

Prevalence and Correlates of Hepatitis C Virus Infection among Street-Recruited Injection Drug Users in San Juan, Puerto Rico

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ABSTRACT *Throughout the world, injection drug users (IDUs) are the group at highest risk for hepatitis C virus (HCV) infection. IDUs residing in the island of Puerto Rico and Puerto Rican IDUs residing in the U.S. mainland have been shown to be at very high risk of infection with HIV. However, the extent to which HCV infection has spread among IDUs in Puerto Rico is not yet known. The aims of this study were to estimate seroprevalence of HCV and to identify the correlates associated with HCV transmission. The sample was drawn through street outreach strategies and was comprised of 400 injection drug users not in treatment, living in the San Juan metropolitan area. HCV and HIV infection were detected by enzyme-linked immunosorbent assay and the results were confirmed by Western blot. Information on sociodemographics, drug use patterns, and risk behaviors was obtained through structured interviews. Bivariate analyses and multivariate logistic regression were used to assess covariates of infection with HCV. The prevalence of HCV infection was 89%. After controlling for sociodemographic characteristics, HCV infection was positively associated with increasing years of injection, injecting in a shooting gallery, tattooing in prison, and self-reported STD infection. Notably, IDUs who had initiated drug injection within the year prior to the study interview had an HCV infection rate of 57%. This study indicates that more aggressive educational programs are urgently needed to reduce the spread of HCV infection among IDUs in Puerto Rico.*

KEYWORDS *Hepatitis C, Injection drug users, Puerto Rico, Shooting gallery, Tattooing.*

INTRODUCTION

Hepatitis C virus (HCV) infection has been recognized as a major health problem worldwide.¹ Throughout the world, injection drug users (IDUs) are the group at highest risk for HCV.²⁻⁶ Moreover, HCV infection has been shown to be rapidly acquired shortly after the initiation of injection practices.^{4,7}

IDUs in Puerto Rico and Puerto Rican IDUs residing in the U.S. mainland have been shown to be at very high risk of infection with HIV. In contrast to other U.S.

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populations, IDU is the most common risk category for AIDS cases in Puerto Rico and among Puerto Ricans in the U.S. mainland.^{8,9} Puerto Rico ranks sixth in AIDS incidence rates among all states and territories.¹⁰ Recent epidemiological studies estimate an HIV seroprevalence rate of 20% among IDUs in Puerto Rico¹¹ and HIV seroincidence at a very high rate of 3.5 per 100 persons at risk.¹² Moreover IDUs in Puerto Rico have been found to inject very frequently, to reuse the same syringe many times, to be more likely to share drug preparation materials, and inject in shooting galleries, compared with IDUs in the U.S. mainland.¹¹⁻¹⁵ However, the extent to which HCV infection has spread among IDUs in Puerto Rico is not yet known.

The aims of this study were to estimate seroprevalence of HCV and to identify the correlates associated with HCV infection among a sample of IDUs in Puerto Rico.

MATERIALS AND METHODS

This study was part of a larger research development project encompassing several different studies. Given the diversity of the research objectives, the sample size ($n = 400$) was initially calculated so as to have statistical power of no less than 80% to detect moderate size associations (odds ratios ≥ 1.40). Ethnographic mapping strategies were used to locate outdoor drug markets in the San Juan metropolitan area in Puerto Rico. Subjects were recruited based on a schedule of randomized visits to the identified sites. Individuals were considered eligible if they were at least 18 years of age, had injected drugs in the last 30 days, and had not been enrolled in drug abuse treatment during the last 30 days. Verification of injection drug use was made through visual examination for signs of recent venipuncture¹⁶ and urinalysis using Abuscreen OnTrak (Roche Diagnostic Systems, Inc.). The recruitment methodology and procedures have been described in more detail elsewhere.¹⁷

Serology testing was performed for HCV using the HCV enzyme-linked immunoassay (EIA) version 2.0 (Abbott) and for HIV-1 using rLAVEIA (BIO RAD Laboratories). Results were confirmed by western blot.

Drug use patterns and HIV/HCV risk behaviors were measured using a revised and culturally adapted version of the risk behavior assessment (RBA).¹⁸⁻²⁰ Drug injection behaviors included number of years injecting and whether the subject had pooled money with other IDUs to buy drugs. Injection risk behaviors included injection in shooting galleries, backloading from one syringe to another, sharing syringes, sharing cotton filters and cookers, and sharing rinse water. Sexual risk behaviors included the number of times the individual had unprotected vaginal, anal, and oral sex and whether the individual had traded sex for money or drugs.

The study design, enrollment procedures, and survey instrument were approved by the Institutional Review Board (IRB) of the Universidad Central del Caribe, School of Medicine.

Association between HCV infection and potential correlates was assessed bivariate by odds ratios and 95% confidence intervals. A multiple logistic regression model using a backward elimination method was then fitted to identify correlates independently associated with HCV infection. All variables used in the univariate analyses were included in the multiple logistic regression model, except age which was highly correlated with years of injection. Several interaction terms were tested in the final model: use of shooting galleries and history of STDs in interaction with injection-related risk.

TABLE 1. Characteristics of 400 injection drug users in San Juan, Puerto Rico

Characteristic	Number	Percent
Total sample	400	100.0
Gender		
Female	89	22.2
Male	311	77.8
Age		
Mean (SD) ^a	32.8 (9.1)	
Less than 25 years old	92	23.0
25–34 years old	156	39.0
35 years old or more	152	38.0
Education level ^b		
<high school	191	47.9
Completed high school	156	39.1
>high school	52	13.0
Years of drug injection ^b		
Mean (SD) ^a	11.6 (10.2)	
0–5 years	157	39.3
6–10 years	75	18.8
11–15 years	47	11.8
16 years or more	120	30.1
HIV infection status (positive) ^b	64	17.0
HCV infection status (positive) ^b	331	89.0

^aStandard deviation.^bVariations in sample size due to missing data.

RESULTS

Table 1 shows that the sample was predominantly male (77.8%). The mean age was 32.8 years, with 39% of the study population between 25 to 34 years old. Almost half of the sample (47.9%) had not completed a high school education. Mean number of years of injection was 11.6, with almost 61% of the sample reporting injecting during more than 5 years. The prevalence of HIV infection was 17.0%, and the prevalence of HCV was 89.0%.

In the univariate analysis (Table 2), the odds of males being HCV seropositive was more than two times that of females (OR = 2.3, 95%; CI = 1.2,4.7). The odds of IDUs more than 35 years old being HCV seropositive was four times higher than the odds of IDUs less than 25 years old (OR = 4.1, 95%; CI = 1.4,12.0). Seroprevalence of HCV was strongly associated with number of years of injection. The odds of IDUs with more than 16 years of drug injection being HCV seropositive was almost 26 times higher than the odds of IDUs with 1 year of injection or less (OR = 25.8, 95%; CI = 5.6,120.2). Participants who had injected drugs in a shooting gallery had odds of HCV infection eight times higher than those who reported never injecting in a shooting gallery (OR = 8.2, 95%; CI = 2.7,25.3). IDUs who reported a history of STDs (herpes simplex virus infection, syphilis, or gonorrhea) had odds of HCV infection seven times higher than IDUs who reported no history of STDs (OR = 7.6, 95%; CI = 1.1,56.7). The odds of HCV infection among individuals who had received tattoos while incarcerated were eight and a half times higher than among those who had not received a tattoo (OR = 8.5, 95%; CI = 3.4,21.3).

TABLE 2. Univariate analysis of hepatitis C virus (HCV) infection among injection drug users in Puerto Rico

Characteristic	Number	HCV-positive (%)	Odds ratio	95% CI
Gender				
Female	60	81.1	1.0	
Male	271	90.9	2.3	(1.2,4.7)
Age				
Less than 25 years old	76	86.4	1.0	
25–34 years old	126	84.0	0.8	(0.4,1.8)
35 years old or more	129	96.3	4.1	(1.4,12.0)
Education				
<high school	165	90.7	1.0	
High school	126	88.7	0.8	(0.4,1.7)
>high school	40	85.1	0.6	(0.2,1.5)
Years of injection				
1 year or less	29	67.4	1.0	
2–5 years	88	85.4	2.8	(1.2,6.6)
6–10 years	66	90.4	4.6	(1.7,12.4)
11–15 years	40	93.0	6.4	(1.7,24.5)
16 years or more	107	98.2	25.8	(5.6,120.2)
HIV serostatus				
Negative	266	87.5	1.0	
Positive	59	95.2	2.8	(0.8,9.4)
Times injected in jail (ever)				
None	190	84.4	1.0	
1–99 times	97	94.2	2.9	(1.2,7.3)
100 times or more	44	98.6	2.8	(0.7,48.3)
Times used shooting galleries (ever)				
None	18	72.0	1.0	
1–99 times	144	84.7	2.2	(0.8,5.7)
100 times or more	169	95.5	8.2	(2.7,25.3)
Times shared rinse water (ever)				
None	125	85.0	1.0	
1–99 times	164	90.6	1.7	(0.9,3.3)
100 times or more	41	95.3	3.6	(0.8,16.0)
Times shared cooker (ever)				
None	118	85.5	1.0	
1–99 times	161	89.4	1.4	(0.7,2.8)
100 times or more	52	96.3	4.4	(0.9,19.5)
Times backloading (ever)				
None	116	85.3	1.0	
1–99 times	170	89.0	1.4	(0.7,2.7)
100 times or more	45	100.0	2.8 x 10 ⁸	(0.0,–)
Times shared needles (ever)				
None	169	86.2	1.0	
1–99 times	142	91.6	1.7	(0.9,3.5)
100 times or more	20	95.2	3.2	(0.4,24.8)
Casual sex partner (ever)				
None	98	90.7	1.0	
With condoms	50	86.2	0.6	(0.2,1.7)
Without condoms	183	88.8	0.8	(0.4,24.8)
Commercial sex partner (ever)				
None	257	90.2	1.0	

TABLE 2. Continued

Characteristic	Number	HCV-positive (%)	Odds ratio	95% CI
With condoms	35	85.4	0.6	(0.2,1.6)
Without condoms	39	84.8	0.6	(0.2,1.5)
STDs (ever) ^a				
No	278	87.4	1.0	
Yes	53	98.1	7.6	(1.1,56.7)
Tattoo (ever)				
No	90	76.9	1.0	
Not in jail	71	89.9	2.7	(1.1,6.2)
In jail	170	96.6	8.5	(3.4,21.3)

^aIncludes herpes simplex virus infection, syphilis, gonorrhea.

Table 3 shows the results of the multiple logistic regression analysis. Using backwards elimination, HCV infection remained positively associated with increasing years of injection, having ever injected in a shooting gallery, self reported history of STDs, and reports of tattoos done both outside and inside prisons. Interaction terms of use of shooting galleries and history of STDs in interaction with injection-related risk were assessed. None were found to be statistically significant (data not shown).

DISCUSSION

The findings of this study suggest that IDUs in Puerto Rico have a very high rate of infection with HCV. The rate of HCV infection found in this study (89.0%) is higher than that reported in countries considered to have among the highest rates around the world.^{2-4,21-23}

Moreover, HCV infection in our sample appears to have been acquired very shortly upon initiation of drug injection. We found HCV seroprevalence to exceed 75% among IDUs who had been injecting for a period of 1 year or less. Rapid increases in HCV seroprevalence as a function of years of injection have been reported elsewhere,^{4,24-27} although the baseline rates and the slopes of the curves reported have generally been lower than in our case. These findings are consistent with some of our previous studies reporting higher overall HIV risk behaviors, particularly the use of shooting galleries.^{28,29}

Use of shooting galleries appeared to be of particularly high risk for HCV infection. Several studies have documented that attending shooting galleries is a high risk behavior for the transmission of HIV³⁰⁻³⁴ especially among Puerto Rican IDUs.²⁸ Based on these findings, Puerto Rican IDUs who use shooting galleries should be educated on the necessity of using clean injecting equipment and on how to clean it properly in order to arrest this emerging epidemic of HCV.

We also found a strong association between having had a tattoo while incarcerated and HCV infection. Since tattooing in jail or prison is commonly performed using non-sterile equipment,³⁵ it is not surprising that this practice would be a risk factor for the transmission of blood borne pathogens. A similar association has been reported in a study conducted among IDUs in Spain.³⁶ Several authors have discussed tattooing as a mode of HCV and HIV transmission.³⁷⁻³⁹ Other studies have noted a high prevalence of tattoos among anti-HCV positive patients with chronic hepatic disease⁴⁰ and among persons attending HIV

TABLE 3. Results of backward multiple logistic regression^a for correlates of HCV seropositivity among injection drug users in Puerto Rico

Characteristics	Adjusted OR	95% CI
Female	1.0	
Male	2.6	(1.1,6.5)
Years of injection		
<1	1.0	
2–5	1.4	(0.5,3.9)
6–10	1.5	(0.5,4.9)
11–15	3.2	(0.7,14.5)
16 or more	16.6	(3.3,84.0)
Times injected in shooting galleries (ever)		
none	1.0	
1–99	1.1	(0.3,4.0)
100 or more	4.0	(1.1,15.9)
History of STD ^b		
No	1.0	
Yes	10.9	(1.2,96.7)
History of tattooing		
Never	1.0	
Out of jail	2.8	(1.1,7.1)
In jail	9.2	(3.2,26.8)

^aBackward elimination method, initially entering all variables listed in Table 2 except age.

^bIncludes herpes simplex virus, syphilis, gonorrhea.

outpatient clinics. Moreover, a study among fishermen in Thailand found a significant association between HIV seroprevalence and having had a tattoo.⁴¹ However, in the United States case control studies have generally reported no association between HCV and tattooing.^{42,43} Inconsistent findings could be reflecting variations in the sanitary conditions under which tattoos are made across countries.

In this study we found that sex with a casual or commercial sex partner without using condoms was not associated with HCV infection. In contrast, history of sexually transmitted diseases was associated with HCV infection. Other studies have also found sexual practices to be unrelated to HCV infection⁴³ and a history of sexually transmitted diseases to be associated with HCV infection.^{42,44} Prevention of HCV spread in the IDU population should thus include harm reduction measures and information on safer sex practices for both IDUs and their sexual partners.

Some of the limitations of this study merit comment. The sample in our study cannot be considered representative of the population of IDUs in Puerto Rico. However, our recruitment procedures were designed to reduce selection biases to the greatest extent possible. More importantly, the study had a cross-sectional design and the temporal sequencing of risk behaviors and HCV infection cannot be established.

Because a vaccine for HCV is unlikely to be developed in the near future, prisons and drug abuse treatment programs in Puerto Rico might play an essential role in controlling the epidemic among drug users. Health care institutions in Puerto Rico will need to intensify their efforts to reduce the risk of HCV transmission among drug injectors and to help those already infected obtain the

care they need. Furthermore, prisons and drug treatment programs will also need to develop and expand linkages with the health care system for HCV prevention screening and referral to care so that their inmates and patients can maintain their health to the greatest extent possible.

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