

## Safe injections and waste management among healthcare workers at a regional hospital in northern Tanzania

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**Abstract:** Unsafe injections and substandard waste management are public health issues exposing healthcare workers and the community to the risk of infections. The objective of this study was to assess the knowledge and practice of safe injections and health care waste management among healthcare workers at a regional hospital in northern Tanzania. This cross sectional descriptive study was conducted in a regional hospital in northern Tanzania. Data was collected through a self-administered questionnaire with additional observations of the incinerator, injections, waste practices, and the availability of medical supplies. Data was analysed in SPSS descriptive statistics and chi-square tests were performed. A total of 223 of 305 (73%) healthcare workers from different cadres were included in the study. The majority of healthcare workers had adequate knowledge and practice of safe injections, but inadequate knowledge about waste management. The majority of the staff reported knowledge of HIV as a risk factor, however, had less knowledge about other blood-borne infections. Guidelines and posters on post exposure prophylaxes and waste management were present at the hospital, however, the incinerator had no fence or temperature gauge. In conclusion, healthcare workers reported good knowledge and practice of injections, and high knowledge of HIV transmission routes. However, the hospital is in need of a well functioning incinerator and healthcare workers require sufficient medical supplies. There was a need for continual training about health care waste management and avoidance of blood-borne pathogens that may be transmitted through unsafe injections or poor health care waste management.

**Keywords:** Safe injections, waste management, occupational risks, healthcare workers, HIV, Tanzania

### Introduction

Unsafe injections and poor health care waste management (HCWM) are public health issues exposing healthcare workers and the community to infections, which cause millions of deaths and direct medical costs each year (Kane *et al.*, 1999; Miller & Pisani 1999; Dziekan *et al.*, 2003). According to official statistics from World Health Organization, in 2000, 5% of the global HIV incidence was estimated to occur because of poor waste handling and contaminated injections (WHO, 2007). In 2010, 1.9 million new HIV infections were recorded in Sub-Saharan Africa (WHO, 2011), with between 12 to 17% of the new infections being due to unsafe injection practices (WHO, 2009). Globally, about two billion people live with hepatitis B, and about a third of those infections are caused by unsafe injection practices (WHO, 2009). Moreover, each year about 3 to 4 million people become infected with hepatitis C (WHO, 2011), of which 40% are caused by unsafe injections and between 10-25% of health care waste is considered infectious, including sharps, syringes, and needles. Pruss-Ustun *et al.* (2005) estimated that over three million healthcare staffs yearly is exposed to injury of contaminated sharps, causing 16,000 HCV infections, 66,000 HBV and 1,000 HIV infections, and most HIV infections occur in Africa.

The segregation of infectious from non-infectious waste is essential, and containers should be used for sharps and not be overfilled to avoid exposure to infections, injuries, and toxic material (Pruess *et al.*, 1999). Improper disposal of waste, can lead to resale of medical equipment on the black market. Additionally, if the incinerator or type of burning does not have

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an adequate filter, pollution may occur and expose people living in close proximity to life hazards (WHO, 2002). About 50% of low-income countries use open burning of syringes, which is not in accordance with the WHO recommendations (WHO, 2002).

Occupational safety and health including the performance of safe injections and waste management are important concerns to protect healthcare workers, patients, and the community. The importance of safety among health staff requires attention, as there is low awareness about it (Gumodoka *et al.*, 1997, MoHSW 2004; Kermode, 2004; Manyele & Anicetus, 2006; Manyele *et al.*, 2008); for example, injection equipment is improperly cleaned and reused for a new procedure without sterilisation (Huari *et al.*, 2003). According to WHO, the occurrence of injections with reused needles and syringes without sterilisation ranges from 40 to 70% globally, and in low- and middle-income countries, one in three injections are unsafe (Hutin *et al.*, 2003). The reuse of a needle increases the risk of HIV and hepatitis, the most common blood borne pathogens (WHO 2010). Statistics indicate that there is higher HIV prevalence among patients receiving a high number of injections (DHS, Uganda 2008). Needle stick injuries are often the result of unsafe injection practices such as recapping, poor disposal of sharps, and overflowing containers. Education and training can reduce the number of infections related to unsafe injections and improve waste management (Vos *et al.*, 1998; Guo *et al.*, 1999; Jayanth *et al.*, 2009; Metha *et al.*, 2010).

Tanzania, as many other countries in Africa, is highly affected by the HIV epidemic and in 2008 there were 1.3 million HIV positive people ([http://www.tz.undp.org/mdgs\\_goal6.html](http://www.tz.undp.org/mdgs_goal6.html)), who occupied over half the hospital beds in the country (MoHSW, 2004). A situation analysis of hospital infection prevention in Tanzania revealed inadequate knowledge and skills among healthcare workers, and a lack of guidelines, equipment, and materials (MoHSW, 2004). Consequently the Tanzanian Ministry of Health and Social Welfare supports the implementation of the concept of occupational safety and health in order to curb the situation. Prevalence, maternal to child transmission, antiretroviral treatment, stigma and fear are more often discussed in the perspective of HIV, than occupational safety and risks for health workers. This study was therefore carried out to assess the knowledge and practice of safe injections and waste management among healthcare workers at a regional hospital in northern Tanzania.

## **Materials and Methods**

### **Study design and data collection**

This cross sectional descriptive study, with an observational part was conducted between June and August 2011 at a regional public hospital in the northern part of Tanzania. The hospital has a capacity of 450 beds and provides services to about 1.6 million people in the area (Urasa & Darj, 2011). Healthcare workers considered being at risk of occupational exposure to HIV and other blood-borne infection through sharp injuries or mucocutaneous exposure, contact with intact or non-intact skin, and contact with mucous membranes, were involved in this study. There were 305 healthcare workers who met the inclusion criteria, involving; nurses, doctors, laboratory technicians, dentists, medical assistants, cleaners, laundry workers, secretary, medical interns and medical students. Excluded in the data collection were those not present at the hospital during the time of the study. There were a total of 236 questionnaires distributed and 13 were excluded due to incomplete forms. In total 223 of the staff participated in the study.

Data was collected through a pre-tested structured questionnaire developed in accordance with WHO guidelines and the guidelines of the Tanzanian Ministry of Health, Infection Prevention and Control. The questionnaire included close-ended and multiple choice questions. The first part consisted on demographic background including sex, age, education level, cadre and length of working experience. A second part investigated knowledge on safe injections and safety while taking care of syringes, pads and other materials that may have been in contact with blood or other body fluids. The questionnaire was translated from English to

Kiswahili and distributed in both languages. Before initiating the study at the hospital, selected staffs from the hospital were invited for a final quality control of the questionnaire. Data collection started after the quality control and final adjustments. Healthcare workers who participated in the pilot study were not included in the main study.

In addition to the questionnaire survey, the investigators acted as observers to gain a better understanding about the correspondence between the participant's response to the survey and the participant's practice in reality. One of the investigators was present at the hospital every day and during occupational shifts of the staff. Observations of injection practices and waste management were primarily focused on the availability of equipment and the use of equipment, such as type of gloves, syringes, sharps containers and incinerator. The observations were made while distributing and collecting questionnaires, and during surgery and rounds in the departments. Meetings with medical officers responsible for the departments and wards, healthcare waste officers, and other healthcare professionals contributed to information regarding safe injections and waste administration.

### **Ethical considerations**

Ethical clearance was approved by the Medical Research Coordinating Committee of National Institute for Medical Research (NIMR) while research clearance was sought from Tanzania Commission for Science and Technology and the Director of the hospital. Informed consent was obtained from the participants.

### **Data analysis**

The Statistical Package for Social Sciences (SPSS) version 19.0 was used for entering and analysing the data. Variables were categorized as follows: knowledge and practice of safe injections and safe waste management, risk factors when safe practices are not used exposure of blood transmission (e.g. being pricked) or through non-intact skin, mucous membranes. They were categorised into adequate or inadequate knowledge and practice, through cut-off points as previously described (MoHSW, 2004; ILO & WHO, 2005). Frequencies and cross tabulations were used to determine the differences or relevant associations between variables. For categorical data, chi-square test was used to test statistical significance between the observed differences or relevant associations between proportions of procedures in groups. P-values <0.05 indicated statistical significance. Cross tabulations was used to determine if work experience and cadre were associated with knowledge and practice of safe injections and waste handling.

### **Results**

Two hundred and twenty-three (n=223, 73%) healthcare workers were involved in the study. The mean age was 38.9±10.2 years. Two-thirds were nurses, and three-quarters had five or more years of work experience (Table 1).

**Table 1: Demographic characteristics (n=223)**

<b>Variable</b>	<b>Response</b>	<b>Frequency</b>	<b>Percent</b>
Age group (years)	<30	49	22.0
	30-50	133	59.6
	>50	41	18.4
Cadre	Nurse	147	65.9
	Doctor	47	21.1
	Laboratory staff	12	5.4
	Others <sup>a</sup>	17	7.6
Working experience (years)	<5	54	24.2
	≥ 5	169	75.8

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Three-quarters of the staff reported adequate practice about safe injections and on waste management. However, about half reported adequate knowledge on injections. Knowledge of waste caretaking, and the risks associated with unsafe practices was inadequate (Table 2).

**Table 2: Knowledge and practice of safe injections and healthcare waste management among healthcare workers (n=223)**

Variable	Adequate (%)	Inadequate (%)
Knowledge injections	113 (50.7)	110 (49.3)
Practice injections	174 (78.0)	49 (22.0)
Knowledge HCWM	94 (42.2)	129 (57.8)
Practice HCWM	173 (77.6)	50 (22.4)
Knowledge risk factors	98 (43.9)	125 (56.1)

Key: HCWM= health care waste management

Laboratory workers reported significant more knowledge on the risk factors for unsafe injections. Knowledge on injection practices and waste management was not significantly different among the cadres (Table 3).

**Table 3: Knowledge and practice of safe injections and health care waste management (HCWM) according to cadre**

Variable	Doctors (n=47)	Nurses (n=147)	Laboratory (n=12)	Others (n=17)	P-value
Knowledge of injection	24 (51.1%)	75 (51.0%)	8 (66.7%)	6 (35.3%)	NS
Practice of injection	36 (76.6%)	118 (80.3%)	9 (75.0%)	11 (64.7%)	NS
Knowledge of HCWM	16 (34.0%)	63 (42.9%)	7 (58.3%)	8 (47.1%)	NS
Practice of HCWM	37 (78.7%)	115 (78.2%)	10 (83.3%)	11 (64.7%)	NS
Knowledge of risk factors	27 (57.4%)	48 (32.7%)	11 (91.7%)	12 (70.6%)	<0.001

The majority of healthcare workers reported HIV transmission as one risk factor when occupational safety is lacking. Nurses reported inadequate knowledge of hepatitis B and both nurses and doctors reported inadequate knowledge about hepatitis C as a risk factor. Staff with work experience of less than five years reported adequate knowledge and practice of injections, and significant more knowledge of risk factors when safety precautions are not practiced compared to those with longer employment (Table 4).

**Table 4: Knowledge and practice of safe injections and healthcare waste management according to working experience**

Variable	<5 years experience (N=54)	≥5 years experience (n=169)	P-value
Knowledge of injection	29 (53.7%)	84 (49.7%)	NS
Practice of injection	44 (81.5%)	130 (76.9%)	NS
Knowledge of HCWM	18 (33.3%)	76 (45.0%)	NS
Practice of HCWM	41 (75.9%)	132 (78.1%)	NS
Knowledge of risk factors	30 (55.6%)	68 (40.2%)	0.048

For blood exposure based on working experience, 46% of participants with five or more years of experience reported being pricked, compared to 35% of participants with less experience. However, blood exposure through non-intact skin, mucous membranes was reported among 50% of participants with less than five years of work experience and 39% of participants with more than five years working experience.

The hospital has guidelines on how to draw blood and offers continual training, and has an adequate system for reporting exposure to blood and other body fluids. At the hospital, there was a healthcare waste management team, who had documents outlining waste management

and training, and there were separate waste containers for infectious waste and for general health care waste. Seventy-four participants (33%) were unaware of the guidelines on how to draw blood and majorities were not aware the hospital offered continual training. The majority of healthcare workers were aware of the reporting system for exposure to body fluid: 94% felt encouraged to report such incidences, and 57% would always report such events. However, 51% felt uncomfortable about handling situations regarding exposure to body fluid. If a person had been exposed to contaminated blood post-exposure prophylaxis (PEP) was available, and the majority had access to PEP.

The observations revealed that unused gloves were available; however, only 48% of the staff reported that multi-sized gloves were always accessible, due to occasional shortage of gloves, and 71% reported they always used gloves when drawing blood from a patient.

According to managers at the hospital, single and auto-disabled needles or syringes were always available at the hospital; however, 23% of healthcare workers reported single and auto-disabled needles or syringes were not always available. A needle or syringe was never reused by 89%, and the needle was not recapped by 60% of the staff. From those who recapped a needle, 13% used two hands and 18% used one hand. For 12% of staff, eye protection was always available, because most of them had bought them themselves, and plastic aprons were always available according to 34% of the participants. The majority of the health care workers performed hand hygiene with soap and water; hand disinfectant was not available at the hospital. Hepatitis B vaccine for healthcare workers was not available or provided.

The incinerator at the hospital was old, open, and did not have the temperature for burning, as required by WHO guidelines. A lack of fencing around the incinerator led to easy access to the disposed materials; the investigator was anecdotally told that things from the incinerator could be obtained and sold on the black market, thus, exposing the community to the risk of infections. Additionally, healthcare workers carrying the waste were at risk of exposure from polluted air.

There was lack of awareness (54% of healthcare workers) about the waste handling team at the hospital: 32% were unaware of the documents, 63% had not been trained in how to handle waste, and 67% were not aware of their own responsibilities to waste management. The majority of the healthcare workers (85%) reported that the wards had separate bags and containers for different waste, and 80% reported the bags and containers were clearly labelled. However, two-thirds of the staffs were not aware of the availability of leak proof bags for disposing of materials used for cleaning blood spills. A lack of sharps containers sometimes occurred, as was the case during data collection, and 45% reported the sharps container is placed within one arms reach and they have experienced overflowing containers. Health personal expressed to the investigator a wish for more education and information about safety and transmission routes.

## Discussion

The present study conducted at a regional hospital in northern Tanzania, may be viewed as an example of many rural or semi-rural hospitals, in low-income settings with a high burden of HIV infections. Occupational safety and health involves the performance of safe injections and health care waste management, and is related to the Millennium Development Goals 4, 5 and 6, to reduce under-five mortality, maternal mortality and to combat HIV/ AIDS, and especially HIV prevention. The global problem with the reuse of needles and syringes without sterilisation is a long-standing issue that increases the risk of transmission of HIV and other blood-borne infections (Kane *et al.*, 1999; WHO 2010).

The healthcare workers in this study reported good knowledge of HIV transmission routes, which supported previous findings from Africa (Hutin *et al.*, 2003; Shiferaw *et al.*, 2012). However, there was lower knowledge about hepatitis B and C and waste management. Awareness about waste management among healthcare workers is expressed as an important

issue in the guidelines from the Ministry of Health in Tanzania. The length of working experience was significant, and less experienced staff at this hospital reported more knowledge about risk factors associated with unsafe injections, as well as good practice compared to the more experienced. This may reflect a high-quality of the nursing education and training. Other studies have contrary found significantly higher risk of needle stick injuries among staff with less experience (Ilhan *et al.*, 2006; Jayanth *et al.*, 2009). Similarly, cadre was significant, with medical doctors reporting the highest exposure to blood through non-intact skin and nurses reporting being pricked more often, as is documented in other studies (Manyele *et al.*, 2008; Jayanth *et al.*, 2009). At this specific hospital there were working descriptions available and awareness among the leadership of working safety. Nevertheless participants in this study reported a lack of medical equipment and supplies, which is previously reported from Tanzania (Gumodoka *et al.*, 1997; Manyele & Anicetus 2006). Moreover, the observations together with the quantitative results from the questionnaires highlighted a gap between knowledge and practice and available resources at the hospital. Limited medical equipment and lack of human resources placed the healthcare worker under pressure and at risk of being infected and the incinerator at the hospital was not up to the standard as required (WHO, 2002). Lack of HBV immunization among healthcare staff was also found in a recent study in Ethiopia (Shiferaw *et al.*, 2012).

Healthcare waste management includes safety programmes for healthcare workers, waste minimisation, and segregation of waste (ILO & WHO 2005). For sustainable occupational safety and health among health workers, the findings of this study suggested the communication of available resources and capacities should be strengthened, such as utilising the waste management team to communicate the WHO and International Labour Organization guidelines, already available at the hospital. Training and education of healthcare workers may improve occupational safety and reduce the number of unsafe injections (Vos *et al.*, 1998; Metha *et al.*, 2010). Such interventions are often feasible and cost-effective (Miller & Pisani 1999, Dziekan *et al.*, 2003), and workshops and seminars have proven to be successful (Guo *et al.*, 1999). However, for such events to occur at this hospital, personal at all levels must be included and encouraged by the management team. As the staff requested more education and information about safety, the hospital management could invite healthcare workers from each ward and level, to be part of the waste management team on a rotational basis. This would allow each individual to be involved in the safely concepts, thus, increasing both overall occupational safety and empowerment of everyone at all levels, to aim for a safe working environment.

The study indicated further training and education about waste management and avoidance of HIV and other blood borne infections is required. Additional qualitative studies in similar settings could provide more understanding about the perceptions of the occupational safety and health, and about HIV, stigma and the fear of being exposed to infected blood. In spite of existing guidelines there may be hinders or hesitations of reporting accidents, due to fear of stigma and blame as reported in a qualitative study from Vietnam (Graner *et al.*, 2010), or the lack of PEP (ILO&WHO 2005). We conclude in this study, that health workers in a Tanzanian setting, to a large extent have knowledge, and they reported adequate practice about injections and the risk of acquire serious infections, while working with blood or other human fluids. However further improvements can be made to guarantee satisfactory waste management to avoid the preventable spread of HIV in accordance with WHO guidelines. The significant results combined with observations emphasis the need of strengthening occupational safety through communication and involvement of health workers at all levels of the hospital.

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### Conflicts of interest

The authors state that there are no conflicts of interest in connection with this article.

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