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Occupational Exposure to Blood and Body Fluids and Utilization of HIV-Post Exposure Prophylaxis among Healthcare Workers in South-Eastern Tanzania

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Abstract

Background: Occupational exposure to needle stick injuries, blood or other body fluids in healthcare facilities poses healthcare workers (HCWs) at to risk of acquiring blood-borne infectious diseases such as human immunodeficiency virus (HIV) infection. Approximately 1,000 HIV infections are transmitted annually to healthcare workers (HCWs) worldwide through occupational exposures, and in Tanzania HCWs experience one to nine needle stick injuries per year. The use of HIV post-exposure prophylaxis (HIV-PEP) can reduce the rate of HIV infection from workplace exposures by 81%. In Tanzania, there is limited knowledge on the usage of HIV-PEP among HCWs particularly in rural settings. We assessed the prevalence of occupational exposure among HCWs and the use of HIV-PEP at a referral hospital in rural Tanzania.

Methods: A cross-sectional study was conducted from September to December 2018 at St Francis Referral Hospital, Ifakara in Kilombero District. Self-administered questionnaire was provided to HCWs who had direct contact with patients to collect information on risk of exposure to blood/body fluids and the use of HIV-PEP among healthcare workers. Data were analyzed using SPSS version 20.

Results: A total of 254 Health Care Workers participated in this study. Among 254 participants, 181 (71.3%) had been exposed to blood/body fluids and 87 (48.1%) both sustained needle prick/cut by sharps and blood/body fluids. Among the exposed HCWs, 136 (75.1%) did not use HIV-PEP. The reasons for low utilization of PEP were mostly reported to be knowledge of the HIV status of the source patient 52 (38.2%), assumption that HIV status of the source patient was negative 40 (29.4%), negligence 17 (12.5%) and lack of information about the existence of post-exposure prophylaxis service 12 (8.8%).

Conclusion: Our findings revealed low utilization of HIV-PEP despite the high rates of occupational exposure of HCWs. The findings highlighted the need to decrease risks of exposure to blood/body fluids so as to minimize occupational exposure to blood-borne diseases among HCWs. Thus, interventions to enhance occupational safety are required. In addition, the need to reinforce knowledge among HCWs through proper training of HCWs on HIV-PEP in our settings is emphasized.

Keywords: Occupational exposure; HIV-post exposure prophylaxis; Healthcare workers; Rural Tanzania

Introduction

Occupational exposure to blood and body fluids due to percutaneous injuries are the common accidents exposing health care workers (HCWs) to a risk of infections from human immunodeficiency virus (HIV) and other blood-borne infectious diseases. It has been shown that 3 million percutaneous exposures to blood or other body fluids occur globally in health care settings annually [1]. More importantly, highest incidences of occupational exposures i.e. about 90% occurring in the least developed countries [2]. These exposures may contribute up to 1000 HIV infections to HCWs annually. Risks of HIV occupational exposure among HCWs in Tanzania are high since HCWs experienced between one to nine needle stick injuries per year [3]. A study conducted in north-western Tanzania reported 48.6% incidents of needle-stick injuries and blood splash within the previous 12 months among HCWs from a tertiary care hospital [4]. In the year 2017, the global HIV prevalence was approximately 36.9 million (31.1 million–43.9 million) [5]. In Tanzania, 1.5 million people were estimated to live with HIV in 2017 and the regional HIV prevalence is ranging from 5% to 11.4% percent [6,7]. To prevent exposure of HCWs to potentially infectious materials from blood or body fluids the use of standard precautions such as safety devices and barriers like gloves, proper disposal of sharps have been recommended to minimize the exposure risk [8]. Although preventing exposures to blood and body fluids is the most appropriate strategy for preventing exposure to HIV, however, when occupational exposures do occur, the use of timely administered Post Exposure Prophylaxis (PEP) is recommended and if properly used it can reduce the risk of HIV infection by up to 81% [9]. Furthermore, some settings where HIV prevalence is high or where the source is known to be at high risk for HIV infection, then all exposures may be considered for HIV-PEP. In Tanzania, there is national guidelines for the management of HIV and AIDS (2017), including measures to prevent exposure of the health service providers to the blood of those receiving care. This includes adherence to standard precautions such as hand hygiene, use of personal protective equipment, proper healthcare waste management, processing of instruments by decontamination, provision of free access to PEP for HIV and provision of training to health service providers in identifying and controlling hazards [10]. In

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addition, it is recommended that Individuals exposed to HIV should be evaluated within two hours rather than days and no later than 72 hours, and the PEP should be initiated within 2 hours after exposure and before testing the exposed person.

In Tanzania, few studies have been conducted to estimate the risk of HIV transmission through blood and body fluids among healthcare workers and thus little is known about the exact magnitude of the problem and the use of HIV-PEP is largely undocumented [4,11,12]. The present study was conducted to explore the prevalence of occupational exposures and assess HCW's knowledge about HIV-PEP and its utilization following occupational exposure to such accidents.

Definition of concepts

Percutaneous injury: Refers to a needle stick injury, laceration injury, or any injury that leads to a break in the skin barrier resulting in an exposure to blood or body fluid.

Mucocutaneous exposure: Refers to a splash that results in exposure through a break in intact skin or of mucous membranes of the eyes, nose, or mouth.

Occupational exposure: The exposure of body fluids by health care personnel *via* percutaneous or mucocutaneous route while performing their work duties.

Post-Exposure Prophylaxis (PEP): Is a short-term antiretroviral treatment to reduce the likelihood of HIV infection after potential occupational exposure through percutaneous injury or mucocutaneous exposure.

Material & Method

Study area

The study was conducted at St. Francis Referral Hospital (SFRH), which is located in Kilombero district, Morogoro region, south-eastern Tanzania. Ifakara is the headquarters of the Kilombero District administration [13]. According to 2012 census, the population of Kilombero District was 407,880 [14]. In this district, there is one referral hospital, i.e. St. Francis Referral Hospital, two public health centres and 38 private and public dispensaries scattered around the district. The SFRH is located in Ifakara town and is the largest health facility. It serves as the referral hospital for primary healthcare facilities (dispensaries and health centers) within Kilombero and Ulanga districts as well as outside the two districts. The hospital has a total number of 417 staffs and the admission average per month is about 682 patients. The SFRH has clinic for HIV patients which is a cohort of HIV patients from two districts i.e. Kilombero and Ulanga Antiretroviral Cohort (KIULARCO) where about 12,185 people living with HIV have been attending the hospital and receiving HIV care [15].

Study design and population

A cross sectional study was conducted from September 2018 to December 2018. The study involved healthcare workers who were at risk of being exposed to infectious materials like blood, tissue or specific body fluids potentially contaminated with HIV. This includes the clinicians, dental personnel, laboratory personnel, nurses (registered nurses, enrolled nurses and midwives) and medical attendants.

Data collection and sample size

Data was collected using a structured questionnaire that was designed to capture information on health workers' emographic characteristics, incidence of occupational exposure to d blood/body fluid *via* percutaneous or mucocutaneous route within 12 months, their knowledge on HIV-PEP and the utilization of the PEP following occupational exposures. The questionnaire was anonymous and self-administered. To ensure the validity, the questionnaire was pretested among fifteen percent of the total sample size (40 HCWs) which was not included in the study. Any ambiguous or unsuitable questions were modified. During data collection, HCWs were asked to complete the questionnaire and then return the filled in questionnaires to the researcher. A returned questionnaire was checked for accuracy and completeness and incase of incompleteness or errors the questionnaire was returned to the respondent to make the necessary corrections.

The sample size was estimated to be 270 HCWs, and this was calculated using Naing et al. formula (2006) using a 23% prevalence of HIV-PEP usage among the health workers [16,17].

Data management and analysis

Data cleaning of all returned questionnaires was done through recheck the completeness and consistencies of responses. Data were analyzed using SPSS program Version 20. The descriptive analysis of the data was performed and data are represented in the form of frequencies and percentage in tables as shown in the results section.

Ethical considerations

The permission to conduct this study in Kilombero district was obtained from the District Medical Officer and the Kilombero District Executive Director. A written informed consent was obtained from each HCW prior to participation into the study. To protect identification of the study participants, all personal information were used during the analysis and omitted from the final reports. In addition, the participants were assured of anonymity in the presentation and publication of the data.

Results

Out of two hundred seventy questionnaires administered to HCWs and 254 questionnaires were completed, which is an overall response rate of 94%. The results show showed that most health care workers were females 131 (51.6%) and they aged between 25 to 35 years. Regarding professional rank, most participants were nurses (28.7%), followed by medical attendants (25.6%), medical doctors (18.5%) and laboratory technicians were 13.4% as indicated in Table 1.

Prevalence of occupational exposures and utilization of HIV-PEP

Among 254 HCWs in this study, the majority 181 (71.3%) had experienced occupational exposure to needle stick injury and/or blood/body fluids in the past 12 months. In addition, almost half of these (48%) were exposed to both needle stick injuries and blood/body fluid whereas 53 (29.3%) were exposed to blood or body fluids and 41 (22.7%) had experienced needle prick or sharp objects injuries as shown in Table 2. The most exposed cadre was dentists (all 3 participants) followed by medical attendants (78.5%) and laboratory technicians (73.5%). Regarding the use of HIV-PEP after occupational exposure, among 181 HCWs who had experienced occupational exposure the majority (75%) did not use HIV-PEP while only 25% received the PEP. Nurses (85%) and medical attendants (80%) were the least likely to use PEP (Table 2).

Health care worker's awareness and knowledge on HIV-PEP

Even though a good number of HCWs (87%) were aware about HIV-PEP, only 57% knew the importance of using HIV-PEP. When

Social Demographic Characteristics	Number (N)	Percentage (%)
Age (years)		
<25	64	25.2
25-35	87	34.3
35-45	74	29.1
>45	29	11.4
Sex		
Male	123	48.4
Female	131	51.6
Cadre		
Specialists	2	0.8
Medical doctors	47	18.5
Clinical officers	19	7.5
Assistant medical officers	11	4.3
Dentists	3	1.2
Laboratory technicians	34	13.4
Nurses	73	28.7
Medical attendants	65	25.6
Work experience		
<2 years	79	31.1
2-6 years	108	42.5
7-11 years	39	15.4
>11 years	28	11

Table 1: Social demographic characteristics of the study participants (n=254).

Variables	Response	Medical doctors	Assistant medical officers	Lab technicians	Nurses	Medical attendants	Dentists	Clinical officers	Total
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Ever had occupational exposures within 12 months N=254	Yes	35 (71.4%)	6 (54.5%)	25 (73.5%)	48 (65.8%)	51 (78.5%)	3 (100%)	13 (68.4%)	181 (71.3%)
	No	14(28.6%)	5(45.5%)	9(26.5%)	25(34.2%)	14(21.5%)	0(0%)	6(31.6%)	73(28.7%)
Sources of exposure									
Needle prick or sharp objects		7(20%)	1(16.7%)	2(15.4%)	10(40%)	9(18.8%)	0	12(23.5%)	41(22.7%)
Blood or body fluid splashes		10(28.6%)	1(16.7%)	4(30.8%)	6(24%)	19(39.6%)	3(100%)	10(19.6%)	53(29.3%)
Both needlestick injuries and blood/ body fluid		18(51.4%)	4 (66.6%)	7(53.8%)	9(36%)	20(41.6%)	0	29(56.9%)	87(48%)
Utilization of PEP after exposure	Yes	14(40%)	2(28.6%)	6(24%)	7(14.6%)	10(20%)	2(66.7%)	4(30.8%)	45(24.9%)
	No	21(60%)	5(71.4%)	19(76%)	41(85.4%)	40(80%)	1(33.3%)	9(69.2%)	136(75.1%)

Table 2: Health care worker's occupational exposure and HIV-PEP usage.

asked about when should the PEP be initiated, 171(67%) reported that HIV-PEP must be taken within 72 hrs after occupational exposure and only few HCWs (19%) had no knowledge on when to start using PEP. Furthermore, most participants were not knowledgeable about the duration of HIV-PEP since only 25 (10%) knew the recommended duration of 28 days. When asked about the source of knowledge on HIV-PEP, 56% got the information through training while 19% learned from the available HIV-PEP guidelines distributed in the wards. Table 3 summarizes these findings.

Possible causes of occupational exposure and barriers to utilization of HIV-PEP

Almost half of the participants 86 (47.5%) reported that they were more likely to experience occupational exposure due to absence or unreliable availability of safety devices and protective barriers such as gloves and goggles. Meanwhile 29% of HCWs perceived lack of knowledge on standard precautions about occupational exposure while 24% thought that high workload in the hospital could increase their risk of occupational exposure. Among 181 (71%) HCWs that experienced occupational exposure 136 (75%) did not use HIV-PEP. When asked about the reasons for not utilizing HIV-PEP, 52 (38%) reported that they knew about HIV status of the source patient (tested negative) whereas 40 (29%) only assumed that patients' HIV results were negative and 17 (13%) were due to negligence and 12 (9%) mentioned that did not have information about where to get HIV-PEP service. In addition, a small percentages of participants mentioned reasons such as fear of confidentiality 5 (3.7%), stigmatization and discrimination 3 (2.2%), not being aware of hospital protocols 3 (2.2%), bad judgment from their colleagues 2 (1.5%) and HIV-PEP service was not available or it was far away 2 (1.5%) as barriers for not using HIV-PEP. Results are summarized in Table 4.

Discussion

The results from our study show high prevalence of occupational exposure among healthcare workers and therefore indicate that healthcare workers in Kilombero district are at risk of acquiring blood-borne infectious diseases. In addition there was low utilization of HIV-PEP and thus poses risk to HIV infection if the exposure were HIV contaminated.

The prevalence of occupational exposure among HCWs in this study was 71%. Additionally, a high proportion of HCWs had experienced

Items	Response	n (%)
Awareness and Knowledge on HIV-PEP	Yes	220 (86.6)
	No	34 (13.3)
Knowledge on the importance of using HIV-PEP	Yes	144 (56.7)
	No	110 (43.2)
Knowledge on when to start HIV PEP medication	within few hours	36 (14.2)
	within 72 hours	171 (67.3)
	Don't know	47 (18.5)
Knowledge on the duration of HIV-PEP medication	4 weeks	167 (65.7)
	28 weeks	25 (9.8)
	6 months	16 (6.3)
	For life	29 (11.4)
	don't know	17 (6.7)
Source of information	Training	122 (55.5)
	PEP guidelines in wards	42(19.0)
	Mass media	14 (6.3)
	Friends	13 (5.9)
	Journals	13 (5.9)
	Don't remember	17 (7.7)

Table 3: Heath care worker's knowledge on HIV-PEP.

Causes of exposures	Frequency (No)	Percentages (%)
Perceived causes of exposures to HIV (N=181)		
Lack of safety devices and barriers (e.g. gloves, goggles)	86	47.5
Lack of knowledge on standard precautions	52	28.7
High workload	43	23.8
Perceived barriers to utilization of HIV-PEP (N=136)		
Knowledge of the HIV status of the source patient (negative results)	52	38.2
Assuming HIV status of the source patient was negative	40	29.4
Negligence	17	12.5
Lack of information about the existence of HIV-PEP service	12	8.8
Fear of confidentiality	5	3.7
Fear of stigmatization and discrimination	3	2.2
Not aware of hospital protocols about HIV-PEP	3	2.2
Fear of judgment from colleagues	2	1.5
HIV-PEP service was not available/far	2	1.5

Table 4: Causes of occupational exposure and barriers to HIV-PEP usage.

both needle injuries and blood/body fluid splashes. These findings are higher than the results obtained in a study conducted in Singida region, central Tanzania [16] and in Mbeya region, south-west Tanzania [18] but comparable with finding from Iran (74%), India (73%) and Ethiopia (74%) [19-21]. The high prevalence of exposure may be due to unavailability of protective equipment as reported by our study participants. In this study, apart from the 3 dentists who participated in the study and reported experience to occupational exposure, medical attendants were also the most exposed cadres which is similar to findings from the previous studies [18,22]. This study shows showed that medical attendants are at high risk of acquiring infections through occupational exposure. A study conducted in Mbeya region Tanzania have reported similar findings [18]. The most probable explanation for the observed high occupational exposure among medical attendants can be due to the fact that most healthcare facilities in rural Tanzania are mainly staffed by lower cadres of health workers who provide basic preventative and curative services [23]. However, studies in other countries like Cameroon [24], Serbia [25] and Kenya [26] have shown that that nurses ranked first.

In the present study, most HCWs who were exposed to needlestick injuries and/or blood/body fluid splashes did not utilize HIV-PEP. Low utilization of PEP among HCWs has also been revealed by studies in Tanzania and other developing countries [16,18,20]. World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) have put the recommended guidelines [9,27] on the use of HIV-PEP among exposed individuals especially in areas with high HIV prevalence or at high risk of acquiring the infection. Our findings revealed that despite that SFRH is hosting a cohort of HIV patients where HCWs care for patients living with HIV on a daily basis but still the uptake of PEP is low hence poses a higher risk of acquiring HIV among HCWs.

It is recommended that HIV-PEP must commence within 72 hours after exposure and once PEP is started, it should be taken for full duration of 28 days [28]. In this study, about 86.6% were aware of the existence of HIV-PEP and 81.5% had knowledge on when to start using HIV-PEP even though very few participants (6.7%) knew about the recommended duration of HIV-PEP. Contrary to these findings, a recent study conducted in Singida, central Tanzania showed that more than half of the participants had inadequate knowledge on HIV-PEP [16]. Availability of training on HIV-PEP i.e. formal and informal training provided during ward round, Monday meetings at the study hospital can explain the differences in these percentages.

Almost half of the participants reported the lack of the protective equipment as a major reason for them to be exposed to blood/body fluid, followed by lack of knowledge on standard precautions and high work load. This finding is in accord to a study done in Ethiopia where inconsistent use of gloves and not complying with standard precautions were the main factors associated with occupational exposure. The absence of protective equipment at healthcare facilities puts HCWs at risk of acquiring blood borne infectious diseases.

Concerning the observed low utilization of HIV-PEP among HCWs, reasons such as knowledge on HIV status of the source patient was negative, assumption that HIV status of the source patient was negative, negligence, lack of information about the existence of post-exposure prophylaxis service, fear of confidentiality, fear of stigma and discrimination were chronologically reported by our study participants. These factors were reported previously in studies in Tanzania [22], USA [29] and Ethiopia [30].

Strength and Limitations

This study was conducted in referral hospital located in a rural setting in Tanzania and it serves more than 70% of the general population. The findings obtained from this study may assist health authorities in rural settings in improving utilization of HIV-PEP among HCWs and reducing or eliminating barriers that prevent the usage of HIV-PEP.

The limitation of this study is the fact that as information was self-reported and thus there is a possibility of over reporting or underreporting. Information on exposure was sought for the preceding 12 months and thus might have introduced recall bias among healthcare workers.

Conclusion

Despite high rates of needlestick and blood/body fluids exposures, the uptake of HIV-PEP among HCWs was low. This is a call for action by government and other stakeholders to decrease exposure risks among HCWs so as to minimize occupational hazards resulting to HIV infection and other blood-borne pathogens. Given the low awareness among lower cadres, trainings and awareness creating regarding HIV-PEP guidelines and safety measures, would bring positive changes on utilization of HIV-PEP upon occupational exposure, but also for the HCWs demand for provision of safety and personal protection equipment.

Conflict of Interest

The authors declare that they have no conflict of interest.

Author's Contributions

SMS and BC conceived the study; SMS collected and analyzed the data; BC reviewed the analytical approach and prepared the first draft. All authors revised the manuscript and approved the final manuscript.

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References

1. Prüss-Üstün A, Rapiti E, Hutin Y (2005) Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. Am J Ind Med 48: 482-490.
2. Wilburn SQ, Eijkemans G (2004) Preventing needlestick injuries among healthcare workers: a WHO-ICN collaboration. Int J Occup Environ Health 10: 451-456.
3. https://www.who.int/occupational_health/topics/needinjuries/en/index1.html
4. Chalya PL , Seni J, Mushi MF, Mirambo MM, Jaka H, et al. (2015) Needle-stick injuries and splash exposures among health-care workers at a tertiary care hospital in north-western Tanzania. Tanzania J Heal Res 17.
5. https://www.unaids.org/sites/default/files/media_asset/unaids-data-2018_en.pdf
6. https://www.usaid.gov/sites/default/files/documents/1860/HIV-AIDS_Fact_Sheet_Aug_2018.pdf
7. https://www.unaids.org/en/regionscountries/countries/unitedrepublicoftanzania
8. https://www.cdc.gov/anthrax/pdf/infection-control-guidelines-for-healtcare-setting-2007.pdf
9. https://nccc.ucsf.edu/wp-content/uploads/2014/03/Updated_USPHS_Guidelines_Mgmt_Occupational_Exposures_HIV_Recommendations_PEP.pdf
10. http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf
11. Mashoto KO, Mubyazi GM, Makundi E, Mohamed H, Malebo HM, et al. (2013) Estimated risk of HIV acquisition and practice for preventing occupational exposure: a study of healthcare workers at Tumbi and Dodoma Hospitals, Tanzania. BMC Health Serv Res 13: 369.
12. Mashoto, KO, Mubyazi GM, Mushi AK (2015) Knowledge of occupational exposure to HIV: a cross sectional study of healthcare workers in Tumbi and Dodoma hospitals, Tanzania. BMC Health Serv Res 15: 29.
13. Geubbels E, Amri S, Levira F, Schellenberg J, Masanja H, et al. (2015) Health & Demographic Surveillance System Profile: The Ifakara Rural and Urban Health and Demographic Surveillance System (Ifakara HDSS). Int J Epidemiol 44: 848-61.
14. http://www.tzdpg.or.tz/fileadmin/documents/dpg_internal/dpg_working_groups_clusters/cluster_2/water/WSDP/Background_information/2012_Census_General_Report.pdf
15. Letang E, Kalinjuma AV, Glass TR, Gamell A, Mapesi H, et al. (2017) Cohort profile: The Kilombero and Ulanga Antiretroviral Cohort (KIULARCO) - A prospective HIV cohort in rural Tanzania. Swiss Med Wkly 147.
16. Kimaro L, Adinan J, Damian DJ, Njau B, (2018) Prevalence of occupational injuries and knowledge of availability and utilization of post exposure prophylaxis among health care workers in Singida District Council, Singida Region, Tanzania. PloS one 13.
17. Naing L, Winn T, Rusli BN (2006) Practical issues in calculating the sample size for prevalence studies. Archives of orofacial Sciences 1: 9-14.
18. Mponela MJ, Oleribe OO, Abade A, Kwesigabo G (2015) Post exposure prophylaxis following occupational exposure to HIV: a survey of health care workers in Mbeya, Tanzania, 2009-2010. Pan Afr Med J 21: 32.
19. Naderi HR, Sheybani F, Bojdi A, Mostafavi I, Khosravi N (2012) Occupational exposure to blood and other body fluids among health care workers at a university hospital in Iran. Workplace Health Saf 60: 419-422.
20. Sharma R, Rasania S, Verma A, Singh S (2010) Study of Prevalence and Response to Needle Stick Injuries among Health Care Workers in a Tertiary Care Hospital in Delhi, India. Indian J Community Med 35: 74-77.
21. Yenesew MA, Fekadu GA (2014) Occupational exposure to blood and body fluids among health care professionals in bahir dar town, northwest ethiopia. Saf Health Work 5: 17-22.
22. Mabwe P, Kessy AT, Semali I (2017) Understanding the magnitude of occupational exposure to human immunodeficiency virus (HIV) and uptake of HIV post-exposure prophylaxis among healthcare workers in a rural district in Tanzania. J Hosp Infect 96: 276-280.

23. http://apps.who.int/medicinedocs/documents/s18419en/s18419en.pdf.

24. Nouetchognou JS, Ateudjieu J, Jemea B, Mbanya D (2016) Accidental exposures to blood and body fluids among health care workers in a Referral Hospital of Cameroon. BMC Res Notes 9: 94.

25. Markovic-Denic L, Maksimovic N, Marusic V, Vucicevic J, Ostric I, et al. (2015) Occupational exposure to blood and body fluids among health-care workers in Serbia. Med Princ Pract 24: 36-41.

26. Mbaisi EM, Ng'ang'a Z, Wanzala P, Omolo J (2013) Prevalence and factors associated with percutaneous injuries and splash exposures among health-care workers in a provincial hospital, Kenya, 2010. Pan Afr Med J 14: 6.

27. https://www.who.int/hiv/pub/guidelines/arv2013/December2014-ARVsupplement-chap5.pdf?ua=1.

28. https://www.who.int/hiv/topics/prophylaxis/info/en/.

29. Leiss JK (2012) Work experience, work environment, and blood exposure among home care and hospice nurses. Ind Health 50: 521-528.

30. Tesfay FA, Habtewold TD (2014) 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, 2014. AIDS Res Treat 2014.