

## BLOOD-BORNE VIRAL HEPATITIS MARKERS AMONG PEOPLE WHO INJECT DRUGS IN CROATIA: PREVALENCE AND RISK FACTORS

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### ABSTRACT

People who inject drugs (PWID) represent a high-risk and high-prevalence group for both hepatitis C (HCV) and hepatitis B virus (HBV) infection. A total of 224 PWID from three geographically distant Croatian regions (three continental counties and one county located on the Adriatic Coast) were tested for the presence of blood-borne hepatitis markers: hepatitis B surface antigen (HBsAg), hepatitis B core total antibodies (anti-HBc) and hepatitis C (anti-HCV) antibodies. Study participants were recruited from the psychiatry hospital ward (19.6%) and outpatient counseling centers (80.4%). Serologic tests were performed using a commercial enzyme-linked fluorescent assay. Initially, reactive anti-HCV samples were confirmed using a third-generation line immunoassay. The overall prevalence of HBsAg, anti-HBc and anti-HCV was 0.9% (95%CI=0.1-3.2), 22.8% (95%CI=17.4-28.2), and 55.8% (95%CI=49.0-62.4), respectively. There were significant regional differences in both anti-HBc (17.9-38.8%,  $p=0.01$ ) and anti-HCV prevalence (49.1-75.5%,  $p=0.007$ ). Anti-HBc prevalence increased gradually with age from 21.3% to 64.3%, starting with the 30-39 age group ( $p<0.001$ ). In contrast, a sharp increase in anti-HCV seroprevalence was observed from 24.6% in PWID less than 30 years to 59.6% in the 30-39 age group. Thereafter, there was a steady increase to 92.9% in PWID above 50 ( $p<0.001$ ). Sharing injection equipment correlated strongly with HBV and HCV seropositivity. Significantly higher seroprevalence rates were found in PWID who reported sharing syringes/needles frequently or occasionally (anti-HBc 34.7%/23.5% vs 14.9%,  $p=0.009$ ; anti-HCV 87.8%/63.5% vs 8.7%,  $p<0.001$ ). Residents of urban areas were more often seropositive compared to residents of suburban/rural areas (anti-HBc 25.3% vs 6.7%,  $p=0.033$ ; anti-HCV 58.8% vs 36.7%,  $p=0.03$ ). Heterosexual individuals had higher HCV prevalence rates compared to homo/bisexual individuals (60.1% vs 25.0%;  $p=0.03$ ). Gender, educational level, marital status, employment status, history of imprisonment, tattooing, and traveling, as well as sexual risk factors, were not associated with HBV or HCV seropositivity.

**Keywords:** Hepatitis B, hepatitis C, people who inject drugs, seroprevalence, risk factors, Croatia

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## INTRODUCTION

Viral hepatitis B and C represent global public health problems. According to the World Health Organization estimates, 58 million people worldwide are chronically infected with the hepatitis C virus (HCV) and approximately 1.5 million new infections occur each year (1). Although most acute HCV infections are subclinical, 80-85% of patients become chronically infected and are at risk of developing liver disease including cirrhosis and hepatocellular carcinoma (2). Regarding hepatitis B virus (HBV) infection, it is estimated that one-third of the world's population has a history of exposure to HBV and 296 million people have chronic infection (3). HBV is transmitted by percutaneous or per mucosal exposure to infected blood and other body fluids, mainly semen and vaginal secretions. The primary transmission mechanism of HCV is through significant or repeated direct percutaneous exposure to infected blood or blood products (4).

In the European region, people who inject drugs (PWID) represent a high-risk and high-prevalence group for both HCV and HBV infection due to many factors, including sharing injection equipment and lack of awareness about hepatitis transmission (5). PWID may account for up to 60% of new HCV infections in developed countries (2). In addition, HCV/HBV co-infection is common in this risk group. The prevalence of HBV and HCV infection among PWID varies widely across European countries (6-10).

In Croatia, there are several published studies on the prevalence of viral hepatitis in the general population (11) and some specific population groups such as prisoners (12), groups with high-risk sexual behavior (13, 14) and pregnant women (15). Some regional studies addressed HCV infection in PWID (16-18), however, there is very little data on the HBV prevalence in this population group (17). The seropositivity varies according to the population tested. The HBV seroprevalence ranges from 7.0% in the general population to 38.8% among PWID, depending on the region. Similarly, the HCV seroprevalence of HCV is highest among PWID (up to 75%) compared with the general population (0.9%) (19).

This study aimed to analyze the prevalence, sociodemographic characteristics, and risk factors for HBV and HCV infection among PWID in three geographically distant continental and coastal Croatian regions.

## MATERIALS AND METHODS

### Study population

The study included 224 PWID from four Croatian counties: the City of Zagreb/Zagreb County (north-western continental), Brod-Posavina (north-eastern continental), and Istria County (northern coastal) tested in the period from 2014 to 2018. Among study participants, 44 (19.6%) were recruited from the psychiatry hospital ward and 180 (80.4%) from outpatient counseling centers. After obtaining informed consent, each participant completed a questionnaire regarding the sociodemographic characteristics (age, gender, marital status, educational level, employment status, place of residence) and potential risk factors (injecting and sexual risk behaviors, history of imprisonment, traveling, tattooing).

### Serological testing

Hepatitis B surface antigen (HBsAg), hepatitis B core total antibodies (anti-HBc), and hepatitis C antibodies (anti-HCV) were detected using an automated enzyme-linked fluorescent assay (ELFA; Vidas, bioMérieux, Marcy l'Etoile, France). The results were interpreted according to the manufacturer's recommendations as follows: HBsAg Long protocol test value <0.10 negative;  $\geq 0.10$  positive, anti-HBc test value <1 positive;  $\geq 1$ - $\leq 1.4$  equivocal;  $\geq 1.4$  negative, anti-HCV antibodies test value <1.00 negative,  $\geq 1.00$  positive. Samples repeatedly reactive for HBsAg were further analyzed using a confirmation test with neutralizing antibodies (Vidas, bioMérieux, Marcy l'Etoile, France). HBV serologic results were classified as follows: active HBV infection (HBsAg positive), past infection (anti-HBc positive). Initially, reactive samples for anti-HCV antibodies were confirmed using a third-generation LIA test (Fujirebio EUROPE N.V., Ghent, Belgium).

### Statistical analysis

The difference between groups of nominal variables was assessed using chi-square or Fisher exact test. The difference between groups of ordinal variables was assessed using the Mann-Whitney U test. The strength of the association was assessed using logistic regression. Statistical analysis was performed using STATA/IC 15.1 for Windows (StataCorp LP, USA). The level of statistical significance was chosen to be  $\alpha=0.05$ .

## RESULTS

### Participants' demographic characteristics and risk behaviors

The majority of participants were males (91.5%). The median age was 35 (range 18-62) years. Of all participants included in the study, 26.9% had elementary school or lesser education, 59.6% were single/divorced, 59.8% were unemployed and 18.8% reported a history of imprisonment. Regarding injecting risk behavior, 37.9% and 21.9% of participants reported sharing injecting equipment occasionally or frequently. Among risk sexual behavior factors, 2.2% reported homosexual/bisexual orientation, 3.1% history of sexually transmitted diseases (STDs), and 11.6% paid sex. About one-half of the participants (48.7%) reported being tattooed and 34.4% reported a history of traveling or long stays abroad.

### Seroprevalence results

The overall prevalence of HBsAg, anti-HBc and anti-HCV was 0.9% (95%CI=0.1-3.2), 22.8% (95%CI=17.4-28.2), and 55.8% (95%CI=49.0-62.4), respectively. There were significant differences in seropositivity among regions. Both anti-HBc and anti-HCV seroprevalence were significantly higher in Istria County compared to Brod-Posavina County and the City of Zagreb/Zagreb County: anti-HBc 38.8%, 18.8%, and 17.9% (p=0.01), anti-HCV 75.5%, 52.2% and 49.1%, respectively (p=0.007) (Table 1). The prevalence of anti-HBc and anti-HCV according to the characteristics of participants is presented in Table 2. Anti-HBc seropositivity increased gradually with age from 21.3% to 64.3% starting with the 30-39 age group (p<0.001). A sharp

increase in anti-HCV seroprevalence was observed from 24.6% in PWID less than 30 years to 59.6% in the 30-39 age group. Thereafter, seropositivity increased steadily to 92.9% in PWID above 50 (p<0.001).

The rate of sharing injecting equipment in Croatian PWID was 59.8% and correlated strongly with both HBV and HCV seropositivity. Anti-HBc prevalence in PWID who did not share equipment was reported to be 14.9% compared to 23.5% and 34.7% in PWID who shared equipment occasionally and frequently (p=0.009). Anti-HCV seropositivity increased from 28.7% in those who reported no sharing equipment to 63.5%/87.8% in those who reported sharing equipment occasionally/frequently (p<0.001). Residents of urban areas were more often seropositive than residents of suburban and rural areas (anti-HBc 25.3% vs 6.7%, p=0.033; anti-HCV 58.8% vs 36.7%, p=0.03). Although unemployed PWID showed higher anti-HCV seroprevalence (59.0%) than employed participants (40.9%), this difference did not reach statistical significance (p=0.054).

Regarding sexual orientation, anti-HCV prevalence was higher in heterosexuals (60.1%) than in homo/bisexuals (25.0%, p=0.03). Other sexual risk factors (paying for sex, and history of STDs) were not associated with anti-HBc or anti-HCV positivity.

Gender, marital status, educational level, history of imprisonment, tattooing, setting of recruitment, and traveling/long staying in endemic countries were not associated with HBV and HCV prevalence.

Results of the logistic regression showed that older age, frequency of sharing injecting equipment and living in urban areas were factors significantly associated with anti-HBc and anti-HCV prevalence (Table 3).

Table 1. Prevalence of HBsAg, anti-HBc and anti-HCV among people who inject drugs in Croatia

Serologic marker	The City of Zagreb / Zagreb County (N=106)		Brod-Posavina County (N=69)		Istria County (N=49)		P
	N (%)	95%CI	N (%)	95%CI	N (%)	95%CI	
HBsAg	1 (0.9)	0 - 5.2	0 (0)	0 - 5.2	1 (2.0)	0.1 - 10.9	0.509
Anti-HBc	19 (17.9)	11.2 - 26.6	13 (18.8)	10.4 - 30.1	19 (38.8)	25.2 - 53.8	0.01
Anti-HCV	52 (49.1)	39.2 - 59.0	36 (52.2)	39.8 - 64.4	37 (75.5)	61.1 - 86.7	0.007

CI=Confidence interval

Table 2. Seroprevalence of anti-HBc and anti-HCV according to participants' characteristics

Characteristic	N tested	Anti-HBc			Anti-HCV		
		N (%)	95%CI	p	N (%)	95%CI	p
Gender				0.576			0.631
Male	205	48 (23.4)	17.8 - 29.8		113 (55.1)	48.0 - 62.1	
Female	19	3 (15.8)	3.4 - 39.6		12 (63.2)	38.4 - 83.7	
Age (years)				<0.001*			< 0.001*
< 30	65	0 (0)	0 - 5.5		16 (24.6)	14.8 - 36.9	
30 - 39	94	20 (21.3)	13.5 - 30.9		56 (59.6)	49.0 - 70.0	
40 - 49	51	22 (43.1)	29.3 - 57.8		40 (78.4)	64.7 - 88.7	
50+	14	9 (64.3)	35.1 - 87.2		13 (92.9)	66.1 - 99.8	
Marital status				0.282			0.264
Single	101	17 (16.8)	10.1 - 25.6		50 (49.5)	39.4 - 59.6	
Married	29	8 (27.6)	12.7 - 47.2		19 (65.5)	45.7 - 82.1	
Steady relationships	61	17 (27.9)	17.1 - 40.8		34 (55.7)	42.4 - 68.5	
Divorced/widowed	32	9 (28.1)	13.7 - 46.7		21 (65.6)	46.8 - 81.4	
Educational level				0.389			0.081
≤ Primary school	60	10 (16.7)	8.3 - 28.5		26 (43.3)	30.6 - 56.8	
High school	145	37 (25.5)	18.6 - 33.4		87 (60.0)	51.1 - 68.0	
> High school	18	4 (22.2)	6.4 - 47.6		11 (61.1)	35.7 - 82.7	
Employment status				0.527			0.054
Employed	44	11 (25.0)	13.2 - 40.3		18 (40.9)	50.1 - 67.4	
Unemployed	134	27 (20.1)	13.7 - 27.9		73 (59.0)	26.3 - 56.8	
Area of residence				0.033*			0.03*
Urban	194	49 (25.3)	19.3 - 32.0		114 (58.8)	51.5 - 65.8	
Suburban/rural	30	2 (6.7)	0.8 - 22.1		11 (36.7)	19.9 - 56.1	
Sampling site				0.235			0.735
Inpatients (hospital ward)	44	13 (29.5)	16.8 - 45.2		26 (59.1)	43.2 - 73.6	
Outpatient settings	180	38 (21.1)	15.4 - 27.8		99 (55.0)	47.4 - 62.4	
History of imprisonment				0.068			0.084
Yes	42	5 (11.9)	4.0 - 25.6		18 (42.9)	27.7 - 59.0	
No	182	46 (25.3)	19.1 - 32.2		107 (58.8)	51.3 - 66.0	
Sharing injection equipment				0.009*			<0.001*
No	87	13 (14.9)	8.2 - 24.2		25 (28.7)	19.5 - 39.4	
Occasionally	85	20 (23.5)	15.0 - 34.0		54 (63.5)	52.4 - 73.7	
Frequently	49	17 (34.7)	21.7 - 49.6		43 (87.8)	75.2 - 95.4	
Sexual orientation				0.49			0.03*

Characteristic	Anti-HBc				Anti-HCV		
	N tested	N (%)	95%CI	p	N (%)	95%CI	p
Heterosexual	143	34 (23.8)	17.1 - 31.6		86 (60.1)	51.6 - 68.2	
Homosexual/bisexual	12	4 (33.3)	9.9 - 65.1		3 (25.0)	5.5 - 57.2	
History of STDs				0.196			0.468
Yes	7	3 (42.9)	9.9 - 81.6		5 (71.4)	29.0 - 96.3	
No	217	48 (22.1)	16.8 - 28.2		120 (55.3)	48.4 - 62.0	
History of paid sex				0.458			0.537
Yes	26	4 (15.4)	4.4 - 34.9		13 (50.0)	29.9 - 70.1	
No	198	47 (23.7)	18.0 - 30.3		112 (56.6)	49.4 - 59.2	
Tattooing				0.867			0.646
Yes	69	14 (20.3)	11.6 - 31.7		37 (53.6)	41.2 - 75.7	
No	109	21 (19.3)	12.3 - 27.9		54 (49.5)	39.8 - 59.2	
History of traveling				0.868			0.261
Yes	77	18 (23.4)	14.5 - 34.4		47 (61.0)	49.2 - 72.0	
No	147	33 (22.4)	16.0 - 30.1		78 (53.1)	44.7 - 61.3	

CI=Confidence interval; STD=Sexually transmitted diseases; \*Significant at 0.05 level

Table 3. Logistic regression for the risk of anti-HBc and anti-HCV seropositivity

Characteristic	Anti-HBc				Anti-HCV			
	OR	95%CI	AOR <sup>a</sup>	95%CI	OR	95%CI	AOR	95%CI
Male vs. female gender	1.63	0.46 - 5.83	-	-	0.72	0.27 - 1.89	-	-
Age group (one-year increase)	1.14*	1.09 - 1.20	-	-	1.15*	1.1 - 1.21	-	-
Marital status								
Single	1		1		1		1	
Married	1.88	0.72 - 4.95	0.98	0.31 - 3.16	1.94	0.82 - 4.58	1.37	0.52 - 3.59
Steady relationships	1.91	0.89 - 4.10	2.85*	1.18 - 6.88	1.28	0.68 - 2.43	1.74	0.84 - 3.60
Divorced/widowed	1.93	0.76 - 4.90	0.63	0.20 - 2.0	1.95	0.85 - 4.45	0.77	0.29 - 2.08
Educational level								
≤ Primary school	1		1		1		1	
High school	1.71	0.79 - 3.72	1.12	0.46 - 2.69	1.96*	1.07 - 3.61	1.39	0.70 - 2.74
> High school	1.43	0.39 - 5.25	0.43	0.09 - 2.06	2.05	0.70 - 6.03	0.98	0.28 - 3.39
Employed vs unemployed	1.32	0.59 - 2.95	1.86	0.76 - 4.60	0.48*	0.24 - 0.96	0.45*	0.21 - 0.99
Imprisonment (yes vs no)	0.40	0.15 - 1.08	0.64	0.22 - 1.85	0.53	0.27 - 1.04	0.86	0.10 - 1.84

Characteristic	Anti-HBc				Anti-HCV			
	OR	95%CI	AOR <sup>a</sup>	95%CI	OR	95%CI	AOR	95%CI
Sharing injection equipment								
No	1		1		1		1	
Occasionally	1.75	0.81 - 3.80	1.36	0.57 - 3.26	4.32*	2.28 - 8.20	4.6*	2.21 - 9.57
Frequently	3.02	1.32 - 6.95	2.34	0.92 - 5.94	17.77*	6.72 - 46.99	21.18*	7.27 - 61.64
Sexual orientation (heterosexual vs. homo/bisexual)	1.60	0.45 - 5.65	4.3*	1.01 - 18.27	0.22*	0.06 - 0.85	0.28	0.06 - 1.22
Risk sexual behavior (yes vs no)	0.83	0.42 - 1.67	1.47	0.66 - 3.31	0.55*	0.31 - 0.98	0.89	0.46 - 1.71
Tattooing (yes vs no)	1.07	0.50 - 2.27	2.38	0.93 - 6.11	1.18	0.64 - 2.15	1.93	0.94 - 3.96
Traveling (yes vs no)	1.05	0.55 - 2.03	0.71	0.34 - 1.51	1.39	0.79 - 2.43	1.08	0.58 - 2.03

aAOR=adjusted for age and gender; \*Significant at 0.05 level

## DISCUSSION

After the introduction of HCV testing in 1992, PWID represent the group with the highest HCV prevalence in Croatia. Studies across Europe showed a wide range of prevalence rates from 34%-78% in Slovakia (20), 40% in Slovenia (8), 42.3-75% in Germany (21), 43.3%-61.3% in Greece (22), 48% in Sweden (23) 52.5% in Bosnia and Herzegovina (24), 53% in Montenegro (25), 59% in Poland (26), 66.8% in Denmark (9), 68.3%-83.2% in Italy (7, 27), 70.5% in Portugal (28), 71.4%-81.3% in Luxembourg (29, 30), 73.9% in Bulgaria (31), 80% in Lithuania (32), 84.2%-88% in Spain (33, 34), 86.5% in Sweden (35), 88.9% in Romania (36), 94.6% in Russia (37) to 96,2% in Estonia (10).

In Croatia, several regional studies conducted from 2001 to 2010 addressed the seroprevalence of HCV in PWID which differed greatly. Significantly higher prevalence was reported in the Split region (65%) (38) compared to Zadar (59%) (16), Zagreb (51.3%) (18), and Rijeka (29%) (38). As in previous Croatian studies, this study found significant geographical differences in HCV prevalence. The highest seroprevalence rate (75.5%) was found in Istria County (Pula) compared to 49.1% in the City of Zagreb/Zagreb County and 52.2% in Brod-Posavina County. According to the data from the National Register of Persons Treated for Psychoactive Drug Abuse (2019), the highest rate of addiction per 100,000 inhabitants was recorded in Istria County (505.7), which reported the highest HCV seropositivity in this study. In the City of Zagreb, Zagreb County, and Brod-Posavina County, addiction rates were 348.3,

131.8, and 105.1, respectively (39). Pula is a tourist destination located on the Adriatic coast with a higher movement of people and goods, which may be the reason for the higher HCV seroprevalence rate compared to continental areas of the country.

Regarding the anti-HBc prevalence, the prevalence of 22.8% among Croatian PWID is comparable to that of Slovenia (17.5%) (8) and Luxembourg (21.6%) (29). In the number of European countries, higher prevalence rates were reported from 40.2%-53% in Germany (40-42), 50% in Switzerland (43), 50.2% in Denmark (9), 55.6% in Romania (36), 70.4% in Italy (7) to a very high of 85.1% in Estonia (10). Similar to the prevalence of HCV infection, there were also significant geographical differences in HBV prevalence in Croatia (17.9%-38.8%). Compared with a previous Croatian study, this study showed a higher anti-HBc prevalence in the Zagreb region (17.7% vs 13%). In Rijeka and Split, prevalence rates were 9% and 31%, respectively (38).

Active HBV infection (HBsAg positive) was found in 0.9% of Croatian PWID. A wide range of HBsAg prevalence was reported in other European countries: 0.8% in Bosnia and Herzegovina (24), 0.9% in Denmark (9), 1.4% in Montenegro (25), 2.5% in Slovenia (8), 7% in Spain (34), and 21.3% in Estonia (10).

As reported in other studies (8, 23, 30), both anti-HBc and anti-HCV prevalence in Croatia increased significantly with age. While anti-HBc positivity increased gradually, anti-HCV positivity increased sharply from

24.6% in PWID less than 30 years to 59.6% in PWID aged 30-39 years, with a further continuous increase of up to 92.9% in PWID older than 50 years.

In addition, seroprevalence rates correlated with injecting risk behaviors. Statistically significant differences in prevalence were found in PWID who reported sharing equipment (anti-HBc 23.5%-34.7% vs 14.9%, anti-HCV 63.5%-87.8% vs 28.7%). PWID from urban areas was more often seropositive (anti-HBc 25.3%, anti-HCV 58.8%) than PWID from suburban/rural areas (anti-HBc 6.7%, anti-HCV 36.7%). The higher seroprevalence in urban areas may be explained by better drug availability.

Educational level was not associated with the prevalence of HBV and HCV markers in the Croatian PWID cohort, whereas in Sweden lower educational level was found to be a risk factor for HCV seropositivity (23).

Some studies have found a higher prevalence of HBV or HCV infection in PWID with a history of imprisonment (30, 40, 44). In a large European multicenter study, a correlation between HCV seropositivity and history of incarceration was observed with HCV prevalence rates reaching 91.4% in individuals who reported staying in prison (45). In contrast, our study found no difference in anti-HBc and anti-HCV among PWID who reported staying in prison and those who did not.

Regarding sexual risk behaviors, a significant association was found between anti-HCV prevalence in heterosexuals compared to homo/bisexuals (60.1% vs 25.0%). Although higher prevalence rates were reported in PWID with a history of STDs (anti-HBc 42.9% vs 22.1%, anti-HCV 71.4% vs 55.3%), the small numbers did not allow to reach the statistical difference.

Tattoos are very common among PWID (48.7% of Croatian PWID reported tattooing), which may also contribute to HBV and HCV transmission (46). Our results showed no significant difference in the seroprevalence rates in PWID who had been tattooed.

Another possible risk factor for HBV and HCV acquisition may be traveling to areas where these infections are endemic. In a study from San Francisco conducted among young PWID, travelers were more likely to be HCV-positive than non-travelers (47). This study showed no significant difference in HBV and HCV seropositivity between PWID with a history of traveling and long stays abroad and those who denied traveling.

An earlier Croatian study from Brod-Posavina County (2002-2009) showed significantly higher prevalence rates of HBV and HCV markers among PWID treated in therapeutic communities compared to outpatients (HBsAg 3.28% vs 1.16%, anti-HCV 60.66% vs 41.86%) (17). This study showed no significant difference in anti-HBc or anti-HCV positivity among patients treated at psychiatric hospital wards and outpatients.

The logistic regression results showed that among Croatian PWID, both HCV and HBV infections were significantly associated with increasing age, needle-sharing behaviors, and residence in an urban area.

## CONCLUSIONS

The results of this study showed that PWID still represents a high-risk group for both HBV and HCV infection in Croatia. Prevalence rates differed significantly between regions and correlated strongly with age and syringe/needle sharing frequency.

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## S A Ž E T A K

### BILJEZI KRVLJU PRENOSIVIH VIRUSA HEPATITISA U INTRAVENSKIH KORISNIKA DROGA U HRVATSKOJ: PREVALENCIJA I RIZIČNI FAKTORI

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Intravenski korisnici droga (engl. *people who inject drugs*; PWID) predstavljaju visoko rizičnu skupinu za infekciju virusom hepatitisa C (HCV) i hepatitisa B (HBV). Ukupno 224 PWID iz tri geografski udaljene hrvatske regije (tri kontinentalne i jedne primorske županije) testirano je na biljege krvlju prenosivih virusa hepatitisa: hepatitis B površinski antigen (HBsAg), protutijela na hepatitis B core antigen (anti-HBc) te protutijela na HCV (anti-HCV). Probir bolesnika i uključivanje u istraživanje učinjeni su na psihijatrijskim bolničkim odjelima (19,6%) te centrima za dobrovoljno HIV savjetovanje i testiranje (80,4%). Serološko testiranje učinjeno je pomoću komercijalnog imunoeznimskog testa s fluorescentnom detekcijom. Uzorci opetovano reaktivni na HBsAg dodatno su testirani metodom s "neutralizacijskim protutijelima". Početno reaktivni anti-HCV uzorci seruma su potvrđeni pomoću immunoblot testa treće generacije. Ukupna prevalencija HBsAg, anti-HBc i anti-HCV iznosila je 0,9% (95%CI=0,1-3,2); 22,8% (95%CI=17,4-28,2) te 55,8% (95%CI=49,0-62,4). Uočene su značajne regionalne razlike kako u prevalenciji anti-HBc (17,9-38,8%,  $p=0,01$ ), tako i u prevalenciji anti-HCV (49,1-75,5%,  $p=0,007$ ). Prevalencija anti-HBc je rasla postupno s porastom dobi od 21,3% do 64,3%, počevši s dobnom skupinom od 30 do 39 godina ( $p<0,001$ ). Za razliku od postupnog porasta seroprevalencije HBV-a, uočen je nagli porast anti-HCV seroprevalencije od 24,6% u PWID mlađih od 30 godina do 59,6% u dobnoj skupini 30-39 godina, nakon čega je daljnji porast seropozitiviteta bio postupan do 92,9% u PWID starijih od 50 godina ( $p<0,001$ ). Zajedničko korištenje pribora za i.v. korištenje droga je značajno koreliralo s HBV i HCV seropozitivitetom. Statistički značajno više stope seroprevalencije dokazane su u PWID koji su naveli podatak o čestom ili povremenom dijeljenju pribora za i.v. korištenje droga (anti-HBc 34,7/23,5% naspram 14,9%,  $p=0,009$ ; anti-HCV 87,8/63,5% naspram 8,7%,  $p<0,001$ ). Ispitanici iz gradskih područja su bili češće seropozitivni u odnosu na ispitanike iz prigradskih/seoskih područja (anti-HBc 25,3% naspram 6,7%,  $p=0,033$ ; anti-HCV 58,8% naspram 36,7%,  $p=0,03$ ). Heteroseksualne osobe su imale višu HCV seroprevalenciju u odnosu na homo/biseksualne odnose (60,1% naspram 25,0%;  $p=0,03$ ). Spol, stručna sprema, bračni status, radni status, boravak u zatvoru, tetoviranje te putovanja izvan Hrvatske kao i rizično spolno ponašanje nisu bili povezani s HBV i HCV seropozitivitetom.

**Ključne riječi:** Hepatitis B, hepatitis C, osobe koje injiciraju droge, seroprevalencija, rizični faktori, Hrvatska.

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