



Hepatitis C Virus Seroprevalence and Associated Risk Factors Among Male Drug Injectors in Kermanshah, Iran

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Abstract

Background: Infection with hepatitis C virus (HCV) is increasingly recognized as a major global health problem.

Objectives: The aim of this study was to measure the prevalence of HCV infection and determine the risk factors associated with HCV among male people who inject drugs (PWID) in Kermanshah, Iran.

Methods: In this cross sectional study, the samples were recruited from 2 drop-in centers and related community outreach sites, using snowball sampling. The questionnaire consisted of 3 sections, including demographics, drug use patterns, and risky behaviors. HCV infection was tested in venous blood samples, collected from the participants, using the ABON rapid test kit. Logistic regression analysis was used to determine the association between HCV status and the associated factors, reported as odds ratio (OR) and 95% confidence interval (CI).

Results: The mean age of the participants was 36.7 ± 8.5 years (range, 18 - 65 years). Over half of the participants (54.8%) tested positive for HCV antibodies; in other words, they had been exposed to the virus. Adjusted OR for people reporting shared equipments within the past month was 3.36 times higher than the OR of people who reported no shared equipments ($P = 0.000$). The adjusted OR of positive HCV among those who injected twice or more per day was 4.33 ($P = 0.000$), compared to those who injected only once a day (or less). With over half the participants having evidence of HCV exposure, there is a need to increase the coverage of harm-reduction programs, especially sterile injection equipment programs. Moreover, increasing access to harm-reduction programs and HCV treatment can ultimately reduce the opportunities for HCV transmission.

Keywords: Harm Reduction, Hepatitis C, Prevalence, Iran, Injecting Drug Use

1. Background

Infection with hepatitis C virus (HCV) is increasingly recognized as a major global health problem (1). It has been estimated that 2% to 3% of the global population (170 million people) are now infected with HCV (2). By the 1970's or earlier, HCV was established in some populations of people who inject drugs (PWID) (3), with estimates of nearly

13.2 million PWID worldwide (4), about 50% of whom seem to have been exposed to HCV infection (5).

Iran has a long established history of illicit drug use. However, a rapid change in the pattern of drug use, with an increase in injecting drug use (mostly heroin), has been observed (6). Evidence suggests that Iran has the highest rate of opioid use globally (6, 7), and according to the na-

tional survey of drug use in Iran, at least 1.12 million people are dependent on illicit drugs, about 5% of whom are current users (6).

Today, injecting drug use is a major and perhaps the most important risk factor for the increasing transmission of HCV infection in the Iranian population (8). The prevalence of HCV infection in PWID ranges from 20% to 90% in different studies (5, 9-17). High-risk injection behaviors are the leading cause of HCV infection among PWID (18). The primary risk factor for HCV infection in PWID is using a needle or syringe, which has been already used by another user (sharing syringes) (13, 15, 19-23). Sharing other injection equipments (eg, cookers, swabs, tourniquets, and mixing water) is also common among PWID (24-28).

Other identified risk factors for HCV in PWID include history of imprisonment (13, 15, 16), drug injection more than the daily frequency (29, 30), history of tattooing (15), and duration of injecting drug use (13). However, there is no recent information on HCV prevalence in PWID in Kermanshah, Iran. The purpose of this study was to measure the prevalence of HCV infection and determine the risk factors for HCV among PWID in Kermanshah.

2. Methods

2.1. Design and Participants

In this cross sectional study, conducted between January and April 2017, samples were recruited from 2 drop-in centers, affiliated to Kermanshah University of Medical Sciences, as well as related community outreach sites. Using snowball sampling, males (above 18 years), who self-reported at least 1 drug injection in the month before the interview, resided in Kermanshah, and provided a written consent form, were recruited in the study. The participants were stratified, based on whether or not they had attended harm-reduction programs regularly (at least 4 visits in the past month) and received harm-reduction kits.

2.2. Questionnaire

Trained interviewers collected data by completing a biobehavioral questionnaire during face-to-face interviews. The questionnaire consisted of 3 sections including demographic information, drug use history, and risky behavior information over the past month before the interview. Prior to administration, the questionnaire content was discussed among 10 experts in fields of epidemiology, behavioral sciences, and harm reduction. Kappa coefficient and intraclass correlation coefficient (ICC) were measured to evaluate the reliability of the questionnaire. ICC ranged from 0.86 to 1, and Kappa coefficient was 0.9-1 for all the variables.

2.3. Ethical Considerations

For confidentiality, no identifying information was collected from the participants. Through the consent procedure, the participants were informed about the objectives, risks, and advantages of participating in the study. They were allowed to withdraw from the study at any time.

2.4. Statistical Analysis

Continuous variables are expressed as mean $\pm$ standard deviation, and categorical variables are presented as number and percentage. Logistic regression analysis was used to determine the association between HCV status and the associated factors, reported as odds ratio (OR) and 95% confidence interval (CI). Variables with P-value below 0.2 were entered into the multiple regression analysis. All data analyses were performed using SPSS version 21 (IBM Corp, Armonk, NY).

2.5. Serological Assay

HCV infection test was performed on venous blood samples, collected from subjects after completing the questionnaire. Serum samples were tested for anti-HCV antibodies, using a rapid chromatographic immunoassay for qualitative detection of HCV antibodies in the serum, known as HCV rapid test device (ABON BioPharm Hangzhou Co., Ltd.; sensitivity, > 99.53%; specificity, 99.78%). Positive samples according to the HCV rapid test were considered anti-HCV positive. All the participants with positive HCV antibodies were referred to a behavioral consultation center, affiliated to Kermanshah University of Medical Sciences for HCV RNA testing via reverse transcription-polymerase chain reaction (RT-PCR) as a confirmatory test. Follow-up was not part of the present study, and we did not collect the subjects' PCR results.

3. Results

3.1. Baseline Demographics

A total of 606 male PWID were recruited in the study. The mean age of the participants was 36.7 ± 8.5 years (range, 18 - 65 years), and the mean (SD) years of education was 8.04 (3.8) years. In total, 270 (44.6%) subjects had attended needle and syringe programs (NSPs) at least once a week during the past 4 weeks (regular attendance group). About half of the participants (53.3%) were unemployed, and 36.1% were homeless (Table 1).

The mean (SD) duration of drug use and injecting drug use was 17.1 (8.1) and 7.3 (6.4) years, respectively. Among the participants, 77.6% had a history of imprisonment, 62%

Table 1. Demographic Characteristics of the Participants Based on HCV Antibody Status

Characteristics	Number (%)	HCV Negative (n, 274) No (45%)	HCV Positive (n, 332) No (55%)	P Value
Age, group (years)				
< 30	119 (19.6)	89 (32.5)	30 (9.0)	0.000
30 - 39	281 (46.4)	107 (39.1)	174 (52.4) ^a	
40 - 49	156 (25.7)	51 (18.6)	105 (31.6) ^a	
≥ 50	50 (8.3)	27 (9.9)	23 (6.9) ^a	
Education				
Illiterate	49 (8.1)	26 (9.5)	23 (6.9)	0.004
Elementary school	125 (20.6)	39 (14.2)	86 (25.9) ^a	
Middle school (up to grade 9)	90 (14.9)	37 (13.5)	53 (16.0)	
High school (up to grade 12)	314 (51.8)	158 (57.7)	156 (47.0)	
University	28 (4.6)	14 (5.1)	14 (4.2)	
Marital status				
Single	382 (63.0)	162 (59.1)	220 (66.3)	0.000
Married	98 (16.2)	70 (25.5)	28 (8.4) ^a	
Divorced	105 (17.3)	32 (11.7)	73 (22.0) ^a	
Separated	21 (3.5)	10 (3.6)	11 (3.3)	
Occupation				
Employed	283 (46.7)	142 (51.8)	141 (42.5)	0.022
Unemployed	323 (53.3)	132 (48.2)	191 (57.5)	
Homelessness				
Yes	219 (36.1)	63 (23.0)	156 (47.0)	0.000
No	387 (63.9)	211 (77.0)	176 (53.0)	
Regular attendance of harm-reduction programs				
Yes	336 (55.4)	149 (54.4)	187 (56.3)	0.681
No	270 (44.6)	125 (45.6)	145 (43.7)	

^aThere is a statistical significance with the first group (P< 0.05).

had a history of tattooing, and 55.3% had a history of sharing injecting equipments in the month before the interview. The minority of the participants (1.8%) reported sharing needles and syringes within the past month (Table 2).

3.2. Anti-HCV Prevalence

HCV antibody testing of 606 samples showed that 54.8% (n, 332; CI, 50.8% - 58.7%) were positive for exposure to HCV infection. Among 332 people who were positive for HCV antibodies, 251 (75%) self-reported their HCV status. Only 12 (4.8%) participants self-reported positive HCV, 11 (4.4%) self-reported negative HCV, and the remaining 228 (90.8%) reported not knowing their current HCV antibody status. Among 453 participants who self-reported their HCV status, 93.4% reported not knowing their current HCV

antibody status. Only 12 (2.6%) samples in our study reported positive HCV, and 18 (4%) samples reported being currently HCV negative.

3.3. Risk Factor Analysis

In the bivariate analysis, several variables were identified as factors correlated with the presence of HCV antibodies. These variables included 2 or more injections per day, a longer duration of drug injection, history of tattooing, history of shared equipments, needle and syringe sharing within the past month, history of imprisonment, age at first drug use, and age of first drug injection (P< 0.2) (Table 3).

Multiple logistic regression analysis revealed factors associated with anti-HCV infection (Table 3). Adjusted OR

Table 2. HCV Risk Factors in the Participants Based on HCV Antibody Status

Characteristics	Number (%)	HCV Negative (n, 274) No (45%)	HCV Positive (n, 332) No (55%)	P Value
Imprisonment				
No	470 (77.6)	171 (62.4)	299 (90.1)	0.000
Yes	136 (22.4)	103 (37.6)	33 (9.9)	
Number of injections per day				
< 2	221 (36.5)	160 (58.4)	61 (18.4)	0.000
≥ 2	385 (63.5)	114 (41.6)	271 (81.6)	
History of tattooing				
No	230 (38.0)	147 (53.6)	83 (25.0)	0.000
Yes	376 (62.0)	127 (46.4)	249 (75.0)	
Sharing equipments within the past month				
No	266 (43.9)	172 (62.8)	94 (28.3)	0.000
Yes	340 (56.1)	102 (37.2)	238 (71.7)	
Needle/syringe sharing within the past month				
No	595 (98.2)	272 (99.3)	323 (97.3)	0.123
Yes	11 (1.8)	2 (0.7)	9 (2.7)	
Age at first drug use (years)				
< 25	509 (84.0)	214 (78.1)	295 (88.9)	0.000
≥ 25	97 (16.0)	60 (21.9)	37 (11.1)	
Age at first drug injection (years)				
< 25	158 (26.1)	61 (22.3)	97 (29.2)	0.063
≥ 25	448 (73.9)	213 (77.7)	235 (70.8)	

for people reporting no shared equipments within the past month was 3.77 times higher than the OR of people who reported no shared equipments ($P = 0.000 < 0.001$). The adjusted OR of positive anti-HCV among those injecting twice or more per day was 4.33 ($P = 0.000 < 0.001$), compared to people who reported injections only once a day (or less). Moreover, both history of tattooing and history of imprisonment were significant in the final model.

4. Discussion

In the present study, we investigated factors correlated with the serological prevalence of anti-HCV among male PWID in Kermanshah, Iran. In line with previous research, we found a significant association between HCV antibody positivity and duration of drug injection, history of tattooing, history of sharing equipments within the past month, history of imprisonment, and frequency of injection per day (13, 15).

4.1. Prevalence of HCV Antibodies

A recent national estimate of HCV prevalence among PWID was 51.46% (95% CI, 34.30 - 68.62) (31). In the present study, we found an HCV antibody prevalence of 54.8% (95% CI, 50.8 to 58.7) in the PWID samples. An earlier study examining HCV among PWID in Isfahan, Iran reported that the prevalence of HCV antibodies was 47.1% (15). Previous research has established that the prevalence of HCV infection in PWID typically ranges between 20% and 90%. However, the rates vary depending on the geographical location, duration of exposure to injecting drug use, number of injections per day, and sharing needles, syringes, or injecting equipments (5).

The high prevalence of HCV antibodies in PWID establishes this population as one of the most important target groups for HCV prevention, treatment, and harm-reduction programs because of their important role in HCV transmission. The world health organization (WHO) has recently introduced global elimination targets for HCV by 2030 (32). Therefore, promotion of HCV treatment, together with sustained harm-reduction interventions, is

Table 3. Multiple Logistic Regression Analysis of Factors Associated with HCV Status in PWID in Kermanshah, Iran

Characteristics	Unadjusted OR (95% CI)	P Value for Unadjusted OR	AOR (95% CI)	P Value for AOR
Occupation				
Employed	1		1	
Unemployed	1.45 (1.05 - 2.01)	0.022	0.89 (0.57 - 1.37)	0.600
Regular attendance in NSPs				
Yes	1			
No	0.92 (0.67 - 1.27)	0.632		
Homelessness				
No	1		1	
Yes	2.96 (2.08 - 4.23)	0.000	1.48 (0.93 - 2.34)	0.095
Number of injections per day				
< 2	1		1	
≥ 2	6.23 (4.31 - 9.00)	0.000	4.27 (2.80 - 6.53)	0.000
History of tattooing				
No	1		1	
Yes	3.47 (2.46 - 4.89)	0.000	2.54 (1.69 - 3.81)	0.000
Sharing equipments within the past month				
No	1		1	
Yes	4.27 (3.03 - 6.01)	0.000	3.77 (2.49 - 5.71)	0.000
History of imprisonment				
No	1		1	
Yes	5.45 (3.53 - 8.43)	0.000	2.36 (1.42 - 3.92)	0.001
Needle/syringe sharing within the past month				
No	1		1	
Yes	3.78 (0.81 - 17.68)	0.090	1.16 (.23 - 5.87)	0.853
Age of first drug use (years)				
< 25	1		1	
≥ 25	0.44 (0.28 - 0.69)	0.000	1.15 (0.64 - 2.06)	0.639
Age of first drug injection (years)				
< 25	1		1	
≥ 25	0.69 (0.47 - 1.005)	0.053	0.72 (0.45 - 1.14)	0.166

Abbreviations: OR: odds ratio; AOR: adjusted odds ratio (all variables with P value < 0.2 entered the model).

crucial to achieving these goals in Iran.

4.2. Variables Correlated with HCV

The present findings indicated that HCV exposure is associated with history of imprisonment, history of tattooing, sharing equipments within the past month, and higher frequency of injections per day. A key finding of this study was the association between recent equipment sharing and risk of HCV transmission. This finding is supported

by research performed in Tehran, Iran, where sharing injecting equipments was identified as a risk factor for HCV infection (13).

Previous research has also identified history of imprisonment as one of the major risk factors for HCV infection in Iran and around the world (15, 16, 33, 34). Many PWID with a history of imprisonment have poor health. Therefore, prison screening for infectious diseases, such as HCV, and provision of health education and prevention programs

are essential in this population. There is also evidence that treatment for HCV in prison settings is achievable and cost-effective (35, 36).

Multiple studies have shown a significant association between history of tattooing and HCV infection. The present study was consistent with previous research from North America, Australia, and Italy, where the odds of being HCV positive increased by 3.4, 2.7, and 1.91, respectively in cases reporting a history of tattooing inside prison (37-39). Moreover, our findings could provide further evidence on the significant association between injecting frequency and HCV infection (29, 30). This reinforces the need to provide PWID with targeted education about HCV transmission and to increase access to sterile injecting equipments (not only sterile needles and syringes) in harm-reduction programs.

There are some limitations in the present study. Although this is a cross sectional study, it included more than 1 recruitment strategy to identify and enroll eligible participants. While the study sample is limited to male PWID from Kermanshah, it is not a random PWID sample. Therefore, the results cannot be generalized to all male drug injectors in Kermanshah or more broadly in Iran. The cross sectional design of the study also prevented the precise analysis of sequential association between risky behaviors and anti-HCV status. Moreover, all behavioral data are self-reported in this study, and therefore, there may be some recall biases; however, limiting a large part of the data to the past month could decrease the bias. Overall, self-report of behaviors has been previously shown to be of adequate reliability and validity in Iranian opiate users (14, 40).

4.3. Conclusion

To reduce the high prevalence of HCV infection among male PWID, it is necessary to provide optimal harm-reduction programs, especially NSPs. If we are to ensure that male PWID can avert new HCV infections and reinfections, increasing harm-reduction coverage and HCV treatment is a priority. Further studies using larger sample sizes and female injectors are required to fully understand the HCV prevalence and risk factors in other parts of Kermanshah.

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Footnotes

Authors' Contribution: Study design: Koorosh Etemad and Asaad Sharhani; data collection and analysis: Yadollah Mehrabi, Alireza Noroozi, and Maryam Nasirian; drafting of the manuscript: Asaad Sharhani, Ahmad Hajebi, and Behrooz Hamzeh; and critical revision of the manuscript: Nahid Khademi, Mehdi Noroozi, Peter Higgs, and Ebrahim Shakiba.

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References

1. World Health Organisation. . Global hepatitis report. World Health Organisation; 2017.
2. Mohd Hanafiah K, Groeger J, Flaxman AD, Wiersma ST. Global epidemiology of hepatitis C virus infection: new estimates of age-specific antibody to HCV seroprevalence. *Hepatology*. 2013;**57**(4):1333-42. doi: [10.1002/hep.26141](https://doi.org/10.1002/hep.26141). [PubMed: [23172780](https://pubmed.ncbi.nlm.nih.gov/23172780/)].
3. Alter MJ, Gerety RJ, Smallwood LA, Sampliner RE, Tabor E, Deinhardt F, et al. Sporadic non-a, non-b hepatitis: Frequency and epidemiology in an urban U.S. Population. *J Infect Dis*. 1982;**145**(6):886-93. [PubMed: [6806403](https://pubmed.ncbi.nlm.nih.gov/6806403/)].
4. Aceijas C, Stimson GV, Hickman M, Rhodes T, United Nations Reference Group on HP, Care among ID, et al. Global overview of injecting drug use and HIV infection among injecting drug users. *AIDS*. 2004;**18**(17):2295-303. [PubMed: [15577542](https://pubmed.ncbi.nlm.nih.gov/15577542/)].
5. Aceijas C, Rhodes T. Global estimates of prevalence of HCV infection among injecting drug users. *Int J Drug Policy*. 2007;**18**(5):352-8. doi: [10.1016/j.drugpo.2007.04.004](https://doi.org/10.1016/j.drugpo.2007.04.004). [PubMed: [17854722](https://pubmed.ncbi.nlm.nih.gov/17854722/)].
6. Amin-Esmaeili M, Rahimi-Movaghar A, Sharifi V, Hajebi A, Radgoodarzi R, Mojtabei R, et al. Epidemiology of illicit drug use disorders in Iran: prevalence, correlates, comorbidity and service utilization results from the Iranian Mental Health Survey. *Addiction*. 2016;**111**(10):1836-47. doi: [10.1111/add.13453](https://doi.org/10.1111/add.13453). [PubMed: [27177849](https://pubmed.ncbi.nlm.nih.gov/27177849/)].
7. Rahimi MA, Vameghi M. Social situation report of Iran (in Persian). Tehran: Rahman Institute Drug Addiction; 2011.
8. Alavian S, Fallahian F. Epidemiology of hepatitis C in Iran and the world. *SEMJ*. 2009;**10**(4):162-72.
9. Amiri ZM, Rezvani M, Shakib RJ, Shakib AJ. Prevalence of hepatitis C virus infection and risk factors of drug using prisoners in Guilan province. *EMHJ*. 2007;**13**(2).
10. Mohammad Alizadeh AH, Alavian SM, Jafari K, Yazdi N. Prevalence of hepatitis C virus infection and its related risk factors in drug abuser prisoners in Hamedan-Iran. *World J Gastroenterol*. 2005;**11**(26):4085-9. [PubMed: [15996035](https://pubmed.ncbi.nlm.nih.gov/15996035/)].
11. Alavi SM, Etemadi A. Hiv/hbv, hiv/hcv and hiv/htlv-1 co infection among injecting drug user patients hospitalized at the infectious disease ward of a training hospital in Iran. *Pak J Med Sci*. 2007;**23**(4):510-3.
12. Kheirandish P, SeyedAlinaghi S, Jahani M, Shirzad H, Seyed Ahmadian M, Majidi A, et al. Prevalence and correlates of hepatitis C infection among male injection drug users in detention, Tehran, Iran. *J Urban Health*. 2009;**86**(6):902-8. doi: [10.1007/s11524-009-9393-0](https://doi.org/10.1007/s11524-009-9393-0). [PubMed: [19844670](https://pubmed.ncbi.nlm.nih.gov/19844670/)].
13. Mir-Nasseri MM, Mohammadkhani A, Tavakkoli H, Ansari E, Poustchi H. Incarceration is a major risk factor for blood-borne infection among intravenous drug users: Incarceration and blood borne infection among intravenous drug users. *Hepat Mon*. 2011;**11**(1):19-22. [PubMed: [22087111](https://pubmed.ncbi.nlm.nih.gov/22087111/)].

14. Mirahmadizadeh AR, Majdzadeh R, Mohammad K, Forouzanfar M. Prevalence of hiv and hepatitis c virus infections and related behavioral determinants among injecting drug users of drop-in centers in Iran. *Iran Red Crescent Med J*. 2009;**11**(3):325.
15. Nokhodian Z, Meshkati M, Adibi P, Ataei B, Kassaian N, Yaran M, et al. Hepatitis c among intravenous drug users in isfahan, Iran: A study of seroprevalence and risk factors. *Int J Prev Med*. 2012;**3**(Suppl1):131-8.
16. Garcia-Alvarez M, Berenguer J, Jimenez-Sousa MA, Pineda-Tenor D, Aldamiz-Echevarria T, Tejerina F, et al. Mxi, OAS1 and OAS2 polymorphisms are associated with the severity of liver disease in HIV/HCV-coinfected patients: A cross-sectional study. *Sci Rep*. 2017;**7**:41516. doi: [10.1038/srep41516](https://doi.org/10.1038/srep41516). [PubMed: 28139728].
17. Malekinejad M, Navadeh S, Lotfizadeh A, Rahimi-Movaghar A, Amin-Esmaili M, Noroozi A. High hepatitis C virus prevalence among drug users in Iran: systematic review and meta-analysis of epidemiological evidence (2001-2012). *Int J Infect Dis*. 2015;**40**:116-30. doi: [10.1016/j.ijid.2015.09.022](https://doi.org/10.1016/j.ijid.2015.09.022). [PubMed: 26460088].
18. Rezaie F, Noroozi A, Armoon B, Farhoudian A, Massah O, Sharifi H, et al. Social determinants and hepatitis c among people who inject drugs in kermanshah, iran: Socioeconomic status, homelessness, and sufficient syringe coverage. *J Subst Use*. 2017;**22**(5):1-5.
19. Villano SA, Vlahov D, Nelson KE, Lyles CM, Cohn S, Thomas DL. Incidence and risk factors for hepatitis C among injection drug users in Baltimore, Maryland. *J Clin Microbiol*. 1997;**35**(12):3274-7. [PubMed: 9399533].
20. Garfein RS, Doherty MC, Monterroso ER, Thomas DL, Nelson KE, Vlahov D. Prevalence and incidence of hepatitis C virus infection among young adult injection drug users. *J Acquir Immune Defic Syndr*. 1998;**18**:S11-S9.
21. Hagan H, Thiede H, Weiss NS, Hopkins S, Jeffrey S. D. , Alexander ER. Sharing of drug preparation equipment as a risk factor for hepatitis C. *Commun Dis Public Health*. 2001;**9**(1):121-6.
22. Hahn JA, Page-Shafer K, Lum PJ, Bourgois P, Stein E, Evans JL, et al. Hepatitis C virus seroconversion among young injection drug users: relationships and risks. *J Infect Dis*. 2002;**186**(11):1558-64. doi: [10.1086/345554](https://doi.org/10.1086/345554). [PubMed: 12447730].
23. Hagan H, Thiede H, Des Jarlais DC. Hepatitis C virus infection among injection drug users: survival analysis of time to seroconversion. *Epidemiology*. 2004;**15**(5):543-9. [PubMed: 15308953].
24. Esmaili A, Mirzazadeh A, Carter GM, Esmaili A, Hajarizadeh B, Sacks HS, et al. Higher incidence of HCV in females compared to males who inject drugs: A systematic review and meta-analysis. *J Viral Hepat*. 2017;**24**(2):117-27. doi: [10.1111/jvh.12628](https://doi.org/10.1111/jvh.12628). [PubMed: 27790803].
25. Ruta S, Cernescu C. Injecting drug use: A vector for the introduction of new hepatitis C virus genotypes. *World J Gastroenterol*. 2015;**21**(38):10811-23. doi: [10.3748/wjg.v21.i38.10811](https://doi.org/10.3748/wjg.v21.i38.10811). [PubMed: 26478672].
26. Wiessing L, Ferri M, Grady B, Kantzanou M, Sperle I, Cullen KJ, et al. Hepatitis C virus infection epidemiology among people who inject drugs in Europe: a systematic review of data for scaling up treatment and prevention. *PLoS One*. 2014;**9**(7):103345. doi: [10.1371/journal.pone.0103345](https://doi.org/10.1371/journal.pone.0103345). [PubMed: 25068274].
27. Razaghi E, Rahimi-Movaghar A, Amin-Esmaili M, Sahimi IE, Baghestani A. The study of prevalence of infectious diseases among injecting drug abusers and their correlated factors in Tehran in 2006-2007. Tehran: INCAS; 2008.
28. Zamani S, Kihara M, Gouya MM, Vazirian M, Nassirimanesh B, Ono-Kihara M, et al. High prevalence of HIV infection associated with incarceration among community-based injecting drug users in Tehran, Iran. *J Acquir Immune Defic Syndr*. 2006;**42**(3):342-6. doi: [10.1097/01.qai.0000219785.81163.67](https://doi.org/10.1097/01.qai.0000219785.81163.67). [PubMed: 16639351].
29. Eckhardt B, Winkelstein ER, Shu MA, Carden MR, McKnight C, Des Jarlais DC, et al. Risk factors for hepatitis C seropositivity among young people who inject drugs in New York City: Implications for prevention. *PLoS One*. 2017;**12**(5):0177341. doi: [10.1371/journal.pone.0177341](https://doi.org/10.1371/journal.pone.0177341). [PubMed: 28542351].
30. Page K, Morris MD, Hahn JA, Maher L, Prins M. Injection drug use and hepatitis C virus infection in young adult injectors: using evidence to inform comprehensive prevention. *Clin Infect Dis*. 2013;**57** Suppl 2:S32-8. doi: [10.1093/cid/cit300](https://doi.org/10.1093/cid/cit300). [PubMed: 23884063].
31. Bagheri Amiri F, Mostafavi E, Mirzazadeh A. HIV, HBV and HCV Coinfection Prevalence in Iran-A Systematic Review and Meta-Analysis. *PLoS One*. 2016;**11**(3):0151946. doi: [10.1371/journal.pone.0151946](https://doi.org/10.1371/journal.pone.0151946). [PubMed: 27031352].
32. World Health Statistics . Monitoring health for the SDGs sustainable development goals. World Health Organization; 2016.
33. Ventura M, Martin L, Jaubert C, Andreola ML, Masante C. Hepatitis C virus intragenomic interactions are modulated by the SLVI RNA structure of the core coding sequence. *J Gen Virol*. 2017;**98**(4):633-42. doi: [10.1099/jgv.0.000719](https://doi.org/10.1099/jgv.0.000719). [PubMed: 28141507].
34. Borba HH, Wiens A, Steimbach LM, Tonin FS, Pedrosa M, Ivantes CA, et al. Rapid virological response of telaprevir and boceprevir in a Brazilian cohort of HCV genotype 1 patients: a multicenter longitudinal study. *Ther Clin Risk Manag*. 2017;**13**:59-64. doi: [10.2147/TCRM.S124663](https://doi.org/10.2147/TCRM.S124663). [PubMed: 28138248].
35. Ranieri R, Starnini G, Carbonara S, Pontali E, Leo G, Romano A, et al. Management of HCV infection in the penitentiary setting in the direct-acting antivirals era: practical recommendations from an expert panel. *Infection*. 2017;**45**(2):131-8. doi: [10.1007/s15010-016-0973-0](https://doi.org/10.1007/s15010-016-0973-0). [PubMed: 28025726].
36. Lloyd AR, Clegg J, Lange J, Stevenson A, Post JJ, Lloyd D, et al. Safety and effectiveness of a nurse-led outreach program for assessment and treatment of chronic hepatitis C in the custodial setting. *Clin Infect Dis*. 2013;**56**(8):1078-84. doi: [10.1093/cid/cis1202](https://doi.org/10.1093/cid/cis1202). [PubMed: 23362288].
37. Abdelmaksoud A. Anti-HCV for porphyria cutanea tarda. *Dermatol Ther*. 2017;**30**(3) doi: [10.1111/dth.12466](https://doi.org/10.1111/dth.12466). [PubMed: 28133909].
38. Mo H, Hedskog C, Lawitz E, Brainard DM, Yang J, Delaney W, et al. Antiviral response and resistance analysis of treatment-naive HCV infected patients receiving multiple doses of the NS3 protease inhibitor GS-9256. *Antiviral Res*. 2017;**140**:151-7. doi: [10.1016/j.antiviral.2017.01.015](https://doi.org/10.1016/j.antiviral.2017.01.015). [PubMed: 28132867].
39. Li X, Li Y, Fang S, Su J, Jiang J, Liang B, et al. Downregulation of autophagy-related gene ATG5 and GABARAP expression by IFN-lambda1 contributes to its anti-HCV activity in human hepatoma cells. *Antiviral Res*. 2017;**140**:83-94. doi: [10.1016/j.antiviral.2017.01.016](https://doi.org/10.1016/j.antiviral.2017.01.016). [PubMed: 28131804].
40. Abnet CC, Saadatian-Elahi M, Pourshams A, Boffetta P, Feizzadeh A, Brennan P, et al. Reliability and validity of opiate use self-report in a population at high risk for esophageal cancer in Golestan, Iran. *Cancer Epidemiol Biomarkers Prev*. 2004;**13**(6):1068-70. [PubMed: 15184266].