

Incidence and Management of Occupational Blood Exposure (OBE) among Medical Students at the University of Bangui

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Abstract

Introduction: Like healthcare workers, medical students are also exposed to a risk of accidental contamination during their hospital internships. However, they do not benefit from prevention services in the same way as workers in this sector, although they actively participate in the routine care provided to patients in the various hospital departments. The objective of our study is to determine the incidence of these accidents and their medical and administrative management among these victims (medical students) not classified in the category of workers. **Materials and Method:** This was a cross-sectional study carried out over three months from January 15 to March 14, 2023. The study population consisted of all medical students at the Faculty of Health Sciences at the University of Bangui. Regularly enrolled students from 2nd to 7th year, on placement in hospitals in the Central African Republic and who gave their informed consent were included. Data were collected through a self-administered questionnaire. **Results:** A cross-sectional study was carried out among medical students concerning the incidence and management of accidents involving exposure to blood in the Central African Republic. Of the 254 students included, three (9%) had already been correctly vaccinated against the viral hepatitis B virus, 198 (77.9%) reported still having access to personal protective equipment, 133 students (52.4%) reported being victims of OBE in the past 12 months. The main types of OBE were stings (62%), followed by liquid splashes (32%) and cuts (6%). Among the 133 victims, 92.9% carried out immediate hand disinfection or abundant eye washing, 41.9% obtained the serology of the source patient and 37% reported the accident to their supervisor. **Conclusion:** It is important that students benefit from better prevention

and management of these accidents.

Keywords

Incidence of Blood Exposure Accidents, Medical Student, Treatment, Bangui

1. Introduction

An occupational blood exposure (OBE) is defined as any percutaneous contact (prick, cut), or projection on mucous membranes (eye, mouth) or on damaged skin (eczema, previous cut) with blood or a biological fluid containing blood [1]. On the one hand, they constitute a medical problem in that they expose health personnel to the risk of contamination by infectious agents, in particular the Human Immunodeficiency Virus (HIV) and viral hepatitis B (HBV) and C (HCV); the seriousness of these conditions lies in their chronicity but also in the serious illnesses they cause. On the other hand, these accidents have a professional nature, which respects an entire administrative procedure [1]. The emphasis should be placed on prevention before implementing treatment which is sometimes difficult and often not respected [2] [3] [4].

In the Central African Republic (CAR), HIV and hepatitis B virus infection still remains a public health problem. In 2022, the prevalence of HIV infection among adults aged 15 to 49 was estimated at 3.4% [5] and that of viral hepatitis B, at 8.8% among voluntary blood donors in 2016 [6] It was 7.4% among sex workers in 2019 [7]. To reduce the frequency of these accidents and therefore the spread of these diseases through care, on-the-job health personnel have been trained in the prevention of OBE. A module on the prevention of OBE has been inserted into the training curriculum of medical students in Bangui. Posters on standard precautions have been made available to the main health facilities in the country. Since the advent of the COVID-19 pandemic, the capacities of health structures have been strengthened in terms of training on the control of nosocomial infections, the provision of personal protective equipment (gloves, gowns, aprons, masks) and in hand washing kit. All of these interventions should help reduce the incidence of OBE in our healthcare structures. Previous studies carried out among health personnel in Bangui in 2012 and 2016 found respective frequencies of 54% and 60% [8] [9]. Knowledge, attitudes and practices regarding OBE among health personnel have been documented [10].

Like healthcare personnel, medical students are also exposed to a risk of accidental contamination during their hospital internships [2] [3] [4]. However, medical students do not benefit from prevention services in the same way as workers in this sector, although they actively participate in the routine care provided to patients in the various hospital departments. The medical student is exposed to the same risk regarding OBE but. In CAR, a case of occupational seroconversion to the human immunodeficiency virus in a medical student at the end of training, victim of OBE, was documented in 2019 [11].

It is in this context that this study aims to determine the incidence of OBE among medical students at the Faculty of Science and Health (FACSS) of Bangui and to assess their management.

2. Materials and Methods

This was a cross-sectional study with descriptive and analytical aims, carried out over three months from January 15 to March 14, 2023. The study population consisted of medical students regularly registered at the FACSS for the academic year 2021-2022. Regularly enrolled students from 2nd to 7th year, on placement in hospitals in the Central African Republic and who gave their informed consent were included. This was an exhaustive survey carried out on a voluntary basis. All students who participated in the survey were informed of the objective of the study and the anonymous nature of the information. A student information and awareness session was organized in each class, at the end of which a self-administered questionnaire was given to each consenting student. The questionnaire consisted of three parts. The first part brings together demographic and educational characteristics (age, gender and year of study), the second part concerns prevention measures (vaccination against the viral hepatitis B virus, availability of protective equipment and devices waste disposal) and the third brings together the history of OBE in these students, the number of blood exposure accidents to which they have been exposed, their mechanisms and circumstances of occurrence, the reasons given by the students to justify the accident and treatment. Data were entered and analyzed using Epi Info version 7 software. The chi-square test was used to compare proportions. A $p < 0.05$ is considered statistically significant. The association measures were estimated by the Odds Ratio (OR) and their 95% confidence interval (CI). The study was carried out in strict compliance with ethics.

3. Results

In total, 254 questionnaires were completed.

3.1. Sociodemographic Characteristics of Students

In this study, men represented 76.0% of our sample (76.0%) with a ratio of 3.2. The average age was 26 ± 3.8 years with extremes ranging from 19 to 34 years. Students aged between 20 - 25 years old represented 44.5% of our sample. Students in the 2nd to 3rd year constituted 38.6% of our sample (**Table 1**).

3.2. OBE Prevention Measures

In this study, 23 students (9%) had already been correctly vaccinated against the viral hepatitis B virus, 198 students (77.9%) reported still having access to personal protective equipment, 152 (59.8%) to a hand washing device. The availability of a waste disposal device (sharps box) within easy reach was reported by 132 students (51.9%). The presence of posters on standard precautions and what to do in the event of OBE was reported by 19.3% of students (**Table 1**).

Table 1. Distribution of students according to socio-demographic characteristics.

| Characteristics | Number (n = 254) | Percentage |
|-----------------------|------------------|------------|
| Sex | | |
| Male | 193 | 76.0 |
| Female | 61 | 24.0 |
| Age range | | |
| >15 - 20 | 12 | 4.7 |
| >20 - 25 | 113 | 44.5 |
| >25 - 30 | 97 | 38.2 |
| >30 - 35 | 32 | 12.6 |
| Level of study | | |
| 2nd to 3rd year | 98 | 38.6 |
| 4th to 5th year | 84 | 33.1 |
| 6th to 7th years | 72 | 28.3 |

3.3. Frequency and Mechanism of Occurrence of OBE

During this study, 133 students (52.4%) reported having been victims of OBE in the last 12 months. The main types of OBE were, punctures by a dirty needle, during recapping or mismatching of the needle (62%) to the hand, followed by splashes of liquid on a mucous membrane or injured skin (32%) and cuts (6%). Approximately 51.1% of victims reported having been the victim of a single accident in the past 12 months. Thirty-three percent (33.9%) reported having suffered two accidents and 15% three or more accidents. Accidents occurred much more in medicine departments (37.6%), followed by surgery (31.6%), gynecology-obstetrics (25.6%) and finally pediatrics (5.2%). Among the victims, students under 25 years old (73.7%) and 2nd and 3rd year students (60.2%) were the most numerous.

3.4. Reasons Given to Justify the Accident

Forgetting standard precautions was mentioned by 62.7% of students, followed by fatigue during guard duty (23%) and negligence (14.3%).

3.5. OBE Support

Among the 133 victims, 92.9% reported having carried out immediate hand disinfection or abundant eye washing. Of the population studied, the serology of the source patient was obtained in 41.9% and 37% declared having reported the accident to their hierarchical superior. The main reasons given by victims who did not report the accident were minimizing the risk of disease transmission from the source patient (57.9%), lack of motivation (33.1%) and ignorance of the declaration procedure (9%).

3.6. Determinants of OBE among Students

The determinants associated with blood exposure accidents were age below 25 years ($p < 0.001$, 7.38 [6.23 - 12.41]), lack of awareness of the danger of recapping needles ($p = 0.011$; 0.51 [0.33 - 0.91]) and the scarcity of a waste disposal device ($p = 0.018$; 0.39 [0.17 - 0.69]). Details are presented in (Table 2).

4. Discussion

Our study focused on OBE exclusively in medical students. This choice is justified by the fact of their strong involvement in care activities and that they do not benefit from prevention services in the same way as the rest of the care staff. However, medical studies fall within the framework of professional schools and therefore very quickly these students are in contact with patients and therefore exposed to the same risks as professional health workers. In the CAR, the lack of qualified health personnel [12] leads to the fact that medical students intervene in all medical and surgical services to sometimes make up for this lack. Studies concerning blood exposure accidents in the CAR have already been carried out among workers and healthcare personnel [8] [9] [10] but we do not have documented data concerning students.

The students in our series were young with an average age of 26 ± 3.8 years, the male gender represented three quarters of our sample (76.0%). Ardamouch, Berahou and Souza-Borges reported a mean age relatively lower than ours and a female predominance [2] [3]. The high school dropout of girls compared to boys at the country level may explain this difference [13].

Prevention of OBE includes the provision of safety equipment, such as containers and personal protective equipment [1], etc. In this study, of the 254 students included, only 51.9% reported always having a sharp waste disposal device on hand.

Table 2. Distribution of students according to their access to personal protective equipment.

| Access to protective equipment | Number (n = 254) | Percentage |
|--------------------------------|---------------------|------------|
| Always | 198 | 77.9 |
| Sometimes | 56 | 22.1 |
| Hand washing device | Number (n = 254) | Percentage |
| Always | 152 | 59.8 |
| Sometimes | 102 | 40.2 |
| Waste disposal system | Number (n = 254) | Percentage |
| Always | 132 | 51.9 |
| Sometimes | 122 | 48.1 |

This prevention also includes vaccination against the hepatitis B virus HBV [1]. The aim of vaccinating healthcare personnel is to protect them against an occupational risk by providing them with individual protection by immunizing them but also prevents them from contaminating those around them. Vaccination against the hepatitis B virus is a means of prevention, not of OBE, but of the risk of infection by the hepatitis B virus. After a well-conducted vaccination, more than 95% of young adults are immunocompetent have an anti-HBS antibody level > 10 IU/l, the internationally accepted protection threshold, and are considered immune, with no subsequent booster necessary [1]. The good vaccination coverage of healthcare workers against hepatitis B in developed countries has led to a virtual disappearance of the risk of hepatitis B of occupational origin [14]. In France, vaccination against HBV has been compulsory for health personnel since 1991 [15] and for medical students since 2007 [16]. In CAR, at the national level, there is no immunization program against the virus of hepatitis B dedicated to health personnel. In our series, only 9% of students were correctly vaccinated. Mossoro *et al.* in 2016 also noted that only 9.3% of their study population was vaccinated against HBV [17]. This low vaccination coverage among students in particular and among health personnel in general has been found by several African authors [3] [18] [19].

Of the 254 students surveyed, 133 declared having been victims of OBE in the last 12 months, a rate of 52.4%. This frequency was found in 2016 among health personnel by Mossoro *et al.* (54%) and is close to that noted by Diemer *et al.* (60%) the same year [9] [17], but is higher than those found respectively by Ardamouch in 2010 (47.6%) in Marrakech, Souza-Borges in 2014 (20.9%) in Brazil and Berahou in 2017 (17.3%) in Casablanca [2] [3] [4].

Our study highlighted a significant link between age and the occurrence of OBE ($p < 0.05$). Students under 25 were more exposed than those over 25. This result could be explained by the fact that students under 25 are mainly in the first cycle (1st to 3rd year), and are less experienced. The International Labor Organization notes that young people aged 18 - 24 are more likely to suffer a serious accident at work than older adults. Lack of experience and psychological immaturity would be the main reasons [20]. Forgetting standard precautions mentioned by 62.7% of student victims of OBE indicates psychological immaturity [20].

The main mechanism of OBE was pricking with a dirty needle, especially during needle recapping. This observation is recognized and has been made by several authors [1] [3] [17] [21]. Diemer *et al.* 2016 noted that liquid splashes were the most numerous [9]. This is due to the fact that this work was done in the maternity wards of Bangui.

Among the victims, only 41.9% obtained the serology of the source patient and 37% reported the accident to their supervisor. This under-reporting is common in cases of OBE [2] [4] [22] [23] [24]. Mossoro *et al.* in Bangui in 2016 already noted the under-reporting of OBE (3%) among victims [17]. The most

Table 3. Analysis of the determinants of blood exposure accidents among students.

| Determinants | Antecedents OBE | | OR [IC at 95%] | P | OR [IC at 95%] | P |
|--|-----------------|-----|------------------------|-------|------------------------|-------|
| | YES | NO | | | | |
| Sex | | | | 0.986 | - | - |
| Male | 101 | 92 | 1.01 [0.57 - 1.79] | | | |
| Female | 32 | 29 | | | | |
| Age | | | | 0.000 | | 0.000 |
| <25 ans | 98 | 27 | 9.75 [5.48 - 17.35] | | 7.38 [6.23 - 12.41] | |
| >25 ans | 35 | 94 | | | | |
| Level of Study | | | | 0.301 | - | - |
| 2nd to 3rd year | 80 | 65 | 1.30 [0.79 - 2.14] | | | |
| 4th to 7th Year | 53 | 56 | | | | |
| Training on OBE | | | | 0.420 | - | - |
| Yes | 129 | 115 | 1.68 [0.46 - 6.11] | | | |
| No | 4 | 6 | | | | |
| Knowledge of the danger | | | | 0.017 | | 0.011 |
| For recapping needles | | | | | | |
| Yes | 93 | 100 | 0.49 [0.27 - 0.89] | | 0.51 [0.33 - 0.91] | |
| No | 40 | 21 | | | | |
| Accident declaration | | | | 0.594 | - | - |
| Yes | 67 | 65 | 0.87 [0.53 - 1.43] | | | |
| No | 66 | 56 | | | | |
| Presence of PPE in the department | | | | 0.091 | - | - |
| Always | 97 | 99 | 0.59 [0.33 - 1.09] | | | |
| Sometimes | 36 | 22 | | | | |
| Waste disposal device | | | | 0.314 | | 0.018 |
| Always | 60 | 72 | 0.77 [0.47 - 1.28] | | 0.39 [0.17 - 0.69] | |
| Sometimes | 73 | 49 | | | | |

common reasons given by students were minimizing the risk of disease transmission from the source patient, and lack of motivation. The trivialization of the risk of OBE was also highlighted by Noé's study among nursing students [24]. In Nice, Keita-Perse *et al.* noted that 39% of student victims of OBE reported their accident [25]. Laraqui and Meunier also noted in their study that under-declaration of OBE was linked to lack of knowledge of procedures, underestimation of risk and the complexity of procedures [26] [27].

In the event of OBE, reporting within 24 hours is essential to guarantee the rights of the victim and serological monitoring according to the serological status of the source patient [24]. Those who did not have access to the serology of the Patient sources either were not put on post-exposure treatment and could have been subject to post-accident seroconversion, or were put on wrong treatment with all the risks that entail arise. In both cases, victim monitoring, when it was established, was difficult. In the national context, this work is the responsibility of referents who must be appointed in each of the large health establishments. In practice, very few healthcare establishments have OBE referents.

The limitations of this study lie in the fact that it is partly based on student declarations and that we have no means of verification. However, these results deserve to be considered and serve as a basis for better management of blood exposure accidents among students (**Table 3**).

5. Conclusion

From this study it appears that OBE are common among medical students at FACSS in Bangui. Actions that pose a risk of OBE, such as recapping, continue to be done. Young age (less than 25 years) and the scarcity of a waste disposal system are associated factors. The virtual non-existence of vaccination against HBV among medical students is to be deplored. The HBV vaccination obligation must be effective for health personnel, extended to students in these sectors. Given that the prevalence of HIV infection and viral hepatitis B is very high in CAR, it is important that the capacity of students is strengthened in terms of continuing education at the internship site, that all services are provided with equipment for the elimination of sharp waste and makes sufficient PPE available. Finally, with the aim of ensuring holistic care for victims of OBE, referents are appointed in each hospital and the procedure for treating OBE is known to everyone.

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Conflicts of Interest

The authors declare that they have no conflict of interest.

References

- [1] Groupe d'Etude sur le Risque d'Exposition des Soignants. Geres/Esther 2008. Prévention et prise en charge des AES. Manuel pratique. Edition de Février 2008. 110 p.
- [2] Adarmouch, L., Sebbani, M., Mouwafaq, S. and Amine, M. (2011) Fréquence des accidents exposant au sang chez les étudiants en médecine à Marrakech. *Médecine et Maladies Infectieuses*, **41**, 158-160. <https://doi.org/10.1016/j.medmal.2010.11.002>
- [3] Souza-Borges, F.R.F., Ribeiro, L.A. and Oliveira, L.C.M. (2014) Occupational Exposures to Body Fluids and Behaviors Regarding Their Prevention and Postexposure among Medical and Nursing Students at a Brazilian Public University. *Revista do Instituto de Medicina Tropical de São Paulo*, **56**, 157-163. <https://doi.org/10.1590/S0036-46652014000200012>
- [4] Berahou, H., Serhier, Z., Housbane, S., *et al.* (2017) Les accidents d'exposition au sang chez les étudiants en médecine de Casablanca (Maroc): Analyse des connaissances et pratiques. *Dans Santé Publique*, **4**, 579-584. <https://doi.org/10.3917/spub.174.0579>
- [5] Comité National de Lutte contre le Sida. Plan stratégique national de lutte contre le VIH et le sida en République Centrafricaine, 2023-2027.
- [6] Nambei, W.S., Rawago-Mandjiza, D. and Gbangbangai, E. (2016) Séro-épidémiologie du VIH, de la syphilis et des virus des hépatites B et C chez les donneurs de sang à Bangui, République centrafricaine. *Médecine et Santé Tropicales*, **26**, 192-198. <https://doi.org/10.1684/mst.2016.0553>
- [7] Comité National de Lutte contre le Sida. Rapport de l'enquête de la détermination du comportement et du profil sérologique liés aux IST/VIH chez les professionnelles de sexe à Bangui, Boali, Bouar, Carnot et Berbérati en République Centrafricaine en 2019.
- [8] Mossoro-Kpindé, H.D., Mossor-Kpinde, C.D., Gbangba-Ngai, E. and Kamalo, C.G. (2012) High Incidence of Occupational Blood Exposures (OBE) in the Health Care Workers Sector of Low Income Countries, Using the Example of Bangui, Central African Republic (CAR). *Retrovirology*, **9**, P115. <https://doi.org/10.1186/1742-4690-9-S1-P115>
- [9] Diemer, H.S.C., Ngbale, R.N., Longo, J.D.D., Manirakiza, A., Gaunefet, C.E., Foumssou, L., Komangoya, N.D., Keke-Yanga, A. and Sepou (2016) Les accidents d'exposition au sang dans les maternités de Bangui. *Médecine d'Afrique Noire*, **63**, 137-142.
- [10] Mossoro-Kpinde, H.D., Gaunefet, E.C., Diemer, H.S.C., *et al.* (2022) Connaissances, attitudes et pratiques relatives aux Accidents d'Exposition au sang (AES) au Complexe Pédiatrique de Bangui (CPB). *Annales de l'université de Bangui. Série D*, **8**, 23-28.
- [11] Mossoro-Kpinde, H.D., Diemer, H.S.C., Gaunefet, C.E., *et al.* (2019) Premier cas de séroconversion professionnelle au virus de l'immunodéficience humaine documentée en République centrafricaine. *Annales de l'université de Bangui, Série D*, **5**, 57-59.
- [12] République centrafricaine. Ministère de la Santé et de la Population, Enquête SARA/HeRAMS, République Centrafricaine, 2019.
- [13] Institut Centrafricain des Statistiques et des Etudes Economiques et Sociales. Rapport de l'enquête par grappes à indicateurs multiples (MICS) 2018-2019, Bangui (République centrafricaine).
- [14] Abiteboul, D. (2011) Vaccination des professionnels de santé: obligations et recommandations. *Journal des Anti-Infectieux*, **13**, 56-64. <https://doi.org/10.1016/j.antinf.2011.01.001>

- [15] République Française. Code de la santé publique art L. 3111-4.
- [16] République Française. Arrêté du 6 mars 2007 relatif à la liste des élèves et étudiants des professions médicales et pharmaceutiques et des autres professions de santé, pris en application de l'article L. 3111-4 du code de la santé publique.
- [17] Mossoro-Kpindé, H.D., Mossoro-Kpindé, C.D., Gaunefet, E.C., Sépou-Yanza, A.M.C., Gbangba-Ngai, E., Kamalo, C.G., Fayomi, B. and Le Faou, A. (2016) Evaluation du risque d'accidents d'exposition au sang chez le personnel de santé en Centrafrique. *Annales de l'université de Bangui, Série D*, **2**, 16-21.
- [18] Sogodogo, A., Diarra, B., Ba, H.O., *et al.* (2023) Prévalence des Accidents d'Exposition au Sang chez le Personnel Soignant au CHU Gabriel Touré Bamako-Mali. *Health Sciences and Diseases*, **24**, 77-80.
- [19] Aroke, D., Kadia, B.M., Anutebeh, E.N., *et al.* (2018) Awareness and Vaccine Coverage of Hepatitis B among Cameroonian Medical Students. *BioMed Research International*, **2018**, Article ID: 3673289. <https://doi.org/10.1155/2018/3673289>
- [20] Organisation Internationale du Travail (2018) Améliorer la Sécurité et la Santé des Jeunes Travailleurs. Genève.
- [21] Nouetchognou, J.S., Ateudjieu, J., Jemea, B., *et al.* (2016) Accidental Exposures to Blood and Body Fluids among Health Care Workers in a Referral Hospital of Cameroon. *BMC Research Notes*, **9**, Article No. 94. <https://doi.org/10.1186/s13104-016-1923-8>
- [22] Noubiap, J.J.N., Nansseu, J.R.N., Kengne, K.K., *et al.* (2013) Occupational Exposure to Blood, Hepatitis B Vaccine Knowledge and Uptake among Medical Students in Cameroon. *BMC Medical Education*, **13**, Article No. 148. <https://doi.org/10.1186/1472-6920-13-148>
- [23] Marjadi, B., Nguyen, J.D., Hoppett, P., *et al.* (2017) Needlestick Injury among Medical Students in an Australian University. *Journal of Infectious Diseases and Epidemiology*, **3**, 34. <https://doi.org/10.23937/2474-3658/1510034>
- [24] Noé, C. (2015) Sous-déclaration des accidents d'exposition au sang: Une situation préoccupante chez les étudiants en soins infirmiers. *Recherche en Soins Infirmiers*, **4**, 49-65. <https://doi.org/10.3917/rsi.123.0049>
- [25] Keita-Perse, O., Pradier, C., Rosenthal, E., Altare, J., Cassuto, J.P. and Dellamonica, P. (1998) Hospital Medical Students: A Population at Risk for Accidental Exposure to Blood. *La Presse Médicale*, **27**, 1723-1726.
- [26] Laraqui, O., Laraqui, S., Tripodi, D., Zahraoui, M., Caubet, A., Verger, C., *et al.* (2008) Évaluation des connaissances, attitudes et pratiques sur les accidents d'exposition au sang en milieu de soins au Maroc. *Médecine et Maladies Infectieuses*, **38**, 658-666. <https://doi.org/10.1016/j.medmal.2008.09.009>
- [27] Meunier, O., De Almeida, N., Hernandez, C. and Bientz, M. (2001) Blood Exposure Accident among Medical Students. *Médecine et Maladies Infectieuses*, **31**, 537-543. [https://doi.org/10.1016/S0399-077X\(01\)00262-1](https://doi.org/10.1016/S0399-077X(01)00262-1)