

East African Medical Journal Vol. 92 No. 1 January 2015

INJECTION SAFETY KNOWLEDGE AND PRACTICES AMONG CLINICAL HEALTH CARE WORKERS IN GARISSA PROVINCIAL GENERAL HOSPITAL

J. M. Mweu, BSN, MScN, T. M. A. Odero, BSN, MSN, MSc, A. C. Kirui, BSN, MSc, MSN, J. Kinuthia, MBChB, MMed, MPH, F. M. Mwangangi, MPH, BSN, S. C. Bett, BSN, MScN and C. M. Musee, BScN, MScN, Kenyatta National Hospital, P. O. Box 20723-00202, Nairobi, Kenya

## INJECTION SAFETY KNOWLEDGE AND PRACTICES AMONG CLINICAL HEALTH CARE WORKERS IN GARISSA PROVINCIAL GENERAL HOSPITAL

J. M. MWEU, T. M. A. ODERO, A. C. KIRUI, J. KINUTHIA, F. M. MWANGANGI, S. C. BETT and C. M. MUSEE

### ABSTRACT

**Background:** The World Health Organization estimates that approximately 16 billion injections are administered in developing countries annually. Injection safety is therefore critical in preventing occupational exposure and infection from blood borne pathogens, hence prevention is a vital part of any comprehensive plan for protecting health workers, patients and maintaining a safe environment.

**Objective:** To determine the knowledge and practice of injection safety among clinical healthcare workers at the Garissa Provincial General Hospital.

**Design:** A cross-sectional descriptive study.

**Setting:** The Garissa provincial General Hospital from September 2011 to July 2012.

**Results:** Injection safety knowledge was high with a score of 12.65 (SD  $\pm$  2.3) out of the total of 16 items. Appropriate injection safety practices were reported by most of the respondents. The level of knowledge was not significantly associated with respondents' demographic characteristics ( $p > 0.05$ ), but was significantly associated with hand washing practice ( $p < 0.05$ ). Inferences were made on an appropriate injection safety practices like non-recapping of needles, hand washing and proper waste management. Drug administration practice varied in the different departments ( $p = 0.043$ ) and recapping of needles was significantly associated with training ( $p = 0.047$ ), designation ( $p = 0.02$ ) and area of deployment ( $p = 0.017$ ).

**Conclusion:** Knowledge on injection safety was high but reported and observed practices were below the set standard. Risky practices such as recapping used syringes, re-use of disposable syringes and overfilling of sharp boxes were observed. There was insufficient provision of injection safety equipment, Poor waste handling and inadequate personal protective gear. Over prescription of unnecessary injections was widespread.

### INTRODUCTION

According to World Health Organization (WHO), each year, about 16 billion injections are dispensed in developing countries and unsafe injection practices are uncommon globally. They convey substantive proportion of avoidable blood borne infections (1). WHO defines safe injection as the one that does not cause harmful effects to the recipient, does not expose the injection provider to any avoidable health related

risks or generate waste that will cause harm to the community (2).

Re-use of syringes or needles is still widely practiced in many clinical settings and it exposes patients to risks of infections. The burden of disease for the year 2000 from unsafe injection practices for these pathogens worldwide included 21 million of Hepatitis B (HBV), which is 32% of new HBV infections, two million of Hepatitis C (HCV) infections, 40% of new HCV infections and 260,000 Human Immunodeficiency Virus (HIV) infections

5% of new HIV infections. Enhanced injection safety practices are needed to ensure sensible and safe use of injections globally (3).

Re-use of needles and syringes was found to be a major contributor to four outbreaks of avoidable and deadly blood borne infections in a study done in United States of America. The study established that these and other outbreaks of viral hepatitis could have been averted by observing the basic safe injection principles that minimises chances of infections (4). A study in North Virginia USA found out that dangerous injection hazards occur and nearly 40% of health care providers had Post Exposure Prophylaxis administered (PEP) following occupational exposure HIV transmission through needlestick injuries (5).

In South East Asia up to 9% of new cases of blood borne diseases are likely to result from unsafe injections (6). Clinicians prescribe injections in considerable cases even when oral medications would be preferred and were similarly effective (7). The obligation for ensuring injection safety rests with national governments, prescribers, administrators, receivers of injections and the wider community (8). The safety of the patient, healthcare worker and the community is ensured by adequate infection control practices in the healthcare institutions. It is disheartening for unsuspecting patients to contract deadly blood borne diseases from healthcare providers (9). Approximate cost of more than USD535 million per year in direct medical expenses is caused by unsafe injection practices. WHO member states agreed to promote total injection safety through appropriate use of barrier protection such as gloves, segregation and disposal of sharps waste to patients and healthcare workers (10).

In a study done in India, 77% of the healthcare providers reported practice of unsafe injections including use of boiling water for sterilization, recapping used needles and exposure to patient's body fluids. Fifty two percent reported needle stick injuries in the previous 12 months (11). In Dominican Republic 98(22.3%) of 440 healthcare workers reported one or more sharp injury during the previous 12 months and 90.7% had recapped a used needle (12). In South East Asia up to 9% of new cases of blood borne diseases are likely to result from unsafe injections (6).

African countries have the highest needle stick exposure than anywhere in the world (13). A study done in Nigeria indicated that only 12.3% of healthcare workers washed their hands before and after administering injections (14).

In Cameroon 44% of health workers reported involvement in some form of unsafe injection procedures and use of inappropriate equipment (15). In Cambodia injections are overused and are frequently administered in an unsafe manner and sharp waste were seen in the hospital environment

(16).

At least 50% of the injections administered in the developing world each year are unsafe and in Kenya, each person has an average of two to three injections per year and 70% of providers reported needle stick injuries (17). In hospitals in Kenya, clinicians still prescribe injections in considerable cases even when oral medications would be preferred and similarly effective (7).

In Kenya, Only thirty six percent of facilities have adequate infection control items which include sharps boxes, color coded waste bins and liners, gloves, adequate running water and soap (18)

An injection safety survey done in Kiambu and Bondo districts established that injection overuse was still rampant and prescribers admitted they were pressed by patients to prescribe or administer unnecessary injections and mostly complied. Constraints in the work environment impeded implementation of injection safety measures by prescribers and providers even with adequate knowledge on safety. Injection waste still remained a constant hazard and needle stick injury reports were made by the healthcare workers and the community. The report indicated that waste handlers were significantly ignorant of PEP and only 20% had been trained on safe waste handling (19).

A study conducted in maternity units in five hospitals which involved a National Referral Hospital, a specialised maternity Hospital, two district hospitals and one sub-district hospital in two provinces in Kenya indicated that only 19.4% of healthcare workers had attended an update course on infection control in the three years preceding the study. The institutions admitted having an inactive infection control committee or team (9).

Ministry of public health and sanitation advocated for proper handling and disposal of hazardous waste. A Kenyan study showed that most hospitals used wheelbarrows to transport waste and more than half did not have waste holding rooms before transportation, only 24% had good sitting for the incinerator (20).

## MATERIALS AND METHODS

*Study Design:* This was a cross-sectional descriptive study that employed both quantitative and qualitative methods of data collection to establish injection safety practices among the health care workers.

*Ethical Approval:* Ethical review and approval was given by Kenyatta National Hospital/University of Nairobi Ethics and Research Committee, written permission from GPGH and informed consent from all participants was obtained. Potential study respondents were approached while in their work

stations in the selected units before being recruited into the study. Participation in the study was voluntary and based on written informed consent. The researcher explained that utmost confidentiality will be ensured and all possible identifiers would be eliminated to avoid breach of privacy. The researcher further informed them of their roles and the overall benefits of taking part in the study.

*Study site:* The study was carried out at Garissa Provincial General Hospital (GPGH) which is the main referral hospital in North Eastern Province.

*Study population:* This included nurses, medical consultants, clinical officer interns and certified Medical doctors, working in medical, pediatric and maternity departments in GPGH.

*Inclusion and exclusion criteria:* Those included were nurses, consultant physicians, Medical officers, Clinical and Medical officer interns who had been working in Maternity, Pediatric Units and Medical wards for at least three months preceding the study, willing to give a written consent and were available at the time of data collection. Students and Healthcare workers who had worked in the selected units for less than three months and those who did not give a written consent or were unavailable were excluded from the study.

*Sampling Method:* Purposive sampling was used to select respondents for inclusion in the study. To ensure adequate representation of all the cadres of healthcare workers, recruitment of sample was done using probability proportional to size (PPS) and based on the percentage of different cadres within the population of healthcare workers.

*Sample size calculation:* Fisher *et al* 1998 formula was utilized and proportionate allocation scheme was applied to ensure adequate representation of the target clinical healthcare workers.

*Piloting of study tools:* The tools were piloted at Kenyatta National Hospital (KNH) which is also a referral hospital and is a public facility charged with almost a similar mandate with GPGH. The sample size for the piloting was 10% of the actual sample size. The self administered questionnaires, ward level checklists and Key informant guides were pre-tested medical, pediatric and maternity units while the waste collection checklist was done in the public health section.

*Data collection procedure:* The data were collected using three different methods namely; a semi-structured questionnaire, observation check lists and key informant interviews. Study participants

who gave written informed consent were given self-administered questionnaires that measured knowledge on safe injection practices in keeping with the set WHO and MOH set guidelines on the same. The knowledge questionnaire which was also guided by WHO tool in rapid assessment of injection safety contained closed ended questions. The self-assessed practice questionnaire contained closed ended questions assessing safe injection practices. These questionnaires were administered by the researcher and a trained research assistant who was trained on the whole process of data collections and was a nurse employed in the hospital. After each questionnaire was completed, the researcher/research assistant read through the completed questionnaires and checked for completeness and validity of responses and verifications were made accordingly.

Four observation checklists were used. One was used on all the enrolled healthcare workers who completed the self-administered questionnaires and was used to observe them as they performed injection procedures to determine their actual injection practices as compared to the set WHO/MOH set standards except for the consultants and also compare it with their responses they had provided them in the questionnaires. The second was used to collect data on safe injection practices, the third was used to collect data on waste transportation and disposal, while the last check list was used to collect data on injection safety supplies management. All these checklists provided data that evaluated injection practices based on the surviving WHO and MOH set guidelines.

The key informant interview sessions were conducted with the nurse in charge of each of the three selected wards, the supplies manager and the hospital medical superintendent. The study tools were also guided by WHO injection safety toolkit. Key informant interview data was done by the researcher and was recorder and later transcribed.

*Data Management and analysis:* Data collected using questionnaires and observation checklists were checked for completeness and edited where necessary and entered into a database and analysed using Statistical Package for Social Scientists (SPSS) version 18. Data from questionnaires were entered into customised MS Access databases and exported to SPSS version 18.0 statistical package for analysis. Univariate analysis of each variable in the data set was conducted to check variable distribution and document completeness of data. For categorical variables frequency distributions were produced using SPSS. Continuous variables were summarized by calculating mean and Standard Deviation depending on the distribution of the specific variable. The main outcome was calculated as percentage of health worker displaying knowledge and appropriate infection prevention practice. Data from key informant

responses that had been tape recorded was transcribed and read before coding which was conducted using open coding approach which was done manually. The data was analysed using a thematic analysis approach to explore for emerging themes based on the codes attached to the data. Data from observation checklists were analysed using descriptive statistics. The chi-square test was also used to compare the level of statistical significance between different health worker demographic characteristics such as the level of training with the observed practice. Statistical significance was also determined at the level  $p < 0.05$ .

## RESULTS

On average, the respondents had a knowledge score of 12.6 (SD  $\pm$  2.3) out of the total of 16 obtained by scoring each correct response as 1 and each incorrect response as 0. About 57% of the respondents reported that they had some form of training on injection safety practices. There was not a statistically significant difference in knowledge between the five target medical groups.

Most respondents had knowledge about transmission of Hepatitis B infection 57(79.2%) and its prevention through vaccination 64(88.9%) but a lower percentage possessed knowledge on hepatitis C transmission 37(51.4%). The areas in which healthcare workers showed the highest knowledge were hand washing 69(95.8%), HIV infection (91.7%), PEP 65(90.3%) choice of correct injection devices (95.8%) and implementing measures to prevent sudden patient movement during injection (94.4%).

In contrast with findings obtained from Key Informant Interview responses showed inadequate knowledge on the contents of Injection safety guidelines among all those interviewed and one pointed out *"to a large extent the hospital is still lagging behind in issues of injection safety"*. The interviewer reported that *"more of them are not trained and we are seeking for forums to have them trained"*. It was also reported that healthcare workers do not segregate waste because *"people do not have the knowledge about how those bins are supposed to be used"* In general, reported awareness about MOH standard on injection safety guidelines was high although the key Informants responses were not entirely accurate. It was stated *"even when the bins are bought the staffs may not use them as they are supposed to, for instance you find that people put food waste where infectious waste is supposed to be dumped"* because they lack knowledge on injection safety. This was reported to be the reason sharp boxes were over filled in the clinical areas assessed. Out of the 72 respondent only 19(26.4%) indicated that they always followed the five recommended steps while reconstituting pre-drawn medication: legibly labeled medication name, time of reconstitution, strength of education, expiry date and person preparing the medication. Fifteen (20.8%) respondents reported adherence to recommended

infection prevention practices during preparation of injections. Data from key informant interview reports indicated unnecessary injections were common in the hospital and that community members preferred injections to oral medications even when the latter were more effective and appropriate. Key informant interview reports It was also indicated that clinicians agreed to prescribe unnecessary injections due to pressure from patients.

The Standard (MOH/WHO) Injection Safety Guideline training and drugs storage: The Ministry of Health (MOH) and World Health Organisation injection safety guidelines were not available in all the sections of the hospital that were assessed although there was a positive perception on the utility of injection safety guidelines in the Key Informant Interviews. One hospital leader reported that his training on the guidelines *"changed my knowledge, attitude and practices as far as injection safety is concerned"* to ensure that the staff get the support they require to maintain safe injection practices. The benefits of guideline use identified in Key Informant interviews encompassed usefulness *"to us as health workers and the patient even including the subordinate staff"* and included prevention of needle stick injuries, and protecting patients from transmission of avoidable deadly infections.

Documentary evidence on adherence to injection safety guidelines: There was no evidence confirming that injection safety training was not provided to all staff categories in the previous one year nor supportive supervision was conducted every three months by MOH as stipulated in the guidelines. Only one ward, the Comprehensive Care Clinic (CCC) had the Post Exposure Prophylaxis (PEP) guidelines displayed as per MOH recommendation.

Drugs were stored under very high room temperatures of 38°C which is beyond what is recommended although the drug store was clean and dry and, with adequate lighting. The drug store however lacked the capacity to store all the required materials in a manner that would minimize contamination. The drug store also lacked firefighting equipment as stipulated in the injection safety guidelines.

Injection preparation, dispensation and hand washing: In the actual on job observer inventory, 21% of the respondents were observed using same syringe to administer different drugs and 10% used same needle to reconstitute different drugs on the same patient. This was mostly in medical ward (83%) and was frequent in participants with a bachelor's degree (100%). The inventory on observation checklist injection safety practice also showed that hand washing was rarely practiced(8%) before putting on gloves to administer injections and less than half washed their hands after contact with the patient while administering drugs (Table 1).

**Table 1**  
*Observed injection practices*

Variable	Performed n(%)	Did not perform n(%)
Staff perform hand hygiene;		
Before putting on gloves to administer injections	6(8.3)	66(91.7)
After removing gloves once the injection is administered	40(55.6)	32(44.4)
After direct patient contact	35(48.6)	37(51.4)
After contact with any form of contamination even when gloves are worn	43(59.7)	29(40.3)
Needles are recapped after injecting a patient	37(51.4)	35(48.6)
Sharps are manipulated in anyway		
before they are used to inject the patient	51(70.8)	21(29.2)
after injecting the patient	44(61.1)	28(38.9)
Sharps are immediately removed from patients environment after they are used on a patient	29(40.3)	43(59.7)
Each needle is used;		
for only one patient	64(88.9)	8(11.1)
for only one drug	51(70.8)	21(29.2)
Each syringe is used;		
for only one patient	61(84.7)	8(11.1)
for only one drug	54(75.0)	15(20.8)
A new needle is used for each medication vial	63(87.5)	8(11.1)

The investigator established that all the wards had taps with running water in all patient care areas but none had hand washing soap or alcohol based hand rubs. There is statistical significant association between the level of training of the participants and washing hands with running water after removing the gloves ( $\chi^2=13.566, p=0.035$ ) Table 2.

**Table 2**  
*Association between level of training and the recommended hand washing practices*

	Value	Degrees of freedom	P-value
Pearson Chi-Square	13.566	6	0.035
Likelihood Ratio	14.222	6	0.027
Number of Valid Cases	72		

*Recapping of used needles, needleprick injuries and post exposure prophylaxis (PEP)*

About 24% of the healthcare workers reported that they did not know that it was unsafe to recap used and potentially infectious needles. The level of training of the participants significantly affected recapping of used and potentially infectious needles ( $\chi^2=10.425, p=0.015$ ). Those who were trained were unlikely to recap used needles hence had a significant lower risk of contracting the fatal diseases. Forty three per cent of the respondents reported that they were engaging in the risky recapping of needles, majority (54.5%) working in maternity unit and this

was mostly done by medical officer interns (75%). This was supported by key informant's report "most people do recap the needles".

While only 43% of the respondents reported that they recapped used needles 51.4% of the health care workers were observed to recap them and only 40% of them immediately removed used sharps from patient's environment as recommended. Seventy point eight per cent of the respondents were observed to manipulate the sharps before injecting the patients.

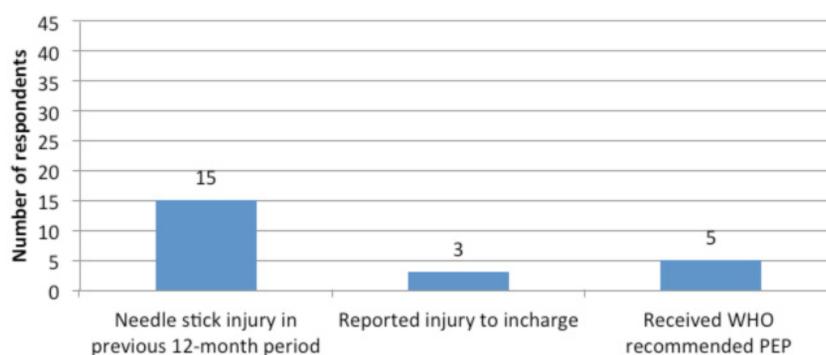
Fishers exact tests examining associations between reported recapping of needles and characteristics of study respondents. There were

statistically significant associations between the practice of needle recapping and designation ( $p=0.02$ ), level of training ( $p=0.047$ ) and department ( $p = 0.017$ ) respondents were working in. The practice showed significant association with area or departmental deployment ( $p = 0.017$ ). All staffs working in pediatrics department reported that they did not practice recapping while 28.6% of respondents working in the maternity department recapped needles. Recapping was significantly influenced by designation based on results in Table 11 ( $p = 0.02$ ). The medical officer interns had the highest (75%) rate

of recapping used needles while the enrolled nurses had no reports of recapping.

Out of the 21% of respondents who had suffered a needle stick injury during the past 12 month period, only 33.3% received the WHO recommended PEP treatment. It was also noted that some participants sought PEP treatment without reporting to the ward in-charge as it is recommended (Figure 1). The WHO/MOH guidelines on PEP were only displayed in only one ward. The key informant responses on the recommended PEP guidelines were varied and incorrect.

**Figure 1**  
*Needle stick cases and actions taken*



#### *Waste generation, segregation and management*

Only 32 (44.4%) out of the 72 participant in this study reported that they practiced all three recommended waste management practices examined namely: disposal in recommended bins, and waste segregation by type and at the point of waste generation. This was supported by the key informant interviews "segregation of waste is a major challenge whereby you may find some people are throwing sharps in dust bins instead of throwing them in sharp containers" also because the institution is "resource constraint" in procuring supplies to facilitate enforcement of safe injection practices. Injection safety equipment such as waste transportation carts were not available and wheelbarrows were used to transport the infectious waste.

Colour coded waste bins were available for the injection wastes but none had the required bin liners. There was no waste segregation at the point of generation and there was mixing of waste in various waste bins and over filled sharp boxes were noted. There was no documentation confirming that injection safety training was provided to all staff categories within the hospital in the last one year which included the waste handlers who were the most vulnerable group due the potential risks involved of contracting deadly infections. waste generated in the clinical areas remained in the wards for 24 hours and was not transferred to secure holding rooms immediately as

recommended. The staff collecting injection wastes did not have personal protective equipment such as aprons, overalls, helmets, heavy duty boots and gloves. The incinerator was poorly cited next to some wards and had no capacity to handle all the generated waste and this was supported by the key informant reports.

## DISCUSSION

Overall, while a high proportion of healthcare workers had high knowledge of injection safety guidelines, observed injection safety practices were way below the WHO/MOH set standards. Despite the absence of injection safety guidelines, overall results indicated that there was high level of knowledge among workers on injection safety in GPGH. This could have been attributed to training attended by 57% of the respondents according to questionnaire responses. It might also have been caused by the vigorous campaigns by MOH on injection safety through the media, trainings and leaflets. These results were in contrast to the outcomes of a study done in Ethiopia which showed that majority of the healthcare workers still had poor understanding of safe injection procedures (21).

In GPGH, majority of the respondents knew that unsafe injections are associated with HIV (92%) and Hepatitis B (79.2%) transmission. Conversely,

51.4% of the respondents were aware that Hepatitis C can be transmitted through unsafe injections. These findings are in tandem with those of a study done in China among 118 health care professionals where healthcare workers knew HIV, Hepatitis B and C (95,89 and 59% respectively) could be transmitted through contaminated syringes and needles (22). Compared to other infections knowledge on Hepatitis C transmission is low.

In GPGH, about 43% of the health workers had some training on infection prevention and safety which showed an improvement from a study conducted in maternity units in five hospitals in Kenya which indicated that only 19.4% of health care workers had attended an update course on infection control in the three years prior to the study (9). This shows that the percentage of those trained had risen from 19.4% in 2009 to the current 43.06% reported in Garissa and this supports my findings of high level of knowledge among health care workers. Additional training would further foster more knowledge considering the positive perception on the utility of injection safety training as voiced in key informant responses that represented the influential top leadership.

In GPGH, the workers who had been trained on injection safety were unlikely to recap used and fatally infected needles. This situation could also have been made worse by the fact that the MOH storage guidelines were not available in all the units and was supported by a national cross-sectional survey on injection safety practices that reported problems with availability of injection safety guidelines (23). This therefore means that more training sessions on injection safety needs to be done to empower the workers with knowledge. This would be so especially considering the positive perception on the utility of the injection safety guidelines and training.

Reported and observed practice was generally poor for the different aspects of injection safety. Problematic areas included hand washing, recapping, and drug administration at individual level. There was reuse of syringes and needles as supported by a study done in the United States that established that this malpractice led to spread of deadly avoidable blood born infections (4). This could have been attributed by the low numbers (43%) of trained personnel on injection safety. Inventory from observation checklists indicated poor practice at ward level which was also reflected by the unavailability of soap at all the taps in patient care areas. Inadequate resources cited during the key informant interviews could have been the cause which is also supported by the observed insufficient provision of injection safety equipment and supplies as it was supported by a perspective that indicated that in some countries unsafe injections comprise up to 70% of the total jabs administered (13)

Health workers were more likely to wash their hands after contact with contamination but only 24

(33)% reported washing hands before administering injections. In a similar study done in West Africa only 12.3% of injection providers washed their hands before and after administering injections (14). In comparison with findings from this study the performance is better however it is still relatively low and presents an opportunity for spread of avoidable fatal infections. All the taps in the patient care areas had running water but none had soap or alcohol hand rubs available as stipulated on the MOH guidelines (10). The reason for this could be attributed to lack of supervision visits by ministry of health officials who could have captured the problem and facilitated a sustainable solution

In GPGH, majority (67%) of the respondents reported that they prepared each injection in a clean designated area where contamination was unlikely to happen. These findings were similar to those of a survey done in Nigeria (14). Only 45(62.5) % of the respondents verify the integrity of the packet of the disposable syringe before use while fourteen participants reported that they reused syringes. Interviewed healthcare managers cited inadequate injection supplies as one of the major challenges in maintaining safe injection practices. Again this could have been caused by high work load of giving injections because injections which were so common in the hospital and put a strain on the few available resources

In GPGH, only 13(18.1%) of the respondents reported that they never compromised hand washing despite increased work load. This practice appears to account for the existing estimates that each year, about 6% of the world population receives injections contaminated with hepatitis B virus and between 417 000 and 1.3 million deaths are caused by unsafe injection practices in medical practices (13).

In GPGH, 20.8% of the respondents had suffered a needle stick injury during the past 12 month period and almost a similar situation was found in a study done in Dominica (12) These cases of needle stick injuries could be associated with recapping of needles which exposes the injection provider to a higher risk of needle stick injury since almost the same number of respondents reported that they recapped used needles

Key informant interview reported that there was widespread use of injections in the hospital and that patients demanded for unnecessary injections and the clinicians mostly complied. Similarly, an injection safety survey done in Kiambu and Bondo districts established that injection overuse was still rampant and prescribers admitted they were pressed by patients to prescribe or administer injections and they often complied (19) This was also similar to a National cross-sectional survey in Kenya on injection safety practices indicated that there is over prescription of injections, (17). This high prevalence of injection use

shows that the wrong perception that injections work better than oral medications continue to be intense and efforts need to be made to influence change of that attitude. This emphasises the need to promote behavior change and communication.

### CONCLUSION

There was high level of knowledge in injection safety among workers in GPGH that had no significant association between designations, level of training or the department where one worked. Although most of the respondents knew that unsafe injections were associated with transmission of infections such as HIV and Hepatitis B, almost half of all the respondents were unaware of the danger of transmitting Hepatitis C via unsafe practices. These findings can be used in designing intervention to improve injection safety which should address resource constraints, target new staff with shorter duration of practice and staff deployed in poor performing departments. We recommend that all the health workers in GPGH should be trained on safe injection practices and injection safety by the WHO/ MOH. Supervisory visits by Ministry of Health be enforced. There is need for the hospital staff and the community health workers to educate the community around the GPGH and the general public that oral medications are also effective.

### ACKNOWLEDGEMENTS

The project described was supported by Award Number 5R24TW008907 from the US National Institutes of Health through the PRIME-K Linked-Strengthening Maternal, Newborn and Child Health Research Training in Kenya. The content is solely the responsibility of the authors and does not necessarily represent the official views of the US National Institutes of Health.

### REFERENCES

1. Ministry of Health (2006 a). Injection Safety and Medical Waste Standards and Guidelines, National Standards and Guidelines on Injection Safety and Medical Waste Management October 2006 a.
2. Ministry of Health (2008-2012). The National Health care Waste Management Plan. John Snow Inc. Kenya.
3. World Health Organization (2010). Sign (Annual Meeting Of The Safe Injection Global Network) 2010, Report of the WHO SIGN2010 Meeting ,9-11 November 2010, Intercontinental Dubai Festival City Hotel Dubai, United Arab Emirates.
4. Siegel J.D, Rhinehart E., Jackson M., Chiarello L. and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings
5. Reid S. (2010). Increase in clinical prevalence of AIDS implies increase in unsafe medical injections, School of Public Health, University of Nevada at Las Vegas, NV, USA *International Journal of STD & AIDS* 2009; 20: 295–299
6. Miller M.A and Pisani E. The cost of unsafe injections, 2006; *Bulletin of the World Health Organization*, 2006; 77: 808-811
7. Ministry of health and Snow J. (2006b). Making Medical Injections Safer (MMIS), Participants Handbook, Inc. Research and Training (MMIS-Kenya Program), March 2006b.
8. Friedman D, Anthony H. and Baron E.L. (2010). General principles of infection control, Injection Safety, Operating room Safety, Disclosures 19.3
9. Muchina P. W. and Muchina E.N., Transmitting Infection: Testing disinfectants used in maternity units in African Journal of Midwifery and Women's Health. 2009; 3: 12-14
10. World Health Organization (2010). SIGN (Annual Meeting Of The Safe Injection Global Network) 2010, Report of the WHO SIGN2010 Meeting, 9-11 November 2010, Intercontinental Dubai Festival City Hotel Dubai, United Arab Emirates
11. Pandit N. B., Choudhary S. K. Unsafe injection practices in Gujarat, India, *Singapore Med J*; 2008; 49: 936
12. Pedro L. M., Moore A., Balcacer P., Montero A., Diaz D., Gómez V., Garib Z., Bruce G. and Weniger B.G., (2007). Epidemiology of needlesticks and other sharps injuries and injection safety practices in the Dominican Republic. *Association for Professionals in Infection Control and Epidemiology*. Inc. doi:10.1016/j.ajic. 552-559.2007.06.001
13. Kermode M. Unsafe injections in low-income country health settings: need for injection safety promotion to prevent the spread of blood-borne viruses. *Health promotion international* 2004; 19: 95-96
14. Akpan, Toyin, BhatShanadi, Deepa; Noel, Megan; Sowande, Abimbola; Van Roekel, Karen; Collins, Ethan; Evaluation of Injection Safety and Health Care Waste Management in Nigeria: 2009 Final Report, March edition. MMIS for the Office of the Global AIDS Coordinator (OGAC) and USAID.
15. Okwen M. P., Ngem B. Y., Alomba F. A., Capo M. V., Reid S. R., Ebong C., and Ewang E. C., Uncovering high rates of unsafe injection equipment reuse in rural Cameroon: validation Of a survey instrument that probes for specific misconceptions, *Harm Reduction Journal* 2011; 8: 3-4
16. Vong S., Perzij F., Sok S., Som S., Goldstein S., Hutin Y. and Tulloch, Rapid assessment of injection practices in Cambodia, *BMC Public Health* 2005; 5:56
17. Ministry of Health (2005). Injection Safety and Healthcare Waste Management, Reference Manual for Health Workers. John Snow Incorporated. Nairobi, Kenya .
18. KSPA (2010). National Coordinating Agency for Population and Development (NCAPD) [Kenya], Ministry of Medical Services (MOS) [ Ministry of Public Health and Sanitation (MOPHS) [Kenya] ), Kenya National Bureau Of Statistics (KNBS) [Kenya], ICF Macro. 2011 Kenya Service Provision Assessment Survey 2010. Nairobi, Kenya: National Coordinating

- 
- Agency for Population and Development, Ministry of Medical Services, Ministry of Public Health and Sanitation, Kenya National Bureau of Statistics, and ICF Macro.
19. Chirchir B., Songa J., Kirui M., Van Roekel K., Mwangi J. and Noel M., (2010). Prescription Record Review in Embu, New Nyanza and Western Provincial General Hospitals. Nairobi, Kenya, Arlington, VA: MMIS for the office of the Global AIDS Coordinator and the HHS Centres for Disease Control and Prevention.
  20. Ministry of Health (2008-2012). The National Health care Waste Management Plan. John Snow Inc. Kenya.
  21. Ernest S. K., Injection safety: knowledge and practice among health workers, Department of Paediatrics , Child Health University of Ilorin; 2002; **21**: 2-4
  22. Yan Youwang, Zhang Guangping, Chen Yu, Zhang Anqiang, Guan Yong, and Ao Hongping. Injection Practices of Health facilities in Jingzhou district, Hubei, China, *Journal of Medical Sciences*; 2006; **60**:407-416
  23. Ministry of Health (2005 b). National Policy on Injection Safety and Healthcare Waste Management- Kenya.