Open Journal of Epidemiology, 2023, 13, 195-207
https://www.scirp.org/journal/ojepi
ISSN Online: 2165-7467
ISSN Print: 2165-7459

Prognostic Factors for the Occurrence of Blood Exposure Accidents among Health Personnel at the Kaolack Regional Hospital (Senegal)

Boubacar Gueye[1*], Fatoumata Ly[2], Ndéye Marième Diagne[3], Martial Coly Bop[1], Alioune Badara Tall[1], Abdoul Aziz Ndiaye[1], Ousseynou Ka[1]

[1]Health and Sustainable Development Department, Alouine Diop University, Bambeye, Senegal
[2]Ministry of Health and Social Action, Dakar, Senegal
[3]Principal Hospital of Dakar, Dakar, Senegal
Email: *boubsan2000yahoo.fr, ly.fatoumata@yahoo.fr, yamaismael@yahoo.fr, martialcoly.bop@uadb.edu.sn, alouinebadara.tall@uadb.edu.sn, abdoulaziz.ndiaye@uadb.edu.sn, ousseynou.ka@uadb.edu.sn, cheikhtacko.diop@uadb.edu.sn

How to cite this paper: Gueye, B., Ly, F., Diagne, N.M., Bop, M.C., Tall, A.B., Ndiaye, A.A. and Ka, O. (2023) Prognostic Factors for the Occurrence of Blood Exposure Accidents among Health Personnel at the Kaolack Regional Hospital (Senegal). *Open Journal of Epidemiology*, **13**, 195-207.
https://doi.org/10.4236/ojepi.2023.133015

Received: June 19, 2023
Accepted: August 8, 2023
Published: August 11, 2023

Abstract

Caregivers are highly exposed to blood exposure accidents (BEA). The objective of our study is to determine the frequency of BEA and to identify the predictive factors for the occurrence of BEAs among caregivers at the Kaolack Regional Hospital (KRH). It is a descriptive and analytical cross-sectional study of KRH's caregivers. The data were collected during the period from 16 to 26 April 2018. The multivariate analysis was carried out using the binary logistic regression model with a dependent variable (occurrence of blood exposure accidents) and 5 explanatory variables (sex, age, service of belonging, professional category and seniority in the profession). A total of 115 caregivers were surveyed out of 144. It is noted that 68 caregivers (59.1%) have had at least one BEA in the previous 12 months. The age of caregivers significantly reduces the risk of developing a BEA (p = 0.004, CI [0.04 - 0.21]); belonging to the age group [20 - 40 years] increases the risk of a BEA by 6.66. Sex significantly influences the occurrence of BEA with a (p = 0.013, CI [1.47 - 19.4]); men are 5 times more likely to develop BEA. The risk of a BEA occurring varies according to the professional category. Senior health technicians have a significantly 50 times lower risk of occurrence of a BEA (p = 0.007, CI [0.00 - 0.24)]. Nurses and midwives have a 5.8 lower risk of developing BEAs (p = 0.031, CI [0.03 - 0.75]). The risk of occurrence of BEAs varies according to the service of belonging; Medicine service caregivers have a significantly 50-fold lower risk of developing BEAs (p = 0.004, CI [0.00 - 0.17]). The identified risk factors will be used to better guide our BEAs prevention interventions.

Keywords

Blood Exposure Accidents, Prognostic Factors of Occurrence, Senegal

1. Introduction

Health professionals in the exercise of their profession are exposed to many risks, among which we have blood exposure accidents (BEA). BEA is defined as accidental contact with blood or body fluid contaminated with blood during a prick with a needle, during a cut with a sharp object or during contact with blood or fluid contaminated on a wound, damaged skin or mucous membrane [1].

Every year, 3 million health workers are victims of BEA; 90% of which are found in developing countries. In developed countries, the incidence of BEA has declined because of efforts to prevent it, while in developing countries BEA remains a major concern for healthcare workers [2] [3].

The Study Group on the Risks of Exposure of Caregivers to Infectious Agents (GERES) found in West Africa, (Ivory Coast, Mali and Senegal) a prevalence of BEA at 33% for percutaneous accidents and 44% for accidents by skin-to-mucous membrane contact in 2005. In Benin, studies have revealed a higher rate (39.7%) of BEA [4].

BEA constitute a real concern within our healthcare structures, where they are characterized by a lack of knowledge of their prevalence, under notification and insufficient preventive measures despite the efforts made in their prevention.

Few data is available on BEA and their predictors of occurrence among health workers in developing countries and particularly in West Africa.

It is in this context, that we undertook this study, the objectives of which are to determine the prevalence of accidents and to identify the predictive factors of the occurrence of BEA in the nursing staff of the Kaolack Regional Hospital (KRH) in Senegal.

2. Framework and Methodology of the Study

2.1. Study Framework

The framework of our study is KRH, a level 2 hospital located in central Senegal. It has 308 beds and 261 agents. Among these agents, we have 31 doctors and 107 paramedics. It includes medical departments (nephrology, internal medicine, outpatient consultations, infectious diseases, pneumology, pediatrics, and dermatology), gyneco-obstetric departments, an emergency and reception department, an administrative department, an anesthesia-intensive care department, diagnostic assistance departments (medical imaging, laboratory), and surgical departments (ophthalmology, general surgery, orthopedics, otolaryngology).

There is a nosocomial infection control committee in the hospital, responsible for the fight against BEA. BEA must be reported to the referring medical doctor responsible for ensuring their treatment.

2.2. Methodology

This is a descriptive and analytical cross-sectional study of nursing staff at KRH level during the period from April 16 to 26, 2018.

The sampling was exhaustive and involved all medical and paramedical staff.

The study included medical and paramedical staff working in Kaolack hospital and trainees from different health training schools.

Not included in the study, staff absent or unavailable during data collection and staff who expressed refusal to participate.

Data collection was done based on a questionnaire administered to staff.

Two categories of data were collected:

- socio-professional data: age, sex, department of affiliation, professional category and seniority in the profession;
- existence of blood exposure accidents in the past 12 months.

The questionnaire is anonymous. The data collected is confidential and kept in a secure place. Participation in the study was free, no harm or benefit arose from participating or not in this study.

The data collected was entered using an input mask developed with the Epidata software. This database was then analyzed with R software version 4.3.0.

The univariate analysis was carried out with a descriptive study of the data (mean, frequency, standard deviation, etc.).

The bivariate analysis was performed with the Chi-square test or Fisher's exact test. These tests made it possible to identify the variables of interest. The confidence interval was 95%, and the difference considered significant if $p < 0.05$.

Multivariate analysis was performed using the binary logistic regression model fitted to all variables with as:

- dependent variable: occurrence of accident of exposure to blood;
- independent variables: sex, age, department to which they belong, professional category and seniority in the profession.

The selection of variables for the full model was made with the significant variables ($p \leq 0.05$ on the Chi-square test or Fisher's exact test) and variables whose $p \leq 0.2$ on these tests.

The final model was determined by the "mixed stepwise method" using maximum likelihood for the introduction and elimination of variables at 5% thresholds.

The model coefficients were then estimated and their significance on the model determined (the likelihood ratio, the deviance test and the Wald test).

The overall significance of the model was determined by the likelihood ratio test. The adequacy of the logistic regression model was studied, *i.e.* we evaluated the quality of fit of the model to the data (Pseudo-R^2, Hosmer and Lemeshow test) and assessed its discriminating power (ROC curve, AUC, index C, residues analysis).

3. Results

Our study covered all the health staff working in the hospital and students. We had 115 completed questionnaires out of the 144 planned, for a response rate of 79.8%.

3.1. Profile of the Study Population

3.1.1. Socio-Professional Data

The population studied is predominantly young (average age: 35.4 years) with an average length of seniority in the profession equal to 8 years.

It is mainly female with 67% women. The medical department accounts for the majority of health workers, with 44.5% of those surveyed.

Nurses and midwives are the socio-professional category most affected, with 30.5% of them having had at least one BEA (Table 1).

Table 1. Distribution of healthcare providers according to age, sex, department to which they belong, seniority in the profession and professional category (n = 115).

Variables	N	%
Age		
Age < 40 years	84	73%
Age ≥ 40 years	31	27%
Sex		
Male	38	33%
Female	77	67%
Departments		
Surgery	12	10.5%
Laboratory	7	6%
Maternity	29	25%
Medicine	51	44.5%
Emergencies	16	14%
Seniority in the profession		
[0. 10) years	81	70.5%
[10, 20) years	23	20%
[20, 30) years	4	3.5%
[30, 40] years old	7	6%
Professional categories		
Medical doctor	15	13%
Senior technician	9	7.8%
Nurse and Midwife	35	30.5%
Nursing assistant	34	29.5%
Student	17	14.7%
Volunteer	5	4.3%

3.1.2. Blood Exposure Accidents

We collected 68 cases of health care providers who had been exposed to blood exposure accidents at least once in the past 12 months; a 59.13% BEA rate during our study.

However, 96 BEA cases were reported by providers (providers were exposed more than once) with 68 who were exposed at least once. These BEA are mainly the result of injuries or cuts and projections of biological products.

In the twelve months prior to the study, 50 providers had suffered injuries from care procedures, a 43.5% rate. Of these, 27 (54%) had a single injury and three (6%) had more than three.

Injuries during the care procedures were exclusively at the hands (92%), and in half of cases caused by the needles. These injuries were reported by 43.5% of providers, but only in 19.4% of cases to the Referring Medical doctor, and washing combined with antisepsis were the first measure taken after the BEA.

Accidental projections of biological products were found in 38 providers (38.7%).

Projections were received more in the hands and face in 42.1% [CI (95%): 26.3 - 59.2] and 36.8% [CI (95%): 21.8 - 54] of cases respectively.

Following projections of pathological biological products, washing and the use of antiseptics were the measures most frequently taken.

Only 18.42% of providers reported spills of biological products in the care environment, and more often to a colleague.

Almost 60.3% of cases involve women. Nurses and midwives account for 28% of BEA cases. Nursing assistants and doctors account for 29.4% and 14.7% of BEA cases respectively. Healthcare providers with less than 20 years of experience in the profession represent 97% of BEA cases. Maternity accounts for 27.9% of BEA cases and the medical department for 47% (**Table 2**).

We also note that 66.6% of doctors, 80% of volunteers, 54.3% of nurses and midwives and 58.8% of nursing assistants have completed at least one BEA in the past 12 months (**Table 2**).

3.2. Results of the Analysis

A bivariate analysis was first performed in order to identify the variables of interest.

3.2.1. Bivariate Analysis

The variables (age, department of affiliation, seniority in the profession) are all significant on the tests ($p < 0.05$). The other variables (sex, risky practices, and professional categories) all have p-values < 0.2 on tests. Thus, all the variables were integrated into the complete model (**Table 3**).

The analysis of the variables did not reveal any interactions or confounding factors.

3.2.2. Multivariate Analysis

A multivariate analysis was initiated in order to identify the risk factors associated with the occurrence of a blood exposure accident. Table 2 presents the results of the prognostic model that we evaluated using binary multiple logistic regression applied to our series.

The final model is made up of variables significant to the Wald test. These are: age, sex, professional category and the department to which the health personnel belong (Table 4).

The final model is validated after a diagnosis made based on the following elements:

- **Identification of variables having a significant effect on the model.**

The p-values associated with the odds ratios tell us whether an odd ratio is significantly different from 1, compared to the reference modality (Table 3). However, this does not indicate whether overall a variable has a significant effect on the model. To test the overall effect on a model, statistical tests (the likelihood ratio, the deviance test and the Wald test) were used. Their results are presented below (Table 5).

Table 2. Distribution of BEA according to age, sex, department to which they belong, seniority in the profession and professional category (n = 115).

Variables	Number of persons having made a BEA	N	% of persons having made a BEA
Age			
Age < 40 years	59	84	70.2%
Age ≥ 40 years	**9**	31	29%
Sex			
Male	27	38	71%
Female	41	77	53.2%
Departments			
Surgery	6	12	50%
Laboratory	3	7	42.8%
Maternity	19	29	65.5%
Medicine	32	51	62.7%
Emergencies	8	16	50%
Seniority in the profession			
[0, 20) years	66	104	63.5%
[20, 40) years	2	11	18.2%
Professional categories			
Medical doctor	10	15	66.6%
Senior technician	2	9	22.2%
Nurse and Midwife	19	35	54.3%
Nursing assistant	20	34	58.8%
Student	13	17	76.5%
Volunteer	4	5	80%

Table 3. Comparison test results applied to variables.

Variables	Number and % of persons having made a BEA	Tests	p value
Age < 40 years	59 (70%)	Fisher exact test	$p < 0.001$***
Female	41 (53.2%)	Fisher exact test	$p = 0.07$
Departments			
Surgery	6 (50%)	$\chi^2_{Pearson}$ 12.04	$p = 0.017$*
Laboratory	3 (42.8%)		
Maternity	19 (65.5%)		
Medicine	32 (62.7%)		
Emergencies	8 (5%)		
Seniority in the profession			
[0, 20) years	66 (63.5%)	Fisher exact test	$p = 0.007$**
[20, 40) years	2 (18.2%)		
Professional categories			
Medical doctor	10 (66.6%)	$\chi^2_{Pearson}$ 8.78	$p = 0.11$
Senior technician	2 (22.2%)		
Nurse and Midwife	19 (54.3%)		
Nursing assistant	20 (58.8%)		
Student	13 (76.5%)		
Volunteer	4 (80%)		

Signification codes: 0 "***" 0.001 "**" 0.01 "*" 0.05 "." 0.1 " " 1.

Table 4. Results of the adjusted logistic model.

Variables	OR	IC	Pr (>|z|)
Sex			
Female	-	-	-
Male	5.01	1.47 - 19.4	0.013 **
Age			
<40 years	-	-	-
≥40 years	0.15	0.04 - 0.51	0.004 **
Professional categories			
Nursing assistant	-	-	-
Volunteer	0.8	0.4 - 22.8	0.9
Medical doctor	0.88	0.15 - 5.00	0.9
Student	0.93	0.18 - 5.03	> 0.9
Nurse and Midwife	0.17	0.03 - 0.75	0.031*
Senior technician	0.02	0.00 - 0.24	0.007**
Departments			
Surgery	-	-	-
Laboratory	0.23	0.00 - 8.27	0.4
Maternity	0.24	0.01 - 2.34	0.2
Medicine	0.02	0.00 - 0.17	0.004**
Emergencies	0.24	0.01 - 3.65	0.3

Meaning codes: 0 "***" 0.001 "**" 0.01 "*" 0.05 "." 0.1 " " 1.

Table 5. Results of the significance tests of the model variables.

	Df	Déviance	AIC	LRT	Pr (>Chi)
Sex	1	106.39	130.39	6.7450	0.009**
Age	1	113.14	135.14	9.8673	0.001**
Professional category	5	116.26	138.26	13.9352	0.016*
Department	4	130.68	146.68	24.2855	0.000***

Null deviance: 155.57 on 114 degrees of freedom; Residual deviance: 106.39 on 103 degrees of freedom; AIC: 130.39; Number of Fisher Scoring iterations: 5.

The tests show that the variables (age, sex, professional category, and department) have a significant effect on the model retained with a p value < 0.05 (**Table 5**).

- **The overall significance of the model**

The overall significance of the model was determined by the maximum likelihood test which revealed a significant difference between the model retained and the model consisting only of the factor studied ($\chi^2 = 49.176$ and p = 0.000).

We can therefore conclude that the explanatory variables simultaneously have an influence on the probability of occurrence of the event studied.

- **Determination of model suitability**

It is a question of appreciating the quality of fit of the model to the data. If the fit is correct, the predicted values will be close to the observed values.

Mc Fadden's Pseudo-R^2 evaluated the overall fit of the model. In this study, the Pseudo-R^2 is 0.46. It is considered significant for this series (p-value > 0.2).

The Hosmer and Lemeshow test by evaluating the calibration of the model also makes it possible to assess the quality of fit of the model to the data. The test gives significant results

($\chi^2 = 1785.2$ and p-value > 0.05); the fit of the model to the data is considered satisfactory.

The ROC curve (Receiver Operating Characteristic) and AUC (Area under the ROC curve) allow to estimate the goodness of fit of the binary classification model. They also make it possible to assess the discriminating power of the model by measuring its predictive capacity.

The area under the ROC curve (AUC) is a measure of the discriminating power of the model. With an AUC equal to 0.84, our model has excellent discrimination (**Figure 1**).

The predictive capacity of the model was also measured by the index C (probability of agreement) which is equal to 0.84; our model is therefore excellent according to the classification.

- **Analysis of residues and levers**

The analysis of these residuals makes it possible to rule on the existence or not of observations that are very poorly adjusted and possibly having a significant effect on the estimation of the coefficients.

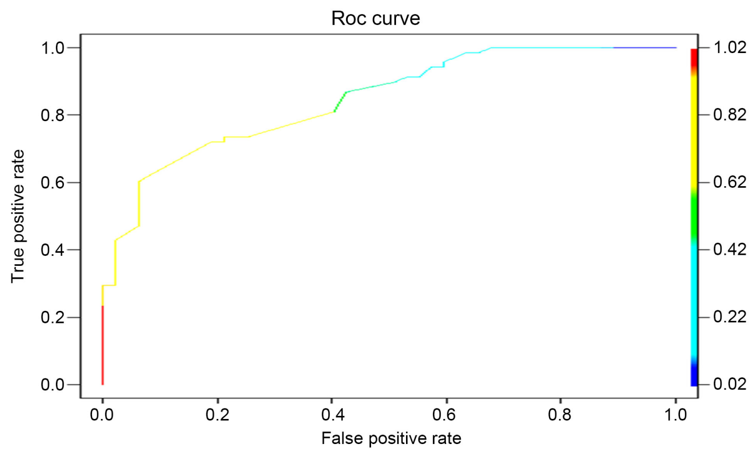

Figure 1. ROC curve.

The Pearson Residues test (p = 1) and the deviance residuals test (p = 0.389), which are used to assess the relevance of the model, show significant results ($p > 0.05$); the model fits the data well.

4. Comments

4.1. Profile of the Study Population

Our study focused on the 144 health care providers working in hospital or in an internship (coming from health training schools). Unfortunately, only 115 agents were investigated; ie a response rate of 79.8%.

The average age in our study is 35.3 years, thus testifying to the youth of our population. This youth is well illustrated by the seniority in the profession, which has an average of 8 years. These results are comparable to studies carried out under similar conditions by Niang* and Ndiaye* who find an average age of 32 and 35 years, respectively [5] [6]. Laraqui* made the same observation with an average age of 33 years in a study carried out among internists in 2 hospitals in Morocco [7]. This youth of the providers in our series can be understood by the inclusion in our study of students from health training schools.

Our study population is predominantly female (67%). This distribution corresponds to the current trend of feminization in the medical discipline.

Our study shows that 44.5% of practitioners mostly serve in medical departments. Most of these practitioners are nurses and midwives (60.87%). Diallo* found in his work a similar proportion of practitioners working in medicine (61.4%) [8]. This is explained by the fact that the medical department is the most important in the hospital, bringing together a large number of specialties.

Blood exposure accidents are common among medical personnel in Kaolack Hospital. In our study, 59.13% of the practitioners had at least one BEA in the last 12 months.

This prevalence is high compared to those found in other studies carried out in France and Morocco where they were 40.3 and 58.9% respectively [7] [9]. The explanation for this difference could be found in the best operating conditions observed in these countries, with better availability and better use of means of protection.

Niang* had found a higher prevalence of BEA (74%), because its target consisted mainly of pediatric surgeons who are very exposed [6]. However Koné* found a frequency of 61.4% in a hospital in Mali in 2005, a frequency similar to that of our study [10].

4.2. Predictive Factors

- **Age**

The age of healthcare workers significantly (p = 0.004) decreases the risk of occurrence of BEA with a CI of [0.04 - 0.21]. Membership of health personnel in the age group [20 - 40] increases the risk of developing BEA by 6.66. Younger staff therefore with little experience are at greater risk of BEA.

Ouologuem* in a study in Mali found in its series of care providers with BEA, that 64.3% of them were under 40 years old [11].

This could be explained by the fact that it is the younger workers, therefore less experienced, who are the most active in the care environment.

Bouhlel* in his study on BEA among young doctors at Farhat Hached University Hospital in Sousse in 2016 found a large number of BEA of young interns in the 1st year, which decreased with seniority [12]. The lack of experience of young trainee doctors seems to be one of the main risk factors for the occurrence of BEA in this professional category. Thus, the training and awareness raising of young doctors is a simple and inexpensive part of preventing potentially serious accidents, the management of which is expensive.

- **Sex**

Gender significantly (p = 0.013) influences the occurrence of BEA with a CI of [1.47 - 19.4]. In fact, men are 5 times more at risk of developing BEA compared to women. Verhoef* demonstrated that male hospitals interns had a greater risk of developing BEA than female [13].

Ouologuem* found these same results in the study [11].

The higher risk appetite in men who perform professional acts without taking all the necessary precautions may be an attempted explanation.

- **Professional category**

The risk of occurrence of BEA varies depending on belonging to a professional category. Senior technicians have significantly (p = 0.007 and CI [0.00 - 0.24)] 50 times less risk of occurrence of BEA. Nurses and midwives are 5.8 less likely to have BEA (p = 0.031, CI [0.03 - 0.75]).

A high frequency of BEA among nurses and midwives compared to other professional categories has been demonstrated by many studies [5] [14] [15] [16] [17].

Ehui* found a frequency of occurrence of BEA of 29.1% for physicians, followed by nurses and orderlies, ie 19.8% and 12.1% respectively [18].

Other authors, however, found that BEAs were much more common in surgeons, and that these accidents were at lower risk of transmission and much less often reported [11] [19] [20].

It should be noted, however, that most of these studies concluded this state of affairs through univariate or bivariate analysis. Our study through a logistic regression finds different results. The adjusted risk of occurrence of BEA is lower among nurses, midwives and senior health technicians than among other professional categories. We could explain it by the fact that nurses, midwives and senior technicians have a higher dexterity than other professional categories when it comes to high-risk procedures (punctures, tissue removal, injection, sutures, etc.).

Senior technicians have a lower risk of occurrence of BEA than nurses and midwives. The fact that senior technicians do with less high-risk actions than nurses and midwives might explain this.

- **Department**

The risk of occurrence of BEA varies depending on the department of health personnel. Those in the medical department have a significantly (p = 0.004, CI [0.00 - 0.17]) 50 times less risk of developing BEA.

It is important to note that in our study, 27.9% of BEA occurred in the maternity department against 47% of the medecine department, which concentrates 44.5% of the hospital staff. Being in the medical department reduces the risk of developing BEA. In fact, in these departments, the nursing staff do less high-risk procedures compared to other departments such as surgery. These results are corroborated by many other studies [19] [20].

One of the limitations of the study is the participation of students and nursing assistants. It is a staff not sufficiently trained whose practices tend to increase the frequency of BEAs. However, this is a constant reality in our health facilities, which always have students in training and care aides.

Although the study data has been collected since 2018, it remains relevant as no significant changes have been observed in the hospital's BEAs control. In addition, the staff structure is still the same. Consequently, the conclusions of the study are still valid for 2022.

As Senegal's hospitals operate in similar contexts, the results of this study could easily be applied to them.

5. Conclusion

BEAs are still a concern for healthcare professionals, particularly those in developing countries where their frequencies remain high. Our study was able to highlight prognostic risk factors for the occurrence of BEA in the nursing staff of KRH. These factors should guide our interventions to prevent BEA. Prevention strategies to improve the safety of caregivers must be oriented towards their training, retraining on BEA, supervision, protective equipment, compliance with standard precautions. Special attention should be given to volunteers and students in training.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Cantineau, A., Brauer, G., Deiss, V., Guillet, N. and Hetch, M.T. (2002) Healthcare Strategy. BEA Prevention and Action Training. *Soins*, **671**, 42-44.

[2] Sow, S., Bouvet, E., Claeys, P., Diallo, M., Doumbia, S., Mboup, S., Ndoye, I., Rachline, A. and Tarantola, A. (2001) Knowledge and Practices at Risk of Blood Exposure Accident (BEA) among Medical Health Care Workers in 3 West African Countries. *XII International Conference on AIDS and STDs in Africa*, Ouagadougou, Burkina Faso, 9-13 December 2001.

[3] Tarantola, A., Abiteboul, D. and Rochine, A. (2006) Infection Risks Following Accidental Exposure to Blood or Body Fluids in Health Care Workers: A Review of Pathogens Transmitted in Published Cases. *American Journal of Infection Control*, **34**, 365-375. https://doi.org/10.1016/j.ajic.2004.11.011

[4] Zannou, D.M., Adè G., Houngbè, F., Fanou, S.P. and Fayomi, B. (2006) Epidemiological Factors Related to Blood Exposure Accidents in Hospitals in Cotonou, Benin. *Médecine d'Afrique Noire*, **53**, 413-418.

[5] Ndiaye, M., Cissokho-Beye, D. and Sow, M.L. (2011) Les accidents avec exposition au sang (AES) au CHNU de Fan de Dakar (Sénégal). CAMIP—L'Actualite de la Santé au Travail.

[6] Niang, K. (2010) Attitudes and Practices of Medical Staff with Regard to HIV Infection and Its Transmission in Health Care Settings: The Case of Paediatric and Paediatric Surgery Departments in Four Hospitals in Dakar-Senegal. Cheikh Anta Diop University, Dakar.

[7] Laraqui, C.H., Tripodi, D., Rahhali, A., Bichara, M., Laraqui, S., *et al.* (2002) Knowledge, Practice and Behavior of Health Care Workers Confronted with AIDS and the Occupational Risk of HIV Transmission in Morocco. *Médecine et Maladies Infectieuses*, **32**, 307-314. https://doi.org/10.1016/S0399-077X(02)00373-6

[8] Diallo, I. (2013) Knowledge, Attitudes and Practices Relating to HIV Infection among Medical Staff at the National Hospital Centre of Fann. University Cheikh Anta Diop, Dakar.

[9] Rabaud, C.H., Leporide, M.L., Vigneau, M.C., Martin, C., May, T. and Canton, P.H. (1996) Accidents avec exposition au sang (AES) au CHU de Nancy: Enquête sur le comportement du personnel vis-à-vis du risque de contamination par le VIH. *Médecine et Maladies Infectieuses*, **26**, 327-331. https://doi.org/10.1016/S0399-077X(96)80207-1

[10] Koné, M.C. and Mallé, K.K. (2015) Les accidents d'exposition au sang: connaissances et pratiques des personnels de santé d'un hôpital du Mali. *Bulletin de la Société de Pathologie Exotique*, **108**, 369-372. https://doi.org/10.1007/s13149-015-0451-4

[11] Ouologuem, S. (2011) Etude épidémiologique et Pronostique des accidents d'exposition au sang dans le service des maladies infectieuses au du point G. Thèse de doctorat en médecine, Université de Bamako, Mali. https://www.bibliosante.ml/handle/123456789/1112

[12] Bouhlel, M., Guedri, S.E., Afia, A.B., Mlayah, S., Kacem, I., *et al.* (2018) [Blood Exposure Accidents in Young Doctors: Frequency and Risk Factors]. *Archives des*

Maladies Professionnelles et de l'Environnement, **79**, 228-229.
https://doi.org/10.1016/j.admp.2018.03.024
http://www.sciencedirect.com/science/article/pii/S1775878518300729

[13] Verhoef, Y. (2013) [Blood Exposure Accidents among Interns: Frequency of Accidents but Low Application of Treatment Recommendations]. University Toulouse III-Paul Sabatier, Toulouse.
http://thesesante.ups-tlse.fr/181/1/2013TOU31066.pdf

[14] Consten, E.C., Van Lanschot, J.J., Henny, P.C., Tinnemans, J.G. and Van der Meer, J.T. (1995) A Prospective Study on the Risk of Exposure to HIV during Surgery in Zambia. *AIDS*, **9**, 585-588. https://doi.org/10.1097/00002030-199506000-00009

[15] Gumodoka, B., Favot, I., Berege, Z.A. and Dolmans, W.M.V. (1997) Occupational Exposure to HIV Infection among Health Care Workers in Mwanza Region in Tanzania. *Bulletin of the World Health Organization*, **75**, 133-140.

[16] Abiteboul, D., Lamontagne, F., Lolom, I., Tarantola, A., Deschamps, J.M., *et al.* (2002) Incidence of Blood Exposure Accidents among Nurses in Metropolitan France 1999-2000: Results of a Multicentre Survey in 32 Hospitals. *Bulletin Epidémiologique Hebdomadaire* (*BEH*), **51**, 256-259.

[17] Boal, W.L, Leiss, J.K., Ratcliffe, J.M., Sousa, S., Lyden, J.T., *et al.* (2010) The National Study to Prevent Blood Exposure in Paramedics: Rates of Exposure to Blood. *International Archives of Occupational and Environmental Health*, **83**, 191-199.
https://doi.org/10.1007/s00420-009-0421-x

[18] Ehui, E., Kra, O., Ouattara, I., Eholie, S., Kakou, A., Bissagnene, A. and Kadio, A. (2007) Management of Accidental Exposure to Blood in the Treichville Teaching Hospital, Abidjan (Côte-d'Ivoire). *Médecine et Maladies Infectieuses*, **37**, S251-S256.
https://doi.org/10.1016/j.medmal.2007.03.016

[19] Daou, A. (2008) Evaluation des accidents d'exposition au sang chez le personnel de santé au CHU du Point G. Thèse de doctorat en médecine, Université de Bamako, Mali. https://www.keneya.net/fmpos/theses/2008/med/pdf/08M599.pdf

[20] Dany, F. (2006) Etude sur les risques de transmission professionnelle du VIH-SIDA à l'hôpital du Point G, Bamako (Mali). Thèse de doctorat en médecine, Université de Bamako, Mali, 95 p.