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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

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SUMMARY

Background: Occupational exposure to blood or other body fluids in healthcare settings puts healthcare workers (HCWs) at risk of acquiring human immunodeficiency virus (HIV) infection. It is estimated that between 200 and 5000 HIV infections are transmitted annually to HCWs worldwide. Use of post-exposure prophylaxis (PEP) has been documented to reduce the rate of HIV infection from workplace exposures by 81%.

Aim: To investigate the extent of occupational exposure to HIV infection during the period of 12 months before the survey and to identify factors associated with uptake of PEP services among HCWs.

Methods: We interviewed 221 HCWs from selected healthcare facilities in Kongwa, Tanzania. Data included occupational exposures to body fluids, knowledge and use of PEP.

Findings: Sixty (27.1%) of the HCWs had experienced exposures to blood and body fluids, of whom 71.7% (43/60) had needlestick injuries. Medical attendants were more frequently exposed, followed by nurses (31.7% and 28.6% respectively). Of the exposed HCWs, seven (11.7%) reported use of HIV PEP. Reporting of exposure [odds ratio (OR): 8.44; $P = 0.016$], knowledge of the HIV status of the source patient (OR: 42.19; $P = 0.007$) and awareness of PEP (OR: 12.72; $P = 0.010$) were significant predictors of PEP use.

Conclusion: Uptake of PEP services among HCWs remains low despite high rate of occupational exposures. Wider dissemination of HIV PEP guidelines and training of HCWs is required in Tanzania to ensure that HCWs have knowledge of, and prompt access to, PEP services.

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Introduction

Three million percutaneous exposures to bloodborne pathogens occur annually among 35 million healthcare workers (HCWs) worldwide, and it is estimated that 2.5% of human immunodeficiency virus (HIV) infections in HCWs are attributable to occupational sharps exposures.¹ In addition, HCWs are at risk of acquiring HIV infection through splashes of contaminated

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blood or body fluids.² In total, 4% of HIV infections among HCWs result from professional exposures; 90% of these occur in low-income countries and are preventable.³

The risk of occupational bloodborne infections for HCWs in low-income countries is exacerbated by a range of factors, such as health facility overcrowding; lower ratios of HCWs to patients; limited awareness of the risks associated with exposure to blood and other body fluids; failure to implement universal precautions; inadequate supplies of basic safety equipment; and the need to handle contaminated needles and other sharps that are processed for reuse. Furthermore, lack of reliable access to HIV post-exposure prophylaxis (PEP) increases the chances of this infection developing after occupational exposure.

The high prevalence of HIV infection in some low-income countries puts HCWs in these countries at particular risk. The Tanzania HIV/Malaria Indicator Survey of 2011/2012 revealed a high HIV prevalence (5.1%) among sexually active persons aged 15–49 years. As the prevalence of HIV infection continues to rise, HCWs will be exposed to an increasing number of contacts with patients with HIV/acquired immune deficiency syndrome (AIDS).⁴ The situation in rural settings may be compounded by inadequate numbers of HCWs and shortage of equipment. Data from Kongwa (Figure 1) indicate an HIV/AIDS prevalence of 2.8% among men and women aged 15–49 years in the general population; and that HIV-related conditions are among the ten most prevalent diseases. However, there are wide variations within the district, with the HIV prevalence being as high as 8.3% at Kibaigwa Health Centre.

The global response to the escalating occupational exposure to HIV among HCWs included publication of the International Labour Organization (ILO) Code of Practice on HIV/AIDS in 2001 followed by the Joint ILO/World Health Organization Guidelines on health services and HIV/AIDS in 2005.^{5,6} The Ministry of Health in Tanzania responded to these publications by developing HIV PEP guidelines which state that any exposed HCW should be able to access services within the same facility. Where on-site services are not available, a local PEP facilitator (a staff member specifically tasked with keeping records of exposures, and giving guidance to exposed HCWs) refers the exposed person to the nearest facility. However, time to reach the referral facility and access PEP varies widely, depending on the time of the day, availability of public transport and geographical terrain. Post-exposure management entails management of exposure site, assessment of infection risk, administration of PEP where indicated, follow-up, and counselling. PEP drugs should be provided within 2 h and not later than 72 h after exposure. For low-risk HIV exposures, a combination of Zidovudine and Lamivudine is used, whereas for high-risk exposures triple combination therapy is recommended, e.g. Zidovudine + Lamivudine + Efavirenz®, or Lopinavir + Ritonavir®.

In these guidelines it is emphasized that any HCW exposed to or infected with HIV occupationally shall be entitled to PEP, or treatment in the case of HIV infection. Facility-level implementation started in 2005 with training of HCWs and appointment of PEP facilitators.



Figure 1. Map of Tanzania showing relative position of Kongwa district in Dodoma region.

Despite all these efforts, there is little information on occupational exposure to HIV and use of PEP services in Tanzania. The aim of this study was to understand the extent and dynamics of occupational exposure to HIV among HCWs in a rural setting.

Methods

We conducted a cross-sectional study in healthcare facilities of Kongwa district in the Dodoma region in central Tanzania (Figure 1). The district healthcare system is organized in a pyramidal structure, with a district hospital at the apex, serving as a referral point for the four health centres, each serving a minimum of 50,000 people. A health centre receives referrals from several dispensaries (there are 45 public dispensaries). In total, there are 382 HCWs, including 176 working in hospitals, 61 in health centres, and 104 in dispensaries. HCWs include clinicians (prescribers); laboratory technicians, nursing staff and medical attendants (workers without any professional training, mainly responsible for facility cleaning; who, in rural areas also work as nurses). No health facility receives seconded medical or nursing students. Although we had no data on the extent of professionally acquired HIV infection among the HCWs, at the time of our survey PEP services were available in only five health facilities (district hospital, three health centres, and one dispensary).

The study targeted HCWs from the hospital and all health centres, and from 20 randomly selected dispensaries. A sample size of 250 was determined based on the proportion (21%) of HCWs who had experienced occupational exposure to body fluids in another study, with precision set at 5% and power at 0.8, and with a 3% margin of error.⁷ The number of HCWs randomly selected from each facility was proportional to the total number of HCWs in each facility, except in the dispensaries where all HCWs present were included. The sample of 250 HCWs comprised 129 from Kongwa hospital, 45 from health centres, and 76 from dispensaries. Interviews were performed using a pretested Kiswahili questionnaire. The dependent variable was reporting of occupational exposure to body fluids and independent variables included social demographics, job title, awareness PEP guidelines, knowledge and access to HIV PEP services. Permission for conducting the study was obtained from district authorities and only HCWs giving consent were interviewed.

Knowledge on PEP was determined for each individual by asking a series of questions including having heard of PEP; read the PEP guidelines; attended HIV PEP training; and understanding of PEP procedures and treatment. The maximum score was 24 points which equated to 100%. Respondents scoring $\geq 60\%$ were categorized as having a high level of knowledge and coded as '1'; respondents were otherwise coded as '0'. Chi-square test and Pearson correlation coefficients were used to examine the relationship between dependent and independent variables and $P < 0.05$ was considered significant.

Results

Sample characteristics

A total of 221 HCWs participated in the study, yielding a response rate of 88.4%; the probability of non-response did not differ by type of health facility or the job title of the HCW. The

places of work of respondents were as follows: hospitals 56.6%, health centres 17.2%, and dispensaries 26.2%. Most of the participants (70%) were females and aged 25–34 years (43.9%). 53.4% of respondents were married. Medical attendants constituted the highest proportion of the HCWs (37.1%), followed by nurses (34.8%); more than half (55.7%) of all respondents had attained college education.

Occupational exposure

More than a quarter of respondents (60/221, 27.1%) reported having experienced an occupational exposure to blood and other body fluids during the period of 12 months before the survey. HCWs more frequently exposed were medical attendants followed by nurses (31.7% and 28.6% respectively), whereas clinicians were the least exposed (17.5%). Needlestick injury was the most reported exposure, accounting for 71.7% of all exposures, followed by splashes with blood/body fluids (23.3%), and cuts with a sharp object (5%).

Knowledge on HIV PEP services

Of the 221 HCWs, 85 (38.5%) had a high level of knowledge of HIV PEP. Although the largest proportion of staff with a low level of knowledge (70.7%) were from the dispensaries, more than half of respondents from the district hospital had low knowledge of HIV PEP services. More than two-thirds of all respondents could not name any of the ARV drugs used for HIV PEP. Among clinicians 67.5% (27/40) had high knowledge of PEP procedures, followed by nurses (49.4%). The less-qualified workers, i.e. medical attendants and cleaners were poorly informed about PEP services although training records showed that they had all attended training sessions on HIV PEP guidelines and local services.

Use of HIV PEP

Of the 25 healthcare facilities, only five (20%) had copies of HIV PEP guidelines and none of them had either reporting or recording mechanisms for occupational exposures. Fewer than a quarter of the study respondents (50/221, 23.5%) reported having seen guidelines, and only 31 (62%) of those who had seen them had ever used them.

Despite a high rate of exposure (60/221, 27%) to blood/body fluids at work, only 28.3% of exposed HCWs had ever sought advice on PEP and only seven (11.7%) had used PEP (mostly laboratory technicians and clinicians). Six of the 43 (14%) HCWs who had occupational exposures that they did not report said that this was because 'the source patients tested negative for HIV'. Reasons given for failure to use PEP services included unavailability of services, particularly in the more rural facilities, distance and cost of transport to facilities where services could be accessed, poor knowledge on the HIV risk and on PEP procedures, stigma related to disclosure, and fear of testing positive as a result of having pre-existing HIV infection.

Predictors of use of PEP services

Table 1 shows predictors of use of PEP services among exposed HCWs. Reporting HIV occupational exposures to supervisors as well as knowing the HIV sero-status of the source patient were statistically significant predictors of PEP use (OR:

Table 1
Predictors of use of post-exposure prophylaxis (PEP) services after occupational exposure to blood/body fluids

Predictor	Use of HIV PEP			Fisher's exact test	
	Yes (N = 7)	No (N = 53)	Total	OR	P-value
Awareness of the PEP guidelines					
Aware	2 (25.0%)	6 (75.0%)	8	3.13	0.232
Not aware	5 (9.6%)	47 (90.4%)	52		
Reporting exposure to supervisors					
Reported	5 (29.4%)	12 (70.6%)	17	8.44	0.016
Did not report	2 (4.7%)	41 (95.3%)	43		
Accessibility to PEP services					
Easily accessible	2 (28.6%)	5 (71.4%)	7	3.86	0.185
Not easily accessible	5 (9.4%)	48 (90.6%)	53		
Source person HIV status					
HIV positive	5 (62.5%)	3 (37.5%)	8	42.19	0.007
HIV negative/unknown	2 (3.8%)	50 (96.2%)	52		
Knowledge on PEP procedures					
Knowledgeable	6 (26.1%)	17 (73.9%)	23	12.72	0.010
Not knowledgeable	1 (2.7%)	36 (97.3%)	37		

HIV, human immunodeficiency virus; OR, odds ratio.

8.44; $P = 0.016$; and OR: 42.19; $P = 0.007$, respectively). Furthermore, HIV-exposed respondents who were knowledgeable of PEP procedures were almost 13 times more likely to use PEP than those who were not (OR: 12.72; $P = 0.010$).

Discussion

This study shows that a significant number of HCWs in Kongwa district are exposed to potentially infectious materials during work, which puts them at high risk of contracting HIV and other bloodborne diseases. A recent study of blood donors at one Tanzanian tertiary teaching hospital revealed that 15.9% had at least one bloodborne pathogen, with 8.8% having HBsAg, 4.7% syphilis, 3.8% HIV, and 1.5% HCV.⁸

A quarter of the respondents reported having experienced occupational exposure within 12 months before the survey, mostly from needlestick injuries. High exposures among HCWs have also been documented in other parts of Tanzania (47.9%) and in Ethiopia (23%) and Kenya (30%).^{4,9,10} However, a far higher exposure rate (83%, 107/129) was reported among HCWs at Mulago hospital in Uganda.⁷ This was a city-based hospital that would be likely to conduct more surgical procedures, and to receive a higher number of road accident victims, both of which are associated with a higher risk of occupational exposures.

The risk of occupational exposure to HIV is most closely related to the activities and duties of the HCW. Nurses predominantly give direct patient care and are also involved in most hazardous activities such as dressing wounds, injecting and various minor surgical procedures.¹¹ In a study done at Thai University, out of 820 reported episodes of occupational exposures, nurses were the largest group at risk, accounting for 27%.¹² Similarly, in the current study, nurses and medical attendants were at higher risk of exposure compared to other types of HCW.

Needlestick injuries were much the most frequent means of exposure in both India (75%) and Dar es Salaam (74%); in Kongwa, such injuries accounted for 71.7% of all exposures.^{13,14} Apart from poor risk perception (as observed in our study), overuse of injections, lack of supplies, and lack of access to or failure to use sharps containers are likely to contribute to the

risk needlestick injuries. Issues such as recapping of needles after use, passing needles from hand to hand during surgical procedures, lack of awareness of the hazard and lack of appropriate training are other factors that have previously been documented.¹

Use of PEP among HCWs in low-income countries is low compared to the high-income countries. This could be related to low knowledge, poor risk perception, lack of confidentiality and poor working conditions among others. Slightly more than a tenth (11.7%) of the HCWs in Kongwa who were occupationally exposed used PEP. This proportion is almost three-fold higher than what was observed in a study in the Thika district of Kenya where PEP uptake among HCWs reporting exposure to needlestick injuries was only 4%.⁹ On the other hand, a survey on knowledge, attitude, and practices towards HIV PEP use among HCWs in Uganda showed an uptake of 21.5% among exposed staff.⁷ In high-income countries such as Greece, PEP was used in 89.9% of 188 reported occupational exposures.¹⁵ A comparably high PEP uptake (74%) was reported among 97 HCWs in London.¹⁶

Many injuries occurring among HCWs are not reported, especially in low-income countries.¹⁷ Whereas 90% of occupational exposures occur in these countries, 90% of reports occur in the USA and Europe.¹⁸ In this study, 28% of HCWs reported their occupational exposures to their supervisors. This is comparable to the proportions reported by the Ministry of Health in Tanzania (22.8%) and in Uganda (28%).⁷ However, in all these studies, exposures might have been under-reported, as many HCWs would merely ignore the injury as trivial.¹⁰ Other factors that might contribute to under-reporting are stigma attached to HIV testing as well as recall bias. Failing to report an exposure and hence use PEP services amidst the significant rate of exposures places staff at a high, and possibly avoidable, risk of contracting HIV/AIDS.

More than half of the HCWs in this study had low level of knowledge on HIV PEP procedures and were not aware of PEP measures to be taken in case of an occupational exposure. Similarly, a study conducted in 18 primary healthcare centres in rural Zimbabwe revealed that 56% of the interviewed HCWs did not have a clear sense of what PEP is.¹⁹ In Kongwa, HCWs

with high knowledge of HIV PEP procedures were significantly more likely to use PEP compared to their contemporaries with low knowledge. High risk of exposure, coupled with poor knowledge of HIV PEP, is of serious concern.²⁰ Lack of knowledge on the availability of PEP on the part of the care provider may translate to missed opportunities for its prescription and lead to an increased risk of seroconversion.^{7,19,21}

Non-availability of HIV PEP guidelines is a serious problem in many healthcare settings in different countries. In this study, less than a quarter of HCWs reported ever seeing the guidelines from the Ministry of Health. However, HCWs are concerned about their safety and health at work, and they value interventions that reduce occupational exposure to infection. The problem is that without knowledge of, or access to, national guidance HCWs may not see local guidance as important and consequently fail to perceive the risk to themselves from exposure to blood and body fluids.¹⁰

It was anticipated at governmental level in Tanzania that all health facilities would have a PEP infrastructure in place that included access to guidelines and identification of PEP facilitators. Recent publications from Tanzania have reported that many facilities lack PEP facilitators, limited awareness of PEP among HCWs, and very low use of PEP despite high exposure status.^{4,11,13} Whereas these reports have been from urban areas, the Kongwa study provides novel and important information of the situation rurally. This should reinforce arguments that a national response to improve the situation is required.

Possible limitations of our study were the low numbers of HCWs surveyed, difficulties in recalling occupational exposures which were perceived as trivial, and stigma attached to HIV testing and positive results. Furthermore, self-reported behaviours might not reflect the actual practice. Nevertheless, our findings are largely comparable to other studies in Tanzania and other African countries.

In conclusion, this study has demonstrated that occupational exposure to blood and other body fluids, especially following needlestick injuries, is a frequent occurrence among HCWs in a rural setting in Tanzania and that HIV PEP access and use is limited. The Ministry of Health should therefore disseminate widely the available HIV PEP guidelines, equip health facilities appropriately, and concurrently provide training to guide HCWs in reporting occupational exposures so as to ensure access and prompt use of PEP services. Whereas the current strategies might over-emphasize HIV PEP, there is a need equally to focus on PEP for other bloodborne infections, especially HBV, which is more prevalent and more infectious than HIV.

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Conflict of interest statement

None declared.

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