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FREQUENCY AND ASSOCIATED FACTORS OF BLOOD EXPOSURE INCIDENTS IN MILITARY HEALTH SERVICE HOSPITALS IN THE CITY OF KISANGANI

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ABSTRACT

Introduction

Healthcare workers face certain occupational risks due to injuries and exposure to blood and human bodily fluids during waste handling. The objective of our study was to determine the frequency and associated factors of blood exposure incidents (BEIs) in military healthcare facilities in Kisangani.

Methods

A cross-sectional analytical study was conducted in four military healthcare facilities in Kisangani from July 10 to December 30, 2023. A total of 422 healthcare providers involved in service delivery and waste management were selected from each department of the different healthcare facilities. Data were collected using a self-administered questionnaire. The collected data were entered into Excel and analyzed using Stata 13. A bivariate analysis using Pearson's chi-squared test was used to identify factors associated with blood exposure incidents.

Results

The majority of participants (82%) had knowledge of universal precaution measures. Standard precaution measures were consistently observed by the respondents, notably wearing gowns during procedures

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(48%), wearing gloves (77%), using single-use syringes (67%), and practicing hygienic handwashing (80%). The frequency of blood exposure incidents was 48%. The factors statistically associated with blood exposure incidents were the nursing professional category ($p<0.005$), the 31–40-year age group ($p<0.005$), and the habit of recapping needles ($p<0.005$).

Conclusion

The frequency of blood exposure incidents is very high among healthcare providers in military healthcare facilities in Kisangani. Needle recapping was the main risk behavior related to BEIs. Strategies or interventions aimed at improving the working conditions of healthcare providers and increasing their adherence to universal precautions are necessary.

KEYWORDS: BEIs, prevention, management, military healthcare facilities, Kisangani

I. INTRODUCTION

Blood exposure accidents (BEA) are defined as any contact with blood or a biological fluid containing blood through a skin puncture (prick, cut) or projection onto a mucous membrane (eye, mouth) or injured skin [1].

BEAs represent a permanent and major danger for healthcare personnel. They can be victims of BEAs during their daily activities and be exposed to infectious risks. Indeed, numerous pathogens can be transmitted in the event of a BEA. Among these agents, the most feared are the hepatitis B virus (HBV), hepatitis C (HCV), and human immunodeficiency virus (HIV). Their severity is linked to the possibility of inducing chronic viremia and the severity of the infections caused [2].

The World Health Organization (WHO) estimates that 3 million healthcare professionals worldwide are victims of BEAs by needlestick injury each year. According to this organization, 40% of all viral hepatitis and 4.4% of HIV infections in these hospital workers are attributable to BEAs [3].

In Africa, the WHO estimated that the prevalence of hepatitis B, hepatitis C, and HIV in Algeria was 11.5%, 2.6%, and 1.3%, respectively [4]. At the CNHU in Cotonou, two out of five people were victims of BEAs at least once, and repeated accidents were frequent [5]. A study conducted by Souad Meddah and Abderrezak Buamra in Paris on the knowledge, attitudes, and practices of contaminating agents in dental practice regarding BEAs [6].

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In Mali, Ouologuem at the CHU du Point G reported that the victims of BEAs were mainly nurses (10.7%), laboratory technicians (10.7%), nursing assistants (14.3%), and cleaning or surface technicians (3.6%) [7].

Regardless of the continent, needlestick injuries with a hollow needle containing blood were mainly involved (up to about 70% of cases in Africa) [8].

During a study conducted in Abidjan, Côte d'Ivoire, on victims of BEAs, doctors were the most represented (29%), followed by nurses (20%). 51% of the victims were correctly vaccinated against hepatitis B, 83% were placed on ARVs, including 45% on dual therapy and 55% on triple therapy. A training policy for healthcare professionals on the prevention of BEAs was strongly recommended [9].

The results of a study conducted in the intensive care unit found that the risk of BEAs is high in this department due to the high frequency of medical and paramedical procedures involving contact with blood. Prevention is essentially based on reducing the frequency of these accidents and, in some cases, resorting to post-exposure prophylaxis [10].

The mandatory vaccination of healthcare personnel against hepatitis B theoretically eliminates the occupational risk in the event of BEAs, and the generalization of post-exposure HIV chemoprophylaxis, taking into account various factors (severity of exposure, time to management, serological status of the source person), is now an integral part of BEA management [11].

In the DRC, as in all developing countries, the frequency of BEAs is high, but contrasting with the low level of knowledge of providers about infectious risk and the inadequacy of prevention and management measures. A study conducted in Kinshasa showed that 89% of subjects cited vaccination of healthcare professionals against Hepatitis B as an effective means of preventing BEAs, needle recapping was observed in 54% of healthcare professionals, 54.9% had already been victims of BEAs, and the most frequent causes of these BEAs were accidental needlestick injuries with hollow needles (40.7%), projection of biological fluids onto mucous membranes (32.2%), unprotected contact with wounds (27.5%), and cuts (20.9%) [12].

During another study conducted at the BIAMBA MARIE MUTOMBO Hospital in Kinshasa, DRC, 11% of healthcare professionals surveyed were aware of the infectious risk from blood exposure, 18% had already been victims of BEAs, the causes of which were accidental needlestick injuries during care administration [13].

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A study conducted in Isiro in the Haut-Uélé province on the knowledge, attitude, and practices (KAP) of healthcare professionals regarding BEAs found that the overall knowledge of the 3 bloodborne viruses (HBV, HCV, HIV) was only 20%, with no difference by sex and department. 60% of professionals had good knowledge of the procedure to follow in case of injury or needlestick with instruments.

In the city of Kisangani, the extent of this problem and the contributing factors are less elucidated, even less so in military healthcare facilities.

The objective of this study is to determine the frequency and factors associated with blood exposure accidents in military healthcare facilities in Kisangani.

II. MATERIAL AND METHODS

2.1. MATERIAL

2.1.1. STUDY SITE

This study was conducted in the city of Kisangani, the capital of the TSHOPO province in the Northeast of the Democratic Republic of Congo. The city of Kisangani has an area of 1910 Km2, a population in 2016 estimated at 1,602,144 inhabitants, and a density of 839 inhabitants/Km2 according to the provincial directorate of the National Institute of Statistics (INS). It has six urban communes: Makiso, Kisangani, Kabondo, Mangobo, Tshopo, and Lubunga.

It is bordered to the north by the territory of Banalia, to the northeast by the territory of Bafwasende, to the west by the territory of Opala, to the northwest by the territory of Isangi, and to the south by the territory of Ubundu. It is located at 0º31' North latitude relative to the Equator (57 km away), 25º11' East longitude relative to the Greenwich meridian, and 428 meters above sea level (altitude 396 meters) according to the INS [20].

From a health point of view, the city of Kisangani has five health zones, including Makiso-Kisangani, Kabondo, Mangobo, Tshopo, and Lubunga, 89 health areas, 110 healthcare facilities, including four military facilities, and several private healthcare facilities [21].

Our study focused on the four (4) military healthcare facilities in Kisangani, namely the Military Hospital of the 3rd Defense Zone, the Military Reference Health Center Camp Lieutenant General BAHUMA, the Military Reference Health Center Sergeant KETELE in the Makiso-Kisangani health zone, and the Military Reference Health Center of the Sergeant LOKOSA Training Center in the LUBUNGA health zone. These four military healthcare facilities benefit from the support of the President's Emergency Plan for Aids Relief (PEPFAR) through the Department of Defense (DoD).

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Currently, the Elizabeth Glaser Pediatric Aids Foundation (EGPAF) provides comprehensive support for the fight against HIV, including activities to prevent blood exposure accidents.

2.1.2. STUDY POPULATION

The population of our study consisted of healthcare professionals from military healthcare facilities. The various military professional categories concerned were Doctors, Nurses, Laboratory Technicians, surface technicians, and other administrative and technical staff.

2.2. METHODS

2.2.1. Study Type and Period

A cross-sectional analytical study was conducted during the period from July 10th to December 30th, 2023.

2.2.2. Echantillonnage

The sample size was calculated using the SCHWARTZ formula as follows:

$$n = \frac{z^2.p(1-p)}{d^2}$$

Considering the proportion of healthcare providers who observe universal precautions in the healthcare setting, which is unknown (50%), with a Z-coefficient at a significance level of 5% at 1.96 and a margin of error of 5%, our sample size was 384 as follows

$$n = \frac{(1,96)^2 .0,5\ (1-0,5)}{(0,05)^2} = 384$$

By adding a non-response rate of 10%, the final size of our sample was 422 subjects.

Distribution of the sample in a weighted manner between military health facilities

Structures	Agents	Proportion
Military Hospital of the 3rd Defense Zone	193	45,7%
Military Reference Health Center of C.I LOKOSA	91	21,6%
Military Reference Health Center Lieutenant General BAHUMA	72	17,1%
Military Reference Health Center Sergeant KETELE	66	15,6%
Total	422	100%

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At each healthcare facility, we proceeded by stratifying by professional category and then drawing subjects from each stratum, proportionally to the number of providers per professional category, according to the inclusion criteria listed below.

2.2.3. Inclusion Criteria

Included in this study were all healthcare professionals from military hospital institutions present on the day of data collection and available to answer our questionnaire.

2.2.4. Variables of Interest

• Dependent variable: experienced a blood exposure accident (BEA) (Yes or No)
• Independent variables:
  - Socio-demographic characteristics: sex, age, qualification, seniority in the department, professional category.
  - Level of knowledge: accidentally transmitted germs, BEA prevention measures, management measures.
  - Provider practices: needle recapping, use of PPE, use of rigid containers for collecting sharps waste, waste disposal techniques.
  - Prevalence of BEAs and management.
  - Institutional policy on BEA prevention and management.

2.2.5. Data Collection Technique

Data were collected by observation using an observation guide and guided interviews using a questionnaire.

2.2.6. Data Analysis Techniques

Data will be entered into Excel and analyzed using STATA13 software. The description of the socio-demographic characteristics of providers, the level of knowledge, and practices in BEA prevention and management will be done using proportions (%) and the mean (±SD) for quantitative variables with a symmetrical distribution. Statistical inferences will be made using Pearson's chi-square test and Student's t-test to identify factors associated with BEAs.

2.2.7. Ethical Considerations

Authorizations were obtained from the military authorities of the various military camps and from the health authorities to conduct this survey, which was accompanied by research authorization from the Faculty of Medicine and Pharmacy. Participation in the study was voluntary, with informed

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consent signatures, and confidentiality and anonymity were respected during the analysis and dissemination of the results.

III. RESULTS

3.1. Socio-demographic characteristics of the respondents.

Table I: Socio-demographic characteristics of the respondents

Variables N=422	Modalities	Frequency	Percentage
Age (mean ± SD) years	37,4 ± 9,4		
Age range	18 à 30	119	28
	31 à 40	164	39
	41 à 50	93	22
	51 and over	46	11
Seniority in the position (mean ± SD) years	7,9 ± 5,7		
Sex	Male	255	60
	Female	167	40
Professional categories	Doctor	20	5
	Nurse	235	56
	Laboratory technician	36	9
	Surface technician	56	12
	Other (administrative, technical and worker personnel)	75	18

The results revealed that the average age of the respondents was 37.4 ± 9.4 years, with the dominant age group being 31 to 40 years. The male sex and the nursing category were the most represented; the average seniority in the position was 7.9 ± 5.7 years.

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3.2. Knowledge of the respondents about Blood Exposure Accidents.

Table II: Evaluation of respondents' knowledge and practices regarding BEAs.

Variables N=422	Modalities	Frequency	Percentage
Knowledge of BEAs	Any accidental contact with blood	340	81
	Other	82	19
BEA risk situations	Needle recapping	341	81
	Poor management of sharps waste	81	19
Diseases at risk of contamination during BEAs	Knows (HIV/AIDS, HBV, and HCV)	368	82
	Other	54	18
Knowledge of measures to take in case of BEAs	Yes	373	88
	No	49	12
Knows the medico-legal procedure to follow in case of BEAs	Yes	1	0
	No	421	100
Knowledge of universal precautions measures	Yes	344	82
	No	78	18
Universal precautions measures	YES (Wearing gowns, glasses, boots, gloves, hand hygiene, environmental management)	344	82
	NO (partially)	78	18
Wearing a gown during procedures	Always	201	48
	Often	115	27
	Rarely	75	18
	Never	31	7
Wearing gloves during procedures	Always	327	78
	Often	55	13
	Rarely	31	7
	Never	9	2
Use of single-use syringes	Always	281	67
	Often	67	16
	Rarely	18	4
	Never	56	13
Handwashing with soap and/or use of alcohol-based disinfectant	Always	338	80
	Often	83	20
	Rarely	1	0
	Never	0	0

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Table II informs us that the vast majority of subjects knew well what is meant by "BEA," knew the three main germs transmitted accidentally in the event of a BEA, knew the BEA prevention measures and universal precautions, and knew needle recapping as a risk factor for BEAs. The medico-legal procedure in the event of a BEA was ignored by almost all providers (Table II).

3.3. Practices of the respondents on BEA Prevention

Table III: Prevalence and institutional policy regarding the management of AES

Variables	Modalities	Fréquency	Percentage
Has already been a victim of BEAs (N=418)	Yes	200	48
	No	218	52
Circumstance of BEA occurrence (N=200)	Recapping	121	61
	Patient care	76	38
	Waste management	3	1
ARV prophylaxis performed (N=200)	Yes	176	88
	No	24	12
Observance of glove wearing (N=422)	Yes	397	94
	No	25	6
Existence of a BEA management protocol in your institution (N=422)	Yes	392	93
	No	30	7
Availability of BEA prevention means in your institution (N=422)	Yes	379	90
	No	43	10
Availability of personnel trained in IPC (N=422)	Yes	131	31
	No	291	69
viability of PPE and materials for biomedical waste management (N=422)	Yes	104	25
	No	318	75

Table III informs us that nearly half of the providers had already been victims of a BEA, with the most represented circumstance of occurrence being recapping. The vast majority of victims had benefited from ARV prophylaxis. The management protocol and BEA prevention measures were available in the vast majority of cases, the availability of trained personnel and PPE is lacking in the majority of declared cases.

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3.4. Prevalence of Blood Exposure Accidents and institutional policy regarding Blood Exposure Accidents.

Table IV: Analysis of factors associated with AES among healthcare providers in military healthcare establishments in Kisangani

Variables	Modalities	Victim of BEAs		Total	p-value
		OUI (N=200)	NON (N=218)	N=418	
Professional categories	Doctor	4 (2)	16 (7)	20 (5)	0,001*
	Nurse	133 (67)	102 (47)	135 (32)	
	Laboratory technician	27 (14)	9 (4)	36 (9)	
	Surface technician	30 (15)	25 (11)	55 (13)	
	Other staff	6 (3)	66 (30)	72 (17)	
Sexe	Male	121 (61)	132 (61)	253 (61)	0,992*
	Female	79 (39)	86 (39)	165 (39)	
Age range	18 à 30	33 (17)	86 (39)	119 (28)	0,001*
	31 à 40	98 (49)	64 (29)	162 (39)	
	41 à 50	43 (22)	48 (22)	91 (22)	
	51 and over	26 (13)	20 (9)	46 (11)	
Needle recapping habit	Yes	187 (94)	29 (13)	216 (52)	0,001*
	No	13 (6)	189 (87)	202 (48)	
Variables	Victim of BEAs				
	YES		NO		
	Mean ± SD CI95%		Mean ± SD CI95%		
Seniority in position	8,8 ± 4,7 [8,17 – 9,48]		6,9± 6,3 [6,12 – 7,80]		0,001**
Age	39,1 ± 8,5 [37,91 – 40,27]		35,8 ± 10,0 [34,46 – 37,14]		0,001**

The analysis of associated factors revealed that the nursing professional category, the age group of 31 to 40 years, and the habit of recapping used needles were associated with BEAs. Also, the average seniority in the position and age were significantly higher among BEA victims than those who had not experienced BEAs ($p<0.05$).

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IV. DISCUSSION

Our study aimed to highlight the prevention and management measures for blood exposure accidents in military healthcare facilities in Kisangani.

Knowledge of respondents about blood exposure accidents

We found that 82% of respondents had knowledge of the definition and circumstances of blood exposure accidents, as well as standard precautions. These results are similar to those found by Ebatetou Ataboho et al. in Brazzaville and H.D (85.5%) and Mossoro-Kpinde in Bangui, who found that the majority (88.1%) of respondents had good knowledge of blood exposure accidents [14,15]. It also emerged from our study that the medico-legal procedure in the event of a BEA was ignored by almost all providers. This situation can be explained by insufficient training and the absence of a doctor in charge of occupational medicine in the various military healthcare facilities in Kisangani. Practices of respondents in BEA prevention

It appears from our study that standard precautions were always observed by respondents, including wearing gowns during procedures (48%), wearing gloves (77%), using single-use syringes (67%), and practicing hygienic handwashing (80%). These results show an insufficiency in the strict observation of standard precautions during procedures by our respondents. These results are similar to those found by Koné, M. and Mallé, K. in Mali, who found that 78.9% of respondents wore gloves, and washing and disinfection after a BEA was applied by only 68.8% of respondents [16]. This situation can be explained by the insufficient implementation of protocols and standard precautions in our healthcare facilities.

Prevalence and institutional policy in BEA management

In our study, the frequency of blood exposure accidents was 48%. These results are similar to those found by Hinson et al. in Benin, who found a frequency of 40% of BEAs among healthcare professionals, and the main circumstance of occurrence was recapping (66.7%) [17]. Studies conducted in Ndjamena found a BEA frequency of 57% among nurses (18), and in Bangui, 52.4% of respondents reported having been victims of BEAs in the last 12 months. The main types of BEAs were needlestick injuries (62%), liquid projections (32%), and cuts (6%) [15]. In the DRC, a study conducted at Biamba Marie Mutombo Hospital in Kinshasa showed that 18.2% of respondents reported having had at least one accidental injury, and 7.3% had a splash of a biological fluid during the year preceding the survey. Nurses reported the highest number of accidents (needlestick injuries and projections of biological fluids). BEAs were mostly due to needles before the professional act [12]. These different studies have shown that the frequency of blood exposure accidents is very high among healthcare professionals in their daily practices.

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Regarding the application of the institutional policy in BEA management, our study showed that 88% of BEAs benefited from post-exposure prophylaxis (PEP) with ARVs, and 93% of respondents affirmed the existence of a BEA management protocol at the healthcare facility level. On the other hand, there is a low proportion of providers trained in IPC (infection prevention and control), and the availability of PPE and materials for biomedical waste management is only around 25%.

Factors associated with blood exposure accidents in military healthcare facilities in Kisangani

In our series, we found that the factors statistically associated with blood exposure accidents are the nursing professional category ($p<0.005$), the age group of 31 to 40 years ($p<0.005$), and the habit of recapping needles ($p<0.005$).

The age of 31 to 40 years was statistically associated with blood exposure accidents. This result differs from those found by Malak Bennani among healthcare personnel at the Avicenne-Marrakech military hospital in Morocco, who found that age was not statistically associated with BEAs [22].

The nursing professional category was associated with blood exposure accidents; this result is identical to that found by Afridi AA et al. (2013) in Pakistan, who found that the nursing profession was associated with BEAs more than doctors because injections are mainly administered by nurses, and they are often involved in blood draws; they are therefore more exposed and more vulnerable to musculoskeletal injuries than other healthcare workers [23]. The nursing profession was also reported as associated with BEAs in studies by Alemayehu T, et al. (2016) among healthcare professionals in Eastern Ethiopia [24].

Another factor associated with blood exposure accidents in our study was recapping. This result is similar to that found by Bekele T, et al. in Ethiopia, who found that participants who practiced needle recapping had a higher probability of being injured with a needle or sharp object in the last 12 months compared to their counterparts [25]. This same result was found by Hanan Berrahou et al. among medical students in Casablanca (Morocco), where needle recapping was one of the factors associated with blood exposure accidents. Hinson et al. in Benin also found that the main circumstances of blood exposure accidents were recapping [17]. In several studies, recapping was revealed as a significant risk factor exposing healthcare providers to BEAs.

Study limitations

Our study was limited to a bivariate analysis of factors associated with BEAs. Ideally, a multivariate analysis would have been performed to eliminate potential confounders and retain only the factors actually associated with blood exposure accidents.

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CONCLUSION

The frequency of blood exposure accidents is very high among healthcare providers in military healthcare facilities in Kisangani. The nursing professional category was much more at risk for BEAs. Needle recapping was the main modifiable risk behavior associated with BEAs. Health policy makers and administrators of military healthcare facilities should formulate strategies to improve the working conditions of healthcare providers and increase their adherence to universal precautions.

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