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Original Article

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Occupational Blood and Body Fluids Exposures: Prevalence, Sources and Predictors among Healthcare Providers in South-South Nigeria

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A B S T R A C T

Background: In Nigeria as in other African countries, blood and body fluids exposure (BBFE) amongst healthcare providers are generally underreported or poorly documented. **Objective:** This study aims to assess the prevalence, sources and predictors of BBFE among healthcare providers in south-south Nigeria. **Method:** This was a cross-sectional study conducted to assess the prevalence, sources and predictors of BBFE among 565 healthcare providers. Data was collected using a semi-structured questionnaire which was self-administered. Descriptive and inferential analysis of data collected was carried out using the IBM SPSS version 22 software. **Results:** Over half (58.6 %) of the study participants reported at least one BBFE in the previous one year preceding the study. Needle stick injury (42.0%) and accidental mucosal exposure (33.0%) were the commonest sources of BBFE respectively; while skin contacts (13.0 %) and sharp cut injury (12.0 %) were the least sources of BBFE among the study participants. The study participants who work in a non-surgical department and who had received IPC training were 40 % and 50% respectively less likely to have BBFE. **Conclusion:** The prevalence of BBFE was high among the study participants. Regular training of healthcare providers in infection prevention and control is recommended.

INTRODUCTION

Healthcare providers have a higher risk of blood-borne infections (BBIs) via blood and body fluids exposure (BBFE).[1-3] BBFE among healthcare providers occurs via percutaneous injury (i.e., needle or sharp injury to the skin), accidental splash to mucous membrane of the eyes, nose or mouth and exposure of non-intact skin.

It is estimated that over 3 million percutaneous injuries occur every year among healthcare providers globally; with over four-fifth of cases occurring in Africa.[4-7] Most of the BBFE among healthcare providers in Africa is due to percutaneous injury (needle stick and sharp cut) which accounts for over three-fifth of BBFE among healthcare providers.[2] It is estimated that about two thirds of healthcare providers in Africa during their entire career are exposed to blood and body fluids (BBFs) and about half of them are exposed to BBFs each year.[2]

The reported prevalence of BBFE among healthcare providers in Africa is 36.0%.[2] In Nigeria, prevalence of 58.2 % and 70.7 % has been reported from

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Table 1: Socio-demographic characteristics of the study participants

Variables	Categories	Frequency (%) N=565
Age (years)	21-30	231 (40.9)
	31-40	219 (38.8)
	41-50	89 (15.8)
	51-60	26 (4.6)
Sex	Male	208 (36.8)
	Female	357 (63.2)
Marital status	Married	305(54.0)
	Not married	260 (46.0)
Profession	Doctors	211 (37.3)
	Nurses/Midwives	165 (29.2)
	*Others	189 (33.5)
Department	Surgical	225 (39.8)
	Non-surgical	340 (60.2)
Years of experience	0 - <1	85 (15.0)
	1-5	229 (40.5)
	6-10	119 (21.1)
	>10	132 (23.4)

*Mean age = 33.0 ± 7.7; Mean years of experience= 7.5 ± 5.7; *Others (health assistants, and final year medical and nursing students)*

Table 2: Sources of BBFE among the study participants

Variables	Categories	Frequency (%)
BBFE (N=565)	Yes	331 (58.6)
	No	234 (41.4)
Sources of BBFE (N=331)	Accidental splash	109 (32.9)
	Needle stick injury	139 (42.0)
	Blood skin contact	43 (13.0)
	Sharp cut injury	40 (12.1)
Activities leading to needle stick injury (N=139)*	Recapping used needles	121 (87.1)
	Administration of injection/intravenous line	62 (44.6)
	Suturing	60 (43.2)
	Discarding biomedical waste	51 (36.7)

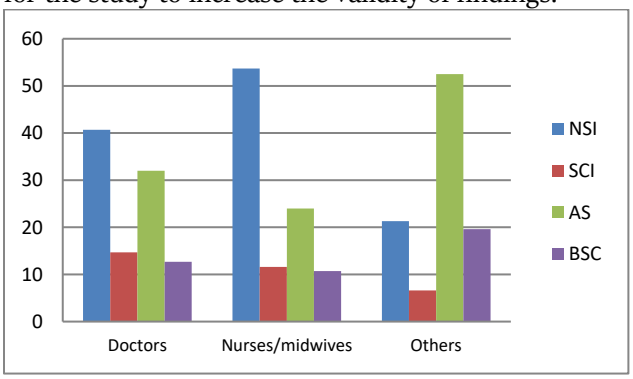
**Multiple responses*

previous studies conducted in Benin City and Zaria, respectively.[6,7] This high prevalence of BBFE among healthcare providers in Nigeria has serious implications for the health of the exposed healthcare providers and patients' safety.[6,7] Healthcare settings in high-income countries have established surveillance systems to track the occurrence of BBFE as well as inform stakeholders on the best strategies to prevent BBFE among healthcare providers.[8] In Nigeria as in other African countries, BBFE among healthcare providers are rarely tracked and are generally underreported and poorly documented.[6,7,9] Healthcare delivery continue to be hazardous in Nigeria in the face of high prevalence of highly infectious blood-borne pathogens (BBPs). Therefore, a good understanding of the sources and predictors of BBFE among healthcare providers will inform decision making to mitigate this challenge. This study was conducted to assess the prevalence, sources and predictors of BBFE among healthcare providers in south-south Nigeria.

METHOD

This was a cross-sectional study of healthcare providers delivering patients' care at three randomly selected public hospitals (two secondary and one tertiary) providing specialist care in Delta State, Nigeria. The study was conducted over a period of eight months (June 2015 to January 2016).

The minimum sample size was determined based on a prevalence of BBFE among health-care providers of 70.7 % reported from a previous study,[6] an error margin of 5 % and standard normal variant at 95% confidence level. The determined minimum sample size was 318; however, 565 participants were selected for the study to increase the validity of findings.



(NSI= Needle stick injury; SCI= Sharp cut injury; AS= Accidental splash; BSC= blood/body fluids-skin contact)

Figure 1: Sources of BBFE by profession of the participants

A multi-stage sampling technique (three stages) was applied in this study. In the first stage, three public hospitals (Central hospital, Warri and Sapele respectively; and Delta State University Teaching Hospital, Oghara) were randomly selected by ballot from a sample frame of six public health facilities (two tertiary and four secondary) providing specialist

Table 3: Predictors of BBFE among study participants

Variables	Categories	N=565 Exp (%) N=331 (58.6)	No Exp (%) N=234 (41.4)	Bivariate Analysis χ2 (p value)	Regression Analysis AOR (95% C.I.)
Age (years)	21-30	131 (56.7)	100 (43.3)	**16.8 (0.001)**	0.6 (0.22-1.41)
	31-40	148 (67.6)	71 (32.4)		0.5 (0.21-1.33)
	41-50	43 (48.3)	46 (51.7)		0.8 (0.32-2.27)
	51-60	9 (34.6)	17 (65.4)		1
Sex	Male	128 (61.5)	80 (38.5)	**1.18 (0.276)**	-
	Female	203 (56.9)	154 (43.1)		
Marital status	Married	174 (57.0)	131 (43.0)	**0.06 (0.806)**	
	Not married	157(60.4)	103 (39.6)		-
Profession	Doctors	159 (75.4)	52 (24.6)	**80.6 (< 0.001)**	0.1 (0.06-0.25)
	Nurses/Midwives	111 (67.3)	54 (32.7)		0.1 (0.03-0.15)
	Others	61 (32.3)	128 (67.7)		1
Department	Surgical	177 (78.7)	48 (21.3)	**62.2 (< 0.001)**	1
	Non-surgical	154 (45.3)	186 (54.7)		0.6 (0.3-0.6)
Years of experience	0 - <1	39 (45.9)	46 (54.1)	**12.3 (0.006)**	6.1 (2.1-18.1)
	1-5	145 (63.3)	84 (36.7)		5.2 (1.9-13.8)
	6-10	78 (65.5)	41 (34.5)		4.2 (1.9-9.2)
	>10	69 (52.3)	63 (47.7)		1
Training on IPC	Yes	68 (33.7)	134 (66.3)	**80.5 (< 0.001)**	0.5 (0.3-0.9)
	No	263 (72.5)	100 (27.5)		1
*__Compliance with SP__	Good	6 (18.2)	27(81.8)	**23.6 (< 0.001)**	1
	Poor	325 (61.1)	207 (38.9)		14.6 (4.1-52.0)
*__Perception of risk BBI__	Good	62 (42.2)	85 (57.8)	**21.1 (< 0.001)**	1
	Poor	269 (64.4)	149 (35.6)		4.7 (2.6-8.4)

*BBI: Blood-borne infection; IPC: Infection prevention and control; SP: Standard precaution; *Others (health assistants, and final year medical and nursing students); *Composite*

health care in Delta State. In the second stage, health care providers in the three selected public health facilities were proportionately allocated into different strata by professional category and in the third stage a simple random sampling technique was used to select study participants, who were randomly selected (table of random numbers) from a list of healthcare providers in each stratum.

Data was collected using a pre-tested semi-structured questionnaire which was self-administered. The questionnaire was tested for its reliability and was validated with a reliability coefficient of 0.8. The questionnaire comprised of 4 sections which elicited information on the socio-demographic characteristics, compliance with standard precaution practices, perception of the risk of acquiring BBIs, 12-month history and sources of BBFE among the study participants in the three randomly selected public health facilities.

The primary outcome variable was the 12-month prevalence and sources of BBFE among the study participants. The secondary outcome variables were (i) infection prevention and control (IPC) training status - recorded using a binary scale (yes/no); (ii) compliance with standard precaution - assessed with ten (10) questions on a 4-Likert scale (never, sometimes, often but not always, always). Each correct response was scored one and every wrong response was scored zero. There was therefore a maximum of 10 points on the compliance with standard precaution. A score of 6 to 10 points was categorised as good compliance, while a score of 0 to 5 points was categorised as poor compliance; and (iii) perception of the risk of acquiring BBIs - assessed with two (2) questions on a 3-Likert scale (agree, disagree, indifferent). Each correct response was scored one and every wrong response was scored zero. There was therefore a maximum of 2 points on the perception of the risk of acquiring BBIs. A score of 2 points was categorised as good perception, while a score of 0 to 1 point was categorised as poor perception.

Statistical analyses

Data generated was analysed using the IBM SPSS version 22 software. Frequency tables were generated. Bivariate analysis using chi-square was carried out and statistical significance set at $p < 0.05$. Binary regression analysis was used to obtain the adjusted odds ratio for all variables significant at a p-value < 0.05 during bivariate analysis.

RESULTS

The study included 208 males (36.8 %) and 357 females (63.2 %). The mean age and years of experience among the study participants were 33.0 ± 7.7 years and 7.5 ± 5.7 years respectively (Table 1).

Over half (58.6%) of the study participants reported at least one BBFE in the preceding year before the study (Table 2). The commonest source of participants' BBFE was needle stick injury (42.0%), followed by accidental splash of BBFs to mucosal surfaces (32.9%), BBFs skin contacts (13.0%) and sharp cut injury (12.1%) in descending order (Table 2). The commonest activity leading to needle stick injury was recapping of used needles (87.1%), followed by administering injection or intravenous line (44.6%), suturing (43.2%) and discarding biomedical waste (36.7%) in descending order (Table 2).

The association of the study participants' age, professional cadre, department of work, years of experience, infection prevention and control (IPC) training status, compliance with standard precaution and perception of the risk of acquiring BBI with BBFE were significant ($p < 0.05$); while the association of the study participants' sex and marital status with BBFE were not significant ($p > 0.05$) (Table 3).

The multivariate analysis revealed that the study participants who work in a non-surgical department (AOR = 0.6; 95 % CI: 0.3 - 0.6) were 40 % less likely to be exposed to BBFs compared to those who work in a surgical department. Also the study participants who had no work experience (AOR = 6.1; 95 % CI: 2.1 - 18.1), had one to five years of work experience (AOR = 5.2; 95 % CI: 1.9 - 13.8) and had six to ten years of work experience (AOR = 4.2; 95 % CI: 1.9 - 9.2) were six-times, five-times and four-times respectively more likely to be exposed to BBFs compared to the study participants who had more than ten years of work experience. In addition, the study participants who had been trained on infection prevention and control (AOR = 0.5; 95 % CI: 0.3 - 0.9) were 50 % less likely to be exposed to BBFs compared to the study participants who have had no training. Furthermore, the study participants who were non-compliant with standard precaution (AOR = 14.6; 95 % CI: 4.1 - 52.0) had a fifteen-fold higher likelihood of being exposed to BBFs compared to the study participants who were compliant with standard precaution. Finally, the study participants who had poor perception of the risk of acquiring BBI (AOR = 4.7; 95 % CI: 2.6 - 8.4) had a five-fold higher likelihood of being exposed to BBFs compared to those who had good perception (Table 3).

DISCUSSION

The study revealed a high 12-month prevalence of BBFE among the study participants. This observed high prevalence is in consonance with previous studies' findings which had reported high prevalence of BBFE among healthcare providers.[6,7,10] The risks of acquiring BBIs such as HIV, HBV and HCV is high in healthcare settings, where healthcare providers are potentially exposed to BBFs of patients.[5-7] This should calls for concern by the relevant stakeholders in the study locations.

Over half (58.6 %) of the study participants had at least one BBFE during their clinical work in the preceding year before the study. The prevalence of BBFE observed in this study was comparable with the prevalence of 58.2% reported among healthcare providers in Edo State, Nigeria,[7] and a prevalence of 53.4% reported among healthcare providers in Tehran, Iran.[11] Needle stick injury and accidental splash (mucosal exposure) were the commonest sources of BBFE among the study participants. The prevalence of needle stick injury and accidental splash (mucosal exposure) among study participants was 42.0 % and 33.0 % respectively. The prevalence of needle stick injury observed in this study was lower than the prevalence of 70.7 % reported from similar studies conducted in Zaria, Nigeria;[6] and prevalence of 64.4 % reported in Ankara, Turkey.[10] Also the prevalence of accidental splash (mucosal exposure) observed in this study was lower than the prevalence of 62.0 % reported from a similar study conducted in an Indonesian teaching hospital.[12]

Nurses and midwives were most affected by needle-stick injury in this study. This is expected as patient handling situations such as administering injection, setting and removal of intravenous lines, recapping of

needles after injections, cleaning up instruments or discarding waste are mostly carried out by nurses and midwives.[13] The higher prevalence of needle stick injury among nurses and midwives observed in this study is in keeping with the findings from previous studies which have revealed that nurses and midwives were most at risk of needle stick injury. The assessment of the causes of needle stick injury in this study, revealed that recapping of needles was the leading cause of needle stick injury as it accounted for over four fifth of all reported needle stick injuries. Previous studies have documented the prevalence of needle stick injury ranging from 10.0 % to 79.0 % among healthcare providers as a result of recapping used needles.[6,14,15]

Study participants who worked in surgical departments in the randomly selected public health facilities were more exposed to BBFs compared to those who worked in non-surgical departments. This observation is in consonance with previous studies' findings which revealed higher prevalence of BBFE among healthcare providers, who worked in surgical units in healthcare settings.[13,16,17]

BBFE carry a definite risk for infection with blood-borne pathogens among healthcare providers. Therefore, the best approach to the control of blood-borne infection from patients to healthcare providers is via the prevention of BBFE. This approach has been reported to be dependent on regular infection prevention and control (IPC) training of healthcare providers.[18] Over three fifth of the study participants had not received any form of IPC training. The study participants who had no IPC training were most exposed to BBFs compared to those who had been trained. This observation is in keeping with previous studies' findings in Nigeria and elsewhere which identified regular IPC training of healthcare providers as a significant factor that drives safety practices among them.[6,18,19] A limitation to this study was the fact that it relied on the self-report of respondents in data collection of BBFE with a subsequent risk of recall bias.

In conclusion**,** there was a high 12-month prevalence of BBFE among the study participants. Needle stick injury and accidental splash (mucosal exposure) were the commonest type of BBFE among the study participants. The study also brings to the fore the positive effect of IPC training and compliance with standard precaution in preventing BBFE. Healthcare providers trained on IPC and who were compliant with standard precaution were less likely to be exposed to BBFs. Considering the high prevalence of BBFE among the study participants, there is the need to stimulate and motivate them to improve their compliance with standard precaution practices. It is recommended that IPC training should be a priority to the stakeholders in the randomly selected public health facilities. The concept of standard precautions needs to be re-emphasized to all healthcare providers and appropriate enforcement steps should be taken in the selected health facilities. This can be achieved via the institution of an IPC program to provide initial and continuing education for healthcare providers on safety practices against BBFE in the healthcare setting.

Ethical considerations

Ethical clearance was obtained from the research ethics committee of the Delta State University Teaching Hospital, Oghara. Institutional consent was also obtained from the management of the three selected public hospitals where the study was conducted. Informed consent was obtained from the participants before inclusion in this study. The participants were informed of the purpose of the research as well as their right to participate or refuse to participate in the study.

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Conflict of interest

The authors declare that there is no conflict of interest

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Authors' contributions

The conception, design, drafting of the research work, analysis and interpretation of the data were done by PGO; while MTO, MIN, NSA, OA were involved in the training of data collectors, data collection and analysis. PGO wrote the initial draft of the manuscript and all

the authors participated in its finalization. All authors read and approved the final manuscript.

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