Published in final edited form as:
J Acquir Immune Defic Syndr. 2008 November 1; 49(3): 327–332. doi:10.1097/QAI.0b013e3181831e85.

High prevalence of HIV, HIV/hepatitis C virus co-infection and risk behaviors among IDUs in Chennai, India: A Cause for Concern

Sunil S Solomon, MBBS, MPH[1,2], **Aylur K Srikrishnan, BA**[2], **Shruti H Mehta, PhD, MPH**[1], **Conjeevaram K Vasudevan, BSc**[2], **Kailapuri G Murugavel, PhD**[2], **Easter Thamburaj, MSW**[2], **Santhanam Anand, BSc, ADCA**[2], **M Suresh Kumar, MD, DPM, MPH**[3], **Carl Latkin, PhD**[1], **Suniti Solomon, MD**[2], and **David D Celentano, ScD, MHS**[1]

[1]Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

[2]YR Gaitonde Centre for AIDS Research and Education, Chennai, India

[3]Consultant, YR Gaitonde Centre for AIDS Research and Education, Chennai, India

Abstract

Objective—To estimate the prevalence of HIV and hepatitis C virus (HCV) and hepatitis B virus (HBV) co-infection as well as current risk behaviors among HIV positive and negative injection drug users (IDUs) in Chennai, India.

Methods—Cross-sectional analysis of a convenience sample of 912 IDUs recruited between March 2004 and April 2005. Specimens were tested for HIV, HBV and HCV. Adjusted prevalence ratios (PR) were estimated using Poisson regression with robust variance estimates.

Results—The prevalence of HIV, HBsAg and anti-HCV were 29.8%, 11.1% and 62.1%, respectively. Among HIV-infected IDUs, prevalence of co-infection with anti-HCV and HBsAg/anti-HCV were 86% and 9.2%, respectively. In multivariate analysis, injecting at a dealer's place (PR: 1.57) and duration of injection drug use ≥ 11 years (PR: 3.02) were positively associated with prevalent HIV infection. Contrastingly, alcohol consumption ≥ 1/week (PR: 0.55) was negatively associated with HIV. HIV positive IDUs were as or more likely compared to HIV negative IDUs to report recent high-risk injection-related behaviors.

Conclusion—There is a high burden of HIV, HCV and HBV among IDUs that needs to be addressed by improving access to therapies for these infections; further, preventive measures are urgently needed to prevent further spread of HIV, HBV and HCV in this vulnerable population.

Introduction

India currently has an estimated 2.5 million HIV-infected persons (though estimates have been as high as 5.7 million in the past years), [1-3] the majority (63%) of whom reside in the four southern states of Maharashtra, Karnataka, Andhra Pradesh, and Tamil Nadu. [4] The focus in India has been on the predominantly heterosexual epidemic (estimated 84% of infections) [5] and its gradual dissemination over the years from sex workers to monogamous housewives. [6] It is only in the northeastern (NE) regions of India that injection drug users (IDUs) receive appreciable attention as the epidemic in this region is driven by injection drug use. [7]

It has increasingly been recognized that IDUs exist outside of the NE regions of India, but these epidemics have been largely ignored. For example, Tamil Nadu is home to an estimated 10,000

Corresponding Author: David D Celentano, ScD, MHS 615 N Wolfe Street, Suite E6547 Baltimore, MD 21205 Email: dcelenta@jhsph.edu Phone: + 1 (410) 955 1356 Fax: + 1 (410) 955 1383.

– 15,000 IDUs [8] and according to the 2006 sentinel surveillance report released by the National AIDS Control Organization (NACO), India, is the state with the highest HIV prevalence among IDUs in India. [4] Yet, there are few community-based reports of HIV prevalence and risk behaviors among IDUs in Tamil Nadu. Further, little is known about the prevalence of co-infection with hepatitis C virus (HCV) and hepatitis B virus (HBV) infection, which occur frequently among IDUs. [9-12]

The objective of this analysis was to characterize the baseline prevalence of HIV infection and associated co-infections (e.g., HCV and HBV) among a cohort of IDUs in Chennai, India. We further characterize correlates of prevalent HIV infection and recent risk behaviors among HIV positive and negative IDUs.

Methods

Study Setting

In March 2005, a longitudinal cohort study aimed at measuring the incidence of HIV, HBV and HCV among IDUs, and examining the natural history of drug abuse in Chennai was initiated through the YR Gaitonde Centre for Substance Abuse-Related Research (YRGCSAR) located in north Chennai. We report here on the baseline findings of this cohort. YRGCSAR was established in November 2004 to provide HIV counseling and testing services to marginalized populations such as IDUs. YRGCSAR is a branch of the YR Gaitonde Centre for AIDS Research and Education (YRGCARE), a non-governmental, not for profit organization, which has been involved in HIV-related research since the mid-1990s and has provided medical and psychosocial care to more than 12,000 individuals living with HIV/AIDS. This study was approved by the YRGCARE and the Johns Hopkins School of Public Health institutional review boards.

Study Population

A convenience sample of IDUs from various regions of Chennai was recruited by field staff acquainted with IDUs in Chennai and their injection venues. To be eligible for the longitudinal study, IDUs had to (1) be able to provide written informed consent for screening, (2) be at least 18 years of age, and (3) have injected at least once in the prior 6 months. A total of 924 IDUs were screened for HIV between March 31, 2005 and March 10, 2006. All participants received pre- and post-test counseling. Participants also received information/counseling on safer injecting practices and sexual risk-reduction counseling. Twelve participants withdrew after screening, leaving 912 of whom 272 tested positive for HIV and were referred to the on-site clinic for further medical evaluation.

Data Collection

Three trained interviewers administered standardized demographic and risk assessment questionnaires to participants at baseline. HIV serostatus was determined using double ELISA testing (Murex HIV-1.2.O, Abbott Murex, UK and Vironostika® HIV Uni-form II Ag/Ab, Biomérieux, The Netherlands). If the results from the two tests were discrepant, participants were invited to return for further testing at three months. Hepatitis C serostatus was diagnosed by the presence of antibodies to HCV (anti-HCV) using the Murex Anti-HCV kit (Abbott Murex, Republic of South Africa), and chronic HBV infection was diagnosed by the presence of hepatitis B surface antigen (HBsAg) (Hepanostika HBsAg Uniform II, Biomérieux, The Netherlands).

Statistical Analysis

The Chi-squared and Mann Whitney tests were used to compare demographic variables for HIV positive and negative IDUs. Univariate and multivariate Poisson regression with robust variance estimates were used to estimate prevalence ratios for correlates of prevalent HIV infection. [13, 14] Logistic regression was not performed, as odds ratios generally overestimate the association between a variable and an outcome if the outcome is common (greater than 10%). [15] We report the fully saturated multivariate model versus the parsimonious model to minimize bias in our estimates. [16] We further compared the prevalence of current risk behaviors by HIV serostatus using chi-squared tests. As there were only 3 female IDUs (of whom one was HIV positive), they were excluded from all analyses. A p-value <0.05 was used to indicate statistical significance. All statistical analyses were performed using Intercooled STATA Version 10.0 (College Station, Texas, USA).

Results

Description of the study population

The median age of the 909 male participants was 35 years (IQR: 30 – 40). Almost all (98.3%) participants were of Tamil ethnicity; fifty-eight percent were married, 32.1% were single, 4% were separated and the remaining were either widowed or divorced (Table 1). Compared to HIV negative IDUs, HIV positive IDUs were more often single (36.5% vs 30.3%) and separated (8.12% vs 2.66%) and less often married (50.2% vs 61.6%) (p-value=0.001). Twenty-eight percent reported no formal education. The majority of the participants worked for daily wages and earned less than USD 36 per month. The median age at first injection drug use for non-medicinal purposes was 25 years, with HIV-positive IDUs initiating drug use at a younger median age (24 years vs. 25 years; p-value <0.001).

Prevalence of HIV, HBV and HCV

Overall, 29.8% were infected with HIV, 62.1% were exposed to HCV (anti-HCV) and 11.1% were chronically infected with HBV (HBsAg). One in four IDUs (25.7%) screened positive for antibodies to both HIV and HCV. Nearly all (95.2%) HIV positive IDUs also screened positive for anti-HCV compared with 48% of HIV negative IDUs. The prevalence of chronic HBV infection in HIV positive and negative IDUs was 9% vs 11.7%, respectively. All IDUs who were chronically infected with HBV (HBsAg positive) were also positive for anti-HCV. Overall 25 persons (2.74%) were positive for HIV, anti-HCV and were chronically infected with HBV; among HIV positive IDUs the prevalence of anti-HCV and HbsAg was 9.19%.

Correlates of Prevalent HIV infection

In univariate analysis, IDUs who were either single or separated, participants with a longer duration of injection, those who reported having injected at a dealer's place in the past and having a tattoo were positively associated with HIV prevalence (p<0.05; Table 2). Alcohol consumption was negatively associated with prevalent HIV infection (p<0.05). Age and history of ever sharing needles were not associated with HIV prevalence.

In multivariate analysis, duration of injection drug use ≥ 11 years (PR: 3.02; 95% CI: 1.36, 6.72) and 6-10 years (PR: 2.45; 95% CI: 1.11, 5.44) were associated with a higher prevalence of HIV (Table 4). Participants with a history of injecting at the dealer's place (PR: 1.57; 95% CI: 1.29, 1.91), and a history of tattooing (PR: 1.78, 95% CI: 1.35, 2.36) remained more likely to be HIV positive. Alcohol consumption more than once week (PR: 0.48; 95% CI: 0.38, 0.62) remained negatively associated with HIV prevalence.

Recent Risk Behaviors

HIV positive IDUs were more likely to have injected in the prior month with 26% having injected more than 30 times compared to 17.4% among HIV negative IDUs ($p<0.01$) . HIV positive IDUs were also more likely to have injected only heroin in the prior month (84.5% vs 66.9%) compared to HIV negative IDUs who were more likely to have injected buprenorphine (19.9% vs 5.8%) ($p<0.001$). HIV positive and negative IDUs had similar needle cleaning (HIV positive vs HIV negative: 57.2% vs 54.4%) and sharing practices (HIV positive vs HIV negative: 29.2% vs 33.7%) as well as similar rates of non-injection drug use (HIV positive vs HIV negative: 83% vs 84.6%) . HIV positive IDUs were less likely to have had sexual intercourse in the prior one month (28.9% vs 46.1; $p<0.001$).

Discussion

We observed a high prevalence of HIV infection, HIV-HCV co-infection and associated risk behaviors among this community-based cohort of IDUs in Chennai, India. Understanding the true burden of disease in a community as well as the prevalent risk behaviors are critical for designing effective prevention interventions to curtail the spread of HIV and other infectious diseases among IDUs as well as from IDUs to their sexual partners and the general population.

Our study represents one of the largest community-based efforts among IDUs in India. The majority of existing HIV prevalence data in India, including those among IDUs, is derived from sentinel surveillance, which has inherent limitations. By comparison to other risk groups, there are few IDU-specific sentinel surveillance sites and the estimates have varied dramatically from year-to-year. In Tamil Nadu, for example, between 2003 and 2006, estimates of HIV prevalence among IDUs varied from 18% to 64%. [17] Thus, it is critical that sentinel surveillance estimates are supplemented with community-based estimates of disease prevalence. Our results are comparable to a prior community-based study conducted among a much smaller sample of 226 married IDUs in Chennai between April and July 2003 (HIV prevalence was 29.2%). [18] This high prevalence translates into a large number of HIV positive IDUs living in Chennai alone and more broadly in India, where an estimated 1.1 million IDUs live. [19] Not surprisingly, all but three IDUs recruited to participate in this study were male, which is consistent with other reports from Chennai suggesting that are few female IDUs in Chennai. [20, 21]

The high prevalence of anti-HCV (86%), and both HBsAg and anti-HCV (9.2%) are analogous to IDUs in other settings and the limited reports from India [9, 11, 12, 21] and have multiple implications. Firstly, co-infection with HIV and HCV has been associated with more rapid progression of liver disease and higher rates of mortality. [22] Similar associations have been observed with hepatitis B as well. [23] Treatments are available for all three infections but they are rarely received by IDUs in India. Only 400 of the 35,000 estimated to be on highly active antiretroviral therapy (HAART) in India are IDUs — all were from the North East. [24] Delivery of HAART in this population will be difficult as even in western countries, IDUs tend to have limited access to HAART compared with other groups and they have also been shown to experience higher rates of treatment failure. [25] Further, in India, nevirapine (NVP) is included in the preferred first-line HAART regimen at most treatment centers. However, severe hepatotoxicity has been observed at a higher frequency among persons co-infected with HBV/HCV receiving a NVP-containing HAART regimen compared to protease-inhibitor and efavirenz based regimens, which are more expensive in India. [26] Innovative methods of HAART delivery such as directly administered antiretroviral therapy [27] and alternate regimens will need to be considered and evaluated among IDUs in the Indian setting given these high rates of co-infection with the hepatitis viruses.

Access to treatment will be critical for those who are already infected, but efforts also need to focus on preventing new infections and thus it is critical to understand what puts IDUs at risk for HIV. Evidence from developed countries have consistently observed that more frequent injection, needle sharing, attending shooting galleries as well as high risk sexual behavior are risk factors for HIV among IDUs. [28-30] In this study, the association of some factors with HIV such as longer duration of injection and having ever injected drugs at a dealer's place are consistent with what has been observed by other Indian studies and those from the West. [9, 18, 30] We also observed an association with a history of tattooing, which has been associated with HIV infection in developing countries. [18, 31] Interestingly, we observed that heavy alcohol use was associated with lower HIV prevalence. Of note, IDUs who reported the heaviest alcohol intake also reported lower frequency of injection. Further, most drug users who combined alcohol with injection drugs (93%) identified insufficient intoxication from the injected drug as the primary reason for combining the two suggesting that those who drank were injecting less.

In addition to having a greater frequency of lifetime risk behaviors, HIV positive IDUs were as risky or more risky compared to HIV negative IDUs with respect to recent risk behaviors. They were significantly more likely to be injecting heroin and had a higher frequency of injection. It has been noted that in the Indian setting, heroin users tend to inject more frequently and more often at a dealer's place, more likely to share equipment and also are more likely to have larger needle-sharing networks. [21] Further, buprenorphine is a pharmaceutical agent that is usually purchased over-the-counter in liquid form by IDUs while heroin is generally acquired from a dealer. During our interactions with the study participants, we learned that IDUs typically have arrangements with pharmacists in their locale wherein the pharmacist selling the IDU a vial of buprenorphine also compels the IDU to buy a sterile needle/syringe at the time of purchase to maximize his/ her profits.

There were no differences in reported recent needle sharing or cleaning of needles between HIV positive and negative IDUs. However, it is important to note that at least 30% of both HIV negative and positive IDUs reported sharing a needle in the prior month suggesting that high risk behaviors are common. While more than 50% of both groups reported cleaning a needle at least once in the prior one month, the majority of IDUs used only tap water or parts of their clothing to clean injection equipment, a finding that is consistent with other studies in India. [12, 20, 21] The majority of the IDUs in this study learned their HIV status for the first time through this study which may explain the finding that HIV positive IDUs were as or more risky than HIV negative IDUs. Monitoring behaviors during follow-up visits will allow us to examine the impact of counseling and testing as well as the impact of knowledge of HIV serostatus on risky injection practices. The fact that most IDUs were diagnosed with HIV for the first time through this study also indicates the lack of perception of HIV risk and/or lack of access to voluntary and counseling testing services. Further, few IDUs in this sample had any access to preventive services such as drug treatment or needle exchange. Finally, none of the HIV positive IDUs were enrolled in any HIV treatment or care programs.

Interestingly, HIV positive IDUs were significantly less likely to report recent sexual intercourse and may reflect that they were more heavy injectors. However, it is important to note that 40.9% of this cohort reported a history of sexual intercourse in the month prior to their baseline assessment. Seventy-five IDUs reported having more than one female sexual partner in the prior one month while 15 reported having sex with other men in the prior month. Thus, a sizable proportion is practicing high-risk sexual behaviors. It is often through these high-risk behaviors that HIV and/or HBV is transmitted from IDUs to their sexual partners as has been reported in Tamil Nadu [18] and Manipur. [32]

The primary limitation of our study was the inability to ascertain the temporality of recent risk behaviors and prevalent HIV infection given our cross-sectional design. Another limitation was the use of HBsAg for the diagnosis of HBV infection and antibodies to HCV for the diagnosis of HCV infection. HBsAg is a marker of chronic HBV infection and thus underestimates the true lifetime prevalence of exposure to HBV infection among these IDUs. A study from Manipur by Saha and colleagues detected antibodies to HBV (anti-HbC) among all IDUs in their sample implying that almost all IDUs had been exposed to HBV. [11] Nevertheless, disease progression is unlikely to occur in HBsAg negative patients so our data reflect the true disease burden of HBV. [33] Conversely, we used an antibody test for the diagnosis of HCV infection, which reflects exposure rather than chronic infection. In most settings, approximately 15-20% spontaneously clear virus; [34] therefore, our prevalence of HCV likely overestimates the true prevalence of chronic HCV infection by this factor.

The findings in this cohort of IDUs in Chennai, India are very similar to the early HIV epidemics among IDUs in the USA and Europe in the late 1980s, both in terms of the prevalence of HIV, HBV and HCV, as well as their injecting practices. [28-30, 35] The incidence subsequently declined among these IDUs primarily due to interventions such as needle exchange, drug substitution/ treatment programs and health education of IDUs. [36-38] However, despite some success among IDUs and MSM who were the focus of interventions in the early years of the HIV epidemic in the USA, new risk groups have emerged in recent years. [39] For example, in the USA, HIV incidence is currently on the rise among minority women whose primary risk factor for infection is heterosexual sex. India may face a similar situation if they focus only on the well described heterosexual epidemic and ignore emerging HIV epidemics, such as the epidemics among IDUs in regions of India besides for the northeast, in their planning of prevention and treatment programs.

In conclusion, there is a large burden of HIV and other blood-borne infections among IDUs in Chennai coupled with high-risk behaviors. Interventions which helped curtail the HIV epidemic among IDUs in the west, such as education on safe injection practices, needle exchange programs, drug substitution and treatment programs, need to be implemented and evaluated for use in India to prevent further spread of the epidemic among IDUs and from IDUs to their sexual partners. Further, measures should to be taken to ensure that the IDUs already infected with HIV have adequate access to care and support.

Acknowledgements

The authors would like to thank the staff at YRGCSAR and YRGCARE who helped with the implementation of this study especially Mr Jayakumar and Mr Guru, who helped with the development of the database and data entry, and our field staffs. We thank Joel E Gallant, MD, MPH for his guidance with the management of the HIV-infected IDUs. We would also like to thank Drs Padmanesan Narasimhan, Balachander and Ramnath Subburaman who help with the functioning of the on-site HIV clinic. This study was supported in part by the US National Institutes of Mental Health (Grant # U10 MH61543), National Institute on Drug Abuse (Grant # R01 DA13142 and R01 DA12568) and the Fogarty International Center/USNIH: (Grant # 2D 43 TW000010-20-AITRP). The funding sources did not play any role in the design, conduct or analysis of the data. Sunil S Solomon had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Most importantly, we would like to thank the participants without whom this paper would not have been possible.

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Table 1

Demographics of Injection Drug Users (IDUs) in Chennai

Variable	Entire cohort[1] (n=912)	HIV Negative (n=638)	HIV Positive (n=271)	p-value[2]
Age				
Median (IQR)	35 (30 - 40)	35 (29 – 40)	35 (30 – 39)	0.73
Ethnicity [n(%)]				
Tamil	896 (98.3)	628 (97.8)	265 (97.8)	0.84
Telugu	9 (0.99)	6 (0.94)	3 (1.11)	
Anglo-Indian	4 (0.44)	2 (0.31)	2 (0.74)	
Malayalee	3 (0.33)	2 (0.31)	1 (0.37)	
Marital Status [n(%)]				
Single	292 (32.0)	193 (30.3)	99 (36.5)	0.001
Married	532 (58.3)	393 (61.6)	136 (50.2)	
Living with partner/ not married	35 (3.84)	25 (3.92)	10 (3.69)	
Separated	39 (4.28)	17 (2.66)	22 (8.12)	
Divorced	11 (1.21)	8 (1.25)	3 (1.11)	
Widowed	3 (0.33)	2 (0.31)	1 (0.37)	
Highest Level of Education [n(%)]				
None	252 (27.6)	169 (26.5)	80 (29.5)	0.77
Primary	315 (34.5)	222 (34.8)	93 (34.3)	
Secondary	241 (26.4)	171 (26.8)	70 (25.8)	
High school/ University/ Professional	104 (11.4)	76 (11.9)	28 (10.3)	
Type of Employment [n(%)]				
Monthly wages	62 (6.82)	48 (7.52)	14 (5.17)	0.20
Weekly wages	53 (5.83)	41 (6.42)	12 (4.43)	
Daily wages	714 (78.3)	497 (77.9)	215 (79.3)	
Unemployed	83 (9.1)	52 (8.15)	30 (11.1)	
Monthly Income [n(%)]				
< USD 12	90 (9.87)	56 (8.78)	32 (11.8)	0.29
USD 12 – 36	394 (43.2)	270 (42.3)	123 (45.4)	
USD 37 – 72	344 (37.7)	251 (39.3)	93 (34.3)	
> USD 72	84 (9.21)	61 (9.56)	23 (8.49)	
Frequency of alcohol consumption				
Never	190 (20.9)	104 (16.3)	86 (31.7)	<0.001
Less than once a week	322 (35.4)	224 (35.1)	98 (36.2)	
More than once or once per week	397 (43.7)	310 (48.6)	87 (32.1)	
Age at first injection drug use				
Median age (IQR)	25 (20 – 30)	25 (20 – 30)	24 (20 - 28)	<0.001

[1] includes three women who were excluded from the univariate and multivariate analysis

[2] p-values were calculated using the Chi-squared test or the Mann-Whitney test

Table 2

Correlates of HIV prevalence estimated using univariate and multivariate Poisson regression among 909 IDUs in Chennai, India

Variable	Unadjusted Prevalence Ratio	95% CI	Adjusted Prevalence Ratio*	95% CI
Age				
per 10 year increase in age	0.96	0.85, 1.09	0.92	0.79, 1.06
Current marital status				
Married / Live-in partner	1	-	1	-
Single	1.31	1.06, 1.62	1.23	1.0, 1.52
Separated	2.18	1.60, 2.97	1.78	1.33, 2.37
Divorced/Widowed	1.10	0.48, 2.56	0.97	0.38, 2.44
Highest Level of Education [n(%)]				
None	*1*	-	*1*	-
Primary	*0.92*	*0.72, 1.18*	*0.98*	*0.78, 1.23*
Secondary	*0.90*	*0.69, 1.18*	*0.87*	*0.67, 1.13*
High school/ University/ Professional	*0.84*	*0.58, 1.21*	*1.0*	*0.69, 1.44*
Years of injecting drug use				
≥ 1 year	1	-	1	-
2 – 5 years	2.18	0.98, 4.82	2.05	0.92, 4.58
6 – 10 years	3.11	1.42, 6.77	2.45	1.11, 5.44
≥ 11 years	3.49	1.61, 7.53	3.02	1.36, 6.72
Frequency of alcohol consumption				
Never	1	-	1	-
Less than once a week	0.67	0.54, 0.84	0.67	0.53, 0.84
More than once or once per week	0.48	0.38, 0.62	0.55	0.43, 0.69
History of ever injecting at dealer's place				
No	1	-	1	-
Yes	1.83	1.50, 2.22	1.57	1.29, 1.91
History of tattooing				
No	1	-	1	-
Yes	2.02	1.53, 2.66	1.78	1.35, 2.36

* adjusted for age, marital status, education level, years of injection drug use, alcohol consumption and history of tattooing and injecting at dealer's place