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A multi-center study of the comparative evaluation of occupational exposure to blood and body fluids among health care workers in Edo central senatorial district, Nigeria

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Abstract

Introduction: *according to the World Health Organization, annually, about 3-4million health care workers (HCWs) are exposed to blood and body fluids (BBFs). This accidental exposure may lead to infections by blood borne pathogens, in particular, hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). This is highly worrisome especially in developing countries like ours where the prevalence of blood borne infections are high and the standard precautions´ practices are poor. Objectives: to determine and compare the prevalence and pattern of occupational exposure to BBF among HCWs at the three level of health care.* ***Methods:*** *the cross- sectional study was conducted amongst 492 HCWs working in 34 health care facilities in Edo Central Senatorial District, Edo State, Nigeria* ***Results:*** *one hundred and eighty nine (38.4%) of the HCWs at the three levels of health care delivery reported having sharps injuries, of these exposures, majority (50.4%) of HCWs in the primary health care centres (PHC) had more exposure to BBFs compared to the secondary(SHC) and tertiary health care (THC) centres where 34.9% and 24.4% had sharp injuries respectively. Similarly, 56.1% of the HCWs at the three levels of health care had exposure to BBFs via mucocutaneous route. Comparatively, more (62.8%) of the HCWs in the SHC had more BBFs exposure compared to HCWs in the in the PHC and THC (24.4%: 60.9%) respectively. Sharp exposures and BBFs splash exposures were common among health assistants (52.2%) and doctors (83.5%), compared to the other categories of HCWs at the three levels of health care.* ***Conclusion:*** *given the high prevalence of occupational to BBFs recorded at the three level of health care delivery, it is no gainsaying that occupational exposure to blood and body fluids requires urgent attention by hospital management and HCWs at all levels through continuous education on infection control and prevention.*

Introduction

Health care workers (HCWs) are persons whose activities involve contact with patients or with blood of patients or other body fluids from patients in health care, laboratory or public safety setting; these exposures are potentially infectious [1-9]. According to World Health Organization (WHO), there are about 35- 40 million health care workers providing services to patients worldwide, however, 3 million of these Health care workers are exposed to percutaneous injury yearly, with over 90% occurring in resource constrained countries[10-12].These preventable exposures can lead to over 20 different blood borne infections, the more serious and more frequently reported ones associated with occupational exposure in health care workers are Human immunodeficiency Virus (HIV), Hepatitis B virus(HBV) and Hepatitis C virus(HCV) infection [13-15]. The risk of contracting these infections after exposure to blood and body fluids through infected needle stick injury is 1 in 250 for HIV, 1 in 20 for HBV and 1 in 40 for HCV infections. Annually, these infections are estimated to result in approximately 16000 HCV, 66000 HBV and 2000 HIV infections [16,17]. “These infections are projected to account respectively, for a burden of 9, 177, and 679 disability adjusted life years between 2000 and 2030” [18]. The Centre for Diseases Control and Prevention (CDC) estimated that 600,000-800,000 needle stick injuries (NSI) occur yearly in USA [19-21].

Although, data from the developed world have shown the enormity of the problem, data from the developing countries are still lacking or incomplete. Data from studies in tertiary care hospitals in India reported incidence ranging from 300 to 400 per annum [22,23]. Also, data from studies involving HCWs in Tanzania and a Government tertiary hospital in South-South Nigeria showed an incidence of 5 needle stick injury per HCW per year and 3.6-9.5 per person year respectively [24,25]. Similarly, data from the University Teaching Hospital, Ilorin, Nigeria showed a high incidence of percutaneous Injury (57.8%) over a six months

period [16]. Additionally, data from cross sectional studies done among Primary Health Care Workers and Secondary Health Care workers in Nigeria revealed that the prevalence of exposure to blood and body fluids ranged between 25%-60% in southern and northern Nigeria respectively [26-28]. Although 90% of occupational exposures occur in developing countries, 90% of reports or documentation of occupational exposure to BBFs are available only for developed countries [29]. This lack of documentation and reporting of occupational exposure caused by needle or mucosal exposure to patients´ body fluids are considered a major drawback to protecting HCWs [30]. Therefore, it is imperative to urgently conduct this study and broaden our knowledge of occupational exposure to BBFs at three level of health care in Edo central senatorial, Nigeria.

Methods

The study was conducted using a comparative cross-sectional study design involving a total of 492 HCWs in 34 health facilities in Edo central senatorial district, Edo State Nigeria. Edo Central Senatorial District, is one of three senatorial districts in Edo State. There are 101 Primary healthcare centres (PHC), 8 Secondary health facilities (SHC) and 1 tertiary health facility within the Senatorial district, all owned and supported by the Local Government, State Government and Federal Government respectively. However, there are paucity of health care workers in the study area especially in the Primary and Secondary care facilities.

Study population and duration: the study population comprised HCWs working at the three levels of health care delivery in Edo Central Senatorial District of Edo state. All consenting HCWs who are involved in direct patient care and having been working in primary, secondary or tertiary public health care setting for at least 12 months prior to the study were included into the study why HCWs on leave were excluded. The minimum sample size for the HCWs was determined using formula for comparative cross sectional studies.

Study design and data collection method: the study was a descriptive cross-sectional design with a comparative component; participants were selected via a multistage sampling technique. An interviewer-administered semi-structured questionnaire was designed and used to collect information from 492 health care workers at the primary, secondary and tertiary health care levels. This data collection instrument was used in collecting information on socio-demographic data, exposure to blood and body fluids (BBFs), type of exposures, number of exposure etc.

Data management: data were entered into a spreadsheet and analyzed using IBM SPSS (statistics product and service solution) version 20.

Ethical considerations

Institutional approval: the study was reviewed and approved by the Department of Community Health, West Africa College of Physicians.

Ethical Approval: ethical approval to conduct this research was obtained from Ethics and Research Committee of Irrua Specialist Teaching Hospital.

Results

Mean age of respondents was 34.58± 8.12years, Mean duration of employment = 4.5± 4.30years. Majority of the respondents, 240(48.8%), were within the age group of 30-39 (mean age of 34.58 ± 8.12years). Out of the total participants recruited 147 (29.0%) were males and 345(71%) were females, giving male to female ratio of 1: 2.3. A significant proportion, 343(69.7%), of the participants had tertiary level of education, while 99(20.1%) and 50(10.2%), of the participants had primary education and secondary education respectively (Table 1). Majority, 307 (62.4%), of the participants were married while 147(35.2%) were singles. One hundred and ninety three (39.2%) of the respondents were nurses while 79(16.1%),

186(37.8%) and 34(6.9%) were doctors, health assistants and laboratory workers respectively. Three hundred and seventy two (75.6%) of the HCWS had been employed for less than five years, while 120(24.4%) of respondents had a work experience of greater than five years (Table 1). As shown in Table 2, one hundred and ninety eight of the participants had both Sharp injury and blood and body fluids splash, while 57 (11.6%) and 117(23.8%) had sharp injury and Blood Splash exposure only respectively. One hundred and twenty (24.4%) of respondents had no exposure to blood and body fluids. The overall life time exposure to BBFs preceding the study was 75.6%. Two hundred and forty-eighty participants were studied at the PHC level, out of which 190(76.6%) were exposed. Additionally, 37 (86.1%) and 145(72.1%) of the HCWS in the SHC and THC volunteered that they had been exposed to BBFs in their entire working carrier. The difference in the occurrence of accidental exposures across the three levels of health care was statistically significant (Table 3). Figure 1presents the relative prevalence of occupational exposure to BBFs at the three levels of health care. At all the levels, exposure to BBFs occurred at a higher frequency compared with exposure to sharps.

Comparatively however, the tertiary level of care recorded the least exposure to BBFs as 98(48.8%) of the respondents were exposed, as against about 151(61%) and 27(63%) of respondents at the PHC and SHC respectively. Also, a relatively higher percentage (50.4%) of PHC workers were exposed to sharp injuries compared with HCWs at the secondary (34.9%) and tertiary (24.4%) levels of health care. Overall, sharp injuries and exposures through splashes of BBFs within the 12 months preceding the revealed that more than one-third, 189 (38.4%), of the health workers were exposed to blood and body fluids through sharp injuries, while about half, 276(56.1%), of the HCWs at all levels of health care had splashes to blood and body fluids. Assessment of number of exposures in the preceding year indicate that about two-thirds of respondents were exposed to BBFs splash at least 2-5 times; 25% were exposed only once while about 2% were exposed more than ten times (Figure 2). In terms of sharps exposure, the number exposed 2-5 times and 5-10 times were about 35% each while 22.3% were exposed only once. About 8% were exposed more than 10 times (Figure 2). The major causes of sharp injuries reported in the study, include needle stick injuries which account for 62% of the exposures compared to ampoule injury, scalpel cut and others (blade, glass items), being 22%, 10% and 6% respectively (Figure 3). The most common circumstances for occupational exposure to blood and body fluids were: sudden movement of a patient during medical procedure, one hundred and thirty three (28.6%); recapping of needles and failure to use PPEs accounted for 111(23.7%) and 98 (21.1%) episodes of exposures respectively. Other risk factors included: exposure during clean-up, during surgery, manipulation of needles, during discarding of needles and others (during delivery, push from colleagues) which account for about 6.7% (Table 4), Figure 4. Almost fifty of the accidental exposure to BBFs in the PHC occurred as a result of sudden movement of patients during medical procedure. Similarly, 38.4% and 12.0% of the exposure in the SHC and THC occurred as a result of sudden movement of patients during medical procedure. The major circumstance for exposure at the PHC and THC was recapping of needles (50.5% and 43.2%). Others (during delivery, push from colleagues) accounted for majority of the exposure at the SHC.

Discussion

Occupational exposure to blood and body fluids by health care workers has been known to constitute significant hazards in health care settings [12,13,16]. These exposures in turn have an impact on HCWs´ households and the health care delivery system, especially in resource poor countries like Nigeria which has inadequate human capacity for health. The life time exposure to blood and body fluids was relatively high across the three levels of health care studied. The higher preponderance of life time exposure to BBFs meant

that HCWs in developing countries like Nigeria are probably at high risk of acquiring blood borne infections resulting from occupational exposure to blood and body fluids. The life time exposure to blood and body fluids among primary health care (PHC) workers was higher compared to what was reported among PHC workers in Northern Nigeria, where less than sixty of the health care workers reported life time exposure to BBFs [26]. In the secondary health and tertiary health care levels, greater than seventy percent of the HCWs had a life time exposure to BBFs. The figures recorded in this study is higher compared to what was reported in other studies conducted among secondary and tertiary health care workers in Nigeria and Iran, where less than seventy percent of the HCWs reported life time exposures to BBFs [16,27, 31]. Generally, HCWs in the tertiary health care setting recorded the lowest prevalence of life time exposure to BBFs compared to HCWs in the primary and secondary health care settings. This is possibly due to better knowledge and adherence to standard precautions among THC workers compared to the secondary and primary health care workers. The difference in findings compared to other studies, may be due to variations in the study respondents, health care settings and availability of standard precautions tools. However, the possible reasons for high prevalence of occupational exposure to blood and body fluids in this study may include; lack of specific measures to address occupational challenges such as inadequate standard precautions´ tools and poor knowledge of standard precautions.

In the PHC, greater that fifty percent of the HCWs were exposed to sharp injuries 12months preceding study. The finding is similar to what was observed among PHC workers in Australia, [32] but the figure recorded in this study is higher compared to the value recorded in other studies in Northern Nigeria [33,34]. In the SHC, majority of the respondents had sharp injuries 12months preceding study. Moreover, studies conducted among SHC workers in Nigeria, Lebanon and Georgia reported lower prevalence of percutaneous injuries [27,35,36]. Furthermore, the annual rate of percutaneous injuries among HCWs at the tertiary health care level was lower than the rates recorded in most parts of Nigeria, where the percentages ranged between 50-90% [16,37-39]. These discrepancies in prevalence is probably due to the design of this study which involved health care settings at both lower and higher levels of care as compared with other studies where a particular level of HCWs was studied. Also, this variation can be explained by the relatively poor adherence to standard precautions recorded in this study and improved health care system in developed world where safety-engineered devices (sheathed and retracting needles) were commonly used. The high prevalence of percutaneous injury recorded in this study simply meant that HCWs in developing countries are at a high risk of developing blood borne infections. These exposures do not only affect the safety and health of the health care workers, but also compromise the quality of health care delivered and thishigh exposure to blood and body fluids are obviously more worrisome and hazardous for HCWs in developing countries where the blood borne pathogens are common [12]. Besides, evaluation and management of such blood borne infections resulting from accidental exposure to BBFs constitute huge financial and psychological burden for the HCWs and the health care system, in terms of cost of management, absence from work and anxiety at work [34,40].

Other studies in Nigeria have found higher prevalence of percutaneous injury, with NSI frequencies greater than fifty percent. This indicates that the magnitude of the problem in Nigeria may be even higher than observed in the present study. Similar studies in more developed parts of the world such as Saudi Arabia have produced results that indicate lower prevalence (14.9%) [32]. In terms of other mode of exposure, a significant proportion of respondents across the three levels of health care delivery were exposed to BBFs through blood and body fluid splashes (mucocutaneous exposures). The high prevalence of blood and body fluid splashes reported in this

present study is likely to be a reflection of the poor standard precautions´ practices as it relates to the use of infection control materials such as PPEs. The blood borne infections contacted through these splash exposures potentially have serious negative outcomes, including prolong illness, disability and death of HCWs [1,12]. Findings from this study show that majority of the respondents at three level of health care were exposed to BBFs via mucocutaneous exposure, especially at the primary and secondary health care level, where greater than sixty of HCWs were exposed as against less than fifty percent recorded in the THC. The observation regarding occupational exposure to BBFs´ splashes at the three level of health care is lower compared to what was recorded in other studies conducted among HCWs in the primary, secondary and tertiary health care levels, where greater than fifty of the HCWs reported mucocutaneous exposures [30,35,37,41,42].The discrepancies may be due to variation in types of health care facilities studied and level of compliance to standard precautions. The main circumstances or risk factors for occupational exposure to BBFs in this study were: sudden movement of the patient during medical procedures and recapping of needles.Needle recapping is one of the most important risk factors associated with sharp injuries, therefore, a simple intervention to mitigate this risk hinges on quality training on standard precautions and positive attitudinal and behavioral changes. The circumstances for exposure to BBFs at the three level of health care are comparable with the reasons given in similar Nigerian studies, Africa and in other parts of the world [26,32,43,44].

Conclusion

The finding from the study showed that majority of the HCWs had significant exposure to blood and body fluids. However, majority of the HCWs at the lower levels of health care had more exposure to BBFs compare to the tertiary health care workers. Consequently, there is need for the government and management at different level of health care facilities to provide comprehensive, continues and quality in-service training for the HCWs. Also, the infection control unit of the hospital should establish surveillance system for registering, reporting and management of occupational injuries and exposures.

What is known about this topic

- *Data from the University Teaching Hospital, Ilorin, Nigeria showed a high incidence of percutaneous Injury (57.8%) over a six months period;*
- *Reports from a cross sectional studies done among Primary Health Care Workers and Secondary Health Care workers in Nigeria revealed that the prevalence of exposure to blood and body fluids ranged between 25%-60% in southern and northern Nigeria respectively;*
- *Although 90% of occupational exposures occur in developing countries, 90% of reports or documentation of occupational exposure to BBFs are available only for developed countries.*

What this study adds

- *Quite unfortunately, most of the studies enumerated above that showed what is already known about this topic were clearly done among HCWs at a particular level of health care delivery. To this effect, this study will bridge this gap and provide a comprehensive BBFs exposure of HCWs at the three level of healthcare delivery;*
- *Also this study will provide a comparative analysis of HCWs exposure at all the level of healthcare. In addition, anecdotal reports and detail search of literatures have shown that this is the first study done among HCWs at the three level of health in the senatorial district and probably in the state; also, it is among the very few studies that have been conducted among HCWs at three tiers of health care;*
- *Hence, is no gainsaying that this study will provide all the necessary basic information*

on occupational exposure to BBFs and as result influence policy decisions on hospital infection prevention and control.

Competing interests

The authors declare no competing interests.

Authors' contributions

All the authors have read and agreed to the final manuscript.

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Table 1: socio-demographic characteristics of health care workers		
Variable	**Frequency(n=492)**	**Percent (100%)**
Age group		
20-29	131	26.6
30-39	240	48.8
40-49	90	18.3
50-59	31	6.3
Marital status		
Single	173	35.2
Married	307	62.4
Divorced	2	0.4
Widowed	10	2.0
Sex		
Males	147	29.0
Females	345	71.0
Level of education		
Primary	50	10.2
Secondary	99	20.1
Tertiary	343	69.7
Job category		
Doctor	79	16.1
Nurse	193	39.2
Health Assistants	186	37.8
Laboratory Workers	34	6.9
Duration of practice(years)		
0-5	372	75.6
>5	120	24.4

Table 2: respondent's life time exposure to BBFs at the three levels	
Variables	**Frequency (n=492)**
Sharp injury alone	57(11.6%)
Blood and body fluids splash only	117(23.8%)
Both	198(40.2%)
None	120(24.4%)

Table 3: respondent's life time exposure to sharp injury and BBFs splashes at the three levels of health care (n=492)						
Health facility	**None**	**Sharp injury alone**	**Blood splash only**	**Both**	**Text**	**p-value**
PHC	58(23.4%)	30(12.1%)	50(20.2%)	110(44.3%)		
SHC	6(14.0%)	3(7.0%)	26(60.5%)	8(18.5%)	X2= 36.60	0.00001
THC	56(27.9%)	24(11.9%)	41(20.4%)	80(39.8%)		

Table 4: circumstances leading to exposure to blood and body fluids		
Risk factors	***Frequency(n=465)**	**Percent (%)**
Sudden movement of patient during medical procedure	133	28.6%
Recapping	111	23.7%
Failure to use PPEs	98	21.1%
During clean up	90	19.4%
During surgery	88	18.9%
Manipulation of needles	67	14.4%
During discarding of needle	59	12.7%
Others	31	6.7%
*Multiple response		

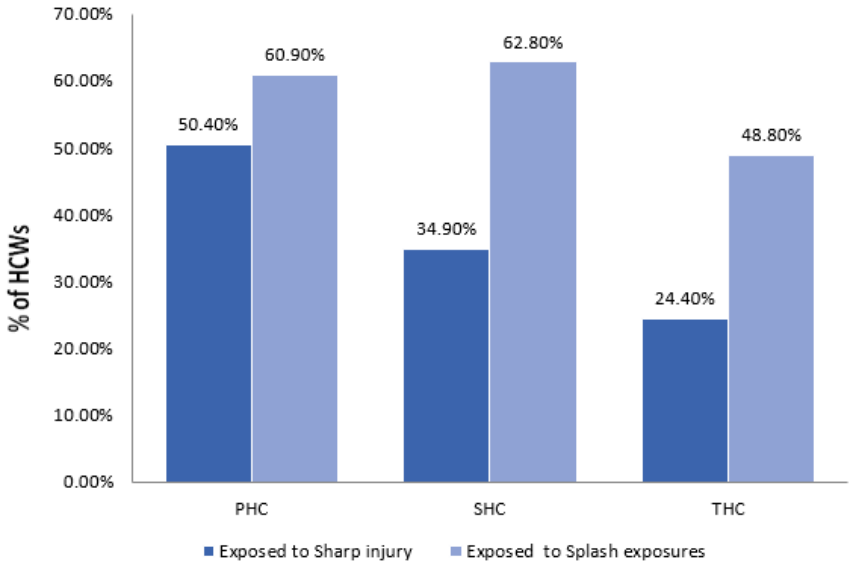

Figure 1: prevalence of occupational exposures to BBFs at the three levels of health care within 12month preceding study

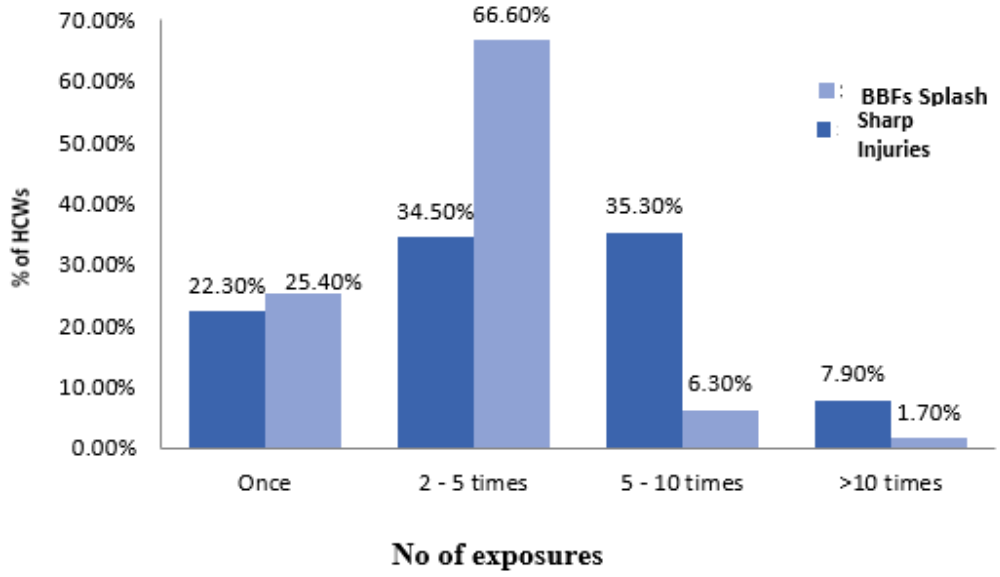

Figure 2: annual frequency of exposure to sharp injuries and BBFs splash

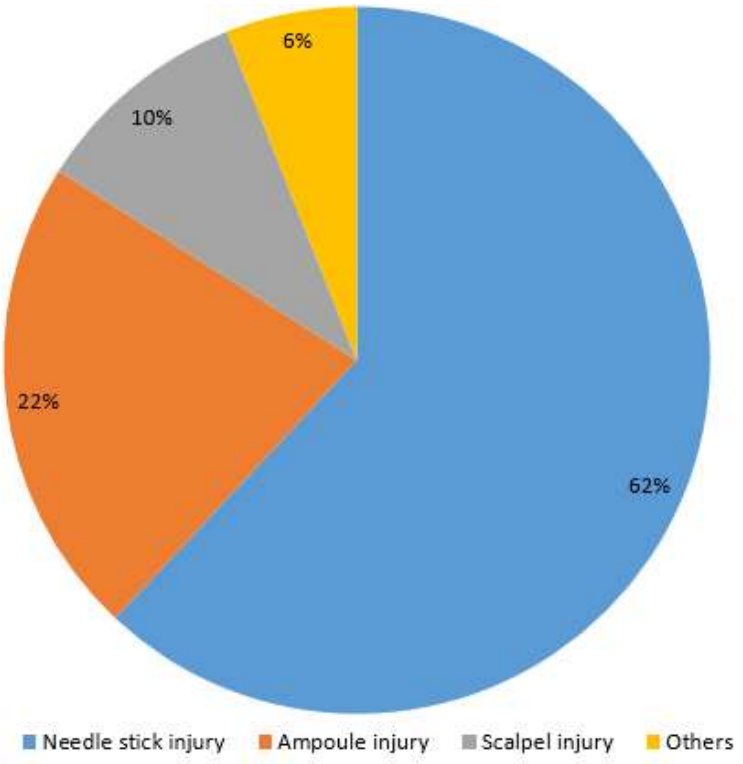

Figure 3: distribution of causes of sharp injuries among the respondents

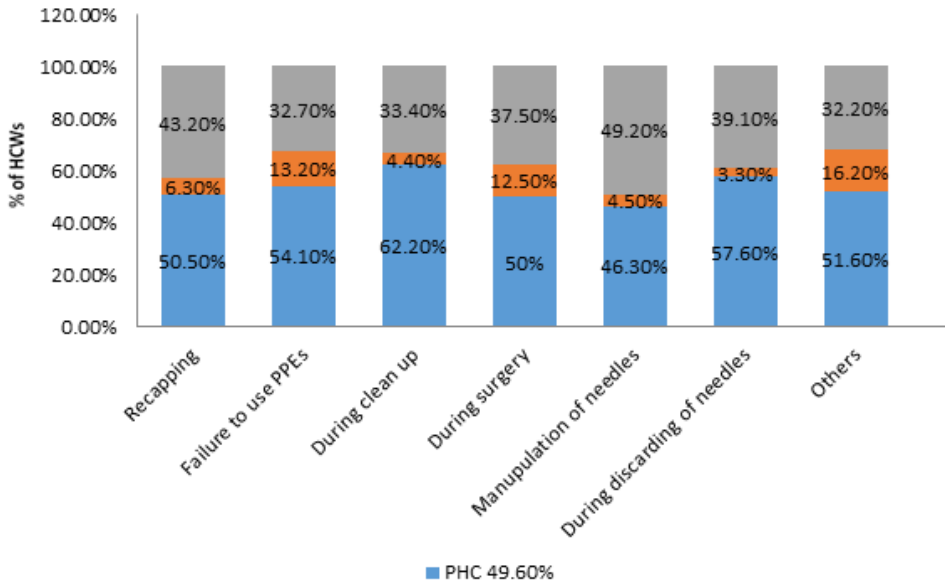

Figure 4: circumstances leading to exposure to blood and body fluids among HCWs at three level of care