

Impact of Hepatitis B Vaccination and Post-Exposure Prophylaxis (PEP) with Antiviral Therapy on Occupational Health Risks among Dental Professionals in Pakistan: A Community Medicine Perspective

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ABSTRACT

Background: The risk of occupational exposure to blood-borne infections, especially Hepatitis B virus (HBV), is increased in dental professionals, as they often come into contact with body fluids and sharp tools that are contaminated with body fluids. The main preventive measures include vaccination and post-exposure prophylaxis (PEP); nevertheless, the level of their usage is not optimal in most low- and middle-income countries, including Pakistan.

Objective: To assess the impact of Hepatitis B vaccination and post-exposure prophylaxis (PEP) with antiviral therapy on occupational health risks among dental professionals in Pakistan.

Methods: This cross-sectional analytical research was carried out in the period between July 2022 and July 2023 at Lyari General & Teaching Hospital, Karachi. A non-probability convenience sampling approach was used to include 72 dental professionals. Data were obtained using a structured and pretested questionnaire that included demographic features, work exposure, vaccination status, and PEP practices. The analysis of the data was done using SPSS version 25 and the results were represented by frequencies, percentages, and mean with standard deviation. While associations were assessed using the chi-square test.

Results: The mean age of participants was 32.6 ± 7.8 years, with a majority being female (56.9%). Needle-stick injuries were reported by 54.2% of participants. Approximately 66.7% were fully vaccinated against HBV, while 13.9% were unvaccinated. Only 30.6% of participants received PEP following exposure. HBV infection was observed in 8.3% of participants. A statistically significant association was found between vaccination status and HBV infection ($p = 0.01$), as well as between PEP utilization and infection risk ($p = 0.03$), indicating higher risk among unvaccinated individuals and those not receiving PEP.

Conclusion: Dental professionals remain at considerable occupational risk of HBV infection due to inadequate vaccination coverage and poor PEP utilization. Strengthening vaccination programs, improving awareness, and ensuring timely access to PEP are essential to enhance occupational safety.

Keywords: Hepatitis B, Vaccination, Post-Exposure Prophylaxis, Dental Professionals, Occupational Exposure, Pakistan.

INTRODUCTION

Hepatitis B virus (HBV) is a significant public health issue of great concern in many countries worldwide, most especially in developing nations where the disease is a heavy burden and in most cases the healthcare facilities are minimal. HBV is highly contracted by coming into contact with infected blood and body fluids and therefore healthcare workers, particularly dental practitioners are highly exposed to occupational risks. Dental practitioners are one of the most susceptible groups to contracting HBV infection because of the nature of the dental practices, which often involve sharp tools, aerosols, and direct contact with saliva and blood⁽¹⁻³⁾.

Hepatitis B vaccination has been shown to be the best preventive vaccine with over 90 percent protection provided when the entire program is undertaken. Moreover, post-exposure prophylaxis (PEP) such as injecting Hepatitis B immunoglobulin (HBIG) and antiviral therapy is a vital intervention in preventing the infection following accidental exposure. Although these preventive measures are available, low and middle-income research studies such as that of Pakistan hail lack optimization in vaccination coverage, low awareness, and adherence to PEP measures among the dental professionals⁽⁴⁻⁶⁾.

The level of HBV in Pakistan is moderately high, and there are frequent reports of work-related exposure among health workers. Nevertheless, there are loopholes in infection control measures, regular immunization schedules, and the use of PEP in a timely manner. Lots of dental workers are fully or half-vaccinated or do not even examine their immunity, which makes them more vulnerable to infection. Moreover, exposure incidences are not reported as they should be and delayed PEP initiation also contributes to greater occupational health hazards⁽⁷⁻⁹⁾.

Despite the numerous research on the prevalence and vaccination of HBV in healthcare workers, very little evidence has been found on the overall effect of vaccination and post-exposure prophylaxis on occupational health risks among dental practitioners in Pakistan. Moreover, the existing literature does not often incorporate a community medicine view that incorporates preventive measures, awareness, and gaps in the healthcare systems.

Therefore, this study aims to assess the impact of Hepatitis B vaccination and post-exposure prophylaxis (PEP) on occupational health risks among dental professionals, while identifying key gaps in preventive practices. The findings of this study may help inform public health policies, strengthen infection control strategies, and improve occupational safety in dental healthcare settings.

MATERIAL & METHODS

This cross-sectional analytical study was conducted over a period of one year from July 2022 and July 2023 at Lyari General & Teaching Hospital, Karachi. The study aimed to evaluate the impact of Hepatitis B vaccination and post-exposure prophylaxis (PEP) with antiviral therapy on occupational health risks among dental professionals in Pakistan from a community medicine perspective.

The sample size of 72 participants was calculated using the World Health Organization (WHO) formula for estimating a proportion, given as $n = (Z^2 \times p \times (1 - p)) / d^2$, where $Z = 1.96$ at a 95% confidence level, $p = 0.5$ (assumed prevalence due to variability in existing literature), and $d = 0.1$ (margin of error of 10%). Substituting these values, the calculated sample size was $n = (1.96^2 \times 0.5 \times 0.5) / (0.1^2)$, which equals approximately 96 participants. However, due to feasibility constraints and limited access to dental professionals, a final sample size of 72 participants was included in the study.

Participants were recruited through a non probability convenience sampling method and included dentists, dental

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assistants, and dental hygienists that were actively engaged in clinical practice. Inclusion criteria included dental professionals aged 20 years and older, with six months of clinical experience, and a desire to take part in the study. The exclusion criteria were persons not in direct contact with the patient or those with missing information and those who refused to provide consent.

A structured, pre-tested questionnaire was used to collect data with sections on demographic characteristics, occupational exposure history (needle-stick injuries and blood/body fluids exposure), Hepatitis B vaccination status, knowledge and awareness on infection control, and post exposure prophylaxis practices. The questionnaire was constructed according to the general guidelines in regard to infection control and literature.

Before data collection, the instrument was checked by the professional review to determine the content validity and pilot study was made on 10% of the sample size (that is not analyzed in the final version) to check the clarity and reliability. Appropriate changes were made. Cronbachs alpha was used to determine the reliability of the questionnaire and the reliability was acceptable (>0.7).

The data were inputted and analyzed in SPSS version 25. The data were summarized using descriptive statistics where quantitative variables (e.g., age) were summarized using the mean and standard deviation, and qualitative variables (e.g., vaccination status, exposure history, PEP practices) were summarized as frequencies and percentages. To analyze the results, the associations between the variables in the study (vaccination status, PEP usage, and occupational exposure) were evaluated by using the chi square statistical test.

RESULTS

The population studied was mainly comprised of young to middle-aged dental experts, and there was a minor female majority. The majority of respondents were practicing dentists with different years of experience.

A significant percentage of dental practitioners cited work-related exposure to blood and sharp objects. The reported needle-stick injuries were frequent, which indicated greater occupational risk.

Most of the participants were immunized; but, there were lapses in full vaccination and testing on immunity.

The use of post-exposure prophylaxis (PEP) was not optimal among the participants despite high rates of exposure.

Table 1: Demographic Characteristics of Participants (n = 72)

Variable	Category	Frequency (%)	Mean ± SD
Age (years)	—	—	32.6 ± 7.8
Age Group	20–30 years	30 (41.7%)	—
	31–40 years	25 (34.7%)	—
	>40 years	17 (23.6%)	—
Gender	Male	31 (43.1%)	—
	Female	41 (56.9%)	—
Professional Role	Dentist	46 (63.9%)	—
	Dental Assistant	16 (22.2%)	—
	Dental Hygienist	10 (13.9%)	—
Experience	<5 years	28 (38.9%)	—
	5–10 years	24 (33.3%)	—
	>10 years	20 (27.8%)	—

Table 2: Occupational Exposure Profile (n = 72)

Variable	Category	Frequency (%)
Needle-stick Injury	Yes	39 (54.2%)
	No	33 (45.8%)
Frequency of Exposure	Once	18 (25.0%)
	Occasional	29 (40.3%)
	Frequent	25 (34.7%)
Exposure Type	Blood	44 (61.1%)
	Saliva	52 (72.2%)
	Sharp Instruments	47 (65.3%)
PPE Usage	Regular	49 (68.1%)
	Irregular	23 (31.9%)
Infection Control Compliance	Yes	46 (63.9%)
	No	26 (36.1%)

Table 3: Hepatitis B Vaccination and Immunity Status (n = 72)

Variable	Category	Frequency (%)
Vaccination Status	Fully vaccinated	48 (66.7%)
	Partially vaccinated	14 (19.4%)
	Not vaccinated	10 (13.9%)
Booster Dose	Yes	26 (36.1%)
	No	46 (63.9%)
Anti-HBs Testing	Yes	29 (40.3%)
	No	43 (59.7%)
Immunity Status	Protected	45 (62.5%)
	Not Protected	27 (37.5%)

Table 4: Post-Exposure Prophylaxis (PEP) Practices (n = 72)

Variable	Category	Frequency (%)
Exposure Requiring PEP	Yes	35 (48.6%)
	No	37 (51.4%)
PEP Received	Yes	22 (30.6%)
	No	50 (69.4%)
Type of PEP	Vaccine Booster	14 (19.4%)
	HBIG	5 (6.9%)
	Antiviral Therapy	3 (4.2%)
Time to PEP Initiation	<24 hours	10 (13.9%)
	24–72 hours	7 (9.7%)
	>72 hours	5 (6.9%)
PEP Completion	Yes	18 (25.0%)
	No	54 (75.0%)

Table 5: Occupational Risk and Outcomes (n = 72)

Variable	Category	Frequency (%)
HBV Infection Status	Positive	6 (8.3%)
	Negative	66 (91.7%)
Occupational Risk Level	Low	24 (33.3%)
	Moderate	28 (38.9%)
	High	20 (27.8%)
High Risk in Unvaccinated	Yes	8 (11.1%)
	No	64 (88.9%)
High Risk without PEP	Yes	15 (20.8%)
	No	57 (79.2%)

Table 6: Association of Hepatitis B Vaccination and PEP with HBV Infection (n = 72)

Variable	Category	HBV Positive n (%)	HBV Negative n (%)	Total	p-value
Vaccination Status	Vaccinated (Full + Partial)	2 (3.3%)	60 (96.7%)	62	0.01*
	Not Vaccinated	4 (40.0%)	6 (60.0%)	10	
PEP Received	Yes	1 (4.5%)	21 (95.5%)	22	0.03*
	No	5 (10.0%)	45 (90.0%)	50	

There was still a high occupational health risk especially when the person is not vaccinated, and when the person does not use PEP after exposure.

As shown in this table, the relationship between vaccination status, PEP use, and hepatitis B infection exists. The prevalence of HBV infection was found to be higher in people who were not vaccinated and those who did not get PEP after exposure.

DISCUSSION

The present study highlights a significant occupational health burden among dental professionals, with a high prevalence of needle-stick injuries and exposure to blood and body fluids. Similar findings have been reported globally, where dental healthcare workers are considered a high-risk group due to frequent exposure to contaminated sharps and oral fluids. The observed exposure rate in this study aligns with international data indicating that millions of healthcare workers experience percutaneous injuries annually, emphasizing the persistent risk of blood-borne infections such as Hepatitis B. This underscores the need for strict adherence to infection control practices in dental settings¹⁰⁻¹².

The vaccination coverage against hepatitis B in this study was moderate, as about 2/3 of the study participants had full vaccination.

This aligns with the results found in Pakistan, where dentist coverage of vaccination has been reported to be at 66.8 per cent, yet again with non-compliance with the three-dose regimen. Although a good vaccine offers over 90% protection, vaccination and post-vaccination immunity tests continue to have gaps, making healthcare workers more vulnerable to them. The lower percentage of people who undergo anti-HBs testing in the present study also reflects the lack of the monitoring of immunity status¹³⁻¹⁵

The use of post-exposure prophylaxis (PEP) in this research was not optimal, although the proportion of the participants reporting cases of exposure was high. These are similar findings in the recent literature, in which compliance with PEP protocols is still low among dental professionals, in many cases because of lack of awareness, delayed reporting, or institutional support. To note, vaccinated people have been indicated to reveal a higher degree of adherence to PEP guidelines, implying that preventive practices and knowledge are connected to each other. The late start and failure to finish PEP in this research could jeopardize the effectiveness of the intervention and predispose the risk of infection¹⁶⁻¹⁸

The research also revealed the occupationally continuing risk of Hepatitis B infection, which showed a calculated percentage among the participants. Past research reveals that despite vaccination, there is still a risk of residual infection due to incomplete immunization, waning immunity, or no booster doses among vaccinated healthcare workers. In addition, unvaccinated persons are at a great risk of infection after needle-stick injuries and the rates of transmission reported range between 6 -30% based on the viral load and exposure conditions. This data supports the significance of full vaccination, frequent screenings of antibodies, and timely vaccination⁽¹⁹⁾.

According to the community medicine perspective, the results of the current research reveal the existing systemic gaps in the preventive healthcare provision such as the lack of vaccination, the lack of PEP use, and the lack of adherence to infection control measures. The World Health Organization highlights that the free provision of vaccination and PEP services are the key strategies to eliminate occupational Hepatitis B transmission⁽²⁰⁾. To enhance occupational safety in Pakistan dental professionals, it is important to strengthen institutional policies, training programs, and awareness campaigns to improve occupational safety among dental professionals.

CONCLUSION

The study concludes that dental professionals in Pakistan remain at considerable occupational risk for Hepatitis B infection due to high exposure rates, incomplete vaccination coverage, and suboptimal utilization of post-exposure prophylaxis. Although Hepatitis B vaccination provides substantial protection, gaps in full immunization, immunity assessment, and timely PEP significantly compromise its effectiveness. Strengthening vaccination programs, ensuring routine antibody testing, promoting early PEP initiation, and improving infection control practices are essential to reducing occupational health risks and enhancing the safety of dental healthcare workers.

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