Introduction

Hepatitis C virus (HCV) infection has emerged as a serious public health threat. The World Health Assembly formulated Global Health Sector Strategy for eliminating viral hepatitis as a public health threat by 2030. Globally, approximately 58 million people are chronically infected and 1.5 million people have a new HCV infection each year. Approximately one-third of infected persons will clear the virus in 6 months following infection without any treatment, while chronic infection with HCV may lead to cirrhosis and hepatocellular carcinoma. The World Health Organization (WHO) estimated approximately 290,000 HCV deaths globally in 2019.

Low- and middle-income countries account for the largest proportion of persons living with HCV (72%). Anti-HCV antibody prevalence varies between 0.09% and 15% in the general population, while recipients of blood transfusion, persons who inject drugs (PWID), non-injecting drug use, unsafe injections, and tattooing are the main risk factors observed in India.

Keywords: Blood transfusion, cases, controls, dental procedures, Hepatitis C infection, injecting drug use, risk factors
and reuse of unsterilized needles/syringes and surgical instruments remain the areas of major concern. IDU is one of the leading risk factors of HCV infection and explains the uneven distribution of HCV infection prevalent worldwide. Approximately 8.5 lakh people inject drugs in India. No single state is contributing significantly in HCV burden, but there are pockets of high prevalence of HCV infection in various states across India. HCV transmission being primarily blood borne is by and large preventable, especially by reducing healthcare, behavioral, and community-level exposure to HCV. WHO identified major gaps in HCV prevention, testing, and treatment among vulnerable populations and advocates integrating community-level services to fill these gaps. Primary care physicians are perfectly placed to offer services through interdisciplinary approach.

HCV infection poses a major healthcare burden in Punjab, and it makes absolutely vital to ponder upon urgent solutions to tackle this problem. A higher prevalence of HCV has been observed in certain geographical areas in Punjab. Previous population-based surveys in Punjab found a 3.6%–5% anti-HCV positivity rate and identified history of surgery, dental treatment, reuse of needles, and blood transfusion as the associated risk factors for HCV. There is a need for more studies to better understand the epidemiological risk factors of HCV infection in the state. In the light of the above discussion, this study was planned to determine the epidemiological variables of hepatitis C infection among adults in a tertiary care hospital in Ludhiana, Punjab, which will be helpful in the prevention and control of HCV infection.

**Materials and Methods**

This hospital-based case-control study was carried out in Dayanand Medical College and Hospital Ludhiana, Punjab, India. The recruitment of cases and controls was done from March 2017 to February 2018. Subjects were included in the study after obtaining written informed consent. Cases were defined as patients ≥18 years of age fulfilling the biomarker criteria such as the presence of HCV RNA with or without anti-HCV or the detection of anti-HCV among persons previously negative for this marker or the occurrence of clinical acute hepatitis with a positive anti-HCV test after exclusion of acute hepatitis B. Incident cases diagnosed in the last 1 month prior to recruitment in the study were included to reduce recall bias. Controls were defined as patients ≥18 years of age not having underlying liver disease and were serologically negative for viral hepatitis C. Any patient who turned out to be seropositive for viral hepatitis was excluded.

Cases were recruited from the outpatient department (OPD)/inpatient department (IPD) of the Gastroenterology department of Dayanand Medical College and Hospital. The controls were recruited from the indoor patients in the hospital. A sample size of 160 cases and 160 controls with a ratio of 1:1 (one control to one case) was calculated by assuming the exposure to be 30% among controls to achieve an odds ratio of 2 with a power of 80% and significance level at 5%.

**Data collection**

Eligible cases as per the inclusion criteria were recruited from the Gastroenterology OPD/IPD. In case of refusal, the next eligible case was taken. Controls were pair-matched by gender, age (±5 years), and locality (urban/rural) of the case. They were recruited from indoor patients who were not living in the case-patient households. Controls were selected from surgery and orthopedics wards where viral markers were done prior to surgery and all the hepatitis C negative subjects were selected as controls. Any subject who either was not willing to participate or who refused to cooperate was excluded.

The information was collected by using a questionnaire through detailed interviews of the cases and controls. Each individual was told about the purpose of the study and confidentiality of information was assured. The questionnaire included information on basic socio-demographic characteristics of the subjects such as age, years of schooling, gender, residence, occupation, current marital status and about previous healthcare-associated exposures, high-risk behaviors, and community-acquired exposures in the last 6 months.

**Statistical analysis**

Statistical analysis was performed using SPSS version 20 (IBM SPSS statistics for Windows, version 20.0 Armonk, NY: IBM Corp.). Descriptive statistics are presented in percentages and mean ± standard deviation. Student’s t test was used to determine the difference between the means of two quantitative variables, while Pearson’s Chi-square (χ²) test was used to find out the difference for the categorical variables. Univariate analysis was performed to compare HCV cases and controls for different variables. Odds ratio (OR), 95% confidence interval (95%CI), and P value (P) were calculated to measure the strength of association for cases and controls in terms of each risk factor. All tests were two-tailed, and P < 0.05 was considered to be statistically significant. Logistic regression was used to control for confounding and to determine which exposure variables were important in predicting HCV infection. Case-control status was selected as dependent variable.

**Ethical considerations**

The study was approved by the institutional ethics committee of Dayanand Medical College and Hospital, Ludhiana (DMCH/P/2016/487-94 dated 08.12.2016).

**Results**

A total of 320 study subjects aged ≥18 years comprising 160 cases and 160 controls were included. Of 320 subjects interviewed, approximately half of the cases and controls were in the age of 40–59 years, followed by 18–39 years (52.5% cases vs. 48.1% controls) (P = 0.945). The mean age of the
cases and controls was 45.9 ± 13.37 and 45.2 ± 13.66 years, respectively \((P = 0.641)\). The majority of cases and controls were males (73.8%) and were from rural areas (78.8%). Approximately half of the cases and 36.3% of controls had 6–10 years of schooling \((OR: 2.79, 95\% CI: 1.48–5.27)\), while 31.9% of cases and 49.4% of controls had more than 10 years of schooling. Most of the cases (75.6%) and controls (81.9%) were currently married \((P = 0.173)\). Significantly higher proportion of cases were farmers as compared to controls \((OR: 1.87, 95\% CI: 1.12–3.12)\) and lesser number of cases were occupied in business or service than controls \((OR: 0.34, 95\% CI: 0.20–0.59)\) [Table 1].

Table 2 reveals the presence of healthcare-related risk factors among cases and controls. It was observed that 27 (16.9%) cases received blood/blood products in comparison to 13 controls (8.1%) in the past. The difference observed was found to be statistically significant \((OR: 2.30, 95\% CI: 1.14–4.63)\). Eleven cases and five controls received blood transfusions more than once. Among the cases, 41.2% were exposed to dental procedure as compared to 28.7% of the controls. It was observed that visiting quacks for the dental procedure was significantly associated with the risk of HCV \((OR: 4.82, 95\% CI: 2.38–9.77)\), whereas attending government \((OR: 0.25, 95\% CI: 0.03–2.22)\) and private healthcare facility \((OR: 0.70, 95\% CI: 0.39–1.26)\) was not associated with HCV infection. No association was observed between the history of exposure to the surgery and the HCV risk. It was found that HCV infection was associated with visits to quacks for receiving intravenous infusion or injections \((16.2\% \text{ in cases vs. } 5.6\% \text{ in controls})\) \((OR: 3.26, 95\% CI: 1.47–7.19)\), whereas visiting private \((OR: 0.88, P = 0.574)\) and government \((OR: 0.64, P = 0.253)\) hospitals for IV infusion/injections was not associated with the HCV infection.

Among the behavioral risk factors, history of injectable drug use \((OR: 26.69, 95\% CI: 3.55–200.24)\), non-injectable drug use \((OR: 10.67, 95\% CI: 1.78–65.24)\), history of smoke use \((OR: 3.03, 95\% CI: 1.02–9.07)\), and history of alcohol use \((OR: 4.06, 95\% CI: 1.26–13.03)\) were found to be associated with HCV infection.

### Table 1: Socio-demographic characteristics of hepatitis C cases and controls

| Socio-demographic characteristics | Cases (%) \((n=160)\) | Controls (%) \((n=160)\) | OR (95%CI) | \(P\) |
|----------------------------------|------------------------|--------------------------|-----------|------|
| **Age (Years)**                  |                        |                          |           |      |
| 18-29                            | 24 (15.0)              | 26 (16.3)                | 0.945\*   |      |
| 30-39                            | 26 (16.2)              | 29 (18.1)                | 1         |      |
| 40-49                            | 38 (23.8)              | 37 (23.1)                | 1         |      |
| 50-59                            | 46 (28.7)              | 40 (25.0)                | 1         |      |
| ≥60                              | 26 (16.3)              | 28 (17.5)                | 1         |      |
| **Gender**                       |                        |                          |           |      |
| Male                             | 118 (73.8)             | 118 (73.8)               | 1         |      |
| Female                           | 42 (26.2)              | 42 (26.2)                | 1         |      |
| **Locality**                     |                        |                          |           |      |
| Urban                            | 34 (21.2)              | 34 (21.2)                | 1         |      |
| Rural                            | 126 (78.8)             | 126 (78.8)               | 1         |      |
| **Years of schooling**           |                        |                          |           |      |
| 0-5                              | 28 (17.5)              | 23 (14.4)                | 2.44 (1.13-5.26) | 0.023* |
| 6-10                             | 81 (50.6)              | 58 (36.3)                | 2.79 (1.48-5.27) | 0.001* |
| 11-12                            | 31 (19.4)              | 39 (24.4)                | 1.59 (0.78-3.25) | 0.204  |
| >12                              | 20 (12.5)              | 40 (25.0)                | 1         |      |
| **Marital Status**               |                        |                          |           |      |
| Single                           | 39 (24.4)              | 29 (18.1)                | 1.46 (0.85-2.50) | 0.173  |
| Married                          | 121 (75.6)             | 131 (81.9)               | 1         |      |
| **Occupation**                   |                        |                          |           |      |
| Farmers                          | 51 (31.9)              | 32 (20.0)                | 1.87 (1.12-3.12) | 0.016* |
| Skilled/unskilled worker         | 109 (68.1)             | 128 (80.0)               | 1         |      |
| Healthcare providers             |                        |                          |           |      |
| Yes                              | 22 (13.8)              | 18 (11.2)                | 1.26 (0.65-2.45) | 0.500  |
| No                               | 138 (86.2)             | 142 (88.8)               | 1         |      |
| Business/Service                 |                        |                          |           |      |
| Yes                              | 25 (15.6)              | 56 (35.0)                | 0.34 (0.20-0.59) | <0.001** |
| No                               | 135 (84.4)             | 104 (65.0)               | 1         |      |
| **Unemployed**                   |                        |                          |           |      |
| Yes                              | 5 (3.1)                | 3 (1.9)                  | 1.69 (0.39-7.20) | 0.479  |
| No                               | 155 (96.9)             | 157 (98.1)               | 1         |      |

OR: Odd ratio; CI: Confidence interval; \(\chi^2=0.750; P=0.395\). Statistically significant; \(P<0.001\). Statistically highly significant
Table 2: Healthcare related risk factors among hepatitis C cases and controls

| Risk Factors                        | Cases (%) (n=160) | Controls (%) (n=160) | OR (95%CI) | P    |
|-------------------------------------|-------------------|----------------------|------------|------|
| Invasive procedures                 |                   |                      |            |      |
| Blood transfusion                   | 27 (16.9)         | 13 (8.1)             | 2.30 (1.14–4.63) | 0.020*|
| Blood donation                      | 33 (20.6)         | 26 (16.2)            | 1.34 (0.76–2.36) | 0.314|
| Surgical procedure                  | 59 (36.9)         | 59 (36.9)            | 1.0 (0.64–1.58)  | 1.000|
| Hospitalization                     | 94 (58.8)         | 86 (53.8)            | 1.23 (0.79–1.91) | 0.368|
| Dental procedure                    |                   |                      |            |      |
| From government health facility     | 1 (0.6)           | 4 (2.5)              | 0.25 (0.03–2.22) | 0.211|
| From private health facility        | 23 (14.4)         | 31 (19.4)            | 0.70 (0.39–1.26) | 0.234|
| From quacks/traditional healers     | 42 (26.2)         | 11 (6.9)             | 4.82 (2.38–9.77) | <0.001**|
| Intravenous injection/infusion      |                   |                      |            |      |
| From government health facility     | 12 (7.5)          | 18 (11.2)            | 0.64 (0.30–1.38) | 0.253|
| From private health facility        | 87 (54.4)         | 92 (57.5)            | 0.88 (0.57–1.37) | 0.574|
| From quacks/traditional healers     | 26 (16.2)         | 9 (5.6)              | 3.26 (1.47–7.19) | 0.004*|
| Needlestick injury                  | 5 (3.1)           | -                    | -          | -    |

OR: Odds ratio; CI: Confidence interval; *P<0.05* statistically significant; **P<0.001** statistically highly significant

use (OR: 2.37, 95%CI: 1.44–3.90), and tattooing from street hawkers (OR: 7.91, 95%CI: 1.44–3.90) was significantly associated with a higher risk of HCV infection. Heroin was the most commonly used intravenous drug; only a few cases reported using cocaine and opium for injecting. It was also observed that the majority of the intravenous drug users (78.3% cases) were reusing the same syringe for injecting the drug. Non-injectable substance use included opium, cannabis, and smoking, and higher use (oral) of opium was reported than smoking and cannabis by the subjects. None of the subjects reported using the intranasal route for the same. Approximately one-fifth of the cases had a history of contact with HCV-infected persons, out of which 61.5% and 38.4% of the subjects reported non-sexual (household member) and sexual contact with the HCV patient, respectively. Only one case had history of contact with IDU. Among the controls, no subjects had any history of contact with HCV patients. All the cases and controls reported heterosexual behavior, and only six subjects reported a history of more than one sex partner, while no male control reported it. Among community exposures, visiting street hawkers for piercing was significantly associated with the risk of HCV and odds of having HCV infection was 2.25 (95%CI: 1.18–4.29) times higher among cases (20.0%) than in controls (10.0%) [Table 3].

On performing multivariate binary logistic regression, it was observed that history of blood transfusion (AOR: 3.38, 95%CI: 1.50–7.62), dental procedure (AOR: 4.65, 95%CI: 2.12–10.24) and intravenous injection/infusion from quacks (AOR: 2.57, 95%CI: 1.05–6.31), IDU (AOR: 17.14, 95%CI: 2.07–141.76), and piercing from street hawkers (AOR: 3.49, 95%CI: 1.41–8.65) independently influenced the risk of hepatitis C infection [Table 4].

**Discussion**

This was a matched case-control study to identify the risk factors for hepatitis C infection in Punjab, India which included incident HCV cases. The present study reported education as a risk factor for HCV infection in the univariate analysis and observed that cases having lesser schooling were more likely to have HCV infection than controls. A similar observation was also reported by Sood et al.[9] in a population-based survey in Punjab, India, Mohd Suan et al.[13] in Malaysia, and Paez Jimenez et al.[14] in urban Egypt in hospital-based case-control studies, wherein low education was an important risk factor associated with higher HCV infection. Irrespective of any population, occupational exposure is not likely to be the source of incident HCV infection.[17] Similar to the observations by Kandeel et al.[13] in a hospital-based case-control study in Egypt and Mohd Suan et al.[15] in Malaysia, the current study reported no independent association between occupation and acquiring HCV infection. As observed in previous studies,[13,15,18] our study reported no significant association with marital status and HCV infection.

The current study identified healthcare-related risk factors such as blood transfusion, dental procedure, and intravenous injection/infusion from quacks or traditional healers independently influencing HCV infection. HCV exposure in healthcare setting may occur through the absence of screened or quality-screened blood transfusion for HCV.[14] India mandated HCV testing in blood banks in 2002.[5,8] Nevertheless, the current study reported a higher risk of HCV infection with a history of blood transfusion (AOR: 3.38, 95%CI: 1.50–7.62) and underscores the need for regular monitoring of blood banks for quality blood screening. Rosa et al.[18] in Sao Paulo observed that history of blood transfusion had a significant independent association with HCV infection (AOR: 7.33). Prior studies conducted in India[9] and abroad[15,19,20] also observed a similar relationship. Our study could not identify any association between hemodialysis and HCV infection.

Globally, most HCV infections in healthcare settings occur as a result of inadequate infection control practices and reuse of equipment for various procedures.[3,14] In the present study, history of any dental procedure was significantly associated with HCV infection. Sood et al.[11] in Ludhiana observed that 39% of HCV-positive versus 28% HCV-negative subjects had a history...
of dental treatment (P < 0.001). Lasher et al.[20] in Hawaii also reported a significant association of dental surgery with acquiring HCV (OR: 2.0). In the present study, visiting quacks for dental procedures was strongly associated with HCV Infection (AOR: 4.65, 95%CI: 2.12–10.24). Reuse of unsterilized instruments can be the contributing factor in HCV transmission. Kandeel et al.[13] observed that visiting a dental outpatient clinic was significantly associated with HCV infection (OR: 1.7).

In the present study, having undergone surgical procedures was not found to be associated with HCV risk. Similarly, Mohd Suan et al.[13] did not observe any association between surgery and HCV infection. The risk of acquiring HCV infection through hospitalization in developing countries has received greater attention.[21] In the current study, 58.8% of cases and 53.8% of controls reported to have a history of hospitalization. This is in contrast to findings by previous studies which identified a significant association between history of hospitalization and HCV infection.[13,16,21] In our study, nil subjects reported to have undergone endoscopy.

Excessive use of injection for medication coupled with unsafe injection practices using unsterilized and reused injection devices enhance HCV risk transmission; especially, unqualified ones/quacks may indulge in these practices.[22,23] Injection safety project with the policy of reuse prevention syringes (RUP) in government health centers was implemented in Punjab in 2016; however, absence of knowledge together with unfair wrong injection practices of healthcare providers remains a major risk of transmission.[23] Sood et al.[24] in Punjab observed that a substantial proportion of physicians reused needles and syringes despite being aware of parenteral HCV transmission. Our study revealed that receiving injection/infusion from quack was significantly associated with HCV infection (AOR: 2.57 95%CI: 1.05–6.31). Sood et al.[26] reported increased chances of being anti-HCV positive among those who did not receive their last injection from a medical doctor. Ghias and Pervaiz in Pakistan concluded that quacks used unsterilized needles more frequently and were unaware about parenteral HCV transmission.[25]

High-risk behaviors have been reported as efficient channels of HCV infection and PWID are at higher risk for blood-borne infections and particularly through sharing of needles.[13,14] As seen in the study conducted by Kandeel et al.,[13] cases (19.5%)

### Table 3: Behavioural risk and community exposures among hepatitis C cases and controls

| Risk Factors                        | Cases (%) (n=160) | Controls (%) (n=160) | OR (95%CI)     | P    |
|------------------------------------|------------------|----------------------|----------------|------|
| **Behavioral risk exposures**      |                  |                      |                |      |
| Injectable drug use                | 23 (14.4)        | 1 (0.6)              | 26.69 (3.55–200.24) | 0.001* |
| Non-injectable drug use            | 61 (38.1)        | 33 (20.6)            | 2.37 (1.44–3.90)  | 0.001* |
| Tattooing from parlour/shop        | 2 (1.3)          | 4 (2.5)              | 0.50 (0.09–2.73)  | 0.419 |
| Tattooing from street hawker       | 21 (13.1)        | 3 (1.9)              | 7.91 (2.31–27.08) | 0.001* |
| History of contact with HCV persons| 39 (24.4)        | -                    | -               | -    |
| History of more than one sexual Partner | 6 (5.1)     | -                    | -               | -    |
| History of imprisonment            | 1 (0.6)          | -                    | -               | -    |
| **Community exposures**            |                  |                      |                |      |
| Piercing from commercial parlour   | 2 (1.3)          | 6 (3.8)              | 0.33 (0.07–1.64)  | 0.173 |
| Piercing from jewellery shop       | 8 (5.0)          | 20 (12.5)            | 0.37 (0.16–0.86)  | 0.222*|
| Piercing from street hawker        | 32 (20.0)        | 16 (10.0)            | 2.25 (1.18–4.29)  | 0.014*|
| Pedicure (for females)             | 4 (9.5)          | 3 (7.1)              | 1.37 (0.29–6.53)  | 0.694 |
| Living with HCV patient            | 29 (18.1)        | -                    | -               | -    |
| Haircut/shaving (for males)        | 72 (61.0)        | 74 (62.7)            | 0.93 (0.55–1.57)  | 0.789 |
| Haircut/shaving from commercial parlour | 65 (55.0)    | 67 (56.7)            | 0.93 (0.56–1.56)  | 0.793 |
| Haircut/shaving at road side barber| 7 (6.0)          | 7 (6.0)              | 1.00 (0.34–2.95)  | 1.000 |
| Haircut/shaving using new blade    | 70 (59.3)        | 73 (61.9)            | 0.90 (0.53–1.52)  | 0.689 |
| Wounded at barber shop             | 53 (44.9)        | 58 (49.1)            | 0.84 (0.51–1.41)  | 0.514 |

OR: Odds ratio; CI: Confidence interval; P<0.05* statistically significant; n=42 each for cases and controls; †‡n=118 each for cases and controls

### Table 4: Multivariate logistic regression analysis for risk factors of hepatitis C infection

| Variable                                      | Adjusted OR (95%CI) | P    |
|-----------------------------------------------|---------------------|------|
| Healthcare-related exposures                  |                     |      |
| Blood transfusion                             | 3.38 (1.50–7.62)    | 0.003*|
| Dental procedure from quack/traditional healer| 4.65 (2.12–10.24)   | <0.001**|
| Intravenous injection/infusion from quack/traditional healer | 2.57 (1.05–6.31) | 0.039*|
| Behavioral risk exposures                     |                     |      |
| Injectable drug use                           | 17.14 (2.07–141.76) | 0.008*|
| Community exposures                           |                     |      |
| Piercing from a street hawker                 | 3.49 (1.41-8.65)    | 0.007*|

AOR: Adjusted odds ratio; CI: Confidence interval; P<0.05* statistically significant; P<0.001**. Statistically highly significant
were more likely to indulge in IDU than controls in the current study. This is also corroborated by the results of previous studies wherein it was observed that using IV drugs was significantly associated with HCV infection.[11,16,20,24] Saraswati et al.[25] in Delhi observed that 70.9% IDUs had HCV antibody-positive tests. In our study, heroin was used frequently as an intravenous drug and had a significant association with HCV infection. The preference for heroin by the cases could be due to the fact that many users are shifting to synthetic drugs such as heroin in India.[28] A national survey on substance use in India reported that approximately half of PWID were injecting heroin, reusing needles/syringes and approximately 27% were sharing it with others.[7] Globally, 8% of HCV-infected cases currently inject drugs.[14] Our study reported that 6.2% of HCV cases were currently injecting drugs. As observed in prior studies, the current study also identified a significant association between non-injectable drug use and HCV infection (OR: 2.37).[18,19] More efforts should be aimed toward linking PWIDs with primary care providers/physicians for early diagnosis and management of HCV infection.

HCV infection may occur by parenteral blood exposure to practices such as tattooing and acupuncture, and especially if the tattooing is performed by non-professionals by using unsterilized and reused instruments.[24] Practices of tattooing from street hawkers were higher in cases than controls in the present study (OR: 7.91). Sood et al.[11] reported that 10.7% of HCV cases had a positive history of tattooing. Previous studies also reported a strong association of tattooing with HCV infection.[15,16,20,24] In the current study, no subject reported a history of acupuncture. Contact with a HCV-infected person is a risk factor; however, acquiring HCV through household contact is a limited risk factor. In the present study, the most common type of contact was non-sexual. Mahajan et al.[19] in Ludhiana also observed that 73% of HCV cases were non-sexual household contacts. As reported by Kandeel et al.[19] the current study could not identify any evidence of sexual contact as a risk factor with HCV infection.

The present study observed that history of body piercing was universal among all the female subjects, and having body piercing from street hawkers was significantly associated with HCV infection (20.0% cases vs. 10.0% of controls). Sood et al.[11] reported that among HCV-positive cases, 49.6% underwent ear piercing. Mohd Suan et al.[19] also observed that persons practicing piercing were at a higher risk of HCV due to repeated use of unsterilized piercing instruments. Other studies also reported significantly higher odds of HCV infection with nose, ear,[13] and body piercing.[24] As seen in previous studies,[13,21,25] the present study also reported no association between shaving/haircut and increased risk of HCV infection.

Despite the best efforts, this type of study is prone to biases; however, careful attention was paid to limit the biases by matching cases and controls, including enrolling only incident cases that were diagnosed in the last 1 month prior to recruitment in the study to reduce recall bias. The limitation of the study can be that the subjects might have concealed sensitive information such as drug use and sexual behavior and reported only socially desirable information. In addition, the comparison was difficult for a few variables as the proportion of subjects was less or almost nil in certain subgroups.

Conclusions

The present study identified multiple risk factors associated with HCV infection. Thus, the existing screening activities among this high-risk population should be strengthened to detect HCV-infected cases. Blood remains a major route of HCV transmission. There is a need for effective implementation and monitoring of blood banks to improve blood safety practices. Preventive and promotive interventions by periodic awareness generation outreach camps on prevention of substance abuse and dangers of piercing/tattooing from street hawkers, particularly among adolescents and young adults, are required. Educational programs for current intravenous drug users regarding the need to use sterilized needles are suggested.

The study highlights the need for increased involvement of qualified and trained healthcare providers with regular training sessions on safe injection control measures and avoiding unnecessary healthcare injections. Further research is required to establish the role of sexual risk behavior in HCV transmission. HCV infection is associated with diverse exposures. Therefore, it is essential to identify these variables for public health planning to prevent and control HCV infection.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for clinical information to be reported in the journal. The patients understood that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. World Health Organization. Global Hepatitis Report 2017. Geneva: World Health Organization; 2017. Available from: https://www.who.int/publications/i/item/global-hepatitis-report-2017. [Last accessed on 2021 Jun 06].

2. World Health Organization. Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021. Accountability for the global health sector strategies 2016–2021: Actions for impact. Geneva: World Health Organization; 2021. Available from: https://www.who.int/publications/i/item/9789240027077. [Last
accessed on 2022 Feb 15].

3. World Health Organization. Fact sheets on Hepatitis C. World Health Organization; 2021 July 27. Available from: https://www.who.int/news-room/fact-sheets/detail/hepatitis-c. [Last accessed on 2022 Feb 15].

4. Government of India. Ministry of Health and Family Welfare. National action plan combating viral hepatitis in India 2019. Available from: https://nhcvcp.gov.in/common_libs/NationalAction-Plan-Combating-Viral-Hepatitis-in-India.pdf. [Last accessed on 2021 Jun 06].

5. Government of India. Ministry of Health and Family Welfare. National viral hepatitis control program operational guidelines 2018. Available from: https://main.mohfw.gov.in/sites/default/files/National%20Viral%20Hepatitis%20Control%20Program_Reference%20file_0.pdf. [Last accessed on 2022 Feb 15].

6. Degenhardt L, Peacock A, Colledge S, Leung J, Grebely J, Vickerman P, et al. Global prevalence of injecting drug use and sociodemographic characteristics and prevalence of HIV, HBV, and HCV in people who inject drugs: A multitask systematic review. Lancet Glob Health 2017;5:e192–207.

7. Ambekar A, Agrawal A, Rao R, Mishra AK, Khandelwal SK, Chadda RK. On behalf of the group of investigators for the National Survey on Extent and Pattern of Substance Use in India. Magnitude of Substance Use in India 2019. New Delhi: Ministry of Social Justice and Empowerment, Government of India. Available from: http://socialjustice.nic.in/writereraddata/UploadFile/Magnitude_Substance_Use_India_REPORT.pdf. [Last accessed on 2021 Jun 06].

8. Artenie AA, Bruneau J, Lévesque A, Wansuwanany JM. Role of primary care providers in hepatitis C prevention and care: One step away from evidence-based practice. Can Fam Physician 2014;60:881-2.

9. Government of India. Ministry of Health and Family Welfare. Viral hepatitis—the silent disease facts and treatment guidelines. National Centre for Disease Control, Delhi. Available from: https://ncdc.gov.in/linkimages/guideline_hep20158117187417.pdf. [Last accessed on 2022 Feb 15].

10. Sood A, Suryagrasad A, Trickey A, Kanchi S, Midha V, Foster MA, et al. The burden of hepatitis C virus infection in Punjab, India: A population-based serosurvey. PLoS One 2018;13:e0200461.

11. Sood A, Sarin SK, Midha V, Hissar S, Sood N, Bansal P, et al. Prevalence of hepatitis C virus in a selected geographical area of northern India: A population-based survey. Indian J Gastroenterol 2012;31:232-6.

12. World Health Organization. Technical considerations and case definitions to improve surveillance for viral hepatitis: Technical report. World Health Organization; 2016.

13. Kandeel AM, Talaat A, Afifi SA, Sayed NM, Fadeel MA. Case control study to identify risk factors for acute hepatitis C virus infection in Egypt. BMC Infect Dis 2012;12:294.

14. Kirkwood BR, Sterne JAC. Essential Medical Statistics. 2nd ed., Ch. 35. Massachusetts: Blackwell Publishing Company; 2006. p. 413-28.

15. Mohd Suan MA, Said SM, Lim PY, Azman AZF, Abu Hassan MR. Risk factors for hepatitis C infection among adult patients in Kedah state, Malaysia: A case-control study. PLoS One 2019;14:e0224459.

16. Paez Jimenez A, Mohamed MK, Sharaf Eldin N, Abou Seif H, El Aidi S, Sultan Y, et al. Injection drug use is a risk factor for HCV infection in Urban Egypt. PLoS One 2009;4:e7193.

17. Shepard CW, Finelli L, Alter MJ. Global epidemiology of hepatitis C virus infection. Lancet Infect Dis 2005;5:538-67.

18. Rosa RS, Martinelli AL, Passos AD. Risk factors for hepatitis C virus transmission in the municipality of Catanduva, State of São Paulo: A case-control study. Rev Soc Bras Med Trop 2014;47:295-301.

19. Perz JF, Armstrong GL, Farrington LA, Hutin YJ, Bell BP. The contributions of hepatitis B virus and hepatitis C virus infections to cirrhosis and primary liver cancer worldwide. J Hepatol 2006;45:529-38.

20. Lasher LE, Elm JL, Hoang Q, Nekomoto TS, Cashman TM, Miller FD. A case control investigation of hepatitis C risk factors in Hawaii. Hawaii Med J 2005;64:296-304.

21. Karmochkine M, Carrat F, Santos O, Cacoub P, Raguin G. A case-control study of risk factors for hepatitis C infection in patients with unexplained routes of infection. J Viral Hepat 2006;13:775-82.

22. Gore C, Lazarus JV, Peck RJ, Sperle I, Safreed-Harmon K. Unnecessary injecting of medicines is still a major public health challenge globally. Trop Med Int Health 2013;18:1157-9.

23. Pépin J, Abou Chakra CN, Pépin E, Nault V, Valiquette L. Evolution of the global burden of viral infections from unsafe medical injections, 2000–2010. PLoS One 2014;9:e99677.

24. Sood A, Midha V, Awasthi G. Hepatitis C–knowledge and practices among the family physicians. Trop Gastroenterol 2002;23:198-201.

25. Ghias M, Pervaiz MK. Identification of epidemiological risk factors for hepatitis C in Punjab, Pakistan. J Ayub Med Coll Abbottabad 2009;21:156-61.

26. Sarna A, Tun W, Bhattacharya A, Lewis D, Singh YS, Apicella L. Assessment of unsafe injection practices and sexual behaviors among male injecting drug users in two urban cities of India using respondent driven sampling. Southeast Asian J Trop Med Public Heal 2012;43:652-67.

27. Sarawasti LR, Sarna A, Sebastian MP, Sharma V, Madan I, Thior I, et al. HIV, Hepatitis B and C among people who inject drugs: High prevalence of HIV and Hepatitis C RNA positive infections observed in Delhi, India. BMC Public Health 2015;15:726.

28. Ambekar A, Tripathi BM. Size Estimation of Injecting Drug use in Punjab and Haryana. UNAIDS India; 2008.

29. Carney K, Dhalla S, Aytamnan A, Tenner CT, Francois F. Association of tattooing and hepatitis C virus infection: A multicenter case-control study. Hepatology 2013;57:2117-23.

30. Mahajan R, Midha V, Goyal O, Mehta V, Narang V, Kaur K, et al. Clinical profile of hepatitis C virus infection in a developing country: India. J Gastroenterol Hepatol 2018;33:926-33.