

## Original Article

# Prevalence of Hepatitis B and C among Drug-Abusing Male Prisoners in Birjand, South Khorasan, Iran

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## Abstract

**Background:** To estimate the prevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) and the associated risk factors among drug-abusing prisoners in Birjand correctional facility.

**Methods:** This is a cross-sectional study on 300 drug-abusing prisoners in 2016. Data were collected through questionnaires and interviews. HBV infection and HCV exposure status of the participants were determined by HBsAg, HBcAb, and HCVAb blood tests using third-generation enzyme immune assays (ELISA). The chi-square test was used to investigate the associations between risk factors and status of HBV infection and HCV exposure. All data were analyzed with SPSS software and  $P < 0.05$  was considered as significant difference.

**Results:** The mean age of participants was  $37.4 \pm 9.4$  years with a range of 20–78 years. The prevalence rates of HBV exposure (total HBcAb) and infection (HBsAg) were 20.7 and 3.3% respectively, and the prevalence of HCV exposure (HCV Ab) was 8%. No co-infection was observed. Seroprevalence results for injecting drug users (IDUs) was 13 (18.8%) for total HBcAb, 1 (1.4%) for HBsAg, and 13 (18.8%) for HCVAb. There was no significant difference between the IDUs and non-IDUs in terms of HBsAg and total HBcAb positive rate, but the prevalence of HCV was significantly higher in the IDUs ( $P < 0.001$ ). In logistic regression analysis, the main risk factors for HCV exposure in the entire samples was injecting drug use and having tattoos (OR = 4.08, 95% CI: 1.64–10.17,  $P = 0.003$ )

**Conclusion:** We found a high rate of HBV and HCV infection in drug-using prison inmates compared to the general population of this area. The main risk factors associated with HCV infection in the prison populations with history of drug abuse were injecting drug use and having tattoo.

**Keywords:** HBV, HCV, IDUs, Prisoners

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## Introduction

Viral hepatitis caused by hepatitis B and C viruses (HBVs, HCVs) is a global public health concern affecting millions of people worldwide. It is estimated that 240 million people are living with HBV infection and 130–150 million people have chronic hepatitis C infection, resulting in about 1.3 million deaths annually from acute infection and hepatitis-related liver cancer and cirrhosis.<sup>1,2</sup> Viral hepatitis B and C are blood-borne infections with a high risk of transmission through unsafe drug injection and sexual activity.<sup>3</sup>

The prevalence of HBV and HCV is low in the general population of Iran, estimated at 1.79% and 0.4% respectively.<sup>4,5</sup> Despite the low prevalence of blood-borne hepatitis in the general population of Iran, a large outbreak of HBV and HCV has been reported among high-risk groups with a prevalence of 30.9% and 51.46% in injecting drug users (IDUs)<sup>6</sup> and 3.8% and 51.9% in HIV-infected persons.<sup>7</sup>

Among high-risk environments, prisons are well-known settings for the spread of blood-borne viruses. According to the 11<sup>th</sup> edition of the world prison population list, in 2016, more than 10.35 million people are held in prison around the world, including 225 000 in Iran.<sup>8</sup>

Prison inmates worldwide have substantially increased prevalence of HBV and HCV, relative to the general population. A complex interplay among individual, social, and environmental factors before, during, and after incarceration leads to an increased risk of these infectious diseases in prisoners.<sup>9</sup> Compared with the general population, incarcerated persons have higher rates of drug abuse and risky sexual behaviors that are predictors of hepatitis outbreak in these people.<sup>10</sup> Tattooing and scarification are also common in prison populations.<sup>11</sup> Most inmates with chronic hepatitis B or C are not aware of their infection. Therefore, detecting hepatitis B and C infection during a prison stay provides opportunities for care, education, and treatment assessment during

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incarceration and linkage to care (LTC) after release.<sup>12</sup>

In this study, we investigated the prevalence of HBV and HCV infection and their associated risk factors among prisoners with a history of drug-abuse that could be used in prison harm-reduction and treatment strategies.

### Materials and Methods

A cross-sectional study was carried out to determine viral hepatitis prevalence among drug-abusing prisoners in Birjand central prison. Sampling was done based on census method. Interviews and sampling were conducted from March to August 2016.

The inclusion criteria were: (i) inmates imprisoned for more than six months and (ii) a history of drug abuse. After written consent was obtained, all eligible participants were interviewed confidentially with a pre-code, structured questionnaire including HBV, and HCV infection risk factors (e.g. history of drug injection, sharing syringes/needles, sexual behavior, and tattooing), and socio-demographic characteristics (e.g. age, marital status, and level of education). All variables can be found in Table 1. Participants could end the interview at any time if they were uncomfortable.

A blood sample (5 mL) was drawn from each participant and collected in Vacutainer tubes with gel and clot activator. The sera were separated as soon as possible and stored at  $-20^{\circ}\text{C}$ .

Total hepatitis B core antibody (HBcAb) and surface antigen (HBsAg) and hepatitis C antibody were assessed using third-generation enzyme immunoassays (DIA.PRO Diagnostic, Bioprobes Srl, Milan, Italy).

Data were analyzed using SPSS software version 19 (IBM, Inc.: Armonk, NY).<sup>13</sup>

The chi-square test and Fisher exact test were used to compare variables. Statistical significance was established at  $P$  values of  $< 0.05$ . In order to identify parameters independently associated with HCV and HBV infection, a logistic regression model was utilized.

### Results

In 2016, a total of 300 drug-abusing prisoners were enrolled in Birjand central prison, South Khorasan province. The mean age of participants was 37.4 years (SD = 9.4; range 20–78).

Out of 300 persons, 69 (23%) were IDUs. Most participants were married (79%). Educational level varied with 47 (15.7%) illiterate, 78 (26%) only attending primary school, 65 (21.7%) not finishing secondary school, 54 (18%) having high-school diploma, and 56 (18.6%) with unknown educational attainment. The identified transmission risk behaviors were injecting drug use (23%), high-risk sexual contact (40%), and tattoos (40%). Twelve (4%) participants had a blood transfusion history (Table 1).

Of the 300 participants, 62 (20.7%) were serologically

**Table 1.** Socio-demographic Background and Risk Behaviors among Prisoners

Characteristic	Total (n = 300)
Mean age, years	37.4 (SD = 9.4)
Gender	
Male	300 (100)
Female	0 (0)
Marital status	
Single	53 (17.7)
Married	237 (79)
Divorced/separated	10 (3.3)
Literacy	
Illiterate	47 (15.7)
Primary school	78 (26)
Secondary school	65 (21.7)
High-School Diploma and upper	54 (18)
Unknown	56 (18.6)
Risk factors	
IDU	69 (23)
High risk sexual behavior	120 (40)
Tattoo	120 (40)
Blood transfusion	12 (4)

Abbreviation: IDU, injecting drug user.

positive for total HBcAb, 10 (3.3%) for HBsAg, and 24 (8%) for HCVAb marker. No co-infection was observed.

Among the IDUs, the frequencies of seropositive individuals for total HBcAb, HBsAg, and HCVAb were 13 (18.8%), 1 (1.4%), and 13 (18.8%), respectively. There was no significant difference between the IDUs and non-IDUs in terms of HBsAg and total HBcAb positive rates, but the prevalence of HCV was significantly higher in the IDUs ( $P < 0.001$ ) (Table 2).

We found that unsafe sexual contact and tattoos were more frequent in the IDUs compared to non-IDUs (Table 3). The results of the logistic regression analysis show that the main risk factors for HCV exposure in the total samples were injecting drug use (odds ratio [OR] = 4.64, 95% CI: 1.97–10.92,  $P < 0.001$ ) and having tattoos (OR = 4.08, 95% CI: 1.64–10.17,  $P = 0.003$ ) (Tables 2 and 4).

### Discussion

This study was conducted to evaluate the prevalence of HBV and HCV and their associated factors among drug-abusing prisoners in Birjand correctional facility, Iran. We found that the prevalence rates of total HBcAb, HBsAg, and HCVAb were 20.7%, 3.3%, and 8% respectively. These values are very high compared to those found in the general population of Birjand city (2 and 40 times for HBsAg and HCVAb, respectively).<sup>14,15</sup>

The high prevalence of HBV and HCV among inmates is a serious public health concern for several reasons. This can be due to higher risky behaviors during the incarceration, including sharing a needle and drug-use equipment, sharing tattooing instruments and unsafe sexual behaviors. Additionally, the infected inmates may not be aware of their infection status; as inmates are often released to the community or transferred to other

Table 2. Comparison of HBV and HCV Prevalence in IDUs and Non-IDUs Prisoners

	IDUs (69)	Non-IDUs (231)	P Value	Risk Estimate (OR 95% CI)
Total HBcAb	13 (18.8)	49 (21.2)	0.673	1.16 (0.58–2.29)
HBsAg	1 (1.4)	9 (3.9)	0.341	2.76 (0.34–22.15)
HCVAb	13 (18.8)	11 (4.8)	<0.001	4.64 (1.97–10.92)

Abbreviation: HBcAb, Hepatitis B core IgM and IgG antibodies; HBsAg, Hepatitis B surface antigen; HCVAb, Hepatitis C virus antibodies.

correctional facilities, the infected inmates could serve as a reservoir.<sup>8</sup>

Despite the large difference in the prevalence of HCV exposure and HBV infection between drug-abusing prisoners and the general population, the rates in our study were lower than previously reported by Azarkar and Sharifzadeh in the same population of this prison and the rates of HCV exposure and HBV infection have decreased from 15.7% and 6.1% to 8% and 3.3% respectively.<sup>16</sup>

In another study conducted in three prisons of the South Khorasan province by Ziaee et al, the prevalence of HCV exposure in drug-abusing prisoners was 7.6%, which is close to the results of our study (8%). In addition, consistent with our study, the rate of HCV was significantly higher among prisoners with a history of drug injection (20.3%). However, the prevalence of HBV among drug-abusing prisoners in Ziaee's study was 9.3% which is very different from the rate (3.3%) reported in the present study.<sup>17</sup>

The reduction in HBV infection rates in this study may reflect the effectiveness of the HBV national vaccination program, as well as different methods since the sample sizes in the other two studies were larger than ours.

The HCV prevalence in prison inmates of Iran varies widely from 7.4% to 64.8%; one explanation may be differences in the proportions of prisoners who use drugs.<sup>10,17-20</sup>

The rate of HCV exposure among drug abuse prisoners in our study (8%) was lower than other parts of the country. In a survey carried out on 5,508 prisoners from

several correctional facilities in Iran, the prevalence of HCV exposure was 12.11% and 42.47% among prisoners with a history of drug abuse and intravenous drug abuse, respectively. Moreover, the prevalence of HBV infection was 2.84% in participants with a history of drug use<sup>21</sup> which is close to the results of our study (3.3%).

The results of this study showed a significant relationship between history of injection drug use and HCV exposure. This finding is consistent with the prevailing pattern in other prisons in the world.<sup>22-24</sup>

Several studies have investigated various factors associated with acquiring HCV infection in prison populations. It seems that the main risk factor associated with HCV infection in prison populations is injecting drug use. This risky behavior is strictly forbidden in prisons worldwide and the difficulty in obtaining sterile injecting syringes in prisons results in widespread sharing of equipment and an increased risk of HCV transmission.<sup>22,23</sup>

Some studies have reported multiple sex partners and unprotected sex as risk factors for HCV transmission.<sup>25,26</sup> In this study, although unprotected sexual contact was more frequent in the IDUs, no significant relationship was found between HCV exposure and this risk factor.

Our findings are also in agreement with previous studies that identified application of tattoos in prisons as a risk factor associated with HCV infection.<sup>11,27</sup>

The strength of this study was determining the prevalence of both HBV and HCV among drug-abusing prisoners that could be used in prison harm-reduction and treatment strategies

In conclusion, we observed a high rate of HBV and HCV infection in prison inmates who use drugs compared to the general population. This high infection rate is associated with a high frequency of high-risk behaviors before and during imprisonment. In order to manage this situation, screening, diagnosis, HBV vaccination and treatment services must be included in prison health systems to reduce the incidence and progression of these infectious diseases.

Table 3. Frequency of Risk Factors among IDUs and Non-IDUs

Risk Factors	Groups		P
	IDUs (69)	Non-IDUs (231)	
Unsafe sexual contact	39 (65.5%)	81 (35.1%)	0.001
Tattoo	46 (66.7%)	74 (32%)	<0.001
Blood transfusion	4 (5.8%)	8 (3.5%)	0.382

Table 4. Relationship between HCV Exposure and Other Risk Factors

	HCV Ab				P Value	Risk Estimate (OR 95% CI)
	Positive		Negative			
	No.	%	No.	%		
Unsafe sexual contact (120)	14	11.7	106	88.3	0.062	2.24 (0.96–5.24)
Tattoo (120)	17	14.2	103	85.8	0.003	4.08 (1.64–10.17)
Blood transfusion (12)	2	16.7	10	83.3	0.271	2.42 (0.49–11.73)

Furthermore, harm-reduction programs for incarcerated IDUs should be integrated to control the HCV.

#### Authors' Contribution

SJ and BT performed the research, SYJ and GS collected the data and provided the first reports. MZ designed and supervised the research, SG interpreted the analysis and wrote the final manuscript. MZ and SG contributed to the discussion and critical revision of the manuscript.

#### Conflict of Interest Disclosures

None declared.

#### Ethical Statement

The study received approval from the Birjand University of Medical Sciences Ethics Committee (with the approval number of IR.BUMS.REC.1394.447) Participation was voluntary and written informed consent was obtained from all participants.

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