

## Blood Exposure Accidents among Health Care Personnel at the Ngaoundere Regional Hospital in Northern Cameroon: Knowledge, Practical Attitudes, and Means of Prevention

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### Abstract

**Introduction:** Blood exposure accidents (BEA) are a major public health problem, especially in developing countries such as Cameroon. Evaluating the knowledge and practices among healthcare workers (HCWs) of the Ngaoundere Regional Hospital (NRH), in relation to BEA, was a logical step towards addressing this concern in Cameroon.

**Design:** From 1 March to 30 April 2021, a descriptive cross-sectional study was conducted at the NRH in the Adamawa region of Cameroon. The study population consisted of the HCWs of the NRH. A total, 218 health care personnel were contacted to participate in the study and 172 (78.89%) HCWs agreed. Data were collected using an anonymous, self-administered questionnaire.

**Results:** A total of 172 HCWs were surveyed and the predominant gender was female (54.7%), the average age was 35.55±7.46 years, and the average longevity was 9.14±6.78 years. Approximately 62.80% of the respondents claimed to have had at least one BEA. The most common BEA was needle stick injury (87.5%), followed by infected blood splashed into the mouth and/or eyes (52.0%) and contact with a wound containing infected blood (48.7%).

**Conclusions:** This study revealed a poor knowledge of interventions after BEA, demonstrated in the practices of HCWs of the NRH, especially according to their professional category, with medical staff having a better knowledge of BEA than paramedical staff.

**Keywords:** Blood exposure accident; Health care workers; Risk factor; Ngaoundere Regional Hospital

### Introduction

The infection risk due to blood exposure accidents (BEA) among health care personnel or health care workers (HCWs) is a major public health problem, especially in developing countries with limited resources [1]. A BEA is defined as accidental contact with blood or a biological liquid contaminated by bacteria, viruses, parasites and fungi, followed a skin injury (sting, cut, scratch, bite) [1].

With the onset of the Human Immunodeficiency Virus (HIV), hepatitis C virus (HCV) and more recently, the epidemics of severe acute respiratory syndrome (SARS), the pandemics of H1N1 influenza, and Ebola virus infections, exposed HCWs are at high risk of infection, especially under difficult working conditions. This is the case reported by studies in the Democratic Republic of Congo and Liberia, showing exposure to Ebola, and reports from Germany, Italy, India, China, Brazil, South Africa, Nigeria and Cameroon, where a number of HCWs were exposed while working on patients with the SARS-CoV-2 [2,3].

Blood exposure accidents are now known to be the most frequent occupational accidents in the hospital environment, and the possibility of infection with HIV, HCV, or HBV poses a serious risk, especially in non-immune individuals, further endangering the lives of HCWs. A thorough evaluation of the frequency of BEA in the medical or paramedical population is made difficult by the under-reporting of these work-related accidents. The World Health Organization (WHO) estimates that more than two million needle-stick injuries are sustained by HCWs annually [4].

In Cameroon, a study conducted at the Bertoua Regional Hospital in 2010 revealed a BEA prevalence of 71.6% with needle recapping during care being considered as a primary risk factor (61.1%) [5], in 2015, a study conducted at the Yaounde Central Hospital reported a 39.6% BEA prevalence in the HCWs over a 12-month period [6]. In 68.4% of these BEA cases, the serological status (HBV and HCV) of the source patient was unknown, and up to 73.7% of the BEA victims did not declare injury [6].

Knowledge of the epidemiological data on BEA allows health personnel to be aware of the circumstances of these accidents in order to put in place ad hoc prevention measures. The present study was conducted with the aim of improving compliance with standard precautions and protocols for the prevention of BEA and other

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**Received:** 03-Jun-2022, Manuscript No: omha-22-66094; **Editor assigned:** 06-Jun-2022, Pre-QC No: omha-22-66094 (PQ); **Reviewed:** 20-Jun-2022, QC No: omha-22-66094; **Revised:** 23-Jun-2022, Manuscript No: omha-22-66094 (R); **Published:** 30-Jun-2022, DOI: 10.4172/2329-6879.1000412

**Citation:** Karyom DAN, Bong-Akee S, Honore ER, Gael OM, Collins BN, et al. (2022) Blood Exposure Accidents among Health Care Personnel at the Ngaoundere Regional Hospital in Northern Cameroon: Knowledge, Practical Attitudes, and Means of Prevention. *Occup Med Health* 10: 412.

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biological fluid, by assessing the knowledge, attitudes and practices of HCWs at the Ngaoundere Regional Hospital (NRH) in relation to BEA, and to provide recommendations on intervention and prevention measures.

## Methodology

### Study design

This was a cross-sectional, descriptive study conducted at the Ngaoundere Regional Hospital (NRH) from 1<sup>st</sup> March to 30<sup>th</sup> April 2021. The NRH is a 2<sup>nd</sup> reference (3<sup>rd</sup> category) hospital in Cameroon's national classification for health structures. The various missions of NRH are summarised in its consultations, therapeutic management of cases, surgical interventions, prevention, medical analyses, medical training, drug administration, and in the implementation of activities recommended by the Ministry of Public Health (MINSANTE).

### Study population

The study population consisted of health care personnel, including specialist doctors (surgeon, dentist, ENT, paediatrician, gynaecologist, etc.), general practitioners, nurses, laboratory technicians, medical and health engineers, and nursing assistants.

### Inclusion and exclusion criteria

Health care personnel working at the NRH, who gave their oral consent to participate in the study, were included while administrative personnel working at the NRH, trainees, personnel of the Pharmacy department of the NRH, and health personnel not working at the NRH were excluded.

### Sampling

Non-probability convenience and consecutive exhaustive sampling was used.

### Epidemiological data and statistical analysis

Data were collected using a survey form and inserted into the Sphinx Plus<sup>2</sup> - Lexica-V5 edition software for statistical analysis. Statistical processing included the descriptive analysis of socio-demographic and professional data, as well as data on knowledge and practices with regards to BEA. The comparison of variables was carried out using the  $\chi^2$  test. A value of  $p < 0.05$  were considered statistically significant.

### Ethical considerations

This study was authorised by the Institute of Health and Biomedical Sciences in Ngaoundere (N°028/005/DIR/21). The protocol for this study was reviewed and validated by the authorities of the Adamawa Regional Delegation for Public Health (N°234L/RA/DSP/BFP/NGE) and the ethics committee of the NRH (N°105/AR/RA/DRSP/HR/NGD). Each questionnaire was completed anonymously and with the participant's approval. Any information obtained about the study participants was kept confidential.

## Results

### Socio-demographic and professional characteristics

A total of 172 (78.89%) HCWs agreed to participate in the study, out of a total number of 218 NRH health care personnel. Of the 172 participants in this study, 94 were female (54.70% of the study population), with a male-female ratio of 0.82. The average age was  $35.55 \pm 7.46$  years, with the age group 30-35 years being the most

represented. The details are shown in (Table 1).

The hospital units of the respondents were predominantly reception and emergency (14.00%), followed by medicine and paediatrics (11.00% and 10.00% respectively). Approximately 33.10% of HCWs, had an average longevity? of  $9.14 \pm 6.78$  years (range, 1 – 32 years) (Table 1).

### Frequency of accidents with blood and/or other biological fluids in Ngaoundere regional hospital

Of the 172 participants, 62.80% ( $n = 108$ ) claimed they had been a victim of BEA, 91 participants remembered being a victim of BEA at least once (range, 1 – 4). The relationship between being a victim of BEA and professional category was statistically significant ( $p = < 0.1\%$ ), as seen in (Table 2). Nurses, who fall in the category of medical staff, were the most affected by BEA (80.70%).

According to the data in (Table 3), BEA was most common in the treatment room (26.70%), followed by the reception and emergency departments (15.10%), the delivery room (14.00%), the patient's bed (12.80%), the laboratory (8.10%), the operating theatre (6.40%), and the intensive care unit (4.10%) shown in (Table 3).

### Mechanisms of occurrence of BEA and risks involved

#### Mechanisms of occurrence of BEA

According to the participants, their perception of the most common mechanism of occurrence of a BEA was needle stick injury (97.10%), followed by cuts (82.60%) and wound contact with infected blood (79.10%). The relationship between individual perceptions on mechanisms of occurrence of a BEA and occupational category (Paramedical or Medical Staff) was statistically significant ( $p = 0.031$ ).

#### Risk factors involved in a BEA

The viral infections HIV, HBV, and HCV were considered potential risks by HCWs, in the following proportions: 99.40%, 96.50% and 95.30% respectively. The relationship between perceived knowledge on the risk of infection with bacteria, viruses, and other microbes due to a BEA, and the professional category was statistically significant with  $p < 0.1\%$  (Table 4).

#### Factors involved in the severity of BEA

Infection in the source patient was only known by 92.4% of HCWs ( $n=159$ ), as a risk factor in increasing BEA severity. The depth of the wound in the source patient was perceived in 85.5% of HCWs ( $n=147$ ), as another factor that could increase the severity of a BEA. The type of source instrument causing injury was the third risk factor, identified by 81.4% of HCWs ( $n=140$ ). Approximately 87.2% of the HCWs ( $n=150$ ) claimed that the vaccination status of the exposed person was not a potential factor in affecting BEA severity. Responses were identical in both PMS and MS groups ( $p=0.87$ ).

### Intervention after a BEA

#### First aid measures

According to the results shown in (Table 5) on knowledge of first aid in the event of a BEA according to professional category, the most appropriate interventions after a BEA were thought to be; washing the affected area with soap and water (76.20%), disinfection with 70% alcohol or Betadine (62.80%), and disinfection with 1/10 diluted bleach (59.90%). Approximately 40.10% of PMS recommended squeezing the wound to make it bleed and 15.16% recommended disinfecting with pure bleach. The relationship between knowledge of first aid and

**Table 1:** Socio-demographic and occupational characteristics.

Characteristics	Study population (N=172)		Professional category				P value
			PMS (n=147)		MS (n=25)		
Gender M/F	N	%	n	%	n	%	
Male	78	45.30%	62	36.00%	16	9.30%	p = 0.043
Female	94	54.70%	85	49.40%	9	5.20%	
<b>Marital status</b>							
Single	62	36.00%	51	29.70%	11	6.40%	
Married	98	57.00%	85	49.40%	13	7.60%	
Cohabitation	6	3.50%	5	2.90%	1	0.60%	p = 0.891
Widowed	1	0.60%	1	0.60%	0	0.00%	
Divorced	1	0.60%	1	0.60%	0	0.00%	
Separated	4	2.30%	4	2.30%	0	0.00%	
<b>Age group</b>							
Less than 30	41	23.80%	39	22.70%	2	1.20%	
from 30 to 35	57	33.10%	43	25.00%	14	8.10%	
From 36 to 41	42	24.40%	40	23.30%	2	1.20%	
From 42 to 47	18	10.50%	14	8.10%	4	2.30%	p = 0.003
From 48 to 53	10	5.80%	8	4.70%	2	1.20%	
From and above	4	2.30%	3	1.70%	1	0.60%	
<b>Hospital unit</b>							
Emergency	24	14.00%	19	11.00%	5	2.90%	
Surgery / operating theatre	16	9.30%	15	8.70%	1	0.60%	
Gynaecology	10	5.80%	8	4.70%	2	1.20%	
Laboratory	16	9.30%	16	9.30%	0	0.00%	
Medicine	19	11.00%	16	9.30%	3	1.70%	
Paediatrics	18	10.50%	17	9.90%	1	0.60%	p = <0.001
Reanimation	7	4.10%	6	3.50%	1	0.60%	
Blood bank	10	5.80%	10	5.80%	0	0.00%	
Maternity	16	9.30%	15	8.70%	1	0.60%	
Radiology and imaging medical	4	2.30%	3	1.70%	1	0.60%	
Day hospital	17	9.90%	16	9.30%	1	0.60%	
Dentistry	9	5.20%	2	1.20%	7	4.10%	
ORL	3	1.70%	1	0.60%	2	1.20%	
Ophthalmology	1	0.60%	1	0.60%	0	0.00%	
Psychiatry	2	1.20%	2	1.20%	0	0.00%	
<b>Medical profession</b>							
Medical Specialist	14	8.10%	0	0.00%	14	8.10%	
General Practitioner	11	6.40%	0	0.00%	11	6.40%	
Nurse	57	33.10%	57	33.10%	0	0.00%	
Midwife/ Birth attendant?	5	2.90%	5	2.90%	0	0.00%	p = 0.001
Laboratory technician	24	14.00%	24	14.00%	0	0.00%	
Medico-Sanitary Engineer	11	6.40%	11	6.40%	0	0.00%	
Health care assistant	50	29.10%	50	29.10%	0	0.00%	
<b>Professional experience</b>							
Less than 5	58	33.70%	46	26.70%	12	7.00%	
From 5 to 9	41	23.80%	36	20.90%	5	2.90%	
From 10 to 14	39	22.70%	38	22.10%	1	0.60%	
From 15 to 19	19	11.00%	15	8.70%	4	2.30%	p = 0.182
From 20 to 24	11	6.40%	9	5.20%	2	1.20%	
25 and above	4	2.30%	3	1.70%	1	0.60%	

**Description:** Table showing socio-demographic and professional characteristics of study participants; PMS (Paramedical Staff); MS (Medical Staff)

professional category was statistically significant with  $p = 0.002$ .

#### Declaration of BEA

Reporting a BEA was perceived as an important response by 76.70% of HCWs, with the lowest perception rates observed among nurses and orderlies, as shown in (Table 6). There was a statistically significant

relationship between reporting a BEA and professional category ( $p < 0.001$ ). Approximately 85.50% of HCWs showed a lack of knowledge for reporting procedures, while 59.9% stated that reporting procedures were complicated.

Approximately 57.00% of HCWs stated that a report should be made after BEA, while 22.70% recommended drawing up a medical

**Table 2:** Frequency of BEA by occupational category.

Characteristics	BEA Victim				Total		P value
	YES		NO		n	%	
	n	%	N	%			
<b>Professional category</b>	108	62.80%	64	37.20%	172	100.00%	
PMS	100	68.00%	47	32.00%	147	100.00%	p = <0.1%
MS	8	32.00%	17	68.00%	25	100.00%	
<b>Profession</b>	108	62.80%	64	37.20%	172	100.00%	
Medical Specialist	4	28.60%	10	71.40%	14	100.00%	
Medical Doctor	4	36.40%	7	63.60%	11	100.00%	
Nurse	46	80.70%	11	19.30%	57	100.00%	p = <0.1%
Midwife/ Birth attendant	3	60.00%	2	40.00%	5	100.00%	
Laboratory technician	11	45.80%	13	54.20%	24	100.00%	
Medical-Sanitary Engineer	5	45.50%	6	54.50%	11	100.00%	
Health care assistant	35	70.00%	15	30.00%	50	100.00%	

**Description:** Table showing the frequency of BEA by occupational category. PMS (Paramedical Staff); MS (Medical Staff)

**Table 3:** Knowledge on mechanisms of occurrence of a BEA by occupational category.

Mechanisms of occurrence of a BEA	Professional category				Total (N=172)		P value
	PMS (n=147)		MS(n=25)		n	%	
	n	%	n	%			
Puncture	167	97.10%	142	96.60%	25	100.00%	
Cutting	142	82.60%	117	79.60%	25	100.00%	
Contact of a wound with blood	136	79.10%	113	76.90%	23	92.00%	p = 0.031
Blood splashes on mouth, eyes	109	63.40%	85	57.80%	24	96.00%	
Cap with a needle after use	106	61.60%	83	56.50%	23	92.00%	
Contact of healthy skin with blood	51	29.70%	50	34.00%	1	4.00%	

**Description:** Table showing the knowledge on mechanisms of occurrence of a BEA by occupational category. PMS (Paramedical Staff); MS (Medical Staff)

**Table 4:** Perceived knowledge of Infectious risks involved in BEA, by occupational category.

Infectious diseases	Professional category				Total (N=172)		P value
	PMS (n=147)		MS (n=25)		n	%	
	n	%	N	%			
HIV (AIDS)	146	99.30%	25	100.00%	171	99.40%	
Hepatitis C	141	95.90%	25	100.00%	166	96.50%	
Hepatitis B	139	94.60%	25	100.00%	164	95.30%	
Syphilis	74	50.30%	20	80.00%	94	54.70%	
Tetanus	59	40.10%	21	84.00%	80	46.50%	p = <0.001
Ebola	51	34.70%	20	80.00%	71	41.30%	
Tuberculosis	40	27.20%	19	76.00%	59	34.30%	
Covid-19	36	24.50%	16	64.00%	52	30.20%	
Malaria	8	5.40%	6	24.00%	14	8.10%	
Cancer	7	4.80%	0	0.00%	7	4.10%	

**Description:** Table showing the perceived knowledge of infectious risks involved in BEA, by occupational category. PMS (Paramedical Staff); MS (Medical Staff)

**Table 5:** knowledge of first aid in the event of a BEA

First aid measures	Professional category				Total (N=172)		P value
	PMS (n=147)		MS (n=25)		N	%	
	n	%	N	%			
Wash with soap and water	108	73.50%	23	92.00%	131	76.20%	
Disinfect the wound with 70° alcohol or Betadine	85	57.80%	23	92.00%	108	62.80%	
Disinfect with bleach diluted 1:10	80	54.40%	23	92.00%	103	59.90%	
Wash with water only	59	40.10%	16	64.00%	75	43.60%	
Squeezing the wound to make it bleed	59	40.10%	1	4.00%	60	34.90%	p = 0.002
Disinfect with pure bleach	23	15.60%	0	0.00%	23	13.40%	

**Description:** this table showing HCWs' knowledge of first aid in the event of a BEA. PMS (Paramedical Staff); MS (Medical Staff)

certificate, as shown in (Figure 1). The 48-hour reporting time limit was known by 18.60% of the HCWs.

### Medical follow-up after BEA

The need for medical follow-up after BEA was known by 88.40% (n=152) of the HCWs. According to the professional category, 20/147 PMS were unaware of this (p=0.05). Of the 172 HWs, 88.4% (n=152) were aware of the need to investigate the source patient's HIV status and only 16/147 PMS were unaware of this (p=0.093). The need for post-exposure prophylaxis after a BEA in the presence of an HIV-positive patient or a patient of unknown serology, was known by 86.60% (n=149) of the HCWs. By professional category, only 23/147 PMS (15.60%) were unaware of the need for post-exposure prophylaxis under the conditions described above (p= 0.034).

### Prevention of BEA

#### Training on BEA

The majority of respondents 117/172 (68.0%) stated that they had never received training on BEA.

#### Protection during care

According to the results obtained, 134/172 (77.9%) of HCWs protected themselves at all times while performing their duties, and 8/172 (4.7%) claimed to protect themselves sometimes, while on duty.

Approximately 84.9% (146/172) of these HCWs confirmed the existence of tools for the prevention of BEA (gloves, nose coverings, gowns) within their department.

#### Universal precautions

Universal precautions are a standard set of guidelines to prevent the transmission of blood borne pathogens from exposure to blood and other potentially infectious materials (OPIM). Universal precautions were introduced by the Centres for Disease Control (CDC) in 1985, mostly in response to the human immunodeficiency virus (HIV) epidemic. This activity reviews universal precautions and highlights the role of the interprofessional team in their application. The existence of universal precautions in relation to BEA was known by only 57.60% of the healthcare personnel (n=99).

#### Universal precautionary measures

The Knowledge of the different universal precautionary measures by occupational category

#### Hepatitis B vaccination

According to the results obtained, 52.90% of the respondents stated that they had been vaccinated against hepatitis B. For those who were

not vaccinated, their reasons are shown in (Figure 2) below.

### Key points for prevention of BEA

According to the data presented in (Figure 3), most of the HCWs (82.00%) recommended continuing the education on BEA as one of the keys for BEA prevention.

### Discussion

Blood exposure accidents are a major concern for HCWs, especially in developing countries. Assessing the knowledge, attitudes and practices of HCWs in the NRH with regards to BEA, was a necessary approach. Out of the 218 health care personnel in the NRH, 172 (78.89%) fully participated in this study. This percentage is comparable to that in most studies dealing with the same subject matter. For example, studies conducted in: Congo Brazzaville (69.9%), Morocco (52.81%), Togo (65,7%), and Ivory Coast (75,5%) [7, 8, 9, 10]. This percentage of HCWs from NRH is the highest yet, and shows the interest of the staff of this hospital in the subject matter. It demonstrates the concern and the need to equip the staff of the NRH on BEA, in order to contribute to the improvement of their working conditions.

The study population was relatively young with an average age of 35.55±7.46 years, predominantly represented by those under 35 years of age (56.90%). Similar data have been reported in the literature [7, 9]. This young demographic could be due to the recruitment of younger HCWs by the MINSANTE in recent years.

The average working experience of the respondents was 9.14±6.78 years, lower than that reported by Ebatetou *et al.*, of 13.7±6.5 years [7] and Younes *et al.*, of 15 years [11]. This further proves that a younger population of healthcare personnel have been recruited by MINSANTE in the last ten years because of the ageing population of HCWs.

Women were predominant in this setting and represented 54.7% of the study population (sex ratio = 0.72). This has equally been observed

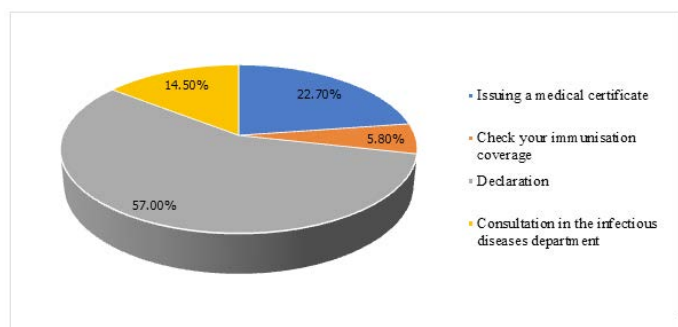


Figure 1: Approach for the declaration of BEA.

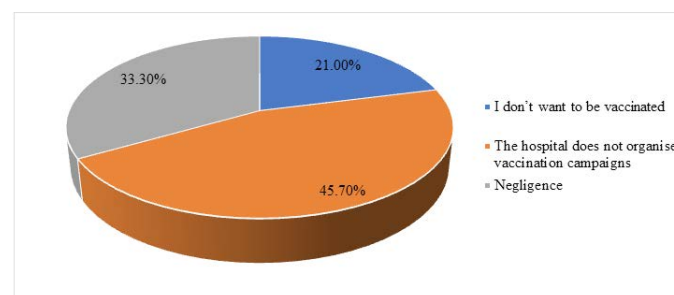


Figure 2: Reasons for not vaccinating against hepatitis B.

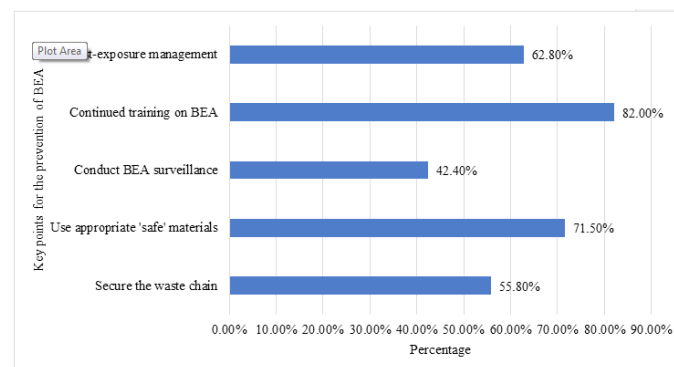


Figure 3: Key points for the prevention of BEA according to the different categories of health care personnel.

**Table 6:** Distribution of reporting rate of blood exposure accidents by occupational category.

Professional category	Mandatory reporting of BEA				P value
	Yes		No		
	n	%	n	%	
<b>Professional category</b>	<b>132</b>	<b>76.70%</b>	<b>40</b>	<b>23.30%</b>	<b>p = 0.003</b>
PMS	107	72.80%	40	27.20%	
MS	25	100.00%	0	0.00%	
<b>Profession</b>	<b>132</b>	<b>76.70%</b>	<b>40</b>	<b>23.30%</b>	<b>p = 0.018</b>
Medical Specialist	15	100.00%	0	0.00%	
Medical Doctor	10	100.00%	0	0.00%	
Nurse	39	68.40%	18	31.60%	
Midwife/ Birth attendant	4	80.00%	1	20.00%	
Laboratory technician	19	79.20%	5	20.80%	
Medico-Sanitary Engineer	11	100.00%	0	0.00%	
Health care assistant	34	68.00%	16	32.00%	

**Description:** table VI represents the reporting rate of blood exposure accidents by occupational category. All MS affirmed Mandatory reporting of BEA

**Table 7:** Knowledge of the different universal precautionary measures by occupational category.

Universal precautionary measures	Professional category		P value
	%PMS (n=147)	%MS (n=25)	
Wear gloves if there is a risk of contact with blood, biological fluids or soiled equipment	91.80%	96.00%	p = 0.013
Place sharps in safety containers immediately after use	87.80%	88.00%	
Wash your hands before and after each treatment	83.70%	80.00%	
Do not recap the needles	74.10%	96.00%	
Do not work on duty if you have skin lesions on your hand	51.00%	56.00%	
Decontaminate soiled surfaces or objects with water only	51.00%	12.00%	
Detach the needles by hand after use	37.40%	4.00%	

**Description:** this table represented the different universal precautions proposed to the HCWs to choose. About this, the awareness rates varied from 4.00% to 96.00%

in other studies including: 54.70% in another study from Cameroon, 57, 50% in Congo Brazzaville, and 72, 50% in Morocco [5, 7, 11]. This high percentage of women is probably because they represent the majority of Cameroon's population and are implicated in education and science, more now than in the past.

The predominant hospital units of the respondents were the reception and emergency departments (14.00%) followed by the medical department (11.00%). In their study, Ebatetou *et al.* found a predominance of the emergency and intensive care units (28.3%) followed by the medical unit (27.3%) and the medical-surgical unit (26%) [7]. Bagny *et al.* in Togo reported a predominance of the medical sector (65.2%) followed by the laboratory (17.7%) [12], Vikkey *et al.* in Benin found a predominance of surgery (27.2%) and laboratory (17.7%) [13]. In Morocco, Moussa *et al.* found a predominance of the surgical pole (48.7%) [8], during the course of their work, 62.80% of the HCWs claimed to have been victims of at least one BEA. Similar frequencies have been reported by several authors in sub-Saharan Africa [1, 9, 11, 14]. According to occupational category, BEA were more frequent among paramedical staff than among medical staff (p < 0.1%). A study by Younes *et al.* also reported that paramedical staff was the most exposed to BEA [11].

The staffs of the NRH appears to have a good knowledge of the main mechanisms of occurrence of BEA, namely: needle stick injury (97.10%), skin cut with a sharp object (82.60%) and contact of a wound with infected blood (79.10%). Ebatetou *et al.* had similar results: needle stick with blood or blood-contaminated biological fluid (85.8%), contact of a wound with infected blood (70.7%) and skin cut with a sharp object (62.20%) [7]. However, these findings differ from those reported by Bagny *et al.*, where needle stick injuries represented 100% of

all BEAs in their setting [12]. Nevertheless, needle stick injuries remain the main risk factor in the occurrence of BEA reported frequently in the literature [11, 12, 15].

The type of infection in the source patient from which a BEA originated, the depth of an infected wound brought in contact with a HCW, and the type of equipment causing injury were the three main factors known by most HCWs (> 81.40%), to be involved in the severity of a BEA. Based on professional category, the responses were identical for both paramedical and medical staff (p=0.87).

The three main infectious agents (HIV, HBV, and HCV) were perceived as risk factors by 99.40%, 96.50% and 95.30% of HCWs respectively. These results were similar to those reported by Laraqui *et al.* and Ebatetou *et al.* [1, 7], but differ from those of Ndiaye *et al.* which were 36.40% for HIV, 29.6% for HBV and 23.3% for HCV [16], and Younes *et al.* who reported rates of 0.3%, 3% and 30% for HIV, HCV and HBV respectively [11]. Based on professional category, medical staff was more aware of the risk of contracting infection, than paramedical staff. The diversity of knowledge acquired during the different basic training courses, between the paramedical and medical staff would explain the difference in perception. The need for initial and on-going training on BEA is essential for all health care personnel in order to aid in the proper management of infectious waste.

### First aid after a BEA

In case of a BEA such as a prick or blood spill on injured skin, the first emergency care consists of, immediately cleaning the wound with running water and soap, disinfecting with a chlorinated derivative (Dakin's solution or Bleach (usually 5.25% or 6.00%–6.15% sodium hypochlorite depending upon manufacturer) is usually diluted in water

at 1:10) or, cleaning with 70% alcohol or iodised polyvidone in dermal solution (ensuring a contact time of at least 5 minutes). In case of a blood spill on a mucous membrane, such as the conjunctiva, rinsing thoroughly, preferably with physiological serum or with water for at least 5 minutes is sufficient. In case of percutaneous exposure, the HCW should not cause the wound to bleed. A risk assessment should be carried out immediately after the BEA, by a referring physician.

In this study, 76.20% of participants recommended washing with soap and water after an accident which is similar to 68.80% found in the Koné *et al.* study and 50% in the Saint-Laurent *et al.* study [17, 18]. With regards to disinfection, 61.35% recommended it, while 21%, 39.3%, and 96% recommended disinfection in the study conducted by Koné *et al.*, Ebatetou *et al.*, and, Saint-Laurent *et al.* respectively [7,17,18]. This low percentage in the knowledge of standard protocols in the event of a BEA can be explained by the fact that there is a lack of ongoing training on BEA, as only 32.00% of the HCWs stated that they had received training on BEA.

As concerns intervening after a BEA, the practice of inducing a bleed was found in 34.90% of the participants in the study. According to the professional category, this rate represents 59/147 of paramedical staff and 1/25 of medical staff. This is much higher than the rate reported by Gondo *et al.* which was 3.33% of respondents [14]. This common attitude of bleeding superficial wounds has no scientific basis and could be considered risky as it turns a superficial wound into a deep wound [14]. It would be important to raise awareness on what to do in case of a BEA.

### Post-exposure prophylaxis

Post-exposure prophylaxis (PEP) is currently the only way to reduce the risk of HIV infection when in contact with an HIV-infected patient or contaminated objects. The importance of using PEP in the presence of an HIV-positive patient or a patient of unknown serology was confirmed by 86.60% of HCWs. In Congo Brazzaville, Ebatetou *et al.* found 79.20% while in Côte d'Ivoire, Eholie *et al.* found 42.5% in favour of PEP [7, 10]. The difference in knowledge on the need to prescribe PEP after a BEA is related to the professional category. Only 15.60% of paramedical staff were unaware of the need for PEP ( $p=0.034$ ). This is logical from the point of view of the different functions and educational levels between medical and paramedical personnel. On the other hand, the difference noted between the two categories, by Eholie *et al.* was not statistically significant [10].

### Declaration of blood exposure accidents

As far as the medico-legal approach is concerned, the declaration of the accident at work must be made 24-48 hours after the accident to the occupational physician or the referring physician, who provides information on the risks incurred, analyses the circumstances in which the accident occurred, assesses the need for serological follow-up, and draws up the initial descriptive medical certificate in order to guarantee the rights of the injured [1]. There is a misconception with regards to the legal time limit for reporting a BEA to occupational medicine and the need to contact the referring doctor for medical follow-up. Usually, a maximum period of 48 hours is required for reporting a BEA by public sector employees, while reporting to a medical doctor for follow-up has to be an immediate action.

During the study, 76.70% of the respondents in all occupational categories thought all BEA should be reported. This result is similar to those obtained by Eholie *et al.* (84.60%) and Ebatetou *et al.* (89, 20%) [7, 10]. The reasons for non-reporting of BEA were mainly due to personal

negligence (85.50%), followed by lack of knowledge on reporting procedures (59.9%), and complicated procedures to follow after BEA (16.9%). It is important to report BEA for better management in case of exposure, and to ensure better surveillance of BEA within the hospital.

### Investigation of the patient's serological status after a BEA

In our survey, the majority (90.60%) of respondents thought that the patient's serological status should be investigated after a BEA. This result ties closely with those by Ebatetou *et al.* (86.3%) and Bagny *et al.* (87.80%) [7,12]. Knowledge of a patient's serological status makes it possible to determine the next steps to take in the event of exposure. Approximately 88.40% of the participants in the study thought medical follow-up was necessary after a BEA. These results are similar to those obtained by Ebatetou *et al.* (87.00%) [7].

### Knowledge and attitudes/practices

#### Training on BEA

Approximately 32.0% of the caregivers claimed to have never received training on BEA. This rate is close to the one reported by Moussa *et al.* of 28.70% [8]. To prevent BEA, the need for initial and continuing training on BEAs remains essential for its health care personnel.

#### Protection during care

About 77.9% of HCWs claimed to protect themselves during care. This result is higher than that reported by Gondo *et al.* 31.3% [14]. The availability of a means of prevention against BEA within the services and the routine supply of personal protective equipment (goggles or visor, single-use gown, single-use mask, single-use gloves, hydro alcoholic solution) in the different areas of activity would greatly contribute to observing safety measures and preventing BEA.

#### Universal precautionary measures

The existence of universal measures for the prevention of BEA was only known by 57.60% of the health care personnel. This result is similar to certain studies found in the literature: in Congo Brazzaville (55.7%), in Ivory Coast (68.7%), in Senegal (68%), in The Democratic Republic of Congo (80%), and higher than those found in Benin (45.5%): [7, 10, 16, 19]. Generally, knowledge on universal precautionary measures, varied from 4.0% to 96.0%. It is necessary to know the universal precautions to apply during care, for any patient whatever is his/her infection status.

#### Hepatitis B vaccination

Hepatitis B virus is a major public health problem, and Cameroon, with a high prevalence of 9.2% in the general population and 8.7% among health workers, is among the most affected countries in the world and in Africa [20]. The management of HVB is still very problematic as it is very costly despite the public health measures already put in place by the government, the best way to prevent the disease remains vaccination.

Approximately 52.90% of respondents claimed to have been vaccinated against hepatitis B. Comparing the vaccinated and unvaccinated participants, versus the BEA and non-BEA groups, a significant variation was observed with regards to BEA ( $p=0.03$ ). Vaccinated participants were mostly found in the non-BEA group. In the study by Gondo *et al.* the reported rate of vaccination against hepatitis B was 66.94% and only 28.9% of respondents reported having been vaccinated against hepatitis [14]. In the absence of vaccination,

the risk of contamination by the hepatitis B virus from a patient carrying HBsAg by health personnel is four times higher than that of the general adult population not working in a hospital environment. The most frequently mentioned reason for non-vaccination was the absence of a vaccination campaign organised by the hospital (45.70%). Hospitals should organise free screening and vaccination campaigns for their staff because effective vaccination remains the best means of prevention against this hepatitis B viral infection.

### **Suggestion from staff interviewed on improving working conditions**

Most respondents called for training (82.0%) on BEA as one of the key points of BEA prevention, followed by the use of appropriate 'safe' equipment (71.50%). This would be due to the absence of initial and continuous training on BEA, which should normally be organised by MINSANTE through programmes and courses, but by the hospital management through the occupational medicine department, the infectious diseases and hospital hygiene departments.

### **Conclusions**

This study highlighted the knowledge, and practices of healthcare personnel at the NRH, in relation to BEA. A high frequency (62.80%) of BEA was reported by the staff of the NRH. The implementation of a surveillance system for occupational contamination among HCWs is imperative. More than half of the staff (68.0%) had never received training on BEA. Hence, the need for education on BEA for NRH health staff remains essential. It was noted that a significant number of the participants in this study (77.90%) took precautions to avoid BEA. The average knowledge of the respondents about the risks of infection and the main infectious agents that can be transmitted during a BEA is no guarantee. Given the low rate of vaccination against hepatitis B, initiatives should be taken to encourage healthcare personnel to be vaccinated against hepatitis B in order to protect themselves, their family members and patients.

### **Recommendations**

#### **Ministry of Public Health**

- The establishment BEA reporting and information systems, awareness and health education on BEA in all health facilities;
- Creation of an occupational health service;
- Provide health coverage for its employees;

#### **To the administration of the Ngaoundere Regional Hospital**

- Implement a policy of routine HIV, HBV, HCV screening for all hospital workers;
- Ensure continuous training of health workers on BEA (declaration, management and prevention);
- Always provide staff with personal protective equipment (gloves, nose coverings, gowns, safety glasses or a face mask, single-use waterproof apron);

#### **To the health staff of the NRH**

- Participate in various workshops and ongoing training on BEA;
- Consider any source of biological fluid as potentially infectious;
- Report all cases of BEA;

- Rigorously observe universal protective measures;
- Vaccinate against certain infections (Hepatitis B)

### **Competing Interests**

The authors declare no competing interests.

### **Conflicts of Interest**

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

### **Authors' Contributions**

All authors contributed to this work. They all read and approved the final version of the manuscript.

### **Acknowledgments**

The authors wish to thank all the health professionals and the administration of the NRH for their participation in this study.

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