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# Knowledge, Exposure, and Reporting Practices of Blood Exposure Accidents among Dentists in Tunisia: A Survey of 308 Tunisian Dentists

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## Abstract

Blood exposure accidents [BEAs] are major occupational hazards in dental practice, since they carry the risk of transmission of potentially fatal pathogens like Human Immunodeficiency Virus [HIV], Hepatitis B and C [HBV and HCV]. Although protocols for prevention and management of BEAs are well established, knowledge gaps and underreporting are prevalent especially in North African countries like Tunisia. This study aims to evaluate the level of awareness, frequency of exposure and reporting practices of BEAs among Tunisian dentists. A cross-sectional and single-center study was conducted among dentists from June 28 to November 18 2022 that included professors, residents, interns, private practice dentists and public sector dentists. A 16-item survey was created using "Google Form" and distributed via email and in Tunisian dentists Facebook groups. 50 printed copies were distributed in the academic dental clinic of Monastir. An excel sheet and the "IBM SPSS" software were used for data analysis of the respondents, 50.6% demonstrated sufficient knowledge regarding general aspects of BEAs; however, 63% reported feeling inadequately informed about their management. A total of 168 BEAs were recorded, of which only 29.8% were officially reported to occupational health authorities' Tunisian dentists possess sufficient knowledge regarding BEAs and their management, Nevertheless, many still feel ill-informed about the subject. Providing additional information could strengthen their knowledge, encourage reporting and enhance prevention efforts in Tunisia.

**Keywords:** Blood exposure accidents, Bloodborne pathogenes, Blood exposure accidents management, Prevention, Specialized training, Education.



## INTRODUCTION

According to the "Groupe d'étude sur le risque d'exposition des soignants" [GERES], A blood exposure accident [BEA] is defined as any contact with blood or a biological fluid containing blood that involves either a skin breach [such as a needle stick or cut] or a splash onto a mucous membrane [eye, mouth] or damaged skin [1]. Accidents occurring under similar circumstances with other biological fluids such as genital secretions, cerebrospinal fluid [CSF], synovial, pleural, peritoneal, pericardial, or amniotic fluids are also considered BEAs [1]. These fluids should be regarded as potentially infectious even if they are not visibly contaminated with blood, similar to a BEA [1].

Potentially fatal pathogens are transmissible via BEAs such as HIV, HVB and HVC with transmission rates hovering around 23% to 37% for HVB, 0.3% for HIV and 1.8% for HVC [2]. Dentists are particularly exposed to BEAs since they deal with rotary instruments, anesthesia needles and sharp instruments. Despite being a high-risk population, there is a limited scientific data available on BEAs for dental care professionals.

In a 2018 retrospective study conducted by the staff of the hospital of Farhat Hached, Tunisia, the departments of dentistery and internal medicine were among the highest departments affected by BEAs [3].

Mrabet, K *et al.,* [2013] concluded that dental care professionals require additional training in dental safety procedures in his observational study among dentists in the region of Bizerte, Tunisia. [4]

Hajjaji Darouiche *et al.,* [2010], found that among the trainee doctors, dental interns were the most affected with BEAs with a prevalence of 87.7% and 85% of these incidents occurred with contamined needle sticks [5]

If we consider the limited body of evidence pertaining to the subject of BEAs both locally and internationally and that dentists are a high-risk population, it is very legitimate to hypothesize that dentists, especially trainees have limited knowledge on the subject. Hence, the objective of this study was to evaluate the current level of knowledge regarding BEAs and their management. Additional objectives included establishing an overview of the main BEAs situations experienced by these students, identifying possible reasons for underreporting, and listing suggestions for improvement in BEAs prevention proposed by the dentists.

## MATERIALS AND METHODS

**Population:**

This descriptive, analytical, declarative, quantitative, and single-center epidemiological study was conducted among Tunisian dentists from June 28 to November 14, 2022. Interns, residents, hospital-university assistants, hospital-university professors, public health dentists, as well as private practice dentists were included in this study. We excluded 4$^{th}$ and 5$^{th}$ year students due to their limited practical experience.

## METHOD

**1) Data collection process:**

We created a 16-question survey in French using "Google Forms" platform, we sent the form via email to the maximum number of eligible dentists starting from June 18 2022. We also published the form in the largest Facebook group for dentists.

We printed 50 copies and distributed them in the academic dental clinic of Monastir. The form completion took 10 minutes, and we strictly maintained anonymity. Dentists were regularly reminded to fill the form via email and Facebook groups on order to maximize the number of responses. We concluded data collection on November 14 2022, after five months of recruitment.

**2) Variables collected:**

We included eight clinical vignettes with multiple-choice responses in the the survey's first section. This was designed to assess dentists on practical situations they might have encountered or are likely to encounter in their work: one vignette covered the definitions of blood exposure accidents [BEAs], another covered transmission risks, two focused on cleaning the affected area, three addressed the necessary medical follow-up, and the last vignette was about BEA reporting. We assigned 100 score for the first section, based on a total of 43 items. We classified responses into four categories according to rate of correct responses: very satisfactory knowledge [>75%], satisfactory [between 50% and 75%], insufficient [between 25% and 50%], and very insufficient [below 25%]. The final part of the questionnaire concerned the participant' possible experience with BEAs during their years of practice, asking about the context of these incidents, their reporting, and possible reasons for non-reporting to occupational health services. Finally, we invited participants to share their opinions and suggestions for improving BEA prevention.

**3) Outcome measures**

The primary objective of this study was to evaluate the knowledge level of dentists regarding BEAs and their management. Therefore, the percentage of correct answers to the knowledge questions in the first section was used as the primary outcome measure. We included the annual BEA incidence rate, context and incidence according to professional status and, the rate of BEA reporting, causes of non-reporting and the proposed preventive measures suggested by participants as secondary outcome measures.

**4) Data processing and statistical analysis**

We analyzed the data exported from "Google" form using "Microsoft excel" and "SPSS" software.

Descriptive analysis: Observed counts and frequencies [%] were used to describe qualitative variables Qualitative variables were described using observed counts and frequencies [%]. As for quantitative variables, we assessed data distribution using skewness and kurtosis coefficients and normality tests. These variables were described by means and standard deviations.

**Analytical analysis:**

For associations between two qualitative variables, Pearson's chi-square test was used for comparing two frequencies when assumptions were met; otherwise, Fisher's exact test was applied. For associations between a qualitative and a quantitative variable, Student's t-test was used for comparing two means, and ANOVA was employed for comparing multiple means. In multivariate analysis, binary logistic regression was applied to calculate Odds Ratios [OR] with 95% confidence intervals [CI]. A significance threshold of $p \leq 0.05$ was adopted.

## RESULTS

**1) Population of the study:**

Our study involved 308 dentists of various grades over a period of five months, from June 18, 2022, to November 14 of the same year.

The largest proportion of participants were private practice dentists [n=107; 34.7%], followed by interns [n=98; 31.8%] and residents [n=40; 13%] while

professors and assistant professors were the lowest 5.5% and 4.5% respectively [Figure 1].

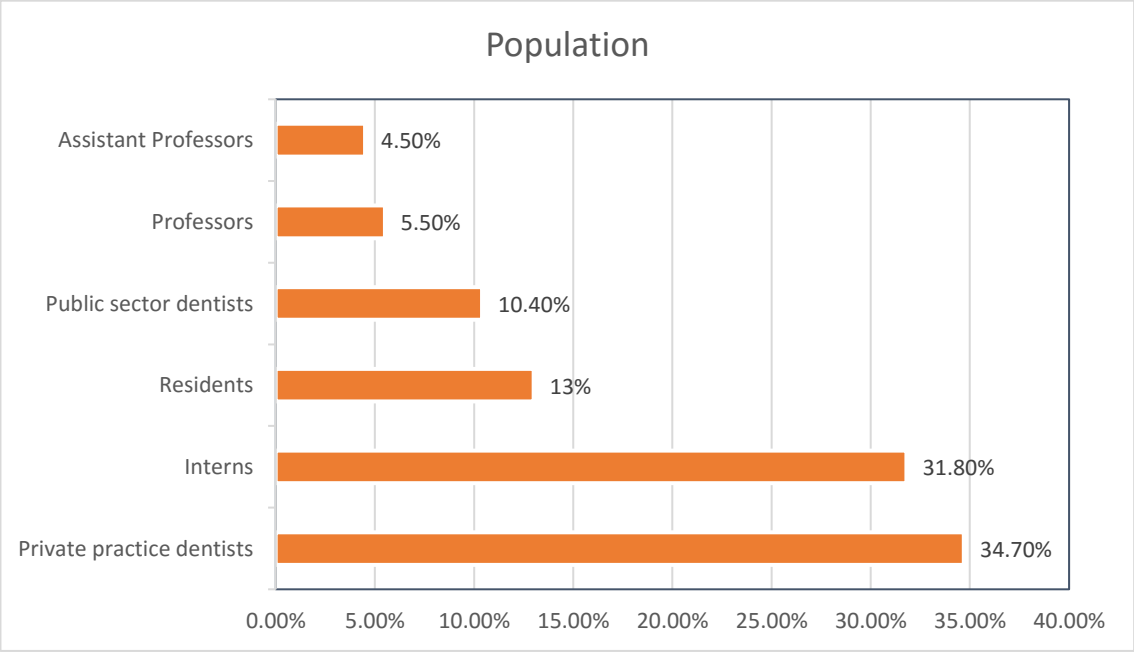


**Figure 1: Distribution of the study population according to professional status**

**2) Primary outcome measure: the knowledge level of participants regarding BEAs**

The overall average knowledge score on BEAs was 56.18 out of 100. University hospital professors achieved the highest scores [81.06/100], while interns had the lowest scores [47.05/100]. More than half of the participants [67.2%] had satisfactory to very satisfactory knowledge [n=207]; Those who had insufficient to very insufficient knowledge were 32.8% [n=101]. [Figure 2]. When assessing the sources of information for participants, personal experience during internship ranked the highest [n=96; 32,2%] followed by university courses [n=78;25.3%]. [Figure 3]. The majority of participants [n=218; 70.8%] were between inadequately informed and completely uninformed. [Figure 4]

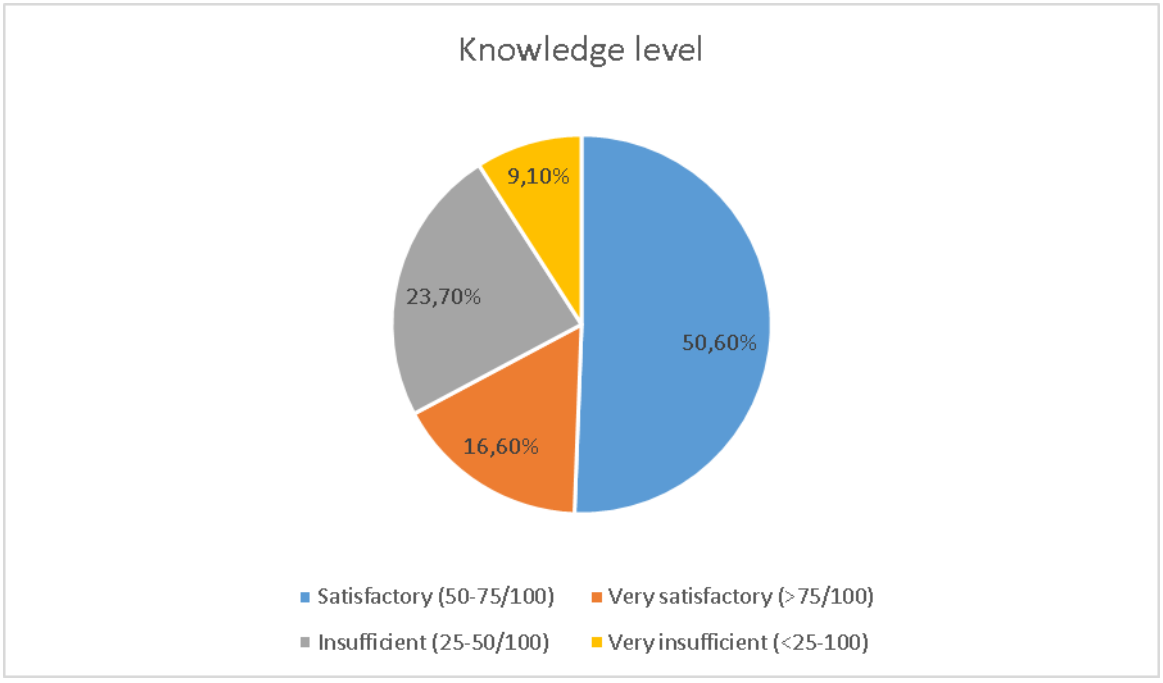


**Figure 2: Participants' knowledge levels regarding BEAs**

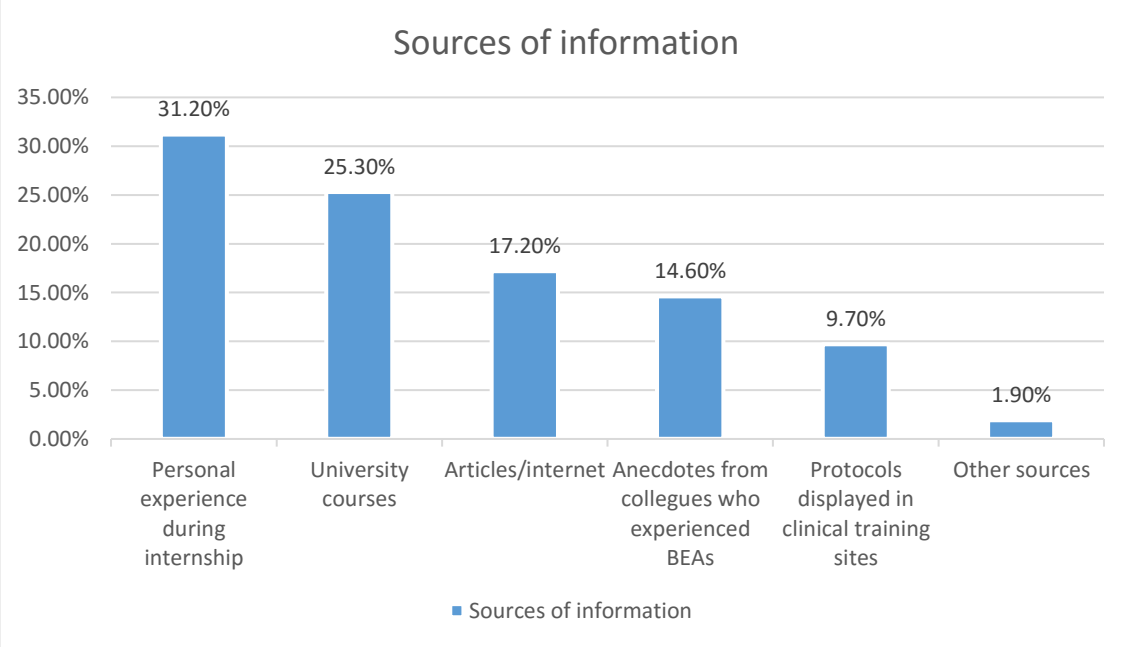


**Figure 3 : Participants' sources of information regarding BEAs**

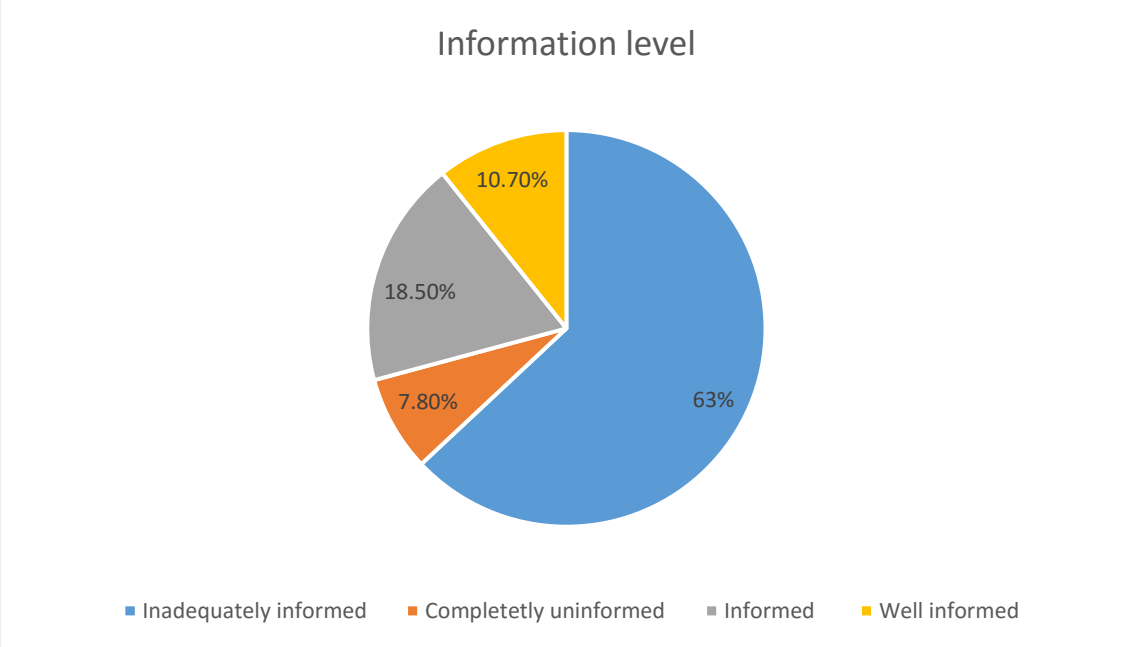


**Figure 4 : Information level regarding BEAs**

**3) Secondary outcomes measure**

**a] Blood exposure accidents frequency, context and incidence according to professional status:**

More than half of the participants [54.5%, n=168] were victims of BEAs. Recapping the needle was the main source of these incidents, accounting for 51.2% of the incidents followed by blood or saliva projection into the eyes [41.1%] [Figure 5]. Public sector dentists, assistant professors and professors were the most affected by BEAs. These findings are likely due to the poorer working conditions. However, since most BEAs occurred during the internship year [59.85%], interns appear to be at the highest risk possibly due to their lack of experience and limited technical proficiency with sharp instruments.

**b] Blood exposure accidents reporting and causes for non-reporting:**

Out of the 168 participants who experienced BEAs, only 50 [29.8%] reported them to the occupational health services. The "lack of information regarding reporting procedures" emerged as the primary cause of non-reporting [52.5%] followed by the

"Complexity of the reporting procedure" [50.8%]. [Figure 6].

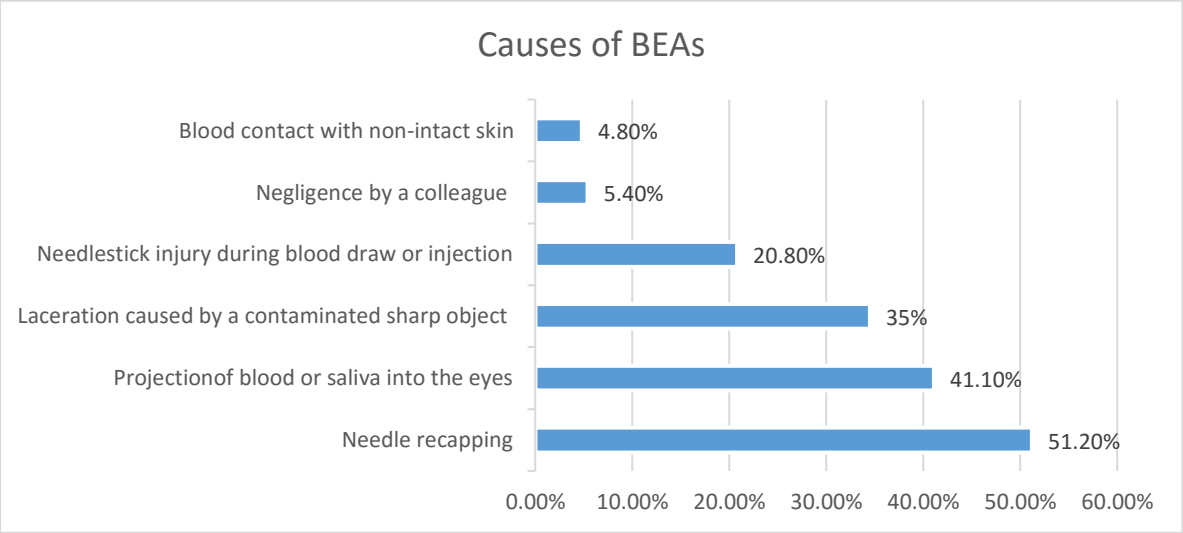


**Figure 5: Causes of blood exposure accidents**

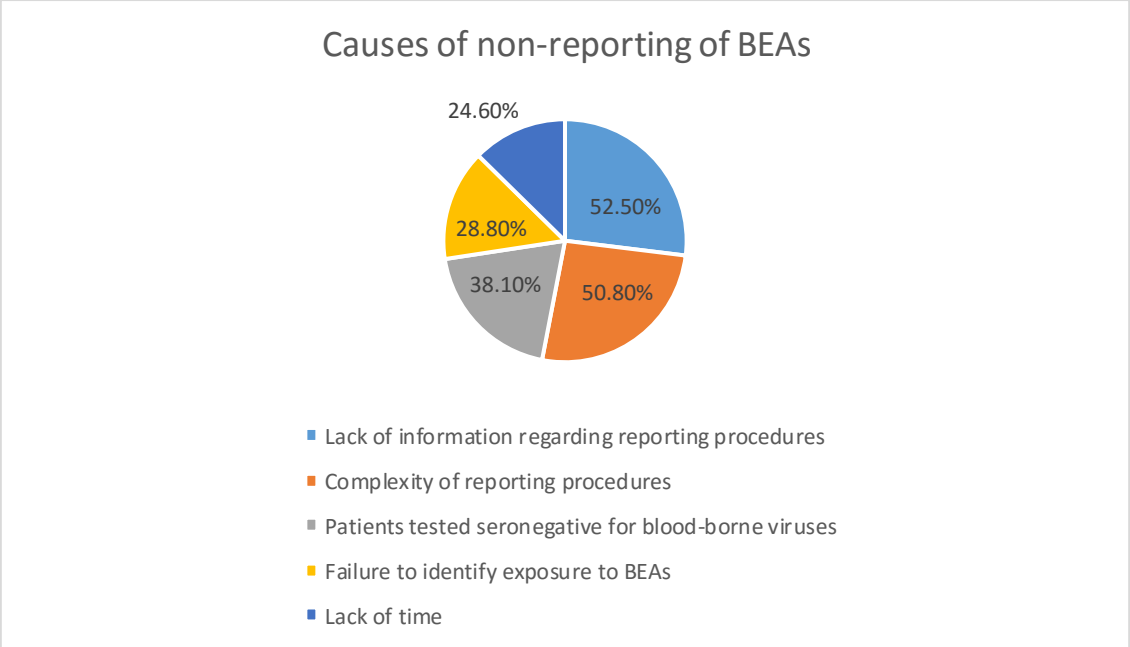


**Figure 6: Causes of non-reporting of BEAs**

**c] Preventive measure suggested by participants:**

We divided all the participants' suggestions into three main categories: Optimizing access to information regarding BEAs, improving prevention and management of BEAs in the workplace and facilitating BEA reporting.

**First section:** Optimizing access to information regarding BEAs:

- Providing free training on BEAs [n=42]
- Integrate specific BEAs courses in the university curriculum [n=18]
- Oragnizing regular conferences or seminars on BEAs [n=10]
- Distribution of flyers and brochures [n=7]
- Conducting awareness campaigns [n=5]
- Developing a mobile application with BEA-specific information [n=2]
- Other methods to facilitate access to information [9]: Dentists suggested other methods to improve information access, including sending periodic informative letters from the dental union about protocols to follow in BEA situations and contact details. Publishing BEA-related information on official

groups and pages, creating specific manuals summarizing the emergency protocols for BEAs and distributing them to healthcare personnel, and making a comprehensive downloadable electronic reference guide available, including decision trees or sheets to consult immediately after an accident.

**Second section:** Improving prevention and management of BEAs in the workplace

- Posting protocols in the workplace [27]
- Enhancing supervision during internships [17]
- Regular staff meetings during internships [9]
- Improving working conditions [10]

**Third section:** Facilitating BEA reporting.

- Simplifying reporting and management protocols [9]
- Other suggestions to facilitate BEA reporting [2]: Additional suggestions included establishing an occupational health service within the dental medicine clinic of Monastir and computerizing the healthcare management procedures related to occupational medicine services, such as appointment scheduling, follow-up on possible doses, advice, and information on management modalities.

## DISCUSSION

In our study, 50.6% of the surveyed participants had a satisfactory knowledge level regarding BEAs. These findings suggest that Tunisian dentists are well informed in these accidents. Only 16.6% of participants had very satisfactory knowledge level, and the majority of whom were university professors. In contrast, 23.7% of participants had insufficient knowledge and 9.1% had very insufficient knowledge. Dental interns recorded the lowest score with an average of 47.05% ± 19.76. This contrast in results confirms the initial hypothesis of this study, which suggested that dental interns may have insufficient knowledge on the subject of BEAs, This gap is likely due not only to their lack of clinical experience compared to other dental professionals, but also to inadequate training on blood exposure accidents [BEAs] during their university education.

For comparison, a 2012 study conducted in a U.S. dental education institution [6] found that all students [both preclinical and clinical] answered more questions correctly regarding the transmission of bloodborne pathogens [66.7%] than questions on post-exposure management [25%]. Fewer than half of the students reported having adequate knowledge about transmission and post-exposure management [47.5% and 37.3%, respectively].

Likewise, a 2015 study conducted in Rabat on BEAs among dental students [7] reported that over 65% of participants had good knowledge of the main infections transmitted by BEAs [HIV, hepatitis B and C viruses]. These findings are consistent with studies by Kasat *et al.,* [8], Souza *et al.,* [9], and Khandelwal *et al.,* [10], where the majority of students demonstrated good knowledge in this area. However, most students in our study had incomplete knowledge of BEA management, a situation similar to that observed in two dental schools in China [11].

All these studies align with the findings of our research, highlighting a clear lack of training on BEAs among dental students during their academic education.

In our study, 54.5% of dentists [n=167] reported at least one blood exposure accident [BEA] during their training. These findings are consistent with similar findings in Germany [54.3%] [12], Rabat [42.7%] [7], Iran [80%] [13], Nigeria [58.8%] [14], and China [15] [71.2%]. In the same context Sedky *et al.,* [16] [2013, Egypt] and Wu L *et al.,* [17] [2016, China] reported that dental students were the most exposed population with prevalence rates of 86.9% and 33% respectively. These results are consistent with the ones of Pavithran *et al.,* [18] [2015, India] who reported a variance prevalence in third cycle dentistry students [14.3% to 42.9%]. These findings are in favor of the hypothesis that the degree of training is a factor in BEAs.

In our survey public sector dentists, assistant professors, and university hospital professors were more exposed to blood exposure accidents [BEAs] than private practitioners, likely due to poorer working conditions. They also had more BEAs over their careers compared to residents and interns, suggesting that longer professional experience increases cumulative risk.

However, most BEAs occurred during the internship year [59.85%], indicating that interns are at the highest risk mainly due to limited experience, poor mastery of clinical procedures, and unfamiliarity with safety protocols. Factors like time pressure and new techniques were also reported as contributing causes [19].

A 2021 Australian study is consistent with our finding, reporting that 65% of dental interns were exposed to BEAs in contrast with a 34.4% prevalence among practicing dentists. [20]

Similarly, a study on BEAs among dentists in South Africa [21] found the highest incidence among undergraduate dental students 62.1% of the 116 reported exposures followed by 14.7% among postgraduate students.

These findings are consistent with other studies from the United States [22]. A cross-sectional observational study conducted in Germany found that 12% of medical students sustained injuries during their

first year of training, compared to 41% in their fourth year [23].

And for the final outcome measure which is the frequency and causes of non-reporting, in our study, only 29.8% of the 168 dentists who had experienced at least one BEA during their career reported the incident. Among the 118 who did not report [70.2%].

Sabine Wicker & Holger F. Rabenau [12] found a similar reporting rate [28.5%], though the main reason for non-reporting there was the perception of low or no risk.

Xu YL *et al.,* [15] also found a high rate of underreporting [67.1%], with dentists being the most affected [73.7%], followed by dental students [68.0%] and nurses [56.4%]. Similarly, Allaudin Siddiqi et al [11], found that nearly 50% of students failed to report BEAs because they believed the infection risk was very low.

Underreporting is a global issue, rates as low as 3 to 30% are consistently reported in studies [24,25,26]. For example, Askarian reported 85% underreporting [27], Mangione 80% [25], and Tarantola 69% [28]. Heptonstall *et al.,* [29] warned that only 1–10% of blood exposures are ever officially reported, and that effective systems should be well-publicized, easy to use, non-judgmental, confidential, and lead to appropriate follow-up.

In our study population, the lack of information, procedural complexity and underestimation of risk [especially if the patient is seronegative] were among the main causes of non-reporting. Other studies also cited low perceived risk and time constraints as major reasons [30].

At the dental clinic of Monastir, the absence of an on-site occupational physician [requiring referral to another hospital] discourages compliance with BEA protocols, particularly among interns. Even though antiretroviral treatment is provided free of charge, the system fails to adequately support the victim.

**Recommendations for improving BEA prevention**

**Raise awareness among dentists:**

Many dentists in our study admitted lacking proper knowledge of BEAs and their management, a gap also seen among practicing professionals. Strengthening education—both initial and ongoing—is essential. Integrating a dedicated BEA module into the dental curriculum and improving preclinical training could enhance awareness and procedural safety. Notably, in Western Algeria, BEA reporting among interns rose significantly after introducing a prevention session in the 6th-year program [31]. In Mali, 99.6% of healthcare workers expressed a need for BEA training [32] Vaccination and monitoring of hepatitis B immunity [anti-HBs >10 IU] must also not be neglected.

**Promote universal precautions:**

BEA prevention also relies on strict adherence to standard precautions:

- Wearing gloves
- Handwashing
- Caution when handling sharp or contaminated instruments
- Use of puncture-proof containers for needles and sharp tools
- Wearing masks, protective eyewear, and gowns in high-risk situations

**Improving the working conditions:**

Providing adequate safety equipment is critical. Items like gowns, goggles, and face shields if available and correctly used can significantly reduce BEA risks. The available equipment should also be new and well-adapted to the procedures.

**Simplify BEA management**

**To enhance BEA management, creating a** "BEA Kit" **is a practical solution. This kit could include:**

- A reminder sheet with first-aid steps
- First-aid materials [DAKIN solution, mild soap doses, saline, bandages, etc.]
- Clear and simplified post-exposure protocols
- Required administrative documents for declaring the incident to occupational health
- Information on necessary tests [source and exposed person serology]
- Explanation of the medical follow-up process

There are many online resources and information sheets. A BEA management kit has also been developed in Tunisia by CMM Tunisia [33] [see Annex 2].

**Heads of departments could implement these kits and post informative posters within their services to ensure:**

- Early and optimal management of BEAs
- Centralized access to necessary materials
- Easier access to information
- Reassurance for interns who lack knowledge

Private practice dentists could do the same in their clinics. It would also be beneficial for dental schools to present these kits during BEA-focused workshops. Use of rapid diagnostic orientation tests.

These tests have been available for about 15 years and, since the 2008 French HAS guidelines [34], are recommended in certain emergency situations like BEAs. A study on the utility of rapid diagnostic orientation tests [RDOT] in BEA management [35] showed that, despite their advantages [results in under 30

minutes, usable by dentists], they remain underused due to a lack of training.

## CONCLUSION

This study showed that Tunisian dentists had moderately good knowledge of BEAs, with 50.6% scoring between 50–75% on clinical scenarios. However, 63% still felt poorly informed. This knowledge gap significantly affected BEA reporting, with only 29.8% of those exposed having reported the incident. Participants suggested improving education through targeted training, early and ongoing informational support [e.g., visible kits in clinics], and better awareness among healthcare staff. They also recommended improving hospital working conditions, simplifying reporting protocols, and strengthening initial training especially for interns with emphasis on standard precautions

**Conflict of Interest:** No conflict of interest is declared.

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