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## Original Article

# Hepatitis B and C Infections in Hamadan Province during 2004-2009

Jalal Poorolajal (MD, PhD)<sup>a\*</sup>, Mohammad Mirzaei (BSc)<sup>b</sup>, Seyyed Jalal Bathaei (BSc)<sup>b</sup>, Mohammad Mahdi Majzoobi (MD)<sup>c</sup>

<sup>a</sup> Department of Epidemiology & Biostatistics and Research Center for Health Sciences, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran

<sup>b</sup> Center for Disease Control & Prevention, Deputy of Health Services, Hamadan University of Medical Sciences, Hamadan, Iran

<sup>c</sup> Deputy of Health Services, Hamadan University of Medical Sciences, Hamadan, Iran

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### \* Correspondence

Jalal Poorolajal (MD, PhD)

**Tel:** +98 811 8260661

**Fax:** +98 811 8255301

**E-mail 1:** [poorolajal@umsha.ac.ir](mailto:poorolajal@umsha.ac.ir)

**E-mail 2:** [poorolajal@yahoo.com](mailto:poorolajal@yahoo.com)

## ABSTRACT

**Background:** Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are major global public health problems. This study was conducted to investigate the incidence rate of these infections over six successive years in Hamadan Province, the west of Iran.

**Methods:** This retrospective cohort study was conducted on the database of hepatitis registry. In this study, 1257 subjects infected by HBV and 705 subjects infected by HCV were detected and enrolled. HBV infection was detected by presence of HBsAg and HCV infection by presence of Anti-HCV. In order to estimate province-based age-specific incidence rates of HBV and HCV infections, we used the same age-specific population as the denominator.

**Results:** The incidence rate per 100,000 population from 2004 to 2009 for HBV infection was 19.60, 12.29, 12.31, 11.13, 9.46, 7.70 ( $P < 0.001$ ) and for HCV infection was 6.73, 7.42, 7.57, 8.45, 5.30, 5.17 respectively ( $P < 0.001$ ). The incidence rate of HBV infection decreased continuously over time, while the incidence rate of HCV infection fluctuated and even increased from 2004 to 2007 then decreased. The rate ratio of trend for HBV infection across successive years was 0.85 [95% CI: 0.82, 0.88] and that of HCV infection was 0.94 [95% CI: 0.90, 0.99].

**Conclusions:** The decreasing trend in the incidence rate of HBV infection in current years may be the result of vast national immunization of newborn and adolescents against hepatitis B infection. On the other hand, fluctuating incidence rate of HCV infection with a temporarily increasing growth is critical and should be the focus of the health policymakers' special attention.

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## Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are major global public health problems <sup>1-2</sup>. These blood-born pathogens are usually spread by sharing infected needles, through infected transfusion, sexual transmission, or vertical transmission. However, transmission of HCV infection is less common than that of HBV infection <sup>2</sup>. HCV

infection, which was formerly known as non-A non-B post transfusion hepatitis infection, is one of the main causes of cirrhosis and hepatocellular carcinoma (HCC) <sup>2</sup>. HBV infection, which is one of the most common and serious infectious diseases worldwide, has a strong correlation with primary liver cancer. Almost 5% of the world population (350 million people)

are chronic carriers of HBV<sup>1</sup> and about 3% (180 million people) are infected by HCV<sup>2</sup>.

The prevalence of chronic HBV infection is detected by hepatitis B surface antigen (HBsAg). Almost 45% of the world population live in regions in which HBV infection is high (HBsAg prevalence of more than or equal to 8%), 43% of the population live in regions in which HBV infection is intermediate (HBsAg prevalence of 2% to 7%), and 12% of the population live in regions in which HBV infection is low (HBsAg prevalence of less than 2%)<sup>3</sup>. Islamic Republic of Iran was considered as a country with an intermediate endemicity<sup>3-4</sup>. However, recent studies estimated the prevalence of chronic HBV and HCV infections in general population about 1.7% and 0.16% respectively<sup>5-6</sup>.

HB vaccine is the most effective and cost-saving means to prevent HBV infection<sup>1,3</sup>. The protection provided by HB vaccine is now well documented and is estimated to persist for at least two decades<sup>7-8</sup>. HB vaccine was introduced into Expanded Program on Immunization (EPI) in Iran in 1993<sup>9</sup>. Immunization of adolescents aged less than or equal to 18 years also integrated into EPI in 2006. Therefore, the prevalence of HBV infection is expected to reduce in recent years because of implementation of the vast immunization program in Iran. In addition, the prevalence of HCV infection is expected to reduce because of optimized blood donor screening and better sterilization procedures for blood products. Accordingly, it is necessary to assess the incidence rate of HBV and HCV infections across successive years to evaluate the trend of these infections over time in recent years. The purpose of the present study was to determine the incidence rate of HBV and HCV infections over six successive years in Hamadan Province, the west of Iran, which may represent the profile of the incidence rate of these infections among Iranian general population in recent years.

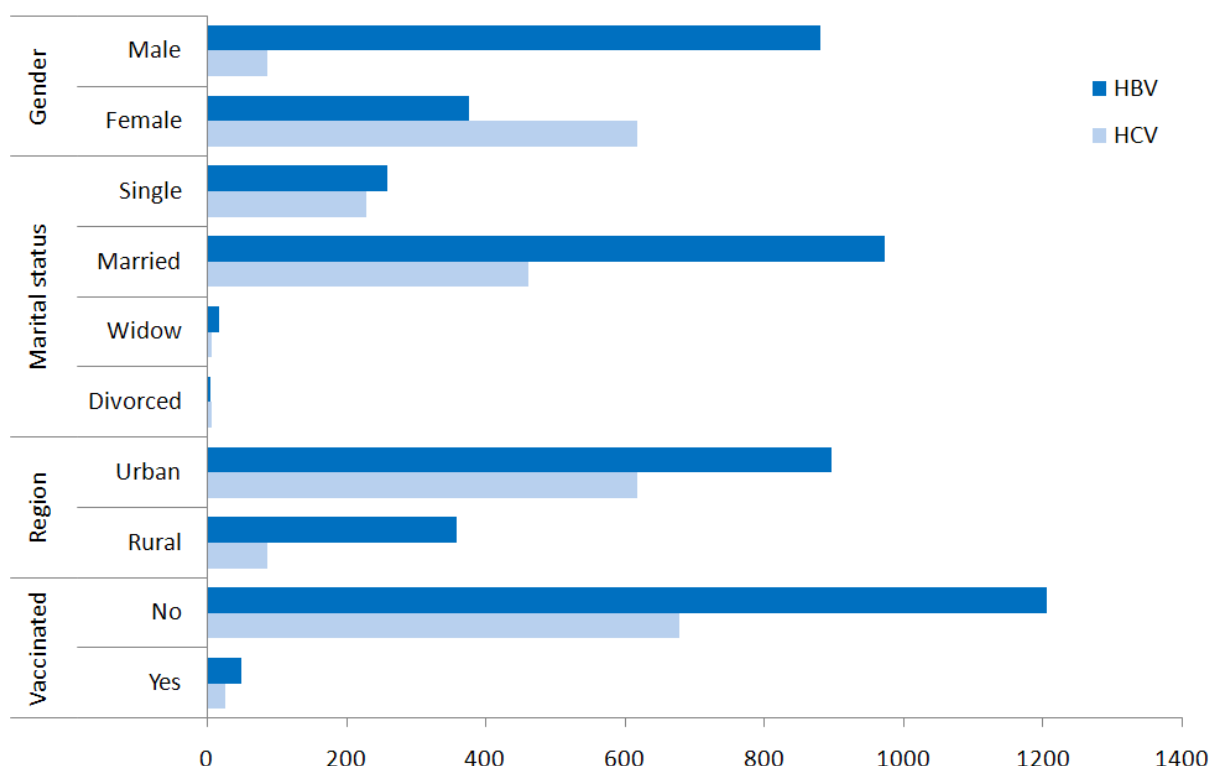
## Methods

This retrospective cohort study was conducted according to the national guideline for the surveillance of hepatitis<sup>10</sup> which is a modified version of World Health Organization

(WHO) guideline for hepatitis B<sup>1</sup>. A surveillance of HBV and HCV infections was set up by Iranian Ministry of Health and Medical Education (MOHME) in 2004. All medical universities affiliated the MOHME including Hamadan University of Medical Sciences participated in this national survey<sup>10</sup>.

According to this guideline, notification of HBV and HCV infections was mandatory. All data on hepatitis B and C infections had to be collected systematically throughout the country. Accordingly, all public and private laboratories, blood transfusion organization, hospitals and medical centers must report all positive test results of serologic markers of HBV and HCV infections to the relevant City Health Center. These markers included HBsAg, HBeAg, Anti-HBc, and Anti-HCV. In addition to the laboratory findings, the demographic characteristics of the patients were also reported which included age, gender, marital status, and residence. The data on HBV and HCV infections and the demographic characteristics of the patients reported from all City Health Centers throughout the province were registered in the database of Province Health Center. The identification of the cases with similar name was clarified and the repeated cases were excluded from the database. We also excluded those cases whose infection was already diagnosed in previous years and those who lived in other provinces.

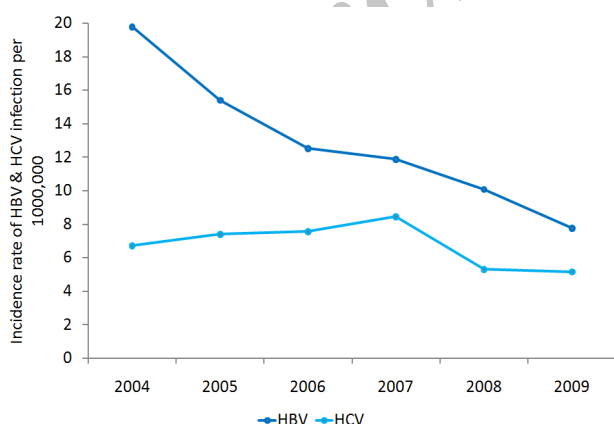
The present study was conducted based on the data registered in Hamadan Province Health Center database. From all serologic markers, which were reported and registered in the database from 2004 to 2009, all subjects whose serologic markers were positive for HBsAg or Anti-HCV were considered as suspected positive cases of HBV or HCV infections respectively. In order to estimate province-based age-specific incidence rates of HBV and HCV infections, we considered the same age-specific population as the denominator. We used Poisson regression at 0.05 significant level in order to estimate rate ratio (RR) of HBV and HCV infections across different years using statistical program STATA version 11.1 (StataCorp, College Station, Texas) for data analysis.



**Figure 1:** The distribution of hepatitis B and hepatitis C virus infections by demographic characteristics

## Results

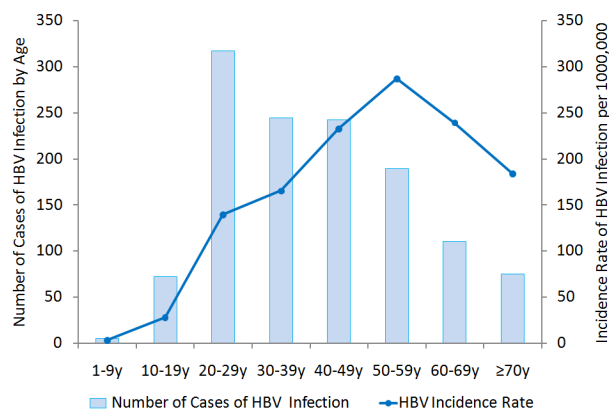
During six years surveillance from 2004 to 2009, 1257 subjects infected with HBV and 705 subjects infected with HCV were diagnosed. Forty subjects were infected with both HBV and HCV infections simultaneously. The demographic characteristics of the patients are shown and compared in Figure 1.



**Figure 2:** The incidence rate of hepatitis B and hepatitis C virus infections by year

The number of subjects with HBV infection was higher in men than in women while the number of subjects with HCV infection was much higher in women than in men. Further-

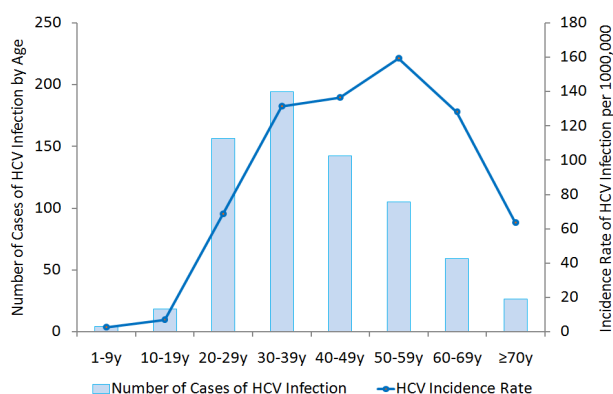
more, both types of infections were more common in the married people than those who were single, divorced or widow. The majority of the patients with HBV infection had not been immunized with HB vaccine.



**Figure 3:** The frequency distribution and the incidence rate of hepatitis B virus infection by age

The incidence rates of HBV and HCV are shown by year in Table 1 and compared in Figure 2. These findings indicate that the incidence rate of HBV infection decreased continuously over time during the last six years while the incidence rate of HCV infection had an increasing growth from 2004 to 2007 then decreased.

The RR estimate of trend for HBV infection across successive was 0.85 [95% CI: 0.82, 0.88] and that of HCV infection was 0.94 [95% CI: 0.90, 0.99].



**Figure 4:** The frequency distribution and the incidence rate of hepatitis C virus infection by age

The absolute frequency distribution of HBV and HCV infections by age and their relevant incidence rates are shown in Figure 3 and 4 respectively. The histograms show that the distri-

bution of hepatitis B and hepatitis C infections are highest in the third and fourth decades of life respectively. However, the line curves indicate that the incidence rates of both hepatitis B and hepatitis C are highest in the sixth decade of life.

## Discussion

The present study represents a provincial-based estimate of six-year surveillance for both HBV and HCV infections from 2004 to 2009. This study indicated that the incidence rate of HBV infection decreased continuously over time. As shown in Table 1, the RR estimates of successive years confirm this reality. On the other hand, the incidence rate of HCV infection increased from 2004 to 2007 then decreased. The RR estimates of successive years did not change significantly. This reveals this reality that incidence rate of HCV infection was steady during the recent years.

**Table 1:** The incidence rate of hepatitis B and hepatitis C virus infections by year

year	Population	Number	Incidence rate per 100,000	95% CI		Rate Ratio	95% CI		Z test
HBV infection									
2004	1724062	338	19.60	17.52	21.69	1.00	-	-	-
2005	1725651	212	12.29	10.63	13.94	0.63	0.53	0.74	<i>P</i> <0.001
2006	1730652	213	12.31	10.65	13.96	0.63	0.53	0.75	<i>P</i> <0.001
2007	1715933	191	11.13	9.55	12.71	0.57	0.48	0.68	<i>P</i> <0.001
2008	1755132	166	9.46	8.02	10.90	0.48	0.40	0.58	<i>P</i> <0.001
2009	1778295	137	7.70	6.41	8.99	0.39	0.32	0.48	<i>P</i> <0.001
Trend	-	-	-	-	-	0.85	0.82	0.88	<i>P</i> <0.001
HCV infection									
2004	1724062	116	6.73	5.50	7.95	1.00	-	-	-
2005	1725651	128	7.42	6.13	8.70	1.10	0.86	1.42	<i>P</i> =0.447
2006	1730652	131	7.57	6.27	8.87	1.13	0.88	1.44	<i>P</i> =0.356
2007	1715933	145	8.45	7.07	9.83	1.26	0.98	1.60	<i>P</i> =0.067
2008	1755132	93	5.30	4.22	6.38	0.79	0.60	1.03	<i>P</i> =0.086
2009	1778295	92	5.17	4.12	6.23	0.77	0.58	1.01	<i>P</i> =0.060
Trend	-	-	-	-	-	0.94	0.90	0.99	<i>P</i> =0.010

There were several cross sectional studies which investigated prevalence of HBV infection<sup>11-16</sup> and HCV<sup>17-23</sup> infection among Iranian general population but no one estimated the incidence rate of hepatitis B and C infections. Hence, the results of the present study are not comparable with the results of the previous studies.

HB vaccine was introduced into EPI in 1993 with 98% vaccination coverage<sup>24</sup>. Therefore, most of the children aged  $\leq 11$  years were immunized against HBV infection by 2004. Furthermore, most of people aged 14 to 18 years were also covered by the HB immunization program in 2006. Accordingly, most of the children less than 18 years were immunized against HB infection by 2009. This age group comprises about 39% of the total population. In such situation, it is expected that the incidence rate of HBV infection decreases as the proportion of immunized people increases among the general population as the result of vast vaccination coverage. The Figure 2 shows this reality and confirms the importance of the protection provided by HB vaccine against HB infection.

On the other hand, there is no effective vaccine to induce protection against HCV infection<sup>2</sup>. Therefore, despite optimized blood donor screening and better sterilization procedures for blood products, a significant decreasing trend in the incidence rate of HCV infection was not seen over time. Figure 2 indicates that the incidence rate of HCV infection increased from 2004 to 2007 then decreased a bit thereafter. This issue is very important from the public health point of view and should be the focus of the health policymakers' special attention.

Figure 3 and 4 show distributions of HBV and HCV infections by age and their relevant incidence rates respectively. Consider the histogram of HBV and HCV infection ignoring the line curve for the moment. There are a lot of people in age groups of 20-29 and 30-39 years comprising 22% and 14% of the total population respectively. Most of the people in these age groups are susceptible to hepatitis B and C infection and thus a large proportion of the total number of hepatitis B and C cases is seen in these age groups. Now let us look at the line curve. The pattern shows an increasing growth in incidence rates of hepatitis B and C

infections with age. The incidence rates reach the maximum level in the sixth decade of life (age group of 50-59 years) then decrease. This issue indicates the importance of recognizing the distinction between the distribution of disease and the incidence rate of the disease.

This study had several limitations. First, the incidence rates of HBV and HCV infections are estimated based on the data collected by a surveillance system, which is usually prone to under-reporting. Therefore, the results of present study may underestimate the true incidence rates of these infections. Second, we considered the newly detected HBV and HCV infections as new cases to estimate the incidence rates. However, we did not know exactly when the cases were really infected. Third, in order to diagnose chronic HBV infection we need to check the HBsAg at least twice. Furthermore, positive anti-HCV in a serum sample does not confirm HCV infection because of false positive results, hence all positive anti-HCV cases ought to be rechecked with more specific tests such as RIBA or PCR. Accordingly, some of the cases reported in this study as HBV or HCV infection might be false positive.

However, despite its limitation, the current study may have a number of implications for health care policy. First, the decreasing pattern of the incidence rate of HBV infection over time is parallel to increasing growth of the proportion of immunized people in the general population indicating the HB vaccine efficacy in control and prevention of HBV infection. Second, fluctuating incidence rate of HCV infection with an increasing growth from 2004 to 2007 is critical and should be the focus of the health policymakers' special attention. Furthermore, such surveillance system with the same method and target population is being conducted throughout the country. Hence, it is expected this survey may represent the dynamics of hepatitis B and C infections among Iranian general population in recent years.

## Conclusion

In conclusion, the incidence rate of HBV infection decreased continuously over time as the proportion of immunized people increased in the general population. This finding may be as the result of vast national immunization of in-



fants and adolescents against hepatitis B infection. On the other hand, fluctuating incidence rate of HCV infection with an increasing growth from 2004 to 2007 is critical and should be the focus of the health policymakers' special attention.

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## Conflict of interest statement

The authors declare that have no conflict of interest.

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