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The relationship between social network factors, HIV, and Hepatitis C among injection drug users in Chennai, India

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Abstract

Objective—The purpose of this study was to examine whether social network factors predict HIV and Hepatitis C (HCV) serostatus after controlling for individual-level factors at baseline among a cohort of male injection drug users in Chennai, India.

Methods—The sample, which was recruited through street outreach, consists of 1,078 males who reported having injected drugs in the last 6 months

Results—The participants reported 3,936 social support and risk network members. HIV and HCV positive serostatus were negatively associated with network member providing emotional support, and positively associated with network member providing material support. In addition, HCV positivity was associated with network member being an active drug user known for more than 10 years and network member being male kin networks, even after adjusting for individual demographic factors and risk behaviors.

Conclusions—These findings suggest that social network factors are significantly linked to HIV and HCV status among IDUs in Southern India and highlight the mixed effects of social capital on health. Future HIV/HCV prevention efforts should incorporate IDU peers to alter drug network injection risk norms. For drug users who have minimal network support, support groups and other informal and formal support mechanisms may help coping with HIV/HCV and cessation of drug use.

Keywords

Social networks; HIV; Hepatitis C; India; social capital; injection drug users

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Conflict of Interest: No conflict declared

1. Introduction

A high burden of HIV have been reported among injecting drug users (IDUs) in India (Panda et al., 2005; Solomon et al., 2008). Among IDUs in southern India, HIV prevalence of approximately 30% has been documented (Panda et al., 2005; Solomon et al., 2008). High prevalence of Hepatitis C (HCV) among IDUs has also been reported in several areas of India (Mahanta et al., 2008). In Southern India, IDUs tend to be highly impoverished and stigmatized. Injection drug use tends to be episodic (Latkin et al., 2010) and includes brown sugar (an adulterated form of heroin) and pharmaceutical agents such as buprenorphine (Panda et al., 2005). However, little is know about the social networks of IDUs in India.

Social network factors have been found to be associated with HIV and sexually transmitted infection (STI) transmission (Friedman et al., 1997; Ward, 2007; Perisse et al., 2010). Indeed, there is evidence that network structural characteristics (e.g. network density and connectivity) and dynamics (e.g. partner concurrency) may lead to high rates of infectious diseases (Morris and Kretzschmar, 1997; Adimora et al., 2006; Choudhury et al., 2006). Network characteristics of IDUs, such as network size, composition, and density have been found to be associated with HIV risk behaviors among IDUs, such as sharing injection equipment and drug use cessation (Latkin, 1995; Neaigus et al., 1996; Lakon et al., 2006; Luke and Harris, 2007; Bohnert et al., 2009), having multiple partners, unprotected sex exchanging sex for money or drugs, and age mixing (Miller, 2003; El-Bassel et al., 2006; Howard and Latkin, 2006).

To date almost no studies have examined the relationship between social network factors and HCV. One study in Canada found that HCV was positively associated with the number of IDUs in the risk network who injected the pain medication talwin or methylphenidate (Ritalin) and negatively associated with number of IDUs in the risk network who had shown the respondent how to inject drugs (Wylie et al., 2006). The authors hypothesized that the latter finding may be due to small dense networks that infrequently admit new members.

The current study builds on prior analyses with a cohort that characterized individual-level factors associated with HIV and HCV infection (Solomon et al., 2008). In the prior analyses, sharing syringes in the prior six months was not associated with HIV or HCV status. We extended these analyses to examine whether social network factors predict HIV and HCV serostatus after controlling for individual-level factors among a cohort of injectors in Chennai, India.

2. Methods

Study participants

Data for this paper came from the baseline assessment of a longitudinal study of IDUs in Chennai, India conducted through the research facilities of the YR Gaitonde Centre for Substance Abuse Related Research (YRGCSAR), a non-governmental and non-profit organization. IDUs were recruited by field staff from areas in Chennai known to be frequented by IDUs between March 2005 and April 2006. Outreach workers visited shooting galleries and other locations to inform IDUs about the study. Participants were also encouraged to refer other IDUs to the study site for participation. To be eligible for the study, IDUs had to (1) 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.

At the baseline, trained interviewers administered a face-to-face survey on HIV and HCV risk behaviors, demographic factors, patterns of drug use and social network factors. Participants also provided a blood specimen. All participants received pre- and post-test

counseling. This study was approved by Institutional Review Boards at YRG CARE and the Johns Hopkins Bloomberg School of Public Health. Participants were compensated Indian rupees (INR) 150 (~USD 3.5) for their time.

Measures

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). HCV was assessed using Murex Anti-HCV kit (Abbott Murex, Republic of South Africa). The social network data were collected based on the Drug and Support Inventory, which has been shown to have predictive validity and internal consistency (Latkin et al., 1996). The inventory included 18 name generators. The name generator section entailed respondents first listing the names (first and last initials) of individuals who provided emotional and material support. The name generator for emotional support was the question “If you wanted to talk to someone about things that are very personal and private or if a situation came up where you needed some advice, is there anybody you could talk to?” Material support was assessed by the question “If you needed to borrow 100 rupees or something valuable, is there anybody you know who would lend or give you 100 rupees or something that was valuable?”

There were six name generator questions to delineate the drug network and the question “Who did you have sex with, in the last six months” delineated the sexual network. Frequency of contact with each of the network members was assessed by asking the question “How often do you talk with or see each of the people you have listed?”; responses were captured on a scale from “every day” to “less than once a year.” The length of time knowing each of the network members was assessed by asking the question “how long you have known each person you have listed?” A standardized measure of length of time participant has known drug using network members was used. Participants also reported on the gender and their relationship with each of the network members.

Sociodemographic characteristics included age, marital status, education, and current employment. Individual level HIV/HCV risk behaviors included history of having tattoo, sex in the past 3 months, age of first injection, frequency of injection and sharing cookers/needles in the prior 6 months.

Data analysis

Analyses were conducted using (1) data from 1078 individuals, out of 1158, who provided blood specimens and completed all survey questions and (2) data reported by these individuals on network members. As social networks may change once individuals are aware of their seropositive status or illness associated with HIV, it is often difficult to determine whether network differences between seropositive and negatives are a cause or a consequence of HIV. To address this problem we removed from the analyses of HIV a small number of injectors who self-reported that they were HIV positive (n=19). A total of 1,059 participants who reported 3,835 social network members were used for the HIV analyses. A total of 1,078 participants who reported 3,936 network members were used for the HCV analyses.

Frequency distributions were calculated to examine the distribution of the variables and to generate a profile of sample characteristics. Logistic regression models with generalized estimating equations (GEE) using network member as the unit of analysis were conducted to assess the association between HIV or HCV seropositivity and individual and social network characteristics. The goal of the analysis was to test whether network level characteristics were significantly associated with HIV and HCV serostatus after adjusting for individual-

level variables. Social network variables that were statistically significant in the bivariate models ($p < 0.15$) were entered into a multivariate model that used backward stepwise selection ($p < 0.20$) with a forced inclusion of individual-level factors to control for potential residual confounding. Generalized estimating equations (GEE) were used to account for the fact that individuals had multiple network partners that contributed to the analysis. For example, if the participant listed 10 network members, each of these network members would be treated as one observation within a cluster of ten. Robust standard errors were used for estimation of the 95% confidence intervals. Variance inflation factor (VIF) was checked to determine the potential multicollinearity among the independent variables. All analyses were performed using Stata Version 10.0.

3. Results

All participants were male, 23.5 % were HIV positive and 54.6% were infected with HCV. Table 1 presents the characteristics of participants. Participants had a median age of 35; almost two-thirds were married and had less than secondary school education. The majority of participants were employed and around two-thirds had a tattoo. More than 59% had penetrative sex in the past 3 months. The median age of first injection was 25 years, with a range from 10 to 55 years. About 12% injected drugs at least 2–3 times/day, less than one third reported sharing dirty cookers at least once a week, and less than one tenth reported sharing dirty needles at least once a week.

The median social network size was 3, with a range from 1 to 15. The median number of network members providing emotional (range 0–9) or material support (range 0–6) was 2. The median number of active drug using network members seen daily was 2, with a range from 0 to 8. The median duration of relationship with drug using network members was 144 months, with a range from 12 months to 480 months. More than one third had at least one female in their social network, about 15% reported female spouse or sex partner in the network, more than one fifth had female kin in the network, and less than 3% reported male kin in the network.

Table 2 presents the results of univariate and multivariate logistic regression models. The VIF among the independent variables in the multivariate logistic regression models ranged from 1.01 to 1.87, indicating there was no multicollinearity among the independent variables. In the univariate analyses, having a tattoo and injecting at least two times a day were positively associated with HIV and HCV seropositivity, and having penetrative sex in the past 3 months and age of first injection were negatively associated with HIV and HCV seropositivity. Neither sharing cookers nor sharing needles was associated with HIV and HCV seropositivity.

In univariate analyses of HIV seropositivity, providing emotional support (Odds Ratio [OR]: 0.69, 95% Confidence Interval [CI]: 0.56, 0.86), active drug user network seen daily (OR: 1.26, 95% CI: 1.01, 1.56), and spouse or sex partner network (OR: 1.55, 95%CI: 1.11, 2.15) were significantly associated with HIV seropositivity. In multivariate analysis of HIV seropositivity, providing emotional support (Adjusted [AOR: 0.48, 95%: 0.34, 0.69) and providing material support (AOR: 1.61, 95%CI: 1.17, 2.20) were independently associated with HIV seropositivity.

In univariate analyses of HCV seropositivity, network members providing emotional support (OR: 0.51, 95%CI: 0.42, 0.63), active drug user network member known for more than 10 years (OR: 1.32, 95%CI: 1.09, 1.61), female network (OR: 1.35, 95%CI: 1.14, 1.5), and spouse or sex partner network (OR: 1.77, 95%CI: 1.26, 2.49) were significantly associated with HCV seropositivity. In multivariate analysis, providing emotional support (AOR: 0.39,

95%CI: 0.29, 0.54), providing material support (AOR: 1.45, 95%CI: 1.09, 1.92), active drug user network member known for more than 10 years (AOR: 1.21, 1.90), male kin network (AOR: 2.61, 95%CI: 1.10, 6.17) were independently associated with HCV seropositivity.

4. Discussion

The study outcomes of HIV and HCV were found to be associated with social network members' drug use, gender, and provision of social support. These findings replicated the prior finding of sharing syringes in the prior six months was not associated with HIV status in this cohort (Solomon et al., 2008). However, adjusting for the individual factors in the multivariate models did little to change the associations between network factors and HIV and HCV.

There are several plausible explanations for the findings of the lack of association between syringe sharing and HIV/HCV status. Although not adequately captured in the data it was observed that injecting in this cohort is often an episodic behavior, based on the price and availability of drugs (Solomon et al., 2008), and hence, the measures of sharing may not capture the risk dynamics of injection. Another explanation for the lack of association between sharing injection equipment and HIV/HCV status may be network configuration. With small dense networks but frequent sharing of injection equipment, HIV/HCV may have difficulty entering the networks, but once it does enter it quickly spreads. Information on HIV and HCV serostatus of the network members may have helped us examine this hypothesis. This dynamic may make it difficult to predict seroconversions.

It is intriguing that reporting male kin network members was associated with HCV status. It is likely that reporting male kin in the social network is a proxy for other social factors. One potential explanation is that male kin members represent social capital. This explanation is consistent with the association between networks providing material support and positive HIV and HCV serostatus. Although social capital is generally viewed as a positive attribute, several investigators have noted the potential negative impact of social capital on health behaviors (Lovell, 2002; Kunitz, 2004; Pronyk et al., 2008). The presence of male kin in the network may be a source of social capital, providing indirect resources, while the material support network provides direct monetary resources for more frequent injecting. The association between personal network factors and serostatus may also be a proxy for sociometric networks attributes such as more frequent turnover, resulting in a greater disease burden within the social networks. It is also possible that the reporting male kin and material supporters in IDUs' networks is a consequence of physical health status.

The finding of penetrative sex as a protective factor is perplexing. It suggests that IDUs did not become infected from their sexual partners, though they are the major risk factor for their partners acquiring HIV (Panda et al., 2005). It is plausible that these partnerships reflect network stability or less frequent drug use, yet it is puzzling that this association is in the opposite direction of reporting male kin and materials support networks. The finding that average duration of relationship with drug partners is a risk factor for HCV is consistent with prior findings of high levels of risk behaviors among close partnerships (Sherman et al., 2001). Interestingly emotional support network was a protective factor for both HIV and HCV. This support may help to regulate drug use and concomitant injection risks. The association between tattooing and HCV status is likely due to the unhygienic conditions of tattooing among network members using ink and needles.

The study is limited by the sampling and recruitment procedures and is primarily based on self-report data, which may have fostered socially desirable responding. The cross-sectional study design also limits casual inferences. The study results suggest that personal network

factors are significantly linked to HIV and HCV status among IDUs in Southern India. On average, IDUs reported small injection and social support networks. For HIV/HCV prevention, it may be feasible to have these small networks encourage their members to engage in risk reduction norms. Yet these small support networks may have few resources, especially for HIV/HCV support and care. Consequently, it may be important to establish support groups and other approaches to provide IDUs with informal and formal support, especially emotional support, for coping with HIV/HCV and cessation of drug use. Although family is often a critical source of social support in India, many participants reported no or only one family member in their social networks. It is likely that the stigma of drug use has significantly reduced the size of IDUs' family support networks. Programs for HIV prevention and care for drug users in India should examine the potential role integrating estranged family members or teaching drug users methods of enhancing communication with family members.

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Table 1

Sample characteristics

	HIV (n=1058)	HCV (n=1078)
	N(%)	N(%)
Age (yrs): Median (IQR)	35(20–56)	35(20–56)
Marital status		
Married/live-in partner	683(64.6)	698(64.8)
Single	314(30.0)	317(29.4)
Separated	47(4.4)	49(4.6)
Divorced/widowed	14(1.3)	14(1.3)
Education		
Less than secondary school	656(62.0)	669(62.1)
At least secondary school	402(38.0)	409(37.9)
Employment status		
Unemployed	109(10.3)	115(10.7)
Employed	949(89.7)	963(89.3)
Having tattoo		
No	386(36.5)	387(35.9)
Yes	672(63.5)	691(64.1)
Had penetrative sex in the past 3 months		
No	430(40.6)	441(40.1)
Yes	628(59.4)	637(59.1)
Age of first injection (yrs): Median (IQR)	25(12–51)	25(12–51)
Injected drugs at least 2–3 times a day		
No	928(87.7)	943(87.5)
Yes	130(12.3)	135(12.5)
Shared dirty cookers at least once a week in prior 6 months		
No		
Yes	739(70.0)	756(70.1)
	319(30.0)	322(29.9)
Shared dirty needles at least once a week in prior 6 months		
No	955(90.3)	973(90.3)
Yes	103(9.7)	105(9.7)
Total number of network members: Median (IQR)	3(2–11)	3(2–11)
Number of networks providing emotional support: Median (IQR)	2(0–6)	2(0–6)
Number of networks providing material support: Median (IQR)	2(0–5)	2(0–5)
Number of drug user networks participant sees daily: Median (IQR)	2(0–7)	2(0–7)
Length of time participant has known drug using networks (in months):		
Median (IQR)	144(12–480)	144(12–480)
Having female in the network		
No	639(60.4)	645(60.0)
Yes	419(39.6)	433(40.0)

	HIV (n=1058)	HCV (n=1078)
	N(%)	N(%)
Having female spouse or sex partners in the network		
No	905(85.5)	916(85.0)
Yes	153(14.5)	162(15.0)
Having female kin in the network		
No	825(78.0)	841(78.0)
Yes	233(22.0)	237(22.0)
Having male kin in the network		
No	1028(97.2)	1046(97.0)
Yes	30(2.8)	32(3.0)

Table 2

Bivariate and multivariate logistic regression models of HIV and HCV

	HIV(n=3835)				HCV(n=3936)			
	Unadjusted logistic regression	OR	95%CI	Adjusted logistic regression	Unadjusted logistic regression	OR	95%CI	Adjusted logistic regression
<i>Individual characteristics</i>								
Marital status								
Married/live-in partner	1	--		1	---	1	---	---
Single	1.23	0.86,1.74	0.99	0.66,1.51	1.02	0.76,1.38	0.73+	0.51,1.04
Separated	1.35	0.67,2.70	1.13	0.57,2.23	2.26	1.15,4.44	2.06+	0.99,4.26
Divorced/widowed	1.82	0.57,5.85	2.08	0.55,7.88	0.85	0.28,2.58	0.78	0.26,2.38
Education: at least secondary school	0.88	0.64,1.23	1.06	0.74,1.52	1.30+	0.99,1.72	1.65**	1.20,2.28
Employed	0.79	0.49,1.29	0.71	0.41,1.22	0.53**	0.33,0.83	0.48**	0.30,0.78
Has tattoo	2.76***	1.89,4.02	2.75***	1.84,4.11	2.15***	1.63,2.85	2.20***	1.61,3.01
Had penetrative sex in the past 3 months	0.56***	0.41,0.77	0.54**	0.38,0.77	0.55***	0.42,0.73	0.50***	0.36,0.68
Age first injected: yrs	0.96**	0.94,0.98	0.96**	0.94,0.99	0.93***	0.91,0.95	0.92***	0.90,0.94
Injected >=2 time a day	2.59***	1.69,3.96	3.00**	1.85,4.81	2.21***	1.42,3.43	2.33**	1.44,3.78
Sharing cookers at least once a week	1.03	0.73,1.44	0.64*	0.43,0.97	1.19	0.89,1.59	1.02	0.70,1.49
Sharing needles at least once a week	1.25	0.76,2.06	1.38	0.79,2.43	0.97	0.62,1.51	0.86	0.49,1.50
<i>Network characteristics</i>								
Provided emotional support	0.69**	0.56,0.86	0.48***	0.34,0.69	0.51***	0.42,0.63	0.39***	0.29,0.54
Provided material support	1.09	0.90,1.33	1.61**	1.17,2.20	0.85+	0.71,1.02	1.45*	1.09,1.92
Active drug user network member participant sees daily	1.26*	1.01,1.56	1.27+	0.99,1.63	0.95	0.78,1.15	---	---
Active drug user network member known for more than 10 years	1.21+	0.97,1.50	---	---	1.32**	1.09,1.61	1.52***	1.21,1.90
<i>Female network</i>								
Female network	1.18+	0.99,1.39	---	---	1.35**	1.14,1.59	---	---
Spouse or sex partner network	1.55*	1.11,2.15	1.36	0.89,2.09	1.77**	1.26,2.49	1.28	0.85,1.93
Female kin	0.96	0.74,1.26	---	---	1.20	0.94,1.53	---	---

	HIV(n=3835)				HCV(n=3936)			
	Unadjusted logistic regression		Adjusted logistic regression		Unadjusted logistic regression		Adjusted logistic regression	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Male kin	1.52	0.69,3.35	---	---	2.42 ⁺	0.99,5.90	2.61 [*]	1.10,6.17

⁺ p<.10,
^{*} p<.05,
^{**} p<.01,
^{***} p<.001