1. Introduction

More than two billion people have been infected with hepatitis B worldwide[1], and among these individuals, more than 350 million individuals are hepatitis B virus (HBV) carriers[1,2]. In all Eastern Mediterranean countries, hepatitis B infection is endemic[3].

By 2009, the World Health Organization Regional Office for the Eastern Mediterranean Region estimated that 170 million people had chronic HBV infection in the region; each year, around 4.3 million new HBV infections occur in the region[4,5].

The risk of infection with hepatitis B is high in five countries (Afghanistan, Pakistan, Yemen, Sudan and Somalia), accounting for more than 55% of the total population of the region, and moderate in the remaining 17 countries, including Iran[6].

Prevalence of hepatitis B surface antigen (HBsAg) in countries in the Mediterranean region ranges from 0.8% in Algeria[7] and 1.69% in Lebanon to 9.9% in Jordan[8]. The percentage of prevalence of HBsAg positive cases in Iran varies from 1.5% to 6.5%. Accordingly, Iran is in the intermediate group of the world in the prevalence of HBsAg positive[9,10]. It is estimated that over 35% of Iranians have been exposed to the HBV and 2%-3% are chronic carriers[10].

Based on the Iranian National Population and Housing Census conducted in 2011, Iran had 31 provinces and the population of the country was 75 149 669 with 21 446 783 people living in rural areas, 53 646 661 residing in urban areas and 22 356 661 non-resident[11]. Since 1993, the Ministry of Health and Medical Education of Iran established the HBV infection registry system and all medical universities participated in this national program[12,13]. The aim of this surveillance system is to eliminate hepatitis B. However, no
specific time has been set to achieve this goal[14]. Although many epidemiological studies of hepatitis B infection have been conducted in Iran, so far as we know, except for the study by Zali in 1996[15], the epidemiology of HBV infection in Iran has not been investigated thoroughly. Eighteen years after Zali et al. paper, it seems that a comprehensive look at the epidemiology of hepatitis B in Iran is necessary. The present study is the first in the country with these large set of data. The aim of this study was to investigate the epidemiological features and demographic characteristics of infected patients and the accurate incidence rates of HBV infection in Iran, according to the data provided by the Iranian National Hepatitis Registry during 2010-2012.

2. Materials and methods

This retrospective study was conducted based on the data provided by the National Hepatitis Registry Database (NHRD). According to this surveillance system recommendation, each case of confirmed HBV infection had to be reported and all of the demographic data on infected cases should be recorded systematically throughout the country[12]. Under these regulations, blood transfusion organization, all public and private laboratories, hospitals and medical centers should report the diagnosed cases to their City Health Department. To ensure the accuracy of the records, in the urban or rural health centers a registered physician justifies the collected data[13]. The information is recorded in a questionnaire provided by the Hepatitis Prevention and Control Office at the Communicable Diseases Management Center of the Ministry of Health and Medical Education.

Based on the data registered at the Iranian National Hepatitis Database (INHD) during 2010-2012, the sample size of this research was 28,227 with confirmed positive test results. All identified patients with HBV infection during the period whose recorded demographic characteristics were complete and accessible were included.

Given that it was to analyze the data provided by the national database, the approval from Ethics Committee was not necessary. Data were analyzed by SPSS 18 software using descriptive statistics to calculate the province-specific incidence of hepatitis B infection regarding the age, sex and region of residence of each infected case.

To estimate the “population at risk” for calculating the incidence rate, all vaccinated individuals under twenty years old were subtracted. The infected persons were ignored, because they comprised a relatively small percentage of the general population.

3. Results

In the present study, the data on all diagnosed HBV infected cases were analyzed provided by NHRD during 2010-2012, approximately 28,227 people.

The average age of infected people was (39.7 ± 16.0) years old and the mean annual incidence rate of the infection was 55.37 per 105 population.

The frequency and the annual incidence rate of HBV infection were slightly higher in men than those in women (Table 1). Nevertheless, the total incidence rate had a gradual decline within three years of the study.

| Parameters | Domain | % |
|------------|--------|---|
| Age groups | 1-9    | 0.7 |
|            | 10-19  | 3.8 |
|            | 20-29  | 28.7 |
|            | 30-39  | 23.8 |
|            | 40-49  | 15.9 |
|            | 50-59  | 13.0 |
|            | 60-69  | 8.0 |
|            | Over 70| 6.1 |
| Sex        | Male   | 51.6 |
|            | Female | 48.4 |
| Marital status | Dead spouse | 1.3 |
|              | Single | 10.5 |
|              | Divorced | 0.4 |
|              | Married | 87.8 |
| Residential status | Urban | 73.8 |
|                   | Rural | 25.6 |
|                   | Nomadic | 0.6 |
| Source of report | Laboratory | 24.5 |
|                 | Hospital | 24.2 |
|                 | Private office | 5.0 |
|                 | Blood transfusion organization | 7.8 |
|                 | Clinic | 1.4 |
|                 | Health center | 37.1 |

There was an apparent difference in the highest incidence and frequency rates according to sex, and between the age groups. The highest incidence and frequency rates were in the 60-69 and 20-29 age groups, respectively. These rates for men were in the 60-69 and 30-39 age groups, and for women in age groups 60-69 and 20-29, respectively (Table 1 and Figure 1). The lowest incidence and frequency rates, regardless of age and sex, were in the age group under 10 years old. The difference between the highest and the lowest incidence rates in various age groups were 40 folds, and more than 60 folds in men and more than 35 folds in women were observed.

The incidence rate of HBV infection in men increased with aging until the age of 70 and declined thereafter. However, in females, the incidence rate increased until the age of 40 and declined thereafter. There was a slight increase between the age of 60 to 70 in females (Figure 1).

The incidence rate in different age groups had a gradual decline within three years of the study.

The highest frequency rate of hepatitis B infection was among the married and the lowest rate was among the divorced cases (Table 1). In Table 2, incidence according to sex and area of residence was calculated and the average of three years was reported. Regarding the distribution of infected people by residential status, the incidence rate was nearly the same in urban and rural areas (Table 2). Health centers reported most cases of the infection (37.1%) while the lowest
number of reports came from the clinics (1.4%).

![Figure 1. Annual incidence rate of HBV infection according to age groups and sex in IR Iran during 2010-2012.](image)

Table 2
The mean annual incidence rate of hepatitis B infection in IR Iran during 2010-2012.

| Parameter | Incidence rate |
|-----------|----------------|
| Sex       |                |
| Male      | 19.16          |
| Female    | 17.77          |
| Region    |                |
| Urban     | 18.71          |
| Nomadic   | 0.27           |
| Rural     | 17.50          |
| Total incidence rate | 55.37 |

*: per 10^5 population.

4. Discussion

The results of the present study showed a slightly higher incidence of HBV infection in men than women, and this difference increased with aging. The highest incidence and frequency rates were noted in 20-29 age group, married cases and residents of urban areas. Health centers diagnosed and reported the majority of patients recorded in NHRD.

To our knowledge, the present study is the first big data analytics that calculated the incidence of hepatitis B infection using all documented cases in NHRD. So far, most published research papers that studied the epidemiology of HBV in Iran estimated the prevalence rate of infection using much smaller data set, and their results cannot be compared with the results of the present study. The mean age of hepatitis B infected cases in Iran was (39.7 ± 16.3) years old while in Iran, this rate was lower in Pakistan [(29.8 ± 12.5) years old] and higher in China [(41.7 ± 12.2) years old] and USA [(43.0 ± 1.0) years old][16-18]. These differences might be attributable to cultural and behavioral differences.

In the present study, the average annual incidence rate of the infection between 2010 and 2012 was 55.37 per 10^5 population. This rate is 24.5 in Singapore, 10.7 in China, 4.8 in Malaysia and 14.4 per 10^5 population in India[19]. The estimated annual incidence rate of hepatitis B infection was 7.4 per 10^5 population in England and Wales[20] and 2.1 per 10^5 in the United States[21]. The lower incidence rate reported in countries such as England and the United States is probably due to the vaccination programs, preventive measures and screening programs. However, considering that these studies did not report how the incidence rate was calculated, these differences might be due to different methods of determining the incidence rate of the infection.

In the present study, the number of patients in each age group was compared with the total population in all age group, and it was found that the highest number of infected people belonged to the 20-29 age group (28.7%). Given that 20-29 age group comprises 23% of Iran’s population, it is clear that this age group is more vulnerable to hepatitis B infection in the age pyramid of Iran. The lowest number of infected people was in the age group under 10 years old. Iranian population aged over 60 years old has the lowest number in age pyramid and less than 10 years old people comprise almost 25% of the general population. But hepatitis B frequency in older age groups is almost 20 times the age group under 10 years. This considerable difference is probably due to the lack of immunization and more exposure to the virus among the older. The hepatitis B infected cases were divided into eight groups, and the highest frequency and incidence rates were in age groups 20-29 and 60-69, respectively. The lowest rates were noted in the age group less than ten years old.

These results are consistent with the findings of studies in Bahrain[22], China[23], Libya[24], Pakistan[16] and USA[21] where the lowest rates were reported in age group less than 10 years and the highest frequency rates were noted in age group 20-30. In Spain[25] and Libya[26], the lowest frequency and incidence rates were in age group less than ten years while the highest incidence rate was noted in age group above 65 years old.

As noted in these studies, the high incidence and frequency rate in older age groups are possibly due to lack of immunization in older population, and their broader range of high risk activities and more situations of exposure to the virus than the youngsters. In this study, the highest frequency rate of HBV infection in men and women was in people aged 30-39 years and 20-29 years old, respectively, and the lowest frequency was noted in the age group under 10 years old. In a study from India, a similar result has been reported[27].

In the present study, the frequency and incidence rate of hepatitis B were higher in men than women. Consistent with these results, in the studies done in Iraq[28], Singapore[19], Turkey[29], China[30], Canada[31], and the National Health and Nutrition Study conducted in USA[32], the prevalence rate of hepatitis B is reported to be higher in men than in women[33]. This study found that the incidence rate increased with aging in men. Similar results have been reported from France[34] and Libya[35].

Overall, the incidence of infection is higher in men, possibly because men are more active in the community and more exposed to the virus. Estrogen may play an important role in the natural resistance of hepatocytes against virus and the consequence of chronic liver disease[36]. Married people comprised the highest
number of HBV infected cases (87.8%) while the divorced population showed the lowest number (0.4%). As almost 60.5% of Iranian population are married and only 10.5% are divorced, these results justify the high frequency of the infection in the married and the very low frequency in the divorced. These findings have also been reported in other Islamic countries[24,35].

In Bahrain, the majority of patients were married and the divorced and widows had much lower frequency of HBV[22]. However, results of the studies conducted in non-Muslim countries such as China[30] and USA[37] have shown a higher incidence of cases among widows.

Based on the results of this study, the highest percentage of hepatitis B infection was noted in the urban areas (73.8%) and the lowest in the nomadic regions (0.6%). The urban population of Iran comprises 71.4% of general population and the nomads comprises 0.1%, indicating a greater risk of infection in urban areas and lower risk, in relation to their population, among nomads.

In the present study, the incidence rate of hepatitis B infection was roughly the same in urban and rural areas, but Mehmet from Turkey reported a much higher incidence rate of the infection in rural regions[29]. This difference might be the results of differences in transmission routes of the infection in different areas. Most HBV cases were reported by health centers and clinics. While, in Norway, the least cases were reported by the laboratory units[38]. However, this could be due to the compliance of more co-operative laboratories in Norway, or due to the firm structure of health care networks in the remotest and the most deprived rural areas in Iran.

The major limitation of this study was the inadequacy of the data reported to the NHRD. Despite being mandatory[13], the report of identified HBV infected cases by the health organizations, especially in the private sector, is far from ideal. Therefore, the findings should be interpreted cautiously. Further, we included the recently diagnosed cases as the new cases to calculate the incidence rate. So, the results may be a little bit overestimated.

Due to the inclusion of hepatitis B vaccination in the national immunization program, the incidence of the infection in people under 20 years old became very low. Most infected individuals in this study had no history of vaccination which shows the effect of introducing HBV vaccination to the newborns since year 2000.

In conclusion, hepatitis B infection prevention programs might focus on people aged 20-40 years, with emphasis on health education and immunization program, the incidence of the infection in people under 20 years old became very low. Most infected individuals in this study had no history of vaccination which shows the effect of introducing HBV vaccination to the newborns since year 2000.

Conflict of interest statement

We declare that we have no conflict of interest.

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