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Original Research Article

BARRIERS AND FACILITATORS OF HEPATITIS B VACCINATION AMONG HEALTHCARE WORKERS IN A TERTIARY CARE HOSPITAL: INSIGHTS FROM A MIXED-METHODS APPROACH

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ABSTRACT

Background: Healthcare workers (HCWs) remain at persistently high risk of occupational Hepatitis B virus (HBV) infection through percutaneous and mucocutaneous exposure to blood and body fluids, and vaccination remains the only reliable means of preventing this entirely avoidable occupational hazard. Despite the long availability of an effective vaccine, vaccination coverage among HCWs in many tertiary care settings continues to fall short of universal targets, and the reasons for this shortfall are not fully captured by quantitative surveys alone. **Objectives:** To determine Hepatitis B vaccination coverage among HCWs in a tertiary care hospital, to examine its association with socio-demographic, occupational, and knowledge-related factors, and to explore the perceptions, attitudes, and beliefs underlying vaccine uptake in order to identify contextual barriers and facilitators.

Materials and Methods: A sequential explanatory mixed-methods study was conducted among 256 HCWs (doctors, nurses, laboratory technicians, and support staff) in a tertiary care hospital in Bhubaneswar between February and March 2026, using a pre-tested semi-structured questionnaire for the quantitative component and ten in-depth interviews, conducted until data saturation, for the qualitative component. Chi-square testing was used to assess quantitative associations, and thematic analysis, combining descriptive and inductive coding, was used to analyse interview transcripts, with the two data streams subsequently triangulated.

Results: Overall, 80% of HCWs had received at least one dose of the vaccine, but only 62% were fully vaccinated, 18% were partially vaccinated, and 20% remained entirely unvaccinated. Vaccination status varied significantly by profession ($\chi^2 = 18.5$, $p < 0.05$) and was strongly associated with knowledge level, with HCWs with good knowledge nearly five times more likely to be fully vaccinated (OR 4.9, 95% CI 2.82-8.44; $p < 0.001$). Residence was the only socio-demographic variable significantly associated with vaccination status ($\chi^2 = 8.2$, $p < 0.01$), with age, gender, and marital status showing no significant association. Thematic analysis of the interviews, yielding 28 codes organised into ten sub-themes across four broader themes, identified lack of awareness, misconceptions, low risk perception, time constraints, and institutional barriers relating to access, cost, and policy as the principal barriers, while prior training exposure and peer influence emerged as key facilitators.

Conclusion: Hepatitis B vaccination coverage among HCWs in this tertiary care hospital was suboptimal, shaped jointly by individual-level knowledge gaps and system-level institutional shortfalls. Improving awareness,

addressing misconceptions, and strengthening institutional policy and access are likely to meaningfully improve vaccination uptake in this and similar settings.
Keywords: Hepatitis B vaccination; healthcare workers; mixed-methods study; occupational exposure; vaccine hesitancy; tertiary care hospital.

INTRODUCTION

Hepatitis B is an infection commonly affecting the liver, caused by the Hepatitis B virus (HBV). While most adults with acute HBV infection recover completely, chronic hepatitis develops in approximately 5% of adults with adult-onset disease, and it is this chronic carrier state that underlies the virus's long-term contribution to cirrhosis and hepatocellular carcinoma.[1] Healthcare workers (HCWs) represent one of the high-risk groups for Hepatitis B infection because of their recurrent occupational exposure, since contact with the body fluids of an infected person is one of the principal routes of HBV transmission. According to estimates, approximately 2 million of the 35 million HCWs worldwide are exposed to the Hepatitis B virus each year through percutaneous blood-borne pathogen exposure.[2]

India carries a disproportionate share of this global burden, with an estimated 29.8 million cases of HBV infection, making it the second-largest global reservoir of the virus.[3] The country has a Hepatitis B surface antigen (HBsAg) prevalence of 2-8% in the general population, placing it in the intermediate zone of HBV endemicity, with seroprevalence reported to be two to four times higher among HCWs than in the general population.[4] Since there is no known cure for established HBV infection, the only safe and efficient means of preventing the disease remain pre-exposure measures, chief among them the Hepatitis B vaccine, which confers more than 90% protection against infection when administered as a complete three-dose schedule.

Despite this well-established efficacy, and despite decades of availability, vaccination coverage among HCWs remains inconsistent across institutions and countries, and a purely quantitative account of "who is vaccinated and who is not" does not, on its own, explain why coverage remains incomplete or what specifically might be done to close the gap. Vaccination behaviour is shaped simultaneously by measurable, structural determinants - occupational category, knowledge level, access to the vaccine - and by less easily measured attitudinal and contextual factors, including risk perception, misconceptions about the vaccine, and institutional policy environment, that are better captured through qualitative enquiry than through a structured questionnaire alone.

Rationale and Research Question

This study was designed to bridge the gap between knowledge and practice by identifying both the measurable determinants and the underlying behavioural factors that influence Hepatitis B vaccination uptake among healthcare workers. It was guided by the research question: how do identified quantitative factors and qualitative perceptions together explain Hepatitis B vaccination uptake among healthcare workers?

Objectives

1. To determine Hepatitis B vaccination coverage among healthcare workers.
2. To examine its association with socio-demographic, occupational, and knowledge-related factors.
3. To explore perceptions, attitudes, and beliefs regarding the Hepatitis B vaccine, and to understand the contextual barriers and facilitators to its uptake.

MATERIALS AND METHODS

Study Design, Area, and Period

A sequential explanatory mixed-methods design was adopted, in which an initial quantitative phase was followed by a qualitative phase intended to explain and contextualise the quantitative findings. The study was conducted in a tertiary care hospital in Bhubaneswar over a two-month period, from February to March 2026.

Study Population and Sampling

The study population comprised healthcare workers - doctors, nurses, laboratory technicians, and paramedical and housekeeping staff - currently employed at the study hospital. Healthcare workers who had been employed at the institution for at least six months and who provided informed consent were eligible for inclusion. For the quantitative component, participants were enrolled by consecutive sampling; for the qualitative component, participants were selected by purposive sampling to ensure adequate representation across occupational categories.

Sample Size

The sample size for the quantitative component was calculated using the standard formula for estimating a single population proportion, $n = Z^2pq/d^2$, where p, the expected vaccination coverage, was taken as 60% on the basis of prior Indian data on Hepatitis B vaccination among healthcare workers.[5]

With Z = 1.96 (95% confidence level), p = 0.60, q = 1 − p = 0.40, and an allowable error d of 10% of p (that is, 6%), the calculated sample size was 256.

For the qualitative component, ten in-depth interviews were conducted, with recruitment continuing until data saturation - the point at which successive interviews yielded no substantively new codes or themes - was achieved.

Data Collection

Quantitative data were collected using a pre-tested, semi-structured questionnaire covering socio-demographic characteristics, occupational category, Hepatitis B knowledge, and vaccination status. Qualitative data were collected through in-depth interviews exploring participants' perceptions, attitudes, and beliefs regarding the Hepatitis B vaccine, and the barriers and facilitators they had personally experienced or observed.

Data Analysis

Quantitative data were entered and analysed using Microsoft Excel and SPSS software (version 22). Descriptive statistics were used to calculate proportions, and the chi-square test was applied to assess associations between categorical variables, with a p-value of less than 0.05 considered statistically significant. Qualitative data were analysed thematically, combining descriptive and inductive coding: interview transcripts were coded, codes were grouped into sub-themes, and sub-themes were further consolidated into broader themes. Findings from the quantitative and qualitative components were subsequently triangulated to provide a comprehensive, integrated understanding of the barriers and facilitators to vaccination uptake.

Ethical Considerations

Written informed consent was obtained from all participants prior to enrolment. Confidentiality of all personal and clinical information was maintained throughout the study, and participation was entirely voluntary.

RESULTS

Quantitative Component

A total of 256 healthcare workers were enrolled in the quantitative component. Overall, 80% of participants had received at least one dose of the Hepatitis B vaccine, but only 62% had completed the full vaccination schedule; 18% were partially vaccinated, having received one or two doses without completing the series, and 20% remained entirely unvaccinated (Table 1).

Table 1: Overall Hepatitis B vaccination coverage among healthcare workers (n = 256)

Vaccination status	Number of HCWs	Percentage
Fully vaccinated (3 doses)	159	62%
Partially vaccinated (1-2 doses)	46	18%
Unvaccinated	51	20%
Total	256	100%

Vaccination status varied significantly across occupational categories ($\chi^2 = 18.5$, df = 3, $p < 0.05$). Doctors showed the highest proportion of full vaccination (75%), followed by nurses (63%), while lab technicians and support staff showed comparatively lower rates of full vaccination (Table 2).

Table 2: Vaccination status among healthcare workers by profession (n = 256)

Profession	Fully vaccinated	Not fully vaccinated	Total	χ^2 value	P value (df=3)
Doctors	60	20	80	18.5	< 0.05
Nurses	50	30	80		
Lab technicians	25	35	60		
Support staff	19	17	36		
Total	154	102	256		

Knowledge level showed a strong and statistically significant association with vaccination status ($\chi^2 = 34.48$, df = 1, $p < 0.001$). Healthcare workers with good knowledge of Hepatitis B were approximately 4.9 times more likely to be fully vaccinated than those with poor knowledge (OR 4.9, 95% CI 2.82-8.44); since this confidence interval does not cross 1, the association is statistically significant (Table 3).

Table 3: Association between knowledge level and vaccination status (n = 256)

Knowledge level	Fully vaccinated	Not fully vaccinated	Total	OR (95% CI)	χ^2 value	P value (df=1)
Good	100	28	128	4.9 (2.82-8.44)	34.48	<0.001
Poor	54	74	128			
Total	154	102	256			

Among the socio-demographic variables examined, only residence showed a statistically significant association with vaccination status: urban healthcare workers had a markedly higher rate of full vaccination than their rural counterparts ($\chi^2 = 8.2$, $p < 0.01$). Age, gender, and marital status showed no statistically significant association with vaccination uptake (Table 4).

Table 4: Association between socio-demographic factors and vaccination uptake (n = 256)

Variable	Category	Fully vaccinated (n=154)	Not fully vaccinated (n=102)	Total	χ^2 value	P value
Age (years)	21-30	90	60	150	3.10	0.21
	31-40	45	25	70		
	>40	19	17	36		
Gender	Male	70	52	122	1.80	0.18
	Female	84	50	134		
Residence	Urban	120	55	175	8.2	<0.01
	Rural	34	47	81		
Marital status	Married	95	58	153	0.52	0.47
	Unmarried	59	44	103		

Qualitative Component

Thematic analysis of the ten in-depth interviews yielded 28 distinct codes, which were consolidated into 10 sub-themes and organised under four broader themes: knowledge and awareness, personal and behavioural factors, institutional and systemic factors, and facilitators of vaccination. (Table 5)

Table 5: Qualitative themes, sub-themes, and illustrative codes identified through thematic analysis

Theme	Sub-themes / illustrative codes	Nature
Theme 1: Knowledge and awareness	Lack of awareness of Hepatitis B risk; misconceptions about transmission and vaccine safety; poor knowledge of the recommended vaccination schedule	Barrier
Theme 2: Personal and behavioural factors	Low risk perception ("it won't happen to me"); time constraints in a busy clinical schedule; fear of side effects	Barrier
Theme 3: Institutional and systemic factors	Limited accessibility of the vaccine at the workplace; lack of a formal institutional vaccination policy; cost barriers where vaccination was not provided free of charge	Barrier
Theme 4: Facilitators	Prior training and exposure to infection-control education; peer influence and encouragement from vaccinated colleagues; no strong perception differences by age or gender	Facilitator

Integration of Quantitative and Qualitative Findings

Triangulation of the two data streams showed a high degree of convergence: the quantitative finding that knowledge level was the strongest predictor of vaccination status was directly corroborated by the qualitative theme of knowledge and awareness gaps, while the significant association between profession and vaccination status was echoed in qualitative accounts of differential training exposure across occupational groups. Similarly, the qualitative identification of institutional barriers - limited access, absent policy, and cost - offers a plausible explanation for the quantitative finding that vaccination coverage, at 62%, remained well short of universal. Socio-demographic variables other than residence showed limited influence in both data streams, consistent with the qualitative observation of no strong perception differences by age or gender (Table 6).

Table 6: Joint display: integration of quantitative and qualitative findings

Domain	Quantitative finding	Qualitative finding	Integrated interpretation
Knowledge	Good knowledge associated with 4.9-fold higher odds of full vaccination (p<0.001)	Lack of awareness and misconceptions repeatedly cited as barriers	Knowledge is a key determinant of vaccination uptake
Occupation	Vaccination status differs significantly by profession (p<0.05)	Training exposure and peer influence vary by occupational role	Professional environment influences vaccination behaviour
Access / policy	Overall coverage moderate (62% fully vaccinated)	Institutional barriers: limited access, absent policy, cost	System-level gaps reduce vaccination coverage
Residence	Urban residence associated with higher vaccination (p<0.01)	Not separately explored as a distinct qualitative theme	Residence influences uptake, plausibly via differential access
Age / gender / marital status	No significant association with vaccination status	No strong perception differences by age or gender	Demographic factors have limited influence on uptake

DISCUSSION

The present study found that Hepatitis B vaccination coverage among healthcare workers in this tertiary care hospital was suboptimal, with only 62% fully vaccinated despite 80% having received at least one dose. This gap between partial and complete vaccination is itself informative: it suggests that the principal obstacle for a meaningful proportion of healthcare workers is not outright refusal but failure to complete an already-initiated three-dose schedule, pointing towards logistical and follow-up barriers -

time constraints, competing clinical duties, and the absence of a structured institutional reminder or tracking system - rather than vaccine refusal as such. This level of coverage sits below the near-universal uptake that would be expected given the vaccine's long availability and its more than 90% protective efficacy, and is broadly consistent with the wider Indian literature on this question: seroprevalence studies have repeatedly shown that HBsAg positivity remains two to four times higher among healthcare workers than in the general population, an excess risk that persists precisely because vaccination coverage in this occupational group has not kept pace with the scale of occupational exposure.[4] Earlier Indian data placed vaccination coverage among healthcare workers at around 60%, a figure this study's 62% full-vaccination rate closely mirrors, suggesting that, at least in some tertiary care settings, coverage has changed little over the intervening years despite growing awareness of occupational blood-borne pathogen risk.[5]

The strong association between knowledge level and vaccination status - healthcare workers with good knowledge being nearly five times more likely to be fully vaccinated - reinforces a finding that recurs across the wider literature on Hepatitis B vaccination in high-risk occupational and student populations, where knowledge, attitude, and practice are consistently found to move together.[2] The qualitative data in the present study give this statistical association a human face: participants did not simply lack facts about Hepatitis B in the abstract, but held specific, actionable misconceptions - about how the virus spreads, about the vaccine's safety, and about their own personal risk - that a generic awareness campaign might not by itself correct, and that instead call for structured, occupation-specific education delivered at the point of induction and reinforced periodically thereafter.

The significant variation in vaccination status by profession, with doctors showing the highest full-vaccination rate and support staff and laboratory technicians showing comparatively lower rates, is consistent with a pattern seen elsewhere: occupational groups with more formal medical training and more structured induction processes tend to show higher uptake, while ancillary and support staff, who are nonetheless exposed to the same infectious hazards in the course of their duties, often receive comparatively less occupational health orientation. The qualitative theme of training exposure and peer influence as facilitators is directly relevant here, since it implies that extending the same structured induction and peer-modelling processes already effective among clinical staff to support staff could plausibly narrow this gap.

The absence of a significant association between vaccination status and age, gender, or marital status, corroborated by the qualitative finding of no strong perception differences by age or gender, suggests that demographic targeting is unlikely to be a productive strategy for improving coverage in this population; the more actionable levers, on this evidence, are knowledge, occupational category, and - in view of the significant urban-rural difference observed - the accessibility of vaccination services, which may plausibly be more limited for healthcare workers commuting from or residing in rural areas.

Taken together, the qualitative themes of institutional and systemic barriers - limited on-site accessibility, the absence of a clear institutional vaccination policy, and cost where vaccination is not provided free of charge - point towards a specific, remediable explanation for the persistence of suboptimal coverage despite generally favourable attitudes towards vaccination in principle. This is consistent with global guidance identifying low- and middle-income country health systems as facing particular structural constraints in achieving universal Hepatitis B prevention coverage, even where individual-level awareness is reasonably good.3 The present findings suggest that institutional factors are not merely a backdrop to individual decision-making but can themselves act as facilitators once addressed - free, on-site vaccination and a clearly stated institutional policy mandating vaccination for all new employees being the most directly actionable of the measures identified.

The principal strength of this study lies in its mixed-methods design, which allowed the quantitative associations to be interpreted in light of the reasons participants themselves gave for their vaccination behaviour, rather than being left to speculative interpretation. The study is nonetheless subject to certain limitations: it was conducted at a single tertiary care institution, which may limit the generalisability of the findings to hospitals with different staffing patterns, institutional policies, or resource availability; vaccination status was based on self-report rather than independent verification against vaccination records or serological testing; and the qualitative component, while conducted to the point of thematic saturation, involved a comparatively small number of in-depth interviews that may not have captured the full range of perspectives across all occupational categories represented in the quantitative sample.

CONCLUSION

The present study found that Hepatitis B vaccination uptake among healthcare workers was suboptimal, with only about 60% being fully vaccinated. Vaccination uptake was significantly associated with knowledge level, profession, and residence, while other socio-demographic factors did not show a significant association. The qualitative findings revealed that lack of awareness, misconceptions, low risk perception, time constraints, and institutional barriers were major factors hindering

vaccination, whereas training exposure, peer influence, and prior exposure to infection-control education acted as key facilitators. The integration of the qualitative and quantitative findings highlights that both individual-level and systemic-level factors jointly influence vaccination behaviour among healthcare workers, and that neither an educational intervention nor a policy intervention alone is likely to be sufficient without the other.

Recommendations

Improving awareness, accessibility, and institutional policies will help to enhance Hepatitis B vaccination uptake among healthcare workers. Specifically, this study's findings support: structured, occupation-specific education addressing the particular misconceptions identified in this population, extended to support staff and laboratory technicians alongside clinical staff; provision of free, on-site vaccination with active follow-up to ensure completion of the full three-dose schedule, particularly for workers who have received only a partial course; and the introduction of a clear institutional policy mandating Hepatitis B vaccination as a condition of employment for all categories of healthcare worker, supported by a tracking system to identify and follow up workers with incomplete vaccination status.

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