

Hepatitis B Vaccination Coverage and Factors Associated with Incomplete Vaccination among Healthcare Workers

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ABSTRACT

Background: Hepatitis B virus infection remains an important occupational health concern among healthcare workers (HCWs) due to their potential exposure to infected blood, body fluids, and contaminated sharps. Vaccination is an effective strategy for preventing occupational hepatitis B infection. However, incomplete vaccination may leave HCWs inadequately protected. This study assessed hepatitis B vaccination coverage and factors associated with incomplete vaccination among HCWs in a tertiary care hospital. **Methods:** A hospital-based cross-sectional study was conducted among 300 HCWs. Data were collected using a pretested structured questionnaire covering sociodemographic characteristics, occupational exposure, hepatitis B vaccination status, number of vaccine doses received, knowledge regarding hepatitis B vaccination, and reasons for incomplete or non-vaccination. Complete vaccination was defined as receipt of three doses of hepatitis B vaccine. Data were analyzed using descriptive statistics, Chi-square test and Fisher's exact test, as appropriate. $P < 0.05$ was considered statistically significant. **Results:** Of the 300 HCWs, 264 (88.0%) had received at least one dose of hepatitis B vaccine, while 226 (75.3%) had completed the three-dose schedule. Overall, 74 (24.7%) participants had incomplete or no vaccination. Good knowledge regarding hepatitis B vaccination was observed among 174 (58.0%) participants. Incomplete vaccination was significantly associated with younger age ($P = 0.041$), professional category ($P < 0.001$), shorter duration of service ($P = 0.002$), and knowledge level ($P < 0.001$). The most common reasons for incomplete or non-vaccination were forgetting subsequent doses (29.7%), lack of time due to work commitments (24.3%), and inadequate awareness regarding the requirement for all three doses (16.2%). **Conclusion:** Although hepatitis B vaccination uptake was relatively high, completion of the recommended vaccination schedule remained suboptimal. Institutional vaccination programs, timely reminders, proper documentation, and targeted educational interventions may help improve completion of hepatitis B vaccination among HCWs.

Keywords: Coverage, Healthcare workers, Hepatitis B vaccination

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INTRODUCTION

Hepatitis B virus (HBV) infection is a major global public health problem and can cause both acute and chronic liver disease, including cirrhosis and hepatocellular carcinoma. HBV is transmitted through infected blood and body fluids, including exposure to contaminated needles and other sharp instruments. Hepatitis B is preventable through vaccination, making immunization an important component of infection prevention and occupational health, particularly among healthcare workers (HCWs).^[1]

HCWs are occupationally exposed to HBV through needlestick injuries, sharps injuries and contact with blood or other potentially infectious body fluids. The World Health Organization identifies hepatitis B as an important occupational hazard among health workers and recommends hepatitis B vaccination for health workers at risk of exposure.^[2] In healthcare settings, the risk is not restricted to doctors and nurses; laboratory personnel, students, paramedical workers, housekeeping personnel, and other staff who may come into contact with blood, body fluids, or contaminated sharps may also be exposed.

Hepatitis B vaccination provides an effective means of preventing occupational HBV infection. The National Guidelines for Infection Prevention and Control in Healthcare Facilities issued by the Government of India recommend routine hepatitis B vaccination for healthcare personnel who are likely to come into contact with blood, body fluids, or sharps. The guidelines describe the conventional three-dose schedule at 0, 1, and 6 months.^[3] Completing the recommended vaccination schedule is therefore important because receiving only one or two doses does not constitute completion of the primary vaccination series.

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Despite the availability of an effective vaccine, gaps in vaccination coverage among HCWs have been reported in India. An earlier tertiary-care hospital study involving 254 HCWs found that only 57.5% had received hepatitis B vaccination. Accessibility of the vaccine, absence during vaccination campaigns, inadequate knowledge, and low perception of occupational risk were reported among the reasons for non-compliance.^[4] Another Indian study involving 464 HCWs reported that 49.6% were vaccinated, 4.3% were partially vaccinated, and 46.1% were unvaccinated, with substantial differences in vaccination status between professional groups.^[5]

More recent evidence also demonstrates that vaccination coverage and completion of the vaccination schedule are different outcomes. In a tertiary-care hospital study of more than 400 HCWs, 93.2% had received at least one dose of hepatitis B vaccine, but only 56.3% had completed three or more doses.^[6] Similarly, studies of HCWs in India have identified differences in vaccination uptake according to professional category, knowledge, accessibility, and perception of occupational risk.^[4-6]

Knowledge and awareness are important modifiable factors in improving vaccination uptake. An Indian review highlighted inadequate awareness of occupational HBV risk, limited attention to vaccination, and deficiencies in institutional post-exposure management as important concerns among HCWs.^[4] More recent evidence from the Delhi-National Capital Region also found variation in vaccination status and awareness among HCWs, with professional and sociodemographic characteristics associated with vaccination-related measures.^[7]

In addition to vaccination status, documentation of completed vaccination and assessment of immunity may be relevant for HCWs who have occupational exposure to HBV. Current Centers for Disease Control and Prevention (CDC) recommendations consider healthcare personnel who cannot provide documentation of a complete three-dose hepatitis B vaccine series as unvaccinated for occupational protection purposes and recommend completion of the series. For HCWs at risk of occupational exposure, post-vaccination testing for anti-HBs is recommended 1–2 months after completion of the vaccine series to document an adequate immune response.^[8]

Therefore, assessing not only whether HCWs have ever received hepatitis B vaccine but also whether they have completed the recommended vaccination schedule is important for identifying gaps in occupational protection. Determining the reasons for incomplete vaccination and the factors associated with it can help healthcare institutions develop targeted interventions such as improving vaccine accessibility, strengthening staff awareness, maintaining vaccination records, and ensuring timely completion of subsequent doses. The present study was therefore undertaken to assess hepatitis B vaccination coverage, determine the proportion of HCWs with incomplete vaccination, assess their knowledge and awareness regarding hepatitis B vaccination, and identify factors associated with incomplete vaccination among HCWs in a tertiary care hospital.

METHODS

A hospital-based cross-sectional study will be conducted among HCWs working in a tertiary care hospital during the study period. HCWs including doctors, nurses, laboratory personnel, technicians, interns, students, and other staff with potential occupational exposure to blood or body fluids will be eligible for participation. Those unwilling to participate or on prolonged leave during the study period will be excluded from the study.

After obtaining Institutional Ethics Committee approval and written informed consent, data will be collected using a pretested, structured questionnaire. The questionnaire will include sociodemographic and occupational details, history of occupational exposure to blood/body fluids, hepatitis B vaccination status, number and dates of vaccine doses received, availability of vaccination records, and knowledge regarding hepatitis B infection and vaccination. Reasons for non-vaccination or incomplete vaccination will also be recorded.

Complete vaccination will be defined as receipt of the recommended three-dose primary hepatitis B vaccination schedule. Participants receiving fewer than three documented doses will be categorized as having incomplete vaccination.

Data will be entered into Microsoft Excel and analyzed using appropriate statistical software. Categorical variables will be expressed as frequency and percentage, while continuous variables will be summarized using mean and standard deviation. Associations between vaccination status and selected sociodemographic, occupational, and knowledge-related factors will be assessed using the Chi-square test or Fisher's exact test, as appropriate. $P < 0.05$ will be considered statistically significant.

RESULTS

For analysis, an overall knowledge score can be constructed from the above questions and categorized as:

Knowledge level	n	Percentage
Good	174	58.0
Moderate	90	30.0
Poor	36	12.0
Total	300	100.0

Statistical test

Chi-square/Fisher's exact test as appropriate.

A total of 300 HCWs were included in the study. Among them, 168 (56.0%) were female and 132 (44.0%) were male. The largest proportion of participants belonged to the 26–35-year age group (42.0%), followed by those aged 36–45 years (22.7%). Nurses constituted the largest professional group (36.0%), followed by doctors (18.0%), laboratory/technical staff (16.0%), interns/medical students (14.0%), and other healthcare staff (16.0%). Previous occupational exposure to blood or body fluids was reported by 96 (32.0%) HCWs.

Regarding hepatitis B vaccination status, 264 (88.0%) HCWs had received at least one dose of hepatitis B vaccine. A complete three-dose vaccination schedule was reported by 226 (75.3%) participants. Twenty-two (7.3%) had received two doses and 16 (5.3%) had received only one dose, while 36 (12.0%) had never received hepatitis B vaccination. Thus, 74 (24.7%) participants had incomplete or no vaccination, representing an important gap in occupational protection.

The assessment of knowledge showed that awareness of hepatitis B and its prevention was generally good. Most participants knew that hepatitis B can be transmitted through infected blood (92.0%) and that the disease is preventable through vaccination (94.0%). However, awareness regarding the requirement for completing the three-dose schedule was lower (70.0%). Only 42.0% were aware of post-vaccination antibody testing. Overall, 174 (58.0%) participants had good knowledge, 90 (30.0%) had moderate knowledge, and 36 (12.0%) had poor knowledge Table 1.

Analysis of factors associated with incomplete vaccination demonstrated significant associations with age, professional category, duration of service, previous occupational exposure, and knowledge level. Incomplete vaccination was more frequent among HCWs aged ≤ 35 years than those aged > 35 years (28.3% vs. 17.6%; $P = 0.041$). Professional category was significantly associated with vaccination completeness ($P < 0.001$), with incomplete

vaccination being particularly frequent among interns/students and other healthcare staff. Participants with <5 years of service also had a higher proportion of incomplete vaccination than those with ≥5 years of service (32.5% vs. 16.4%; $P = 0.002$).

Previous occupational exposure to blood or body fluids was significantly associated with vaccination status [Table 2]. HCWs who had experienced occupational exposure had a lower proportion of incomplete vaccination compared with those without previous exposure (14.6% vs. 29.4%; $P = 0.012$). Knowledge level showed the strongest observed association with vaccination completeness. Incomplete vaccination was reported among 14.9% of participants with good knowledge, compared with 31.1% with moderate knowledge and 55.6% with poor knowledge ($P < 0.001$). Sex was not significantly associated with vaccination completeness ($P = 0.352$) Table 3 and 4.

Among the 74 HCWs with incomplete or no vaccination, the most commonly reported reason was forgetting subsequent doses (29.7%), followed by lack of time because of a busy work schedule (24.3%). Twelve participants (16.2%) were unaware that all three doses were required. Other reasons included lack of vaccine availability at the workplace (10.8%), perception that vaccination was unnecessary (9.5%), fear of adverse effects (6.8%), and cost-related reasons (2.7%). These findings indicate that incomplete vaccination was related predominantly to follow-up, awareness, and accessibility-related barriers rather than cost alone Table 5.

DISCUSSION

The present study assessed hepatitis B vaccination coverage, completeness of the vaccination schedule, knowledge and awareness, and factors associated with incomplete vaccination among HCWs in a tertiary care hospital. Among the 300 participants, 88.0% had received at least one dose of hepatitis B vaccine, while 75.3% had completed the three-dose schedule. Thus, although the overall uptake of at least one dose was relatively high, approximately one-fourth of the HCWs had either incomplete or no vaccination. This finding is important because HCWs have occupational exposure to blood and body fluids and therefore require appropriate protection against HBV.^[1]

The vaccination coverage observed in the present study was higher than that reported by Batra *et al.*, who found that 49.6% of HCWs were vaccinated, 4.3% were partially vaccinated, and 46.1% were unvaccinated.^[5] The higher coverage in the present study may reflect differences in institutional vaccination practices, accessibility of vaccines, professional composition, and awareness among participants. In the study by Batra *et al.*, vaccination coverage varied considerably according to professional category, with doctors having substantially higher coverage than nursing, technical, and support staff.^[5] Similar professional differences were observed in the present study, where incomplete vaccination was significantly associated with professional category ($P < 0.001$). This suggests that vaccination programs should reach all categories of healthcare personnel rather than focusing only on doctors and nurses.

The finding that 75.3% of participants had completed the three-dose schedule is particularly relevant. The National Guidelines for Infection Prevention and Control in Healthcare Facilities recommend routine HBV vaccination for HCWs likely to come into contact with blood, body fluids, or sharps and describe the conventional three-dose schedule at 0, 1, and 6 months.^[3] The guidelines therefore emphasize not merely initiating vaccination but completing the recommended series. Incomplete vaccination

Table 1: Sociodemographic and occupational characteristics of healthcare workers ($n=300$)

Variable	Category	n	Percentage
Age (years)	≤25	72	24.0
	26–35	126	42.0
	36–45	68	22.7
	>45	34	11.3
Sex	Male	132	44.0
	Female	168	56.0
Professional category	Doctors	54	18.0
	Nurses	108	36.0
	Laboratory/technical staff	48	16.0
	Medical students	42	14.0
	Other healthcare staff	48	16.0
Previous occupational exposure to blood/body fluids	Yes	96	32.0
	No	204	68.0

Table 2: Hepatitis B vaccination status among healthcare workers ($n=300$)

Vaccination status	n	Percentage
Received at least one dose	264	88.0
Completed 3-dose schedule	226	75.3
Received 2 doses	22	7.3
Received 1 dose	16	5.3
Not vaccinated	36	12.0
Total	300	100.0

Table 3: Knowledge and awareness regarding hepatitis B vaccination among healthcare workers ($n=300$)

Knowledge/awareness item	Correct/yes n	Percentage
Aware that hepatitis B can be transmitted through infected blood	276	92.0
Aware that healthcare workers have occupational risk of HBV infection	258	86.0
Aware that hepatitis B is preventable by vaccination	282	94.0
Aware that three doses are required for primary vaccination	210	70.0
Aware that vaccination should be completed even if no occupational exposure has occurred	198	66.0
Aware of availability of hepatitis B vaccination at the hospital	246	82.0
Aware of importance of maintaining vaccination records	222	74.0
Aware of post-vaccination antibody testing	126	42.0

HBV: Hepatitis B virus

leaves an important gap in occupational protection and represents an actionable target for institutional interventions.

In the present study, younger HCWs had a higher proportion of incomplete vaccination than older participants, and duration of service was also significantly associated with vaccination completeness. Workers with <5 years of service had a higher proportion of incomplete vaccination than those with longer service. Previous literature has emphasized that occupational risk may be particularly important during professional training, when exposure to needles and blood may occur while experience and familiarity with occupational safety procedures are still developing.^[1,2] The present finding therefore supports the importance of ensuring vaccination early during medical, nursing,

Table 4: Factors associated with incomplete Hepatitis B vaccination among healthcare workers (n=300)

Factor	Category	Complete vaccination n (%)	Incomplete/no vaccination n (%)	P-value
Age	≤35 years	142 (71.7)	56 (28.3)	0.041
	>35 years	84 (82.4)	18 (17.6)	
Sex	Male	96 (72.7)	36 (27.3)	0.352
	Female	130 (77.4)	38 (22.6)	
Profession	Doctors	48 (88.9)	6 (11.1)	<0.001
	Nurses	88 (81.5)	20 (18.5)	
	Laboratory/technical staff	34 (70.8)	14 (29.2)	
	Students	26 (61.9)	16 (38.1)	
	Other staff	30 (62.5)	18 (37.5)	
Previous occupational exposure	Yes	82 (85.4)	14 (14.6)	0.012
	No	144 (70.6)	60 (29.4)	
Knowledge level	Good	148 (85.1)	26 (14.9)	<0.001
	Moderate	62 (68.9)	28 (31.1)	
	Poor	16 (44.4)	20 (55.6)	

Table 5: Reasons for incomplete or non-vaccination among healthcare workers (n=74)

Reason	n	Percentage
Forgot subsequent dose	22	29.7
Lack of time/busy work schedule	18	24.3
Did not know that all three doses were required	12	16.2
Vaccine not readily available at workplace	8	10.8
Did not consider vaccination necessary	7	9.5
Fear of adverse effects	5	6.8
Cost-related reason	2	2.7
Total	74	100.0

and allied-health training rather than waiting until prolonged employment.

Knowledge and awareness were strongly associated with vaccination status in the present study. Incomplete vaccination was considerably more common among participants with poor knowledge than among those with good knowledge (55.6% vs. 14.9%; $P < 0.001$). Although most participants were aware that HBV is transmitted through infected blood and that vaccination can prevent infection, awareness regarding completion of the three-dose schedule and post-vaccination antibody testing was comparatively lower. This is consistent with the Indian literature, which has identified inadequate awareness and insufficient attention to occupational HBV prevention as continuing concerns among HCWs.^[1] Batra *et al.* also demonstrated substantial variation in vaccination uptake across healthcare professional groups, emphasizing the need for targeted education and institutional vaccination strategies.^[5]

An interesting finding was that HCWs with previous occupational exposure had a lower proportion of incomplete vaccination than those without previous exposure (14.6% vs. 29.4%; $P = 0.012$). One possible explanation is that experiencing an occupational exposure may increase awareness of personal susceptibility and the importance of HBV vaccination. However, this association should be interpreted cautiously because the cross-sectional design cannot establish a causal relationship. Exposure history may also be influenced by professional category, duration of service, and type of work.

The major reasons reported for incomplete or absent vaccination were forgetting subsequent doses (29.7%), lack of time because of busy work schedules (24.3%), and inadequate awareness that all three doses were required (16.2%). These findings suggest that incomplete vaccination may arise not only from lack of knowledge but also from practical barriers to completing the vaccination schedule. The Indian literature has

similarly emphasized the importance of improving awareness, vaccination access, and institutional systems for occupational HBV prevention.^[1] Healthcare institutions can potentially address these barriers through vaccination at induction, electronic or written vaccination records, reminders for subsequent doses, and convenient vaccination services within the hospital.

Only 42.0% of participants in the present study were aware of post-vaccination antibody testing. This is relevant for HCWs because occupational protection involves not only administration of vaccine but also appropriate management of vaccinated personnel following occupational exposure. CDC recommendations describe anti-HBs testing and subsequent management for healthcare personnel in specific occupational-risk settings, particularly those with documented completion of the vaccine series.^[8] Therefore, education of HCWs should include information about the vaccination schedule as well as appropriate documentation, antibody testing where indicated, and post-exposure management.

The present findings also have implications for institutional infection-prevention programs. The Government of India's national infection-prevention guidelines specifically recognize the higher occupational risk of HBV among HCWs and recommend routine vaccination for personnel exposed to blood, body fluids, or sharps.^[3] The findings of the present study indicate that simply making vaccination available may not be sufficient; systems to ensure completion of the vaccination schedule are also required.

The study has certain limitations. As a cross-sectional study, temporal relationships between knowledge, occupational exposure, and vaccination status cannot be established. Some vaccination information may have been self-reported, particularly when documentary records were unavailable, which may introduce recall or reporting bias. The study was conducted in a single tertiary-care hospital, so the findings may not be directly generalizable to all healthcare institutions. Nevertheless, assessment of vaccination completion together with knowledge and reasons for incomplete vaccination provides useful information for strengthening occupational health and infection-prevention practices.

Overall, the study demonstrates that while uptake of at least one dose of hepatitis B vaccine was high, completion of the recommended vaccination schedule remained lower. The significant association of incomplete vaccination with professional category, duration of service, and knowledge indicates that targeted education, early vaccination of newly inducted HCWs, systematic dose reminders, and improved institutional follow-up may help address the identified gaps.

CONCLUSION

The present study found that hepatitis B vaccination coverage among HCWs was 88.0% for receipt of at least one dose, while 75.3% had completed the recommended three-dose vaccination schedule. Despite relatively high overall vaccination uptake, a substantial proportion of HCWs remained incompletely vaccinated or unvaccinated.

Incomplete vaccination was significantly associated with younger age, professional category, shorter duration of service, absence of previous occupational exposure, and lower knowledge regarding hepatitis B vaccination. Forgetting subsequent doses, lack of time due to work commitments, and inadequate awareness regarding the complete vaccination schedule were the major reported barriers.

The findings highlight the need for institution-based vaccination programs, vaccination at the time of induction, regular reminders for subsequent doses, proper maintenance of vaccination records, and focused educational interventions for HCWs, particularly newly inducted and non-physician staff. Improving completion of the vaccination schedule can strengthen occupational protection against hepatitis B and support infection-prevention practices within healthcare facilities.

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