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The association of syringe type and syringe cleaning with HCV infection among IDUs in Budapest, Hungary

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Abstract

We assessed whether syringe type, syringe cleaning and distributive syringe sharing were associated with self-reported and laboratory confirmed HCV infection among Hungarian IDUs. Injecting drug users (N=215) were recruited from non-treatment settings in Budapest, Hungary between October 2005 and December 2006. Multivariate logistic regression models identified correlates of self-report of being HCV infected and testing positive for HCV. While 37% tested positive for HCV, 14% of the total (39% of those who tested positive) self-reported being HCV infected. Using any two piece syringes was significantly associated with self-reported HCV infection, while distributive syringe sharing was not associated with self-report of being HCV infected. Engaging in receptive sharing of only one-piece syringes but always cleaning before reuse was not associated with testing HCV positive, while any receptive sharing of only one-piece syringes and not always cleaning before reuse was significantly associated with testing HCV positive. Sharing cookers and squirting drugs from one syringe into another syringe were not associated with testing HCV positive. The high percent of those HCV infected who did not know they were infected highlights the need to provide better access to confidential testing and counseling services. Counseling should emphasize secondary prevention of HCV among HCV infected IDUs. Our findings also indicate that syringe type and syringe cleaning practices may play a role in HCV transmission. Ethnographic research should identify the reasons why IDUs may use two-piece syringes and suggest means to reduce their use. Thorough cleaning of one-piece syringes when sterile syringes are unavailable may be an efficient way to reduce the risk of HCV infection.

Keywords

HCV infection; one-piece and two-piece syringes; syringe cleaning; minorities; Central Europe

1. Introduction

Sharing of non-sterile syringes represents the highest risk of infection with blood-borne pathogens among injection drug users (IDUs) (Golub et al. 2007). One aspect of syringe sharing

that may influence the risk of infection when the syringes are shared is the type of syringes that IDUs use to inject. One-piece syringes have minimal dead space between the needle and the depressed plunger (Grund and Stern, 1991), compared to detachable two-piece syringes, which have considerable dead space between the needle and the depressed plunger (Picture 1). Since more blood may be retained in the two-piece syringes, they are more effective vehicles of pathogen transmission (Zule et al. 1997; Zule et al. 2002) and have been linked to greater transmission of bloodborne pathogens (Zule et al. 1997; Grund and Stern, 1991; Gaughwin et al. 1991). While there is evidence that HIV infection is higher among IDUs who used any two-piece syringes compared to IDUs who used only one-piece syringes (Zule et al. 2002), little is known about the association of Hepatitis C virus (HCV) infection and syringe type.

Cleaning and disinfecting used syringes before sharing may greatly reduce the risk of infection with bloodborne pathogens. While HIV prevention interventions among IDUs emphasize disinfecting used needles with bleach before reuse (Centers for Disease Control and Prevention, 1993), other researchers question the efficiency of bleach use (Titus et al. 1994) and suggest that heat, thorough cleaning with water, or an acidic environment may be sufficient to inactivate HIV (Clatts et al. 1999; Abdala et al. 2001; Abdala et al. 2004; Heimer et al. 2007). Little is known, however, about the effect of syringe cleaning on HCV inactivation and a subsequent reduction in transmissibility.

Another aspect of syringe sharing that may influence the risk of transmission with bloodborne pathogens is behavior change resulting from knowledge of being infected. IDUs who know that they are infected may adopt informed altruism (Des Jarlais et al. 2004): they may engage in less distributive syringe sharing to prevent infecting presumed uninfected IDUs (Schlumberger et al. 1999; Des Jarlais et al. 2004; Desenclos et al. 1993). They may also engage in ordered sharing, a form of serosorting where, when there are not enough syringes, uninfected IDUs inject before the infected IDUs (Des Jarlais et al. 2004). While informed altruism and ordered sharing has been documented in the context of HIV, research has found that knowledge of HCV serostatus may have little or no impact on risky injecting behaviors (Ompad et al. 2002; Golub et al. 2007).

The prevalence of HIV among IDUs in Hungary, a Central European country with 10 million inhabitants, is estimated to be under 1% (National Center for Epidemiology, 2007; Rácz et al. 2007; European Centre for the Epidemiological Monitoring of AIDS, 2006). However, the prevalence of HCV among Hungarian IDUs is estimated to be around 30% (European Monitoring Centre for Drugs and Drug Addiction, 2006; Ujhelyi et al. 1998; Topolánszky, 2002). The aim of this study was to assess among IDUs in Budapest, Hungary the prevalence and correlates of self-reported and laboratory-confirmed HCV infection. We hypothesized that distributive syringe sharing would be lower among those who self-reported being HCV infected. Furthermore, we hypothesized that the use of two-piece syringes would be associated with HCV infection, and that cleaning of one-piece syringes before receptive syringe sharing would reduce HCV risk nearly to the level of using sterile syringes.

2. Methods

2.1. Setting and participants

Between October 2005 and December 2006, 215 injecting drug users were recruited in Budapest, Hungary from non-treatment settings using a combination of street outreach and chain referral methods (Gyarmathy and Neaigus, 2006) for a cross-sectional research study examining network risk for HIV, HBV and HCV. Participants were recruited from areas of the city where drug users often congregate, from the needle exchange, and through referral by other IDUs who were in the study. Individuals who self-reported injecting drugs in the past 30 days were eligible to participate. Self report of drug use (e.g., heroin, cocaine, amphetamine

and methamphetamine) was verified by urine tests for those who reported injecting drugs in the past 2-3 days (nobody tested positive for methamphetamine). Drug injection was verified by inspection of injecting marks for those who reported injecting in the past 30 days. Participants were paid HUF 2000 (about USD 10) for participation and HUF 500 (about USD 2.5) for bringing in their nominated network members or other IDUs who were eligible to participate in the study. After providing their informed consent, eligible participants were administered a structured survey interview that took about 2 hours to complete.

After completing the interview, participants provided blood samples for biological testing and were given counseling on drug use related infections. We used Biomerieux HIV Uniform II (Ag+Ab) for HIV antibody screening. Ortho HCV 3 kit confirmed by RIBA were used for HCV antibody screening. The Institutional Review Boards at the National Development and Research Institutes, Inc. in New York, USA and the Hungarian Academy of Sciences in Budapest, Hungary approved all human subjects procedures.

2.2. Measures and variables

The dependent variables in this analysis were self-report of being HCV infected and laboratory confirmed HCV infection. Independent variables measured past 30-day syringe use and sharing, sharing of injecting equipment other than syringes, risk behaviors, risk network characteristics, other blood exposure, and background variables. Variables assessing *syringe use and sharing* were: distributive syringe sharing of any type of syringe; and a composite variable assessing syringe type, receptive syringe sharing, and syringe cleaning practices (1. using only one-piece syringes and not engaging in receptive syringe sharing [reference]; 2. using only one-piece syringes and engaging in receptive syringe sharing but always cleaning before sharing; 3. using only one-piece syringes and engaging in receptive syringe sharing and not always cleaning before sharing; and 4. using any two-piece syringes). *Sharing other injecting equipment* assessed sharing cookers or sharing filters, and squirting drugs from one syringe into another syringe. *Risk behavior variables* were: any unprotected vaginal sex, any unprotected anal sex, daily alcohol use, daily heroin injecting, amphetamine injecting at least once a week, taking a “break” (not injecting any drugs for at least seven consecutive days) during their injecting career (1. not taking a break; 2. taking a break that lasted between a week and a month; and 3. taking at least one break that lasted for over one month [based on median cutoff for length of break]). *Risk network variables* were: number of injecting partners and number of sex partners. *Other blood exposure variables* included engaging in a bloody fight, having any tattooing, having unprotected sex when the participant’s sex partner or (if female) the participant was having her period, having any piercings, and having genital piercings. *Control variables* were: gender, age, Roma ethnicity, having at least a high school education, being homeless, and years since first started injecting.

2.3. Statistical analysis

All 215 participants were included in the analysis of the correlates of self-reported HCV infection. Of the 215 participants who were interviewed, 186 (86.5%) provided biological samples. Those who provided biological samples were significantly less likely than those who did not provide samples to have at least a high-school degree; there were no significant differences in age, gender and Roma (Gypsy) ethnicity. Of the 186 participants, one person tested indeterminate for HCV. Thus, 185 participants were included in the analysis examining the correlates of laboratory-confirmed HCV infection.

Univariate analyses with contingency tables to describe distribution and chi-square tests with corresponding p-values were used. Variables with at least marginal ($p < 0.20$) association in the univariate analysis were chosen for logistic regression analysis. Multivariate logistic regression with backwards elimination was used to assess significant associations with HCV

infection. To test our hypotheses, distributive syringe sharing was kept in the model assessing correlates of self-report of being HCV infected, and the syringe use and syringe sharing variables were kept in the model assessing laboratory-confirmed HCV infection. In addition, to control for selection bias, at least high-school education was kept in the analysis assessing laboratory-confirmed HCV infection. Adjusted odds ratios (aOR) and 95% confidence intervals (95%CI) of the final multivariate regression models are reported.

3. Results

3.1. Sample characteristics

About three quarters (77%) of the sample were male, and the mean age was 27.9 years (median=27, SD=6.5, range: 18-56) (Table 1). About one fifth (21%) was Roma, about a quarter (24%) had at least a high school education, and 13% were homeless. Participants have been injecting for a mean of 7.5 years (median=7, SD=5.3, range: less than a year - 25 years). Only few (7%) reported that they used any two-piece syringes. Most (71%) reported using only one-piece syringes and not engaging in receptive syringe sharing, 12% reported using only one-piece syringes and engaging in receptive syringe sharing but always cleaning the syringe before reusing it, and 11% reported using only one-piece syringes and engaging in receptive syringe sharing and not always cleaning the syringe before reusing it. One in five (20%) reported engaging in distributive syringe sharing. The majority (61%) reported sharing cookers or filters, and about a quarter (27%) reported squirting drugs from one syringe into another syringe. Nobody tested positive for HIV. Altogether 37% tested positive for HCV: 23% of the total (61% of those who tested positive) self-reported being HCV negative but tested HCV positive, and 14% of the total (39% of those who tested positive) self-reported positive and tested positive.

3.2. Correlates of self-reported HCV infection

In univariate analysis, distributive syringe sharing was not associated with self-report of being HCV infected. The combined variable syringe type and syringe sharing, daily heroin injecting, not taking breaks from injecting, accidental needle stick injury, older age, being homeless, and longer time since first injecting were associated with self-report of HCV infection. In multivariate analysis, distributive syringe sharing was not associated with self-report of being HCV infected. Using any two piece syringes, injecting heroin daily, female gender, and a higher number of years since first injecting were significantly and very strongly associated with self-report of being HCV infected.

3.3. Correlates of laboratory-confirmed HCV infection

In univariate analysis, the combined variable syringe type and syringe sharing, tattooing before 2003, older age, Roma ethnicity, not having at least a high school education and longer time since first injecting were significantly associated with testing positive for HCV. In multivariate analysis, engaging in receptive sharing of only one-piece syringes but always cleaning before reuse was not associated with HCV infection, while receptive sharing of only one-piece syringes and not always cleaning before reuse was significantly associated with testing positive for HCV. Furthermore, Roma ethnicity, not having at least a high school education and longer time since first injecting were associated with testing positive for HCV.

4. Discussion

In this study we found moderate levels of HCV infection, and that the majority of those who were infected were unaware of being infected. In addition, our findings lend support to our hypotheses that the use of two-piece syringes would be associated with HCV infection, and that cleaning of one-piece syringes before receptive syringe sharing would diminish HCV risk

nearly to the level of using sterile syringes. However, our hypothesis that distributive syringe sharing would be lower among those who self-reported being HCV infected, was not supported.

One innovation of this analysis is our finding that receptive syringe sharing of one-piece syringes but always cleaning before sharing was not associated with HCV infection, indicating that thorough cleaning of one-piece syringes seems to diminish HCV risk to the level of using sterile syringes. In a post hoc analysis of this sample of Hungarian IDUs, we found that among those who reused syringes, only one person used bleach, whereas the majority used hot or cold water to clean used syringes. This suggests that for one-piece syringes, cleaning (regardless of the cleaning agent) may be sufficient to remove enough blood from the syringe to considerably decrease the risk of HCV infection upon reuse (Abdala et al. 2001). In addition, most of the participants were heroin injectors who injected brown powder heroin mixed and cooked with large amounts of ascorbic acid. However, amphetamine injectors, who used no heat or acid to prepare the drugs, did not have higher levels of HCV infection. This suggests that, unlike for HIV (Clatts et al. 1999; Heimer et al. 2007), heat and/or acidic environments may not be as important as syringe cleaning to reduce HCV infection risk for those who used one-piece syringes.

Another of the novel findings of this analysis is the association of using any two-piece syringes with self-reported HCV infection. One might argue that this association may be confounded by years of injecting, because the use of two-piece syringes has been associated with years of injecting (Zule et al. 2002), and years and/or lifetime frequency of injecting have been associated with increased risk of HCV (and HIV) infections (Gyarmathy et al. 2002; Neaigus et al. 2007). However, we controlled for years of injecting drug use in our final multivariate model, and both years of injecting and the use of two-piece syringes were independently and significantly associated with self-reported HCV infection. It is also possible that two-piece syringe use may be a consequence of knowledge of being HCV infected, (i.e., those who know they have HCV may be more likely to use two-piece syringes), but we believe this is highly unlikely.

There was, however, no association between using any two-piece syringes and testing positive for HCV. While years of injecting was associated with self-report of being HCV infected in this study, only few shorter term injectors used two-piece syringes. In addition, most of those who tested HCV positive were shorter term injectors who self-reported being HCV negative. Thus, this sample did not have enough power to detect an association, if there was one, between laboratory confirmed HCV infection and the use of two-piece syringes. Analysis of an IDU sample where a larger proportion of IDUs, especially of new IDUs, use two-piece syringes is needed to examine the association of using two piece syringes and laboratory confirmed HCV infection.

The negative association of high school education and the positive association of Roma ethnicity with discordant HCV infection may have several explanations. For example, differences in risk behaviors, testing behaviors, and/or risk networks may contribute to the association of Roma ethnicity and high school education with HCV. Post-hoc analysis of our data yielded no differences in risk- or testing behaviors among these groups, which suggests the possible role of risk networks. It may be that IDUs with at least a high school education and Roma IDUs have isolated injecting networks, but while high-school educated IDUs may have low HCV prevalence networks with little interaction, Roma IDUs may have high HCV prevalence and highly interacting injecting risk networks in which HCV and other bloodborne infections can spread rapidly (Neaigus et al. 1994).

Some non-significant results are noteworthy, including a lack of an association between self-reported HCV infection and distributive syringe sharing, and a lack of an association between

laboratory confirmed HCV infection and sharing other injecting equipment (cookers/filters and squirting drugs from one syringe into another syringe). While some studies have found a decrease among infected IDUs in risk behaviors towards presumptive uninfected IDUs (Schlumberger et al. 1999; Des Jarlais et al. 2004; Desenclos et al. 1993), other studies have found that a sizeable proportion of HIV or HCV infected IDUs still engage in risk behaviors that may put uninfected IDUs at risk for getting infected (Latka et al. 2006; Ompad et al. 2002; Purcell et al. 2006; Golub et al. 2007; Metsch et al. 2007). While our preliminary findings indicate strong disclosure norms for HCV infection among Hungarian IDUs (Gyarmathy et al. 2006), the results of this study suggest that disclosure of infected status may not lead to a reduction in risk behaviors. Our finding that those who self-reported being infected with HCV were not less likely to engage in distributive syringe sharing, is thus disconcerting. However, this also suggest that other factors, such as structural factors, contextual factors, or beliefs and norms, or a combination of these, may influence syringe and other injection paraphernalia sharing to a greater extent than knowledge, by itself, of being infected (Gyarmathy and Neaigus, 2006). To explore the lack of an association between laboratory confirmed HCV infection and sharing other injecting equipment, we did a post-hoc analysis among those IDUs who did not share syringes (Hagan et al. 2001). In this post-hoc analysis we found that neither cooker sharing nor squirting drugs from one syringe into another syringe were associated with HCV infection. This suggests that IDUs may share other injecting equipment mostly when all syringes are sterile, as we observed in this study.

A limitation of this analysis is that we were unable to assess how cleaning and not cleaning two-piece syringes were associated with HCV infection because only relatively few participants used any two piece syringes. In addition, due to the small number of people who were reusing and cleaning their syringes, we were unable to assess how cleaning with bleach, hot water or cold water are related to HCV infection (Kapadia et al. 2002). Furthermore, we assessed only squirting drugs from one syringe into another syringe, while other syringe mediated drug sharing behaviors also exist (Koester et al. 2005). Another limitation is that we did not assess lifetime use of one-piece and two-piece syringes and other lifetime injecting behaviors, hence the use of past 30-day variables may not adequately assess longer-term HCV risk behaviors. We were also unable to assess unmeasured nosocomial transmission of HCV, especially prior to the increased standards of testing of the blood supply. Furthermore, it is difficult making causal inferences based on findings in cross-sectional studies. Finally, this sample may not be a representative sample of all IDUs in Budapest, or all IDUs in Hungary.

Due to the indication of risk associated with the use of two-piece syringes, ethnographic research should identify the reasons why IDUs may use them and suggest means to reduce the use of these higher-risk syringes. In addition, research should evaluate the effectiveness of bleach, thorough cleaning with cold and hot water and other methods in inactivating not only HIV, but also HCV and other bloodborne pathogens. Longitudinal studies among both low-HCV prevalence and high-HCV prevalence IDU populations are needed to confirm the lack of association between sharing 1-piece syringes that have been cleaned and HCV infection. The results of such research studies should be incorporated into prevention messages aimed at IDUs, along with discouraging IDUs infected with bloodborne pathogens from distributive syringe sharing (Kapadia et al. 2007; Ompad et al. 2002). In addition, we also conclude that there is an urgent need to not only provide confidential testing and counseling, but also increase IDUs' access to and utilization of these services (Gyarmathy et al. 2004), especially those of marginalized, minority (Roma) IDUs (Gyarmathy and Neaigus, 2005; Gyarmathy et al. in press). One way to accomplish this is to combine needle exchange with regular testing and counseling services (Lithuanian AIDS Center, 2008). Syringe exchange programs may also consider adopting the Hungarian model that requires their clients to return used syringes with their needles broken off and placed inside the syringe. However, to prevent accidental needle stick injuries (Lorvick et al. 2006), needles should be broken off using appropriately designed

devices (Centers for Disease Control and Prevention, 1998). Lastly, prevention programs should target special IDU sub-populations, such as Roma IDUs to prevent and control HCV and/or HIV.

This manuscript provides one of the first comprehensive reports on the correlates of HCV infection from Central Europe, an area from which little information is currently available. Much of the difference between injection practices in Hungary and other countries may be the result of structural issues, including drug composition, policing practices, and social network structure, the assessment of which is beyond the scope of the present study. This study is a first attempt to build a body of research in Hungary that will allow comparisons to be drawn between the nature of injection drug use and disease risk in Hungary and elsewhere in the world.

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One-piece syringe

Two-piece syringe

Picture 1. Mean volume of fluid retained with plunger depressed in one-piece and two-piece syringes

Table 1
Sample description and univariate correlates of self-report of being HCV infected

Characteristic	Total N (%)	Self-reported Uninfected N (%)	Self-reported infected N (%)
Total	215 (100)	182 (84.7)	33 (15.3)
<i>Syringe use and sharing</i>			
Syringe type and sharing			
only 1p did not share	152 (70.7)	136 (89.5)	16 (10.5)
only 1p shared cleaned	26 (12.1)	21 (80.8)	5 (19.2)
only 1p shared not clean	23 (10.7)	19 (82.6)	4 (17.4)
any 2-piece	14 (6.5)	6 (42.9)	8 (57.1) *
Distributive syringe sharing of any kind of syringe			
no	173 (80.5)	146 (84.4)	27 (15.6)
yes	42 (19.5)	36 (85.7)	6 (14.3)
<i>Sharing of other injecting equipment</i>			
Sharing cookers or filters			
no	85 (39.5)	75 (88.2)	10 (11.8)
yes	130 (60.5)	107 (82.3)	23 (17.7)
Squirting drugs from one syringe into another syringe			
no	158 (73.5)	136 (86.1)	22 (13.9)
yes	57 (26.5)	46 (80.7)	11 (19.3)
<i>Risk behavior variables</i>			
Unprotected vaginal sex			
no	112 (52.1)	92 (82.1)	20 (17.9)
yes	103 (47.9)	90 (87.4)	13 (12.6)
Unprotected anal sex			
no	183 (85.1)	153 (83.6)	30 (16.4)
yes	32 (14.9)	29 (90.6)	3 (9.4)
Daily alcohol use			
no	178 (82.8)	151 (84.8)	27 (15.2)
yes	37 (17.2)	31 (83.8)	6 (16.2)
Daily heroin injecting			
no	148 (68.8)	133 (89.9)	15 (10.1)
yes	67 (31.2)	49 (73.1)	18 (26.9) *
Stimulant (amphetamine/ecstasy/cocaine) injecting at least once a week			
no	151 (70.2)	125 (82.8)	26 (17.2)
yes	64 (29.8)	57 (89.1)	7 (10.9)
Taking breaksfrom injecting			
no breaks	105 (48.8)	81 (77.1)	24 (22.9)
1 week to 1 month	43 (20.0)	40 (93.0)	3 (7.0) *
over 1 month	67 (31.2)	61 (91.0)	6 (9.0)
<i>Risk network variables</i>			
Two or more injecting partners			

Characteristic	Total N (%)	Self-reported Uninfected N (%)	Self-reported infected N (%)
no	55 (25.6)	51 (92.7)	4 (7.3)
yes	160 (74.4)	131 (81.9)	29 (18.1)
Two or more sex partners			
no	179 (83.3)	150 (83.8)	29 (16.2)
yes	36 (16.7)	32 (88.9)	4 (11.1)
<i>Other blood exposure variables</i>			
Bloody fight			
no	120 (55.8)	102 (85.0)	18 (15.0)
yes	95 (44.2)	80 (84.2)	15 (15.8)
Any tattooing			
no	96 (44.7)	83 (86.5)	13 (13.5)
yes	119 (55.3)	99 (83.2)	20 (16.8)
Tattooing before 2003			
no	116 (54.0)	102 (87.9)	14 (12.1)
yes	99 (46.0)	80 (80.8)	19 (19.2)
Having sex when partner/self on period			
no	108 (50.2)	93 (86.1)	15 (13.9)
yes	107 (49.8)	89 (83.2)	18 (16.8)
Having unprotected sex when partner/self on period			
no	126 (58.6)	109 (86.5)	17 (13.5)
yes	89 (41.4)	73 (82.0)	16 (18.0)
Any piercing			
no	152 (70.7)	128 (84.2)	24 (15.8)
yes	63 (29.3)	54 (85.7)	9 (14.3)
Genital piercing			
no	199 (92.6)	169 (84.9)	30 (15.1)
yes	16 (7.4)	13 (81.3)	3 (18.8)
Accidental needle stick injury			
no	162 (75.3)	142 (87.7)	20 (12.3)
yes	53 (24.7)	40 (75.5)	13 (24.5) *
<i>Control variables</i>			
Gender			
male	166 (77.2)	144 (86.7)	22 (13.3)
female	49 (22.8)	38 (77.6)	11 (22.4)
Age - mean (SD)	27.9 (6.5)	27.3 (6.4)	31.6 (6.0) *
Ethnicity			
Non-Roma	171 (79.5)	142 (83.0)	29 (17.0)
Roma	44 (20.5)	40 (90.9)	4 (9.1)
High school education			
no	163 (75.8)	137 (84.0)	26 (16.0)
yes	52 (24.2)	45 (86.5)	7 (13.5)

Characteristic	Total N (%)	Self-reported Uninfected N (%)	Self-reported infected N (%)
Homelessness			
no	187 (87.0)	162 (86.6)	25 (13.4)
yes	28 (13.0)	20 (71.4)	8 (28.6) *
Years since first injecting - mean (SD)	7.5 (5.3)	6.5 (4.7)	12.8 (5.4) *

*
p<0.05

Table 2
Multivariate correlates of self-report of being HCV infected

Characteristics	self-reported HCV infected
<i>Syringe use and sharing</i>	
Distributive syringe sharing of any kind of syringe	0.9 (0.3, 2.8)
Using any two-piece syringe	6.2 (1.6, 24.1) *
<i>Risk behavior variables</i>	
Daily heroin injecting	3.4 (1.4, 8.5) *
<i>Control variables</i>	
Female gender	2.9 (1.1, 8.0) *
Years since first injecting	1.3 (1.2, 1.4) *

*
p<0.05

Table 3
Univariate correlates of laboratory-confirmed HCV infection

Characteristic	Total N (%)	HCV negative N (%)	HCV positive N (%)
Total	185 (100)	116 (62.7)	69 (37.3)
<i>Syringe use and sharing</i>			
Syringe type and sharing			
only 1p did not share	131 (70.8)	88 (67.2)	43 (32.8)
only 1p shared cleaned	22 (11.9)	16 (72.7)	6 (27.3)
only 1p shared not clean	19 (10.3)	7 (36.8)	12 (63.2)
any 2-piece	13 (7.0)	5 (38.5)	8 (61.5) *
Distributive syringe sharing of any kind of syringe			
no	150 (81.1)	92 (61.3)	58 (38.7)
yes	35 (18.9)	24 (68.6)	11 (31.4)
<i>Sharing of other injecting equipment</i>			
Sharing cookers or filters			
no	67 (36.2)	45 (67.2)	22 (32.8)
yes	118 (63.8)	71 (60.2)	47 (39.8)
Squirting drugs from one syringe into another syringe			
no	134 (72.4)	87 (64.9)	47 (35.1)
yes	51 (27.6)	29 (56.9)	22 (43.1)
<i>Risk behavior variables</i>			
Unprotected vaginal sex			
no	88 (47.6)	55 (62.5)	33 (37.5)
yes	97 (52.4)	61 (62.9)	36 (37.1)
Unprotected anal sex			
no	154 (83.2)	98 (63.6)	56 (36.4)
yes	31 (16.8)	18 (58.1)	13 (41.9)
Daily alcohol use			
no	152 (82.2)	96 (63.2)	56 (36.8)
yes	33 (17.8)	20 (60.6)	13 (39.4)
Daily heroin injecting			
no	126 (68.1)	83 (65.9)	43 (34.1)
yes	59 (31.9)	33 (55.9)	26 (44.1)
Stimulant (amphetamine/ecstasy/cocaine) injecting at least once a week			
no	136 (73.5)	90 (66.2)	46 (33.8)
yes	49 (26.5)	26 (53.1)	23 (46.9)
Taking breaksfrom injecting			
no breaks	91 (49.2)	56 (61.5)	35 (38.5)
1 week to 1 month	37 (20.0)	24 (64.9)	13 (35.1)
over 1 month	57 (30.8)	36 (63.2)	21 (36.8)
<i>Risk network variables</i>			
Two or more injecting partners			
no	48 (25.9)	32 (66.7)	16 (33.3)

Characteristic	Total N (%)	HCV negative N (%)	HCV positive N (%)
yes	137 (74.1)	84 (61.3)	53 (38.7)
Two or more sex partners			
no	150 (81.1)	94 (62.7)	56 (37.3)
yes	35 (18.9)	22 (62.9)	13 (37.1)
<i>Other blood exposure variables</i>			
Bloody fight			
no	99 (53.5)	60 (60.6)	39 (39.4)
yes	86 (46.5)	56 (65.1)	30 (34.9)
Any tattooing			
no	78 (42.2)	55 (70.5)	23 (29.5)
yes	107 (57.8)	61 (57.0)	46 (43.0)
Tattooing before 2003			
no	97 (52.4)	68 (70.1)	29 (29.9)
yes	88 (47.6)	48 (54.5)	40 (45.5) *
Having sex when partner/self on period			
no	93 (50.3)	58 (62.4)	35 (37.6)
yes	92 (49.7)	58 (63.0)	34 (37.0)
Having unprotected sex when partner/self on period			
no	109 (58.9)	66 (60.6)	43 (39.4)
yes	76 (41.1)	50 (65.8)	26 (34.2)
Any piercing			
no	130 (70.3)	85 (65.4)	45 (34.6)
yes	55 (29.7)	31 (56.4)	24 (43.6)
Genital piercing			
no	170 (91.9)	110 (64.7)	60 (35.3)
yes	15 (8.1)	6 (40.0)	9 (60.0)
Accidental needle stick injury			
no	139 (75.1)	85 (61.2)	54 (38.8)
yes	46 (24.9)	31 (67.4)	15 (32.6)
<i>Control variables</i>			
Gender			
male	140 (75.7)	90 (64.3)	50 (35.7)
female	45 (24.3)	26 (57.8)	19 (42.2)
Age - mean (SD)	28.3 (6.7)	27.1 (6.6)	30.3 (6.3) *
Ethnicity			
Non-Roma	143 (77.3)	97 (67.8)	46 (32.2)
Roma	42 (22.7)	19 (45.2)	23 (54.8) *
High school education			
no	147 (79.5)	85 (57.8)	62 (42.2)
yes	38 (20.5)	31 (81.6)	7 (18.4) *
Homelessness			

Characteristic	Total N (%)	HCV negative N (%)	HCV positive N (%)
no	161 (87.0)	104 (64.6)	57 (35.4)
yes	24 (13.0)	12 (50.0)	12 (50.0)
Years since first injecting - mean (SD)	7.6 (5.4)	6.5 (4.9)	9.4 (5.6) *

*
p<0.05

Table 4
Multivariate correlates of laboratory-confirmed HCV infection

Characteristics	tested HCV positive
<i>Syringe use and sharing</i>	
Receptive sharing of only one-piece and always cleaning	0.7 (0.2, 1.9)
Receptive sharing of only one-piece and not always cleaning	3.1 (1.1, 8.9) *
<i>Control variables</i>	
Roma ethnicity	2.6 (1.2, 5.6) *
High school education	0.4 (0.1, 1.0) *
Years since first injecting	1.1 (1.0, 1.2) *

*
p<0.05