

# The Epidemiology and Trend of incidence of Hepatitis B and C Infections in Southern Iran (2014-2020)

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## Abstract

**Background:** Viral hepatitis is one of the world's top five infectious diseases that cause premature death. Each year, at least one million people die from these infections worldwide. This study investigated the epidemiological features and trend of hepatitis B virus (HBV) and hepatitis C virus (HCV) infections in Abadan City, southern Iran.

**Methods:** This cross-sectional study was performed on recorded data of HBV and HCV infections from the notifiable disease surveillance system of Abadan University of Medical Sciences from 2014 to 2020. The incidence per 100,000 population for HBV and HCV infections has been calculated by study years and age groups. The chi-square test was applied to compare various types of infections.

**Results:** The average age of the participants was 40.47±13.20, ranging from 1-88 years. This study estimated the prevalence of HBsAg-positive cases from 2014 to 2020 as 1.53, 6.92, 7.07, 7.07, 8.15, 3.23, and 3.38 per 100,000, respectively. Also, the incidence of HCV-infected cases during these years were 3.23, 6.46, 11.84, 6.46, 8.92, and 2.15 per 100,000 populations, respectively. The average age of patients varied widely based on the type of hepatitis (P=0.001) so that the mean age in HBV-infected patients was 41.06±12.41 years, 41.76±12.99 years in HCV-infected and 22.93±18.02 years in HBV/HCV-infected patients.

**Conclusion:** The findings of this study suggest a lower prevalence of hepatitis B and C compared to other regional studies conducted in Iran. In recent years, the incidence of HBV and HCV has declined, indicating the successful implementation of the vaccination plan and observance of health tips in Abadan.

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**Keywords:** Epidemiology, Hepatitis B virus, Hepatitis C virus, Incidence, Iran

## Introduction

Viral hepatitis is a significant health problem and the most common cause of liver disease worldwide.<sup>1</sup> Viral hepatitis is among the five most common causes of premature death, with at least one million yearly mortality.<sup>2</sup> Hepatitis B virus (HBV) causes hepatitis B. HBV is a coated double-stranded DNA virus that

causes serum hepatitis.<sup>3</sup> HBV infection ranks as the tenth leading cause of death worldwide, resulting in 500,000 to 1.2 million annual deaths due to various conditions, including chronic hepatitis, cirrhosis, and hepatocellular carcinoma.<sup>4,5</sup> The disease is endemic in certain parts of Africa and Asia and is highly prevalent worldwide. The prevalence of HBV infection varies between 1% and 20% worldwide.<sup>6</sup> The prevalence of this

disease has been reported to be 2-7% in Iran.<sup>2</sup> Hepatitis C virus (HCV) is a well-known chronic liver disease responsible for more than half of liver transplantations in Western countries. HCV is one of the known causes of chronic liver disease, resulting in more than 50% of liver transplants in Western.<sup>7</sup>

Outbreaks of HCV are a public health concern affecting both developed and developing countries. In 2005, it was estimated that more than 185 million people worldwide were infected with HCV.<sup>8</sup> It is estimated that about three to four million people will be infected with chronic HCV infection each year; 170 million people will get chronic HCV infection, while more than 350,000 die each year from the disease, and 3 to 4 million people develop new HCV infections.<sup>8</sup> <sup>9</sup> The global prevalence of HCV is 1-2%, and more than 170 million people worldwide are infected with this virus, while more than 350 thousand people die annually due to this disease. On the other hand, 3-4 million people contract HCV infection annually.<sup>8</sup>

Hepatitis C becomes chronic in 70-80% of cases.<sup>8</sup> <sup>9</sup> In some patients, the disease's progression causes liver cirrhosis.<sup>8,10</sup> About 70-80% of cases present with chronic HCV infection, and numerous cases present as active chronic for 2-3 years.<sup>8,9</sup> In some patients, the disease progression may cause cirrhosis of the liver. The HCV infection can be sporadic or epidemic.<sup>8,9</sup> Since there is no effective vaccination against this virus, the incidence of the disease is expected to increase worldwide.<sup>8</sup> In Iran, HCV infection is low in the general population (less than 1%).<sup>11</sup> In comparison, it has been reported in more than 70% of injection drug users, patients who undergo transfusion of blood products (e.g., in hemophilia and thalassemia patients), and hemodialysis.<sup>8</sup> Chronic HBV infection is considered the most important cause of cirrhosis. One of the most important causes of cancer, chronic HCV infection, is considered a significant risk factor for hepatocellular carcinoma.<sup>12</sup> This study examined the epidemiological features and trends of hepatitis B and hepatitis C in Abadan between 2014 and 2020.

## Methods

### Study Setting

This cross-sectional study extracted the recorded data of HBV and HCV from the notifiable disease surveillance system of Abadan University of Medical Sciences during 2014-2020 in Abadan city. Abadan is located in the southwest of Iran, and the population under the auspices of Abadan University of Medical Sciences is 650,000 (according to the 2016 census). The data were utilized by census method on the recorded data of hepatitis B and C from the Abadan University of Medical Sciences reportable disease care system during the years 2014-2020. According to the National Guidelines for Hepatitis Management, reporting HBV

and HCV infections is mandatory in Iran. Therefore, all public and private laboratories, blood transfusion centers, hospitals, and health care centers must report all HBV and HCV-positive serology results to health centers every month. All available cases were used in this study, and sampling was not performed. This study was approved by the research ethics committee of Abadan University of Medical Sciences (IR.ABADANUMS.REC.1401.093).

1. The inclusion criteria for study participation were residency in Abadan city for a minimum of five years and having a newly confirmed case of HBV/HCV infection (individuals who had not been patients before or had not previously undergone diagnostic testing and had recently become patients or were newly diagnosed with the disease).

2. Variables extracted from the patients included age, gender, occupation, area of living (Abadan, Khorramshahr, and Shadegan), reason for testing, source of disease report, and marital status.

### Statistical Analysis

The incidence per 100,000 population for HBV and HCV infections has been calculated by study years and age groups. The chi-square test was applied to compare various types of infections, including HBV, HCV, HBV & HCV, according to the mentioned variables. The HBV and HCV incidence trend during these years was analyzed using the Cochran-Armitage trend test.

Chi-square and Fisher's exact test were also used to investigate the factors affecting hepatitis B, C, HBV, and HCV co-infected patients. To compare the mean age in the two groups of patients, due to the normal age distribution, a t-test was utilized. A P-value less than 0.05 was considered statistically significant. The data analysis was conducted using SPSS, version 25.0, and Excel (2010).

## Results

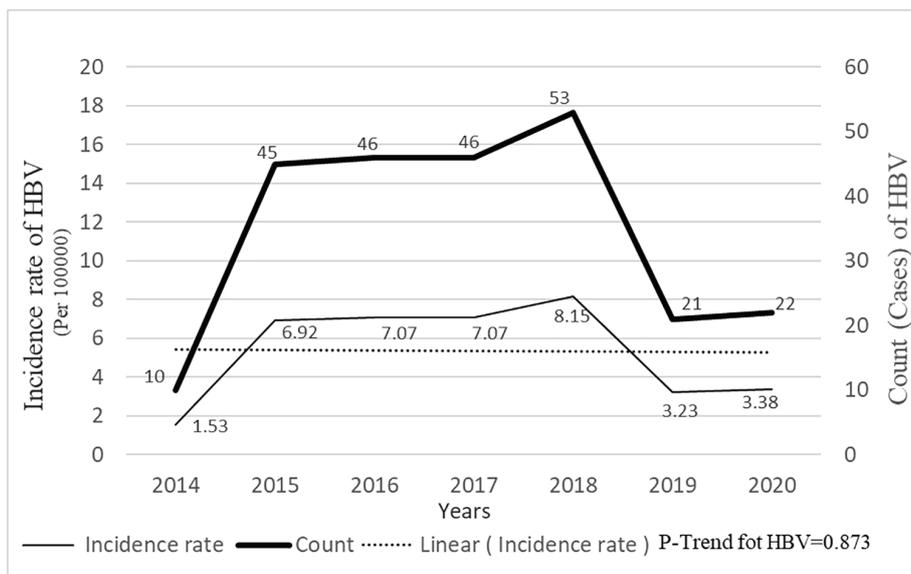
In this cross-sectional study, 524 patients were reported (243 HBV-infected, 267 HCV-infected, and 14 cases of HBV/HCV infections). The mean age of patients was 40.47±13.20 years. The mean age of male and female patients was 41.33±13.18 and 37.89±12.98, respectively. The mean age of patients was significantly different by type of hepatitis (P=0.001), i.e., the mean age in HBV-infected patients was 41.06±12.41 years, 41.76±12.99 years in HCV-infected and 22.93±18.02 years in HBV/HCV-infected patients. Table 1 shows demographic characteristics of hepatitis B, C, and HBV and HCV co-infected patients.

As presented in Table 1, 75% and 25% of patients were males and females, respectively, with HCV infection most prevalent in men and HBV infection in women. In 23% of cases, the main reason for

**Table 1:** Baseline characteristics of hepatitis B, C and HBV and HCV co-infected patients

Variable		Total (N=516)	HBV* (N=243)	HCV** (N=267)	P value	HBV & HCV (N=6)
Gender	Female	129 (25)	94 (38.7)	35 (13.10)	0.001	0
	Male	387 (75.00)	149 (61.3)	232 (86.9)		6 (100)
Marital status	Married	380 (73.6)	194 (79.8)	182 (68.2)	0.035	4 (66.7)
	Single	91 (17.6)	37 (15.2)	53 (19.8)		1 (16.7)
	Divorce & widow	29 (5.6)	9 (3.7)	20 (7.5)		0
	Unknown	16 (3.2)	3 (1.2)	12 (4.5)		1 (16.7)
	Job	Employed	186 (35.50)	72 (29.62)		107 (40.07)
Household	93 (17.70)	71 (29.24)	22 (8.25)	0 (0.00)		
Others	245 (46.80)	100 (41.15)	138 (51.68)	7 (50.00)		
Region	Urban	486 (92.70)	219 (90.12)	254 (95.13)	0.038	13 (92.85)
	Rural	38 (7.30)	24 (9.88)	13 (4.87)		1 (7.15)
Examination cause	High risk behavior	121 (23.10)	50 (20.57)	66 (24.74)	0.001	5 (35.71)
	Pregnancy	14 (2.70)	12 (4.96)	2 (0.75)		0 (0.00)
	Clinical symptoms	123 (23.50)	57 (23.45)	57 (21.34)		9 (64.29)
	Voluntarily	56 (10.70)	28 (11.52)	28 (10.48)		0 (0.000)
	Other	210 (40.00)	96 (39.50)	114 (42.69)		0 (0.00)
Source of reporting	Clinic	17 (3.24)	7 (2.88)	10 (3.74)	0.001	0 (0.00)
	Laboratory	274 (52.29)	146 (60.08)	121 (45.31)		7 (50.00)
	Hospital	39 (7.40)	13 (5.37)	20 (7.49)		6 (42.85)
	Public Health Center	110 (24.00)	52 (21.39)	57 (21.37)		1 (7.15)
	Blood transfusion center	81 (15.5)	25 (10.28)	56 (20.97)		0 (0.00)
	Prisons	3 (0.60)	0 (0.00)	3 (1.12)		0 (0.00)
	Age Group	0-14	6 (1.2)	0 (0)		6 (2.2)
15-24	22 (4.3)	12 (4.9)	10 (3.7)	0		
25-34	162 (31.4)	87 (35.8)	75 (28.1)	0		
35-44	155 (30)	68 (28)	83 (31.1)	4 (66.7)		
45-54	89 (17.2)	42 (17.3)	46 (17.2)	1 (16.7)		
55-64	54 (10.5)	22 (9.1)	31 (11.6)	1 (16.7)		
>65	28 (5.4)	12 (4.9)	16 (6)	0		
Reason for review	Risk factor	111 (21.5)	47 (19.3)	62 (23.2)	0.006	2 (33.3)
	Pregnancy	14 (2.7)	12 (4.9)	2 (0.7)		0
	Other	210 (40.7)	96 (39.5)	114 (42.7)		0
	Voluntarily	56 (10.9)	28 (11.5)	28 (10.5)		0
	Symptom	117 (22.7)	57 (23.5)	57 (21.3)		3 (50)
	Special patients	8 (1.6)	3 (1.2)	4 (1.5)		1 (16.7)

\*HBV: Hepatitis B virus; \*\*HCV: Hepatitis C virus



**Figure 1:** Incidence of HBV infection in Abadan during 2014-2020

testing was high-risk behaviors, and 23.50% of cases underwent detection tests due to the manifestation of clinical symptoms. 52.3% of cases were reported from laboratories.

The overall incidence rate per 100,000 population from 2014 to 2020 for HBV infection was 1.53, 6.92, 7.07, 7.07, 8.15, 3.23, and 3.38, respectively. The corresponding values for HCV infection were 3.23, 6.46, 11.84, 6.46, 8.92, 2.00, and 2.15, respectively, and crude incidence rate per 100,000 population from 2014 to 2020 for HBV infection was 0.8 (0.3-1.3), 4.2 (1.9-6.4), 9.2 (4.2-14.2), 6.4 (2.8-10.0), 10.8 (5.4-16.2), 3.3 (0.6-6.5), and 4.6 (1.1-8.1), respectively. The

corresponding values for HCV infection were 2.5 (0.4-4.6), 5.1 (2.1-8.1), 11.6 (6.5-16.6), 9.8 (4.4-15.1), 11.0 (5.6-16.4), 4.8 (0.8-8.8), and 4.9 (0.8-8.9), respectively (Figure 1 and 2 and Table 2).

The relative frequency distribution of HBV and HCV infections by age and their relevant incidence rates are shown in Figures 3 and 4, respectively. Most HBV and HCV infections were observed among individuals 25-34 and 35-44 years old, respectively. The line curves indicate that the incidence rates of both hepatitis B and hepatitis C are the highest in this age group as well.

There was a significant association between

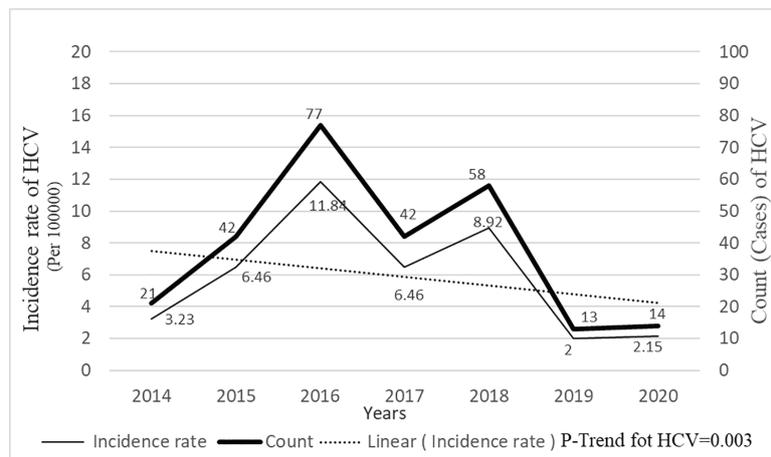


Figure 2: Incidence of HCV-infected patients in Abadan city during the years 2014-2020

Table 2: Crude and Age-standardized rate (per 100,000 population) for HBV and HCV

Years	HBV*		HCV**	
	Crude rate	Age-standardized rate 95% Confidence interval	Crude rate	Age-standardized rate 95% Confidence interval
2014	1.53	0.8 (0.3-1.3)	3.23	2.5 (0.4-4.6)
2015	6.92	4.2 (1.9-6.4)	6.46	5.1 (2.1-8.1)
2016	7.07	9.2 (4.2-14.2)	11.84	11.6 (6.5-16.6)
2017	7.07	6.4 (2.8-10.0)	6.46	9.8 (4.4-15.1)
2018	8.15	10.8 (5.4-16.2)	8.92	11.0 (5.6-16.4)
2019	3.23	3.3 (0.6-6.5)	2.00	4.8 (0.8-8.8)
2020	3.38	4.6 (1.1-8.1)	2.15	4.9 (0.8-8.9)
Total	37.2	40.0 (30.5-49.5)	40.9	49.6 (38.3-61.0)

\*HBV: Hepatitis B virus; \*\*HCV: Hepatitis C virus

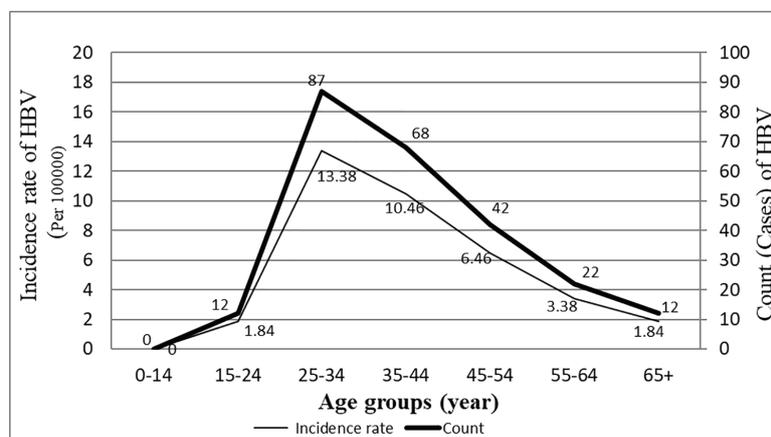
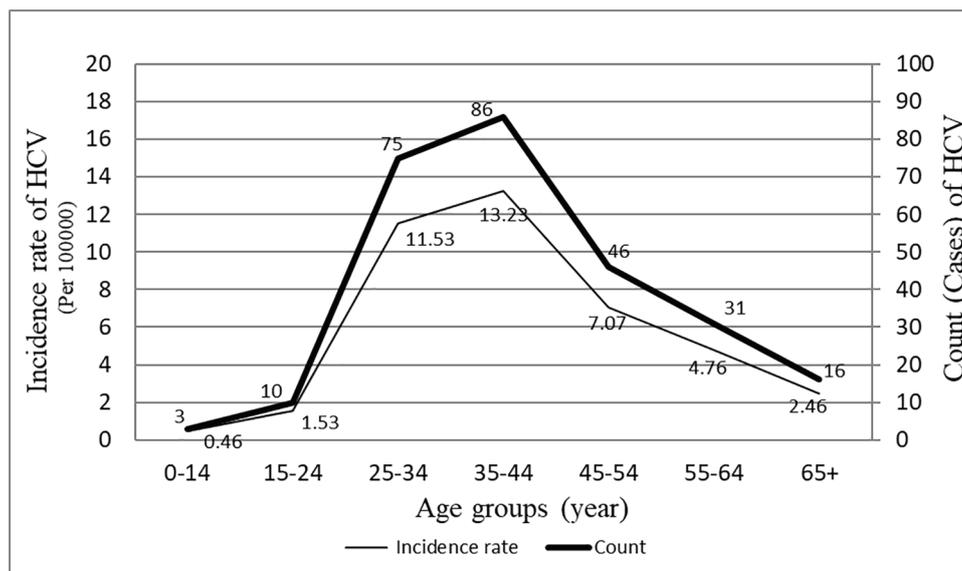


Figure 3: Incidence of HBV-infected patients in Abadan city during the years 2014-2020 by age groups



**Figure 4:** Incidence of HCV-infected patients in Abadan city during the years 2014-2020 by age groups

infection type and gender, marital status, job, region, source of (results) reporting, and cause of examination ( $P < 0.05$ ). Examining the disease trend over different years, the test results indicated that while the number of hepatitis B patients fluctuated, the overall trend was insignificant ( $P\text{-Trend} = 0.873$ ). In contrast, a statistically significant decreasing trend was observed for hepatitis C ( $P\text{-Trend} = 0.003$ ).

## Discussion

This cross-sectional study was conducted on records of patients registered in the notifiable disease surveillance system of Abadan City between 2014 and 2020. The mean age of patients was  $40.47 \pm 13.13$  years. The mean age of patients varies significantly according to the type of hepatitis. Hepatitis B was more prevalent in the age group of 25-34 years, and hepatitis C was more prevalent in 35-44 years. 75% and 25% of patients were male and female, respectively, with hepatitis C being the most common type of infection in men and hepatitis B in women. Hepatitis B and C were both more prevalent in urban areas.

In this study, the incidence of positive HBsAg among the study population was estimated as 1.53, 6.92, 7.07, 7.07, 8.15, 3.23, and 3.38 per 100,000 population from 2014 to 2020, indicating that the incidence of HBV was lower than the current actual prevalence in the society (less than two percent). Similar studies conducted in Iran and other countries have revealed contradictory results.<sup>13-15</sup> As such, according to the results of studies in different countries, such as China, Congo, Cameroon, Senegal, and Indonesia (endemic countries), the disease incidence was reported as 4-13.8%, whereas in countries, such as Canada, Switzerland, France, Germany (low incidence countries) it was reported to be between

0.12 and 1.1%. In Iran, on average, 3% of people are infected with the virus.<sup>16-18</sup> The highest incidence was 8.83% in African countries and 5.26% in the western Pacific region. The vast difference between countries may be due to different risk factors or transmission routes.<sup>18</sup> The lower rate of HBsAg positive cases in our study compared to the reported percentage of positive cases in Iran can be attributed to the successful implementation of the national vaccination plan in the province since 1994, improved public awareness, vaccination, and treatment of high-risk individuals, screening of transfusion blood products and complete coverage of appropriate medications and treatments.<sup>10</sup>

In the present study, the incidence of HCV during 2014-2020 was estimated at 3.23, 6.46, 11.84, 6.46, 8.92, and 2.15 per 100,000 population, respectively. In the last decade, the incidence of hepatitis B in Iran has decreased significantly. It has changed from a region with a moderate incidence to a low incidence.<sup>19</sup>

- One of the reasons for the declining trend of HBsAg positive cases reported in our study compared to the reported percentage of positive cases in our country is the successful implementation of the national vaccination plan in the province since 1994. Public awareness, treatment, and vaccination of high-risk individuals, screening Injected blood, and complete coverage of appropriate and timely medications and treatments.<sup>19</sup> The downtrend of HBV (Hepatitis B virus) is obvious in many countries.<sup>18</sup> According to the World Health Organization, approximately 180 million people, or roughly 3% of the world's population, are infected with HCV. Iran is among the countries with a disease incidence of 1-2.5%.<sup>20</sup> However, according to the literature, the incidence of HCV Ab is increasing.<sup>21</sup> In our study, the gender distribution of patients was 75% and 25%, which was supported by the national results (65% in

men vs. 35% in women),<sup>22</sup> most international studies,<sup>23, 24</sup> and studies in other parts of the world.<sup>25</sup> In the present study, the incidence of HCV during the years 1399-1393 was estimated to be 3.23, 6.46, 11.84, 6.46, 8.92, and 2.15 per 100,000 population, respectively. In a study conducted in rural areas of Fars province, the incidence of hepatitis C was reported to be 0.24%.<sup>26</sup> In the Jamali study (1%),<sup>27</sup> Marat (1.6%),<sup>28</sup> Postchi (0.5%),<sup>29</sup> and Zamani (0.08%) have been reported and have been the lowest since 2015.<sup>30</sup> A US study showed that the incidence of hepatitis decreased from 1.9% in 2001 to 1.3% in 2005 and remained stable until 2010.<sup>31</sup> The WHO estimates that about 180 million people, equivalent to 3% of the world's population, are infected with HCV, and Iran is among the countries with an incidence of 1 to 2.5%.<sup>32</sup> However, with the review of various studies, the incidence of HCV Ab is increasing, and the age of its incidence is decreasing.<sup>33</sup>

In the present study, the incidence of HBV was 61.3% in men and 38.7% in women. This is similar to the national results, 35% in women compared to 65% in men.<sup>22</sup> In one study, the incidence of HBV in women is higher than in men (3.9 compared to 2.91).<sup>34</sup> In another study, the incidence of HBV was 60.3% in men and 39.7% in women.<sup>33</sup> A study conducted in Qom showed that the incidence of hepatitis B infection was 56% in men and 44% in women.<sup>23</sup> In a study conducted in Ahvaz, 72% of patients were male, and 28% were female.<sup>35</sup> The results of a study conducted in Gurgaon showed that the incidence of HCV was 6.2% in men and 38.8% in women.<sup>33</sup> In the present study, the incidence of HCV was 86.9% in men and 13.10% in women. A study showed that the incidence of hepatitis C was 63% in men and 37% in women.<sup>36</sup> The results of a study showed that the incidence of HCV was equal in men and women (0.2).<sup>34</sup> However, several studies showed no significant difference between gender and hepatitis C infection.<sup>34, 37</sup>

The results of several studies demonstrated no significant relationship between gender and HBV infection.<sup>34, 37</sup> The results of another study showed that the frequency of HBV infection was higher among men, which can be due to several factors, including a higher number of drug-addicted men, especially injection drug users, and use of shared syringes, the higher number of male prisoners than female, and the incidence of high-risk sexual behaviors.<sup>38</sup> In the present study, the incidence of HCV infection was higher among men than women, consistent with previous studies results.<sup>28, 38, 39</sup> However, the fact remains that the results of several studies showed that there was no significant difference between gender and HCV infection.<sup>40, 41</sup>

Most people with HBV infection are in the age group of 25-34 years (13.38 per 100,000 population), followed by the age group of 35-44 years (10.46 per 100,000 population). In addition, in the distribution

of HCV-infected patients by age, most patients were 35-44 years (13.23 per 100,000 population), which complied with the results of other studies.<sup>42, 43</sup> The higher incidence of HCV infection in this age group can be explained by the fact that this age group is considerably more active and is more frequently exposed to risk factors for HBV infection than other age groups.<sup>34</sup> The mean age of the patients was 13.20±40.47 years. The course of HBV infection is directly associated with the age at infection onset as it is about 90% acute (with or without symptoms) in adults and more than 90% chronic in infants.<sup>2</sup>

In the present study, the majority of HCV-positive cases were single, which was in accordance with the results of several studies<sup>44, 45</sup> and can be explained by the fact that singles are less dependent and less monitored and have more free time, which can lead to high-risk behaviors among these individuals.<sup>46</sup> In this study, the frequency of HBV infection was higher in married people than singles, which was consistent with the results of several similar studies.<sup>47, 48</sup> The higher rate of HBV infection among married people can be due to a lack of serious sex counseling and necessary premarital tests.<sup>49</sup>

Those with no administrative job positions displayed the highest frequency of HBV and HCV infections, consistent with similar previous studies.<sup>47, 48</sup> The possible reason for this could be the higher probability of risky behaviors in positions with less supervision.<sup>49</sup>

## Limitation

In reviewing the information of the patients of health care centers, it was found that some of the necessary information was not fully recorded in the existing forms, resulting in a lack of full interpretation and conclusion of the available data in numerous cases. Another limitation of our study was the calculated amounts and percentages from the data of the national report of hepatitis cases, which are less likely to be reported. Therefore, the obtained rates may be lower than the actual disease rates within the community. The low number of cases in some years of study may be due to the small number and lack of registration of cases.

## Conclusion

According to the results obtained from our study, the incidence of hepatitis B and C was lower in Abadan province compared to other studies conducted in Iran. In recent years, the incidence of HBV and HCV has declined, indicating the successful implementation of the vaccination plan and observance of health tips in Abadan. Preventive interventions, including training programs and safe blood transfusions, are critical to reducing disease burden. Several factors may have contributed to

the decline in incidence. These include: Immunization against HBV, improved recruitment of low-risk donors, establishment of CFU removal setup, implementation of computerized data registration for blood donors in blood transfusion services, increased public knowledge about transfusion-transmitted infections, risk factors, and transmission routes, enhancement of public health programs, achieving 100% voluntary blood donation, an increase in regular/recurring donations, improvements in automation and the use of highly sensitive screening test kits. It is suggested that more studies be done in this field.

### Ethical Approval

Informed consent was obtained from all participants. The analysis data file did not contain the participants' names. This study was approved by the research ethics committee of Abadan University of Medical Sciences (No. 1214).

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No financial support was received for this study.

### Authors' Contribution

All authors contributed to the study's conception and design. HA participated in the design of the study. MG and RK performed data collection and wrote the manuscript. EP and HA participated in the design of the study. AH and MH revised the manuscript. MG, AJ, and RK helped with statistical analysis and prepared the illustrations. AV and HA edited the manuscript. All authors read and approved the final manuscript.

**Conflict of Interest:** None declared.

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