regional Office for South Asia and Ministry of Social Justice and Empowerment, Government of India, (R Ray). 'The Extent, Pattern and Trends of Drug Abuse in India, National Survey'. New Delhi.
- Schwartlander B, Ghys PD, Pisani E, Kiessling S, Lazzari S, Carael M, et al (2001). HIV surveillance in hard-to-reach populations. *AIDS*, 15 (suppl. 3):S1-S3.
- Zamani S, Kihara M, Gouya MM, Vazirian M, Nassirimanesh B, Ono-Kihara M, Ravari SM, Safaie A (2006). High Prevalence of HIV infection associated with Incarceration among community-based Injecting Drug Users in Tehran, Iran. *J. Acquir. Immune. Defic. Syndr.*, 42(3) :342-346.