

Occupational Exposure to Bloodborne Pathogens and Management of Exposure Incidents in Nigerian Dental Schools

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Abstract: The goal of this study was to determine the frequency of occupational exposures to bloodborne pathogens amongst Nigerian clinical dental students, their HBV vaccination status, and reporting practices. A cross-sectional study of all clinical dental students in the four Nigerian dental schools was carried out by means of an anonymous self-administered questionnaire that asked questions on demography, number and type of exposure, management of the exposures, personal protection against cross infection, and the reporting of such exposures. One hundred and fifty-three students responded (response rate of 84.5 percent). Only thirty-three (37.9 percent) were fully vaccinated against HBV. Ninety (58.8 percent) of the students have had at least one occupational exposure. There was no significantly associated difference between sex, age, location of school, and exposure. Most of the exposures (44.4 percent) occurred in association with manual tooth cleaning. There was inadequate protection of the eyes. None of the exposures were formally reported. It is the responsibility of training institutions to ensure the safety of the students by mandatory HBV vaccination prior to exposure and adequate training in work safety. Written policies and procedures should be developed and made easily accessible to all workers to facilitate prompt reporting and management of all occupational exposures.

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Bloodborne pathogens pose a definite risk for all oral health care workers because of the nature of dental procedures that utilize sharp instruments and also due to the limited access in the oral cavity. The risk of occupational exposure to bloodborne viruses depends on the prevalence of the infection/disease in the patient population and the nature and frequency of contact with blood and body fluid through percutaneous or per mucosal routes.¹ The risk of infection after exposure is influenced by inoculation and route of exposure, as well as the susceptibility of the exposed worker.²

Worldwide, the prevalence of hepatitis B virus (HBV) varies greatly. Compared with Europe and North America, where HBV currently affects less than 1 percent of the population,³⁻⁵ the virus is endemic in areas such as China, Southeast Asia, and Sub-Saharan Africa, including Nigeria, which has carrier

rates exceeding 8 percent.³ Most of the infections in these areas start at childhood usually by perinatal transmission and by horizontal transmission among children.³ Specifically, chronic carrier rates among the general population in Nigeria range from about 12 percent to 48.7 percent in different states and cities.⁶⁻⁹ A prevalence of 18.3 percent of hepatitis B surface antigen was found in patients undergoing extractions at a Nigerian teaching hospital.¹⁰ In this respect, the Nigerian oral health care worker can be said to be at high risk of contracting HBV. A study conducted in 1997 demonstrated the high susceptibility of dentists to Hepatitis B and C infection; the findings of this study indicated that 45 percent of the Nigerian dentists examined had detectable HBsAg, indicating active infection. This level of infection among dentists was significantly higher than that reported among medical doctors in the same study.¹¹

Safe and effective vaccines against HBV have been available since 1982⁵ and have resulted in a dramatic decrease in the prevalence of HBV infection in many countries.¹² Immunization against HBV also substantially reduced the susceptibility of health care workers to HBV infection and is thus an essential part of infection control programs for oral health care workers. Compared with the United States and Canada, where more than 90 percent of dentists have been vaccinated,^{13,14} and the United Kingdom, where more than 90 percent of dental students have been vaccinated,¹⁵ a significant number of dentists in Nigeria are not protected.^{16,17} Dental personnel who either have not completed the course of hepatitis B immunization or who are nonresponders to the vaccine are at significant risk of infection.⁴ However, accidental exposure to hepatitis B infection in such persons can be easily managed with prophylaxis when such exposures are reported and treatment is commenced within a short period.⁴

There are no data on the prevalence of HIV infection among dental staff in Nigeria, either occupationally acquired or otherwise; however, the prevalence of HIV infection among the general population of Nigerians has been reported to be 3.9 percent.¹⁸ In terms of absolute numbers, the country ranks second in Sub-Saharan Africa.¹⁹ Consequently, oral health personnel in Nigeria have substantial risk for occupational exposure to HIV due to the nature of dental treatment and the prevalence of HIV infection among the general population.

One of the groups at risk for exposure is dental students who may be at higher risk due to their inexperience with infection control procedures and the necessity to work on patients without any assistance most of the time. These risks for dental students are supported by a study by Kennedy and Hesler, which found that dental students reported significantly greater numbers of percutaneous and mucosal exposures than any other category of dental health care worker in the United States.²⁰ Therefore, it is necessary that health professions training institutions such as dental schools implement necessary guidelines for infection control and safe work practices, as well as creating a protocol for dealing with reported occupational injuries. Adequate monitoring mandates the reporting of all occupational exposures. Accordingly, the aim of this study was to determine the frequency of occupation exposure in clinical dental students, their HBV immunization status, and the reporting practices and management of exposure incidents in the four dental schools in Nigeria.

Method

The study was a cross-sectional study of all clinical dental students who have spent at least six months in clinical postings in the four dental training institutions in Nigeria (Lagos, Ibadan, Ife, and Benin). A questionnaire was developed from a survey instrument previously used in a study conducted in a UK dental school.²¹ It was pretested for clarity on ten students at the College of Medicine in Lagos who were not included in the final sample. The data were collected between December 2005 and February 2006.

The questionnaire consisted of twenty-six questions on each student's background, HBV vaccination status, frequency of occupational exposures, including number and nature, use of protective equipments, post-exposure management, and reporting practices. Twenty-two of the questions were precoded with an open-ended option tagged "others" where necessary for respondents to specify any answer not included in the options. Questions on the number of exposures and clinic where the exposure occurred were left open ended.

For the purpose of clarity and to guide in answering the questions, a definition of occupational exposure was included in the questionnaire as "any needlestick injury, cut abrasion, or instrument puncture or any other exposure to blood and other body fluids such as splashes into the eyes, nose, mouth, or broken skin."

No institutional approval was required for the collection of this data from students at the four dental schools. However, participation of the students was voluntary, and the questionnaire was anonymous, thereby guaranteeing the confidentiality of the data obtained. The questionnaires were distributed at the end of lecture periods to all clinical dental students who attended the lectures and who were willing to participate. Results were analyzed using the EPI-INFO version 6 software. Chi-square test of association was used to compare differences, and a probability of 0.05 or less was considered statistically significant.

Results

One hundred and fifty-three dental students responded to the questionnaire. This represented an overall response rate of 84.5 percent. Distribution of students and response rate for each school are shown in Table 1.

Table 1. Response rate according to school

School	Number (Total)	Response Rate
Lagos	69 (73)	94.5%
Ibadan	37 (42)	88%
Ife	26 (26)	100%
Benin	21 (40)	52.5%

Eighty-two students (52.6 percent) were twenty-six years and older. There was a statistically significant difference in age distribution among the schools, with respondents from Ife and Benin more likely to be twenty-six years and above ($p=0.000$). Ninety-one (59.5 percent) of the respondents were males; there was no difference in gender distribution of the students among the four schools.

Hepatitis B Vaccination Status and Prevalence of Exposure

Eighty-seven (56.9 percent) students had started the vaccination series, but only thirty-three (37.9 percent) reported that they were fully vaccinated. None reported that they have been tested for sero-conversion. While there was no difference between schools in number of students that have started the vaccination series, there was a statistically significant difference between schools with respect to being fully vaccinated. More than one third of the students from Ibadan (40.5 percent) had completed their vaccinations compared with the other schools ($p=0.0002$). Table 2 shows immunization status in the various schools

Ninety (58.8 percent) of the students admitted to having had at least one occupational exposure to blood and body fluid since they started their clinical training. However, eight of them did not specify the number of exposures they have had. Of the remaining eighty-two students, a total number of 242 exposures were reported, with three students reporting forty-five

(18.6 percent) of these exposures. The mean number of exposures for these eighty-two students was 2.95 (SD 2.91). Students' gender, age, experience, and the location of the school were not significantly associated with frequency of occupational exposure.

Associated Factors

The majority of the students (forty; 44.4 percent) reported that the exposure incidents occurred while performing manual scaling and polishing. This was followed by injuries sustained in the course of giving local anesthesia. This was reported by thirty-one (34.4 percent) of the students. The other procedures that resulted in the exposure incidents are shown in Figure 1. There was no difference in the risk of exposure with respect to time of conducting the procedure (whether the procedure was performed in the morning or afternoon). Also, sixty-five (76.5 percent) of the students reported that they were working unassisted when the exposure occurred.

On the nature of the exposure, puncture wound was the most frequently recorded injury as seen in forty-two (46.7 percent) students. This was followed by splashes of saliva into the eyes (twenty-four; 26.7 percent), splashes of blood (fifteen; 16.7 percent), as well as cuts (seven; 7.7 percent) and abrasions (two; 2.2 percent)

At the time of exposure, eighty-one (90 percent) of the students were wearing latex gloves, sixty-seven (74.4 percent) wore facemasks, and only nine wore protective eyewear (nineteen of the students use prescription lenses). One student had no protection as he was assisting someone else at the time.

Reporting and Management of Exposure

None of the students formally reported the exposure. Thirty-five (38.9 percent) of the students indicated that they did not know that they had to report, while twenty-five (27.8 percent) said there was nobody indicated to receive the report and twenty (22.2 percent) thought it was not necessary. The remaining ten students (11.1 percent) did not respond to the question. Over 90 percent of the students claimed that they are not aware of any guideline or protocol for post-exposure management in their institution.

Table 2. Immunization status according to school

	Not Vaccinated	Incomplete	Full Vaccination	Total
Benin	11/52.4%	7/33.3%	3/14.3%	21
Ibadan	18/48.6%	4/10.9%	15/40.5%	37
Ife	14/53.8%	6/23.1%	6/23.1%	26
Lagos	23/33.3%	37/53.6%	9/13.1%	69
Totals	66	54	33	153

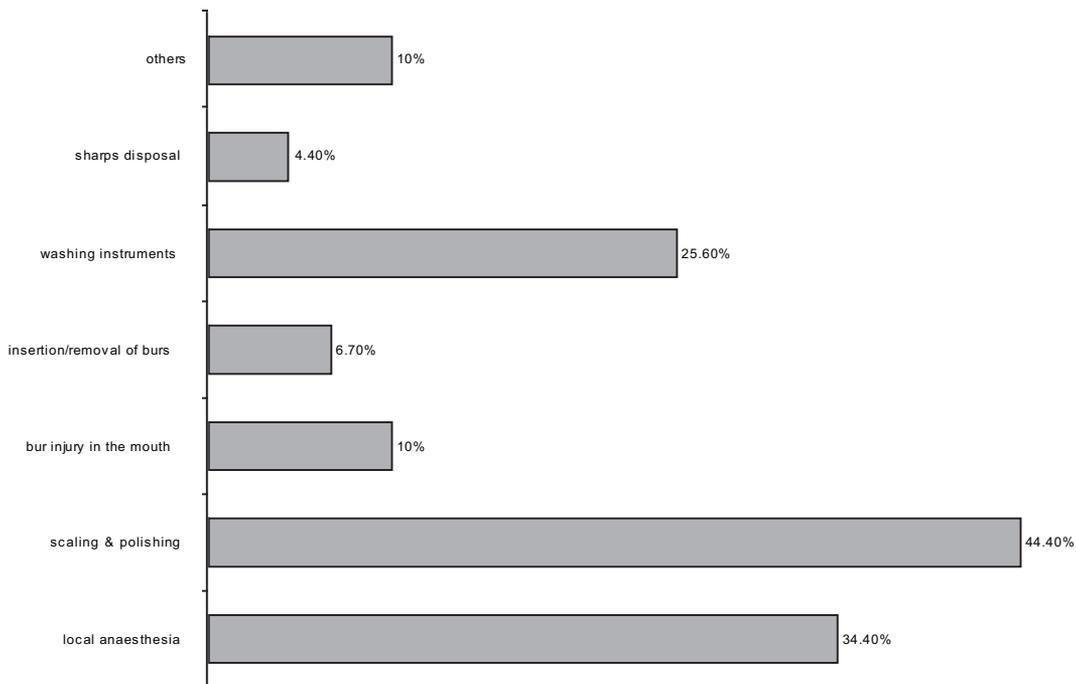


Figure 1. Distribution of procedures causing the exposures

Rinsing of exposure site with water was the most frequently used first aid measure in 46 percent of cases. Other measures used by the students included rinsing with hypochlorite solution (fourteen students) and methylated spirit or denatured alcohol (twenty-four students). However, twelve students (13.3 percent) did nothing concerning the wound, and notably, eight of these students had puncture wounds.

Discussion

This study collected data about exposure to bloodborne pathogens from clinical dental students at the four dental schools in Nigeria. The overall response rate was good and met standards for this type of survey-based research²² in all the schools except Benin, which had some disruptions in the academic year following closure of the university.

The findings indicated a very low rate of HBV vaccination with only thirty-three (37.9 percent) students completing the three-dose vaccination series. The vaccination rate is much lower than that

noted amongst dental students in the UK.¹⁵ A similar low rate of uptake of HBV vaccination has been reported among cadres of dental personnel including dental students at the University College Hospital, Ibadan, despite the free access to the vaccine for all workers²³ and amongst Nigerian dentists in another study.¹⁶ However, this study found that students from Ibadan still had a higher rate of vaccination than the other three universities; this can be attributed to the reported free access to the vaccine. Therefore, the rate of vaccination can be improved if the other universities take a cue from this example.

The low vaccination rate reported is a serious shortcoming, especially in an area regarded as endemic for the hepatitis B virus.³ This stresses the need for closer monitoring and enforcement of vaccination amongst dental personnel including dental students. It is the responsibility of training institutions to ensure that students are protected against hepatitis B virus before they are placed in clinical situations where they are at risk for exposure to HBV. A number of reasons may be responsible for the failure to complete the vaccination series although this study did not investigate for the possible reasons. There

appears to be a high rate of noncompliance with multiple dose vaccines.^{24,25}

For the population under consideration, more in-depth study is necessary to develop protocols that can be put into place to help improve students' compliance with the vaccination regime in view of its critical importance for both their health and the patients' health.

The finding from this study that 58.8 percent of the students have experienced occupational exposures demonstrates that dental students are at a high risk of developing serious infections with bloodborne pathogens including HIV infection. For example, it has been shown that the estimated risk of acquiring infection of hepatitis B from a percutaneous exposure ranges from 5 to 45 percent.²¹

In contrast to findings in Canada,²⁶ where bur injuries were the most frequently recorded exposures among dental students, the use of manual instruments for tooth cleaning appears to be associated with the highest rate of occupational injury in our study. This is somewhat similar to findings in the UK, which noted that the greatest percentage of exposures amongst year five students occurred during tooth cleaning.^{15,21} Manual cleaning of teeth and root surfaces requires dexterity and good techniques. Our study suggests that there may be an indication for more training of the students especially in work practice controls. Such controls might include restricting the use of the fingers for tissue retraction and minimizing the potential uncontrolled movements of scalers and similar instruments.

Another factor that might increase the risk of occupational exposures may be the absence of chairside assistants. More exposures were noted to have occurred when students were working alone than when assisted in the UK.²¹ Nigerian students frequently work unassisted due to shortage of chairside assistants, who are referred to as dental nurses in Nigeria. Shortage of middle level oral health manpower is a problem in Nigeria and may be due to an inadequate number of training schools leading to inadequate supply rather than financial reasons. An effort to address this shortage involves a new dental nursing training program at the Lagos University Teaching Hospital. It is anticipated that the training program will increase the number of assistants to parallel the increase in dental student enrollment, which has occurred in recent years.

Students' use of personal protective equipment in this study, which is a critical component of standard precautions, was found to be similar to

a previous Nigerian study,¹⁶ which noted that the use of protective eyewear was inadequate. Only 10 percent of the students in this study were wearing protective eye shields. Although some students wore prescription glasses, prescription glasses alone are not acceptable to adequately protect the eyes. Protective eyewear should have solid side shields or alternatively a face shield.¹ This finding, however, is not peculiar to Nigeria, as the study in the UK also noted that 60 percent of the students were not wearing protective eyewear when they experienced an exposure incident.²¹ While the risk of infection is less with mucosal splash than via percutaneous injuries, this may be an important route of exposure in this population, considering the fact that saliva and blood splashes were the next most commonly cited exposures after puncture wounds. Dental students should receive instructions to help them understand the risks associated with treating patients without protective eyewear; hopefully, comprehension of the risks will improve compliance with the use of protective eyewear.

An aspect of post-exposure management that was completely inadequate was the reporting of occupational exposures. None of the students reported the exposure incidents. Although studies have observed that reporting of occupational exposures in most centers is generally low,^{20,21,27} reasons given by the students in this study centered around the lack of post-exposure protocol in each of the centers. This is similar to reasons given by a group of Nigerian dentists in a previous study.¹⁷ We confirmed that post-exposure management protocols exist in all four Nigerian schools, but the implementation of these protocol appears to be suboptimal given the students' lack of awareness of these procedures. There is a need for the development of a formal reporting protocol, which would include the exact protocol to be followed as well as the consequences of not reporting. It is important that such protocol and post-exposure incident services be introduced to students at the time of their orientation before they begin their clinic experiences. Access to such programs should be readily available and rapid so that the time between exposure and post-exposure prophylaxis is as short as possible.

Conclusions

A combination of standard precautions, engineering, work practice, and administrative controls

are the best means to minimize occupational exposures amongst all oral health care workers including students. It is the responsibility of training institutions to ensure the safety of the students by requiring mandatory HBV vaccination prior to exposure and adequate training in work safety. It is important that there are written policies and procedures to facilitate prompt reporting and management of all occupational exposures; this information should be made easily accessible to all workers. Adequate monitoring mandates the reporting of all occupational exposures and is a means of quality control in health care delivery. We would like to recommend, therefore, that processes for monitoring occupational exposures be made functional in all Nigerian dental schools to promote safety, quality, and value in the oral health care services provided.

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