

## Occupational exposure to hepatitis infection among Turkish nurses: frequency of needle exposure, sharps injuries and vaccination

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### SUMMARY

The aim of this study was to assess the demographic factors and pattern of injuries sustained by nurses, and to determine the occupational hazard of exposure to hepatitis B (HBV) and C (HCV) viruses among nurses. The study involved 906 hospital-based nurses working in three large hospitals. Between August 2002 and January 2003 a total of 595 practising nurses were accepted for inclusion. The results of questionnaires completed were collated and  $\chi^2$  and ratios were used for analysis. Of the 595 nurses, 111 (18.7%) had evidence of previous or current HBV infection and 32 (5.4%) of HCV infection. We found that 11.2% of the nurses who had worked for a period of between 0 and 5 years and 37.1% of those who had worked for a period between 16 and 20 years had evidence of HBV or HCV infection. Of the nurses working in surgical clinics, 59.4% had evidence of previous HBV or HCV infection and those working in hospital clinics had an 18.2% infection rate. Of the nurses occupationally exposed to HBV and HCV infections, 22.4% had received sharps injuries from apparatus and 63.6% had suffered needlestick exposure. Findings also showed 2.7% HBsAg positivity and 5.4% anti-HCV positivity. Of the 452 (76%) nurses who faced the occupational hazard of exposure to hepatitis infections, 27.7% (125/452) had not been vaccinated against HBV. Nurses working in our health-care sector are frequently exposed to occupational exposure for HBV and HCV infections. In order to prevent the infection of nurses with hepatitis, we advocate precautions and protection from sharps injuries. A programme of education, vaccination and post-exposure prophylaxis must be implemented.

### INTRODUCTION

There are known to be more than 2 billion people in the world infected with hepatitis B virus (HBV). HBV is most prevalent geographically in such places as China, South-East Asia and Africa. In Europe between 900 000 and 1 million people are infected with HBV each year. In Germany, 35 in every 100 000

people are newly infected and in the United States 140 000–320 000 people contract acute HBV infection each year [1–5].

When considering the whole world, HBV infection is the most common cause of viral hepatitis. Approximately 5% of the world's population are HBV carriers [3, 6] and approximately 1–2 million people every year lose their lives to complications connected to HBV infection [7]. The number of people carrying the infection without experiencing any symptoms stands at 200–300 million. The developed Western countries have 1% of HBV carriers, and developing

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countries such as those in South-East Asia and countries with poor socio-economic conditions have up to 20% carriage rate [7]. The United States has an infection carrier rate of 0.5% [4]. In Turkey approximately 4 million of the population (4.8%) are estimated to be carriers of chronic HBV [8, 9]. Almost 170 million of the world's population are known to have been infected with hepatitis C virus (HCV) [10]. Between 0 and 1.8% of the blood donor population in Turkey have been found to be HCV-antibody positive [8, 9].

During the course of normal everyday work in hospitals, health workers are brought into contact with blood and body fluids [4, 5, 11], and are exposed to the risk of HBV and HCV [12]. In developed countries exposure to HBV amongst health-care workers is common, with an increased risk of at least 3–6 times that of the general population; in developing countries this figure is estimated to be 6–18 times more [8]. The occupational hazard is highlighted by the fact that every year in the United States 200–300 health workers lose their lives to HBV and HCV infection acquired at work [11]. To recognize occupational risk, in 1992 the World Health Organization (WHO) and the International Labor Organization (ILO) accepted that HBV and HCV were occupational diseases for those working in the health sector [8, 11].

The purpose of this study was to determine the risk of exposure to HBV and HCV infections faced by Turkish nurses in relation to the level of nursing education, length of service, place of work, the estimated average number and nature of injuries experienced, and the estimated number of vaccinations administered.

## METHODS

### Patients

The entire working population of nurses in three large hospitals, namely the hospitals of Osmangazi University, The Public, and The Social Insurance Association, located in the city of Eskisehir in the north-west of Turkey were assessed. The total bed capacity of these hospitals is 2100, and the total number of nurses employed 906. We aimed to contact all of the nurses; however, when the study was conducted between August 2002 and January 2003, 258 nurses were unwilling to participate in the study and 53 nurses were unable to find the time to participate. The cohort therefore consisted of 595 nurses.

Table 1. Evidence of HBV and HCV infection in the study group of nurses

	Evidence of hepatitis	
	(n = 595)	%
HBV (HBsAg and/or anti-HBc)	111	18.7
HCV (anti-HCV)	32	5.4
HBV and HCV	452	75.9
Total	595	100.0

The cohort were given a questionnaire seeking the nurses' age, education level, length of service, place of work (which clinic), circumstances of encounter with chronic HBV- and HCV-positive patients, form of contact with the patient, frequency of hand needlestick injuries, and the circumstances of seeking medical assistance after injuries such as needlestick and sharps.

Interviews were carried out to verify appropriate responses from the research questionnaires. Nurses who had a positive hepatitis serum marker result within the last 6 months were accepted in this study, and those whose result was over 6 months ago, or who had no serology result of hepatitis serum markers were sent to the Osmangazi University Hospital's Gastroenterology Department, where blood tests were taken to obtain hepatitis markers.

### Laboratory tests

Hepatitis markers were determined by the AxSym fully automated micro-ELISA system (Abbott Laboratories, Chicago, IL, USA), for HBsAg, anti-HBs, anti-HBc, anti-HbcIgM and anti-HCV.

Before the commencement of the study, management and ethical agreement was obtained.

The results of the study were analysed using the SPSS 11.0 package program and  $\chi^2$  and ratios were also used.

## RESULTS

A total of 906 questionnaires were distributed to hospital-based nurses in the three hospitals and 595 nurses (65.7%) complied with the study. This group of nurses had experienced a rate of 24.1% (143/595) exposure to patients with either post-anti-HBV or -HCV infections, with 18.7% (111/595) exposed to HBV and 5.4% (32/595) exposed to HCV (Table 1).

Table 2 shows the data for details of study nurses, e.g. the level of education, length of service, economic

Table 2. Details of study nurses with evidence of HBV and HCV infections and possible risk factors

Demographic characteristics	Evidence of hepatitis infection					
	Yes (n = 143)		No (n = 452)		Total (n = 595)	
	n	%	n	%	n	%
Level of education	$\chi^2 = 6.1$ , D.F. 2, $P < 0.05$					
High school for health studies	63	44.1	150	33.2	213	35.8
Bachelor's degree	68	47.5	246	54.6	314	52.8
Licence	12	8.4	56	12.4	68	11.4
Location of the neighbourhood nurses were living around the city	$\chi^2 = 47.18$ , D.F. 2, $P < 0.001$					
Central	18	12.7	174	38.5	192	32.3
Central-peripheral	53	37.2	169	37.4	222	37.3
Peripheral	72	50.1	109	24.1	181	30.4
Nurses' total household income level together with their husbands	$\chi^2 = 6.03$ , D.F. 2, $P < 0.05$					
$\leq$ Minimum wage*	13	9.1	39	8.6	52	8.7
Between minimum wage and average wage for healthy living	89	62.2	326	72.1	415	69.8
$\geq$ Average wage†	41	28.7	87	19.2	128	21.5
Length of service (years)	$\chi^2 = 47.8$ , D.F. 4, $P < 0.001$					
0-5	16	11.2	137	30.3	153	25.7
6-10	21	14.7	108	23.9	129	21.7
11-15	25	17.5	85	18.8	110	18.5
16-20	53	37.1	80	17.7	133	22.4
20 and over	28	19.6	42	9.3	70	11.8
Place of work	$\chi^2 = 11.3$ , D.F. 2, $P < 0.05$					
Surgical clinic	85	59.4	198	43.8	283	47.6
Internal clinic	26	18.2	130	28.8	156	26.2
Operating theatre	32	22.4	124	27.4	156	26.2
Past history of hepatitis	$\chi^2 = 12.1$ , D.F. 2, $P < 0.05$					
Family history	$\chi^2 = 12.1$ , D.F. 2, $P < 0.05$					
Yes	25	17.5	34	7.5	119	20.0
No	109	76.2	386	85.4	435	73.1
Don't know	9	6.3	32	7.1	41	6.9
Total	143	24.0	452	76.0	595	100.0
Suspicious sexual history due to nurses' husbands	$\chi^2 = 0.97$ , D.F. 2, $P > 0.05$					
Yes	4	2.8	12	2.6	16	2.7
No	137	95.8	427	94.5	564	94.9
Don't remember	2	1.4	13	2.9	15	2.4
Total	143	24.0	452	76.0	595	100.0
Any chronic illness	$\chi^2 = 18.44$ , D.F. 1, $P < 0.001$					
Yes	63	44.1	114	25.2	177	29.7
No	80	55.9	338	74.8	418	70.3
Total	143	24.0	452	76.0	595	100.0
Continuous medicine usage	$\chi^2 = 11.74$ , D.F. 1, $P < 0.05$					
Yes	46	32.2	84	18.6	130	21.8
No	97	67.8	368	81.4	465	78.2
Total	143	24.0	452	76.0	595	100.0
Having an invasive procedure, e.g. having tooth out, caesarean, in the past	$\chi^2 = 0.41$ , D.F. 1, $P > 0.05$					
Yes	121	84.6	372	82.3	493	82.9
No	22	15.4	80	17.7	102	17.1
Total	143	24.0	452	76.0	595	100.0

\* Minimum annual wage for the cost of living in Turkey is \$4000.

† Average annual wage for the cost of living in Turkey is \$8000.

Table 3. Frequency of injury, use of protective measures and seeking medical assistance in study nurses

Frequency of injuries to nurses	Evidence of hepatitis infection				Total (n = 509)	
	Yes (n = 143)		No (n = 452)			
	n	%	n	%	n	%
Forms of injury	$\chi^2 = 9.5$ , D.F. 2, $P < 0.05$					
Sharps injuries	32	22.4	87	19.2	119	20.0
Needlestick exposure	91	63.6	245	54.2	336	56.4
No form of injury	20	14.0	120	26.6	140	23.6
Frequency of nurses using protection	$\chi^2 = 99.7$ , D.F. 1, $P < 0.001$					
Used protective measures	51	35.7	361	79.9	412	69.2
Didn't use protective measures	92	64.3	91	20.1	183	30.8
Nurses seeking/not seeking medical assistance after injury	$\chi^2 = 54.8$ , D.F. 1, $P < 0.001$					
Sought assistance	54	37.8	325	71.9	379	63.6
Did not seek assistance	89	62.2	127	28.1	216	36.4

condition, family history of hepatitis and place of work for nurses who had and had not been exposed to HBV and HCV infection. It was found that the group of nurses with a high-school education had a 44.1% rate for risk of exposure to HBV and HCV, while the group educated to university standard had a risk of just 8.4% ( $P < 0.05$ ).

Of the nurses that lived around the centre of the city 12.7% had been exposed to the risk of HBV and HCV infection, whereas for the group that lived elsewhere this rate was higher (50.1%). Nurses' total household income level affected the risk of exposure to hepatitis infections with 71.3% of nurses earning below the average wage level and 28.7% above it. Of the nurses that had worked for a period of between 0 and 5 years, 11.2% had encountered HBV and HCV infection, whereas for the group with a length of service of 16–20 years the figure was 37.1% ( $P < 0.001$ ).

Of nurses with evidence of previous hepatitis, 17.5% had a family history of hepatitis infections, whereas for those with no family history of hepatitis this rate was 76.2%. The nurses with evidence of hepatitis infections only had 2.8% sexual history of more than one lifetime sexual partner for themselves or their partner.

The place of work also affected the risk of exposure to infections with 59.4% of nurses working in surgical clinics, 22.4% working in the operating theatre and 18.2% working in internal diseases ( $P < 0.05$ ) having evidence of HBV or HCV infection.

Table 3 shows the rates for nurses both exposed and not exposed to the viral hepatitis infection and

Table 4. Serological viral markers in 595 study nurses

Viral markers	Positive		Negative	
	n	%	n	%
HBsAg	16	2.7	579	97.3
Anti-HBs	472	79.3	123	20.7
HBeAg	10	1.7	585	98.3
Anti-HBc	67	11.1	528	88.7
Anti-HCV	32	5.4	563	94.6

frequency of injuries, protective procedures and medical assistance received. Of the group of nurses who contracted HBV and HCV infection through work or socially, 22.4% had sharps injuries, and 63.6% needlestick injuries; 35.7% of nurses who had been exposed to HBV and HCV infections had taken precautions such as double gloves, protective clothing and hand washing against contraction of the disease, while 79.8% of nurses had no known occupational exposure to HBV and HCV infections ( $P < 0.001$ ). A total of 37.8% of nurses who experienced occupational exposure to HBV and HCV infections started to use protective clothing after injury, while 71.9% were not exposed to the infection ( $P < 0.001$ ).

Despite not having experienced exposure to HBV and HCV, 72.3% of nurses accepted inoculation against HBV, while 27.7% did not.

Table 4 shows the number of the nurses who were positive for viral hepatitis virus markers. Of these 2.7% were HBsAg positive and 5.4% were anti-HCV positive.

## DISCUSSION

In this study, the participation rate of the nurses was 65.7% (595/906). In total, 18.7% (111/595) had been exposed to HBV infection, and 5.4% (32/595) to HCV infection. This result is in accordance with findings of previous studies, showing the level of prevalence for exposure to HBV and HCV amongst nurses to be between 16.0–20% and 1.0–4% respectively [11–15].

Education plays a role in exposure to infection. It was discovered that 44.1% of nurses in the cohort had received a normal high-school or equivalent education and had evidence of contact with hepatitis infection, while those who had been educated to university standard, as well as attending further education, had an infection rate of 8.4%. Another study on the frequency of injury amongst nurses showed that further education correlated with a reduced frequency of injury from 86 to 12% [16]. This emphasized the importance of systematic and continuing education for nurses in protection against infection.

Of nurses with evidence of hepatitis, 17.5% had a family history of hepatitis infections, whereas for those with no family history of hepatitis, this rate of hepatitis evidence was higher (76.2%). Similarly, for nurses with evidence of hepatitis infections only 2.8% had a suspicious sexual history of more than one sexual partner for themselves or their partner. However, nurses could have acquired infection socially rather than through health-care work.

The number of nurses who had serological evidence of previous HBV and HCV infections was 11.2% for the group that had been working for a period of between 0 and 5 years, and 37.1% for the group that had been working for between 16 and 20 years. This result is consistent with the fact that the longer the period of employment for nurses in hospitals, the more they were exposed to infection by cuts and punctures from apparatus (sharps), and by increased contact with contaminated products.

The percentage of nurses working in surgical clinics with evidence of previous hepatitis infections was found to be 59.4%; those working in operating theatres was 22.4%, and those working in clinics was 18.2%. In another study, needlestick punctures to the hand were more common in surgical clinics [16]. The results of this study are in accordance with studies previously conducted in that the highest risk groups in the hospital with regard to HBV and HCV infections were, in order of risk: the dressings clinic, operating theatre, emergency service intensive care unit,

haemodialysis unit and clinic [2, 13]. Working with wounds and blood contact, contaminated apparatus, needlestick punctures and accidental cuts are typical reasons why nurses are at a higher risk of HBV and HCV infection.

In this study, of the nurses exposed to HBV and HCV infections, 22.4% (32/143) had evidence of sharps injuries from apparatus, and 63.6% had needlestick punctures. A rate of 86% (123/143) of exposure to the hepatitis infection was attributed to puncture and injuries. The frequency of injury to all nurses from cuts from apparatus was 20% (119/595), while the frequency of needlestick punctures to the hand was 56.4% (336/595). In a previously published study, punctures and cuts by apparatus (sharps injuries) for health workers was 39% [17]. In another study the rate observed for frequency of injury in health-care workers was 31.4% [16]. In research conducted in Turkey, the findings for sharps injuries were 81%, and frequency of needlestick exposure 91% [18]. In a different study, it was discovered that, in 118 operations, the lowest figure for risk of exposure was 50%, the frequency of sharps cuts and injuries for doctors was 8.0%, and that for nurses was 15.0% [5]. It was found in a further study that the frequency of injury from previously used syringes was 39% [19]. In a different study, it was found that 86.8% of nurses had experienced puncture wounds to the hand [20].

Exposure to hepatitis infection for the most part occurs through puncture wounds and cut injuries from apparatus; lack of the necessary protection, insufficient education, lack of attention by nurses at work, and not having information about viral hepatitis could together explain why our hepatitis infection rates in nurses are so high. Data collected in our interviews support the idea that, for the majority of exposure to hepatitis infection, the main cause was not taking full precautions against infection (64.3%).

Our study found that for those nurses taking protective measure such as using double gloves and hand washing, evidence/lack of evidence of HBV and HCV infections were 35.7% (51/143) and 79.9% (361/452) respectively. In spite of the recommendations of the Center for Diseases Control (CDC) that the most important factor in reducing the number of cases of HBV and HCV infections amongst health-care workers is the adoption of universal precautions such as the wearing of gloves, protective goggles/visor, mask and protective aprons, most health workers did not attach much importance to these essentials [5, 19]. Only 35% of health workers were seen to observe the

guidelines in an evaluation carried out in an infection clinic in Denmark [21]. In Australia, it was observed that only 58% of nurses having contact with blood and body fluids paid attention to the guidelines for universal protective measures [22]. Similarly, in a study in Turkey, it was found that 42% of health workers did not use essential protective equipment [18].

During our research we found that of those nurses not infected with HBV and HCV, 72.3% (327/452) stated that they had been vaccinated against HBV and 27.7% (125/452) had not. Only 1 in 4 nurses was considering immunization. This reflects nurses' indifference to getting immunized [23–25]. Of the nurses ( $n=125$ ) asked why they were not immunized, 57% (71/125) said that there was no opportunity, 19% (24/125) blamed bureaucratic procedures (paperwork), 17% (21/125) did not trust the vaccine, 9.6% (12/125) were frightened due to adverse effects, and 3.2% (4/125) said that the inoculation was too expensive. The most important reasons for not being inoculated were not having the opportunity and too much paperwork. This could be solved by the implementation of a locally funded inoculation in order to reduce the problems of chronic hepatitis. In Italy, widespread use of the hepatitis B inoculation has seen figures for HBV infection in health-care workers fall from 48% to 18% in 10 years [26].

This study found that, contrary to other studies, most nurses (72.3%) had received the inoculation. In another Turkish study conducted in 1996 [24], the figure was only 21.8% and in another study on health workers it was found to be 53.2% [27]. An accelerated national hepatitis B inoculation programme was established in 1998 in Turkey. This result shows that the rate of inoculation in Turkey has increased gradually.

In the study group of nurses, 2.7% were HBsAg positive and 79.3% were anti-HBs positive. The findings of our survey were different from others where HBsAg and anti-HBs positives were approximately 10 and 40% respectively [8, 28]. The reason for finding a higher rate for anti-HBs positive in our study could be due to both previous immunity to the infection and having had the vaccine. In a study conducted in the United States it was found that evidence of infection to HBV was 4.9% [29]. However, big variations were seen between the study participants. In researches carried out on different ethnic groups in different parts of the world, differences of between 0 and 20% in HBsAg positivity were found [29, 30].

We presume that some HBV and HCV infections in our nurses were also acquired socially rather than

by health-care work. We believe that the appropriate widespread use of the universal precautions, guidelines (including the offer of HBV inoculation), and implementing a directed, organized and continuous education programme for injuries are important for nurses. The use of post-exposure prophylaxis with hepatitis B immunoglobulin and vaccine reduce HBV infection rates in nurses exposed to HBV. Furthermore, we think that this issue should remain in the public eye, and we also suggest further organized and systematic studies be conducted to establish which infections are acquired socially and which ones as a result of health-care work. We also believe that health workers should be provided with a better awareness of their own health.

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