journal of global health Reports

Assessment of knowledge and usage of HIV post exposure prophylaxis among healthcare workers in a regional hospital in Ghana

Felicia Babanawo[1], Abdallah Ibrahim[2], Ozge Sensoy Bahar[3], Augustine Adomah-Afari[4], Ernest Maya[5]

[1]Policy, Planning, Monitoring, and Evaluation Division, Ghana Health Service, Accra, Ghana
[2]Department of Health Policy and Planning, School of Public Health, University of Ghana, Accra, Ghana
[3]Brown School, Washington University in St. Louis, Missouri, USA
[4]Department of Health Policy and Planning, School of Public Health, University of Ghana, Accra, Ghana
[5]Department of Population, Family and Reproductive Health, School of Public Health, University of Ghana, Accra, Ghana

Cite as: Babanawo F, Ibrahim A, Bahar OS, Adomah-Afari A, Maya E. Assessment of knowledge and usage of HIV post exposure prophylaxis among healthcare workers in a regional hospital in Ghana. J Glob Health Rep 2018; 2: e2018028.

Background Post exposure prophylaxis remains the single most important means of decreasing HIV infection upon occupational exposure. It offers over 80% protection against HIV sero-conversion when initiated within 72 hours of exposure and if the treatment regimen followed diligently for 28 days. This study assessed the level of knowledge and usage of post exposure prophylaxis among healthcare workers in the Eastern Regional Hospital, Koforidua, Ghana where HIV prevalence is high.

Methods A cross-sectional study was conducted among 185 HealthCare Workers (HCWs) between May and July 2016. Data was collected using self-administered structured questionnaires and analyzed with Stata-13 version. Bivariate associations were tested using chi-square or Fisher's exact test as appropriate. Multivariate analysis was conducted with logistic regression. A P-value of ≤0.05 was considered statistically significant.

Results Out of the 185 HCW interviewed, 96.8% considered themselves at risk of occupational exposure with 83.2% reporting occupational exposure within the last 12 months. Nearly all participants (97.3%) knew about the existence of post exposure prophylaxis (PEP). A majority (90.8%) acknowledged the effectiveness of PEP in preventing HIV infection. About 89% knew that the exposed area should be washed with soap and water or flushed with copious amounts of water and 65.4% knew whom to contact after exposure. Although about 93% knew PEP should be started within 72 hours of exposure, only 38.9% knew the duration of treatment to be four weeks. The accurate drug regime following a high-risk needle stick injury was known by 25.1% while the proportion of needle stick injuries could result in HIV transmission was unknown by 65.9%. Although 51.9% were eligible to take PEP, only 33.8% reported having received PEP.

Conclusions Despite high levels of knowledge of the effectiveness of HIV PEP, the appropriate first aid to perform and the time of commencement of PEP, Usage of PEP was low among HCWs despite the high prevalence of occupational injuries. Training to prevent occupational exposure, increase the level of knowledge and use of PEP is recommended.

CORRESPONDENCE TO:
Felicia Babanawo | Policy, Planning, Monitoring, and Evaluation Division | Ghana Health Service Headquarters | P.O. Box KW 1228 | Kwabenya | Accra | Ghana
negbebab@yahoo.com

Implications for the public

Since HIV/AIDS is prevalent in some communities and at some work places such as health institutions, healthcare workers are exposed to this condition due to the nature of their work. If healthcare workers are reluctant to comply with PEP guidelines, especially using antiretroviral treatment as part of PEP, then the general public may be at increased risk with regular contacts with healthcare workers, especially those working closely with people living with HIV/AIDS.

It is important to ensure that public education efforts are directed to demystify the stigma associated with HIV infection to encourage early reporting and care for HIV infected persons. The provision of adequate and suitable protective clothing and logistics would help to minimize healthcare workers' exposure to HIV related infections in the course of their work and ultimately minimize the risk of exposure to the general public.

The human immune deficiency virus (HIV) infection remains a public health concern, especially in sub-Saharan Africa (SSA). Out of the over 36 million people living with HIV (PLWHIV) worldwide, SSA alone has over 25 million (70%) making it the continent with the biggest disease burden (*1*). In Ghana, the average national prevalence of HIV infection reported in 2016 is 2.4% (*2*). The Volta and Brong Ahafo regions recorded the highest prevalence of 2.7% followed by the Ashanti and Eastern regions at 2.6% each. The highest prevalence rate (4.2%) were reported in Agormanya, a town in the Eastern Region and Sunyani, a town in the Brong Ahafo region (*2*).

HIV transmission can occur through unprotected sexual intercourse, transfusion of contaminated blood and blood products, and mother to child transmission (*3*). For health care workers (HCWs), occupational exposure to HIV infected blood and other bodily fluids is another cause of HIV acquisition (*4*, *5*).

According to WHO (2008), over 38,000 needle stick injuries occur in hospitals around the world annually, exposing about 35 million HCWs to HIV infection. Ninety percent of these exposures occur in developing countries thereby increasing HCWs' proneness to HIV infection in these countries (*6*, *7*). Despite underreporting, occupational exposures are estimated to be responsible for nearly 1,000 HIV infections each year (*6*-*8*). The introduction of antiretroviral therapy (ART) has improved the outcomes for infected individuals, and pre- and post-exposure prophylaxis have considerably reduced infections in some exposed individuals (*4*-*6*). The most effective approach to reducing work-related HIV infection among HCWs is to prevent exposure to blood and other potentially infective body fluids by observing universal infection prevention measures, including post-exposure prophylaxis (PEP).

PEP refers to a set of services delivered to manage individuals' exposure to HIV infection and prevent HIV infection (*9*). It remains the single most important approach to decreasing HIV infection once an occupational exposure has occurred. PEP initiated between 60 minutes and 72 hours of exposure and the treatment with ART for 28 days is able to prevent about 80% of HIV infections (*5*). In Ghana, according to the NACP (*10*) (WHO, 2014), PEP services comprise of washing the part exposed with soap and water or flushing with copious amounts of water for mucous membranes, reporting the incidence of exposure, counselling of exposed person and source of infection, assessing the risk of infection, testing for HIV after informed consent is obtained followed by 28 days antiretroviral regimen. Per NACP (*10*) guidelines, a high-risk exposure is considered if the exposure is either percutaneous from a sharp instrument or needle stick, exposure to large volume of blood, injury is deep and extensive and the source of exposure unknown (example needle prick or a cut from a trash bag or safety box) or the source of exposure is HIV positive. A low-risk classification is considered when exposure is either to a small volume of blood from asymptomatic HIV positive patient, percutaneous exposure with a solid needle, a superficial injury or mucous membrane exposure. One is classified as having a very low-risk, if the exposure involves splashes of body fluids unto intact skin whether or not blood is involved. The recommended drug regimen for persons classified as high risk is Zidovudine (AZT) 300 milligram (mg), Lamivudine (3TC) 150

mg and Lopinavir/ritonavir (LPV/r) 400 mg taken at 12 hourly intervals for 28 days. Those with low risk are given only AZT 300 mg and 3TC 150 mg 12 hourly for 28 days while those classified as very low risk requires no PEP (*10*-*12*).

HCWs' knowledge and usage of HIV PEP are critical because once occupational exposure occurs; PEP becomes the only means of preventing HIV infection. The benefits of having adequate knowledge on PEP and using PEP in the event of exposure cannot be taken for granted, especially among doctors, nurses, midwives and laboratory staff who work directly with patients and may be exposed to blood and other bodily fluids in the performance of their daily duties (*6*). However, a number of HCWs, especially in developing countries, lack substantial knowledge on PEP which negatively affects its usage among them (*4*-*6*). For instance, in Nigeria, Ajibola and colleagues (*6*) studied 300 HCWs at Lagos University Hospital and found out that even though 83% of HCWs were aware of HIV PEP, 46% did not know when PEP should be initiated after an occupational exposure and 54% did not know the duration of the treatment. Moreover, even though occupational exposure history was recorded in about 70% of participants, only about 40% of them reported the incident. Significantly, over half of those who did not report their exposure did so simply because they were unfamiliar with whom to report to. Aminde et al. (*5*) in Cameroon documented that, only about 1 in 4 nurses had adequate knowledge on HIV PEP despite the fact that about 8 out of 10 had heard about it.

HCWs must have adequate knowledge on PEP and patronize PEP services in order to effectively use PEP. Although some studies have documented satisfactory knowledge on PEP among HCWs (*7*, *13*, *14*), several others, especially in Africa, have also reported gaps in knowledge (*4*-*6*). To address these gaps in the literature, this study was carried out to assess the level of knowledge and use of HIV PEP among some categories of healthcare workers in the Eastern Regional Hospital, Koforidua.

METHODS

Study setting

This cross-sectional study was conducted between May and July 2016 at the Eastern Regional Hospital in Koforidua, Ghana. Eastern Regional Hospital is the largest hospital in the region and receives referrals from all over the region. The bed capacity is 350 with an average annual outpatient department (OPD) attendance of over 133,000. As of 2015, the facility comprised about 700 staff, of which 55 were doctors, 288 nurses and midwives, and 19 laboratory technicians (*15*). Over 7,000 and 10,000 PLWHIV were attended to in the year 2014 and 2015 respectively (*15*). This high number of PLWHIV cases increases the risk of HIV occupational exposure for HCWs who come into close contacts with them.

Even though HIV PEP is provided as part of routine services at the hospital, a team composed of five members has been put up to oversee occupational PEP. The hospital's protocol on PEP is the same as the national protocol stated above (*10*). It includes taking the appropriate first aid measure, reporting exposure to immediate superior, going through counselling and laboratory investigations and lastly taking the recommended regimen of treatment. In the year 2014, a total of 32 occupational exposures were reported and managed, while between January and June 2015, 12 cases were seen (*15*).

Study population and sampling technique

The study population consisted of doctors, nurses, midwives and laboratory technician. These four categories of HCW were selected because they work directly with patients and therefore are particularly prone to occupational HIV exposure.

The minimum sample size was obtained using the single population proportion formula (formulation $n = (Z\ \alpha\ /2)^2\ p\ (1–p/d^2)$ where n = sample size, $Z\ \alpha\ /\ 2$ = statistic for the level of confidence (1.96), p = prevalence and d = margin of error (*16*). With 5% margin of error, 95%

confidence interval with alpha 0.05 and an anticipated 40% knowledge on HIV PEP, a sample size of 365 was arrived at. The minimum sample size obtained however was bigger than the total number of the target population of 361. Therefore, a finite population correction formula (nf = ni / (1+ni/N) where nf = modified sample size, ni = unmodified sample size, and N = sum total of the target population (*11*) was used to correct final sample size of 183 which was adjusted by 10% to arrive at the final sample size of 200. The sample was divided proportionately among the various cadres of health workers and consisted of 33 doctors, 11 laboratory staff, 92 nurses and 64 midwives. To select the individual subjects for the interviews, the list of the various cadres of health workers were obtained and arranged in alphabetical order and given numbers. Google random sample generator was then used to select the required number for the interview).

Data collection procedures

A self-administered structured questionnaire adapted from other studies (*5*, *7*, *8*, *17*, *18*) was used for data collection. Individual questions that tested knowledge and usage of PEP and were relevant to the research setting and objectives of this study were adopted and modified and used. The questionnaire was pre-tested at Madina Polyclinic in Accra using a total of 10 similar HCW. The responses obtained from the pre-testing were used to modify the final questionnaire used for the study. The final version of the questionnaire comprised of 22 multiple choice questions. The data collected included socio-demographic characteristics, participants' knowledge and use of HIV PEP.

The questionnaires were distributed to participants at their workplace by the lead author and two trained research assistants. Participants were allowed two hours to fill the questionnaire. Data collectors then returned to collect them. Data was collected over a period of three weeks.

Data analysis

Data collected were entered, cleaned and analyzed using Stata Version 13.0 (StataCorp, College Station, TX, USA).

Scoring and analysis of the level of knowledge

Participants' level of knowledge was assessed using the number of correct responses. Each correct response was assigned a score of one (*1*) and a wrong response was assigned zero (0). The correct responses were then summed up to give the total score. There were 22 questions in total. A participant scoring less than 50% (less than 11 out of 22 correct responses) was classified as having poor knowledge; 50-69% (12 to 15 of correct responses) average knowledge and 70% or more (16 to 22 of the correct responses) were classified as having adequate knowledge (*5*, *17*).

Differences between those with poor, average and adequate knowledge were analyzed using chi-square test for association. For the purposes of determining factors associated with adequate knowledge, however study participants were divided into 2 sets; those with poor knowledge (0-12 correct responses) and those with good knowledge (13-22 correct responses).

Unadjusted and adjusted logistic regression models were computed to determine the odds ratios associated with good knowledge on post exposure prophylaxis. A *P*-value of ≤0.05 was considered statistically significant.

Determining usage of PEP

The number of respondents who were exposed, reported the incident and used PEP were counted and reported as percentages using frequency statistics. Participants who were exposed reported the incident and utilized the PEP services were then grouped into two; those who utilized PEP services and those who did not in order to determine the usage of PEP among exposed HCWs.

Ethical considerations

Ethical approval for this study was obtained from the Ghana Health Service Ethical Review Committee (GHS-ERC: 27/12/15). A written informed consent was obtained from all participants prior to participation in the study.

RESULTS

Socio-demographic characteristics of study population

Out of the 200 respondents contacted, 185 filled the questionnaire, giving a response rate of 92.5%. The remaining questionnaires were not included in the analysis and demographics because of missing responses. Respondents' age ranged from 20 to 59 years, (71.4%) were females, 93.5% were of the Christian faith and about half (50.3%) were single. Nurses and midwives constituted 77.8% of the respondents. Regarding educational status, 75.1% had at least a diploma and more than a third (36.8%) had 2 – 4 years working experience (Table 1).

Table 1. Socio-demographic characteristics of participants

VARIABLE	FREQUENCY (N=185)	PERCENTAGES (%)
Age range (years):		
20-29	106	57.3
30-39	52	28.1
40-49	9	4.9
50-59	18	9.7
Sex:		
Male	53	28.6
Female	132	71.4
Religion:		
Christians	173	93.5
Muslims	12	6.5
Educational status:		
Certificate	46	24.9
Diploma	79	42.7
Bachelor's degree	57	30.8
Master's degree	3	1.6
Marital status:		
Married	83	44.9
Divorced/separated	6	3.2
Widowed	3	1.6
Single	93	50.3
Profession/cadre:		
Doctor	85	16.8
Nurse	31	45.9
Midwife	59	31.9
Laboratory technician	10	5.4

Knowledge of PEP among HCWs

The knowledge of post exposure prophylaxis was assessed as a proportion of all the 185 respondents. A majority (97.3%) had heard of the PEP concept. In all, 60.5% heard about PEP through seminars or workshops and most participants (90.8%) believed that PEP was effective in preventing HIV. Regarding indications for PEP, needle stick injury or cut from a used instrument was the most mentioned (94%), followed by a splash of blood or bodily fluid on a broken mucosal surface (84.9%)

Regarding participant's knowledge on the type of bodily fluids (excluding blood) considered as high risk for transmission of HIV, only the following fluids were correctly identified (Multiple response): cerebrospinal fluid (62.7%), peritoneal fluid (50.3%), synovial fluid (34.6%), and breast milk (54%).

Furthermore, with respect to first aid procedure(s) to perform in the event of occupational exposure, washing the affected area thoroughly with soap and running water (89.2%) and flushing the infected area with water in case of a mucous membrane exposure (53.5%) were mainly identified. About two thirds of respondents (65.4%) knew correctly that occupational exposure must be reported to their immediate supervisor, (90.3%) knew correctly that PEP must be started within 72 hours of an exposure, 25.4% knew correctly that the three-drug regimen must be used and 38.9% knew correctly treatment must be taken for 4 weeks as shown in Table 2.

Table 2. Knowledge of PEP in the Eastern Regional Hospital

VARIABLES AND RESPONSES	FREQUENCY (N)	PERCENTAGE %
Heard about PEP		
Heard	163	97.3
Have not heard	5	2.7
Source of information:*		
Seminar/workshop	112	60.5
Ward rounds	69	37.3
PEP training	57	30.8
Newspaper/radio/television	25	13.5
Journal	23	12.4
Protocol	22	11.4
School	15	8.1
Proportion of needle stick from patients that result in HIV transmission:		
1/100	47	25.4
1/500	9	3.8
3/1000	7	4.9
Don't know	122	65.9

Overall, the aggregate knowledge on PEP among respondents were, poor knowledge (scoring less than 11 out of 22 correct responses) 30.8% (57), average knowledge (correct scores between 12 and 15) 49.2% (91)

Table 2. Continued

VARIABLES AND RESPONSES	FREQUENCY (N)	PERCENTAGE %
Indication(s) of PEP:*		
Needle stick injury/cut from a used instrument	174	94.0
Splash of blood/bodily fluids on mucosal surface	157	84.9
Occupational exposure in emergency rescue workers	61	33.0
Sexual abuse/ rape	114	61.6
Intravenous drug users	46	24.9
Consensual sex where partners HIV status is unknown	73	39.4
Bodily fluids considered as high risk for HIV transmission:*		
Breast milk	100	54.0
Peritoneal fluid	93	50.3
Saliva	90	48.6
Urine	73	39.4
Synovial fluid	64	34.6
Vomitus	53	28.6
Stool	22	11.9
First aid procedure to perform when exposed?*		
Wash site thoroughly with soap under running water	165	89.2
Flush area with water if in mucous membrane exposure	99	53.5
Promote active bleeding of a wound	72	38.9
Squeeze blood from the site	63	34.0
Clean with spirit/antiseptic	27	15.7
Dress wound	16	8.6
First person to report exposure to:		
Immediate supervisor	121	65.4
Occupational health and safety coordinator	33	17.8
Pharmacist	15	8.1
Doctor	10	5.4
Don't know	6	3.3
Both patient and health worker should be screened:		
Should be screened	176	95.1
Should not be screened	9	4.9
How soon should PEP be started after exposure?		
Within 72 hours	167	90.3
After 72 hours	17	9.2
After 1 week	1	0.5
Drugs used in PEP*:		
Zidovudine	108	58.4
Lamivudine	95	51.9
Lopinavir-ritonavir	29	15.7
Don't know	60	32.4
Ideal PEP drug regime following needle stick injury:		
1 drug regime	23	12.4
2 drug regimen	44	23.8
Expanded/3 drug regime	47	25.4
Don't know	71	38.4
Duration of PEP:		
1 week	5	2.7
2 weeks	16	8.7
4 weeks	72	38.9
3 months	28	15.1
6 months	30	16.2
Don't know	34	18.4

PEP – post-exposure prophylaxis
*Multiple responses.

while the remaining 20% (37) had adequate knowledge (correct responses between 16 and 22) on PEP. (NB those who were not aware of PEP were classified as having poor knowledge).

Factors that were significantly associated with knowledge of HIV PEP (Table 3) were a cadre of HCW (P=0.006), educational status (P=0.008) and years of health service experience (P=0.001).

A simple logistic regression conducted (Table 4) showed that the odds of good knowledge on PEP were less among midwives (odds ratio OR=0.28; 95% confidence interval CI=0.11-0.69) and laboratory technicians (OR=0.16; 95% CI=0.03-0.87) compared to medical doctors. The odds of good knowledge of PEP was 2.98 times higher among respondents with a bachelor's degree compared to those with certificates (OR=2.98; 95% CI=1.33-6.69). The odds of good knowledge on PEP was also 4.60 times higher among respondents with 5-7 years of experience than those with less than 1 year experience and 2 to 4 years (OR=4.60; 95% CI=1.65-12.80). In the multiple regression analyses, only health service experience (in years) was found to be associated with knowledge on PEP. The odds of good knowledge on PEP was 4.34 times higher among respondents who practiced for 5-7 years compared to those who have practiced for less than 1-year (AOR=4.34; 95% CI=1.46-12.90).

Use of PEP among exposed participants

Overall, there were 154 (83.2%) exposed individuals out of which 77 (50%) reported their exposure. Among the 77 who reported their exposure, their risk of contracting HIV was assessed as 13 (16.9%) being rated high, 27 (35%) low, and 20 (26%) were assessed as very low. The remaining 17 (22.1%) did not remember their assigned risk. Thus forty out of the 77 [13 (16.9%) high risk and 27 (35.0%) low risk] were eligible for antiretroviral medication. Among the forty only 26 (65%) stated they were put on antiretroviral drugs out of which 14 (53.8%) completed their medications. Among the 12 who did not complete their medication, 11 (91.7%) reported adverse effects as the reason for non-completion while the remaining one stopped because the patient tested negative for HIV.

As regards the 77 respondents who did not report their exposure, their reasons included: patients being HIV negative (from patients' existing records), 38 (49.3%) just did not want to report 14 (18.2%), not believing they could be HIV positive 13 (16.9%), not knowing whom to report to 7 (9.7%,) and those who were unaware of PEP were 5 (6.5%).

DISCUSSION

This study which looked at knowledge and use of HIV PEP showed that almost all (97%) respondents had heard about PEP while 90% agreed that PEP is effective in preventing HIV. Most respondents commonly mentioned washing the exposed body part with soap and water (flushing mucous membranes with copious amounts of water) as first aid. Ninety percent knew that PEP should be started within 72 hours of exposure. Regarding aggregate knowledge of PEP, 20% were considered to have adequate knowledge. Doctors had more knowledge of PEP compared to laboratory technicians, nurses, and midwives. The only factor that significantly increases one's PEP knowledge was having worked for between five and seven years (*P*=0.001, adjusted odds ratio AOR=4.34; 95% CI=1.46-12.90) as compared to those who have worked for one year.

A considerable number of our respondents knew instances such as needle stick injuries, cuts from used instruments, splashes of blood or bodily fluids on broken skin or mucosal surfaces as well as sexual abuse or rape are which could result in HIV infection and are therefore indications for PEP. On the other hand, knowledge about other groups of people (eg, emergency rescue workers, waste management staff, intravenous drug users and consensual sexual partners whose HIV status are unknown) who are also at risk of exposure to HIV was low. This lack of knowledge of these at-risk groups may hinder the provision of PEP to these people if need be as the HCW will not consider PEP for them even when they report exposure. There will be the need to bring this to the attention of the HCWs.

Apart from blood, cerebrospinal fluid, synovial fluids, amniotic fluid, pericardial fluid, peritoneal fluid and pleural fluid are also considered as high-risk fluids for the transmission

Table 3. Unadjusted and adjusted bivariate logistic regression of factors associated with good knowledge by selected variables of respondents

VARIABLES	UNADJUSTED OR (95% CI)	ADJUSTED OR (95% CI)
Cadre:		
Medical doctor	1	1
Nurse	0.68 (0.29-1.57)	1.77 (0.50-6.27)
Midwife	0.28 (0.11-0.69)*	1.00 (0.23-4.30)
Laboratory technician	0.16 (0.03-0.87)*	0.40 (0.23-4.30)
Education status:		
Certificate	1	1
Diploma	1.28 (0.60-2.72)	0.72 (0.28-1.86)
Bachelor's degree	2.98 (1.33-6.69)*	2.85 (0.95-8.51)
Master's degree		
Years of service:		
Less than 1 year	1	1
2-4 years	2.31 (1.07-4.99)	2.29 (0.99-5.28)
5-7 years	4.60 (1.65-12.80)*	4.34 (1.46-12.90)*
8-10 years	0.43 (0.08-2.23)	0.31 (0.05-2.18)
More than 10 years	0.76 (0.28-2.02)	0.73 (0.22-2.43)

OR – odds ratio, CI – confidence interval
*Multiple responses.

Table 4. Factors associated with good knowledge among healthcare workers

CHARACTERISTICS	KNOWLEDGE OF PEP, N (%)		X^2(DF)	*P* (FISHER EXACT TEST)
	POOR KNOWLEDGE	GOOD KNOWLEDGE		
Age (years):				
20–29	58 (54.7)	48 (45.3)		
30–39	24 (46.2)	28 (53.8)	5.6931 (3)	0.128/0.134
40–49	7 (77.8)	2 (22.2)		
50–59	13 (72.2)	5 (27.8)		
Sex:				
Male	25 (47.2)	28 (52.8)	1.9052 (1)	0.167
Female	77 (58.3)	55 (41.7)		
Religion:				
Christian	94 (54.3)	79 (45.7)	0.6898 (1)	0.406/0.552
Muslim	8 (66.7)	4 (33.3)		
Marital status:				
Married	45 (54.2)	38 (45.8)		
Divorced/separated	5 (83.3)	1 (16.7)		0.202/0.247
Widowed	3 (100.0)	0 (0.0)		
Single	49 (52.7)	44 (47.3)		
Cadre:				
Medical doctor	12 (38.7)	19 (61.3)		
Nurse	41 (48.2)	44 (51.8)	12.4324 (3)	0.006/0.006
Midwife	41 (69.5)	18 (30.5)		
Laboratory technician	8 (80.0)	2 (20.0)		
Educational status:				
Certificate	30 (65.2)	16 (34.8)		
Diploma	47 (59.5)	32 (40.5)		0.010/0.008
Bachelor's degree	22 (38.6)	35 (61.4)		
Master's degree	3 (100.0)	0 (0.0)		
Years of service:				
Less than 1 year	31 (66.0)	16 (34.0)		
2-4years	31 (45.6)	37 (54.4)		
5-7 years	8 (29.6)	19 (70.4)	18.6228 (4)	0.001/0.001
8-10 years	9 (81.8)	2 (18.2)		
More than 10 years	23 (71.9)	9 (28.1)		
Exposure status:				
Exposed	82 (53.3)	72 (46.7)	1.3249 (1)	0.250
Unexposed	20 (64.5)	11 (35.5)		

PEP – post exposure prophylaxis, x^2 – chi-square statistics, df – degree of freedom

of HIV in the healthcare setting (*7*, *13*). In this study, cerebrospinal fluid, synovial fluid and breast milk were individually identified by approximately half of the respondents, showing similar rates to other studies conducted in Jamaica, Nepal, and Nigeria (*13*, *14*, *17*). Though breast milk contributes significantly to Mother-To-Child Transmission of HIV, its contribution to HIV transmission in healthcare settings is not documented (*13*). This consistency in knowledge could be due to the facts that HCWs are well informed about the availability of micro-organisms in these bodily fluids. It was also noted that more than a quarter of the participants misidentified saliva, urine, faecal matter and vomitus as high-risk fluids for the transmission of HIV. These fluids are recognized as low risk for the transmission of HIV (*13*).

About 90% of our respondents knew that when a percutaneous injury occurs, the site must be washed with soap under running water and over half knew that mucous membranes should be flushed with copious amounts of water. Other studies such as Agaba et al (*17*), Aminde et al (*5*) and Bairy et al (*7*) also documented a high percentage of respondents (over 95%) having adequate knowledge for the first aid for exposure but in contrast, lower levels of knowledge (about 40%) were reported by Lamichanne et al (*14*) and Foster et al (*13*). This means that the level of importance given to PEP in the various study sites are different as first aid after exposure is one of the most important elements in HIV infection prevention as far as HCWs exposure is concerned.

Incidentally, a third of our respondents also mentioned squeezing of blood from the injury site, which is not recommended as it may cause further tissue injury, which in turn may rather increase the risk of infection (CDC guidelines 2016).

More than a third of our respondents did not know any of the commonly used drugs for PEP (ie, Zidovudine, Lamivudine and especially Lopinavir-ritonavir) at the study site even though protocols pasted in all wards, laboratory and consulting rooms provides information on the drugs. Lamichanne et al (*14*) and Owolabi et al (*19*) had also reported lower levels of knowledge on drugs used for PEP in their respective study sites. This is not surprising, given the fact that respondents were neither the dispensers of the drugs nor members of the PEP team and hence lacked knowledge of the drugs used for PEP.

Over 90% of the respondents knew that PEP must be started within 72 hours of exposure. This is of particular importance as not knowing when to start antiretroviral could lead to exposed individuals not reporting in time for treatment. Knowledge on the exact duration of antiretroviral medication for PEP was poor. This finding correlates with those of only 5-7 years of health service experience was found to be predictive of good knowledge. This is difficult to explain as same cannot be said about those with 8 and above years of service experience. It is, however, possible that after several years of working they had become complacent with whatever PEP knowledge they had and have not updated themselves with current knowledge. Aminde et al (*5*) discovered that the only predictor of good knowledge was awareness of hospital policy on PEP.

It was observed in this study that PEP services were underutilized. Over eight out of ten study participants had occupational exposure within 12 months preceding the study. This could be an indication that not much attention is being paid to universal precaution. More troublesome is the fact that just half of the exposed reported their exposure. Majority of those who did not report their exposure did so because the patients were HIV negative according to their existing records. What is not known is how long ago those tests were conducted. It is important for all staff to report occupational exposure to the PEP team and let the team determine their risk as they may not have the expertise to determine their risk themselves. Reporting the exposure will also give the facility accurate data on occupational exposure and the rate of sero-conversion which could be used for planning in-service training, workshops and seminars on HIV PEP.

Another source of worry is the fact that about a third of those who did not report their occupational exposure did so either because they just did not want to report the exposure or did not believe they could be HIV positive. This should be of great concern as any one of them

can contract HIV and pose as a danger to all the patients they see. In addition, this should be a source of worry for the management of the facility considering the relatively high numbers of PLWHIV that are attended to at the facility and the 80% occupational exposure. This has the potential of derailing whatever PEP programme is in place at the health facility no matter how good it is and calls for a lot of education on universal infection prevention measures and PEP in the facility.

Similarly, high (80%) levels of non-reporting of occupational exposure has been observed in Nigeria (*20*) in contrast to 25% reported in Kenya, (*21*). Low patronage of PEP antiretroviral medication has also been reported by Mponela et al (*22*). and Aminde et al (*5*). This may be due to the fear of testing for HIV and the stigma attached to taking antiretroviral drugs. Also, side effects associated with most of the antiretroviral drugs has been identified as a cause of poor adherence to medication and may have contributed to the low patronage of the antiretroviral drugs as reported by Tetteh et al (*12*).

Limitations of the study

This study assessed the occurrence of occupational exposure and use of PEP through self-reporting. It is possible that respondents reported what is socially desirable. However, judging from the high non-reporting of exposure and low use of antiretroviral medication, we do not think this occurred. Secondly, the study did not include all cadres of HCWs as it was limited to doctors, nurses, midwives and laboratory technicians. Hence, study findings cannot be generalized to all HCWs in the facility or to other facilities. It is, however, important to state that these categories of workers stand a higher risk of being exposed to HIV as they serve as frontline workers.

CONCLUSIONS

The study concludes that adequate knowledge of HIV PEP among the doctors, nurses, midwives and laboratory technician as a group was generally low at the Eastern Regional Hospital, Koforidua, there was a high prevalence of occupational exposure to HIV among these categories of healthcare workers however, there was low reporting of such occupational exposures, low usage of PEP as well as non-compliance with antiretroviral treatment as part of PEP. The findings of the study provide useful lessons for policy and practice in the health sector of Ghana and other resource-constraint countries. Although the health sector through the National AIDS Control Programme has put in place strategic guidelines, including infection prevention and control practices and the PEP to reduce healthcare workers' exposure to HIV-related infections, it appears that the implementation of such strategies is minimal at the various healthcare institutions.

Therefore, there is the need for continuous education on PEP and its importance in the reduction of occupationally acquired HIV infection among health workers.

That is, policy makers in the health sector of Ghana and other countries with similar challenges should try and intensify continuous healthcare worker education (where guidelines are available) on the use of PEP or institute measures to establish and enforce the implementation of PEP guidelines (where non-existent) so as to reduce healthcare workers' exposure to HIV at the work environment.

Policy makers and management of healthcare institutions in Ghana and other countries should ensure that educational efforts consider how to demystify the stigma associated with HIV infection in most of the communities – future studies could consider this. Due to the HIV stigma, many of the healthcare workers, although occupationally exposed to HIV were feeling reluctant to report and compliance with antiretroviral treatment as part of PEP. The common knowledge among many people in most of the communities is that people who are promiscuous or lead untoward lifestyles are victims of HIV related infections. Given this context, even though the healthcare workers may know that they have to report any incidence of exposure, they were not confident to do so.

Another strategy that would help to avert healthcare workers' exposure to HIV related infections in the course of their work is to ensure adequate provision of protective clothing and logistics. Consequent to the current dwindling or limited budgetary allocation to the health sector, the management of healthcare institutions may not be able to procure all the needed protective clothing. The lack of provision and use of suitable protective clothing is likely to pose the greatest risk of exposure to HIV for healthcare workers at the healthcare facilities.

Acknowledgments: We acknowledge the management and staff of the Eastern Regional Hospital, Koforidua.

Funding: None.

Authors' contributions: FB developed the research idea, conducted the research and drafted the full manuscript and is the corresponding author. AI contributed to the research design, methods and reviewed the initial manuscript. OSB contributed to the research introduction, discussion and reviewed the entire manuscript. AAA contributed discussions and policy implications and reviewed the entire manuscript. ETM contributed to the data analysis and interpretation, reviewed the entire manuscript.

Competing interests: The authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare no conflict of interest.

REFERENCES

1. World Health Organization. HIV/AIDS. Available: http://www.who.int/mediacentre/factsheets/fs360/en/. Accessed: 1 April 2018.
2. Ministry of Health. National AIDS control programme, G. H. S. (2016). May 2016. HIV Sentinel Survey Report.
3. Aynalem Tesfay F, Dejenie Habtewold T. Assessment of prevalence and determinants of occupational exposure to HIV infection among healthcare workers in selected health institutions in Debre Berhan Town, North Shoa Zone, Amhara Region, Ethiopia. Aids Res Treat. 2014;2014:731848. PubMed https://doi.org/10.1155/2014/731848
4. Alenyo R, Fualal J, Jombwe J. Knowledge, attitude and practices of staffs towards post-exposure Prophylaxis for HIV Infection at Mulago Hospital in Uganda. East Cent Afr J Surg. 2009;14:99–102.
5. Aminde LN, Takah NF, Noubiap JJN, Tindong M, Ngwasiri C, Jingi AM, et al. Awareness and low uptake of post exposure prophylaxis for HIV among clinical medical students in a high endemicity setting. BMC Public Health. 2015;15:1104. PubMed https://doi.org/10.1186/s12889-015-2468-9
6. Ajibola S, Akinbami A, Elikwu C, Odesanya M, Uche E. Knowledge, attitude and practices of HIV post exposure prophylaxis amongst health workers in Lagos University Teaching Hospital. Pan Afr Med J. 2014;19:172. PubMed https://doi.org/10.11604/pamj.2014.19.172.4718
7. Bairy KL, Ganaraja B, Indira B, Thiyagar N, Choo CM, See CK. Awareness of post-exposure prophylaxis guidelines against occupational exposure to HIV in Hospital Sungai Petani. Med J Malaysia. 2005;60:10–4. PubMed
8. Gupta A, Anand S, Sastry J, Krisagar A, Basavaraj A, Bhat SM, et al. High risk for occupational exposure to HIV and utilization of post-exposure prophylaxis in a teaching hospital in Pune, India. BMC Infect Dis. 2008;8:142. PubMed https://doi.org/10.1186/1471-2334-8-142
9. World Health Organization. Post -exposure prophylaxis for HIV infection-clinical protocol for the WHO European Region. Geneva: World Health Organization; 2014.
10. National AIDS Control Program. 2010. Guidelines for Antiretroviral therapy in Ghana.
11. Mathewos B, Birhan W, Kinfe S, Boru M, Tiruneh G, Addis Z, et al. Assessment of knowledge, attitude and practice towards post exposure prophylaxis for HIV among health care workers in Gondar, North West Ethiopia. BMC Public Health. 2013;13:508. PubMed https://doi.org/10.1186/1471-2458-13-508
12. Tetteh RA, Nartey ET, Lartey M, Mantel-Teeuwisse AK, Leufkens HGM, Nortey PA, et al. Adverse events and adherence to HIV post-exposure prophylaxis: a cohort study at the Korle-Bu Teaching Hospital in Accra, Ghana. BMC Public Health. 2015;15:573. PubMed https://doi.org/10.1186/s12889-015-1928-6
13. Foster TM, Lee MG, McGaw CD. Knowledge and practice of occupational infection control among healthcare workers in Jamaica. West Indian Med J. 2010;59:147–52. PubMed
14. Lamichanne J, Aryal B, Dhakal KS. Knowledge of nurses on Post Exposure Prophylaxis of HIV in Medical Colleges of Chitwan District, Nepal. Int J Pharm Biol Arch. 2012;3:1394–9.

15. Annual report 2015, Eastern Regional Hospital, Koforidua, Ghana. (unpublished report).
16. SAS Institute Inc. 2011. SAS/STAT® 9.3 User's Guide. Cary, NC: SAS Institute Inc; 2011.
17. Agaba PA, Agaba EI, Ocheke AN, Daniyam CA, Akanbi MO, Edith N. Awareness and knowledge of human immunodeficiency virus post exposure prophylaxis among Nigerian Family Physicians. Niger Med J. 2012;53:155–60. PubMed https://doi.org/10.4103/0300-1652.104386
18. Mashoto KO, Mubyazi GM, Mushi AK. Knowledge of occupational exposure to HIV: a cross sectional study of healthcare workers in Tumbi and Dodoma hospitals, Tanzania. BMC Health Serv Res. 2015; 15:29. PubMed https://doi.org/10.1186/s12913-015-0700-z
19. Owolabi RS, Alabi P, Ajayi S, Daniel O, Ogundiran A, Akande TM, et al. Knowledge and practice of Post-Exposure Prophylaxis (PEP) against HIV infection among health care providers in a tertiary hospital in Nigeria. J Int Assoc Physicians AIDS Care (Chic). 2012;11:179–83. PubMed https://doi.org/10.1177/1545109711401409
20. Ogoina D, Pondei K, Adetunji B, Chima G, Isichei C, Gidado S. Prevalence and determinants of occupational exposures to blood and body fluids among health workers in two tertiary hospitals in Nigeria. Afr J Infect Dis. 2014;8:50. PubMed https://doi.org/10.4314/ajid.v8i2.7
21. Mbaisi EM, Ng'ang'a Z, Wanzala P, Omolo J. Prevalence and factors associated with percutaneous injuries and splash exposures among health-care workers in a provincial hospital, Kenya, 2010. Pan Afr Med J. 2013;14:10. PubMed https://doi.org/10.11604/pamj.2013.14.10.1373
22. Mponela MJ, Oleribe OO, Abade A, Kwesigabo G. Post exposure prophylaxis following occupational exposure to HIV: a survey of health care workers in Mbeya, Tanzania, 2009-2010. Pan Afr Med J. 2015;21:32–45. PubMed https://doi.org/10.11604/pamj.2015.21.32.4996