The Prevalence of Human Immunodeficiency Virus Type 1 and Hepatitis C Virus among Injection Drug Users Who Use High Risk Inner-city Locales in Miami, Florida

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In order to estimate the prevalence of human immunodeficiency virus type 1 (HIV-1) and hepatitis C virus (HCV) co-infection in hard-to-reach intravenous drug users, 199 subjects from high-risk inner-city locales, the so called "shooting galleries", were consented, interviewed, and tested in Miami, FL, US. Positive HIV-1 status was based on repeatedly reactive ELISA and confirmatory Western Blot. Positive HCV status was based on reactive ELISA and confirmatory polymerase chain reaction techniques. Overall, 50 (25%) were not infected with either virus, 61 (31%) were HIV-1/HCV co-infected, 17 (8%) infected by HIV-1 only, and 71 (36%) infected by HCV only. The results of the multivariable analyses showed that more years using heroin was the only significant risk factor for HCV only infection (odds ratio = 1.15; 95% confidence interval = 1.07, 1.24) and for HIV-1/HCV co-infection (odds ratio = 1.17; 95% confidence interval = 1.09, 1.26). This paper demonstrates that HIV-1/HCV co-infection is highly prevalent among so called "shooting galleries".

Key words: hepatitis C virus - human immunodeficiency virus 1 - co-infection - injection drug users

Several studies estimated that human immunodeficiency virus (HIV) and hepatitis C virus (HCV) co-infection rates among injection drug users (IDUs) in the US can be as high as 90-95% (Maier & Wu 2002). In terms of international estimates, a multi-center observational study in Brazil examined the co-infection rate among IDUs participating in a needle exchange program and found 42% of the population was HIV/HCV co-infected (Proietti et al. 2000).

Effects of HIV/HCV co-infection are particularly problematical. There is increasing evidence supporting the concept that people infected with HIV have an increased rapid course of their hepatitis C infection (Maier & Wu 2002). Treatment of co-infection is often complex because highly active anti-retroviral therapy (HAART) is frequently hepatotoxic, especially in the presence of HCV (Saves et al. 2000).

In this paper we report on the prevalence of HIV-1/HCV co-infection among a population of hard-to-reach IDUs in 8 high-risk inner-city locales in Miami, Florida. These locales or "shooting galleries" as they are commonly called are considered particularly high-risk areas for blood borne infection due to the injection behaviors that regularly occur there, such as sharing needles and other paraphernalia, the presence of infected blood, and drug injection kits that can be stored and rented repeatedly (McCoy et al. 1995).

SUBJECTS AND METHODS

Subjects - From January 1995 through December 1996, 201 IDUs were recruited from high-risk inner-city locales in Miami, Florida. All study participants were at least 18 years old and reported that they had injected drugs within 48 h of recruitment. Injection was verified by visual inspection of track marks. Informed consent for study participation and biological testing was obtained from 199 out of 201 potential study subjects. They agreed to participate in the study, to provide blood and urine samples, and to answer questions relating to their history of drug use. Consent was also obtained to store blood samples for further testing.

Methods - Each study participant was transported to the University of Miami Assessment Center, also located in inner-city Miami, for data collection. Structured interviews were conducted using a questionnaire. Information collected included demographic information, drug use history, and injection practices. In this particular subjects were questioned on booting and jacking. *Booting* is a process that uses a syringe to draw blood from the user's arm, mixes the drawn blood with the drug already taken into the syringe, and injects the blood-drug mixture back into the vein. Jacking is a procedure in which the user injects a portion of dissolved cocaine, pulls blood back into the syringe, and waits for the subsequent rush to subside. The user then repeats this process with a larger amount of the drug until the entire drug dose is mixed with blood and injected, thus emptying the syringe.

Use of heroin, cocaine or both was confirmed by urinalysis (Roche Diagnostics). Blood was drawn by certi-

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fied phlebotomists and subsequently tested for HIV-1. Pre- and post-test counseling was conducted. Positive HIV-1 status was based on repeatedly reactive enzyme-linked immunosorbent assay (ELISA) and confirmatory Western Blot.

The Medical Sciences Subcommittee for the Protection of Human Subjects in Research at the University of Miami granted approval to test the existing frozen blood specimens for HCV in 1999. Positive HCV status was based on reactive ELISA and confirmatory polimerase chain reaction (PCR) techniques. In the case of discrepancy between ELISA and PCR test results, confirmatory recombinant immunoblot analysis (RIBA) was performed.

Statistical analysis - Statistical analysis was performed using SAS version 8.2 (SAS Institute Inc 1999-2001, Cary, NC). Data analysis was restricted to the 199 (99%) of the 201 total study participants who provided blood samples and informed consent. Categorical data are reported as frequencies and percents; continuous data was reported as mean and standard deviation. We used logistic regression to analyze factors related to the disease status, a multinomial outcome (Hosmer & Lemeshow 2000). The "not infected" group was always used as the reference outcome group. Bivariate regressions were run for each independent variable as a predictor of disease status. A backward elimination selection process was used to run multivariable regressions to determine independent predictors of disease status.

RESULTS

Almost all study participants were non-Hispanic Black (98%). Hispanic and White non-Hispanic accounted for 1% each. Participants were categorized in four groups based on their infection status: no infection, co-infection with HIV-1 and HCV, HIV-1 only infection, and HCV only infection. Overall, 50 (25%) were not infected with either virus, 61 (31%) were HIV-1/HCV co-infected, 17 (8%) infected by HIV-1 only, and 71 (36%) infected by HCV only.

Table I shows socio-demographic characteristics by infection status and Table II shows risk behavior variables by infection status. Statistically significant differences among the four infection status groups were found for the following variables: employment status, age at the time of the study, age at initiation of injecting drugs, time using drugs, and reported bleeding while injecting.

Odds ratio and respective 95% confidence limits for HIV-1 and HCV infection by socio-demographic variables and by risk behavior variables are presented in Tables I and II, respectively. The following variables were identified as risk factor for HCV only infection and for HIV-1/HCV co-infection: increasing age, more years of use of alcohol, crack, heroine, speedball, as well as having injected more times during the last 30 days previous to the interview. Bleeding during drug injection was also found as risk factor.

Variables identified to be protective for HCV only infection and for HIV-1/HCV co-infection included: older age at first intravenous drug injection, more years of marijuana use, and booting.

Having an occasional job as opposed to being unemployed was identified as a protective factor for HIV-1/HCV co-infection. Having an illegal source of income as opposed to a legal source was also found to be a protective factor.

Male gender and an education level equal or greater than high school were found to be risk factors for HCV only infection; while living in own home as opposed to on the street was found to be protective.

The results of the multivariable analyses showed that more years using heroin was the only significant risk factor for HCV only infection (odds ratio = 1.15; 95% confidence interval = 1.07, 1.24) and for HIV-1/HCV co-infection (odds ratio = 1.17; 95% confidence interval = 1.09, 1.26).

DISCUSSION

Most of the HIV/HCV co-infection rates have been reported by clinic-based or program-based studies. These prior studies report co-infection rates ranging from 42% to 81% (Merrik et al. 1998, Proietti et al. 2000, Maier & Wu 2002). Our somewhat lower co-infection rate (31%) may be due to a few reasons: (1) this is not a clinic-based population; (2) there are too few subjects in the HIV-1 only group. The latter fact makes it difficult to conclude much about them. We believe that should there be additional cases in the HIV-1 only group the risk analyses would reflect similar findings for the HCV only and the HIV-1/HCV groups.

We found a high prevalence of HCV infection as compared to HIV-1 infection. This confirms previous reports in young IDUs that the prevalence of HCV infection was four times higher than HIV infection (Mendes-Correa et al. 2001). HCV seems to be more rapidly acquired after initiation of IV drug use than other viral infections, including hepatitis B virus (HBV) and HIV (CDC 1998). This more rapid acquisition of HCV infection compared with other viral infections among IDUs is likely to be caused by high prevalence of chronic HCV infection among IDUs as well as its higher virus loads, that result in a greater likelihood of exposure to an HCV infected person (CDC 1998). Furthermore, transmission rates based on needle-stick injuries suggest that HCV is spread relatively easily; in one recent study, between 3 and 9% of hospital workers contracted HCV following needle stick injury (Alter & Moyer 1998), compared to an HIV infection risk of less than 1% (Zaric et al. 2000). Similarly, a study of needle stick injuries in dental practice found transmission rates of 0.1-0.3% for HIV and 2.7-10% for HCV (Robinson 1998).

The high prevalence of HCV in this population of IDUs suggests a need to screen for HCV during intervention efforts since many individuals may be unaware of their infection status. Additional incentive to screen injection drug users for both HIV and HCV is that IDUs coinfected with HIV and HCV are at increased risk for several conditions that can lead to a more rapid disease progression including, but not limited to: inability of the liver to detoxify antiviral drugs (Thomas et al. 1996, Saves 2000), accelerated progression of liver fibrosis (Benhamou et al. 1999), development of lipodystrophy (Zylberger et al. 2000) recurrence or activation of Hepatitis C (Manegold et al. 2001), infection with other Hepatitis viruses, and more rapid progression to end-stage disease.

TABLE 1

Demographic characteristics, odds ratios, and 95% confidence intervals by human immunodeficiency virus 1 (HIV-1) and hepatitis C virus (HCV) infection status

Characteristic Odds Ratios (95% CI)	Not infected (n = 50)	HIV-1 only infected (n = 17)	HCV only infected (n = 71)	HIV-1/HCV Co-infected (n = 61)	p [a]
Age in years (mean)	36.94	36.88	42.81	42.78	< 0.001
OR (95% CI)		1.00 (0.93-1.08)	1.14 (1.07-1.22)	1.17 (1.09-1.26)	
Gender (%)					0.1751
Female	62.00	58.82	43.66	45.90	
OR (95% CI)		1.00	1.00	1.00	
Male	38.00	41.18	56.34	54.10	
OR (95% CI)		1.14 (0.37-3.51)	2.11 (1.01-4.41)	1.92 (0.90- 1.26)	
Education level (%)					0.1195
< High school	36.73	17.65	30.99	36.07	
OR (95% CI)		1.00	1.00	1.00	
High school	44.90	35.29	45.07	50.82	
OR (95% CI)		1.19 (0.52- 2.72)	1.64 (0.36- 7.48)	1.15 (0.50- 2.64)	
> High school	18.37	47.06	23.94	13.11	
OR (95% CI)		1.55 (0.56- 4.29)	5.33 (1.13-25.12)	0.73 (0.23-2.27)	
Employment (%)					0.0065
Unemployed	12.00	5.88	16.90	31.15	
OR (95% CI)		1.00	1.00	1.00	
Occasional job	62.00	47.06	38.03	45.90	
OR (95% CI)		0.44 (0.14- 1.32)	1.55 (0.16-14.77)	0.29 (0.10-0.82)	
Regular job	26.00	47.06	45.07	22.95	
OR (95% CI)		1.23 (0.38- 3.98)	3.69 (0.37-6.57)	0.34 (0.10-0.82)	
Source of income (%)					0.1157
Legal	62.00	62.50	76.06	80.33	
OR (95% CI)		1.00	1.00	1.00	
Illegal	38.00	37.50	23.94	19.67	
OR (95% CI)		0.98 (0.31-3.13)	0.51 (0.23- 1.13)	0.40 (0.17-0.94)	
Dwelling (%)					0.2386
Street	6.00	29.41	12.68	18.03	
OR (95% CI)		1.00	1.00	1.00	
Home	78.00	52.94	76.06	68.85	
OR (95% CI)		0.46 (0.12- 1.82)	0.14 (0.03-0.69)	0.29 (0.08-1.13)	
Shelter	16.00	17.65	11.27	13.11	
OR (95% CI)		0.33 (0.07- 1.71)	0.23 (0.03-1.58)	0.27 (0.06- 1.36)	
Partnering status					0.4955
No partner	46.00	35.29	43.66	50.82	
OR (95% CI)		1.00	1.00	1.00	
Partnered	28.00	29.41	16.90	16.39	
OR (95% CI)		0.64 (0.25-1.63)	1.37 (0.35-5.33)	0.53 (0.20- 1.40)	
Ex-partnered	26.00	35.2	39.44	32.79	
OR (95% CI)		91.60 (0.68- 3.74)	1.77 (0.47- 6.62)	1.14 (0.47- 2.76)	

a: Chi-square test of independence for categorical variables and GLM for continuous variables.

Although not confirmed by the multivariate analyses, our results coincide with prior reports that demonstrate that among IDUs, HIV infection is linked to frequency of injection (Marmor et al. 1987, Schoenbaum et al. 1989). Furthermore, injection drug use in the prior two months was among several risk behaviors significantly associated with HIV infection in a drug injectors community of Santos, Brazil (de Carvalho et al. 1996). Additionally, HCV infection in IDUs has been linked to age and duration of injection (van Beek et al. 1994, Lamden et al. 1998). Similarly, a recent study among street-recruited IDUs in New Mexico found that HCV infection in these subjects was positively associated with increased age, years of injection, and heroin use (Samuel et al. 2001).

We found male gender to be a risk factor for HCV infection whereas other studies found no gender difference for HCV infection among drug users (Edeh et al. 2000).

Emphasis on prevention of all blood-borne pathogens including HCV and HIV must be a vital part of public health messages targeting injection drug users, particularly those who are hard to reach or who may not be ready to enter a drug treatment program.

We demonstrate that HIV-1/HCV co-infection is highly prevalent among hard-to-reach IDUs that inject at so-

TABLE II

Risk behavior variables, odds ratios and 95% confidence limits for human immunodeficiency virus 1 (HIV-1) and hepatitis C virus (HCV) infection status

Risk behavior variable Odds Ratio (95% CI)	Not infected (n= 50)	HIV-1 onlyinfected (n = 17)	HCV onlyinfected (n = 71)	HIV-1/HCVco-infected (n = 61)	p[a]
Age at first IV drug injection	27.04	25.41	20.70	20.78	< 0.001
Odds Ratio (95% CI)		0.98 (0.92 - 1.04)	0.89 (0.84 - 0.94)	0.88 (0.83 - 0.94)	
Years using alcohol	21.91	20.89	26.57	28.51	< 0.001
Odds Ratio (95% CI)		0.98 (0.91- 1.06)	1.08 (1.02 - 1.13)	1.13 (1.06 - 1.21)	
Years using marijuana	20.72	20.16	27.05	26.46	< 0.001
Odds Ratio (95% CI)		0.98 (0.92 - 1.04)	0.89 (0.84 - 0.94)	0.88 (0.83 - 0.94)	
Years using crack	11.89	11.63	11.87	10.95	0.850
Odds Ratio (95% CI)		0.99 (0.90 - 1.08)	1.17 (1.09 - 1.26)	1.17 (1.08 - 1.27)	
Years using cocaine	13.58	13.75	21.04	21.48	< 0.001
Odds Ratio (95% CI)		0.99 (0.89 - 1.10)	1.00 (0.94 - 1.07)	0.98 (0.91 - 1.04)	
Years using heroine	10.69	17.26	24.10	22.22	< 0.001
Odds Ratio (95% CI)		1.00 (0.94 - 1.08)	1.14 (1.07 - 1.20)	1.19 (1.11 - 1.28)	
Years using speedball	12.05	14.43	21.62	20.57	< 0.001
Odds Ratio (95% CI)		1.07 (0.97 - 1.18)	1.17 (1.09 - 1.26)	1.15 (1.07 - 1.24)	
Times injected last 30 days	58.92	42.99	85.33	78.65	0.0428
Odds Ratio (95% CI)		1.02 (0.91 – 1.16)	1.13 (1.05 - 1.22)	1.17 (1.07 - 1.28)	
Bleeding while injecting (%)					0.0134
No	64.00	70.59	43.66	39.34	
Odds Ratio (95% CI)		1.00	1.00	1.00	
Yes	36.00	29.41	56.34	60.66	
Odds Ratio (95% CI)		0.74 (0.23 - 2.44)	2.29 (1.09 - 4.83)	2.74 (1.27 - 5.94)	
Booting (%)					0.0509
No	4.00	5.88	18.31	19.67	
Odds Ratio (95% CI)		1.00	1.00	1.00	
Yes	96.00	94.12	81.69	80.33	
Odds Ratio (95% CI)		0.67 (0.06 - 7.85)	0.19 (0.04 - 0.87)	0.17 (0.04 - 0.80)	
Jacking (%)					0.5311
No	52.00	47.06	61.97	60.66	
Odds Ratio (95% CI)		1.00	1.00	1.00	
Yes	48.00	52.94	38.03	39.34	
Odds Ratio (95% CI)		1.22 (0.41 - 3.67)	0.67 (0.32 - 1.38)	0.70 (0.33-1.50)	

a: Chi-square test of independence for categorical variables and GLM for continuous variables.

called “shooting galleries”. Consideration should be given to establishing aggressive street outreach activities to offer HIV/HCV screening and counseling to this high risk population of IDUs. Focus should be placed on young users, early in their drug use experience.

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