

## Original Article

# Hepatitis B Infection: Prevalence and Response to Vaccination among Health Care Workers in Babol, Northern Iran

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### ABSTRACT

**Background & Objectives:** Hepatitis B is one of the major health problems in the world. Health care workers (HCWs) are at high risk of acquiring hepatitis B virus. The aim of this study was to evaluate the prevalence of HBV infection and the immune response to HBV vaccine among the HCWs in Babol, northern Iran.

**Methods:** This study was accomplished on 527 HCWs and administrative staff working at Rohani Hospital, Babol, northern Iran from 2011 to 2012. HBs- Ag, HBe- Ab and HBs- Ab were measured by ELISA method. All susceptible staff vaccinated with recombinant hepatitis B vaccine (Pasteur Institute of Iran) and HBs - Ab titer was evaluated 3 months after the last dose.

**Results:** Anti-HBe was positive in 32 (6.1%) and HBs-Ag in 4 (0.75%) of the participants. The HBV exposure in HCWs was four times greater than the administrative staff (6.65% vs. 1.63%). There was significant association between HBV exposure and occupation and also educational level ( $P < 0.001$ ), however, this association was not found with age and gender. Seroconversion was seen in 211 (91.7%) of 230 participants who received three-dose series of hepatitis B vaccine. The seroconversion is significantly decreasing by the increase of age ( $P < 0.001$ ), however, no significant association was seen with age and gender.

**Conclusion:** Considering high HBV infection exposure in HCWs, it is mandatory to ensure vaccination program and postvaccination evaluation along with education and safe work environment preparation.

**Keywords:** Hepatitis B, Health Personnel, Vaccination

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## Introduction

Hepatitis B virus (HBV) is a major health problem and one of the leading causes of chronic liver disease. Globally, there are approximately 1.8 billion people with HBV infection of whom 350 to 400 million people are chronic carriers and suffer from chronic HBV infection. Annually, one million people die from HBV induced hepatic failure, cirrhosis or hepatocellular carcinoma (1-5). Currently, vaccination is the only measure for prevention of the disease (3, 4).

Since 1993, neonatal HBV vaccination has been issued nationwide in Iran (1). Generally, Iranian people of 18 years of age or older; are at risk for HBV infection. Up to now, no standard recommendation for HBV vaccination in those people was issued, except some vaccination program for some high risk people (6).

Despite strong recommendation about universal precaution against blood-borne infections, World Health Organization (WHO) and the Center for Disease Control (CDC) reported that more than 85 million health care workers (HCWs) are exposed to sharp medical devices injuries, worldwide (7).

HBV infection is one of the recognized occupational hazard and non-immune HCWs are constantly at increased risk of getting HBV infection (8). According to WHO, 66000 new cases and 261 deaths have been estimated due to occupational HBV infection among HCWs (9).

The risk of HBV infection in HCWs is influenced by the prevalence of HBS Ag-positivity and prevalence of immunity to HBV among HCWs. HBV different endemicity has been recognized worldwide. The highest HBV infection was reported from Africa and Asia (10). However, in the Middle East, Iran has low HBV endemicity (9). Approximately 1.3% to 8.69% of the Iranian population is chronic HBV carriers and 70% to 80% of chronic hepatitis cases are due to HBV (1). In spite of several studies on HBV infection, there is still room for more investigations on

HBV infection among the HCWs in Iran.

This descriptive cross-sectional study was undertaken to evaluate the seroprevalence of hepatitis B infection and vaccination response among the HCWs in Babol, northern Iran.

## Materials and Methods

This study was conducted from 2011 to 2012 on 466 HCWs (except the physicians including nurses, aid-nurses, midwives, paramedical technician, and cleaning staff) and 61 administrative employees at Rohani Hospital in Babol, northern Iran. Written informed consent was obtained from all staff and approved by the Ethics Committee of Babol University of Medical Sciences, Iran. Information (occupation, gender, age, educational level, history of HBV infection and history of HBV vaccination) were obtained through a questionnaire. Blood samples were collected and HBV serological markers including HBsAg, anti-HBs and anti-HBc were evaluated using available ELISA kit (Delaware, Biothec Inc., USA). Specificity and sensitivity of the test was > 99%. According to the manufacturer's instruction antibody values less than 10 mIU/ml were considered as seronegative. With regard to serological markers, the participants were classified to four groups as follows: current infection [HBs -Ag (+), HBs- Ab (-), HBC- Ab(+)], immune after infection [HBs Ag (-), HBs Ab (+), HBc Ab (+)], immune after vaccination [(HBs Ag(-), HBs Ab (+), HBC Ab (-)] and susceptible [HBs-Ag (-), HBs- Ab (-), HBc- Ab(-)](5).

Susceptible persons received recombinant hepatitis B vaccine (Pasteur Institute of Iran). It is worth mentioning that this is the first time that the efficacy of this type of vaccine was evaluated in HCWs in Iran. Three months after the last dose of vaccine, HBs Ab titer was evaluated using ELISA (Delaware, Biothec Inc., USA). Antibody values less than 10 mIU/ml were considered as nonresponse, values more than 100 mIU/ml as good response and values between 10-99 mIU/ml as poor response. The analysis was carried out

by chi square test and descriptive statistics using SPSS 20.0 (SPSS Inc, Chicago, IL, USA) .

## Results

We screened a total of 527 hospital staff, out of these, 86 were male (16.3%) and 441 (83.7%) were female. The median age of males and females were 29±4 years and 31±5 years, respectively. Of these 527, 466 were HCWs and 61 were administrative employees. None of them was reported to have previous history of HBV infection.

The evaluation of serological markers reveal that 32 (6.8%) of all participants were HBV exposed. From these, 28 HCWs were immune after infection and 3 had current infection, meaning that totally 6.65% from 466 HCWs were HBV exposed. Moreover, one out of 61 administrative employees (1.63%) had current infection. There was statistical significant association between hepatitis B exposure and occupation and also educational level ( $P<0.001$ ), however no significant association was found with age and gender (Table 1).

**Table 1-** Distribution of baseline characteristics and hepatitis B status among the Rohani Hospital staff, Babol, northern Iran

	Current infection n (%)	Immune after infection n (%)	Immune after vaccination n (%)	None-immune n (%)	Total n (%)
<b>Gender</b>					
Male	1(1.2 )	6(7 )	16(18.6 )	63(73.3 )	86(100 )
Female	3(0.7 )	22(5 )	235(53.3 )	181(43 )	441(100 )
<b>Age groups(years)</b>					
20-29	3(1.4 )	14(6.6 )	84(39.4 )	112(52.6 )	213(100 )
30-39	1(.4 )	13(4.8 )	135(50.2 )	120(44.6 )	269(100 )
40-50	0(0 )	1(2.2 )	32(71.1 )	12(26.7 )	45(100 )
<b>Occupation</b>					
HCWs (nurse,aid-nurse, midwife, technician)	0(0 )	23(5.1 )	251(55.8 )	176(39.1 )	450(100 )
Cleaning staff	3(18.8 )	5(31.3 )	0(0 )	8(50 )	16(100 )
Administrative employee	1(1.6 )	0(0 )	0(0 )	60(98.4 )	61(100 )
<b>Educational level B.Sc.</b>	0(0 )	17(4.9 )	208(59.8 )	123(35.3 )	348(100 )
Associate degree	0(0 )	5(5.1 )	34(34.3 )	123(60.6 )	99(100 )
Diploma	4(5 )	6(7.5 )	9(11.3 )	61(76.3 )	80(100 )
<b>Total</b>	4(0.8 )	28(5.3 )	251(47.6 )	244(46.3 )	527(100 )

The review of previous vaccination history revealed that 278 (52.8%) of participants had hepatitis B vaccination documentation. Among them, 13 persons had received 1-2 vaccination doses, from those 11 (84.6%) and 2 persons (15.4%)

were immune and nonimmune, respectively. Two hundred sixty-five persons received  $\geq 3$  vaccination doses, from those 239 (90.2%) and 26 (9.8%) were immune and nonimmune, respectively (Table 2).

**Table 2-** Results of seromarkers and vaccination history among the Rohani Hospital staff, Babol, northern Iran

Dose	Current infection n (%)	Immune after infection n (%)	Immune after vaccination n (%)	None-immune n (%)	Total n (%)
0	4(1.6)	15(6.0)	1(0.4)	229(92.0)	249(100.0)
1-2	0(0.0)	0(0.0)	11(84.6)	2(15.4)	13(100.0)
$\geq 3$	0(0.0)	13(4.9)	239(90.2)	13(4.9)	265(100.0)
<b>Total</b>	4(0.8)	28(5.3)	251(47.6)	244(46.3)	527(100.0)

Of 230 susceptible participants who completed the three-dose series of the hepatitis B vaccine, 172 (74.8%), 39 (17%), 19 (8.3%) were classified as good responders, low responders and non-responders, respectively. The median antibody level after vaccination was  $552 \pm 445$  mIU/ml.

The anti HBs response after of hepatitis B vaccine was decreased significantly by the increase the age ( $P < 0.001$ ). No statistical significant association between vaccination response and gender was found (Table 3).

**Table 3-** Distribution of anti- HBs titer after vaccination according to age and gender among the Rohani Hospital staff, Babol, northern Iran

Variables	Anti -HBs titer < 10 mIU/ml n (%)	Anti -HBs titer 10-99 mIU/ml n (%)	Anti -HBs titer > 99 mIU/ml n (%)	Total n (%)
<b>Age (yr)</b>				
20-29	5(4.6)	12(11)	92(84.4)	109(100)
30-39	10(9.1)	24(21.8)	76(69.1)	110(100)
40-50	4(36.4)	3(27.3)	4(36.4)	11(100)
<b>Gender</b>				
Male	3(4.9)	10(16.4)	48(78.7)	61(100)
Female	16(9.5)	29(17.2)	124(73.4)	169(100)
<b>Total</b>	19(8.3)	39(17)	172(74.8)	230(100)

## Discussion

This study showed that HBV infection in HCWs was 6.65%, 4 times more than the administrative staff (1.63%). This might be explained by the occupational HBV exposure of HCWs. This result

is lower than a study from Uganda (5). As we noted, the risk of hepatitis B infection in HCWs is influenced by the prevalence of infection among society and it is higher in Africa than the Middle East, especially Iran. It may partly explain this

difference. Another study among HCWs carried out in Fars Province, Iran showed that the prevalence of HBsAg positivity was 2.9% (9). This finding was lower than our result.

Among people, HCWs who perform invasive procedure or handle biologic specimens are one of the high risk groups because of occupational hazards. In our study, significant association between occupation and hepatitis B infection was found ( $P < 0.001$ ). This finding was similar to Ciordia *et al.* who studied HBV in HCWs in Brazil and found that occupational related injuries increasing hepatitis B infection up to 1.29 times (11).

In the present study among the HCWs most cases of HBV infection was found among the cleaning staff. This difference can be explained on the basis of lack of their awareness about blood-borne pathogens. Similarly, Bahmani *et al.* reported the highest rate of HBV exposure among the non-professional staff; however they could not find any significant difference (9). Besides, a study from India reported no difference between the different occupational groups of HCWs (12).

In the current study, 278 hospital staff had hepatitis B vaccination history, from which 252 (90.2%) subjects were immune. This result was greater than one study from Shahrood, Iran which reported 72% immunity with the hepatitis B vaccination history (13). Moreover, our result was more compared with a study from India (79%) (14).

In our study, although not significant, most of the cases of HBV infection were in age group of 20-29 years old. This may be in part explained by their low experience in their job. Bahmani *et al.* found similar finding (9).

In this study, HBV infection in male and female staff was 8.1% and 5.7%, respectively. However, no statistically significant association was found. In the study carried out among the high risk population, including HCWs in southwest of Iran, all HBs Ag seropositive cases were males (15).

In our study, the most with exposure to HBV was

seen in cases with educational level of diploma (12.5%), followed by associate degree (5.1%) and B.Sc (4.9%) and this was statistically significant ( $P < 0.001$ ). This difference might be as a result of their knowledge about HBV infection, specimen handling, training in HBV prevention and available vaccination program.

As previously mentioned, after a complete 3-dose series of vaccination, 74.3% ,17% and 8.3% cases were classified as good responders, low responders and nonresponders, these findings are in agreement with Zamani *et al.* study (6). However, they used Cuban hepatitis B vaccine that was available in Iran since 1994. The recombinant vaccine made by Pasteur Institute of Iran was available in 2011 and in the present study for the first time; it is used for vaccination of HCWs. It seems that the efficacy of this type of vaccine is high, but there is still need to investigate about vaccine failure and so on.

In comparison to several similar studies, the immunity after vaccination in this study was acceptable (6, 16, 17). It seems that the young age of most participants and high female to male ratio in this study could be the reason. Several studies revealed that increase age reducing the immunity and also seroconversion in women is higher than men attributed to low BMI and less cigarette smoking (4, 11, 18).

In this study, seroconversion after vaccination declined with increasing the age and this reduction was statistically significant.

The limitations of our study were marked female preponderance. Similarly, we evaluated HCWs of Rohani Hospital. We recommend similar studies designed in other university hospitals and big populations.

## Conclusion

The present study reveals that the prevalence of HBV infection among HCWs are high, four times more than other employees. On the other hand, exposure to infectious body specimens are also high and only about 50% of HCWs were vacci-

nated. Considering the major sequels of chronic liver diseases due to HBV infection, there is still substantial need for training, work place safety improvement, 3-doses series vaccination of all susceptible HCWs at the beginning of their job and after vaccination response control.

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The authors declare that there is no conflict of interest.

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