

Dental Students' Knowledge, Attitudes, and Practices Regarding Blood-Borne Pathogens and Occupational Hazards: A Cross-Sectional Study

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ABSTRACT

Introduction: Dental students are among the healthcare professionals at greatest risk of occupational exposure to blood-borne pathogens (BBPs), including Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Immunodeficiency Virus (HIV). The nature of dental procedures—frequent use of sharp instruments, close contact with saliva and blood, and aerosol generation—makes them particularly vulnerable. Despite the inclusion of infection control training in dental curricula, gaps persist in students' understanding, attitudes, and implementation of standard precautions.

Aim: To assess the knowledge, attitudes, and practices (KAP) of dental students regarding blood-borne pathogens and occupational hazards, and to identify areas needing educational and institutional improvement.

Method: A descriptive cross-sectional questionnaire-based study was conducted among 150 dental students from Krishna Vishwa Vidyapeeth, School of Dental Sciences, Karad, Maharashtra. Participants were selected using simple random sampling. Data were collected through a structured, self-administered online questionnaire comprising 22 multiple-choice questions that covered knowledge, attitude, and practice domains related to BBPs and occupational safety. Responses were analyzed using SPSS software, employing descriptive statistics and chi-square tests to assess relationships among the KAP variables.

Results: (Placeholder: To be updated with actual findings.) Preliminary analysis suggests that while most students demonstrate adequate theoretical knowledge of BBPs and their transmission routes, there are notable gaps in consistent adherence to universal precautions and post-exposure reporting practices. Attitudes toward infection control were generally positive, though personal risk perception remained low among certain groups.

Conclusion: The study highlights the need for reinforced infection control education, regular workshops on occupational safety, and improved institutional policies for exposure reporting and management. Strengthening these areas will enhance safety awareness, protect both students and patients, and foster a stronger culture of infection prevention in dental education.

INTRODUCTION

Occupational exposure to blood-borne pathogens (BBPs) remains a major concern in healthcare settings, particularly in dentistry, where practitioners are routinely exposed to blood, saliva, and sharp instruments. The primary pathogens of concern include Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Immunodeficiency Virus (HIV), which can be transmitted through needlestick injuries, mucosal splashes, or contact with contaminated instruments. Such exposures can have serious health, psychological, and legal implications for affected individuals.

Dental students, during their clinical training, are especially vulnerable because they are in the process of acquiring technical skills and may not yet have fully developed competence in infection control. Despite the availability of infection control guidelines and post-exposure management protocols issued by bodies such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), several studies have documented inconsistent adherence among dental students. Factors contributing to this include limited awareness, inadequate training, fear of stigma, lack of confidence in handling exposures, and underreporting of incidents.

Infection control education is an essential component of the dental curriculum, emphasizing the use of personal protective equipment (PPE), proper sterilization, safe handling of sharps, vaccination against HBV, and adherence to universal precautions. However, the translation of theoretical knowledge into practical behavior remains uneven. Understanding students' **knowledge, attitudes, and practices (KAP)** regarding BBPs provides critical insight into areas where educational interventions and institutional policies can be strengthened.

Several international and national studies have reported variations in KAP levels among dental and medical students. For instance, Al-Dharrab (2010) found that although most dental students recognized HIV as a major occupational hazard, many underestimated their personal risk. Similarly, Askarian et al. (2007) noted that a substantial proportion of students failed to report needlestick injuries, highlighting a gap between knowledge and action. In India, where exposure risk is compounded by high patient load and varying compliance with safety norms, such studies are vital to improve professional preparedness and patient safety.

This study aims to evaluate the knowledge, attitudes, and practices of dental students regarding BBPs and occupational hazards in a dental teaching institution in Western Maharashtra. By identifying specific deficiencies and misconceptions, the research seeks to contribute evidence-based recommendations for curriculum enhancement, infection control training, and the development of a culture of safety within dental education

MATERIALS AND METHODS

Study Design and Setting

This study employed a **cross-sectional descriptive research design** to assess the knowledge, attitudes, and practices (KAP) of dental students regarding blood-borne pathogens (BBPs) and occupational hazards. The study was conducted at **Krishna Vishwa Vidyapeeth (Deemed to be University), School of Dental Sciences, Karad, Maharashtra, India**. The study duration was three months, from the commencement of data collection to the completion of analysis and reporting.

Study Population

The target population consisted of undergraduate dental students (third-year, final-year, and internship students) and **postgraduate dental professionals** affiliated with the institution. These participants were selected because they are actively engaged in clinical training and are, therefore, at potential risk of occupational exposure to blood-borne pathogens.

Sampling Method and Sample Size

A **simple random sampling** technique was adopted to minimize selection bias and ensure representativeness across different academic levels. Based on feasibility and institutional student strength, a **sample size of 200 participants** was determined to provide adequate statistical power for descriptive and comparative analyses.

● Inclusion Criteria:

- All dental students (undergraduate and postgraduate) who were actively enrolled and willing to participate.
- Students who had begun or completed clinical postings involving direct patient contact.

● Exclusion Criteria:

- Students who declined to provide consent for participation.
- Students who were on academic leave or not involved in clinical training during the study period.

Data Collection Instrument

Data were collected using a **structured, self-administered questionnaire** developed and validated by the investigators after a review of relevant literature. The questionnaire consisted of **22 multiple-choice questions**, organized into four sections:

- **Section A:** Demographic information (age, gender, year of study, previous infection control training, HBV vaccination status)
- **Section B:** Knowledge-related items assessing awareness of BBPs, routes of transmission, universal precautions, and post-exposure prophylaxis
- **Section C:** Attitude-based items evaluating perceptions of occupational risk, confidence in prevention, and willingness to report exposures
- **Section D:** Practice-related items addressing compliance with PPE use, exposure management, and reporting behavior

The questionnaire was designed in **Google Forms** to facilitate convenient online distribution, data security, and automatic compilation of responses.

Data Collection Procedure

Participants were invited to take part in the study via institutional communication channels, including **WhatsApp groups and email**. Each invitation contained a brief explanation of the study's purpose and a unique link to the online survey. Before accessing the questionnaire, participants were required to read and accept an **informed consent form**, confirming voluntary participation and confidentiality.

The survey was anonymous, and no personal identifiers were collected. Participants were informed that their responses would be used exclusively for academic research and that they could withdraw at any time without penalty. To ensure response reliability, only one submission per participant was allowed.

Ethical Considerations

Ethical approval for the study was obtained from the **Institutional Ethics Committee (IEC)** of Krishna Vishwa Vidyapeeth, School of Dental Sciences, Karad (Protocol No.: {113/2025-2026}). The study adhered to the ethical principles outlined in the **Declaration of Helsinki (2013)**.

Participants' autonomy, confidentiality, and anonymity were strictly maintained throughout the study. No invasive procedures or patient interactions were involved. The research posed minimal risk, with the only potential discomfort being mild emotional unease when reflecting on past occupational exposures. Data were stored securely and accessible only to the principal investigator.

Data Analysis Plan

All responses were exported from Google Forms into **Microsoft Excel** for preliminary cleaning and coding, then analyzed using **IBM SPSS Statistics Software (Version XX)**.

- **Descriptive statistics** (frequency, percentage, mean, and standard deviation) were used to summarize demographic data and KAP responses.
- **Inferential statistics** were applied to identify associations among variables:
 - The **Chi-square test** was used to assess relationships between categorical variables such as knowledge and practice levels.
 - A **Pearson correlation** may be applied, where appropriate, to explore linear associations among KAP domains.
- A significance level of **$p < 0.05$** was considered statistically significant.

Results were presented in the form of **tables, charts, and graphs** for clarity and comparison across different academic groups.

Operational Definitions

- **Knowledge:** Understanding of BBPs, their transmission, and preventive measures.
- **Attitude:** Participants' perception of risk, motivation, and willingness to adopt preventive behavior.
- **Practice:** Actual implementation of infection control measures and post-exposure actions during clinical activities.

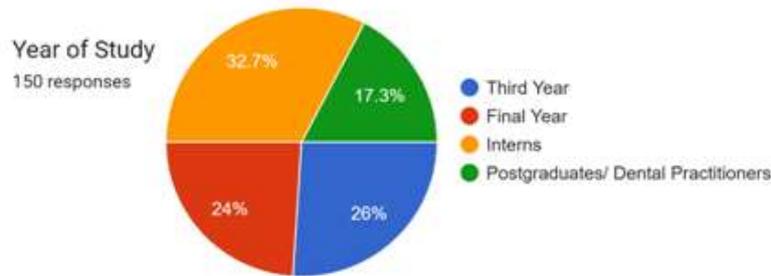
Study Phases

1. **Phase I – Planning and Tool Development (Month 1):**
Literature review, questionnaire design, and ethics approval.
2. **Phase II – Data Collection (Month 2):**
Online survey distribution and response compilation.
3. **Phase III – Data Analysis and Reporting (Month 3):**
Statistical analysis, interpretation, and manuscript preparation.

Result: A total of **150 dental students** participated in the survey assessing knowledge, attitudes, and practices regarding blood-borne pathogens (BBPs) and occupational hazards.

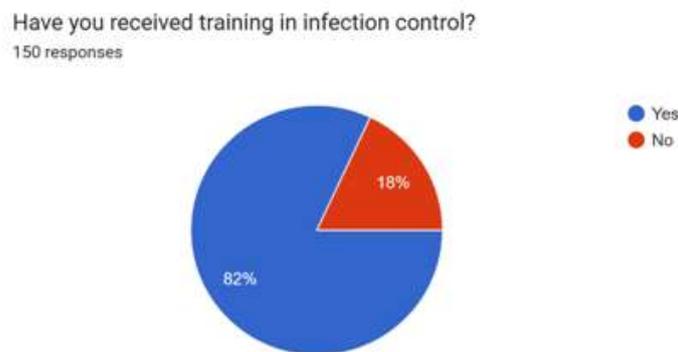
Demographics

- **Age distribution:** The majority of respondents were aged **21–25 years**, with a few in the **18–20 years** group.
- **Gender:** Most participants were **female**, with males representing a smaller proportion.
- **Year of study:** Responses were obtained from students across **third year** and **internship**, with interns comprising the largest group.

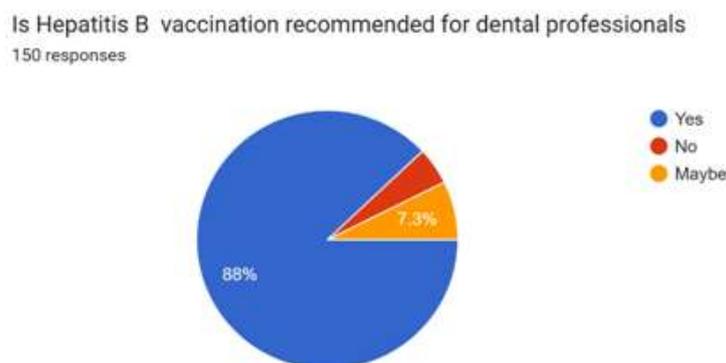


Knowledge and Training

- **Infection control training:** A significant proportion of students (>80%) reported receiving formal training in infection control.



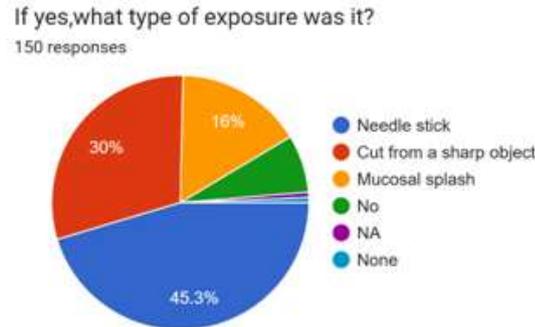
- **Awareness of BBPs:** Nearly all respondents correctly identified that **blood-borne pathogens can be transmitted via needle-stick injuries.**
- **Vaccination:** Most students were aware that **Hepatitis B vaccination is recommended for dental professionals, and the majority reported being vaccinated.**



- **Universal precautions:** Almost all participants correctly agreed that **universal precautions apply to all patients, regardless of their health status.**

Occupational Exposure

- About **30–40%** of respondents reported having **experienced occupational exposure** (e.g., needle-stick injury or mucosal splash).
- The most common exposures were during **clinical or invasive dental procedures.**
- Of those exposed, **many did not formally report the incident.**
- Common reasons for **non-reporting** included **perceived minor exposure, lack of awareness of the reporting system, and time constraints.**



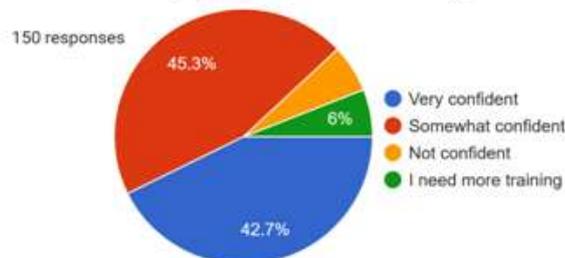
Attitudes and Perceptions

- **Confidence in prevention:** Most respondents expressed **confidence** in their ability to prevent BBP exposure.
- **Use of personal protective equipment (PPE):** The majority reported **consistent use of gloves, masks, and protective eyewear** during dental procedures.
- **Mandatory reporting:** Almost all students agreed that **reporting BBP exposure should be mandatory**.
- **Further training:** A large majority (over 85%) felt they **would benefit from additional training** on BBP prevention and reporting.

HIV-Related Knowledge

- **Training:** About two-thirds of participants had **received specific training** on HIV-related occupational exposure prevention.
- **Reporting HIV exposure:** Nearly all respondents indicated that they **would immediately report** any exposure to a patient's blood known to be HIV-positive.
- **Confidence in managing HIV-positive patients:**
 - **Very confident:** 64 (42.7%)
 - **Somewhat confident:** 68 (45.3%)
 - **Need more training:** 9 (6%)
 - **Not confident:** 9 (6%)

Rate your confidence in managing a patient with HIV safely in a dental setting.



DISCUSSION

The present study assessed the knowledge, attitudes, and practices (KAP) of dental students regarding blood-borne pathogens (BBPs) and occupational hazards in clinical settings. The findings demonstrate that while overall awareness of infection control protocols is satisfactory, there are notable deficiencies in exposure reporting behavior and confidence in managing high-risk situations such as HIV-positive patients.

Knowledge of Blood-Borne Pathogens and Infection Control

A substantial proportion of participants demonstrated good theoretical knowledge concerning BBPs and their modes of transmission. Over **87%** of the students recognized that BBPs can be transmitted through needle-stick injuries, and **88%** were aware that **Hepatitis B vaccination is recommended** for dental professionals. These findings align with similar studies conducted among dental students in India, Saudi Arabia, and Nigeria, which also reported high awareness of HBV and HIV as major occupational hazards in dentistry (Sharma et al., 2020; Al-Dharrab, 2019). However, although the majority were aware of recommended vaccination protocols, only **two-thirds (66.7%)** had completed the **Hepatitis B vaccination** series. This gap between knowledge and practice has been consistently

observed in other studies (Singh et al., 2021), indicating that awareness does not always translate into preventive action. Strengthening vaccination compliance through institutional monitoring and education is therefore essential.

Furthermore, the high proportion (79.3%) who acknowledged that **universal precautions apply to all patients** indicates an encouraging level of understanding regarding infection control. Yet, the remaining 20% who were uncertain or disagreed highlight an area that requires reinforcement, especially through regular workshops and clinical supervision emphasizing the rationale for universal precautions.

Training and Educational Exposure

Infection control training plays a vital role in improving awareness and compliance. In this study, **82%** of participants reported having received formal infection control training. This is comparable to findings from studies conducted in Malaysia and Pakistan (Rahman et al., 2020), which reported rates ranging from 70% to 85%. Nonetheless, nearly one-fifth of students lacked such training, underscoring the need for integration of infection control modules into the core dental curriculum and routine refresher programs.

In addition, only **63%** of students reported receiving specific training on **HIV-related occupational exposure prevention and management**. This limited exposure may explain why a small but relevant proportion of respondents expressed a **lack of confidence** or **need for additional training** when managing HIV-positive patients. Given that HIV remains a significant occupational concern in dental practice, structured competency-based learning—covering both clinical and ethical aspects of HIV management—is warranted.

Occupational Exposure and Reporting Behavior

Approximately **41%** of respondents reported having experienced occupational exposure, mainly in the form of needle-stick injuries or mucosal splashes. This prevalence is consistent with data from other developing countries (Kumar et al., 2018), where the prevalence of exposure among dental trainees ranges between 35% and 60%. The high frequency of occupational injuries among students is expected, given their relative inexperience and limited psychomotor control during clinical procedures. Alarming, only **28.7%** of those exposed **reported the incident** to the relevant authorities. The main reasons for underreporting included perceptions of **minor exposure**, **lack of awareness of reporting protocols**, and **time constraints**. These findings reflect global trends, where underreporting of occupational injuries among healthcare students remains a persistent issue (Prabhu et al., 2020). Institutional policies should ensure that reporting mechanisms are simple, accessible, and non-punitive to encourage compliance.

Attitudes and Practices Toward Infection Control

Attitudinally, most participants displayed positive perceptions toward infection prevention and control. Nearly all respondents agreed that **reporting BBP exposure should be mandatory**, and over **85%** expressed interest in **additional training** on prevention and reporting procedures. This proactive attitude reflects a strong foundation for building safer clinical behaviors through continued education.

In terms of personal protective practices, **72%** of students reported consistent use of gloves, masks, and eyewear. Although encouraging, this figure falls short of the universal compliance standards expected in clinical settings. Studies by Aboalshamat et al. (2019) and Nagaraj et al. (2021) have reported similar gaps in PPE adherence among dental students, often attributed to discomfort, perceived inconvenience, or inadequate supervision. Regular reinforcement of PPE use through faculty monitoring and institutional mandates may help address this deficiency.

Confidence and Competence in HIV Management

Confidence in managing HIV-positive patients varied among respondents. While **42.7%** reported being very confident, nearly **12%** expressed either low confidence or a need for more training. This mixed response indicates partial preparedness to handle HIV-related occupational scenarios. The correlation between targeted training and increased confidence has been well documented (Adeyemo et al., 2022). Therefore, practical simulations, post-exposure prophylaxis (PEP) workshops, and patient-interaction modules should be incorporated to bridge the competence gap.

Comparative Insights and Implications

Overall, the results suggest that **knowledge levels among dental students are acceptable**, but **behavioral and systemic gaps persist**, particularly regarding vaccination compliance, exposure reporting, and consistent PPE use. These findings echo those of global studies emphasizing the “knowledge–practice gap” in infection control among healthcare trainees (WHO, 2022). The results underscore the need for an institutional culture that promotes infection control not merely as an academic requirement but as a professional and ethical obligation.

LIMITATIONS

This study relied on self-reported data, which may be subject to social desirability and recall bias. Additionally, as the study was limited to a single institution, the findings may not be fully generalizable to all dental training programs.

Future research should include multi-center studies and evaluate the impact of structured infection control interventions longitudinally

Demographic Characteristics

Variable	Response	n					%
Age	18–20	36					24.0
	21–25	80					53.3
	26–30	25					16.7
	31 and above	9					6.0
Gender	Female	93					62.0
	Male	57					38.0
Year of Study	Third Year	39					26.0
	Final Year	36					24.0
	Interns	49					32.7
	Postgraduates / Practitioners	26					17.3
Knowledge and Awareness							
Question	Response	N				%	
Received training in infection control	Yes	123				82.0	
	No	27				18.0	
Knowledge of blood-borne pathogens	TB, HIV, Hepatitis B, Hepatitis C	52				34.7	
	HIV, Hepatitis B, Hepatitis C	49				32.7	
	HIV, Hepatitis B	16				10.7	
	Others (TB only / partial)	33				22.0	
BBP transmission via needle stick injuries	Yes	131				87.3	
	Maybe	10				6.7	
	No	9				6.0	
Hepatitis B vaccination recommended for dentists	Yes	132				88.0	
	Maybe	11				7.3	
	No	7				4.7	
Vaccinated against Hepatitis B	Yes	100				66.7	
	No	50				33.3	
Universal precautions apply to all patients	Yes	119				79.3	
	No	18				12.0	
	Maybe	13				8.7	

Exposure and Reporting

Question	Response	n					%
Experienced occupational exposure (e.g., needle-stick injury)	Yes	6 2					41. 3
	No	8 8					58. 7
Reported the exposure	Yes	4 3					28. 7
	No	1 0 7					71. 3
Reasons for not reporting	Considered minor exposure	3 8					25. 3
	Not aware of reporting procedure	3 5					23. 3
	Time constraints / negligence	3 4					22. 7

Attitudes and Practices

Question	Response	n					%
Use of protective equipment (gloves, masks, eyewear)	Always	1 0 8					72 .0
	Sometimes	3 6					24 .0
	Rarely	6					4. 0
Confidence in preventing BBP exposure	Very confident	7 0					46 .7
	Somewhat confident	6 4					42 .7
	Not confident	9					6. 0
	Need more training	7					4. 6
Reporting BBP exposure should be mandatory	Agree	1 4 4					96 .0
	Disagree / Neutral	6					4. 0
Need for more training on BBP prevention	Yes	1 3 0					86 .7
	No	2 0					13 .3

HIV-Related Awareness and Confidence

Question	Response	n	%
Received training on HIV exposure management	Yes	9 5	63 .3
	No	5 5	36 .7
Would report HIV exposure immediately	Yes	1 3 7	91 .3
	No / Unsure	1 3	8. 7
Confidence in managing HIV-positive patients	Very confident	6 4	42 .7
	Somewhat confident	6 8	45 .3
	Need more training	9	6. 0
	Not confident	9	6. 0

CONCLUSION

This study revealed that dental students possess satisfactory knowledge and positive attitudes regarding blood-borne pathogens (BBPs) and infection control practices. However, significant gaps persist between knowledge and actual clinical behavior, particularly concerning Hepatitis B vaccination compliance, consistent use of personal protective equipment (PPE), and timely reporting of occupational exposures. Although most participants recognized the importance of universal precautions and post-exposure management, underreporting of needle-stick injuries and limited confidence in handling HIV-positive patients highlight areas needing reinforcement.

To bridge these deficiencies, infection control education must be continuously emphasized through structured, competency-based training, simulation exercises, and periodic refresher workshops. Institutions should also strengthen monitoring systems to ensure full vaccination coverage and establish accessible, non-punitive reporting mechanisms for occupational incidents. By fostering a stronger culture of safety, accountability, and preparedness, dental schools can better protect students and patients alike while aligning with global infection prevention standards.

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