

# Hepatitis B Immunisation in Health Care Workers

Surg Cdr CN Chaudhari\*, Col MR Bhagat<sup>+</sup>, A Ashturkar<sup>#</sup>, Surg Capt RN Misra\*\*

## Abstract

**Background:** Hepatitis B virus (HBV) infection is an important occupational risk in health care workers (HCW). In spite of HBV vaccine availability in Armed Forces, the high prevalence of HBV infection in HCW continues to be a problem. The study was undertaken to study the HBV vaccine-compliance among HCW.

**Methods:** A cross-sectional study was conducted at a tertiary care hospital. HCW were requested to fill up the pre set questionnaire to assess the HBV vaccination coverage.

**Result:** Amongst 254 HCW, only 57.7% were vaccinated against HBV. The vaccine compliance was lowest among housekeeping professionals. The mean age at vaccination was high (30.5 years). Amongst the vaccine non-compliant subjects, 34.3% were above 30 years of age. 32.2% HCW completed primary vaccination after spending more than 10 years in the profession. Accessibility of HBV vaccine, knowledge and perception of HBV risk were important factors in vaccine non-compliance.

**Conclusion:** Due to low and delayed HBV vaccine-compliance, HCW continue to be at the risk of occupational HBV. Health education highlighting occupational risk of HBV, accessibility of vaccine and mandatory vaccination of HCW is recommended to increase HBV vaccine compliance among HCW.

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**Key Words :** Health care workers; Hepatitis B virus; Occupational risk; Hepatitis B vaccine

## Introduction

Health care workers (HCW) are defined as persons whose activities involve contact with patients or with blood or other body fluids from patients in health care or laboratory settings [1]. They are at occupational risk of exposure to blood borne pathogens. Hepatitis B virus (HBV) infection is a well recognized occupational risk in HCW. One of the most efficient modes of HBV transmission in the health care setting is percutaneous exposure to HBV due to an unintentional injury from a sharp objects contaminated with HBsAg-positive blood from an infected patient [2]. The global burden of HBV due to contaminated sharp injuries alone in HCW is estimated to be 66000 cases and 261 deaths annually [2]. In developing countries only 40-60% HBV infections in HCW are attributed to percutaneous occupational exposure due to sharp injuries [2]. Hepatitis B is a vaccine preventable disease for which a safe, immunogenic and effective vaccine is available since 1981[3]. All HCWs are required to be vaccinated against HBV [1,3,4]. However World Health Organisation (WHO) has estimated that mean HBV vaccination rate amongst HCWs ranges from 18-39% in developing countries to 67-79% in developed countries [2]. As per estimates, only 18% of HCW of South East

Asia including India are vaccinated against HBV [2]. Occupational Health and Safety Administration (OHSA) of United States mandates all health care facilities to offer HBV vaccine to their employees [4]. Various studies have highlighted the importance of knowledge of occupational risk of HBV and accessibility of vaccine as important factors in vaccine compliance [5,6].

HBV vaccine is accessible to all HCW of Indian Armed Forces, however a study published in 2004 reported HBsAg prevalence of 8.3% among serving Army Medical Corps personnel with more than 10 years of service [7]. The present study was undertaken to assess HBV vaccination status among HCW and to study factors responsible for vaccine non-compliance.

## Material and Methods

A cross-sectional study was carried out at a tertiary care hospital in January 2005. A total of 254 at risk HCWs were enrolled for the study. They included medical professionals, nursing officers, paramedics i.e. medical assistants (sailors) working in different wards, intensive care units and housekeepers i.e. sailors of domestic branch and ward sahayikas (defence civilian) working in laboratories and acute care wards. All subjects were requested to fill up a pre-set questionnaire to determine their health status, vaccination history and relevant information related to HBV vaccination.

\*Classified Specialist (Microbiology), INHS Jeevanti, Vasco-Da-Gama-403802. \*Senior Advisor (Medicine & Gastroenterology), Command Hospital Central Command, Lucknow. #Ex-Post Graduate Student (Pathology), INHS Asvini, Colaba Mumbai.-400005. \*\*Commanding Officer, INHS Kalyani Visakhapatnam.

**Table 1**  
**HBV vaccination status among different professionals**

Vaccine status	Medical	Nursing	Paramedics	Housekeeping	Total
Compliance	37 (77.1%)	64 (68.8%)	45 (43.3%)	0	146 (57.5%)
Non-compliance	11 (22.9%)	29 (31.2%)	59 (56.7%)	9 (100%)	108 (42.5%)
(a) Partially vaccinated	9 (18.7%)	23 (24.7%)	16 (15.4%)	0	48 (18.9%)
(b) Non-vaccinated	2 (4.2%)	6 (6.5%)	43 (41.3%)	9 (100%)	60 (23.6%)
<b>Total</b>	<b>48 (100%)</b>	<b>93 (100%)</b>	<b>104 (100%)</b>	<b>9 (100%)</b>	<b>254 (100%)</b>

$\chi^2=26.83$ ,  $df=2$ ,  $p < 0.001$  significant

In the study vaccine compliant subjects were those who had been administered minimum three doses of Hepatitis B vaccine, at schedule of 0, 1 and 6 months, intramuscularly, with dose of 20 microgram of HBsAg (hepatitis B surface antigen) at each setting, thus completing the minimum primary vaccination series. Vaccine non compliant were those who had not completed primary vaccination or had not been administered any dose of HBV vaccine. It consisted of two subgroups : Partially Vaccinated subjects who have started vaccination but did not complete three doses of primary vaccination i.e. left after one or two dose (s) of primary vaccination series and Non vaccinated subjects who were not exposed to HBV vaccine.

Chi square test was used to test the significance of difference in various groups. 'Z' test and 'Student's t test' were applied in finding out standard difference in the mean of two groups in groups with sample size above 30 and less than 30 respectively.

## Results

Out of 254 HCWs enrolled for the study, 48 (18.9%), 93 (36.6%), 104 (40.9%) and nine (3.5%) subjects were medical, nursing, paramedics and housekeeping professionals respectively. Of these, 146 (57.5%) HCW were vaccinated against HBV (Table 1). Analysis revealed that 77% of medical professionals were vaccine-compliant as against 43% paramedics, but none of the housekeeping personnel was vaccine-compliant. The profession-wise difference of vaccination-coverage was statistically highly significant. Study subjects included 151 (59.4%) male and 103 (40.6%) female. Amongst them 77 (51%) males were vaccine-compliant against 69 (67%) females. The difference in vaccination compliance in male and female was statistically significant ( $\chi^2=6.41$ ,  $df=1$ ,  $p < 0.02$ ).

The age of study subjects ranged from 19 to 54 years. Amongst them, 53.9% were in age group of 21 to 29 years (mean  $30.1 \pm 8.6$  years), however, it was  $36.9 \pm 7.7$  years among medical professionals and the difference was statistically significant by Z test ( $p < 0.01$ ). Table 2 shows age at which primary vaccination was completed by study subjects. The mean age at vaccination was  $30.5 \pm 7.3$  years in medical professionals as against  $24.7 \pm 6.1$  years in nursing professionals and the difference was significant by Z test ( $p < 0.01$ ). Age distribution of vaccine non-compliant study subjects is presented in Table 3. The results highlight that 34% of HCW of the vaccine non-compliant group were over 30 years of age. Again the mean age of vaccine non-compliant

**Table 2**  
**Age at primary vaccination in vaccine compliant HCW**

Age group	Medical	Nursing	Paramedics	Total
<19 year	1 (2.7%)	10 (15.6%)	3 (6.7%)	14 (9.6%)
20-29 year	18 (48.7%)	39 (60.9%)	26 (57.8%)	83 (56.8%)
30-39 year	12 (32.4%)	14 (21.9%)	12 (26.7%)	38 (26.0%)
40-49 year	6 (16.2%)	1 (1.6%)	4 (8.9%)	11 (7.5%)
<b>Total</b>	<b>37 (100%)</b>	<b>64 (100%)</b>	<b>45 (100%)</b>	<b>146 (100%)</b>

Age group  $\leq 29$  &  $\geq 30$  yrs,  $\chi^2=6.7488$ ,  $df=2$ ,  $p < 0.05$  significant

medical professionals was highest at  $35.0 \pm 7.2$  years as against lowest of  $26.11 \pm 7.4$  years in paramedics and the difference was statistically significant ( $t_{68}=3.73$ ,  $p < 0.001$ ).

The data of completion of primary vaccination in relation to date of joining the health profession is presented in Table 4. Vaccine-compliant study subjects completed primary immunisation at mean professional seniority of  $6.5 \pm 6.2$  years. Amongst professional categories, nursing professional had an early primary immunisation at  $4.8 \pm 5.2$  years as against  $7.2 \pm 6.4$  years and  $8.5 \pm 6.6$  years among medical and paramedics respectively; the difference in mean age of professional seniority in primary vaccination was statistically significant when compared with nursing professionals by 'Z' test ( $p < 0.01$ ). Data analysis revealed that 32.2% of HCW of vaccine-compliant group took the vaccine after spending more than decade in the health profession. Based on professional seniority, vaccine compliance and age at primary vaccination, we calculated cumulative risk of HBV in years. These study subjects have spent 2397 years in the health profession of which 1747 (72.9%) years were with occupational risk of HBV.

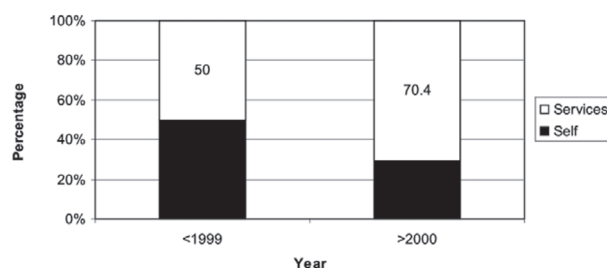
The HBV vaccine became freely available to all HCWs of Armed Forces around year 2000 (before that it was on case to case basis for select HCW), based on which we analysed the financing of vaccine by 'self' (vaccine cost paid by individual) or 'services' (vaccine provided by services, free of charge), the result of which is presented in Fig 1. The trend of financing of vaccine by self in study subjects decreased from 50% before year 1999 to 29.6% after year 2000, which is statistically significant ( $\chi^2=5.80$ ,  $df=1$ ,  $p < 0.02$ ). Analysis of data also revealed, HBV vaccine uptake till 1999 in study subjects (those study subjects joined health profession and vaccinated on or before 1999) was 33.1% (48 / 145) as against current vaccine uptake of 57.4% (146 / 254), which was statistically significant ( $\chi^2=21.96$ ,  $df=1$ ,  $p < 0.001$ ). The findings reaffirmed a direct relationship between vaccine uptake and accessibility of vaccine. Interestingly majority of subjects who were

**Table 3****Age distribution of vaccine non-compliant study subjects**

Age (years)	Medical	Nursing	Paramedics	Housekeepers	Total
<19	–	3 (10.3%)	4 (6.8%)	–	7 (6.5%)
20-29	3 (27.2%)	13 (44.8%)	44 (74.6%)	4 (44.4%)	64 (59.3%)
30-39	5 (45.5%)	9 (31.0%)	5 (8.5%)	5 (55.6%)	24 (22.2%)
>40	3 (27.2%)	4 (13.8%)	6 (10.2%)	–	13 (12.0%)
<b>Total</b>	<b>11 (100%)</b>	<b>29 (100%)</b>	<b>59 (100%)</b>	<b>9 (100%)</b>	<b>108 (100%)</b>

**Table 4****Primary vaccination in relation to profession seniority**

Experience (Years)	Medical	Nursing	Paramedics	Total
Ideal	12 (32.4%)	26 (40.6%)	5 (11.1%)	43 (29.4%)
(a) Joining	9 (24.3%)	3 (4.7%)	2 (4.4%)	14 (9.6%)
(b) 0-1 years	3 (8.1%)	23 (35.9%)	3 (6.7%)	29 (19.9%)
Late	10 (27.0%)	24 (37.5%)	22 (48.9%)	56 (38.3%)
(a) 2-4 years	2 (5.4%)	15 (23.4%)	12 (26.7%)	29 (19.9%)
(b) 5-9 years	8 (21.6%)	9 (14.1%)	10 (22.2%)	27 (18.5%)
Very late(>10)	15 (40.5%)	14 (21.9%)	18 (40.0%)	47 (32.2%)
<b>Total</b>	<b>37 (100%)</b>	<b>64 (100%)</b>	<b>45 (100%)</b>	<b>146 (100%)</b>

 $\chi^2=9.41$ ,  $df=4$ ,  $p < 0.01$  significant $\chi^2=5.80$ ,  $df=1$ ,  $p < 0.02$  significant**Fig. 1 : Financing of HBV vaccine**

vaccinated from service sources after year 2000 joined services before 1999.

The reasons for vaccine non-compliance were investigated (Table 5). Out of 108, 90 (83.3%) HCW gave the reason for HBV vaccine non-compliance. Amongst them 31.1% HCW were unable to complete primary vaccination because of non-accessibility of vaccine. Absence during vaccine drive due to leave or temporary duty was one of the most common reasons for not completing primary immunisation in partially vaccinated HCW. Attitude and knowledge regarding occupational HBV risk were other important factors in vaccine non-compliance. Two nursing professionals did not take the vaccine as they were 'pregnant' during vaccine drive.

## Discussion

The study highlighted HBV vaccine compliance of 57.5% in our HCWs in spite of accessibility of HBV vaccine since year 2000. Vaccine compliance of more than 77% has been reported in countries where vaccine is freely available [2]. A study from a medium sized teaching hospital from India reported 38.7% HCW

**Table 5****Reasons for vaccine non-compliance**

Reason	Number	Percentage
Non availability of vaccine at unit	28	31.1%
Absent when vaccine drive going on at unit	24	26.7%
HBV is a minor disease	18	20.0%
Not aware of HBV	12	13.3%
Forgot to take vaccine	5	5.6%
Others	3	3.3%
<b>Total responded</b>	<b>90</b>	<b>100%</b>

vaccinated against HBV [8]. Table 6 gives the vaccine compliance amongst HCWs, as reported by various authors. Considering easy accessibility of HBV vaccine to all HCW of the Armed Forces, HBV vaccine compliance of 57% is low by all standards.

Another important highlight of the study was late primary vaccination in vaccine-compliant subjects. Age at vaccination of one third of HCW was more than 30 years and equal number of vaccine noncompliant HCW were above 30 years of age. Various studies reported higher age at vaccination in adult being an important factor for high HBV vaccine 'non response', lower initial (within six months of primary vaccination) Geometric Mean Concentration of protective anti-HBs (antibody to hepatitis B surface antigen) and decline in anti-HBs below 10 mIU/ml, after 15 years of the primary vaccination [4,15]. Further, mean professional age at primary vaccination of study subjects was as high as 7.2 and 8.5 years among medical and paramedics respectively. Late primary vaccination resulted in HCW of the study spending 72.9% years in health profession with occupational risk of HBV. Studies reported maximum occupational risk of HBV during training and early years of health profession when exposure is maximum and awareness of risk of blood borne pathogen is minimal [2,5]. Thus, late vaccination has reduced the cost effective benefit of HBV vaccine in our subjects.

The various factors attributed to low and late vaccine uptakes in our study subjects were as follows:

- Profession: Vaccine compliance was lower in paramedics and housekeeping professionals as compared to the nursing and medical professionals. Other studies have also shown that professional

**Table 6****Vaccine compliance reported by various authors**

Author	Publication	Study population	Compliance	Remark
Doebbeling et al [5]	1996	HCW selected by stratified random sampling at teaching hospital, University of Iowa	54%	voluntary
Manhoney et al [9]	1997	HCW of 115 randomly selected hospitals, United States	66.5%	VP
Kumar et al [8]	2000	HCW of medium sized teaching hospital, India	38.7%	voluntary
Vranckx et al [10]	2004	HCW, Belgium	84.9%	VP
Hesham et al [11]	2005	HCW and undergraduate students of tertiary care teaching hospital, Malaysia	58.4%	VNP
Utomi IL [12]	2005	Dental practitioners, Nigeria	48.1%	VNP
Ali et al [13]	2005	HCW of tertiary care hospital, Pakistan	86%	VP
Shrestah et al [14]	2006	HCW of tertiary care hospital, Nepal	48.9%	VNP
Present study		HCW of tertiary care Armed Forces Hospital, India	57.7%	VP

VP- Vaccine cost paid by organisation, VNP- Vaccine cost not paid by organisation

categories and awareness of risk amongst professionals are important factors in HBV vaccine uptake [5,6,16]

- b) Professional Seniority: Non-compliance was highest in paramedics and housekeepers in their early profession when the risk of acquiring blood borne infection including HBV is maximum [2,5].
- c) Gender: Female subjects had better vaccine compliance as compared to males. This difference is attributable to uneven distribution of gender in profession as 90.3% females were nursing professionals, while 71.5% of males were paramedics and housekeeping professionals.
- d) Accessibility of vaccine : The study also highlighted the importance of vaccine accessibility in vaccine-compliance. The vaccination drive did not result in desired effects as a sizable number HCW were unable to complete the primary vaccination during vaccine drive due to movements such as temporary duties and leave. The accessibility of vaccine is an important factor in vaccine uptake in HCW [2,4]. Hence it is obligatory on the part of the health organisation to make HBV vaccine accessible to HCWs at all times [4].
- e) Attitude and Knowledge of HBV Risk : Awareness on various aspects of HBV infection or low perception of occupational risk of HBV is an important reason for vaccine non-compliance. The awareness was related to profession and work area [5,6] and forms an important factor in vaccine uptake.

The study has limitations as stratifying sampling was not undertaken. The low sample size of paramedics and housekeeping professional probably underestimates the vaccine non-compliance. Even with these limitations, the study highlights – *We do not practice what we preach!* As a team leader, the medical officer is responsible for low awareness and poor vaccine uptake

in HCWs. Further, prevention of HBV infection in HCWs is important to prevent its transmission to the patients through them [17,18]. This is possible only if, we practice prevention by increasing awareness of risk of HBV infection and ensuring 100% HBV vaccination amongst HCWs.

To conclude, the study highlights low and delayed vaccine compliance in health care workers leading to continued occupational risk of HBV. Attitude, knowledge of HBV infection and accessibility of HBV vaccine were important factors in low and delayed vaccination. The study recommends health education of HCWs on occupational risk of HBV and mandatory vaccination of HCW in prevention of occupational HBV infection.

### Conflicts of Interest

This study has been funded by research grants from the O/o DGAFMS.

### Intellectual Contribution of Authors

*Study Concept* : Surg Cdr CN Chaudhari, Col MR Bhagat

*Drafting & Manuscript Revision* : Surg Cdr CN Chaudhari

*Statistical Analysis* : Surg Cdr CN Chaudhari, A Ashturkar

*Study Supervision* : Surg Cdr CN Chaudhari, Surg Capt RN Mishra

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